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NUTRITION EDUCATION TO MINIMIZE HEALTH RISK: APPROACHES
FOR TEACHING COLLEGE STUDENTS AND
FEMALE HIGH SCHOOL ATHLETES

by

Katie Nicole Brown

A dissertation submitted in partial fulfillment
of the requirements for the degree

of

DOCTOR OF PHILOSOPHY

in

Nutrition, Dietetics, and Food Sciences

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2013

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ABSTRACT

Nutrition Education to Minimize Health Risk: Approaches for Teaching
College Students and Female High School Athletes

by

Katie Nicole Brown, Doctor of Philosophy

Utah State University, 2013

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Department: Nutrition, Dietetics, and Food Sciences

Adolescence is a time of increased control over food choices and dietary practices. Participating in high school sports or attending college presents unique nutritional concerns and health risks. Some female high school athletes have low energy availability (consuming inadequate calories to compensate for exercise energy expenditure), which can result in menstrual dysfunction, bone loss, and injury, also known as the female athlete triad (Triad). College students who consume diets low in fruits and vegetables and high in fast food are at increased risk for weight gain, chronic disease, and some cancers.

Nutrition education interventions that were tailored to the participants' unique nutritional concerns yielded positive results such as increased Triad knowledge among female high school athletes and increased self-efficacy and readiness to change dietary behaviors among college students. Peer-led education was preferred by college students, but not by high school students.

(314 pages)

PUBLIC ABSTRACT

Nutrition Education to Minimize Health Risk: Approaches for Teaching
College Students and Female High School Athletes

Katie Nicole Brown

Obesity, heart disease, and osteoporosis are among the major health concerns facing Americans today. Obesity, elevated blood cholesterol, and even atherosclerosis are affecting America's children and adolescents and putting them at increased risk for heart disease later in life. Similarly, low bone mineral density is seen among some adolescents including female athletes, increases their risk for immediate and lifetime fracture. Female athletes who do not consume enough calories to compensate for calories expended during physical activity are in a state of low energy availability which can lead to menstrual dysfunction, as well as bone loss, and injury (the female athlete triad (Triad)). The Triad is of particular concern because the associated bone loss may not be reversible. College students with poor diet and exercise habits may be at increased risk for obesity and heart disease later in life. The objectives of the research studies included in this dissertation were to develop and provide education to minimize health risk among college students and female high school athletes.

The first study assessed Triad knowledge and awareness among female high school athletes and their coaches. Most coaches and athletes were largely unaware of the Triad, its risk factors, or potential negative impacts on lifetime health of the athlete. This research revealed that, with proper training and resources, coaches had the potential to be a conduit for screening for the Triad and providing Triad education to female high school athletes. A peer-led Triad education intervention was piloted in the second study. Junior and senior athletes were trained by a research assistant and then taught their peers about the Triad. There was a significant increase in Triad knowledge from the beginning to the end of the intervention.

Healthy Eating 101, a brief, peer-led nutrition workshop was taught to half of the students enrolled in a college freshman orientation course. A cross-sectional study was conducted mid-semester to determine if the diets of those who participated in the workshop had higher diet quality compared to students who did not participate in the workshop. There were no differences in diet among those two groups. Responses by participants in a focus group help the following semester indicated that follow-up in the form of additional workshops, cooking classes, emails, or meeting with nutrition students who would serve as "nutrition coaches" might improve their dietary patterns. The final study implemented and evaluated a nutrition education intervention, Viva Vegetables!, into a college nutrition course. The viewing of online videos featuring dietitians teaching about various vegetables and demonstrating simple ways to prepare them was coupled with in-class tasting experiences. Though no changes in vegetable intake were observed, there were increases in cooking self-efficacy and readiness to increase vegetable intake, both of which are associated with vegetable intake.

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I would also like to thank my grandparents who started a legacy of post-high school education, and always encouraged me to find an occupation for which I would be excited to get out of bed every day. I thank my parents who taught me to love learning and value education, and provided financial support and endless encouragement. I am grateful to my roommates who fed me, and provided comic relief and emotional support, all of which sustained me during the writing of this dissertation.

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Katie Nicole Brown

CONTENTS

	Page
ABSTRACT	iii
PUBLIC ABSTRACT	iv
ACKNOWLEDGMENTS	v
LIST OF TABLES	ix
LIST OF FIGURES	x
CHAPTER	
1. INTRODUCTION AND BACKGROUND	1
Abstract	1
Introduction	1
Background	2
Study Objectives	9
References	10
2. THE FEMALE ATHELTE TRIAD AMONG HIGH SCHOOL ATHLETES	15
Abstract	15
Introduction	15
Low Energy Availability	16
Menstrual Irregularity	21
Bone Health	24
Diagnosis	32
Treatment	37
Summary and Conclusions	38
References	39
3. KNOWLEDGE OF THE FEMALE ATHELTE TRIAD AMONG FEMALE HIGH SCHOOL ATHLETES AND THEIR COACHES	46
Abstract	46
Introduction	47
Methods	49
Results	51
Discussion	57
Conclusions	62
References	63

4. IMPLEMENTATION AND EVALUATION OF A PEER-LED EDUCATIONAL INTERVENTION TO DECREASE THE RISK OF THE FEMALE ATHLETE TRIAD AMONG HIGH SCHOOL ATHLETES	65
Abstract	65
Introduction	66
Methods.....	68
Results	77
Discussion	93
Conclusions	104
References	104
5. NUTRITIONAL STATUS OF YOUNG ADULTS AND INTERVENTIONS TO IMPROVE HEALTH STATUS: A REVIEW	111
Abstract	111
Introduction	112
Nutritional Status of College Students	115
Barriers to Healthy Eating.....	117
Previous Interventions.....	121
Future Directions for Research.....	125
Summary and Conclusions	126
References	127
6. IMPROVING DIETS OF COLLEGE STUDENTS: SURVEY OF DIETARY HABITS AND FOCUS GROUP PERSPECTIVES ON HOW TO BEST TEACH STUDENTS..	134
Abstract	134
Introduction	135
Materials and Methods	136
Results	140
Discussion	145
Conclusions	148
References	149
7. INCREASED SELF-EFFICACY FOR VEGETABLE PREPARATION FOLLOWING AN ONLINE, SKILL-BASED INTERVENTION AND IN-CLASS TASTING EXPERIENCE AS A PART OF A GENERAL EDUCATION COURSE	152
Abstract	152
Purpose	153
Methods.....	155
Results	159
Discussion	164
SO WHAT? Implications for Health Promotion Practitioners and Researchers	167
References	168

8. SUMMARY AND CONCLUSIONS	172
Summary	172
Conclusions	176
APPENDICES	177
APPENDIX A. District and School Permission.....	178
APPENDIX B. Coach and Athlete Awareness Surveys	182
APPENDIX C. Female Athlete Triad Intervention Survey Tools.	188
APPENDIX D. Female Athlete Triad Intervention Curriculum	201
APPENDIX E. Healthy Eating 101 Surveys and Curriculum.....	266
APPENDIX F. Viva Vegetables Surveys and Curriculum	283
APPENDIX G. Co-Author Releases	285
APPENDIX H. Permission to Reprint	293
CURRICULUM VITAE.....	301

LIST OF TABLES

Table	Page
3-1 Athlete characteristics.....	53
3-2 Athlete Triad knowledge	54
3-3 Coach bone-health-related knowledge	56
4-1 Athlete baseline demographics.....	78
4-2 Changes in Triad knowledge and sports nutrition knowlege	80
4-3 Menstrual history and status	82
4-4 Changes in body image, risk for disordered eating, and pressure to be a certain weight from pre- and post-intervention survey	83
4-5 Energy, macronutrient, and micronutrient intake.....	86
4-6 Participant characteristics by level of energy availability	88
4-7 Participant evaluation of the educational intervention	90
4-8 Peer-leader evaluation of their teaching experience.....	91
6-1 Comparison of population characteristics by focus group and Healthy Eating 101 participation.....	143
7-1 Baseline characteristics of participants by quartile of baseline vegetable intake..	160
7-2 Beginning-of-semester and end-of-semester vegetable intake by self-efficacy of vegetable preparation	161

LIST OF FIGURES

Figure	Page
3-1 Coach knowledge of relationships between Triad components	55
7-1 Stage of change at the beginning and end of spring semester 2009	163
7-2 Self-efficacy of vegetable preparation at the beginning and end of spring semester 2009	164

CHAPTER 1

INTRODUCTION AND BACKGROUND

Abstract

Adolescents have increased nutritional needs to support physical growth and maturation. Those participating in sports have further increased needs. Unfortunately, adolescence is often marked by a decline in healthy habits. Adolescents are at risk for malnutrition in terms of both quality and quantity. For example, female high school athletes are at risk for undernutrition, which may contribute to development of the female athlete triad. The female athlete triad is characterized by low energy availability (dietary energy intake – exercise energy expenditure), menstrual dysfunction, and bone loss. Adolescent bone loss increases risk for immediate and lifetime fracture and may not be reversible. Those transitioning from high school to college are at risk for overnutrition and possible weight gain. Consequently, their risk for chronic disease is also elevated. Both scenarios put adolescents at increased immediate and lifetime health risk. Educational interventions that aimed to improve the nutrition of these at-risk portions of the adolescent population were implemented and evaluated.

Introduction

Adolescence is broadly defined as the onset of puberty up to age 19 [1, 2]. This period is marked by physical and mental growth and maturation. Other than infancy, increases in growth velocity are only seen in adolescence [3]. Teenagers gain 15% of their adult height and 50% of their adult weight during adolescence [3]. Adolescence is

also associated with development of secondary sex characteristics and menarche among females [3]. The initiation, occurrence, and rate of these changes varies widely among individuals [3].

Growth during adolescence necessitates increased calorie and nutrient intake. However, specific needs vary according to rate of growth, stage of maturation, and physical activity [3]. Food choices during adolescence are important due to the increased needs for growth and development. As adolescents mature they experience changes in responsibilities and gain more autonomy over food choices. Their emerging independence often results in poor nutrition in terms of both quality and quantity.

Background

In general, adolescence is marked by a decrease in diet quality. Consumption of healthy foods such as milk, fruits, and vegetables decline [4]. Of the 15,425 high school students (grades 9-12) who participated in the 2011 Youth Risk Behavior Surveillance System (YRBSS), only 14.9% drank 3 or more glasses of milk daily [5]. Similarly, only 22.4% ate fruits or vegetables 3 times daily [5]. Consumption of fruits and vegetables was higher among males, and milk intake was higher among females [5].

Adolescence is also characterized by an increased consumption of soda and fast food [4]. The YRBSS data indicated that 30% of adolescents consumed soda 2 or more times daily [5]. Males were more likely than females to report daily soda consumption [5]. Results from a large, nationally representative study revealed that 39% of adolescents ages 14-19 years ate fast food on a typical day [4]. Those who reported consuming fast

food had significantly higher intakes of calories, fat, and saturated fat, and lower intake of fiber [4].

For some adolescents, undernutrition, or the consumption of insufficient energy or nutrients [2], is a concern. Though only 4.1% of Americans ages 12-19 years are underweight (BMI-for-age that is less than the 5th percentile) [6]; however, adolescents may have a healthy BMI-for-age and be undernourished in terms of calories or nutrients. Results from *What we Eat in America 2005-2006* highlighted the low intake of calcium, and vitamin D among adolescents (ages 14-19) [7]. Adolescent calcium consumption was below the recommended 1300 mg/day [8]; males consumed 1256 ± 57 mg/d and females consumed even less (843 ± 37.3 mg/day). Vitamin D consumption was also far below the 15 mcg/day recommendation [8]; 3.8 ± 0.23 mcg/d for females and 6.2 ± 0.44 mcg per day for males [9].

Adolescents with very busy schedules may be more likely to consume inadequate calories. Inadequate intake of calories is of particular concern for adolescent female athletes. Sports participation elevates calorie needs. Some athletes may feel pressure to be a certain body weight and may restrict their calorie intake. Others may have eating disorders. However, inattention, or lack of knowledge may also contribute to inadequate intake among adolescent female athletes.

Regardless of the cause, inadequate calorie intake among female high school athletes can negatively impact their growth and lifetime bone health. The female athlete triad (Triad) is a syndrome that can be initiated by inadequate calorie intake. The first component of the Triad is low energy availability (EA) (dietary energy intake – exercise energy expenditure). Low EA is achieved by increased exercise energy expenditure,

decreased dietary energy intake, or a combination of the two. Though disordered eating among female high school athletes has been reported at rates of 18-35% [10-14], a study that specifically measured EA among this population reported that of the 36% who had low EA, only 4% were at risk for disordered eating [15] indicating that some low EA is inadvertent.

When athletes do not consume enough calories to compensate for the calories expended during exercise, there is inadequate energy available for normal body function including menstruation and bone growth. Therefore, menstrual dysfunction and bone loss are components of the Triad [16]. Loss of menses, or amenorrhea, increases risk for osteoporosis due to decreased estrogen levels [1]. Prolonged low EA results in decreased peak bone mass [17] and immediate and long-term risk for stress fracture [18-21]. Risk for fracture doubles with every decrease of one standard deviation in bone mineral density (BMD) [22]. A study by Rauh et al evaluated injuries among 163 female high school athletes. Those who had menstrual dysfunction had a 3 times greater risk for injury than those who had eumenorrhea [18]. In addition, one study reported that secondary amenorrhea was a substantially more influential risk factor for elevated bone turnover than was low calcium intake (OR = 20.83 (2.04, 212.97) and 5.5 (1.01, 29.85), respectively) [23].

Components of the Triad are prevalent among female high school athletes. A study by Hoch et al, the only study to date that assessed EA among female high school athletes, reported that 36% had low EA [15]. Estimates of menstrual irregularity among high school athletes ranged from 17%-54% [10-12, 15]. Low BMD estimates ranged from 13%-18% [10, 15].

Low dietary intake and the Triad can have lasting effects. Though EA and menstrual irregularity may normalize after sports participation (and high energy output) ends, the impact on bones can endure [24]. Failure to reach peak height or peak BMD may also result [17]. A study by Hosmer et al reported that any injury incurred prior to menopause was predictive of post-menopausal fracture among a sample of Caucasian women ages 65 years and older [21]. Therefore, athletes who incurred fractures related to the Triad are at risk for fractures later in life. Bone loss due to the Triad may be irreversible [24-26].

The overconsumption of energy or nutrients, also known as overnutrition [2], can result from consumption of energy-dense foods such as fast food, sweets, and sweetened beverages. During growth spurts, adolescents often eat large amounts of food to meet their nutritional needs [3]. Overnutrition may result if the amount of food consumed during growth spurts is maintained when the growth rate slows. Similarly, failure to compensate for decreased physical activity when transitioning from high school to college may result in overnutrition [27-29]. Overnutrition may also occur as adolescents gain greater autonomy over food choices and may choose to consume unhealthy foods more frequently.

Excess intake of fat and calories increases risk for unhealthy weight gain and comorbidities. The prevalence of obesity among adolescents in the United States is high: 18.1% of adolescents (12-18 years) are obese [30]. Data from the 2005-2006 National Health and Nutrition Examination Survey (NHANES) indicated that obese adolescents (ages 12-19 years) had a higher rate of pre-diabetes than did adolescents with normal weight (2.6, CI = 1.3-5.1) [31]. Overweight girls and adolescents had higher odds of

having unhealthy lipid profiles than their normal-weight peers: cholesterol > 200 mg/dl (1.5 (0.6-3.6), $p = 0.37$), HDL < 50 mg/dl (5.4 (2.8-10.3), $p < 0.001$), and LDL >130 mg/dl (3.0 (1.3-7.0), $p = 0.01$) [32]. Obese adolescents are also at risk for orthopedic and respiratory problems [33].

Weight gain is a concern for those transitioning from high school to college. Not all freshmen gain weight, and for the proportion of college freshman who do gain weight, it is usually less than the famed “freshman 15” [34]. Studies that evaluated average freshman weight gain reported weight gain that ranged from 1.8 lbs during the first semester [35], to 8.8 lbs in the first year [29]. A longitudinal study by Harris et al reported an increased proportion of participants who were obese as 18-26-year olds compared to when they were teens [36]. Weight gain during this time is concerning because it may increase risk for heart disease [37], adult obesity, and mortality [38].

Obesity in adolescence is often maintained or augmented into adulthood. Data from 555 white children indicated that adult overweight could be predicted from obesity in early (age 13 years) and late adolescence (age 18 years). Those who had a BMI-for-age at or above the 75th percentile when they were 8-18 years old had 2-fold greater odds of being overweight at age 35 years as compared with those at the 50th percentile [39]. Furthermore, results from the US National Longitudinal Study of Adolescent Health observed that obese adolescents were at greater risk for becoming severely obese during young adulthood (hazard ratio = 16.0; 95% CI, 12.4-20.5) [40].

Weight gain and obesity increase health risk. Results from Willett et al suggested that weight gain after age 18, even among women with a healthy BMI (18-25 kg/m²), was associated with increased risk for coronary heart disease [37]. Overweight and obesity are

among the leading causes of cancer in developed countries [41]. Obesity is associated with increased risk for diabetes. A survey of 195,005 adults participating in the Behavioral Risk Factor Surveillance System (BRFSS) in 2001 revealed that those who were obese had 3.44-7.37 times higher odds of having diabetes than did those with a normal weight [7]. The 1998-2002 NHANES data indicated that of those who had diabetes, 85% were overweight or obese [42]. Hypertension [43], stroke [44], dyslipidemia [45], gallbladder disease [46], sleep apnea [47], and respiratory problems [48], and osteoarthritis [49] are associated with obesity.

Many adolescents are at increased health risk and do not know it. It is likely that adolescents do not internalize the health risks associated with their dietary choices because consequences of their choices are rarely immediate. Adverse health consequences of malnutrition, such as weight gain, progression of chronic disease, and loss of BMD develop gradually and often imperceptibly. For example, an athlete may have low EA, but may not experience menstrual irregularity for several months. Similarly, changes in BMD as a result of low EA may not be detected for a year or longer [16]. One study of college freshmen reported that weight gain occurred at a rate of 24 g/day, which indicates that on average, weight gain may go undetected for a significant period of time [50].

Health habits are often not evaluated until after a problem is detected. For example, a female athlete may not evaluate health habits until after incurring an injury. Similarly, a college freshman may not think twice about the late-night pizza parties until he or she has gained weight and has to buy new clothes. Interviews of college freshmen and sophomores revealed that though they had interest in learning about improving their

diets, the major motivator for dietary change would be diet-related illness or disease [51]. Unlike freshman weight gain, the relationship that dietary intake has with both menstruation and bone loss/stress fracture is not well known. A female high school athlete may not realize that not eating enough to make up for her exercise and training may increase risk for bone fracture.

Surveys of health care professionals as well as collegiate and high school coaches indicate that awareness and knowledge of the Triad is limited. In one study done in a major midwestern metropolitan area, 48% of physicians and only 8% of coaches could correctly identify all three components of the Triad [52]. Considering the low awareness among coaches, it is probable that the relationship between Triad components is likely not well known among female high school athletes. Even after a stress fracture, a female athlete likely does not think to evaluate her menstrual status or dietary intake.

Adolescents are at risk for poor health because they have increased nutritional needs but often poor dietary intake in terms of quality, quantity, or both. Limited awareness of the implications of their current health practices and low knowledge of some diet/health relationships further increase their health risk. Providing nutrition education during adolescence may prevent adverse health consequences. Transitions in lifestyle and activity such as participating in sports or starting college are prime opportunities for providing education. Education aimed at increasing awareness, knowledge, self-efficacy, and skills specific to the lifestyle and activities of the adolescent allows for immediate application and may benefit the immediate and lifetime health of the adolescent.

Study Objectives

1. Assess the prevalence of the Triad among female, high school athletes.
Evaluate athlete and coach knowledge and awareness of the Triad.
2. Create, implement, and evaluate a peer-led nutrition education intervention designed to teach female, high school athletes about the Triad.
3. Develop, implement and evaluate Healthy Eating 101, a peer-led educational intervention for college freshmen aimed at helping freshman obtain or maintain healthy eating habits as they transition from high school to college.
4. Implement and evaluate Viva Vegetables!, a program incorporated into a general education nutrition course that was designed to increase self-efficacy and vegetable intake via online, skill-based vegetable preparation videos and vegetable tasting experiences.

Research described in this dissertation adds to the body of literature regarding the Triad among female high school athletes. Studies included provide the first evaluation of knowledge of all components of the Triad, and utility of a peer-led Triad educational intervention among female high school athletes. In addition, the first evaluation of a screening tool to assess risk for the Triad among female high school athletes is included in this dissertation. These research studies also provide insight into Triad knowledge among high school coaches, as well as an additional evaluation of inadvertent low EA (low EA without elevated risk for disordered eating).

Knowledge of effective strategies for teaching college students about nutrition is enhanced by the research included in this dissertation. Results from these studies provide

increased understanding of the utility of the peer-led model, tasting experiences, and viewing of online skill-based food preparation videos among college students. Additional insight is gained into barriers to healthy eating and preferred modes of education among this population.

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CHAPTER 2
THE FEMALE ATHLETE TRIAD AMONG
HIGH SCHOOL ATHLETES: A REVIEW

Abstract

The female athlete triad (Triad) is a syndrome characterized by low energy availability (energy intake - exercise energy expenditure), menstrual dysfunction, and low bone mineral density [1]. Current research indicates that low energy availability (EA) may be due to disordered eating, but may also be inadvertent. Low EA results in changes to metabolic and reproductive hormones. Decreased estrogen can result in menstrual dysfunction, which can negatively impact bone health. Even in the absence of menstrual dysfunction, low energy availability suppresses bone formation. Though the mechanisms are not fully understood, suppression of growth factors due to energy deficiency inhibits bone growth. Bone loss due to low EA, menstrual dysfunction, and low estrogen levels can increase immediate and lifetime risk for stress fractures. This may negatively impact both current athletic performance/sports participation and mobility/physical functioning later in life. Bone loss, and/or limited bone accrual is often not reversible. Triad components are prevalent among female high school athletes. Triad diagnosis and treatment are discussed, and suggestions for Triad screening and prevention are given.

Introduction

The American College of Sports Medicine (ACSM) Position Stand: The Female Athlete Triad (Stand) describes the female athlete triad (Triad) as an interrelationship

between energy availability (EA), menstrual function, and bone health. As described in the Stand, each component of the Triad has a spectrum ranging from health to subclinical disorders to disease. EA impacts bone health directly by influencing the production of hormones involved in bone growth, and indirectly by influencing bone resorption via menstrual function and estrogen levels. Optimal nutrition supports physical performance, promotes bone growth, and inhibits bone resorption. On the other hand, low EA, which occurs when athletes do not consume adequate energy to compensate for exercise energy expenditure, can result in amenorrhea (the absence of a menstrual period) and osteoporosis [1]. Individuals can move along the various spectrums at different rates and may not exhibit all three conditions simultaneously. Low EA may not noticeably affect menstrual status for weeks or months, and subsequent changes in bone mineral density may not manifest for more than a year [1].

Low Energy Availability

Energy availability is defined as dietary energy intake minus exercise energy expenditure. This refers to the energy that remains after energy is expended for exercise and is the amount of energy available for normal body functions, maintenance, and growth [1]. When an athlete's dietary intake does not compensate for her exercise energy expenditure she is in a state of low EA. In this state, less energy is available for growth, reproduction, regulation of temperature, or maintenance of cells [2]. Available energy is redistributed to facilitate restoration of energy balance and survival, but this redistribution of energy may have a negative impact on the well-being of the athlete [1]. For example, menstrual function may become disrupted as a means of preserving energy for functions

required for survival [3]. Research among habitually sedentary, regularly menstruating women who began exercising showed that 45 kcal/kg of lean body mass (LBM) is considered optimal [4, 5]. When EA falls below 30 kcal/kg LBM menstrual dysfunction occurs [5]. EA below 45kcal/kg LBM but above 30 kcal/kg LBM is associated with suppressed bone formation [6].

Previous studies reported markers of chronic energy deficiency among female athletes. These markers include decreased metabolic rate [7], and a decreased level of triiodothyronine (T3) [8, 9], glucose, insulin [10], and insulin-like growth factor 1 (IGF-1) [10]. Increased levels of growth hormone (GH) [10] and cortisol [10] are also markers of chronic energy deficiency. Increased GH accompanied by decreased growth hormone-binding protein (GHBP) is indicative of GH resistance [11]. These changes in metabolic hormones indicate decreased glucose utilization and increased mobilization of fat for use as energy [12] and preservation of protein [10]. These changes were more extreme among amenorrheic athletes compared to those who had regular menses [9, 10].

There are no existing studies of the effects of chronic energy restriction on sports performance of adolescent female athletes. However, results from studies of adolescent male wrestlers suggest that chronic energy restriction can have negative effects on strength and strength and power. Chronic energy restriction among male wrestlers was accompanied by high levels of GH and low levels of IGF-1. Subsequent decreases in strength and power (average of 13%) were observed [11]. Decreased IGF-1 was also observed among male military trainees whose energy intake was not sufficient to compensate for energy expended. On average, vertical jump, power, and strength decreased by 20% over the course of the 8-week training camp [13].

Another study of adolescent male wrestlers who consumed a diet that provided approximately 23 kcal/kg LBM for 7 days reported no changes in the performance of an 8-minute run at 85% of VO_{2max} . There was, however, a 7% reduction in power (as measured by the Wingate Test) among those whose energy-restricted diet contained a normal percentage of carbohydrates. Those whose energy restricted diet had a high percentage of carbohydrates did not experience a decrease in power [14]. Though low EA may impact performance, many female athletes may have low EA without noticeable changes in body weight or performance. Effects of nutritional inadequacy may not be evident until after bone health is deterred and an athlete incurs an injury.

Disordered Eating

The 1997 the ACSM position stand on the Triad included “disordered eating” as a Triad component. In the 2007 update of the position stand, the wording was changed to “low EA (with or without disordered eating)” [1]. Disordered eating (DE) may lead to low EA, but low EA may exist without disordered eating. Prevalence of disordered eating in female high school athletes ranges from 4-20% [15-18]. Comparisons between studies are difficult due to the differences in assessment tools used.

Studies by Nichols et al, which utilized the Eating Disorders Examination Questionnaire (EDE-Q), reported the DE prevalence to be 18.2% (2006, n = 170) and 20% (2007, n = 423), respectively [15, 17]. Criteria were based on EDE-Q global and subscale (weight concern, shape concern, eating concern, and dietary restraint) scores > 4; the 2007 study included in the criteria the presence of 1 episode of pathogenic weight-control behaviors such as bingeing or vomiting in the previous 28 days. Beals reported that of 23 adolescent volleyball players, none had elevated Eating Disorder

Inventory (EDI) scores, and none reported using laxatives, diet pills, vomiting, or fasting. However, 22% reported advertently restricting their energy intake [16]. Then-Nissenbaum reported that of 311 female high school athletes who participated in a school sport including dance and cheer, 35.4% reported DE, using the EDE-Q (same criteria as Nichols, 2007, except pathogenic weight control behaviors were only counted if they occurred 2 times in the previous 28 days) [18]. The higher prevalence of DE in the study by Then-Nissenbaum may have been due to the inclusion of athletes involved in dance and cheer.

Studies of elite athletes in both Australia and Norway observed higher rates of eating disorders among “lean build” or “aesthetic” sports based on the Diagnostic and Statistical Manual of Mental Disorders-IV criteria. Byrne and McClean reported that among elite, Australian athletes (n = 155, ages 15-36 years) who participated in “lean build” sports (gymnastics, ballet, light-weight rowing, swimming, diving, and long-distance running) had a higher prevalence of eating disorders than those in non-lean sports (volleyball, basketball, and tennis), 30% and 8%, respectively [19]. Sundgot-Borgen and Torstveit conducted a study of 1620 elite female athletes (ages 15-29 years). They reported that the prevalence of eating disorders was higher among aesthetic athletes (diving, figure skating, and gymnastics) (43%) compared to game ball athletes (16%) [20]. A study that included 210 German female high school athletes reported no differences in risk for disordered eating (using a score > 10 on the Eating Attitudes Test) (EAT-26). However, those classified as elite athletes had a significantly higher prevalence of risk for disordered eating than those who were classified as non-elite athletes [21].

Inadvertent Low Energy Availability

Though eating disorders can lead to low EA, they are not the sole cause. Chronic inadequate consumption of calories relative to calories expended in exercise can also contribute [22]. Busy schedules, inattention to the amount of food consumed, lack of knowledge of nutritional needs, or blunted hunger cues may contribute to inadequate dietary intake among athletes and thus contribute to inadvertent low energy availability.

Hubert, King, and Blundell evaluated the hunger response post-exercise among 11 healthy, female college students. Ad libitum food intake at lunch was assessed following one of the following treatments: 1. exercise, high-energy breakfast (500 kcal) (EHB) 2. exercise, low-energy breakfast (64 kcal) (ELB) 3. No exercise, high energy breakfast (NEHB) 4. No exercise, low-energy breakfast (NELB). The participants served as their own controls and completed one treatment per week for four weeks. Food for both the calorie-controlled breakfast and ad libitum lunch was provided at a research center [23].

When exploring the effects of breakfast intake and exercise, participants were hungrier at lunchtime after consuming LB ($p < 0.05$). LB appeared to have an effect on hunger before lunch regardless of exercise ($p < 0.005$). Participants in the LB groups consumed more food and calories during lunch than did those in the HB groups ($p < 0.05$), although they failed to consume enough calories to compensate for the LB. There were no observed differences when comparing the food and kcal intake of those who exercised and those who did not, regardless of breakfast intake [23].

Additional support for this notion comes from participant reports from the 1998 study by Loucks et al (1998) [4]. Participants with low EA were satisfied with their energy intake and found it difficult to consume the amount of food necessary to reach

adequate EA [4]. Few studies evaluating the impact of inadvertent low energy availability among athletes have been published [1]; however, it is an increasingly important area of research and topic of presentations at professional conferences. A recent study by Hoch et al reported low EA among 36% of female high school athletes; however only 5% were at risk for DE [24].

Menstrual Irregularity

On average, once menses begins menstrual cycles occur every 28 ± 7 days; this is termed eumenorrhea; deviations from this average plus standard deviation are termed menstrual irregularity (MI). The definition of MI varies from study to study, which makes comparison difficult. MI is further categorized as oligomenorrhea (>35 days between menstrual cycles), and secondary amenorrhea (post-menarche absence of menstrual cycles for > 90 days) [1]. Menstruation may be irregular after menarche. However, results from large studies indicate that menstrual cycles are usually between 21 and 45 days, even in the first gynecologic year [25, 26]. The World Health Organization conducted a study of 602 girls ages 11-15 years in which menstrual diaries were kept beginning at menarche. By the end of the 2-year study, 86% of participants had achieved menstrual regularity [27]. According to NHANES 1999-2002, the average age for menarche for females in the United States is 12.3 years (CI = 12.24 to 12.45) [28]. This would suggest that on average, high school athletes have achieved menstrual regularity.

Results from a study by Hoch et al reported that MI is more prevalent among female high school athletes compared to similarly aged females who are sedentary (54% and 21%, respectively). It should be noted that the high prevalence may be due to the

inclusion of “history of primary or secondary” amenorrhea in addition to the current MI assessed in the other studies discussed here [24]. Nichols et al reported MI prevalence of 23.5% (2006, n = 170) and 20% (2007, n = 423) among high school female athletes participating in a variety of sports in California (see **Disordered Eating** for more study details) [15, 17]. Among elite female high school volleyball players (n = 23), 48% reported irregular menstrual cycles [16]. Thein-Nissenbaum reported a prevalence of 18.8% for MI among 311 female high school athletes (including athletes participating in aesthetic sports) [18].

Variation in the estimated prevalence may be due to differences in sample size, MI criteria, and sports included. Nichols et al (2007) observed that among their sample, those in lean-build sports, such as cross-country, track, and swimming, had higher prevalence of MI than did non-lean build sports (volleyball, basketball, soccer, softball, lacrosse, and field hockey) [15]. In the study by Thein-Nissenbaum et al, MI was more common among aesthetic athletes than those participating in Team/Anaerobic sports; however, this observation was not statistically significant [18]. The higher percentage of MI may have been influenced by the level of competition; participants were elite volleyball players.

Estrogen and Menstrual Dysfunction

The ovaries are the primary source of systemic estrogen for premenopausal non-pregnant women [29]. Estrogen is secreted by the ovaries at various points in the ovarian cycle. During the follicular phase (days 1-14) an oocyte-containing follicle is developed as a result of the secretion of anterior pituitary hormone, follicle stimulating hormone (FSH). The follicle secretes estrogen and progesterone. The follicle continues to secrete

estrogen as it matures from a primary follicle, to a secondary follicle, to a vesicular follicle. The vesicular follicle releases the oocyte (ovulation) [12].

Ovulation occurs at about day 14 of the menstrual cycle, which is associated with a peak in estrogen. This serves as a feed back mechanism resulting in a cessation of FSH secretion and an end to the follicular phase [12]. The spike in estrogen induces the secretion of gonadatropin-releasing hormone (GnRH) from the hypothalamus.

Subsequent leutinizing hormone (LH) release from the anterior pituitary initiates the luteal phase in which the empty follicle (corpus luteum) is developed [12].

The release of GnRH, and subsequent release of LH, is paramount in reproductive function [5]. Disruption of pulsatile release of GnRH and subsequent pulsatile release of LH causes menstrual and ovarian dysfunction [30]. Ovarian dysfunction, meaning that the oocyte does not develop and is not released (anovulation), interferes with cyclic changes to the endometrium and can result in amenorrhea [31]. This type of amenorrhea is termed hypothalamic amenorrhea [32]. Most cases of secondary amenorrhea The majority of cases of secondary amenorrhea are anovulatory [31].

Loucks, Verdun, and Heath (1998) provided evidence that low EA, not the stress of exercise, reduced the frequency and increased the amplitude of the pulsatile release of LH [4]. Nine regularly-menstruating, previously sedentary women (ages 18-29 years) participated in strenuous exercise (approximately 70% of aerobic capacity, 4 hours/day) for 4 days. Participants were assigned in a random order to a treatment in which their exercise and food intake was regulated at either 10 kcal/kg LBM or 45 kcal/kg LBM. Blood samples were taken every 10 minutes for 24 hours on days 8, 9, or 10 of 2 of their menstrual cycles after 4 days of strenuous aerobic exercise to assess LH pulsatility.

Findings were compared to results from a previous study with similar EA treatments among non-exercising women [33].

The stress of exercise did not result in LH disruption. However, among participants with low EA, the pulsatile release of LH was disrupted; frequency was increased by 10% and the amplitude was increased by 36%. Such changes in frequency and amplitude follow the pattern of LH release in amenorrheic women [34]. The earlier study of non-exercising women with low EA reported a LH frequency suppression of 23%, and LH pulse amplitude increase of 40% [33], suggesting a protective effect of exercise on LH pulsatility. A study by Williams et al reported that disruption in the release of LH was achieved by a combination of dietary restriction and increased energy expenditure [35]. These findings suggest that low EA is the common factor in the disruption of LH pulsatile release among regularly-menstruating women.

Bone Health

Bone is a tissue composed of an organic matrix with mineral depositions to provide strength to the matrix. Bone growth initiates during embryotic development and continues as a child grows. Bone growth is accelerated during adolescence; the majority of bone growth occurs during this time [36]. Most linear growth ends by age 18 for women and age 20 for men, although peak bone mineral density (BMD) is reached between ages 25-30 years [12, 36]. Bones are classified as either cortical or trabecular. Cortical bone is very compact and makes up most of the bone tissue in the body including long bones. Trabecular bone is spongier and less dense than cortical bone. The open

structure of trabecular bones has a large surface area, and is more affected by estrogen than is cortical bone [36].

Even after linear growth ceases, bone tissue is constantly remodeled to maintain bone strength and integrity [12]. Osteoblasts (bone building cells) and osteoclasts (bone absorbing cells) work together to remodel bones. Osteoclasts secrete acids and enzymes that break down, or resorb bones creating small cavities on the bone surface [36]. Osteoblasts fill these cavities by secreting the organic matrix, which is composed of type I collagen. Collagen polymerizes into a fiber with three-strands [36]; minerals soon precipitate on the mature collagen fibers. This process is initiated by Interleukin-1, Interleukin-2 and other cytokines [36, 37]. Physical stress such as exercise promotes the action of osteoblasts thereby increasing BMD [12].

Hormones such as vitamin D, estrogen, growth hormone (GH) and thyroid hormone promote bone growth. Vitamin D serves to increase the absorption of calcium. GH promotes bone growth and regulates the rate at which protein synthesis occurs [12]. Thyroid hormone promotes bone growth by increasing metabolic activity on the cellular level [12]. Estrogen increases the number of osteoblasts [12, 38], appears to influence calcium absorption in the intestines [39], and may increase reabsorption in the kidneys [40].

During growth, osteoblast activity is greater than osteoclast activity which results in bone growth [12]. In healthy, young individuals the synchronized actions of the osteoblasts and osteoclasts result in maintenance of BMD. Adequate nutrition and eumenorrhea in the presence of exercise promote optimal bone health by promoting adequate estrogen levels which inhibits bone resorption [1]. For this reason, athletes often

have higher bone mineral density at a given age when compared to non-athletes of the same age [1]. Weight-bearing exercise promotes bone growth more so than does non weight-bearing exercise [41] due to increased force on the bone, which stimulates osteoblasts [12]. A study by Torstveit et al compared the bone mineral density of 300 elite Norwegian athletes and 300 non-athletic controls. Athletes had 3-20% higher bone mineral density than controls ($p < .001$). Athletes who participated in high impact sports, such as power lifting, gymnastics, and sprinting, had higher bone mineral density than did those who participated in lower-impact sports such as swimming, biking, and bowling. BMD of sedentary individuals was similar to that of those who participated in low impact sports [41]. A study of female, high school varsity athletes and age-matched sedentary controls provided evidence to suggest that exercise is associated with higher BMD among female adolescent athletes, even in the presence of MI. In this study athletes had both higher BMD and higher prevalence of MI as compared to sedentary controls (30% vs. 15%; 54% vs. 21%, respectively). The effect of exercise on BMD among women who have low levels of EA and estrogen is not known [1].

Type I osteoporosis, also called estrogen- or androgen-deficient osteoporosis, traditionally occurs in post-menopausal women due to the cessation of estrogen production in the ovaries [36]. In this state, osteoblasts are unable to completely fill the small cavities created by the osteoclasts and a continual cycle of bone loss occurs as a result [42]. Accelerated bone loss occurs for men when they are in their sixties or seventies as a result of decreased testosterone [12, 36]. Women experience bone loss much earlier as a result of decreased estrogen secondary to menopause [12].

Osteoporosis can be influenced both by natural decline in bone mineral density with age and failure to reach peak bone mass in adolescence [43]. Loss of menses, or amenorrhea, increases risk for osteoporosis at any age due to decreases in estrogen levels. However, young women with low EA may also experience bone loss as a result of non estrogen-dependent mechanisms [6]. Bone loss is associated with increased risk for fracture [44-46].

Estrogen-Related Bone Loss

Estrogen and Bone

Estrogen effects bone growth and remodeling by influencing osteoblasts and osteoclasts. A study by Jilka et al reported that in vitro, estrogen inhibits the production of Interleukin-6, which stimulates the production of osteoclasts [37]. Ex vivo cultures of ovariectomized mice had high levels of osteoclasts in bone. Estrogen prevented the increase in osteoclast production in bone [37]. In vitro, osteoblast proliferation was enhanced in the presence of estrogen [38]. Higher calcium content of the cultures incubated with estrogen [47] suggests increased matrix mineralization in the presence of estrogen.

Estrogen and Calcium

Intestinal Calcium Absorption

When compared to controls, ovariectomized rats had lower intestinal calcium absorption. When estrogen was replaced, there was a significant increase in calcium absorption among ovariectomized rats [48]. The calcium absorption fraction was studied

in a sample of 189 middle-aged women. A greater fraction of consumed calcium was absorbed when calcium intake was low (.45 when consuming 200 mg), and a much smaller fraction of calcium was absorbed (.15) when calcium intake was high (> 2000 mg). A noteworthy observation was a severe drop in the efficiency of calcium absorption among the participating women at the time of menopause (0.022) [39].

Reabsorption of Calcium in the Kidney

Previous animal studies have reported conflicting results regarding calcium reabsorption in the kidneys [49]. In a study using rabbit kidney distal tubules, Brunette and Leclerc reported increased calcium excretion when incubated with estrogen [49]. However, human studies provided evidence that estrogen positively affects calcium reabsorption in the kidney. A study by Nordin et al compared the urinary calcium levels of pre- and post-menopausal women. The post-menopausal women had higher levels of urinary calcium than did the pre-menopausal group. The authors concluded that increased urinary calcium excretion was due, in part, to decreased reabsorption in the kidney as a result of estrogen deficiency [40]. Adami et al reported that estrogen-deficient (post-menopausal women without estrogen treatment) women had higher urinary calcium levels, and lower rates of renal calcium reabsorption than did estrogen-replete women (pre-menopausal or post-menopausal with estrogen therapy) [50].

Menstrual Irregularity and Bone loss

Previous research indicates that bone mineral density is lower among amenorrheic athletes. A study by Drinkwater et al evaluated 14 amenorrheic and 14 eumenorrheic athletes. These researchers found that the amenorrheic group had lower BMD at the

lumbar vertebrae site (1.12 g per squared centimeter) compared to the eumenorrheic group (1.3 g per squared centimeter) [51]. An earlier study by Marcus et al [52] reported that amenorrheic elite athletes had lower BMD than eumenorrheic elite athletes, but higher than sedentary controls and previously published data of amenorrheic active women [53]. These findings suggest that amenorrhea may decrease the bone-building effects of exercise.

A cross-sectional study by Barrak et al compared risk factors of athletes with and without elevated bone turnover as measured by markers of bone resorption (abnormal values of bone-specific alkaline phosphatase (BAP) and C-telopeptides of type I collagen (CTX) compared to age and sex-specific norms). Their results indicated that amenorrhea was a significant risk factor for elevated bone turnover (Odds ratio = 20.83), whereas the impact of calcium intake did not have nearly the magnitude (Odds ratio = 5.5) [45]. Nichols et al also observed lower BMD at the trochanter site for oligo/amenorrheic athletes than for athletes who were eumenorrheic [15]. Areas composed of mostly trabecular bone, such as the spine, may be more sensitive to estrogen due to the open structure and large surface area [36]. Consequently these areas are more susceptible to BMD loss following menstrual dysfunction [54, 55].

Menstrual Irregularity and Injury

MI and low BMD are associated with increased risk for stress fractures and musculoskeletal injuries [44-46], which can limit or exclude athletes from sports participation and competition. Additionally, incidence of Triad components may increase lifetime fracture risk. Injuries incurred prior to menopause are predictive of post-menopausal fractures [56].

Menstrual irregularity in college athletes has been reported to be a strong predictor of injuries [44]. In a study of 240 long distance runners, prevalence of stress fractures was highest among those with very irregular menstruation (0-5 menses per year) (49%). Fractures were less prevalent for those who were irregular (6-9 menses per year) and eumenorrheic (10-13 menses per year), 39% and 29%, respectively [45].

A study of 163 female high school athletes conducted by Rauh, Nichols, and Barrak observed that athletes with oligo/amenorrhea had a 2.9 times greater risk of musculoskeletal injury during the season than did their eumenorrheic counterparts ($p = 0.004$) [53]. Those with low BMD (Z-scores of -2) had a 4.5 times greater risk for injury [44].

Non-Estrogen Dependent Mechanisms for Bone Loss

Research by Ihle and Loucks highlights negative changes in bone metabolism that are not due to estrogen deficiency. They studied the effects of energy balance (45 kcal/kg LBM) and three levels of caloric restriction (30, 20, and 10 kcal/kg LBM, respectively) on markers of bone formation and resorption including plasma osteocalcin (OC) and serum type I procollagen carboxy-terminal propeptide (PICP) among 29 young women who were sedentary, had a normal weight, and had regular menstrual function. N-terminal telopeptide (NTX) was used as a marker of bone resorption. OC is a binding protein which is synthesized by osteoblasts which functions to bind calcium during matrix mineralization [6]. PICP is cleaved off of pro-collagen molecules during collagen polymerization. NTX is cleaved off of collagen molecules during bone resorption [6].

Bone resorption was only affected at the level of 10 kcal/kg LBM as evidenced by elevated NTX. However, bone formation was repressed, as evidenced by decreased PICP

at levels below 45 kcal/kg LBM but above 30 kcal/kg LBM. The authors concluded that the effect of mild low EA could negatively affect bone formation and attainment of potential peak bone mass, and that the mechanism for these effects were independent of estrogen [6].

Athletes with chronic energy restriction often exhibit, low levels of glucose, insulin, IGF-1 [10], T3 [8, 9], and GHBP with elevated GH [11]. Decreased metabolic rate [7], GH resistance [11], decreased glucose utilization, and increased mobilization of fat stores are also markers of chronic energy restriction [10]. Disruption of these hormones may result in non estrogen-dependent bone loss.

Irreversibility of Bone Loss

Most research suggests that loss in BMD due to menstrual dysfunction is not reversible. Drinkwater et al conducted a 15.5-month follow-up study that compared the lumbar vertebrae BMD for eumenorrheic athletes (n = 7), previously amenorrheic athletes who had resumed menses (n = 7), and amenorrheic athletes (n = 2). At follow-up, amenorrheic athletes showed a decrease in BMD (-3.4%) [57]. The group who had resumed menstruation showed an increase BMD of .071 g/cm² (6.3%) ($p < .01$), however, they still had BMD that was lower than the eumenorrheic athletes. Amenorrheic athletes and cyclic athletes who were previously amenorrheic had BMD values lower than those of eumenorrheic sedentary women. Though the low number of participants who were amenorrheic was a limitation, results from this study suggest that eumenorrheic athletes had BMD values higher than those of eumenorrheic sedentary women from a previous study [57].

Drinkwater et al reported that BMD of oligo/amenorrheic athletes was 84.8% of the BMD of eumenorrheic athletes [54]. A later study by Keen et al re-evaluated the same athletes 6-10 years later. Those who had previously been oligo/amenorrheic but had resumed regular menstrual function had BMD that was 84.4% of athletes who had always had regular menstruation, indicating that bone loss was not reversed despite resumption of normal menstrual function [55]. A study of 25 premenopausal ultramarathon runners indicated that low BMD in the lumbar spine was associated with a history of menstrual dysfunction regardless of resumption of normal menses [58].

Diagnosis

Energy Availability

Exercise Energy Expenditure

In order to assess EA, exercise energy expenditure (EEE) must be assessed. Direct calorimetry directly measures the heat released from a person's body. This technique requires a specially designed room that can sense changes in temperature. While direct calorimetry can measure resting energy expenditure (REE) relatively accurately, it can not accurately detect rapid changes in expended energy associated with exercise. In addition, exercise machines create heat that confounds the measurement [59]. This technique is costly and does not reflect free-living conditions [60].

Indirect calorimetry assesses energy expenditure by determining O₂ utilization. This is determined by finding the difference in volumes of inspired and expired CO₂ and O₂. Specialized equipment measures the volume of the air and the fraction of both CO₂ and O₂ using the following equations: $VO_2 = (V_I \times F_I O_2) - (V_E \times F_E O_2)$ and $VCO_2 = (V_I$

$\times F_I\text{CO}_2) - (V_E \times F_E\text{CO}_2)$, where V_I = volume of inspired air, $F_I\text{O}_2$ = fraction of oxygen in the inspired air, V_E = volume of expired air, and $F_E\text{O}_2$ = fraction of oxygen in expired air, $F_I\text{CO}_2$ = fraction of CO_2 in the inspired air, and $F_E\text{CO}_2$ = fraction of CO_2 in expired air [59].

The respiratory exchange ratio (RER) can then be calculated ($V\text{CO}_2 / V\text{O}_2$). The RER varies according to exercise intensity and subsequent type of substrate being utilized (i.e., fat has a lower RER than does carbohydrate or protein). Caloric expenditure for various RERs have been established [59]. Indirect calorimetry provides the best measure of REE and EEE among healthy, free-living individuals [59].

Indirect calorimetry in the lab setting requires cumbersome equipment and trained personnel. Portable calorimeters allow for more measurements in regular exercising environments such as on a playing field [59]. Cost is a barrier to use of this technique, particularly in large studies in which EEE is measured for each participant.

The doubly labeled water technique also measures O_2 and CO_2 . Participants consume $^2\text{H}_2$ and ^{18}O which diffuses throughout the body. Turnover rates of these isotopes are measured via samples from saliva, blood or urine. CO_2 production can be calculated from the turnover rates and used to estimate energy expenditure. This method requires several weeks of sample collection due to the slow turnover rate of the isotopes. The doubly labeled water method accurately determines overall energy expenditure, but is not well suited for measuring short-term EEE [59].

Resting energy expenditure can be measured via direct or indirect calorimetry, or estimated using one of many equations. Harris and Benedict conducted a study among healthy adults in the United States in which regression equations that included weight,

height, and age were derived from indirect calorimetry data [61]. A study by Roza and Shizgal reported that estimated REE was within 14% of REE measured by indirect calorimetry [62]. The World Health Organization (WHO) conducted a similar study, but with people from many different countries. The WHO equations are age and gender specific and are derived from the individual's weight. Estimated REE are moderately to highly correlated ($R = 0.65-0.97$) to measured REE, depending on the age and gender group. Estimated REE with measured REE for females ages 10-18 years had a correlation of 0.90 [63].

If REE and activity type and duration are known (measured or estimated), EEE can be estimated with the use of metabolic equivalent (MET) values from the Ainsworth Compendium of Activities [64]. One MET is the energy expended while sitting still. MET values are a ratio of energy expended in relation to energy expended while sitting [65]. The constant of caloric expenditure per MET allows for estimation of EEE. EEE estimates are more accurate if REE is measured and not estimated [60]. Accurate exercise logs are necessary for this technique.

Accelerometers are portable devices that measure movement of part(s) of the body such as a limb. Accelerometers measure steps per minute, etc. and determine MET values accordingly. The MET values can then be used to estimate EEE. Vanhelst et al reported that EEE estimated by MET values from the accelerometer was highly correlated with oxygen consumption measured by indirect calorimetry [66].

Energy Intake

There are no established guidelines for assessing energy intake to evaluate EA. The doubly labeled water technique is used to measure energy expenditure and is used as

a biomarker with which to compare reported dietary intake. Compared to doubly labeled water, energy intake assessed via food logs, food recalls, and food frequency questionnaires are often underreported [67]. It should be considered, however, that validation via the doubly labeled water technique exists on the basis that among weight-stable individuals, energy intake and total habitual energy expenditure are approximately equal [67]. This validation method would therefore be limited among populations such as adolescents who are still growing. In addition, the nature of the samples required (urine, blood, saliva), and the necessary duration (several weeks) are limitations to this validation method.

Three-day food logs are often used to assess short-term intake [68]. Not having to rely on memory is a strength of this method. However, recording dietary intake may prompt individuals to make changes to their dietary intake during the recording period [68]. Food recalls are limited by participant memory, and accuracy in reporting food intake. Self-consciousness about diet may result in underreporting [60]. Underreporting has been observed with both the use of recalls [69] and food diaries [70]. Dietary history methods have been shown to be good estimators of energy intake among adolescents [71]. The required 1-2 hour meeting with a trained interviewer necessary to obtain a dietary history is a limitation of this method [60].

Amenorrhea

There is no specific blood test to diagnose hypothalamic amenorrhea; however, gonadotropins are characteristically low or normal, estradiol is low, prolactin and thyroid stimulating hormone are in the normal range. Hypothalamic amenorrhea is diagnosed by excluding other causes of amenorrhea. A pregnancy test is conducted first.

Checking levels of FS and LH is conducted to rule out polycystic ovary syndrome (PCOS); a high LH/FSH ratio is indicative of PCOS. Hyperprolactinemia may be indicative of a pituitary tumor; this is investigated using magnetic resonance imaging [72]. Ovarian failure is diagnosed by FSH and LH tests; high FSH is indicative of ovarian failure [72]. Thyroid stimulating hormone (TSH) is measured to rule out thyroid disease; high or low levels of thyroid hormones are indicative of thyroid disease which can also induce amenorrhea [31]. Amenorrhea with low FSH suggests hypothalamic or pituitary dysfunction [31].

Osteoporosis

Bone health and osteoporosis are assessed by determining BMD. BMD is measured via dual energy x-ray absorptiometry (DXA). Multiple criteria for the diagnosis of low BMD and osteoporosis exist; however, most are not specifically designed for high school athletes. The International Society for Clinical Densitometry (ISCD) recommends that the World Health Organization (WHO) criteria not be used because it compares the individual's BMD to average peak bone mass of postmenopausal Caucasian women. However, the ISCD criteria of >-2 SD below the mean may be too conservative for female athletes who may have higher BMD as a result of weight bearing exercise [1]. The ACSM and ISCD recommend comparing bone density to an age-matched norm, categorizing athletes as having low BMD if BMD Z-scores fall between -1 and -2 SD with the presence of a clinical risk factor such as low body weight or prior fracture. A BMD Z-score of ≥ -2 is the suggested criteria for categorizing athletes as having osteoporosis [1]. Because low bone mineral density may not be noticeably affected for a

year, attention should be paid to menstrual status and energy availability among athletes [1].

Because changes in BMD may not be seen for over 1 year, blood markers can be a more sensitive indicator of change in bone formation and resorption. Plasma osteocalcin (OC) and serum type I procollagen carboxy-terminal propeptide (PICP) are used as markers of bone formation. OC is a binding protein found in bone that is made by osteoblast and functions to bind calcium during matrix mineralization [6]. When a matrix is being formed, PICP is cleaved from pro-collagen molecules; blood levels of PICP is a measure of current collagen formation. During bone resorption, N-terminal telopeptide (NTX) is released from collagen molecules and circulated; therefore, NTX is used as a marker of bone resorption [6]. Both methods are costly and may be limiting in certain situations.

Treatment

The main treatment goal for athletes with the Triad is raising EA to 45 kcal/kg LBM. Though physicians often prescribe hormone replacement therapy, the ACSM position stand indicates that the best treatment for the Triad is to increase EA. Treatment for the Triad should be interdisciplinary. A Registered Dietitian should be on the team to assess energy intake and dietary adequacy. In the case of eating disorders, the team should include a clinical psychologist [1].

Hormone replacement therapy (HRT) has been shown to slow the decline of bone loss in post-menopausal women [36]. There are risks associated with HRT such as increased risk for cancer [73]. Studies of the effectiveness of HRT and oral contraceptive

pills (OCP) among amenorrheic athletes are mixed. Some, but not all, studies report some improvement in BMD, however, increases in weight may be a confounding factor in these studies [1]. Pharmacological therapy is not advised for young females due to the lack of evidence of efficacy, and the risk of premature closure of the growth plates [1]. While these treatments may influence resumption of menstruation, it does not address the underlying problem of low EA [1]. The first recommended treatment strategy is developing a personalized plan to increase energy availability by making modifications to dietary intake, EEE, or both [74, 75].

Prevention of low EA is indicated to avoid MI and bone loss. The Stand recommends raising awareness of the risks associated with low EA and MI. It also recommends that education regarding nutritional requirements, particularly energy, calcium, and vitamin D, be provided. Teaching young athletes about the benefits of weight-bearing exercise on lifetime health is also recommended [1].

Summary and Conclusions

Menstrual irregularity and injuries are common among female high school athletes. Low EA among this population has not been studied extensively. One study reported that low EA was prevalent among female high school athletes. Few of these athletes had increased risk for disordered eating, suggesting that in the study population low EA was largely inadvertent [24]. Immediate and long-term consequences such as injury and osteoporosis are well documented. Some research suggests that the negative impact that low EA and MI has on bones may be irreversible. Diagnosis of Triad components requires analysis of dietary intake and EEE. Indirect calorimetry is a good

method for assessing EEE. A 3-day weighted food log validated via doubly-labeled water would be an ideal method for assessing dietary intake. Methods such as food and exercise logs may be more feasible in terms of equipment, cost, and participant burden. MI is often reported via menstrual questionnaires, although extensive medical tests are required to verify that MI is hypothalamic in nature. BMD is often assessed via DXA and compared to age and gender specific normative values. However, blood markers may be more sensitive measures of short-term bone growth. Injuries are often assessed as an alternative measure of BMD, or in addition to BMD measurements. The main objective for treating the Triad is to increase the athlete's EA. Oral contraceptives are not recommended for treatment of functional hypothalamic amenorrhea because it does not correct the underlying problem (low EA). Prevention methods such as consciousness-raising and athlete education are warranted.

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CHAPTER 3
KNOWLEDGE OF THE FEMALE ATHLETE TRIAD AMONG FEMALE HIGH
SCHOOL ATHLETES AND THEIR COACHES

Abstract

Purpose: To evaluate the prevalence of risk factors for the female athlete triad among female high school athletes (ages 14-17 years), and to assess knowledge/awareness of the Triad among athletes and their coaches. **Methods:** Female athletes ($n = 240$) and their coaches ($n = 10$) from 2 high schools in the western United States completed brief surveys. 190 were included in the analyses of the menstrual history questions. Triad knowledge was assessed for 170 participants. **Results:** Most (87%) athletes were healthy weight, but 60% felt pressure to be a certain weight. 17% reported a history of stress fracture. 21% had a history of secondary amenorrhea, and 64% reported menstrual irregularity. Of the 152 who had menstrual irregularity, those who had reached menarche ≥ 2 years previous ($n = 123$) were at greater odds of having menstrual irregularity than girls with more recent menarche ($n = 29$) (OR = 3.95, $p = .014$). Only 5% of athletes had heard of the Triad, but none could list the components. Average Triad knowledge score was 2.97 ± 1.61 out of 8. Coaches reported that they observed athletes with Triad risk factors, but had poor knowledge of the Triad. Most were comfortable discussing menstruation with their athletes, but had no screening procedures, and provided limited nutrition education. Barriers to screening and education were time, knowledge, and educational resources.

Conclusions: Menstrual irregularity (67%) and Triad risk factors (46% had 2 or more) were common among athletes. However, Triad knowledge among athletes and coaches was low. Screening and education may increase Triad knowledge and decrease Triad prevalence among high school athletes. Efforts should focus on educating coaches and providing them with educational resources.

Introduction

The female athlete triad (Triad) is a condition characterized by low energy availability (energy intake – exercise energy expenditure), menstrual dysfunction, and bone loss [1]. The Triad is a problem among female high school athletes [2-5] but may also impact sedentary adolescent females as well [3]. There is evidence to suggest that bone loss associated with the Triad may not be fully reversible even when energy availability increases and menstrual regularity returns [6-8]. The Triad can negatively impact immediate and lifetime bone health and fracture risk [9-11]. Stress fractures can exclude athletes from participation in team practices and competitions.

Previous studies reported that knowledge of the Triad and its health implications were largely unknown among high school and college coaches [12, 13]. A study of 91 college coaches reported that only 43% could correctly list all 3 components of the Triad. One study that included high school and college coaches reported that only 8% could correctly identify all 3 components of the Triad, and only 16% of coaches reported asking female athletes questions about menstruation [12].

In 2007 the American College of Sports Medicine refined the definition of the Triad. The College replaced Triad component “disordered eating,” with “low energy

availability with or without disordered eating” [1]. Studies prior to 2007 do not accurately reflect the knowledge of the Triad among coaches of female high school athletes.

Considering the low levels of Triad knowledge of coaches of high school athletes reported in previous studies, it is likely that few coaches understand the impact that low EA can have on menstrual and bone health.

It is likely that high school athletes have limited Triad knowledge as well. A study by Feldman et al reported that most female high school athletes were unfamiliar with the relationships between menstrual dysfunction, bone mineral density, and injury risk (median score was 1 out of 6) [14]. This study did not, however, assess female high school athletes’ knowledge of the low energy availability and its consequences.

Increased Triad awareness among athletes may result from pre-season screening that focuses on risk for the Triad and knowledge of its health effects. In addition, screening would provide valuable information to guide the development of educational interventions for teams. Standardized screening procedures are not established or required in the college or high school settings. Previous studies reported that few colleges had adequate screening procedures in place [15] and it is likely that this practice is rare in the high school setting as well.

The objectives of this study were to 1) evaluate the awareness/knowledge of the Triad and its health implications, as well as coaches’ current practices regarding Triad screening and intervention, and 2) explore the use of a brief survey to assess knowledge and prevalence of Triad risk factors among female high school athletes. The results of this survey will be used to guide the development of future screening and intervention programs.

Methods

Athletes

Two hundred forty female athletes from 2 high schools in the western United States participating in the following sports were invited to participate. Members of the female cross-country, volleyball, soccer, tennis, drill, cheer, color guard, and swimming teams participated in this study. Participants were recruited via a letter of information sent home prior to survey administration. Parents and/or athletes who did not wish for the athlete to participate had the option to return a signed document that would exclude the athlete from the study. No documents were returned. Participants were not compensated for completing the survey. All procedures were reviewed and approved by the Utah State University Institutional Review Board.

Participants completed a 34-question survey designed to assess knowledge of the Triad, and prevalence of self-reported Triad risk factors. The survey was completed after practice, and before a registered dietitian gave a nutrition/Triad presentation. Triad knowledge/awareness was assessed using a modification of questions used by Pantano [13], and Feldmann et al [14] with 3 questions added to capture information about energy availability. Questions assessing general nutrition knowledge were also included. To prevent guessing, knowledge/awareness questions had the response options of True/False/I don't know. Menstrual and stress fracture history questions were from a screening tool developed by Beals and Hill [16] that has been used in the collegiate, but not high school, athlete population. The breakdown of the questionnaire (see Appendix B) was as follows:

- Demographics (4 questions)

- Triad knowledge (11 questions, including 3 EA questions)
- Nutrition knowledge (4 questions)
- Triad risk factors including eating behaviors (2 questions), body weight beliefs (3 questions), menstrual history (8 questions), and history of stress fracture (2 questions).

Coaches

Seven coaches of the sports teams who were asked to complete the athlete survey were invited to complete a 30-question, anonymous, online survey. A modification of a tool created by Pantano [13] addressed each Triad component in 3 sections: knowledge/awareness, coach observations of Triad risk factors among athletes, and course of action/current practices. The survey had primarily free-response questions. All procedures were reviewed and approved by the Utah State University Institutional Review Board.

Analysis

A reference age and date of birth was assigned for each school grade-level reported. Menstrual irregularity was defined as those who reported somewhat or very irregular menstrual cycles (within 4-10 day variation, or >10 day variation, respectively) [16]. Number of Triad risk factors was determined by adding up the presence of the following attitudes or behaviors: history of amenorrhea, history of stress fracture, self-reported not eating enough kcals, underweight (BMI-for-age <5%ile), pressure to be a certain weight, and wanting to lose >10 lbs but were in a healthy weight range. A Triad knowledge score was computed by summing across the 8 T/F/I don't know Triad questions, where correct answers were assigned a score of 1 and incorrect or I don't know answers were assigned a score of 0. Mean differences in responses among teams and

coaches were assessed using analysis of variance (ANOVA) with Hochberg's GT2 *post hoc* test. Comparisons of categorical variables were conducted using Chi Squared distributions and subsequent odds ratios, with Fisher's exact test in the case of low expected frequencies.

Results

Athletes

Female athletes representing cross-country, volleyball, soccer, tennis, drill, cheer, color guard, band, and swimming teams were invited to participate. Of the 408 who were invited, surveys were received from 240 (59%). Most participants (95%) were white, and 87% were considered normal weight according to their self-reported BMI for age percentile [17]. Nine percent were overweight or obese, and 4% were underweight. Sixty-one percent wanted to lose weight. Average desired weight change was -6.09 ± 10.34 lbs (range = -55 – 23 lbs). Sixty percent felt pressure to be a certain weight. The most commonly selected sources of this pressure were the athletes themselves and society/media. Seventeen percent reported a history of stress fracture. Eighty percent thought they ate enough (Table 3-1).

Questions regarding menarche were completed by 237 participants. Twelve (6.2%) had not achieved menarche; and 4 (33%) of those were classified as primary amenorrhea because they were ≥ 15 years old [18]. Average age at menarche was 12.86 ± 1.29 years. Participants were asked if they could accurately answer questions regarding their menstrual status. Of the 225 who had achieved menarche, any who left the question unanswered ($n = 4$) or indicated that they could not accurately answer menstrual

questions ($n = 31$) were excluded from analysis (190 participants (79%) remained in analysis of menstrual questions).

Over half (63%) reported menstrual irregularity, but only one reported current secondary amenorrhea. However, 39 (21%) had a history of secondary amenorrhea, 9 (23%) of which were within two years of menarche. Of the 152 with menstrual irregularity, 81% were not within 2 years of menarche. Additionally, girls who had reached menarche ≥ 2 years previous ($n=123$) had a 3.96 times higher odds of having menstrual irregularity than girls with more recent menarche ($n=29$), ($p = .014$). On average, the athletes reported $1.9 \pm .97$ Triad risk factors. Forty-six percent of athletes had 2 or more risk factors.

Only 5% had heard of the Triad, and none could correctly list the Triad components. Due to refinements of the survey questions, Triad knowledge was assessed for 170 (71%) of participants. Participants answered few Triad knowledge questions correctly (2.97 ± 1.61 out of 8). Twenty-nine percent thought that skipping a period during sports performance was normal. Half (49%) knew that not eating enough could cause them to lose their period. Only 17% knew that skipping their period could make their bones weak (Table 3-2). Triad knowledge score differed among teams ($p = .008$). Cheerleaders had the highest average Triad knowledge score (4.1 ± 1.66 out of 8). *post hoc* pairwise comparisons indicated that the mean score for cheerleaders was only significantly different than members of the swim team ($p = 0.049$).

Table 3-1 Athlete characteristics

	All Athletes (n = 240) Mean \pm SD
Height, ft ^a	5.42 \pm .23
Weight, lbs ^a	125.96 \pm 19.2
BMI	20.88 \pm 2.7
BMI for age	49.55 \pm 25.81
Average desired weight change	-6.09 \pm 10.34 (range = -55.0 – 23.00)
	n (%)
Grade	
Freshmen	50 (20.8)
Sophomore	65 (27.1)
Junior	66 (27.5)
Senior	59 (24.6)
White†	222 (94.9)
Underweight < 5%ile	10 (4.2)
Normal weight 5-85%ile	206 (86.9)
Overweight > 85%ile	18 (7.5)
Obese \geq 95%ile	3 (1.3)
Think they eat enough calories	187 (79.6)
Wanted to gain weight	34 (14.2)
Wanted to lose weight	147 (61.3)
Wanted to lose > 10 lbs and were within a healthy weight range	34 (69.4)
History of Stress fracture ^b	41 (17.2)
Pressure to be a certain weight ^b	143 (59.6)
Myself	118 (68.2)
Coach	8 (3.3)
Peers	58 (33.5)
Parents	33 (19.1)
Society/Media	67 (38.7)

^an < 240 reported height and weight. Consequently all variables related to height and weight had fewer than 240 participants.

^bn < 240

Knowledge/Awareness

Three coaches had heard of the Triad, but only 1 could correctly identify all 3 components. Few coaches knew of the relationship between Triad (Figure 3-1). When asked to list consequences of low energy availability with or without disordered eating,

Table 3-2 Athlete Triad knowledge

n = 170		
Knowledge Score (out of 8) ^a	2.97 ± 1.61 (0-8)	
	I don't know n (%)	Correct Responses n (%)
16. Skipping my period makes my bones weak. (T)	103 (60.6)	28 (16.5)
18. Skipping my period is my body's way of saying I'm training too hard. (T)	82 (48.2)	45 (26.5)
20. Teenagers with weaker bones will likely still have weaker bones as adults. (T)	38 (22.4)	21 (12.4)
21. I feel that skipping my period while playing sports is normal. (F)	70 (41.2)	48 (28.2)
22. I'm not old enough to have weak bones. (F)	29 (17.1)	120 (70.6)
24. Not eating enough could cause me to lose my period. (T)	66 (38.8)	83 (48.8)
25. Stress fractures (very small cracks or breaks) occur more often in girls that skip their period. (T)	107 (62.9)	42 (24.7)
26.1 How much I eat does not affect bone health. (F) ^b	8 (13.3)	48 (80.0)
26.2 Not eating enough calories could cause me to have brittle bones. (T) ^c	34 (30.9)	71 (64.5)
26. Combined (n = 170)		119 (70.4)

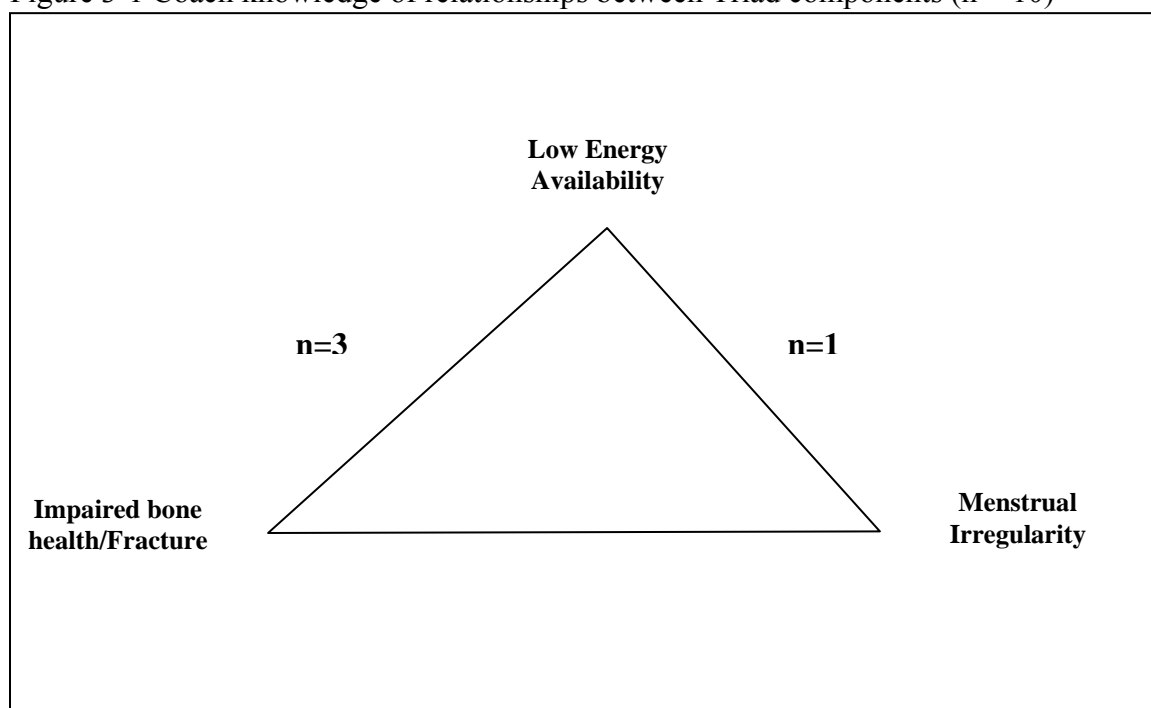
^aKnowledge score was a summation of the 8 questions listed in this table.

^bAnswered by tennis and soccer (n = 59)

^cAnswered by band, color guard, volleyball from school 2, cheer, drill, swimming (n = 111)

impaired performance was reported by 7, while injury was only listed by 2, and menstrual function was only listed by 3 (Figure 3-1). Three coaches thought that menstrual irregularity as a result of sports participation was normal. Four did not know any immediate health consequences, and 2 did not know any treatments for menstrual irregularity. Birth control/hormone replacement (n = 3), changes in diet (n = 5), changes in exercise (n = 4), and increase in percent body fat (n = 1) were reported treatments for menstrual irregularity. While 7 listed difficulty becoming pregnant later in life, only 2 indicated injury or osteoporosis as consequences of menstrual irregularity. As seen in Table 3-3, knowledge of factors related to bone health was limited.

Figure 3-1 Coach knowledge of relationships between Triad components (n = 10)



Coach Observations of Triad Components and Risk Factors among Athletes

Coaches reported that their athletes exhibited attitudes and behaviors that put them at risk for the Triad. Most coaches reported stress fractures (n = 7) and disordered eating (n = 6) among their athletes. Half reported concern that their athletes did not eat enough and 30% indicated that some of their athletes restricted their food intake and desire to lose weight.

Course of Action/Current Practices

Coaches indicated that if they suspected that an athlete was experiencing components of the Triad, they would talk to the athlete, the parents, school counseling staff, or refer to other trained medical professionals. Few coaches reported that they would refer the athlete to a dietitian (n = 1), provide athlete or team education (n = 2), or

Table 3-3 Coach bone-health-related knowledge

Question	Correct Responses (%)
The recommended amount of calcium for high school girls is 1300 mg/day	40
The recommended amount of vitamin D for high school girls is 600 IU or 15 mcg	10
The recommended number of servings of dairy products is 3 per day for high school girls	50
Peak bone age is attained between the ages of 19 and 22	30

reduce the athlete's training load (n = 1). Four of the coaches indicated that they never asked their athletes about menstruation; the remaining 6 asked their athletes sometimes. However, 9 (including 2 of the 3 males) reported that they felt comfortable discussing menstrual status with their athletes.

Screening

Limited time (n = 5), and lack of knowledge of screening procedures (n = 3) were barriers to Triad screening. Difficulty in detecting risk factors, and unwillingness of parents to get their daughters the help were also reported barriers. Though menstrual history information was obtained via the pre-participation form, all coaches reported that they did nothing with the pre-participation physical forms other than give them to the athletic trainer. One athletic trainer anecdotally reported that physical forms were filed without review.

Education

Education varied from absent (n = 4), minimal/incomplete (n = 1), or focused only on basics such as consuming adequate food and water, hydration, and pre-game fueling (n = 3) among most coaches. Two reported formal nutrition education early in the season. Most coaches discussed carbohydrate needs (n = 6), while discussion of calcium needs (n = 3), bone health (n = 2), and menstrual irregularity (n = 2) was uncommon. Limited time (n = 7), lack of Triad knowledge/education (n = 4), lack of Triad information/resources (n = 1), and being a male coach (n = 1) were barriers to providing education.

Discussion

Athletes

This is the first study to both explore the use of a survey to screen for risk for the Triad, and to assess all components of Triad knowledge using current ACSM guidelines among female high school athletes and their coaches. Despite the high prevalence of menstrual irregularity and Triad risk factors, knowledge and awareness among athletes and coaches was low.

Six of the questions used by Feldman et al to assess knowledge of the relationships between menstrual function and bone health among female high school athletes were utilized in the present study. When comparing the 6 questions that were common in the present study and the study by Feldmann et al, the average Triad knowledge score among athletes was higher than those reported by Feldmann et al (2.97 \pm 1.61 vs. 1.18 (SD not reported)). In addition, a higher percentage of participants from

the present study correctly answered all questions except for “Skipping my period while playing sports is normal” (97 ± 10.9 vs. 50 ± 48.5).

Though Feldman et al looked at the awareness of the relationship of bone mineral density with menstrual status [14], no study has evaluated knowledge and awareness of the relationship between low energy availability with both menstrual status and bone health. The following questions were added to the questions created by Feldmann et al:

1. Not eating enough could cause me to lose my period. (T)
2. How much I eat does not affect bone health. (F)
3. Not eating enough calories could cause me to have brittle bones. (T)

Only 50% answered the first question correctly. Eighty-percent answered the second question correctly. This seemed unusually high, so the wording was modified (Questions 3). After modification, 65% answered it correctly. This suggests that the modified wording made the question less obvious. General knowledge of calcium and its impact on bones could have led the participants to think in terms of diet quality rather than the amount of energy intake when responding to those questions. Hence, these questions may not have measured participants’ true knowledge of the relationship between energy intake and menstruation and bone health. Further research to determine optimal wording of questions to assess knowledge of these relationships is warranted

Additional observations from survey responses highlight areas that could be addressed in education provided to athletes. Though this cannot be confirmed, it was inferred that some athletes may have low energy availability and not realize it. Eighty percent of participants thought they ate enough, but 63% of athletes experienced menstrual irregularity even though they had achieved menarche more than 2 years

previous. The current study did not include methods to assess causes for amenorrhea, but these results suggest that teaching athletes about the proper amount of food they need to consume to avoid low energy availability is warranted. Additionally, girls who had reached menarche two or more years previous had a 3.96 times higher odds of having menstrual irregularity than girls with more recent menarche ($p = .014$). This finding suggest the necessity of teaching athletes that though some menstrual irregularity is common at the onset of menarche, attention should be given to menstrual irregularity and possible low energy availability in girls who have achieved menarche more than 2 years previous.

Coaches

Though coaches reported observing Triad risk factors among their athletes, coaches had limited knowledge of the health implications of the Triad. There were no differences in knowledge among male or female coaches. Though the sample size and number of male coaches was low, this finding is in accordance with a report of knowledge among college coaches [13]. No Triad screening was reported, and nutrition education was minimal and did not discuss the Triad or its health consequences. Coaches reported being comfortable discussing menstruation with their athletes, however, limited time, knowledge, and educational resources were barriers to providing Triad education to their athletes.

While more than half provided instruction regarding the carbohydrate intake and avoiding disordered eating practices, only 3 reported discussing calorie or calcium needs. The American College of Sports Medicine recommends education that focuses on optimizing energy availability to minimize the risk of the Triad [1]. Education regarding

the importance of bone health throughout the lifespan, with special attention to childhood and adolescence is warranted [19, 20]. Athletes should be warned that low energy availability can lead to menstrual dysfunction, bone loss, and increased risk for injury [20]. Current recommendations for the intake of calcium and vitamin D should also be discussed [21, 22].

The approach that most of these coaches reported taking to helping athletes with components of the Triad included talking to the athlete, and parent if necessary, and then referring to the school counselor or other professional. These responses are in line with the recommendations from the American College of Sports Medicine. The College recommends that family involvement is indicated for young athletes, and that a multidisciplinary approach be used [1]. Including a registered dietitian in the treatment team is recommended by the College [1]; however, this was only reported by one coach in the current study. Coaches' responses indicate that they feel unknowledgeable, and perceive that these medical-related issues are out of their scope of practice. Additionally, lack of time, knowledge, and resources were reported barriers to Triad screening and education.

Though appropriate referrals to health professionals and mental health specialists are indicated for the treatment of athletes with Triad components, coaches should play a key role in Triad prevention, screening and education. Coaches may have a unique ability to influence the knowledge, beliefs and behaviors of their athlete, and may be able to influence policies and procedures related to Triad screening and prevention.

The pre-season physical exam has been identified as a prime opportunity for screening for the Triad [1, 23, 24]. The survey used in the current study may be useful as

a stand-alone assessment, or an effective supplement to the pre-participation physical form. Both the physical form and the survey tool assess menstrual function and stress fracture history. However, the physical form does not assess Triad knowledge. In addition, if physical forms are turned into the trainer, coaches may not have opportunity to review them. It took less than 15 minutes for athletes to complete, and identified gaps in the athletes' knowledge. Screening in and of itself could provide opportunities to increase awareness of the Triad. In addition, these findings could be used to focus education for individual athletes and teams.

Coach/trainer evaluation of pre-participation physical forms/knowledge survey could be a relatively quick and feasible approach to screening for the Triad. This may, however, require changes to the schools' existing protocols for submitting and processing the pre-participation physical form. This change in practice would align with the College's recommendation to both educate and include school athletic administrators and trainers in the effort to prevent the Triad [1, 24, 25]. Providing coaches with training, and easy-to-use resources may increase the Triad knowledge, and improve the screening and education practices among coaches of female high school athletes.

Limitations

This study was limited by self-reported data. Mid-study modifications of the athlete survey resulted in knowledge being assessed for only 71% of participants. Lack of validated tools for both athletes and coaches were limitations to this study. The free-response nature of the coach survey may have resulted in a different picture of coach knowledge than if coaches were able to select the correct answer. Using the same knowledge questions for coaches and athletes would have eased comparison of

knowledge among coaches and athletes. Small sample size and low number of male coaches limited the statistical power for comparisons examining associations between coaches' responses.

Conclusions

This study ascertained that though menstrual irregularity and stress fracture history were relatively common (63%, $n = 217$, and 17%, $n = 41$ respectively) among this population of female high school athletes, knowledge of the Triad and its health consequences was limited among both athletes (average Triad knowledge score 2.97 ± 1.61 out of 8) and coaches. None of the coaches reported screening their athletes for the Triad. In addition, most coaches reported that nutrition education provided to their teams was minimal and did not address the Triad. The screening tool used in the present study was easily administered, and information it provided could be used to tailor education for athletes. Coach/trainer use and review of this survey tool, alone or as a supplement to the pre-participation physical form would aid in screening athletes and guiding the education provided to athletes. Providing coaches with Triad education and easy-to-use resources for Triad education may improve the education given to athletes and aid in the prevention of the Triad.

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CHAPTER 4
IMPLEMENTATION AND EVALUATION OF A PEER-LED EDUCATIONAL
INTERVENTION TO DECREASE THE RISK OF THE FEMALE ATHLETE
TRIAD AMONG FEMALE HIGH SCHOOL ATHLETES

Abstract

Purpose: To implement and evaluate a peer-led educational intervention aimed at increasing knowledge/awareness of the female athlete triad (Triad) and decrease risk of low energy availability (EA), menstrual irregularity, disordered eating, poor body image, and injury among female high school track and field athletes.

Methods: Female athletes (n = 29) participated in a 4-week Triad education intervention, underwent anthropometric assessments, completed food recalls, and completed pre- and post-surveys.

Results: 63% of athletes had low EA, but none had increased risk of disordered eating. History of amenorrhea was reported by 25%, and 50% reported current menstrual irregularity, few athletes reported history of stress fractures (0.6%). Baseline Triad knowledge and awareness was low (4.7 ± 2.6 out 10). Significant increases in Triad knowledge were observed pre- to post-intervention. The educational intervention was accepted and enjoyed by participants; however, most (86%) preferred that the coach or other adult provide education instead of their peers.

Conclusions: Triad components were prevalent in this population; however, Triad knowledge/awareness was low. The peer-led Triad education intervention resulted in

increased Triad knowledge. Future educational interventions should include education on low EA without disordered eating.

Introduction

The female athlete triad (Triad) is a condition characterized by low energy availability (EA) (dietary intake – exercise energy expenditure), menstrual dysfunction, and bone loss [1]. In the original Triad position stand published by the American College of Sports Medicine (1997), the Triad definition included disordered eating [2]. The current position stand (2007) acknowledged that low EA resulted from low energy intake, high caloric expenditure, or a combination of both. The current position stand replaced “disordered eating” with “low energy availability with or without disordered eating” [1].

Previous studies reported that Triad components were prevalent not only among elite athletes, but high school athletes as well [3-6]. Estimates of menstrual irregularity among high school athletes ranged from 17-54% [3, 4, 7, 8]. Low bone mineral density estimates ranged from 13-18% [3, 4]. Hoch et al conducted the only published study to date that assessed EA among high school athletes. Findings from this study indicated that 54% of athletes had low EA, but none were at risk for disordered eating [4]. These findings suggest that low EA in this population may be inadvertent [4].

When athletes have low EA, less energy is allotted to growth and reproduction [9], which can result in impaired menstrual function [10]. Low EA and/or menstrual irregularity can impede attainment of peak bone mass [11]. Significantly, impaired bone accrual, or losses due to menstrual dysfunction may not be fully reversible even when optimal EA and eumenorrhea are restored [11-13]. Even in the presence of eumenorrhea,

low EA was associated with bone loss in young women [14]. Menstrual dysfunction and low bone mineral density (BMD) are associated with increased risk for stress fractures and musculoskeletal injuries [15-17], which can limit or exclude athletes from sports participation and competition. Additionally, incidence of Triad components may increase lifetime fracture risk. Injuries incurred prior to menopause are predictive of post-menopausal fractures [18].

Unfortunately, many coaches and health professionals do not recognize the relationships between EA, menstruation, bone health, and risk for injury [19, 20]. Screening among collegiate athletes is limited [21]. There is no available data on Triad screening practices among high school athletes that include the 2007 ACSM definition of the Triad. One study by De La Torre and Snell evaluated the procedures for screening for the Triad based on the 1997 definition. Of 91 high schools in an urban school district in the western United States, 22% reported screening for disordered eating and 33% of schools screened for menstrual irregularity [22].

Evaluating knowledge of Triad components and associated health risks is also limited. Though no previous studies evaluated knowledge of all 3 Triad components, Feldmann et al reported that few athletes understood the relationships between menstrual irregularity and bone health. Of the 103 athletes studied, less than 10% knew that menstrual irregularity could have a negative impact on bone health or increase risk for fracture. In addition, 50% thought that skipping their period was normal [23].

De La Torre and Snell reported that of the 91 high schools surveyed, only 33% provided athlete education that included the components of the Triad. Education methods varied from individual counseling to the provision of written materials. In addition,

education was only mandatory for 9% of schools [22]. To date, no educational interventions based on the 2007 definition of the Triad have been implemented and evaluated among high school female athletes.

Interventions, such as the Healthy Weight Intervention (HWI) developed by Stice and colleagues [24, 25], and the Athletes Targeting Healthy Exercise and Nutrition Alternatives (ATHENA) [26] program resulted in decreased disordered eating behavior and increased nutrition knowledge among adolescent girls. However, these interventions did not focus on the Triad. A modified version of the HWI that was included in the Female Athlete Body Project, a program that focused on a healthy body image and the Triad, improved body image and reduced attitudes and behaviors among college athletes. Though not formally measured, there were anecdotal reports that awareness of the Triad was increased and 7 athletes sought medical consultation regarding the Triad [27].

The purpose of this study was to implement and evaluate a peer-led Triad education intervention among a girls' track team at one high school in Northern Utah. The intervention aimed to increase knowledge and awareness of the Triad as well as decrease the risk of low EA, menstrual dysfunction, disordered eating, poor body image, and injury among participants.

Methods

Participants were recruited from a public high school in northern Utah. Approximately half of the 800 female students participated in sports. The sum of the number of girls on each sport team was 451 (56%); however, this sum does not take into consideration girls who participated on more than one sports team. Athletes were

recruited via a flier that was included in their pre-participation packet of information. Written parent permission/youth assent was obtained prior to the study. Procedures for this study were reviewed and approved by the Institutional Review Board of Utah State University. Female track team members (13-18 years) who consented to participate were included in this research.

Baseline Assessment

On the first 2 days of practice (Feb 2012), participants completed a 73-questions survey to obtain demographic, Triad knowledge, and Triad risk factor information (see Appendix C). Triad knowledge/awareness was assessed using a modification of questions used by Pantano [20], and Feldmann et al [23] with 3 questions added specific to EA. General sports nutrition knowledge questions were also included. Menstrual and stress fracture history questions were taken from a screening tool developed by Beals and Hill that has been used in the collegiate athlete population [28]. Body image was assessed using a body mass index (BMI) based silhouette matching tool created [29] and validated [30] by Peterson et al. Participants selected a BMI-based silhouettes that they felt was the best reflection of their current appearance, and a silhouette that best reflected what they wanted to look like [29]. Risk for disordered eating was assessed using the Eating Attitudes Test (EAT-26) [31].

Trained researchers obtained anthropometric data in a private room. Participants removed shoes and socks for all measurements and wore light clothing. Participants' height was measured using a portable stadiometer (Charder HM-200P, Taiwan) following the procedures for measuring pediatric populations [32, 33]. Weight was taken using a portable scale (Seca 869, Germany). Skinfold thickness was measured at the calf and

triceps site using a Lange caliper (Santa Cruz, California). Percent body fat (%BF) was estimated using the Slaughter equation, a gender-specific equation developed for children and youth ages 7-17 years ($\%BF = 0.610 (\sum 2SKF) + 5.1$) [34]. All measurements were taken twice or until measurements were within 10%.

Description of Educational Intervention

Throughout the track season, participants took part in an interactive, peer-led, 4-session long nutrition/Triad education intervention (see Appendix D). The sessions were taught before or after practice depending on the coach's preference for that particular day. The coach asked junior or senior track team members to serve as peer-leaders. The six who agreed to serve as peer-leaders taught the educational sessions. Peer-leaders were given manuals of the session curriculum as well as copies of the participant workbooks. A research assistant trained them the evening before they would teach their peers. Training was a combination of research assistants modeling methods and peer-leaders practicing teaching each other. There was opportunity for discussion and answering questions to ensure that the peer-leaders felt prepared to teach their peers the following day. Participant workbooks containing worksheets with "take home messages" summarizing main points and emphasized application of the information were provided to each participant at the beginning of the education session. Aspects of this intervention were modeled from an intervention utilized by Becker et al [35]. Becker's intervention was a modification of a program created by Stice and Presnel [36] for adolescent girls. Becker's modifications addressed concerns specific to athletes [27], and implemented the peer-led model [35]. Specific aspects that were taken from the previously developed

curriculum include the goal setting activity in session 2, and the healthy body image discussion in session 4.

Session 1

The intervention was broken into 4 sessions. In the first session, the program goal was introduced and a preview of the topics that would be covered was given. The first session involved a discussion of calories, energy, energy balance, and EA. An activity using the MyPlate website (<http://www.choosemyplate.gov/>) provided a visual demonstration of how to estimate portion sizes. Participants received instructions on how to complete a 3-day diet and exercise log and enter the data into the online MyPlate supertracker analysis program (<http://www.choosemyplate.gov/>).

Session 2

In session 2, the peer-leader had a follow-up discussion on the 3-day diet and exercise log. Participants then used their 3-day MyPlate reports to evaluate their EA. The Triad and its components were then introduced. Normal menstruation was defined, and the impact of nutrition on Triad components was then explained. These principles were reinforced in 2 brief (1-3 minute) video clips of college athletes who described their experiences with the Triad and negative consequences such as injury and exclusion from participation in practice and competition. Participants then learned about SMART goals (specific, measurable, achievable, relevant, timely) [37], and set their own goals to improve their nutrition, exercise, or other health-related behavior such as sleeping.

Session 3

Session 3 focused on bone health as a component of the Triad. Peer-leaders emphasized the importance of accruing bone during the teenage years, and maintaining optimal bone mineral density throughout life. Factors affecting bone mineral density were discussed, as well as health implications including immediate and lifetime fracture risk. The potential effect of low bone mineral density and injury on athletic performance and sports participation was emphasized. Participants learned about dietary and other sources of calcium and vitamin D, as well as the recommended intake of both nutrients. A food label analysis activity included in the participant workbook demonstrated the relative amount of calcium and vitamin D in commonly-consumed foods. Participants also evaluated their intake of foods high in calcium and vitamin D using their MyPlate printout.

Session 4

Session 4 aimed to address the topic of body image, and summarize all that had been covered in the sessions. First participants searched in magazines and cut out pictures of what they thought was an “ideal” female body. They then identified examples of a “sport-specific ideal” female body. This was followed by a discussion of the pressures placed by the media for females, and female athletes in particular to look a certain way. Participants then viewed an image of several Olympic athletes, all with different heights, weights, and body types. This started a discussion on the individuality of an ideal body. The concept optimal health and physical performance was more important than a pre-determined body image was emphasized by a video clip of a former collegiate athlete

who described how pressure to be a certain body weight ultimately ended her athletic career.

The peer-leaders proposed a definition of an athlete-specific healthy ideal body image from Becker et al which taught the importance of keeping a balance between physical health, mental health, quality of life, and athletic performance [27]. The importance of pre- and post-workout fueling was discussed and highlighted in a video clip. Athletes then completed a worksheet to create a plan to adequately fuel their bodies to enhance health and athletic performance. Participants were provided with chocolate milk to serve as an example of an appropriate post-workout snack because it provides carbohydrates, protein, as well as fluid and electrolytes.

Bod Pod

Nine athletes, including 5 from the main study, were also assessed using the Bod Pod (Rome, Italy). Participants' height, weight, and skinfold measurements were taken by trained researchers using the standardized protocol used for the baseline anthropometric assessment. Participants wore a bathing suit, or a sports bra and spandex shorts, and a swim cap over their hair as outlined in the suggested Bod Pod protocol [38]. Body density (body mass/body volume) and thoracic gas volume were measured via the Bod Pod. Percent BF was calculated using the Siri conversion [39].

Diet and Exercise Assessment

Three, consecutive 24-hour diet and exercise recalls (1 weekend day and 2 weekdays) were conducted midway through the season. Participants were given sample food and exercise recalls that demonstrated the degree of detail they should include in

their recalls. Researchers prompted the participants to think of the first thing they ate or drank that day. Participants were asked to think of their daily routine/activities to help them remember the foods and beverages they consumed. Research assistants reminded the participants of the diet record training they received during the first education session and provided portion estimate handouts and aided participants in estimating portion sizes. Upon completion, research assistants checked the recall and provided prompts to help participants provide descriptive detail, and to remind them to include condiments, beverages, etc. Athletes were asked to record all physical activity that lasted longer than 15 minutes including the intensity and duration of the activity. For participants who missed the last of the 3 practices in which recalls were conducted ($n = 3$), a recall from another day was included.

Energy and nutrient intake, as well as exercise energy expenditure were quantified using the ESHA Food Processor software version 10.9.1 [40]. The Food Processor contains over 35,000 foods, ingredients, recipes, and exercises. Exercise energy expenditure estimates were calculated by multiplying resting energy expenditure (REE) by the metabolic equivalent (MET) for each reported activity based on the Ainsworth Compendium of Physical Activities [41]. REE was estimated based on weight and gender using age and gender equations established by the World Health Organization [42].

Energy availability was calculated by subtracting exercise energy expenditure from dietary caloric intake [1]. Energy availability per kg of lean body mass was determined from the %BF estimates from the baseline skinfold measurement. Energy availability was categorized as ≥ 45 kcal/kg LBM (optimal EA), < 45 kcal/kg LBM (EA level associated with increased bone turnover), and < 30 kcal/kg LBM (EA level

associated with menstrual dysfunction based on research by Loucks et al, Ihle and Loucks, and Loucks and Thuma [10, 14, 43].

End-of-Season Assessment

A second, 91-question survey was given prior to the region track meet in an effort to survey all track athletes. The survey aimed to evaluate changes in knowledge, body image, menstrual status, injury status, and risk for disordered eating. Additional questions were added to evaluate the educational intervention and the peer-led approach.

A separate survey was given to peer-leaders to assess the perceived effectiveness of the educational intervention and the peer-led approach, and perceived acceptability of the intervention among the participants they taught. Peer-leaders were asked about their experience teaching their peers: if it was worth their time, and if they would recommend this experience to others.

Pre-participation physical form data and injury information was obtained from the school's athletic trainer. Performance data was obtained via an online track meet result website. Percent change in performance was determined by comparing each athlete's best performance (time or distance) to their performance (time or distance) at a track meet early in the season.

Definition of Outcome Measures

Triad knowledge score was calculated by summing the scores from each of the 9 Triad True/False/I don't know (correct = 1, incorrect = 0, I don't know = 0) and 1 question about the age range when females build the most bone (13-18 years = 1). Sports Knowledge score was calculated by summing the scores of each of the 6 True/False/I

don't know sports nutrition questions (correct = 1, incorrect = 0, I don't know = 0).

Primary amenorrhea was defined as the absence of menarche by age 15 years [44].

Secondary amenorrhea was defined as > 90 days without a menstrual cycle after the onset of menarche [1]. Menstrual Irregularity was defined as menstrual cycles that were either somewhat irregular (within 4-10 days of when it was supposed to occur) or very (greater than 10 days from when it is supposed to occur) irregular [28].

Body dissatisfaction was calculated by subtracting perceived current body mass index (BMI) from perceived ideal BMI. Body distortion was calculated by subtracting current perceived BMI from measured BMI. For the purposes of this study, trainer-reported injury was determined by the school's athletic trainer and defined as "an injury from either overuse or direct trauma that occurred during participation in the current sport season" [6]. BMI was calculated by dividing participants' measured weight in kg by their measured height in meters squared. BMI-for-age was calculated using participants' date of birth, assessment date, and measured height and weight via the Center for Disease Control (CDC) BMI calculator

(http://www.cdc.gov/healthyweight/assessing/bmi/childrens_BMI/tool_for_schools.html)

which is based on the CDC growth charts [45]. Risk for disordered eating was

determined by an EAT-26 score >15 [4].

Analysis

Paired t-tests were used to assess changes in knowledge, body image, and disordered eating variables. Independent t-tests were used to assess differences in means among groups (i.e., study drop-outs vs. completers, $EA \geq 30$ kcal/kg LBM vs. $EA < 30$ kcal/kg LBM, etc.). Due to the differences in group sizes, a pooled variance estimate t-

test was used. For variables in which violations to normality or heterogeneity of variance occurred, non-parametric tests comparisons of the groups were made. The Mann-Whitney test and the Wilcoxon test were conducted and reported as median (Mdn) and range. Associations between categorical variables were assessed using Chi Squared distributions, with the use of Fisher's Exact test in the case of low expected frequencies. Triad knowledge score and sports nutrition knowledge score were calculated by summing the scores from each question.

Results

Sample

Of the 55 members of the track team, 49 (89%) athletes consented to participate and completed the baseline survey and anthropometric measurements. Twenty-nine (61.7%) completed the final survey. Fewer of those who dropped out of the study reported participating in recreational sports compared to those who completed the study. No other significant differences were observed (Table 4-1). Of those who completed both surveys, 22 (75.8%) provided representative information for 3, 24-hour diet and exercise recalls (1 participant's recall information was excluded because no physical activity was reported for 2 of the 3 days). Four of the 6 peer-leaders completed the peer-leader survey. Fifty-two percent of participants were freshmen. Ninety-three percent were white; 7% were Hispanic. Most (72%) played another school sport, and more than half (63%) reported participating in another sport (recreation team, dance, etc.). The majority (93%) were considered at a healthy weight based on BMI-for-age percentile. One participant

was underweight, and 1 was considered overweight [46]. Average %BF was 27.29 ± 6.51 (Table 4-1).

Table 4-1 Athlete baseline demographics

	Baseline n = 47 Mean \pm SD / Median (range)	Dropouts n = 18 Mean \pm SD / Median (range)	Completers n = 29 Mean \pm SD / Median (range)
Age, yrs	15 (14-18)	15.5 (14-18)	15 (14-18)
Age at menarche, yrs	13 (9-16)	15 (9-13)	13 (11-16)
Height, cm	164.76 \pm 7.025	165.5 \pm 8.13	164.3 \pm 6.35
Weight, kg	55.1 (42-94)	62.48 (42-94)	54.4 (42-67)
Percent Body Fat	28.25 \pm 7.89	29.79 \pm 29.65	27.29 \pm 6.51
Desired weight change, lbs	4.75 (-12.5-75)	7 (-12.5-75)	4 (-5-20)
BMI, kg/m ²	20.46 (15.95-32.72)	21.02 (15.95-32.720)	20.38 (16.11-24.31)
BMI for age percentile	50.05 \pm 25.83	55.8 \pm 29.55	46.46 \pm 23.04
Underweight < 5%ile	2 (4.3)	1 (5.6)	1 (3.4)
Normal weight 5- 85%ile	39 (83.0)	12 (66.7)	27 (93.1)
Overweight > 85%ile	4 (8.5)	3 (16.7)	1 (3.4)
Obese \geq 95%ile	2 (4.3)	2 (11.1)	0 (0)
	%	%	%
Grade			
Freshmen	51.1	50	51.7
Sophomore	19.1	11.1	24.1
Junior	17.0	11.1	20.7
Senior	12.8	27.8	3.4
Ethnicity			
White	87.2	77.8	93.1
Hispanic	12.8	22.2	6.9
% play other school sports	68.1	61	72.4
% play other rec. sports	46.8	22	62.9 ^a
Event			
Distance	42.6	35.3	48.3
Sprints	31.9	29.4	64.5
Hurdlers	14.9	17.6	13.8
Throwers	8.5	17.6	3.4

^a $p < 0.5$

Knowledge

Triad Knowledge

Eighty-six percent of participants attended the first education session, 79% attended sessions 2 and 3, and 82% attended session 4. At baseline only 2 participants had heard of the Triad. None of the participants could list the components of the Triad. On average, participants answered fewer than 5 of 10 questions correctly. Only 10 (34.5%) knew that skipping their period while playing sports was not normal. Fewer than 25% knew that skipping their period could make their bones weak, and less than 30% knew that stress fractures were more common among athletes who skipped their period (Table 4-2).

Awareness of the Triad increased from the beginning to the end of the season. At the end of the season 6 (21%) could accurately name all components of the Triad. Seven (24%) reported bone health, 10 (35%) reported menstrual regularity, and 10 (35%) reported energy (included something along the lines of energy, EA, exercise and/or eating) as being involved in the Triad. Triad knowledge score increased from 4.72 ± 2.6 to 7.68 ± 1.79 , ($p < .0001$) By the end of the season 23 (79.1%) knew that skipping their period while playing sports was not normal, 25 (86.2%) knew that skipping their period could make their bones weak, and 26 (89.7%) knew that stress fractures occur more frequently in girls who skip their period. The percent that could correctly identify the age range in which the most bone accrual occurs increased from 48.2 to 77.8% (Table 4-2). Participants who attended three or four sessions had higher Triad knowledge scores than those who only attended one or two sessions (6.4 ± 2.14 vs. 8.0 ± 1.50 , $p = .03$).

Table 4-2 Changes in Triad knowledge and sports nutrition knowledge (n=29)

	Pre-intervention		Post-intervention	
	Don't know	Correct	Don't know	Correct
Triad Knowledge				
Age when females build the most bone (13-18) ^a		48.2%		77.8% ^b
Skipping my period can make my bones weak. (T)	62.1%	24.1%	10.3%	86.2%
Stress fractures (very small cracks or breaks) occur more often in girls that skip their period. (T)	62.1%	29.6%‡	10.3%	89.7%
Not eating enough could cause me to lose my period. (T)	31.0%	65.5%	3.4%	75.9%
Teenagers with weaker bones will likely still have weaker bones as adults. (T)	24.1%	75.9%	6.9%	31.0%
I'm not old enough to have weak bones. (F)	17.2%	65.5%	0%	100%
Skipping my period is my body's way of saying I'm training too hard. (T)	58.6%	17.2%	20.7%	65.5%
How much I eat does not affect my bone health. (F)	10.3%	75.9%	6.9%	89.7%
I feel that skipping my period while playing sports is normal. (F)	58.6%	34.5%	17.2%	79.1%
Exercise/Training too much could cause me to lose my period. (T)	51.7%	37.9%	6.9%	79.3%
Sports Nutrition Knowledge				
Protein is the main energy source for the muscles. (F)	27.6%	10.3%	24.1%	13.8%
Carbohydrates should make up at least 50% of total calories. (T)	37.9%	37.9%	27.6%	72.4%
When exercising in a hot environment and sweating a lot, Gatorade helps your body rehydrate better than water. (T)	24.1%	48.3%	20.7%	55.2%
Vitamins are a good source of energy. (F)	13.8%	10.3%	10.3%	20.7%
Milk products are the only source of calcium in the diet. (F)	13.8%	75.9%	6.9%	82.8%
Including protein and carbohydrates in my post-workout snack helps me recover better. (T)	27.6%	72.4%	13.8%	75.9%
All foods can be part of a healthy diet. (T)	14.3%	42.9%	27.6%	65.5%
Each athlete has a set body fat percentage they should aim for to maximize their athletic performance. (F)	35.7%	10.7%	28.6%	17.9%

^a This question was a multiple choice question. Don't know was not an option.

^b n = 27

Sports Nutrition Knowledge

Sports Nutrition knowledge increased from $3.06 \pm .151$ out of 8 at baseline to 4.03 ± 1.40 , $p = 0.005$ at the end of the season (Table 4-2). The number of participants who knew that all foods could be part of a healthy diet increased from 12 (42.9%) to 19 (65.5%). Similar increases were seen for athletes who knew that carbohydrates should

make up at least 50% of their total calories, 11 (37.9%) to 21 (72.4%). Those who attended 3 or 4 education sessions had a higher end-of-season sports nutrition knowledge score compared to those who attended 2 or 3 sessions (4.0 ± 1.3 vs. 4.14 ± 1.57 , $p = .0021$).

Menstrual Status

All but 2 participants had achieved menarche. One was classified as having primary amenorrhea, which is the absence of menarche after age 15 (2 standard deviations above the average age at menarche (13 years)) [47]. One participant was excluded from the analyses of menstrual status because she reported that she could not accurately answer questions about her menstrual status. At baseline, 46.2% reported that their menstrual cycles were very regular (within 3 days of when it is supposed to start), 50% reported that their menstrual cycles were somewhat irregular (within 4-10 days of when it is supposed to occur), and 3.8% reported that their menstrual cycle was very irregular (greater than 10 days from when it is supposed to occur). Menstrual irregularity (somewhat or very irregular) was 53.8%. History of amenorrhea was reported by 6 (23.1%). There were no significant changes in menstrual status from the beginning to the end of the season. Six participants reported skipping a period during the season, and one reported having gone more than 3 months since her last menstrual cycle (Table 4-3).

Body Image

Body image, assessed by body distortion (perceived current BMI – measured BMI) and body dissatisfaction, (perceived ideal BMI – perceived current BMI) was constant over the course of the season (Table 4-4). For clarity, and because there were no

changes in body distortion or body dissatisfaction from the beginning to the end of the season, only end-of-season and body image data will be described.

Table 4-3 Menstrual history and status

	Baseline n = 26 %/ Mean ± SD	Final (n = 23) %
Had not achieved menarche		6.9 ^a
Could accurately answer questions about their menstrual cycle		96 ^b
Very accurately. I usually know when my monthly cycle will start.		31
Fairly accurately. I don't know exactly when it will start, but I would notice if I haven't had a menstrual cycle in a while.		65
Not very accurately. I don't usually pay attention to my menstrual cycle.		4
Age at menarche	12.96 ± 1.15	
Primary amenorrhea ^c	4	
History of secondary amenorrhea ^d	23	
History of secondary amenorrhea within 2 years of menarche	15	
Season Regularity	0	4.3 ^e
Very regular (within 3 days of when it is supposed to occur)	4	50
Somewhat irregular (within 4-10 days of when it is supposed to occur)	50	35
Very irregular (greater than 10 days from when it is supposed to occur)	4	4
Menstrual irregularity (somewhat or very irregular)	54 ^e	38 ^e
Menstrual irregularity within 2 years of menarche	31 ^e	22 ^e

^a n = 29

^b Two had not achieved menarche and one could not accurately report menstruation. For the remainder of the table n = 26 unless otherwise specified.

^c No menstrual cycle by age 15

^d Absence of menstrual cycle for > 90 days that occurs after menarche

^e n = 18-23

Perceived current BMI was significantly higher than measured BMI by approximately 3 kg/m² (23.50 ± 2.37 vs. 20.23 ± 1.95, *p* < .0001). For a reference 65'' female, this would indicate that she thought she weighed 141 pounds, when she actually

Table 4-4 Changes in body image, risk for disordered eating, and pressure to be a certain weight from pre-and post-intervention survey

	Pre-intervention n = 29 Mean ± SD / Mdn (range)	Post-intervention n = 29 Mean ± SD / Mdn (range)	<i>p</i>
Height, cm	164.3 ± 6.35		
Desired weight change, lbs	-5.027 ± 9.08		
Weight, kg	54.72 ± 5.64		
BMI ^a	20.23 ± 1.95		
Perceived Current BMI ^b	23.41 ± 2.71	23.50 ± 2.375	.771
Perceived Ideal BMI ^c	21.97 ± 2.19	22.38 ± 1.89	.173
Body Dissatisfaction ^d	-1.44 ± 1.97	-1.13 ± 1.92	.176
Body Distortion ^e	2.97 (.06 – 7.53)	3.44 (-.65-6.51)	.740
EAT-26 Score	4.0 (0-13)	4.0 (0-20)	.990
	%	%	
EAT-26 Score > 15	0	6.8	
Bingeing	13.7	3.4	
Vomiting	0	0	
Laxative	0	0	
Exercise > 60 minutes per day to lose or control weight?	28.5	3.4	
Lost ≥ 20 lbs in the last 6 months	0	0	
Pressure to be a certain weight ^f	25	25	
Myself	24.1	21.4	
Coach	3.4	3.4	
Peers	10.3	14.3	
Parents	3.4	7.1	
Society/Media	17.2	17.2	

^a BMI calculated as measured weight in kg divided by measured height in meters squared.

^b BMI that matched the silhouette that the participant thought best represented her current BMI.

^c BMI that matched the silhouette that the participant thought best represented the BMI she would like to have.

^d Calculated as Perceived Ideal BMI - Perceived Current BMI.

^e Calculated as Perceived Current BMI – BMI.

^f n = 28

weighed 121 pounds. There were no differences in measured height (Mdn =165.10 cm; range =147.32-173.99) or reported height (Mdn = 165.8 cm; range =148.60 – 173.9), $p = 0.810$ or measured weight (55.41 ± 5.54 kg) and reported weight (53.99 ± 5.54 kg), $p = 0.28$.

Perceived current BMI was higher than perceived Ideal BMI (23.50 ± 2.37 vs. 22.38 ± 1.89 kg/m², $p = .004$). For a 65” girl, this would indicate that she weighed 140 lbs and wanted to weigh 132 lbs. This derived desired weight loss was greater than the average desired weight change (-5.02 ± 9.08) as calculated from participant reported current weight and ideal weight. Perceived Ideal BMI was higher than Measured BMI (22.38 ± 1.89 vs. 20.23 ± 1.95 kg/m², $p = .000$).

Less than 25% felt pressure to achieve or maintain a certain weight. The most frequently reported sources of this pressure were themselves (24.1%) and society/media (17.2%). There were no significant differences to participant perceptions of pressure related to body image from the beginning to the end of the season (Table 4-4).

Risk for Disordered Eating

At baseline, the median EAT-26 score was 4.0 (range = 0-13), and it did not change significantly over the course of the season ($p = 0.99$). However, two participants were classified as at risk (score ≥ 15) at the end of the semester. Only one of these participants attended the education session in which body image issues were addressed. At baseline, 4 (13.7%) participants reported bingeing, and excessive exercise to lose weight was reported by 8 (28.5%). At the end of the season, only 1 (3.4%) reported bingeing, and 9 (32.1%) reported excessive exercise (Table 4-4).

Body Fat Percentage

Average %BF, determined via skinfold thickness, was $27.29 \pm 6.51\%$ (skinfold 1, Feb 2012). Five participants had their body composition assessed a second time via skinfold (skinfold 2, March 2012) and Bod Pod (Bod Pod, March 2012). Comparison of skinfold1 and skinfold2 (paired t-tests) indicated that skinfold measurements were highly correlated ($r = .98$, $p = .003$) and reliable ($24.98 \pm 6.89\%$ vs. $23.4 \pm 7.2\%$, $p = .06$). Percent body fat estimated from skinfold1 was highly correlated with %BF from the Bod Pod ($r = .923$, $p = .025$). However %BF mean estimates were significantly higher than estimates from the Bod Pod ($24.98 \pm 6.89\%$ vs. $15.1 \pm 2.46\%$, $p = .01$). Similarly, EA/kg LBM estimates calculated from skinfold1 and Bod Pod had a high correlation ($r = .938$, $p = .018$), but had significantly different mean values (45.08 ± 7.88 kg vs. 39.37 ± 4.66 kg, $p = .03$).

Dietary Analysis

Dietary calcium intake was only 77% of the Recommended Dietary Allowance (RDA); average intake was 1005 ± 469 mg. Average intake of vitamin D was only 61% of the RDA. However, average dietary intake of iron, vitamin B6, and Vitamin B12 were above the RDA (Table 4-5). Intake of fruits and vegetables was also low. Average intake of total fruits and vegetables was $.85 \pm .79$ cups and $.83 \pm .50$ cups, respectively.

Low Energy Availability

Fifty percent ($n = 11$) of those who completed 3, 24-hour diet and exercise recalls had moderately low EA (defined as EA lower than 45 kcal/kg LBM but higher than 30 kcal/kg LBM). Six (27.3%) had EA above 45 kcal/kg LBM, and 5 (22%) had EA below

Table 4-5 Energy, macronutrient, and micronutrient intake

	Mean \pm SD n = 22	% DRI	Recommended intake ^a
Caloric Intake	1836 \pm 336	.72 \pm .13	2300-2800
Prot (g/kg/day)	1.29 \pm .28	.69 \pm .12	1.2-1.4
Carb (g/kg/day)	4.67 \pm .91	.99 \pm .227	6-10
Fat (g)	64.72 \pm 17.7	---	---
Fib (g) ^a	16 \pm 6.5	62.9 \pm 25.31	26
Vit B6 (mg)	1.2 \pm .68	104.4 \pm 57.05	1.2
Vit B12 (mcg)	3.2 \pm 2.5	135.8 \pm 108.3	2.4
Vit C (mg)	62.0 \pm 49.2	95.4 \pm 75.84	65
Vit D-mcg (mcg)	3.0 \pm 2.6	61.4 \pm 53.2	5
Folate (mcg)	380 \pm 339	94.8 \pm 84.6	400
Calc (mg)	1005 \pm 469	.77 \pm .36	1300
Copper (mg)	.72 \pm .22	80.8 \pm 25.8	.89
Iron (mg)	16 \pm 15	107.3 \pm 101.8	15
Magnesium (mg)	171 \pm 61.4	47.5 \pm 17.1	360
Phosphorus (mg)	799 \pm 352	63.9 \pm 28.2	1250
Zinc (mg)	7.8 \pm 3.9	87.3 \pm 43.5	9
Vit K (mcg)	29.4 \pm 34.7	39.3 \pm 46.4	75

^a Recommendations from Food and Nutrition Board, Institutes of Medicine, and National Academies Dietary Reference Intakes for girls ages 14-18 years and the American Dietetic Association, Dietitians of Canada, and the American College of Sports Medicine position stand [48-53].

30 kcal/kg LBM. Those with EA < 30 kcal/kg LBM consumed fewer calories (1416 \pm 217 kcals vs. 1960 \pm 255 kcals, $p = .002$), though there was no difference in exercise energy expenditure (375 \pm 128 kcal vs. 288 \pm 84 kcal, $p = .22$). Those with EA < 30 kcal/kg LBM had a higher ratio of exercise energy expenditure to caloric intake (Table 4-6). When calculated per 1000 kcal, there were no significant differences in intake of food groups or nutrients.

Incomplete data on the exercise logs necessitated imputation. Twenty-seven percent of distance runners (n = 3) and 100% of sprinters (n = 10) wrote “track practice” and indicated a time and intensity, but did not provide further details for one or more days. Information from other athletes’ recalls was used to create reference workouts. Due

to poor recording by the sprinters, the reference sprint workout was included for two of the three days. The hurdlers ($n = 4$) only indicated a time for hurdling. A reference hurdling workout created by mimicking the distances covered by sprinters during the reported duration was repeated twice.

Injury

Only two participants reported having a stress fracture in the past. Two participants reported experiencing stress fractures during the season. The report from the athletic trainer indicated that no participants had experienced stress fractures, but that 6 (20%) experienced shin splints. When comparing EA groups, there were no differences in shin splint incidence (Table 4-6). There were no differences in shin splint incidence when comparing groups based on menstrual regularity.

Relationship Between Energy Availability, Menstrual Status, Injury, and Performance

The relationships between EA, menstrual status, injury, and performance were explored. There were no significant differences in menstrual regularity or injury status when comparing the different levels of EA. Due to incomplete performance data, it was not possible to compare performance between groups. At the end of the season, those who had $EA < 45$ kcal/kg LBM had had higher scores in the body distortion measure compared to those with $EA > 45$ kcal/kg LBM ($p = .049$). There was a trend of higher exercise energy expenditure to caloric intake ratio ($p = .05$). This relationship was significant when comparing those who had $EA < 30$ kcal/kg LBM to those who had $EA \geq 30$ kcal/kg LBM. Body dissatisfaction for those who had $EA < 30$ kcal/kg LBM indicated

that on average they wanted to have a higher BMI, while those with EA > 30 kcal/kg LBM wanted to have a lower BMI (Table 4-6).

Performance

Performance data were obtained via online track meet result websites. Some

Table 4-6 Participant characteristics by level of energy availability

	n = 22	
	≥ 30kcal/kg LBM ^a (n = 15) %	< 30 kcal/kg LBM (n = 5) %
Menstrual irregularity1	46.7 ^b	60
Menstrual irregularity2	40 ^b	40
Self-reported injury	12.5 ^b	0
Trainer reported injury	29.4 ^b	40.0
Eat enough (self-reported)	88	80
Ethnicity (% White)	94.1	80
History of amenorrhea	20 ^b	20
	Mean ± SD/ Median (range)	Mean ± SD/ Median (range)
Age	15.5 (14-17)	15 (14-16)
Age at menarche	13 (12-15) ^b	13 (12-15)
Triad Knowledge1	4.0 (1-9) ^b	5 (0-8)
Triad Knowledge2	9 (6-9)	9 (3-10)
EAT 26 Score1	4.00 (0-13)	4.0 (1-8)
Calcium, mg	828 (418-2557)	770 (716-969)
Percent Body Fat	27.67 ± 7.5	25.35 ± 5.56
Caloric Intake	1960 ± 255	1416 ± 217 ^c
Exercise Energy Expenditure	288 ± 84	375 ± 128
Exercise Energy Expenditure/Caloric Intake	.128 (.08-.21)	.1697 (.10-.35) ^d
BMI for age	44.74 ± 23.07	39.32 ± 29.02
Desired weight change	-7.22 ± 7.74	3.2 ± 10.28
Body Distortion 1	3.04 ± 2.01	3.39 ± 3.02
Body Distortion 2	3.10 ± 1.9	4.49 ± 1.25
Body Dissatisfaction1	-1.94 ± 1.8	0 ± 2.54
Body Dissatisfaction 2	-1.5 ± 1.75	.90 ± 1.81 ^d
BMI	21.18 ± 1.94	19.4 ± 2.46

^a Level at which menstrual dysfunction occurs [10, 43].

^b n < 22

^c p < .005

^d p < .05

the top 9 finishers; therefore, performance data were available for 78% of the athletes. Percent change in performance was higher among those with menstrual irregularity at baseline ($9.38 \pm 5.65\%$ vs. $-.20 \pm 5.404\%$, $p = .014$). Analysis of variance indicated that throwers had significantly greater increases in performance than running events ($17 \pm 2.0\%$) vs. distance runners ($5.50 \pm .873\%$) and sprinters ($2.5 \pm 5.92\%$), $p = .013$.

Evaluation of the Intervention

Thirty-one participants (62% of baseline) completed the end-of-season survey. On average, participants attended 3 of the 4 intervention sessions (range 1-4). Seventy-nine to 86% of participants attended any given session. Only 9 (31%) completed 3-day food logs. About two-thirds of participants reported enjoying the educational intervention, thought it was worth their time, and thought that next year's team should participate. Fifty-two percent reported making changes to their diet, and feeling better about their bodies as a result of this education. Fifty-nine percent thought the educational intervention helped bring the team together and act as a more cohesive group (Table 4-7).

Survey results indicated that all participants agreed that the information provided was at an appropriate level for high school students. Food samples, group discussions, movie clips, handouts, and "take home message" summaries of what had been taught in the session were aspects that the participants enjoyed. Participants indicated preference for sessions that were shorter, more interesting, less detailed, and did not interfere with practice.

When asked to describe any dietary changes resulting from the educational intervention, participants reported drinking more water, improved hunger regulation,

Table 4-7 Participant evaluation of the educational intervention

	% Strongly agree or agree n = 29 %
4. I enjoyed learning about nutrition and the female athlete triad.	69%
5. This education program was worth my time.	69%
6. The information was presented at a level appropriate for high school students.	100%
7. I think next year's track team should participate in this education.	69%
8. I liked having one of my peers on the track team teach this class rather than a teacher or other adult.	14%
9. I have made changes to my diet after attending the education sessions.	52%
10. I have made changes to my physical activity as a result of attending these educational sessions.	59%
11. I feel better about my body after attending the educational sessions.	52%
12. This program helped bring the team together and act as a more cohesive group.	59%

increased caloric intake, and increased consumption of calcium-rich foods. Improved diet quality (more fruits and vegetables, etc.) and decreased junk food consumption, as well as inclusion of pre- or post-workout snacks were also reported.

Fifty-two percent felt better about their bodies as a result of the education session. Free-response comments included: "I feel more confident! ...it really is okay if I don't look like a model," "everyone is different, magazines are fake," "I don't worry about my weight 'every athlete is different'," "you don't have to be deathly skinny," "I feel better about my body and care more on how it's performing," and "I feel less self-conscious about my self." It was evident that the activities and video clips from education session 4 were memorable for some participants.

Participants appreciated that the peer-instructors were familiar to them, and acknowledged that they felt comfortable asking questions and participating in discussions. Participants felt that peer-instructors could relate well to them. However, only 4 (14%) preferred that one of their peers teach them instead of a coach, teacher, or other adult (Table 4-8). Participants felt that the peer-leaders “didn’t exactly know what they were talking about,” “did not listen respectfully,” “went through it too fast, they just wanted to get it done.” Classroom management issues and side tracking from the education session were reported. Peer-instructors indicated that they generally enjoyed teaching. In addition, they learned more about the Triad and gained valuable teaching skills as a result of teaching (Table 4-8).

Peer-instructors acknowledged that the information was important for athletes to know. They valued the interactive training they received the evening prior to teaching their peers. They noticed benefit from being taught the material and having an opportunity to teach each other. They appreciated having the manual to review again before teaching their peers.

Table 4-8 Peer-leader evaluation of their teaching experience

	Ranking from 1-10
1. I enjoyed teaching my peers about nutrition and the female athlete triad	7.0
2. Serving as a peer instructor was worth my time	7.25
3. I think next year’s track team should participate in this education	6.62
4. I would recommend this peer-teaching experience to next years’ track team members	6.87
5. I have made changes to my behavior as a result of participation in this education	8.0
6. My teaching skills were enhanced	7.0
7. I feel more confident in teaching my peers	7.0
8. I know more about sports nutrition and the female athlete triad	8.0

The peer-leaders ranked their enjoyment teaching their peers about nutrition and the Triad as a 7 (on a scale from 1-10). Fewer girls joined the track team than the coach anticipated when inviting junior and senior athletes to serve as peer-leaders. Consequently, 4 peer-leaders formed pairs and each pair taught a group of their peers. They enjoyed working together so that they could “build...off what the other one said.” Comments such as “I think they like learning from us because they know us already” and “I think the girls like how it was taught by peers so that it didn’t feel so much like school” indicate that the peer-instructors felt that the peer-led approach was well received by participants.

Peer-instructors provided valuable feedback regarding the educational sessions. Understandably, they suggested that any training or teaching not interfere with track practice. One suggested that training occur during the school’s “flex” hour, which is set aside for group meetings and making up tests or homework. They requested that scripts be simplified and shorter. One peer-instructor thought that the movie clips were too much of a hassle and one requested having an athlete who had experienced the Triad talk to them in person. They also suggested including more pictures, making the sessions more interesting.

One indicated that the program would be benefited if the peer-instructors were more dedicated. Of the 4 who completed the survey, 2 agreed to serve as peer-leaders because they wanted to learn about nutrition. Reasons reported by the other two peer-leaders included “my friends were doing it,” and “my coach asked me to,” respectively. When asked to list any improvements in their teaching skills, they reported increased ability to “summarize and relate to the younger girls,” to find “balance between being

nice so they could trust you, and getting the info across quickly and in an exciting way.”

Other improvements included being more assertive, staying on topic, and being more comfortable talking in front of people.

Discussion

This is the first study to implement and evaluate a peer-led Triad education program among high school female athletes. Athletes were largely unaware of the Triad and its consequences at the beginning of the season. Significant increases in Triad and sports nutrition knowledge resulted from participation in the intervention. The study duration was not long enough to observe changes in menstrual status or injury rates pre to post intervention. Few participants completed baseline food logs; consequently, change in diet and EA could not be measured.

Average EAT-26 score and body image measures remained constant. This suggests that risk for disordered eating did not increase as a result of the intervention. This is a positive finding considering that it has been suggested that discussing body image and eating disorders may increase the likeliness of at-risk persons to engage in disordered eating behavior [54, 55]. A study by Carter et al evaluated a primary prevention of eating disorders program. Initially, there was a decrease in disordered eating behavior, but an increase in dietary restraint at 6 months post-intervention among those who were concerned for their weight at baseline [56]. In the present study, 52% reported feeling better about their bodies as a result of participation in the education sessions. In addition, 63% of athletes had low EA (< 45 kcal/kg LBM), but none had an

EAT-26 score above 15. This supports the finding by Hoch et al that low EA was inadvertent [4].

The educational intervention was accepted and enjoyed by participants and peer-leaders. Based on participant feedback, improved execution of the curriculum by peer-leaders by having the coach facilitate the sessions, holding the session during the school day, and shortening and simplifying the curriculum may result in improved acceptance of the education. The burden of participation would be lessened if repeated without research assessments. Few ($n = 9$) completed 3-day food logs, which was problematic because the intervention was designed for individual diet analysis and goal setting. Future interventions should consider more general methods for individualizing the intervention that do not require as much responsibility from participants.

Preference for an adult instructor was a surprising finding considering the successful utilization of peer-teaching in the Female Athlete Body Project [27] and the ATHENA study [26]. Participants and peer-leaders in the Female Athlete Body Project were college students; they may have been older and more mature than those in the present study [27]. Perhaps modeling the ATHENA program's coach-facilitation of the peer-led program would have been more effective [26]. Coach involvement may have ameliorated the classroom management issues, and may have provided peer-leaders with a heightened feeling of accountability for their performance as instructors. Coach involvement was specifically avoided, because some female high school athletes may feel uncomfortable discussing their body image and menstrual cycle with their coach present.

At the beginning of the season, Triad knowledge was low. A higher percentage of participants from the present study correctly answered questions about the relationship

between menstrual status and bone health, as well as age and bone health compared to Feldmann's group [23]. For example, 29.6% of athletes correctly answered that stress fractures occur more often in girls who skip their period compared to 9.7% in the Feldmann study [23]. However, a smaller percentage of participants from the present study correctly answered questions about training and menstruation (17.1 vs. 21.4%). For the six questions that were common to both studies, participants in the present study had a higher average score than those reported by Feldmann et al (2.44 ± 1.45 vs. $1.45 \pm$ SD not reported) [23].

At baseline, none of the participants could correctly identify the three components of the Triad. This was lower than the 18 (10%) reported by Australian women participating in a variety of sports (ages 18-40 years) [57]. However, at follow up, 6 (20%) could correctly identify all components of the Triad. The percent of participants who knew that menstrual dysfunction could impact bone health (24.1-29.6%, see Table 4-2) was lower than reported for exercising women in Australia (54%) [57], a group of Division I and III athletes (29-38%) [58], and university students (31.5%) [59], but higher than for junior high school female athletes (7.5%) [60].

Positive increase in Triad knowledge and sports nutrition knowledge were observed from the beginning to the end of the season. Attendance at the educational sessions was associated with higher knowledge scores. The magnitude of improvement was greater for Triad knowledge questions than for sports nutrition knowledge questions. This is not surprising as the main focus of the educational intervention was the Triad.

Though the study by Feldmann et al assessed knowledge of the relationship of bone mineral density with menstrual status [23], no study to our knowledge has

specifically assessed knowledge regarding EA and its effects on menstruation and bone health. The current study added the following questions specific to EA:

1. Not eating enough could cause me to lose my period (T)
2. How much I eat does not affect my bone health (F)
3. Exercising/Training too much could cause me to lose my period (T)

Increased knowledge of the effects of excess energy expenditure was observed.

The number who correctly knew that exercising/training could cause them to lose their period (question 3) increased from 37.9% to 79.3% after the education sessions. The first two questions were answered by most participants and consequently the percent increase was not substantial for either question (65.5 to 75.9% and 75.9 to 89.7%, respectively).

General knowledge of calcium and its impact on bones could have led the participants to think in terms of diet quality rather than the amount of energy intake when responding to those questions. Further research to determine effective methods to assess athlete knowledge regarding EA is warranted.

Those who had < 30 kcal/kg LBM had significantly lower caloric intake than who had higher levels of EA, however no differences in exercise energy expenditure were observed. When nutrient variables were computed per 1000 kcal, there were no differences in diet composition when comparing those with low EA to those with high EA. This indicates that the compositions of diet were similar, but those with low EA ate less.

Percent of participants with low EA was higher than in the study done by Hoch et al. However, those with low EA did not have elevated EAT-26 scores. This observation parallels the conclusion of Hoch et al, indicating that in this sample, low EA was

inadvertent. Comparisons between EA groups (≥ 45 and < 45 kcal/kg LBM, ≥ 30 and < 30 kcal/kg LBM) yielded results that were not consistent, which may be due to small sample size. Higher ratio of exercise energy expenditure compared to caloric intake appeared to be higher for those with low EA at both levels. Those with EA < 45 kcal/kg LBM thought that their BMI was higher than it actually was (body distortion). Those with EA > 30 kcal/kg LBM wanted to gain weight and were at no higher risk for disordered eating than those with higher levels of low EA. Overall, the results suggest that low EA was inadvertent.

Nearly 25% of participants reported a history of amenorrhea, which is within the range reported by previous studies (1.2%-30%) [3-5, 8]. Prevalence of menstrual irregularity was 50%, which was similar to that reported by Hoch et al [4] but higher than others (13-25%) [3, 5, 6, 8]. Stress fracture history was uncommon ($n = 2$, .6%), and a smaller percent of participants incurred injuries ($n = 6$, 21%) in general compared to previous reports ($> 60\%$) [6, 15]. Though no stress fractures occurred during the season, shin splints, or medial tibial stress syndrome, may result in a tibial stress fracture if training load is maintained or increased [61]. This suggests that though no stress fractures were observed, athletes with shin splints may be at risk for stress fractures. Small sample size and low prevalence and incidence of injuries may have prevented detection of relationships between injuries, menstrual function, and EA.

The DE classification criteria of a score ≥ 15 on the EAT-26 was used to enable comparison with the study done by Hoch et al [4]. The end-of-season survey revealed that 2 (6.8%) of the participants in the present study had an EAT-26 score ≥ 15 , which was similar to those reported by Hoch (4%) [4]. Comparison to other studies is difficult

due to the differences in sample size, tools, and classification criteria. For example, Rosendahl et al classified athletes as having DE if they had an EAT-26 score > 10 ; of the 210 German female high school athletes studied, 26% had DE [62].

Comparing results from the present study to results from studies which utilized the Eating Disorder Examination Questionnaire (EDE-Q) [63] is difficult because the EDE-Q uses different questions to assess DE than does the EAT-26. In addition, the inclusion and classification criteria for pathogenic weight control behaviors differed among studies that utilized the EDE-Q. For example, the 2006 study by Nichols et al reported that of the 170 female high school athletes, 18% had DE based on the EDE-Q global or subscale scores > 4 criteria [3]. In addition to the EDE-Q global and subscale scores (weight concern, shape concern, eating concern, and dietary restraint), Thein-Nissenbaum et al also classified athletes as having DE if they reported 2 or more pathogenic weight control behaviors (such as induced vomiting or laxative use) more than once in the previous 28 days [7]. Of the 311 athletes, 35.4% had DE [7]. The 2007 study by Nichols et al reported that of the 423 athletes studied, 20% had DE. Classification criteria included a EDE-Q global or subscale score > 4 , or 1 pathogenic weight-control behavior more than once in the previous 28 days [8].

The rates of bingeing (13.7%) and excessive exercise to control weight (28.5%) reported in the current study were higher than reported by previous studies. Though Hoch et al did not report pathogenic weight control behaviors separately, the combined prevalence was low (5%) compared to the current study [4]. The studies by Nichols et al [7,8] reported lower prevalence of bingeing (6.5% and 6.9%) than the current study; however, at the end of the season, the rate of bingeing in the current study was similar

(3.4%). There were no reports of vomiting or laxative use in the current study. Nichols' studies reported that 7% and 3% reported vomiting, and 1.8% and 1.7% used laxatives [3, 8].

Responses to disordered eating behavior questions (bingeing and excessive exercise to control weight) were likely inaccurate. Participant comments and questions during the baseline survey necessitated clarification for both of these items. For example, some of the participants interpreted binging, as eating extra food when they got home from practice. A research assistant clarified that a binge entailed eating abnormally large amounts of food coupled with a lack of control, not just additional food to appease hunger after their workout. Some participants did not notice the "to lose or control weight" aspect of the question regarding exercise in excess of 60 minutes per day. Participants did not express any confusion regarding the vomiting or laxative use questions. Not all athletes completed the survey at the same time; therefore, some may not have heard the clarifications.

Twenty-four percent of participants reported feeling pressure to achieve or maintain a certain body weight. Participants perceived their BMI to be higher than it actually was (body distortion). They also desired their BMI to be lower than their perceived current BMI. The finding that females overestimated their BMI was consistent with previous studies, however, previous studies found that females desired a BMI that was much less than their actual [29, 64, 65]. In the current study, perceived Ideal BMI was higher than their Measured BMI. The average EAT-26 score was low. Findings from a study of college cheerleaders, color guard members, and drill team members reported that body dissatisfaction was similar between those who were at risk for disordered eating

and those who were not at risk [65]. Considering previous research and finding from the current study, it is possible that in general, there was some body dissatisfaction and distortion among the participants, but not an increased risk for disordered eating.

Athletic performance was included in analyses because it is likely a meaningful outcome to athletes who may not internalize future implications of their current health status. Despite the importance of athletic performance as an outcome measure, it proved to be a difficult concept to capture and thus its utility was limited. Performance improves throughout the season due to training, which can make it difficult to determine effects of other variables on performance. Impaired performance among athletes with low EA or menstrual dysfunction may not be evident until injury occurs. In addition, many physical and psychological factors contribute to athletic performance, which increases the difficulty of determining the impact of Triad components on athletic performance. Percent change in performance was not a good outcome measure because magnitude of change varied widely among events. For example, athletes in throwing events had greater percentage increases than did sprinters. Larger sample size would allow for comparison of percent change among athletes within the same event.

Limitations

This study was limited by the small sample size, which resulted in decreased statistical power. As such, some associations may not have been detected, and there is risk that the findings reported in this study were not significant. Pooled variance estimate t-test and non-parametric tests were used to try and mitigate effects of non-normality and large differences between comparison groups. Because only one team was included in the

study, results may have limited generalizability to other sports teams in other areas of the country.

Reliance on self-reported data and lack of control group are limitations to this study. The menstrual status portion of the surveys included a question to assess how accurately the participants could answer questions regarding their menstrual cycle. Those who could not accurately answer these questions were excluded from analysis. Incomplete data and subsequent imputed values in the exercise recalls were also limitations to this study. The reference workouts yielded more conservative exercise energy expenditure values than “running, track practice” option available in the ESHA database. Though not optimal, this approach was systematic and conservative. Using estimated rather than measured REE values to determine EEE was also a limitation of this study.

Though there are not established guidelines for estimating energy intake to assess EA [4], a 3-day food and exercise log is the preferred method [66] and used in epidemiological studies evaluating EA [4]. Because few participants completed food logs, 3, 24-hour diet and exercise recalls (1 weekend day and 2 week days) were obtained. Using a recall method may have resulted in more representative data because food was not recorded at time of consumption. In addition, having a research assistant present at time of recording may have decreased the number of omitted foods.

Food recalls are limited by participant memory and accuracy in reporting food intake. Self-consciousness about diet may result in underreporting [67]. Underreporting has been observed with both the use of recalls [68] and food diaries [69]. Compared to doubly labeled water, the multiple 24-hour recall method has been shown to be an

effective method for estimating energy intake in children ages 4-11 (with parents as reporters) [70]. Dietary history methods have been shown to be good estimators of energy intake among adolescents [70]. The required 1-2 hour meeting with a trained interviewer necessary to obtain a dietary history prohibited the use of this method in the present study [67].

Percent BF may have been overestimated by calculations based on the baseline skinfold assessments. Though only 5 participants had %BF estimated from both skinfold measurements and Bod Pod, there was a significant difference in %BF estimates when comparing the two techniques. On average, %BF estimates from skinfold were 8% higher than estimates from the Bod Pod. This was reflected in differences in EA/kg LBM estimates, which affected EA classification. It is possible that additional athletes would be classified as having low EA if %BF was estimated via the Bod Pod.

Skinfold measurements were reliable. Lange skinfold calipers were used in this study. Harpenden calipers were used in the original validation study; however, this is not indicated in multiple textbooks. Schmidt and Carter reported that Lange and Harpenden calipers have similar pressures: 8.37g/mm² and 8.25 g/mm², respectively [71]. However, there have been reports that Harpenden calipers yield smaller measurements than do Lange calipers [71, 72]. Increased force required to open the Harpenden calipers has been hypothesized to allow further compression of the adipose tissue resulting in a smaller reading [73]. It is likely that the %BF estimates in the present study (using the Lange calipers) were high resulting in conservative EA estimation and classification.

Percent BF estimates derived from the Slaughter equation have been reported to be reasonably accurate (-0.3 to 1.3%), but have large standard deviations, which can

alter %BF estimations by more than 10% when compared to the 4-compartment model [74]. The Jackson and Pollock equation is validated for the estimation of body density in adult women [75]. A study by Wong et al reported that, though not designed for adolescent populations, the Jackson and Pollock equation may provide more precise estimates of %BF than does the Slaughter equation, and may be more useful in providing individual estimates of %BF [74]. Webster and Barr [76] caution against using field methods to estimate %BF among adolescent athletes. When field methods must be used, Webster and Barr [76] recommend the Jackson and Pollock equation [75], and adjusting for lower density of fat-free mass in younger populations via Lohman's age adjusted specific constants [77].

Lab methods such as the Bod Pod or hydrostatic weighing were not feasible for the entire sample. Distance from the high school to the body composition lab, and low participant reliability prevented the use of these methods in the present study. Among field methods, a skinfold technique was selected over bioelectrical impedance (BIA) because ensuring euhydration would be difficult. Lukaski reported that lean mass was underestimated by 5 kg when clients were dehydrated [78]. The Slaughter equation was initially selected because it only required triceps and calf skinfold measurements. The Jackson and Pollock method was not used in the current study to minimize the invasiveness of the procedures on the participants as it includes measurements of the anterior suprailiac, abdomen, and thigh. This study did not measure bone mineral density, or blood markers for bone growth or resorption. Therefore, neither the prevalence of all 3 Triad components, nor change in bone health could be assessed.

Conclusions

This is the first study to implement and evaluate a peer-led Triad education intervention among high school female athletes. Athletes were largely unaware of the Triad and its consequences at the beginning of the season. The educational intervention resulted in increased Triad and sports nutrition knowledge and did not increase risk for disordered eating. Of the 63% athletes with low EA (< 45 kcal/kg LBM), none had an EAT-26 score above 15, which indicated that participants were not at increased risk for DE and that low EA among participants was inadvertent. Future educational interventions should include education on low EA without disordered eating.

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CHAPTER 5
NUTRITIONAL STATUS OF YOUNG ADULTS AND
INTERVENTIONS TO IMPROVE HEALTH:
A REVIEW

Abstract

The transition from high school to college is associated with increased responsibility and autonomy, as well as increased stress, and limited time. Decreased breakfast consumption, irregular timing and frequency of meals, increased consumption of fast food, and inclusion of energy-dense foods that are low in nutrients often mark this transition. These habits can be associated with weight gain. However, with or without weight gain, poor diet can increase risk for chronic diseases and some cancers. Barriers to healthy eating include limited time, money, nutrition knowledge, and food preparation skills. Psychological, social, and environmental factors can negatively affect healthy eating among this population. Habits formed during the college years affect lifetime health. Weight gained during this time is often maintained or augmented. Nutrition education and intervention during the college years may influence knowledge, attitudes, and behaviors that may ultimately benefit the lives of the college students and their future families. Nutrition education interventions should focus on college students' barriers to healthy eating. Computer-based and/or face-to-face nutrition counseling, social marketing, and cooking classes yielded positive results such as improved attitudes and dietary adequacy. Interventions that can be incorporated into the college students' existing routine, or can be accessed remotely may be cost-effective approaches to reach many

students. Previous research provided evidence that college nutrition classes may serve as a useful avenue for affecting behavior change of many students. The application of the peer-led model in teaching nutrition to college students should be further investigated.

Introduction

The transition from high school to college is a time of increased responsibilities and autonomy. Development of personal identity, including health beliefs and values, occurs during this time [1]. As parental control begins to diminish, young adults have more control over the decisions they make, including health behaviors. For some, this period is associated with a decline in exercise and healthy eating [2]. In addition to the low diet quality, this decline can lead to weight gain.

Reported weight gain from studies evaluating freshman ranged from 1.8 lbs during the first semester [3], to 8.8 lbs in the first year [4]. However, no change in weight [5], and weight loss [6] were also reported. Though most studies observe weight gains below the famed “freshman 15,” weight gain during the first year of college is a reality for some students [7]. A study by Hovel et al followed female college students from their freshman to their junior year. On average, weight had returned to baseline by the junior year. Weight loss was associated with moving away from on-campus housing and pre-paid meal plans at the dining hall [3].

Women typically finish their linear growth in their late teens, while men continue to grow until their early twenties [8], however, some bone growth can occur up to age 25 [9]. Therefore, some weight gain may be attributed to growth. A study of over 200 college students by Gropper et al observed small (average increased from 66.64 ± 3.49

to 66.72 ± 3.49 inches) but statistically significant increases in height during the freshman year [10]. Hoffman et al reported that of the 67 participants, 73% gained weight. Average weight gain among that group was 3.1 kg (6.82 lbs). Average gain in fat mass was 1.2 kg (2.64 lbs), while lean mass increased by 1.8 kg (3.96 lbs). Physical activity was not assessed in this study [11].

For athletes or other individuals who engage in physical activity and training, weight gain may be attributed to gains in lean mass. However, many studies report decreased levels of physical activity during the transition from high school to college. Casperson et al reported lower levels of physical activity among young adults compared to adolescents [12]. Decline in physical activity has been reported in freshman health studies [2, 13, 14]. Butler et al reported a decline in physical activity and physical fitness, as well as loss of lean mass from the beginning to the end of the freshman year [4]. Gropper et al reported that ~60% of weight gain among freshmen was attributed to increases in fat mass [10]. Gains in fat may contribute to overweight and obesity as well as risk for chronic disease.

According to data from the American College Health Association National College Health Assessment (ACHA-NACHA), the percentage of college students who are overweight or obese is not decreasing (29.4% in 2000 vs. 34.1% in 2011) [15, 16]. A study by Engeland and colleagues found that body mass index (BMI) during adolescence (14-19 years) was predictive of both adult BMI and mortality. Those who were overweight or obese when they were young were more likely to be overweight or obese into adulthood. Extreme obesity was associated with elevated risk for adult mortality – 30-40% higher than those with a healthy BMI [17]. Results from Willett et al suggested

that weight gain after age 18, even among women with a healthy BMI (18-25 kg/m²), increased risk for coronary heart disease [18].

Food choices can impact BMI. In previous research, diets high in meat and low in fruits and vegetables were associated with high BMI [19, 20]. Results from the Canadian Community Health Survey (2004) indicated that BMI was negatively associated with fruit and vegetable intake. Of the 11,818 participants, those with the greatest reduction in risk for obesity had the highest intake of fruit and vegetables. Those in the 90th quantile of intake were nearly 4 times less likely to be obese when compared to those in the 30th quantile [21]. Soda intake was associated with weight gain among adolescent girls ($p < .05$) [22]. Similarly, fast food intake was positively correlated with BMI among an adult population in Minnesota ($p = .02$) [23].

Poor diet increases risk for diseases such as hypertension, cardiovascular disease, osteoporosis, and type 2 diabetes [24]. Previous research indicated that low intake of fruits and vegetables was positively associated with risk for colorectal cancer [25], heart disease [26], and diabetes [27]. Green-leafy vegetables appeared to have an especially protective effect [26, 27]. Dietary patterns that are high in fiber, fish, and vegetables are associated with decreased risk of heart disease and stroke [28, 29].

College is an ideal time for individuals to gain knowledge and skills necessary to plan healthy diets and make prudent food choices. Intervening at this time may improve students' attitudes and behaviors regarding food and nutrition. Improved attitudes and behaviors may ultimately impact the health and well-being of the individual and his/her future family [30]. This paper will review literature regarding the health status of college students, barriers to healthy eating, and interventions that may improve students' attitudes,

knowledge, skills, and behaviors related to healthy eating. Areas of further research will also be proposed.

Nutritional Status of College Students

Transitioning from high school to college can promote a decline in healthy eating. College students' lifestyles are often characterized by unhealthy behaviors in terms of eating frequency, as well as the types of foods consumed. Busy schedules may result in skipped meals [31, 32], unhealthy snacking [33], and frequent fast-food consumption [34]. Their diets are characteristically high in fat, sugar, and sodium [35], and low in milk, fruits, and vegetables [30].

Skipped Meals

Transitioning from high school to college can disrupt regular eating patterns. Results from the National Longitudinal Study of Adolescent Health (n=15,000) indicated that breakfast consumption decreased from $4.34 \pm .06$ to $3.09 \pm .05$ days per week ($p < .0001$) when comparing adolescents to young adults [36]. A study by Li et al reported that on average, college students skipped 2.4 meals per week [37]. One study found that those who skipped breakfast had the lowest intake of micronutrients compared to individuals with other eating patterns [38].

Unhealthy Snacking

Snacking is a component of the typical college student lifestyle. In one study, college students reported snacking 3-4 times daily [39]. In a focus group conducted by Nelson et al, college students reported eating at times other than regularly-scheduled meals such as

eating late at night or at social events [40]. Snacking can be problematic because snack foods are often high in calories and low in nutrients [41]. In a study by Kerver et al, calorie intake increased dramatically with more frequent eating episodes [38].

Previous studies have evaluated the types of snacks consumed by college students. McArthur, Holbert, and Forsythe reported that vegetables were consumed as a snack by more students when they were off campus compared to on campus (29% vs. 5.5% respectively) [39]. Nelson and Story conducted a study to evaluate the foods in 100 students' dormitory rooms. The percentage of students who had salty snacks, granola bars, desserts, and candy ranged from 70-88%. Fruit/vegetable and dairy products were only had by 57% and 41%, respectively [42]. Though snacking can contribute to intake of essential nutrients [38], the frequent consumption of unhealthy snacks may have a negative impact on students' health.

Fast Food Consumption

The National Longitudinal Study of Adolescent Health reported that frequency of eating out increased from $2.15 \pm .05$ to 2.48 ± 0.5 ($p < .0001$) from adolescence to young adulthood [36]. Driskell, Kim, and Goebel reported that in a study of 288 students at a Midwestern university, over 90% reported eating fast food 6-8 times weekly [43]. In a study of over 6000 children and adolescents, fast food was associated with increased calories, fat, and saturated fat, and lower intake of fiber [44]. Previous studies reported that fast food intake was associated with increased BMI among women [45] and adult African-American men [46], but not among adolescents [47]. The effect of fast food consumption on BMI may not be noticeable until later in life.

Fruit and Vegetable Intake

Results from Project EATS-II provide evidence of decline in healthy eating after high school. Fruit and vegetable intake was measured at baseline for 1710 middle-adolescents (average age $15 \pm .8$ years) [48] and again 5 years later. Total fruit and vegetable intake declined by more than $\frac{1}{2}$ serving per day [49]. Overall decreases in diet quality, marked by decreased fruit/fruit juice and milk intake, and increased consumption of sweetened drinks, salty snacks, and red meat in adulthood compared to childhood was observed in the Bogalusa Heart Study [32].

College students' diets do not meet the United States Department of Agriculture (USDA) recommendation to consume at least 5 servings, or 2.5 cups of vegetables daily (http://www.choosemyplate.gov/food-groups/vegetables_amount_table.). According to the ACHA-NACHA II only 5.2% of students reported eating 5 or more servings of fruits and vegetables daily. Most Americans are not consuming the recommended amount of fruits and vegetables [50, 51]. The percent of persons aged 18-25 years who consumed >2 servings per day of vegetables and fruits were among the lowest in the nation compared to other age groups [51].

Barriers to Healthy Eating

Decreased social support, inadequate planning and self-monitoring, lack of availability of healthy foods, and the cost of healthful food are barriers to healthy eating among college students [40, 52-54]. It has also been suggested that young people may have a less developed understanding of the effects of eating an unhealthy diet than older

adults [55]. Lack of time, money [56], and cooking skills are major barriers to healthy eating among college students [57].

Social Support

Decreased social support during the transition from high school to college was reported by Clusky and Grobe [52]. Students reported decreased social support because they no longer had the positive role models and built-in structure for healthy eating (i.e., eating healthy foods at regular mealtimes) that living with their families provided [52]. In another study, college freshmen and sophomores reported that their friends had a stronger impact on their dietary choices than did their families because most meals were eaten with friends [54]. Strong et al reported that social support for healthy eating was associated with diet quality [54]. Though friends can provide social support, it may take time to establish social circles.

Planning/Self-Monitoring Skills

A study by Strong et al, which included interviews of college freshmen and sophomores, revealed that students did not plan healthy meals and snacks despite their desire to eat healthily [54]. In a focus group study by Nelson et al, students reported limited free time and difficulty balancing school and other responsibilities. Studying and attending social activities often took precedence over healthy eating and exercise. Difficulty scheduling time to plan and prepare healthy foods was a reported barrier to healthy eating [40].

Availability of Healthy Foods

For students with limited transportation options, grocery stores may not be easily accessible. These students may resort to convenience stores on campus which may contribute to unhealthy food choices [40]. Dining halls too can present barriers to healthy eating. A study by Peterson, Duncan, and Null indicated the “limited availability of healthy foods within the dining hall” was the number one barrier to making healthy food choices among students with meal plans [58]. The sheer amount and vast variety of food items (including elaborate desserts, etc.) available can also promote overeating [40]. College students in a study by Shive and Morris reported that limited variety and high cost of healthy food at fast food restaurants and convenience stores was a barrier to healthy eating [56].

Knowledge/Understanding

A study by McArthur, Holbert, and Forsythe evaluated the nutrition knowledge related to snacking of students in a health-related field compared to those in a non-health related field. When answering questions about characteristics of snacks, all students scored highly, regardless of their field. Among those in a health-related field, knowledge was weakly associated with improved snack quality at home ($r = 0.149$, $p = 0.024$), but not on-campus [39]. Strong et al conducted a study that included interviewing 30 college freshmen and sophomores. A major theme from these interviews was that students thought a healthy diet contained fruits, vegetables, grains, and meat or protein [54]. As discussed above, college students’ diets are characteristically low in fruits and vegetables. These findings suggest that college students do have a general knowledge of the nutritional quality of foods, and that knowledge does not ensure sound dietary choices.

This may be due to limited life experience that would lead them to internalize the long-term implications of their dietary choices [59].

Time

College students report limited time as a barrier to healthy eating. In a study by Larson et al, time was the most commonly-reported barrier to preparing meals (35% of men and 37% of women) [60]. Students with busy schedules or who perceive that they do not have enough time to prepare meals may opt for fast food or other convenience options instead of preparing their own meals. According to Larson et al, college students who ate on the run had higher intakes of fast food, soft drinks, fat (both total and saturated), and lower intakes of healthy foods such as fruits and vegetables ($p \leq .01$) [61].

Money

Limited money to spend on food can be a barrier to healthy eating. In a study by Shive et al a quarter of the participants reported that cost was a barrier to fruit consumption [56]. This is problematic for busy students who often choose fast-food or other convenience foods. In many fast food restaurants items such as salads or fruit parfaits can be more expensive than other food items. This was observed in a focus group composed of male and female college students. Both male and female participants expressed concern that unhealthy food was less expensive than healthy food [52].

Cooking Skills/Meal Preparation

Meal preparation has been observed to positively impact diet quality among young adults. Larson et al reported that most young adults do not prepare meals even weekly. Young adults who prepared meals frequently not only ate less fast food, but were more

likely to have intake within the recommended amounts of fat ($p < 0.001$), calcium ($p < 0.001$), fruit ($p < 0.001$), vegetables ($p < 0.001$), and whole grains ($p < 0.003$) [62].

Among participants in study to evaluate fast food consumption among college students, limited time was reported by over half as being a contributing factor in their fast food consumption [34].

Previous Interventions

Face-to-Face Counseling

A 4-month intervention that included a 45-minute face-to-face counseling session with telephone follow-up resulted in increased fruit and vegetable consumption and decreased intake of fat among 600 women (ages 40-70 years). During the counseling session, participants set goals that were specific to increasing fruit and vegetable intake and decreasing fat intake [63]. An evaluation of studies utilizing telephone interventions to modify diet concluded that additional face-to-face contact was a component of most of the effective interventions [64]. Another review of 907 articles published before 2002 indicated that goal-setting and small groups were important factors in success in changing dietary behaviors [65].

Social Marketing

Social marketing has been shown to improve dietary choices. An intervention that reached 1,367 randomly-selected college students promoted fruit intake by providing fruit, fruit juice, and fruit smoothie samples and coinciding nutrition information about the samples at health fairs on the college campus. This intervention resulted in an increase in fruit intake from the beginning to the end of the intervention [56]. Another

social marketing intervention utilized point-of-purchase signage indicating healthy food choices. The intervention resulted in increased awareness of healthy food choices, and an increase in students who selected cottage cheese or low-fat salad dressing as a result of the intervention [58].

Cooking Skills

Interventions that focus on improving cooking skills have been studied in adult and youth populations. A study by Newman and colleagues reported significant increases in healthy eating among adults as attendance at cooking classes increased, however, the authors note that improvements were also seen as a result of other facets of the intervention including telephone and print interventions [66]. A study of 113 adults reported increased fruit intake after participating in a cooking skill intervention program [67]. An interactive cooking class in which participants could taste the foods they prepared resulted in an increase in fruit and vegetable intake among adult and youth participants [68].

Interventions aimed at improving cooking skills of college students are limited [69]. One study of college sophomores found that interactive cooking classes resulted in increased cooking self-efficacy and enjoyment of cooking, and improved attitudes towards cooking. More students in the intervention group agreed that cooking helped them eat healthier diets and save money than did those in the control group (demonstration only) [69]. Due to busy schedules, or transportation limitations, college students may have difficulty attending onsite, extra-curricular cooking classes. A study by Clifford et al evaluated the impact of brief, 15-minute cooking demonstrations among

50 college students. Increased knowledge of recommended intake of fruits and vegetables as well were observed. However, there were no changes in dietary intake [70].

Nutrition Course

A study done by Ha et al observed improvements in fruit and vegetable intake following a college nutrition course. The course focused on increasing awareness of the tie between nutrition and chronic disease and on motivating students to increase consumption of fruits and vegetables, making it very applicable to the individual. Integrated feedback on dietary choices and inclusion of hands-on activities kept the students engaged throughout the course of the intervention. Even with an overall decrease in consumption of fried potatoes ($p < 0.05$), intake of fruit and vegetables increased from the beginning to the end of the semester ($p < .05$). Intake of fresh produce also increased ($p < 0.05$) [71].

Computer-Based/Online

Providing nutrition information on the internet may be more accessible than other approaches to influence dietary choices [43]. Interactive websites that specifically cater to college students may appeal to students who regularly use the internet, and may be a cost-effective intervention strategy [72]. Ninety percent of participants in a study by McArthur, Holbert, and Forsythe reported that they wanted to learn more about healthy snacking, and 57% indicated that online was their preferred mode [39].

A study by Delichatsios et al evaluated a weekly computer-based counseling intervention among sedentary adults (mean age 45.9 years). The intervention group received weekly guidance, advice and feedback regarding their dietary habits over 6

months. The control group received counseling to increase physical activity. Those in the control group experienced significant increases in fruit intake, fiber intake, decreased percent of calories from saturated fat, and increased overall diet quality compared to the control group [73].

An interactive online program that included links to nutrition information that was tailored to college students was evaluated by Franko et al. Program users assessed their own health practices and attitudes and set goals to improve their health. Those who participated in the intervention had increased motivation to improve their diet and had an improved outlook towards exercise compared to participants who did not receive the intervention [74].

Peer-led Interventions

Peer teaching is employed in various settings due to its potential to improve the feasibility, sustainability, and effectiveness of teaching. Using students as teachers is a cost-effective maneuver, and is sustainable because as long as there are students, there are teachers. In addition, peer-teachers can relate to the students because they are in a similar stage of life and knowledge level. Peer-teachers may also benefit in terms of solidification of knowledge by having to teach it to someone else [75]. Adolescent peer-led nutrition-related interventions have been studied. The peer-led model has been studied in college populations in interventions to address drug use and disordered eating. However, use of the peer-led model for nutrition education among college students has not been studied extensively.

The peer-led model has proved effective in improving nutrition knowledge and behavior among high school athletes. The Athletes Training and Learning to Avoid

Steroids (ATLAS) program is a peer-led educational intervention developed for male high school athletes. Positive results of this program include decreased drug use, and improved nutrition behaviors such as decreased use of sports supplements [76]. In a similar program for female athletes, Athletes Targeting Healthy Exercise and Nutrition Alternatives (ATHENA), trained peer-teachers to deliver an educational intervention to their peers. Post-intervention, the participants had decreased disordered eating behavior and [77] increased nutrition knowledge [78].

The peer-led model has been utilized in alcohol and eating disorder interventions among college students. Becker and colleagues reported positive changes in attitudes and behaviors related to disordered eating, as a result of a peer-led intervention [79]. In a study by Larimer et al, participants who received the intervention had decreased alcohol intake. There were no differences observed when comparing the outcomes of those who received the intervention from their peers and intervention with the professional instructors [80].

Future Directions for Research

Many effective approaches to improving dietary behaviors among adults have been identified. However, not all have been extensively researched among college students. In addition, though interventions such as face-to-face counseling and social marketing are effective, they may not be the most preferred or feasible options for college students. Interventions that can be incorporated into students' routines, such as inclusion in a college course, may be effective and warrants further research [71]. Providing information and educational tools online is preferred by college students and fits their

busy lifestyles. Online interventions may be cost-effective and sustainable. Therefore, this method should be employed and studied more extensively. In addition, interventions aimed at improving cooking skills of college students may improve diet quality among this population.

As described earlier, peer-led education has had positive results in both high school and college populations. As part of a study to assess health habits of freshmen at Oregon State University, student focus groups were held to identify possible interventions to enhance the health of college students. The study participants expressed desire for “peer-led classes providing strategies for managing healthful living during college” [52]. Further research should investigate the efficacy of the peer-led model in nutrition education for college students.

Summary and Conclusion

The transition from high school to college is associated with many changes in routine, responsibilities, and social support. This transition is often accompanied by decreases in health habits. Development of poor health habits and consequential weight gain can increase immediate and lifetime health risk. Barriers to healthy eating include limited time, limited money, lack of social support, inadequate nutrition knowledge and cooking skills. Previous research has identified intervention strategies that show promise for improving the nutrition knowledge and behaviors among college students. Modifications of interventions may need to be made to fit the interests and lifestyles of college students. Future research should focus on interventions that address college

student barriers to healthy eating, and are in a format that meet the preference and availability of the students.

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CHAPTER 6

IMPROVING DIETS OF COLLEGE STUDENTS: SURVEY OF DIETARY
HABITS AND FOCUS GROUP PERSPECTIVES ON
HOW TO BEST TEACH STUDENTS^{1,2}

Abstract

Objective: Assess dietary patterns of college freshmen, identify barriers to healthy eating, evaluate effectiveness of a brief nutrition workshop, and ascertain additional strategies for future interventions.

Participants: College freshmen (181 men, 334 women), at a university in the western United States.

Methods: Participants (n = 515; 181 men, 334 women) completed a survey on diet and health habits during their first month of college (September 2009). Of those who completed the survey, 266 participated in a nutrition workshop as part of their freshman orientation. Twenty-one (5 men, 16 women) also participated in one of three focus groups (January and February 2010).

Results: Average freshmen diets did not meet the Dietary Guidelines for Americans (n = 515). Healthy eating was a concern for most (88.7%). Focus group participants endorsed workshop timing and made suggestions concerning content and format of follow-up nutrition education.

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Conclusions: Most freshmen are concerned about diet and could benefit from nutrition education. Continued education via cooking classes, meeting with “nutrition coaches,” an interactive website, and/or emails may influence freshmen dietary behaviors.

INTRODUCTION

The transition from high school to college is associated with changes in schedules, routines, responsibilities and autonomy. These lifestyle changes may initiate a decline in healthy eating (Racette et al. 2005). For many incoming freshmen, this is a time of increased personal control of dietary choices. Many are planning, shopping for, and cooking their own meals for the first time. Students with pre-paid meal plans have access to a wide variety of foods and have control over both the type and amount of food they consume.

Diets of college students are characteristically low in fruits and vegetables (Racette et al. 2005; Racette et al. 2008) and high in fat and sodium (Anding et al. 2001). Limited time and money are major barriers to healthy eating (Betts et al. 1997). Decreased social support, lack of motivation, inadequate planning and self-monitoring, lack of availability of healthy foods, inept food preparation skills, and the cost of healthful food are also barriers to healthy eating (Cluskey and Grobe 2009; Nelson et al. 2009; Greaney et al. 2009; Strong et al. 2008). Such barriers, whether real or simply perceived, may promote food choices that include an abundance of processed and pre-prepared meals, and frequenting fast-food restaurants, which can limit healthy options and can contribute to the prevalence of obesity (U.S. Department of Health and Human Services 2008).

Previous studies have evaluated the efficacy of interventions aimed at improving students' eating habits. Effective interventions include weekly computer-based counseling (Delichatsios et al. 2001), face-to-face counseling (Stevens et al. 2002), social marketing (Shive and Morris 2006), and the use of a college nutrition class (Matvienko et al. 2001). As part of a study to assess health habits of freshmen at Oregon State University, student focus groups were held to identify possible interventions to enhance the health of college students. The study participants expressed desire for "peer-led classes providing strategies for managing healthful living during college" (Cluskey and Grobe 2009).

Focus groups have been shown to be a useful means of obtaining qualitative information for use in the development, assessment, and adaptation of health promotion or intervention programs (Rabbie 2004; Redmond and Curtis 2009). The purpose of this study was to use an online survey to assess diet quality of freshmen and evaluate the effectiveness of a brief nutrition workshop, Healthy Eating 101, in stimulating dietary change by comparing the diets of those who participated in the workshop to those who did not. Focus groups were held to gain additional insight concerning barriers to healthy eating, acceptability and value of Healthy Eating 101, and suggestions for topics, resources and approaches that may help freshmen students establish or maintain healthy lifestyles as they transition from high school to college.

MATERIALS AND METHODS

All students enrolled in a voluntary freshman orientation course (n=1400) were invited to complete a comprehensive diet and health survey (see Appendix E) and later invited to participate in focus groups. The institution's review board reviewed and

approved all study methods and procedures. Participants completed an electronic consent before completing the online survey, and provided written signed consent before participating in the focus groups. Students who completed the survey had the option to enter their names in a prize drawing. Students who participated in the focus groups received ten dollars and a coupon for free ice cream.

Healthy Eating 101

Of the 1400 students enrolled in a university freshman orientation course, approximately half participated in a brief nutrition education workshop, Healthy Eating 101 (see Appendix E). The workshop was taught during the week prior to fall semester 2009. The aim of this workshop was to promote healthy eating habits, and provide strategies that may attenuate the weight gain that is sometimes associated with the first year of attending college. Healthy Eating 101 utilized small group interaction and was taught by undergraduate dietetic students.

The curriculum for the workshop was developed to address barriers to healthy eating identified in previous studies. The nutrition education provided in the workshop included three, 15-minute lessons that focused on components of a well-balanced meal, quick and easy meal planning, and eating healthily on a budget. Shopping the perimeter of the grocery store to focus on whole foods and avoid boxed or frozen meals was emphasized.

Hands-on components included building a meal by selecting food models to demonstrate a meal that contained three food groups, a race to prepare a simple turkey wrap, and a game in which students would guess the prices and compare the nutritional value of fast-food, frozen, boxed and homemade meals. Samples of the turkey wrap were

provided. Additional information including nutrition and physical activity handouts/links and recipes were available on the Healthy Eating 101 website.

Survey

In September of 2009, 515 of the approximately 1400 students who participated in the freshmen orientation course chose to complete a comprehensive health survey that included information on usual dietary intake and physical activity habits during their first month of attending college. Of the 515 who completed the survey, 52% had previously participated in Healthy Eating 101 (taught in August 2009 as part of their freshman orientation course). Usual dietary intake during the first month of their fall semester as a freshman was assessed using a modification of the Youth and Adolescent Questionnaire (YAQ) food frequency questionnaire. The YAQ was modified to include additional questions to delineate which types of bread, cereal, pasta, and rice were consumed to better assess the intake of whole grains. Energy drinks were also added. Nutrient composition for each food was obtained from the Food Processor (ESHA version 7.02) nutrient database (ESHA Research 2005). Total nutrient intake was determined by summing the totals of all food items. Average intake of food groups and nutrients were compared to the *Dietary Guidelines for Americans* (U.S. Department of Health and Human Services and U.S. Department of Agriculture 2005).

Focus Groups

Focus group participants were recruited from those who completed the online survey and were not limited to students who participated in Healthy Eating 101. Of the 359 who completed the survey and consented to be contacted for further research, 21(5

men, 16 women) responded to an email invitation and participated in one of three focus groups (n=4-9 students). Eight (38%) of the 21 focus group participants participated in Healthy Eating 101. The focus groups lasted one hour and were held in January and February of 2010. The questions asked in the focus group were designed to gain information regarding students' perceived barriers to healthy eating, perception of the value of Healthy Eating 101, and suggestions of additional topics, resources, and techniques to promote healthy eating among college freshmen. Two investigators facilitated each discussion; one served as a moderator, and one took notes. The proceedings were recorded and later transcribed. Recordings were independently evaluated by two investigators, and all investigators who participated in facilitation of the focus groups discussed the results to identify themes and draw conclusions.

Statistical Analysis

Descriptive statistics for both the focus group participants and the survey population were generated using PASW software. Associations between continuous variables (i.e. age, body mass index (BMI), and dietary variables) and the factor of interest (i.e. participation in Healthy Eating 101) were assessed using analysis of variance (ANOVA). Associations between categorical variables (i.e. gender, ethnicity, etc.) and the factor of interest were assessed using χ^2 distributions. ANOVA and χ^2 tests were also used to determine if the focus group participants were representative of the survey group as a whole. The null hypothesis was rejected at the 0.05 level of significance.

RESULTS

Survey Results

Of the 1400 incoming freshmen enrolled in a freshmen orientation course at a university in the western United States, 515 completed the health survey. Sixty-eight percent were female, and 94% were non-Hispanic white. The mean age was 18.23 ± 2.0 years, and the mean BMI was $23.0 \pm 4.1 \text{ kg/m}^2$. Most (88.7%) reported being concerned about healthy eating, and 224 (43.5%) participated in a meal plan at the university dining hall.

Usual dietary intake was assessed using a food frequency questionnaire. In general, freshman diets did not meet the *Dietary Guidelines for Americans* (U.S. Department of Agriculture 2005). Average intake (servings/day) of fruits (1.42 ± 1.00), vegetables (1.5 ± 1.10), whole grains ($1.06 \pm .90$) and low-fat dairy products (1.86 ± 1.60) was low. Only 38.3% reported consuming three or more servings of fruits and vegetables daily. On average, freshmen reported consuming fast food once per week. In addition, only about half of the recommended amount of potassium, and about 68% of the recommended amount of fiber was consumed by these freshmen (Table 7-1).

Diets varied between genders. Males reported consuming significantly more calories than did the females. When adjusted to control for calorie level, females had higher intake of fruits, vegetables, low-fat dairy products, and whole grains. Vitamin A, vitamin C, iron, fiber, and potassium intake among females was higher than reported by males. Males consumed more red meat and sweetened beverages, and had a higher percentage of total calories from fat.

A greater percentage of males reported having a meal plan for the university's dining hall (51.5% vs. 39.7%, $p = .012$). Males also frequented fast food restaurants more often than did females (1.2 ± 1.64 vs. $.75 \pm 1.62$ visits per week, $p = .001$). Fast food consumption was not associated with differences in BMI. A smaller percentage of males were concerned about healthy eating (78.2 vs. 93.7, $p < .0001$). Fewer males knew the recommended amount of dairy products that should be consumed daily, but no other differences in nutrition knowledge were observed. There were no differences in self-efficacy to plan, shop for, or prepare healthy meals when stratifying by gender.

When comparing the dietary patterns (reported in September 2009) of those who participated in Healthy Eating 101 (taught in August 2009) to those who did not, no differences in content or quality were observed. There were no differences in consumption of micronutrients, macronutrients, or food groups such as fruits and vegetables. Thus, Healthy Eating 101 did not result in behavior change (Table 6-1).

Focus Group Results

Of the 21 students who participated in the focus groups, 5 (24%) were male, 16 (76%) were female, 19 (90%) were non-Hispanic white. The mean age was 17.9 years, and average BMI was 24 ± 4.51 kg/m². Seven (33%) reported having a meal plan at the university's dining hall, and 17 (81%) expressed concern about making healthy food choices. Eight (38%) participated in Healthy Eating 101. When these descriptive measures were compared to that of the entire survey population of 515 freshmen, no statistical differences were identified. Furthermore, no statistically significant differences existed between the dietary intake of the focus group participants and the survey population (Table 6-1).

Students reported limited time and lack of money as significant barriers to healthy eating. Inconvenience of preparing healthy food was also discussed. Students reported reliance on vending machines, snack items, and convenience foods such as Ramen Noodles. Difficulty cooking for only one or two people was also mentioned. Those who had meal plans at the university dining hall found it challenging to select healthy, balanced, and energy appropriate meals from the vast and unlimited food options available in the dining hall. Prevalence of unhealthy food options, and limited variety of fresh produce was mentioned; although some were satisfied with the variety of healthy options available. Other barriers included limited knowledge and/or cooking experience, and work and school schedules conflicting with normal meal times.

In general, those who participated in Healthy Eating 101 advocated the inclusion of nutrition education in the freshman orientation course. Students enjoyed the small group interaction utilized in the teaching of Healthy Eating 101, and felt that the length was appropriate. There was a preference for dietetic students serving as peer-instructors rather than a nutrition professor or other professional. Students indicated that receiving this education from their peers made it more relevant because both the student and the instructor were in the same phase of life and had common barriers to healthy eating.

Students who lived on campus felt that the workshop content was valuable and could be applied in the future even though their meal plans at the dining hall alleviated their responsibility to plan, shop for, and prepare meals. Interactive and practical elements of the course, such as the assembly of a turkey wrap, discussion of shopping the perimeter of the grocery store, and a meal pricing game were memorable and enjoyable. The information regarding planning meals to save time and money, sticking to a grocery

Table 6-1
Comparison of population characteristics by focus group and Healthy Eating 101 participation

	Survey Population (n = 515)	Focus Group Participants (n = 21)	P-value*	Students who did not participate in Healthy Eating 101 (n = 249)	Healthy Eating 101 Participants (n = 266)	P-value*
Female	334 (67.6%)	16 (76.2%)	.409	164 (65.9%)	186 (69.9%)	.324
Male	160 (32.4%)	5 (23.8%)	.409	85 (34.1%)	80 (30.1%)	.324
Non-Hispanic White	466 (94.3%)	19 (90.5%)	.460	233 (93.6 %)	252 (94.7%)	.574
Participate in a meal plan	224 (43.5%)	7 (33.3%)	.338	111 (44.6 %)	113 (42.5%)	.631
Mean age (years)	18.23± 2.0	17.9±1.3	.448	18.12±1.80	18.32±2.08	.256
Average BMI	23.0±4.1	24±4.51	.275	23.04±4.2	23.09±4.19	.887
Weekly fast food consumption	.9129±1.63	.428±.779	.261	.87±1.57	1.00±1.72	.419
Concerned about healthy eating†	457 (88.7%)	17 (81.0%)	.249	224 (90%)	233 (87.6%)	.396
Kcals	1905 ± 768	1703 ± 623	.240	1907±785	1881±745	.692
% kcals from fat	33.6±5.6	33.3±6.4	.798	30.18±5.04	30.39±5.07	.841
% kcals from saturated fat	11.6±2.85	11.2±2.74	.509	11.5±2.80	11.69±2.85	.462
Calcium (mg)	1094.45±558	978.0±566	.329	1096±567	1092±550	.936
Iron (mg)	15.7±6.2	13.3±4.82	.080	15.66±6.49	15.77±6.30	.894
Vit A (mcg, RAE)	900.3±505	821.8±498	.467	874±516	924±492	.256
Vit C (mg)	91.6±.78	85.84±81.8	.734	96.7±97	86.9±55	.163
Iron (mg)	15.7±6.2	13.3±4.82	.080	15.66±6.49	15.77±6.30	.894
Folate (mcg)	203.4±118	164.1±88	.119	525±237	513±239	.582
Potassium (mg)	2480.9±1092	2403.3±1131	.740	2482±1155	2479±1037	.975
Fiber (mg)	17.6±5.9	15.8±5.9	.304	17.59±7.96	17.52±7.27	.926
Sodium (mg)	2682±1095	2419.7±810	.261	2726±1156	2641±1035	.378
Fruits (spd)	1.42±1.00	1.55±1.16	.543	1.45±1.00	1.40±1.05	.603
Vegetables (spd)	1.5±1.10	1.5±.87	.987	1.54±1.13	1.46±1.05	.384
Low-fat dairy	1.86±1.60	1.75±1.72	.737	1.82±1.66	1.90±1.55	.594
Whole grains	1.06±.90	.6919±.48	.050	1.05±.87	1.08±.92	.691

*Associations between continuous and categorical data and single factors of interest were assessed using analysis of variance and χ^2 distributions.

†Concerned about making healthy food choices included participants who reported “somewhat concerned” and “very concerned”.

list, keeping meals quick and simple, and relative prices of foods were noted as valuable. Food samples were a highlight of the workshop. Students expressed the need for improved marketing of the Healthy Eating 101 website; few students had visited the website, and many said they had lost the web address.

Suggestions for topics to include in future nutrition education endeavors, as well as suggested strategies for presenting the nutrition information were not limited to those who participated in Healthy Eating 101. Suggestions included portion size, cost per serving, and unit price of food. Students also requested ideas for grab-and-go foods, and easy recipes for one or two people.

In general, focus group participants recognized the potential benefit of a format that included follow-up nutrition education instead of just one workshop prior to the first week of school. Suggested formats for follow-up included additional Healthy Eating 101 workshops later in the semester, cooking classes, a website, emails, and handouts. Students were enthusiastic about meeting with dietetic students who would serve as “nutrition coaches” to provide basic nutrition information and tips to improve their diets.

Students believed that “nutrition coaches” would provide desired one-on-one interaction and individualized advice for meal planning and healthy eating. Cooking classes were mentioned several times. Students indicated that they valued hands-on experiences and free food. They emphasized that cooking classes should be optional, drop-in classes that are free of cost, and should focus on simple techniques, recipes with a few common ingredients, and tailored to feed one or two people. One student suggested holding cooking classes in the evening allowing students to eat for dinner the foods they prepared in the class.

The majority of students requested weekly emails with nutrition tips and recipes, although some students preferred handouts to emails. Students discussed favorable characteristics including catchy email titles, and allowing interested students to sign up for the emails. Another suggestion was a well-marketed website to provide recipes and nutrition information. Magnets with web address, emails with links to website, and showing the website during class were all mentioned as possible marketing strategies.

DISCUSSION

Survey results were consistent with those of previous studies which indicated that in general the diets of college freshmen do not meet the *Dietary Guidelines for Americans* (Racette et al. 2005; Racette et al. 2008; Anding et al. 2001). Intake of fruits, vegetables, whole grains, and low-fat dairy were low. The percentage of students who reported consuming three or more servings of fruits and vegetables daily was similar to the national average as reported in the American College Health Association National College Health Assessment II (ACHA-NCHA II), 38.3 vs. 34.3 respectively (American College Health Association 2009).

Similarly, freshmen only consumed approximately half of the recommended amount of potassium, and about two-thirds of the recommended amount of fiber. Average frequency of fast-food consumption was similar to some reported in previous research (Morse and Driskell 2009; Driskell et al. 2006) but lower than reported by Driskell et al. (2005).

Numerous gender differences were observed. Males had lower intakes of key food groups and nutrients than did females. As found in other studies, males had higher fast

food, sweetened beverage, and red meat consumption than did females (Morse and Driskell 2009; Driskell et al. 2006). The smaller percentage of males who were concerned about healthy eating than were females was consistent with previous research (Morse and Driskell 2009; Bryant and Dundes 2008). However, there were essentially no differences in nutrition knowledge or self-efficacy associated with healthy eating. The differences in intake may in part be due to a more prevalent lack of concern for healthy eating observed among males.

As in previous research, the main barriers to healthy eating reported in this study included limited time, money, and knowledge and/or cooking experience. Those who had meal plans at the university dining hall had conflicting views of the foods available at the dining hall. Variation in knowledge or skill in selecting healthy foods may have contributed to this discrepancy. Inadequate meal planning skills were also reported, with a greater emphasis on the aspect of cooking for one or two people.

Most of the students who participated in Healthy Eating 101 found the timing (during freshman orientation one week prior to the beginning of the semester), length (45 minutes) and structure (peer taught, interactive, and rotating through three 15-minute stations) of Healthy Eating 101 to be acceptable. However, all students agreed that follow-up nutrition education of some kind would be beneficial. Survey results indicated that Healthy Eating 101 did not affect the dietary behaviors of participating freshmen despite their interest in and appreciation for the workshop. There were no differences in the diets of the students who participated in Healthy Eating 101 (n=266) and those who did not (n=249). This was true at the food group, macronutrient, and micronutrient level (Table 6-1).

Focus group participants provided insightful suggestions for topics that should be included in nutrition education provided to freshmen, as well as strategies for presenting this information. The need for ongoing nutrition education, rather than a brief workshop prior to the first week of classes was discussed. Suggestions for follow-up reinforcement included cooking classes, meeting with dietetic students serving as “nutrition coaches,” and receiving information via email or websites. Students also suggested consideration of additional topics including cooking for one or two people and easy meals for students with limited cooking skills when developing future curriculum.

Cooking classes have been shown to be effective in increasing vegetable intake in both youth and adults, though few interventions have been focused on college students. One study of college sophomores found that interactive cooking classes have been shown to increase cooking self-efficacy and enjoyment of cooking, and improve attitudes towards cooking. More students in the intervention group agreed that cooking helped them eat healthier diets and save money than did those in the control group (demonstration only) (Levy and Auld 2004). A study by Newman and colleagues reported significant increases in healthy eating as attendance at cooking classes increased, however, the authors note that improvements were also seen as a result of other facets of the intervention including telephone and print interventions (Newman et al. 2005).

Previous research has found face-to-face counseling to be influential in improving dietary intake (Stevens et al. 2002). Results from the present study indicate that receiving nutrition education from peers may be a preferred method of providing this additional exposure to nutrition information. Providing nutrition information on the internet may be more accessible than other approaches to influence dietary choices (Driskell et al. 2006).

Interactive websites that specifically cater to college students may appeal to students who regularly use the internet, and may be a cost effective successful way to reach a large number of people (Cousineau et al. 2004).

Evaluation of the impact of the nutrition workshop was limited due to the cross-sectional nature of this study and subsequent lack of baseline dietary intake data. As seen in other freshmen health studies, the majority of participants were non-Hispanic white females (Cluskey and Grobe 2009; Kasparek et al. 2008; Desai et al. 2008). However, this is representative of the demographics of the students enrolled in the freshmen orientation course. Another limitation was that not all the focus group participants had participated in Healthy Eating 101. Because this research was conducted at a single university in the western United States the findings of this study may not be generalizable to all freshmen students (Rabbie 2004).

Strengths of this study include the size and representative nature of the study sample used. When comparing the 515 freshmen who participated in the study to the 1400 enrolled in the freshmen orientation course, no differences in demographics or dietary patterns were observed. The quantitative data, including usual intake of individual foods and nutrients, was also a strength of this study.

CONCLUSION

Diets of college freshmen students did not, in general, meet the *Dietary Guidelines for Americans*. Survey data suggests that the brief nutrition workshop Healthy Eating 101 did not influence dietary behavior after one month. Concern for healthy eating among most (88.7%) of the freshmen surveyed warrants continued nutrition interventions. Follow-up nutrition education may be more effective than a brief nutrition workshop

prior to the first week of the semester. Peer teaching is a preferred method of receiving nutrition education. Although further research is required, future nutrition interventions that include continued exposure via cooking classes, meeting with “nutrition coaches,” an interactive website, and/or distribution of nutrition information and recipes for one or two people may effectively influence changes in dietary behaviors of freshmen. Previous research and the current study have suggested that males may be at greater risk for poor nutrition, and may be less concerned about health than female students. For these reasons, future research to identify approaches that appeal to male students may be warranted.

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CHAPTER 7

INCREASED SELF-EFFICACY FOR VEGETABLE PREPARATION FOLLOWING
AN ONLINE, SKILL-BASED INTERVENTION AND IN-CLASS TASTING
EXPERIENCE AS A PART OF A GENERAL EDUCATION
COLLEGE NUTRITION COURSE^{3,4}

Abstract

Purpose. *Assess the effectiveness of the integration of vegetable demonstration videos and tasting experiences into a college nutrition course to influence students' readiness to change vegetable intake, self-efficacy for vegetable preparation, and usual vegetable intake.*

Design. *Quasiexperimental, preintervention-postintervention comparisons.*

Setting. *College nutrition course.*

Subjects. *Of the 316 students enrolled in the course, 186 completed the online assessments (145 female, 41 male; mean age, 20 years).*

Intervention. *Participants viewed online vegetable preparation videos and participated in vegetable tasting experiences that featured four target vegetables, one vegetable each month for 4 months.*

Measures. *Preintervention and postintervention online surveys determined usual vegetable intake, readiness to change vegetable consumption, and self-efficacy of vegetable preparation.*

³ Coauthored by Katie N. Brown, Heidi J. Wengreen, Tamara S. Vitale, and Janet B. Anderson (see Appendix G).

⁴ Published in the American Journal of Health Promotion, 2011, 26:14-20.

Analysis. *Chi-square distribution and paired sample t-tests were used to examine differences preintervention and postintervention.*

Results. *Stage of readiness to change vegetable intake shifted from contemplation toward preparation ($p < .001$). Self-efficacy of vegetable preparation increased and postintervention self-efficacy was associated with total and target vegetable consumption ($p = .001$ and $p = .005$, respectively). The average intake of asparagus, one of four target vegetables, increased ($p = .016$); similar changes were not observed for target or total vegetable consumption.*

Conclusion. *Online vegetable demonstration videos may be an effective and cost-efficient intervention for increasing self-efficacy of vegetable preparation and readiness to increase vegetable consumption among college students. More research is needed to determine long-term effects on vegetable consumption.*

Purpose

Diets high in fruits and vegetables have been associated with decreased risk of chronic diseases including cardiovascular disease and some types of cancer.¹⁻⁴ Both fruits and vegetables are nutrient-rich sources of a wide range of micronutrients with many proposed health benefits. Vegetables are, however, generally a better source of some micronutrients such as vitamin A, vitamin E, vitamin K, calcium, magnesium, iron and potassium than are fruits. High vegetable consumption is associated with increased diet variety and lower body mass index (BMI) among college students.⁵

Despite costly national campaigns coupled with community-based interventions aimed at increasing vegetable intake such as the 5-A-Day for Better Health program and

the Fruits and Veggies – More Matters healthy initiative, the average intake of fruits and vegetables among all Americans is far less than recommended.^{6, 7} According to the Behavioral Risk Factor Surveillance System (BRFSS), a nationally representative telephone health survey system, young adults report the lowest intake of vegetables of all age groups.⁸ The American College Health Association National College Health Assessment (ACHA-NACHA) reports that only 5.2% reported eating five or more servings of fruits and vegetables daily.⁹ Previous studies have reported that college students are more likely to eat the recommended amounts of fruits than vegetables.^{5, 10} Interventions to increase vegetable consumption may be an effective way to improve dietary variety and adequacy, as well as attenuate weight gain among college students.

The barriers to consuming adequate amounts of vegetables among young adults include cost, effort to prepare vegetables, lack of knowledge, sociopsychological and socioenvironmental factors, and availability of vegetables.^{10, 11} Research in child populations shows that increased exposure to vegetables increases vegetable consumption, although similar studies have not been conducted in young adult populations.¹² Previous research has observed that increases in knowledge do not always result in behavior change.¹³ Interventions that teach food preparation skills have been suggested for those who are prepared to change their behavior related to vegetable intake.^{14, 15} Few interventions to increase vegetables have been targeted at young adults specifically.¹⁶ Among those studies, few have focused on exposure to vegetables, skill development, or improving self-efficacy of selecting and preparing vegetables.

The objective of this study was to assess the effectiveness of the integration of vegetable demonstration videos and tasting experiences into a college nutrition course to

influence students' readiness to change vegetable intake, self efficacy for vegetable preparation, and usual vegetable intake.

Methods

Design

The design of this study was quasiexperimental and utilized preintervention and postintervention comparison of attitudes and behaviors regarding vegetable preparation and intake.

Sample

The study was conducted at a land-grant university in the western U.S during spring semester 2009. All students enrolled in a large general education nutrition class were invited to participate. This course fulfilled a general science credit. As such, students from a variety of majors were enrolled in the course. The Viva Vegetables! program included both video instruction and tasting experiences and was integrated into the curriculum of the course (see Appendix F).

Students provided informed consent for the data collected during their assessments to be used for research purposes. The informed consent form was read to the class by one of the researchers, and the students' questions were answered at that time. The researcher emphasized that the class instructor would not view their study assessments and that their responses would not influence their grades. Points towards their grades were awarded based solely on completion of study assessments. Hard copies of the informed consent documents could be obtained via the online classroom management Web site. Students who did not wish to have their data included in the study

could print and sign the informed consent to have their data excluded from the study; data from the remainder of the students were included in the study. The study procedures were reviewed and approved by the institution's Institutional Review Board.

Intervention

The Viva Vegetables! program focused on one target vegetable each month for four months. The target vegetables were onions (January), potatoes (February), salad greens (March), and asparagus (April). Target vegetables were selected based on local seasonal availability, and to both highlight familiar/frequently consumed vegetables as well as less familiar vegetables (unpublished data). The Viva Vegetables! program was unique because it combined online video instruction on selecting, storing, and preparing the target vegetables with an in-class tasting experience of the target vegetable in a recipe demonstrated in the video; both components were integrated into the curriculum of the general education nutrition course. The 15-minute videos were developed by two Registered Dietitians (J.A., T.V.) who were faculty members in the nutrition department of the university and were familiar to the students. The videos were taped in a home setting and included detailed, step-by-step demonstrations of how to prepare the target vegetables using simple techniques. The vegetable preparation skills demonstrated in the video instruction applied to many vegetables, not only the target vegetables. Students were asked to view the video clips at their convenience up to 2 weeks before the in-class tasting experience.

Measures

Students were asked to complete an online survey at the beginning of the semester (January) and again at the end of the semester (April). The survey included information about health habits, demographic characteristics, attitudes regarding vegetable intake, and estimates of usual dietary intake over the previous 3 months. In addition, students were asked to complete postviewing and posttasting assessments following these activities for each of the four target vegetables. The postviewing assessments included four questions about past preference and intake of the target vegetable. The post-tasting assessments included eight questions about current purchasing, cooking, and eating habits as well as intentions to try the target vegetable in a new recipe in the next month.

Usual dietary intake was assessed using a food frequency questionnaire (FFQ) based on the method developed for use in the Harvard Nurse's Study FFQ; its design has been tested and validated for replicated use in populations including young adults.^{5,6} The FFQ contained 123 foods including 21 vegetables, four of which were target vegetables featured in the intervention. The FFQ food list was modified to include foods commonly consumed among this population such as granola bars, frozen entrées, macaroni and cheese, ramen noodles, and sports drinks (unpublished data). Participants reported their frequency of consumption of each food. Nutrient composition of foods was obtained from the Food Processor (ESHA version 7.02), a nutrient database of approximately 30,000 foods including foods from the United States Department of Agriculture (USDA) nutrient composition data tables and brand-specific information obtained from manufacturers.¹⁷ Total macronutrient and micronutrient intake was determined by

summing the totals of all food items. Nutrients were adjusted for energy intake by computing the amount of nutrient per 1000 kilocalories (kcal).

Stage of readiness to change vegetable consumption behavior was assigned using an algorithm developed by Ma *et al.*¹⁸ and used and validated by others.^{16, 19, 20} The correlation between vegetable intake and assigned stage of change was 0.43 ($P < 0.0001$) which supports the validity of this algorithm. Participants were categorized as precontemplation (no intention to change vegetable consumption), contemplation (intended to change vegetable consumption in the next 3 months), preparation (intended to change vegetable consumption in the next 30 days), action (currently ate 2.5 cups of vegetables daily), and maintenance (had eaten 2.5 cups of vegetables daily for 3 months). The criteria of 2.5 cups of vegetables was based on the Department of Health and Human Services and the Department of Agriculture's 2005 *Dietary Guidelines for Americans*.²¹

Analysis

The SPSS version 15.0 for Windows software program was used for all statistical analysis. Total vegetable and target vegetable intake were examined both as continuous variables and as categorical variables for which individuals received a quartile score based on the study population-specific distributions of intake. Associations between continuous and categorical data and single factors of interest were assessed using analysis of variance and chi-squared distributions. Changes in food and nutrient consumption from the beginning to the end of the semester (January – May) were assessed using paired-sample *t*-tests. The null hypothesis was rejected at the .05 level of significance.

Results

Of the 376 students enrolled in the course on the first day of class, 281 (75%) provided consent to participate and chose to complete the first survey. Seventy-nine (28%) participants dropped out of the study and did not provide end-of-semester data. Of the 203 who completed surveys at both the beginning and end of the semester, the data from 18 participants were excluded from analysis due to implausible energy intake as reported on either FFQ. Thus, the 186 (66%) participants who provided complete and probable information about usual dietary intake at the baseline and follow-up surveys and completed at least one Viva Vegetables! assessment were included in the analyses.

Sixty-one percent of the participants were freshmen, and the average age of participants was 20 years. Seventy-eight percent of participants were female and the majority (94.6%) was non-Hispanic white. Most (93.5%) participants reported being either somewhat or very concerned about making healthy food choices. More women than men completed the study ($p = .03$). There were no other significant differences between those who completed the study and those who dropped out. The majority of the participants prepared their own meals at least weekly (91.4%); 58.1% reported preparing their own meals daily.

Diet composition at baseline differed by gender. Male participants had higher average energy intake ($p = .019$) and consumed a greater percent of energy from fat than did female participants ($p = .001$). Women consumed a greater percent of energy from carbohydrates than did men ($p < .001$). There were no differences in either total vegetable intake or target vegetable intake by gender. The average total vegetable intake at the beginning of the semester was 1.63 ± 1.24 servings per day. Those in the lowest quartile

of vegetable intake reported only eating one-half serving, while those in the highest quartile of intake reported eating more than three servings daily (Table 7-1).

Table 7-1
Baseline Characteristics of Participants by Quartile of Baseline Vegetable Intake

Quartiles	Q1(n = 47)	Q2(n = 46)	Q3(n = 47)	Q4(n = 46)	p*
Female, %	72.3	80.4	76.0	82.6	0.64
Non-Hispanic White, %	95.7	95.7	89.4	97.8	0.296
Happy with weight, %	40.4	45.7	36.2	45.7	0.537
Age, † y	19±1.54†	20.34±4.16	20.31±3.61	20.97±4.78	0.087
Average body mass index†	22.7±3.65	22.92±3.37	23.13±4.65	23.33±4.64	0.884
Vegetable intake, † servings/d	.5970±.21	1.03±.10	1.58±.25	3.31±1.37	0.048
Calories†	2073.2±9.12	1772.1±742.5	2207.1±882.0	1849.2±785.6	0.048
Vit A, † retinol activity equivalents (RAE)	132.6±91.46	173.65±88.37	274.66±149.3	561.3±464.8	<0.0001
Vit C, † mg	35.8±27.73	34.92±19.55	45.79±22.33	70.71±30.93	<0.0001
Folate, † mcg	185.21±73.2	186.84±60.54	181.75±49.17	218.6±58.1	0.014
Iron, † mg	7.91±3.36	7.73±2.23	7.8±7.81	9.3±2.85	0.015
Potassium, † mg	1185.5±274.5	1208.1±285.7	1200.8±256.1	1416.1±282.8	0.000
Total kcal from fat, %	30±6	32±6	32±7	28±5	0.003
Total kcal from pro, %	15±3	16±3	15±3	16±2	0.058
Total kcal from cho, %	55±7	52±7	54±8	57±5	0.006
Very concerned about making healthy food choices, %	28.3	25.5	32.6	53.3	0.068
Freshman, %	68.1	58.7	48.9	67.4	0.192
Living on campus, %	31.9	17.4	18	15	0.155
Access to full kitchen, %	89.4	93.5	80.9	78.3	0.136
	Readiness to increase vegetable consumption, No. (%)				
Precontemplation	30 (63.8)	13(28.3)	12(25.5)	6(13)	0.000
Contemplation	6(12.8)	7(15.2)	8(17)	5(10.9)	
Preparation	10(21.3)	21(45.7)	16(34)	21(45.7)	
Action	0(0)	2(4.3)	2(4.3)	1(2.2)	
Maintenance	1(2.1)	3(6.5)	9(19.1)	13(28.3)	
	Self-efficacy of vegetable preparation, No. (%)				
Agree	18(38.3)	25(54.3)	33(70.2)	34(73.9)	0.004
Neutral	11(23.4)	13(28.3)	7(14.9)	5(10.9)	
Disagree	18(38.3)	8(17.4)	7(14.9)	7(15.2)	

* Associations between continuous and categorical data and single factors of interest were assessed using analysis of variance and χ^2 distributions. Changes in food and nutrient consumption were assessed using paired-sample *t*-tests.

† Mean ± SD.

The average total vegetable intake and target vegetable intake did not change from the beginning to the end of the semester (Table 7-2). The average total vegetable intake was 1.63 ± 1.24 at the beginning of the semester assessment and 1.63 ± 1.3 ($p = .980$) at the end of the semester. Of the vegetables targeted in the intervention (onions, salad greens, asparagus and potatoes), only the intake of asparagus changed from the beginning to the end of the semester. Reported consumption of asparagus increased from $.02 \pm .36$ servings daily at the beginning of the semester to $.03 \pm .19$ at the end of the semester ($p = .016$). Similarly, the percent of participants who reported eating asparagus less than one time per month decreased from 68.3% to 57.5% from the beginning to the end of the semester ($p < .0001$).

Table 7-2
Beginning-of-Semester and End-of-Semester Vegetable Intake
by Self-efficacy of Vegetable Preparation

	Agree (Start n = 110, End = 36), Mean \pm SD	Neutral (Start n = 36, End = 22), Mean \pm SD	Disagree (Start n = 40, End = 28), Mean \pm SD	<i>p</i> *
Total vegetable intake at the beginning of the semester	1.85 \pm 1.31	1.32 \pm .84	1.28 \pm 1.26	.012
Total vegetable intake at the end of the semester	1.82 \pm 1.40	1.27 \pm .91	.9 \pm .64	.002
<i>p</i>	.904	.253	.243	
Total target vegetable intake at the beginning of the semester	.55 \pm .41	.45 \pm .35	.39 \pm .38	.065
Total target vegetable intake at the end of the semester	.58 \pm .56	.41 \pm .35	.31 \pm .22	.024
<i>p</i>	.693	.117	.304	

*Associations between continuous and categorical data and single factors of interest were assessed using analysis of variance and χ^2 distributions.

Changes in vegetable and target vegetable intake were assessed using paired-sample *t*-tests.

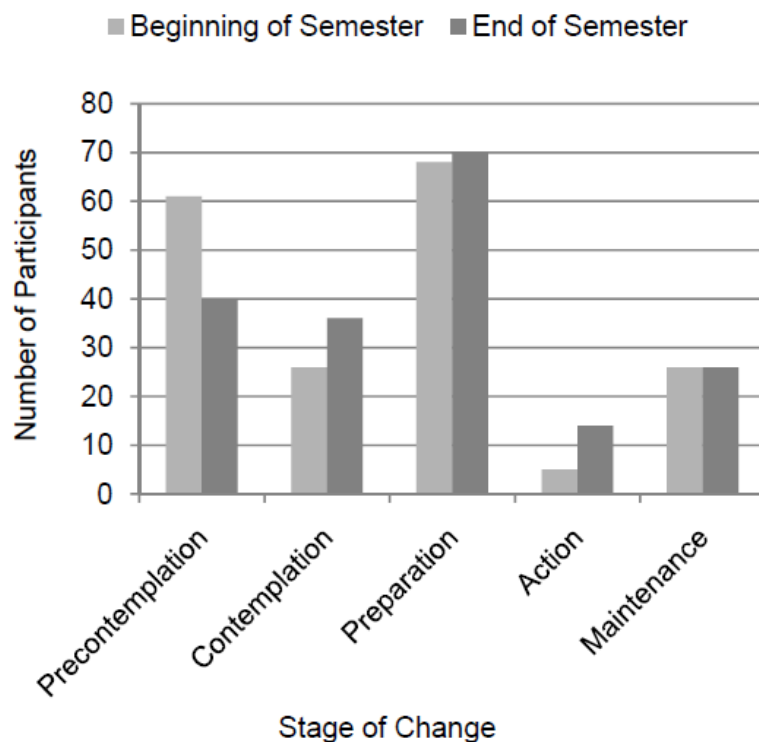
Participants were categorized into stages of change regarding their reported readiness to consume the recommended amount of vegetables at the beginning and the end-of-semester assessments. Those in the precontemplation stage received a score of 1,

those in the contemplation stage received a score of 2, those in the preparation stage received a score of 3, those in the action phase received a score of 4, those in the maintenance stage received a score of 5 (Figure 7-1). For comparison of baseline characteristics, participants were then grouped into either preaction (precontemplation, contemplation, preparation; $n = 155$) or action (action and maintenance; $n = 31$) groups. Degree of readiness to increase vegetable consumption was positively associated with baseline vegetable intake ($p < .001$); those in the action group consumed more vegetables than did those in the preaction group. In addition, those in the action group were more likely to report being very concerned about making healthy food choices than were those in the preaction group ($p = .045$).

The number of participants in each of the stages of change at the beginning and end of the semester is shown in Figure 7-1. The mean stage of change score increased from 2.5 ± 1.34 to 2.7 ± 1.27 ($p < 0.019$) indicating a shift in stage of change from contemplation towards preparation. The percentage of students in the precontemplation stage decreased from 32.8% to 21.5 % from the beginning to the end of the semester. Subsequent increases were seen in all stages except maintenance. The percentage of students in the action group increased from 2.7% to 7.5% (Figure 7-1); nine participants switched from a preaction stage to an action from the beginning to the end of the semester.

Self-efficacy was positively correlated with vegetable intake ($R=.26, p < .0001$), which supports the validity of this measure. Self-efficacy of skills needed to prepare vegetables was assessed at the beginning and end of the semester using a 5-point Likert

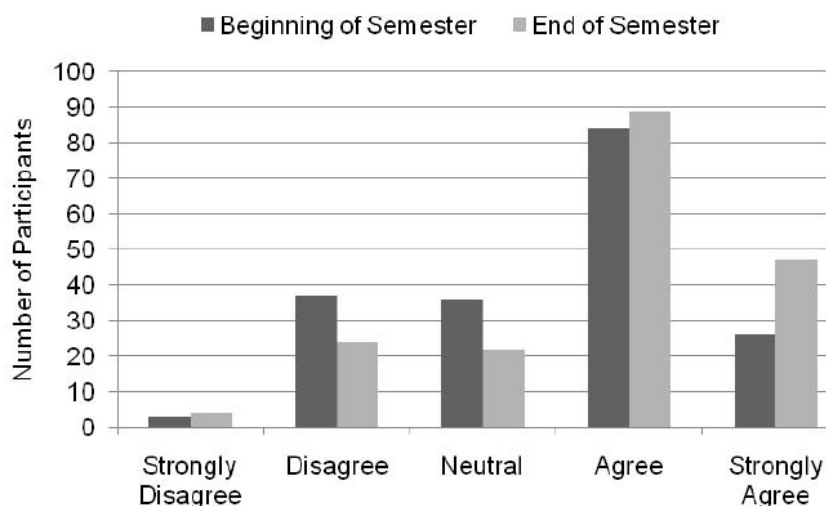
Figure 7-1
Stages of Change at the Beginning and End of Spring Semester 2009



scale. Participants were asked to report their level of agreement to the statement “I can prepare vegetables in many different ways.”²²

Twenty-two percent of students disagreed with this statement. Self-efficacy of vegetable preparation at the beginning of the semester was associated with increased total vegetable intake but not target vegetable intake ($p = .002$, $p = .065$, respectively; Table 7-2). The degree of self-efficacy of vegetable preparation increased from the beginning to the end of the semester (Figure 7-2). The percent of participants who reported knowing how to prepare vegetables in many different ways increased from 59.2% to 73.1 % from the beginning to the end of the semester ($p < .001$). Self-efficacy of vegetable preparation at the end of the semester was associated with both total vegetable intake and target vegetable intake ($p = .002$, $p = .024$, respectively).

Figure 7-2
Self-Efficacy of Vegetable Preparation at the Beginning
and End of Spring Semester 2009



*Self-Efficacy was determined by level of agreement with the statement "I know how to cook vegetables in many ways."

Discussion

The combination of a general education nutrition course and supplemental instruction that included vegetable demonstration videos and in-class tasting experiences resulted in a significant increase in readiness to increase vegetable consumption and self-efficacy of vegetable preparation among students enrolled in the course. Total vegetable intake did not increase from the beginning to the end of the semester. Intake of three of the four target vegetables did not change, but an increase in consumption of asparagus was observed from the beginning to the end of the semester.

The average number of servings of vegetables consumed was slightly lower than that reported in other studies of young-adults attending college.^{16, 23-25} Research has shown that those in the earlier stages of change are less likely to use change processes that involve experimentation or behavior change.^{26, 27} Previous studies have also found

that that assessing an intervention based on a single behavioral outcome may inadequately represent the impact of the intervention and may result in rejection of effective interventions.^{22, 28} For these reasons we included assessments of self-efficacy, and progression of readiness to change.

At the beginning of the semester, 86% of participants were in a preaction stage (precontemplation, contemplation, preparation) of readiness to consume at least 2.5 servings of vegetable per day. The shift in readiness to increase vegetable consumption was primarily within the preaction stage (Figure 7-1). The observation that the majority of the change in readiness to increase vegetable consumption was seen in the pre-action stages supports our finding that the average servings of vegetables and target vegetables consumed daily did not change. Under these conditions we would not expect a change in behavior, but rather a shift in readiness to change behavior.

A positive shift in self-efficacy of vegetable preparation from the beginning to the end of the semester was observed. In addition, self-efficacy of vegetable preparation was associated with total vegetable intake and total target vegetable intake at the end of the semester. The intervention appears to have had the greatest influence on the self-efficacy of vegetable preparation for the target vegetables; self-efficacy of vegetable preparation was associated with target vegetable consumption at the end of the semester, but not at the beginning of the semester. Other studies have reported self-efficacy as a predictor of fruit and vegetable intake among adults and college students.^{29, 30}

It is notable that among the target vegetables (onions, potatoes, salad greens, asparagus), an increase in intake was only seen for asparagus. Asparagus was the only target vegetable that not all of the students had previously tasted; 23 reported never

having tasted asparagus. In addition, it was the most infrequently consumed and least-liked of the target vegetables; 68.3% reported eating asparagus never or less than once per month (onions, 12.8%; potatoes, 1.3%; salad greens 8.5%). Seventeen percent reported either disliking or hating asparagus (onions, 15.7%; potatoes, 0%; salad greens, 6.9%). Taste exposure may be an important component for increasing consumption of unfamiliar vegetables. Providing vegetables prepared in ways that are novel to the students may also support these goals.

The study population may not be representative of the national population. The majority of the participants were non-Hispanic white women. Reliance on self-reported data and the convenience sampling from a nutrition class may have introduced additional bias. However, vegetable intake was not only below the recommended level (2.5 cups daily, or 5 servings daily), but lower than findings of similar studies^{31, 32} even for those who reported being very concerned about making healthy food choices. The quasiexperimental design lacks randomization, which also limits the generalizability of our findings. Strengths of this study include the type of intervention and FFQ used. A full, 123-question FFQ modeled after the Nurses' Health Study was used. The FFQ did not, however, account for seasonal variation in dietary intake. Vegetable and fruit intake were assessed separately to more accurately measure vegetable intake.

Others have demonstrated the effectiveness of a general nutrition class to promote consumption of fruits and vegetables in college students.^{10, 25} This intervention is unique in that it integrated vegetable demonstration videos aimed at increasing vegetable preparation skills and tasting experiences into the current general education nutrition course curriculum. Although the intervention in the present study did not appear to affect

total vegetable consumption, an increase in the consumption of one of the target vegetables was observed. In addition, positive shifts in self-efficacy and stage of change were observed, both of which have been identified as appropriate outcome measures other than vegetable intake to determine effectiveness of a nutrition intervention.²² Long-term effectiveness of this intervention is not known.

SO WHAT? Implications for Health Promotion Practitioners and Researchers

What is already known about this topic?

Lack of knowledge of how to prepare vegetables is a barrier to vegetable consumption among college students,¹¹ however, knowledge is not always highly correlated with behavior change.^{13, 30} Previous research suggests that interventions that provide exposure,¹² and aim to increase skills^{14, 15} have potential to influence behavior change. Increasing vegetable intake may help college students to meet nutrient recommendations that support health, maintenance of healthy body weight, and prevention of chronic diseases and some cancers.

What does this article add?

No previous study to date has examined the feasibility and effectiveness of integrating demonstrational videos and tasting experiences into a traditional college nutrition course as a way to enhance desired dietary behavioral changes. Many college students do not feel confident in their ability to prepare vegetables, and few consume the recommended amount of vegetables. Findings from this study suggest that increased exposure to vegetables via tasting and viewing experiences may increase students' self-efficacy for vegetable preparation and readiness to increase vegetable intake.

What are the implications for health promotion practice or research?

Online nutrition education videos that focus on food preparation skills may be an effective and cost-efficient intervention for increasing self-efficacy of vegetable preparation and readiness to increase vegetable consumption among college students. In-class tasting of target vegetables in new ways provides additional exposure which may influence consumption of target vegetables. This study provides evidence that online demonstration videos and in-class tasting experiences may enhance traditional nutrition education and may address barriers to intake in a college population. The use of vegetable demonstration videos may be an effective means to teach preparation skills needed for behavior change.

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CHAPTER 8

SUMMARY AND CONCLUSIONS

Summary

Adolescence is a time of physical and mental maturation. Consequently, adolescents have increased nutritional needs to support growth. Those participating in sports have further increased needs. Unfortunately, adolescence is often marked by a decline in healthy habits. Adolescents are at risk for malnutrition in terms of both quality and quantity. For example, female high school athletes are at risk for undernutrition, which may contribute to development of the female athlete triad (Triad). Athletes who expend a lot of energy through training and team practices and do not eat enough calories (dietary energy intake) to compensate are in a state of low energy availability (EA) (dietary energy intake – exercise energy expenditure). Low EA can lead to menstrual dysfunction (skipped menstrual periods, or complete loss of menstruation). Menstrual dysfunction and subsequent hormonal changes can negatively affect bone homeostasis resulting in bone loss. Adolescent bone loss increases risk for immediate and lifetime fracture and may not be reversible.

College students may also be at increased risk for malnutrition. Increased responsibilities and stress accompanied by decreased time may put them at risk for overnutrition. Overnutrition can lead to weight gain, which is often maintained or augmented resulting in overweight and obesity in adulthood. Unhealthy habits that contribute to overnutrition may put students at risk for developing chronic diseases.

Adolescence is an ideal time to provide nutrition education because immediate and lifetime health risk is influenced by health habits established at this time. Nutrition education that is pertinent to their stage of life may be more valued by adolescents. The objective of the research included in this dissertation was to create, implement, and evaluate nutrition education interventions aimed at decreasing health risk among three populations: female high school athletes, college freshmen upon entering college, and students enrolled in a general education nutrition course. Peer-teaching, online videos, and tasting experiences were techniques utilized in this research.

Female Athlete Triad among High School Athletes

Results from surveys of female athletes ($n = 240$) participating in a variety of sports and their coaches ($n = 10$) indicated that though Triad risk factors were prevalent among athletes and observed by coaches, knowledge among coaches and athletes was low. For example, 75% of athletes and 50% of coaches thought menstrual irregularity during sports participation was normal. In addition, coaches reported that no screening procedures were in place and Triad/nutrition education was limited.

Results from the first study were used to create and implement a 4-session, peer-led Triad educational intervention that was piloted among members of the girls' track team ($n = 29$) at another high school in the same school district. Results from that study indicated that 63% of athletes had low EA (< 45 kcal/kg lean body mass); however, none of them were at risk for disordered eating. There was an increase in Triad knowledge following the intervention. Due to poor response in baseline food records, assessment of change in dietary intake was not possible. The study was not long enough to evaluate changes in menstrual status or injury rates. The educational intervention was acceptable

and enjoyed by participants and peer-instructors. Participants appreciated that the peer-leaders could relate well to them, and acknowledged that they felt comfortable asking questions and participating in the discussions. However, only 14% preferred that one of their peer-instructors teach them instead of a coach, teacher, or other adult.

These studies are the first to assess Triad knowledge (all parts including low EA) among female high school athletes and their coaches, and the first to assess a peer-led Triad educational intervention. Results from research included in this dissertation both highlight the need for Triad education and describe an intervention that was successful in improving Triad knowledge and awareness among female high school athletes. Study results provide additional evidence that low EA may be inadvertent in this population, highlighting the need for inclusion of the topic of inadvertent low EA in Triad education.

The brief survey used in this research could serve as a stand-alone screening tool or in combination with the pre-participation physical form. Such use of the survey would assist coaches and/or trainers in providing an overall assessment of athletes' risk for the Triad and as well as educational needs. The curriculum could be incorporated into team practice schedules (i.e. educational sessions could be conducted on practice days that have short workouts such as the day before a competition). Modifications could be made to the curriculum to allow for coach facilitation rather than peer-instruction. Research to determine best practices for providing Triad education is warranted. Future studies should assess the impact of such an educational intervention on dietary intake, menstrual irregularity, and bone health/injury. Coach education, training, and provision of Triad education resources should also be a focus of future research.

Healthy Eating 101

Healthy Eating 101, a brief, interactive, peer-led nutrition educational workshop was incorporated into a freshman orientation course. Online surveys were administered to assess the diets of participants. Focus groups were conducted to evaluate Healthy Eating 101 and discuss strategies for providing nutrition education and improving dietary habits of college freshmen. As seen in previous studies, the average diets of college freshmen did not meet current recommendations. Males had higher intakes of fast food, sweetened beverages, and a higher percentage of calories from fat. Males were also less concerned about healthy eating than were females. There were no differences in diet quality when comparing those who participated in Healthy Eating 101 and those who did not. Focus group participants indicated that follow-up in the form of additional sessions, cooking classes, online information, or meeting with an undergraduate dietetic student who would serve as a “nutrition coach” may be more effective in improving their dietary behaviors than a single workshop.

Focus group participants expressed interest in healthy eating and acknowledged that freshman orientation was a good time to provide nutrition education. The peer-teaching model was preferred. Future research should assess changes in attitudes and eating behaviors among college freshmen following a peer-led educational intervention that includes follow-up. Because males may be at greater risk for poor nutrition, and may be less concerned about health than female students, future research to identify approaches that appeal to male students may be warranted.

Viva Vegetables!

Viva Vegetables!, a program designed to increase vegetable intake among college students via online videos and tasting experiences as part of a general education college nutrition course resulted in improved cooking self-efficacy and readiness to increase vegetable consumption among college students. Neither the average intake of total nor target vegetables changed as a result of the intervention. However, there was a slight increase in intake of asparagus, which was the least-liked and least familiar of the target vegetables.

This research provides evidence that online nutrition education videos that focus on food preparation skills and in-class tasting experiences may increase self-efficacy and readiness to increase vegetable consumption, teach skills that are necessary for behavior change, and enhance traditional nutrition education at the college level. The Viva Vegetables! videos can easily be incorporated into curriculum for general education nutrition courses as have been for all Utah State University NDFS 1020 courses (including online, concurrent enrollment, and distance education).

Conclusions

As was demonstrated in the studies described in this dissertation, nutrition education during adolescence that is specifically tailored to their stage of life, may positively affect knowledge and attitudes related to health and nutrition. In addition, nutrition education provides opportunities to acquire skills that may influence behaviors and habits that have the potential to decrease risk of adverse (and in some cases irreversible) health consequences including heart disease, and osteoporosis.

APPENDICES

Appendix A. District and School Permission



February 8, 2012

True Rubal, Director
Utah State University Institutional Review Board
Office of Research and Graduate Studies
Utah State University
4460 Old Main Hill
Logan, UT 84322-4460

Dear True:

I am writing in regards to the proposed research project of Dr. Heidi Wengreen and doctoral candidate, Katie Brown. This project aims to improve the health and nutrition of female athletes at Mountain Crest High School by implementing and evaluating a peer-led sports nutrition education program. This project has been approved by the administration of Mountain Crest High school. I hereby indicate approval for this project to take place in Cache County School District.

Sincerely,

Craig Ashton

Craig Ashton
Director of Curriculum



Sky View High School

Relationships, Character & Knowledge...for Life!

520 South 250 East • Smithfield • Utah 84335
(435) 563-6273 • FAX (435) 563-9534

October 19, 2011

R.E. Letter of Support

To The Utah State University Institutional Board:

This letter is in support of the research project conducted by Dr. Heidi Wengreen and doctoral candidate Katie Brown in surveying our female athletes at Sky View High School. This process has been beneficial in two ways: (1) our female athletes have gained insight into their current nutritional knowledge and health practices and (2) our coaches are more aware about their knowledge of health concerns that are specific to female athletes. I look forward to continued work with this project at Sky View high School.

Sincerely yours,

David J. Swenson, Principal
Sky View High School

Joel L. Allred
Assistant Principal

David J. Swenson
Principal

Tim G. Smith
Assistant Principal

Mountain Crest High School

255 South 800 East • Hyrum, Utah 84319
Phone (435) 245-6093 • Fax (435) 245-3670
Web Address: <http://www.ccsd.ut.org/mc>

Robert Henke
PRINCIPAL

Sheri Hansen
ASSISTANT PRINCIPAL

Terry Williams
ASSISTANT PRINCIPAL

February 7, 2012

R.E. Letter of Support

To the Utah State University Institutional Review Board:

I am writing to document my permission for Dr. Heidi Wengreen and doctoral candidate, Katie Brown to conduct a research project aimed at improving the health and nutrition of the female athletes at Mountain Crest High School. I provide permission to do surveys at Mountain Crest High School and to investigate in the following:

- 1) Surveying the female athletes to gain insight into their current nutrition knowledge and health practices.
- 2) Piloting with on female sports team an educational intervention aimed at increasing nutrition knowledge and improving health behaviors of female athletes.

Thank you,



Robert Henke
Principal

Appendix B. Coach and Athlete Awareness Surveys

Sport _____

Date _____

Pre-Season Nutrition, Health and Athletic Performance Questionnaire

You may use either a pen or a pencil to complete the survey as long as it is **DARK ENOUGH TO READ**. Please be sure to mark your answers correctly as shown.

Answer Selection: Correct = ● Incorrect = ✗ ☒ ⊖

1. Have you ever heard of the Female Athlete Triad?

- Yes
 No

2. Please list the three conditions that are included in the Female Athlete Triad.

1. _____
2. _____
3. _____
 I have no idea

3. Year in school

- Freshman (9th grade)
 Sophomore
 Junior
 Senior

4. Ethnic group

- White/Caucasian
 Other _____

5. Height

_____ Feet
_____ Inches

6. Current body weight in pounds. (If you are unsure, give your best estimate)

_____ pounds

7. What do you think is your ideal weight?

_____ pounds

8. Do you think you eat enough calories?

- Yes
 No

9. Do you feel pressure to be a certain body weight?

- Yes
 No

10. If you do feel pressure to be a certain weight where does that pressure come from? (select all that apply)

- Myself
 Coach
 Peers
 Parents
 Society/media

11. Have you ever suffered a stress fracture (a very small bone crack or break) as a result of training or competition?

- Yes
 No

12. If yes, how many have you had?

in the past year _____

in your life _____

13. At what age do females experience the greatest increase in bone density, that is, build the most bone?

- 11-14 years
 15-18 years
 19-22 years
 23-25 years

14. How many servings of dairy products (milk, cheese, cottage cheese, yogurt, etc) are recommended for females ages 9-18 to consume each day?

- 1
 2
 3
 4
 5

	True	False	Don't know
15. The recommended amount of Calcium for me as an athlete is higher than the amount recommended for teenagers who do not participate in sports.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
16. Skipping my period makes my bones weak.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
17. Gatorade helps my body rehydrate better than water if I am exercising for long periods of time in a hot environment and I am sweating a lot.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
18. Skipping my period is my body's way of saying I'm training too hard.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
19. The best recovery snack to eat after working out is one that contains carbohydrates and fat in a 3:1 ratio.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
20. Teenagers with weaker bones will always have weaker bones.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
21. Skipping my period while playing sports is normal.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
22. I'm not old enough to have weak bones.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
23. Low carbohydrate diets are best for improved athletic performance.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
24. Not eating enough could cause me to lose my period.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
25. Stress fractures (very small bone cracks or breaks) occur more often in girls that skip their period.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
26. Not eating enough calories could cause me to have brittle bones.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

27. Have you ever had a menstrual period? (If no, you do not have to answer the remaining questions)

- Yes
 No

28. How accurately do you think you can answer questions about your menstrual periods?

- A) Very accurately. I usually know when my monthly cycle will start.
 B) Fairly accurately. I don't know exactly when it will start, but I would notice if I haven't had a menstrual cycle in a while.
 C) Not very accurately. I don't usually pay attention to my menstrual cycle.

29. How old were you when you had your first menstrual period? _____

31. How many menstrual periods have you had...

in the past 12 months? _____

in the past 6 months? _____

33. Have you ever gone for 3 or more months without having a menstrual period?

- Yes
 No

30. When was your last menstrual period?

_____/_____(mo/year)

32. A regular period occurs about the same time every month (i.e., every 4 weeks or every 28 days.) Which of the following best describes your menstrual period?

- Very regular** (within 3 days of when it is suppose to occur)
 Somewhat irregular (within 4-10 days of when it is suppose to occur)
 Very irregular (greater than 10 days from when it is suppose to occur)

34. If yes, how many times have you gone 3 or more months without having a period? _____

If yes, how many months did you go without having a period? _____

Coach of Female High School Athletes Survey

1. What is your gender?
 - Male
 - Female
2. Have you ever heard of the Female Athlete Triad?
3. Please list the three components of the Female Athlete Triad
4. Do you think your athletes consume enough calories to meet the demands of their training?
 - Yes
 - No
5. When coaching female athletes, do you notice them restricting their food intake?
 - Yes
 - No
6. Do your athletes express a desire to lose weight?
 - Yes
 - No
7. When coaching female athletes, have you noticed any disordered eating behavior?
 - Yes
 - No
8. What would be your course of action if you suspected that an athlete had an energy deficit (from over-exercise, under-eating, or both)?
9. What would be your course of action if you suspected that an athlete had an eating disorder?
10. Please describe any health and/or performance consequences of an energy deficit (from over-exercise, under-eating, with or without disordered eating).
11. What do you do with the menstrual regularity information that is included on the pre-participation physical exam form?
12. Do you ask your athletes about their menstrual cycle?
13. Do you feel comfortable discussing menstrual regularity with your athletes?
 - Yes
 - No

14. Do you believe that irregular menstruation or absent menstruation is a normal consequence of exercising among female athletes?
 - Yes
 - No
15. Please describe any immediate health consequences of menstrual irregularity or loss of menstrual function.
16. Please describe any long-term health consequences of menstrual irregularity or loss of menstrual function.
17. Are any long-term health consequences of menstrual irregularity or loss of menstrual function irreversible?
18. Please describe the best way/ways to treat menstrual irregularity or loss of menstrual function.
19. What would be your course of action if an athlete told you that she had menstrual irregularity or loss of menstrual function?
20. What is the suggested intake of Calcium (mg) for females ages 9-18 years?
21. What is the suggested intake of vitamin D (IU) for females ages 9-18 years?
22. What is the recommended intake (servings per day) of dairy products (milk, cheese, cottage cheese, yogurt, etc.) for females ages 9-13 years old?
23. Which of the following are good sources of vitamin D?
 - Nuts and beans
 - Fruits, vegetables, whole grains, and lean beef
 - Fortified dairy products and fatty fish
 - There are no good sources of vitamin D
 - Here in Cache Valley we can get all the vitamin D we need from the sun
24. Please indicate the age range in which peak bone mineral density in women is reached.
 - 11-14 years
 - 15-18 years
 - 19-22 years
 - 23-25 years

25. How often have you encountered or treated a female athlete with a stress fracture?
- Never
 - 1-5 times
 - 6-10 times
 - 11 times or more
26. What would be your course of action if an athlete had a stress fracture?
27. Please describe the nutrition education provided to your athletes.
28. Which of the following are currently included in education provided to your athletes?
- Calcium needs
 - Vitamin D needs
 - Carbohydrate needs
 - Protein needs
 - Calorie needs
 - Menstrual regularity
 - Bone health
 - Prevention/treatment of disordered eating
29. Please describe any barriers to providing nutrition education to your athletes.
30. Please describe any barriers to providing education about the female athlete triad.
31. Please describe any barriers to screening for or treating the female athlete triad.

Appendix C. Female Athlete Triad Intervention Survey Tools

ID _____ Event (sprints, throwing, hurdling, etc) _____

Track Pre-Season Nutrition, Health and Athletic Performance Questionnaire

You can use a pen or a pencil, just make sure you marks are dark.

Answer Selection: Correct = ● Incorrect = ✕ ☒ ⊖

1. What other sports do you participate in?

School Sports

- 1. _____
- 2. _____
- 3. _____
- 4. _____
- 5. _____

Other Sports (dance, rec teams, etc.)

- 1. _____
- 2. _____
- 3. _____
- 4. _____
- 5. _____

2. Which sport do you consider your main sport?

3. Have you ever heard of the Female Athlete Triad?

- Yes
- No

4. Please list the three conditions that are included in the Female Athlete Triad.

- 1. _____
- 2. _____
- 3. _____
- I have no idea

5. Year in school

- Freshman (9th grade)
- Sophomore
- Junior
- Senior

6. Date of Birth (month/day/year)

Example: June 15 1992

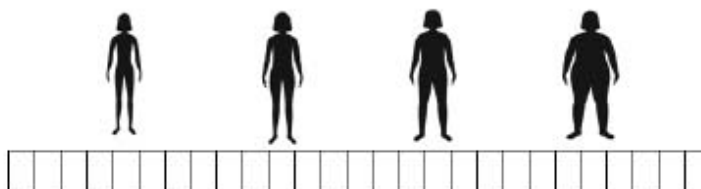
7. Height

_____ Feet
_____ Inches

8. Current body weight in pounds. (If you are unsure, give your best estimate)

_____ pounds

9. Place an "X" in the box which best reflects your current appearance.



10. Have you ever suffered a stress fracture (a very small bone crack or break) as a result of your training or competition?

- Yes
- No
- I don't know

11. When do females build the most bone?

- 0-6 years
- 7-12 years
- 13-18 years
- 19-25 years
- I don't know

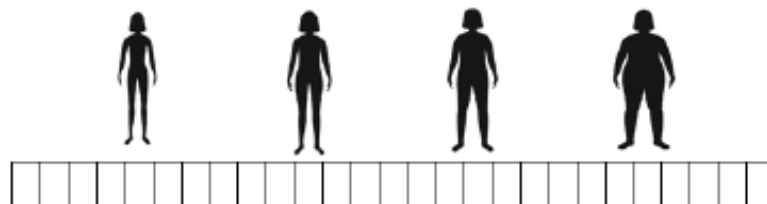
12. Ethnic group

- White/Caucasian
 Other _____

13. What do you think is your ideal weight? (What would you like your weight to be?)

_____ pounds

15. Place an "X" in the box that reflects the appearance you would most like to look like.



16. Do you feel pressure to achieve or maintain a certain body weight?

- Yes
 No

17. If you answered yes to 16, where does that pressure come from? (select all that apply)

- Myself
 Coach
 Peers
 Parents
 Society/media

	True	False	Don't know
18. Protein is the main energy source for the muscle.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
19. Skipping my period can make my bones weak.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
20. Stress fractures (very small bone cracks or breaks) occur more often in girls that skip their period.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
21. Carbohydrates should make up at least 50% of total calories.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
22. Not eating enough could cause me to lose my period.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
23. Teenagers with weaker bones will likely still have weaker bones as adults.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
24. When exercising in a hot environment and sweating a lot, Gatorade helps your body rehydrate better than water.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
25. I'm not old enough to have weak bones.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
26. Vitamins are a good source of energy.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
27. Skipping my period is my body's way of saying I'm training too hard,	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
28. Milk products are the only source of calcium in the diet.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
29. How much I eat does not affect my bone health.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
30. Including protein and carbohydrates in my post-workout snack helps me recover faster.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

	True	False	Don't know
31. I feel that skipping my period while playing sports is normal.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
32. Exercising/Training too much could cause me to lose my period.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
33. All foods can be part of a healthy diet.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
34. Each athlete has a set body fat percentage they should aim for to maximize their athletic performance.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

35. Have you ever had a period? (If no, you do not have to answer the remaining questions)

- Yes
 No

36. How accurately do you think you can answer questions about your periods?

- A) Very accurately. I usually know when my monthly cycle will start.
 B) Fairly accurately. I don't know exactly when it will start, but I would notice if I haven't had a menstrual cycle in a while.
 C) Not very accurately. I don't usually pay attention to my menstrual cycle.

37. How old were you when you had your first period? _____

38. When was your last period?

____/____ (mo/year)

39. How many menstrual periods have you had...

in the last 12 months? _____

in the last 6 months? _____

40. Please describe the regularity of your periods

- Very regular (within 3 days of when it is supposed to occur)
 Somewhat irregular (within 4-10 days of when it is supposed to occur)
 Very irregular (greater than 10 days from when it is supposed to occur)

41. Have you ever gone for 3 or more months without having a period?

- Yes
 No

42. If yes, how many times have you gone 3 or more months without having a period? _____

If yes, how many months did you go without having a period? _____

42. Do you feel pressure to achieve or maintain a certain body weight?

- Yes
 No

43. If you answered yes to 42, where does that pressure come from? (select all that apply)

- Myself
 Coach
 Peers
 Parents
 Society/media

44. Please provide any additional feedback about this research project/educational program

Please think about the track season and rate the following items

	Excellent	Good	Fair	Poor
45. My physical health was...	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
46. My mental health was...	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
47. My quality of life was...	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
48. My athletic performance was...	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

49. Have you experienced any stress fractures since the track season began?

- Yes
 No
 I don't know

50. Do you feel that your performance improved over the course of the season?

- Yes
 No
 I don't know

51. If you answered yes to question 50, what do you think were the reasons for this?

52. What would you like to do differently in a future sports season to improve your health and sports performance?

53. Have you ever had a menstrual period? (If no, you do not have to answer the remaining questions)

- Yes
 No

54. When was your last menstrual period?

____/____ (mo/year)

55. How accurately do you think you can answer questions about your periods?

- Very accurately. I usually know when my monthly cycle will start.
- Fairly accurately. I don't know exactly when it will start, but I would notice if I haven't had a menstrual cycle in a while.
- Not very accurately. I don't usually pay attention to my menstrual cycle.

57. Did you skip any periods since the track season began?

- Yes
- No
- I don't know

59. How many periods have you had since track season started (the end of February)?

56. Since the track season began, how regular has your period been?

- Very regular (within 3 days of when it is supposed to occur)
- Somewhat irregular (within 4-10 days of when it is supposed to occur)
- Very irregular (greater than 10 days from when it is supposed to occur)

58. Has the frequency of your periods changed since the track season began?

- Yes, more frequent
- Yes, less frequent
- No change
- I don't know

60. Has the heaviness of your periods changed since the track season began?

- Yes, heavier
- Yes, lighter
- No change
- I don't know

	Always	Usually	Often	Sometimes	Rarely	Never
1. Am terrified about being overweight.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
2. Avoid eating when I am hungry.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
3. Find myself preoccupied with food	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
4. Have gone on eating binges where I feel that I may not be able to stop.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
5. Cut my food into small pieces.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
6. Aware of the calorie content of foods that I eat.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
7. Particularly avoid food with a high carbohydrate content (i.e. bread, rice, potatoes, etc.).	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
8. Feel that others would prefer if I ate more.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
9. Vomit after eating.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
10. Feel extremely guilty after eating.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
11. Am preoccupied with a desire to be thinner.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
12. Think about burning up calories when I exercise.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
13. Other people think that I am too thin.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
14. Am preoccupied with the thought of having fat on my body.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
15. Take longer than others to eat my meals.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
16. Avoid foods with sugar in them.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
17. Eat diet foods.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
18. Feel that food controls my life.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
19. Display self-control around food.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
20. Feel that others pressure me to eat.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
21. Give too much time and thought to food.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
22. Feel uncomfortable after eating sweets.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
23. Engage in dieting behavior.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
24. Like to have my stomach empty.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
25. Have the impulse to vomit after meals.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
26. Enjoy trying rich new foods.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
In the past 6 months have you:	Never	Once a month or less	2-3 times a month	Once a week	2-6 times a week	Once a day or more
Gone on eating binges where you feel that you may not be able to stop?*	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Ever made yourself sick (vomited) to control your weight or shape?	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Ever used laxatives diet pills or diuretics (water pills) to control your weight or shape?	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Exercised more than 60 minutes a day to lose or control weight?	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Lost 20 pounds or more in the past 6 months	Yes	<input type="radio"/>	No	<input type="radio"/>		
* Defined as eating much more than most people would under the same circumstances and feeling that eating is out of control						

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Name _____

Date _____

Post-Education Nutrition, Health and Athletic Performance Questionnaire

1. Have you ever heard of the Female Athlete Triad?

- Yes
- No

2. Please list the three conditions that are included in the Female Athlete Triad.

- 1. _____
- 2. _____
- 3. _____
- I have no idea

To answer the rest of the questions on this page, please think back to the 4 nutrition education classes that were held after practice on Wednesdays. These were taught by some of the junior and senior track athletes.

3. Please fill in the circle for each education you attended. (If you did not attend any of the education sessions, skip to question 21).

- I did not attend any education sessions
- 1 (Energy balance and MyPlate)
- 2 (Female Athlete Triad and menstruation, movie clip of college athlete)
- 3 (Bone health and injury)
- 4 (Health body image, pre- and post- workout fueling, movie clip of college athletes, chocolate milk)

Please rank your agreement to the following statements

	Strongly Agree	Agree	Neither Agree nor Disagree	Disagree	Strongly Disagree
4. I enjoyed learning about nutrition and the female athlete triad.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
5. This education program was worth my time.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
6. The information was presented at a level appropriate for high school students.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
7. I think next year's track team should participate in this education.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
8. I liked having one of my peers on the track team teach this class rather than a teacher or other adult.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
9. I have made changes to my diet after attending the education sessions.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
10. I have made changes to my physical activity after attending the education sessions.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
11. I feel better about my body after attending the education sessions.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
12. This program helped bring the team together and act as a more cohesive group.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

13. Please describe any changes you made to your diet as a result of attending the education sessions.

14. Please describe any changes you made to your physical activity as a result of attending the education sessions.

15. Please describe any changes to the way you feel about your body as a result of attending the education sessions.

16. What aspects of the educational classes do you feel went well?

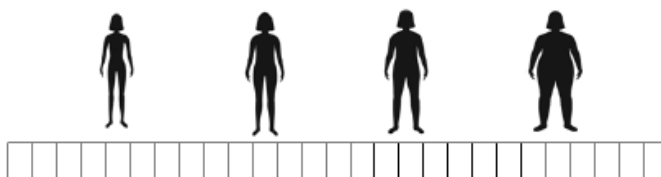
17. What aspects of the classes do you feel should be changed or could be improved?

18. What components would you have found helpful in the education session that could be added to future classes?

19. What aspects of the peer-led model (having one of the Jr. or Sr. girls teach the education sessions) worked well?

20. What aspects of the peer-led model (having one of the Jr. or Sr. girls teach the education sessions) did NOT work well?

21. Place an "X" in the box which best reflects your current appearance.



22. Do you think you eat enough calories?

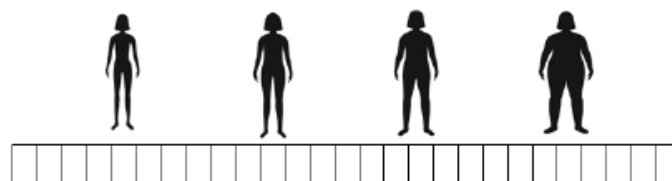
- Yes
- No
- I don't know

23. When do females build the most bone?

- 0-6 years
- 7-12 years
- 13-18 years
- 19-25 years

	True	False	Don't know
24. Protein is the main energy source for the muscle.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
25. Skipping my period makes my bones weak.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
26. Stress fractures (very small bone cracks or breaks) occur more often in girls that skip their period.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
27. Carbohydrates should make up at least 50% of total calories.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
28. Not eating enough could cause me to lose my period.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
29. Teenagers with weaker bones will always have weaker bones.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
30. When exercising in a hot environment and sweating a lot, Gatorade helps your body rehydrate better than water.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
31. I'm not old enough to have weak bones.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
32. Vitamins are a good source of energy.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
33. Skipping my period is my body's way of saying I'm training too hard.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
34. Milk products are the only source of calcium in the diet.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
35. How much I eat does not affect my bone health.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
36. Including protein and carbohydrates in my post-workout snack helps me recover faster.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
37. I feel that skipping my period while playing sports is normal.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
38. Exercising/Training too much could cause me to lose my period.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
39. There is room for all foods in the diet.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
40. Each athlete has a set body fat percentage they should aim to reach to maximize their athletic performance.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

41. Place an "X" in the box that reflects the appearance you would most like to look like.



42. Do you feel pressure to achieve or maintain a certain body weight?

- Yes
 No

43. If you answered yes to 42, where does that pressure come from? (select all that apply)

- Myself
 Coach
 Peers
 Parents
 Society/media

44. Please provide any additional feedback about this research project/educational program

Please think about the track season and rate the following items

	Excellent	Good	Fair	Poor
45. My physical health was...	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
46. My mental health was...	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
47. My quality of life was...	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
48. My athletic performance was...	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

49. Have you experienced any stress fractures since the track season began?

- Yes
 No
 I don't know

50. Do you feel that your performance improved over the course of the season?

- Yes
 No
 I don't know

51. If you answered yes to question 50, what do you think were the reasons for this?

52. What would you like to do differently in a future sports season to improve your health and sports performance?

53. Have you ever had a menstrual period? (if no, you do not have to answer the remaining questions)

- Yes
 No

54. When was your last menstrual period?

____/____ (mo/year)

55. How accurately do you think you can answer questions about your periods?

- Very accurately. I usually know when my monthly cycle will start.
- Fairly accurately. I don't know exactly when it will start, but I would notice if I haven't had a menstrual cycle in a while.
- Not very accurately. I don't usually pay attention to my menstrual cycle.

57. Did you skip any periods since the track season began?

- Yes
- No
- I don't know

59. How many periods have you had since track season started (the end of February)?

56. Since the track season began, how regular has your period been?

- Very regular (within 3 days of when it is supposed to occur)
- Somewhat irregular (within 4-10 days of when it is supposed to occur)
- Very irregular (greater than 10 days from when it is supposed to occur)

58. Has the frequency of your periods changed since the track season began?

- Yes, more frequent
- Yes, less frequent
- No change
- I don't know

60. Has the heaviness of your periods changed since the track season began?

- Yes, heavier
- Yes, lighter
- No change
- I don't know

	Always	Usually	Often	Sometimes	Rarely	Never
1. Am terrified about being overweight.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
2. Avoid eating when I am hungry.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
3. Find myself preoccupied with food	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
4. Have gone on eating binges where I feel that I may not be able to stop.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
5. Cut my food into small pieces.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
6. Aware of the calorie content of foods that I eat.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
7. Particularly avoid food with a high carbohydrate content (i.e. bread, rice, potatoes, etc.).	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
8. Feel that others would prefer if I ate more.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
9. Vomit after eating.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
10. Feel extremely guilty after eating.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
11. Am preoccupied with a desire to be thinner.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
12. Think about burning up calories when I exercise.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
13. Other people think that I am too thin.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
14. Am preoccupied with the thought of having fat on my body.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
15. Take longer than others to eat my meals.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
16. Avoid foods with sugar in them.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
17. Eat diet foods.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
18. Feel that food controls my life.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
19. Display self-control around food.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
20. Feel that others pressure me to eat.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
21. Give too much time and thought to food.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
22. Feel uncomfortable after eating sweets.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
23. Engage in dieting behavior.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
24. Like to have my stomach empty.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
25. Have the impulse to vomit after meals.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
26. Enjoy trying rich new foods.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
In the past 6 months have you:	Never	Once a month or less	2-3 times a month	Once a week	2-6 times a week	Once a day or more
Gone on eating binges where you feel that you may not be able to stop?*	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Ever made yourself sick (vomited) to control your weight or shape?	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Ever used laxatives diet pills or diuretics (water pills) to control your weight or shape?	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Exercised more than 60 minutes a day to lose or control weight?	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Lost 20 pounds or more in the past 6 months	Yes	<input type="radio"/>	No	<input type="radio"/>		
* Defined as eating much more than most people would under the same circumstances and feeling that eating is out of control						

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Appendix D. Female Athlete Triad Intervention Curriculum

Peer Leader Manual

Mountain Crest High School Female Athlete Education Program

Session 1

Name_____

Session 1: Introduction to the Female Athlete Education Program

Materials Needed

- Computer with projector hook-up for the MyPlate demonstration
- Pens
- Participant Workbooks

Session Outline

- Introduce the program goal and preview topics to cover.
- Discuss energy and differentiate between the terms energy and calories.
- Discuss energy balance and energy availability.
- Demonstrate how to measure portion sizes using an activity on the MyPlate website.
- Provide instruction on completing a three day diet and exercise log, and how to input these in to the MyPlate SuperTracker.

Overview

The focus of session one is to provide an overview of the program, and discuss the topics of energy balance and energy availability. The students will also be encouraged to implement what they learn from the program by keeping food and exercise logs.

Introduction (5 minutes)

*Welcome, everyone. I am excited to begin the first session of this education program. Let's start by introducing ourselves. Everyone please say your name, then tell us a food you couldn't live without. I'll start us off. My name is _____ and I am looking forward to teaching these sessions and learning with you over the next few weeks. A food I couldn't live without is _____ **

*Peer leader: When you say the food you couldn't live without, say your favorite junk food item. This will help others in the group know they can say whatever kind of food they want, and will help lessen the idea that this "nutrition class" will just tell them to eat vegetables and never have junk food. One thing the program will emphasize is that there is room in the diet for all foods, so starting this icebreaker activity off in this way will help set up for some aspects of the program.

Continue introductions. Make sure everyone is acquainted with one another. This will help the session run more smoothly and will help everyone feel comfortable.

Voluntary Commitment and Overview (5 minutes)

After introductions have been completed, present the reason for this program and ask the group members if they are willing to voluntarily commit to participating in the class.

- *The purpose of this workshop is to help you improve your athletic performance by evaluating your health and nutrition. We are going to be talking about many aspects of health including nutrition, physical activity, body image, menstrual periods, and bone strength.*
- *This workshop has been specially designed to meet the needs of female high school athletes and is modeled after a program that has been shown to help female collegiate athletes. This intervention is simple and can be easily incorporated into your busy life.*
- *This workshop is in a group format so we can support each other as we all strive to be healthy and improve our athletic performance.*

- *This is a great opportunity to learn more about how to use knowledge about nutrition to give you an advantage over those you compete with. Even though all athletes are going to be training hard this season, other teams may not be focusing on fueling their bodies. This program will give you the information and tools you need to provide your body with proper fuel for success.*



Are you willing to give this a try?

Go around the room and have each participant say publicly that they are willing to actively participate. It is important to solicit verbal commitment to engage in the sessions and activities because this increases the level of investment in the group.

Confidentiality (2 minutes)

It is important to discuss the issue of confidentiality with the group, as personal details of some of the group members' lives may be revealed during the course of the program. As this program will be conducted in a high school setting, the participants are very likely to know each other and will come into contact outside of the group. It is critical that participants, especially adolescents such as will be found in this population, feel confident that anything they share will not be repeated to anyone outside of the group in order to facilitate their discussion or personal experiences that may be embarrassing or sensitive.

- *While we are going through the different parts of this class, some of us will probably reveal some personal details about our lives. This can be hard to do when we aren't sure if we can trust that others won't repeat what we've said.*
- *We ask that everything said in our group remains completely confidential, meaning you respect everyone in the group by not discussing the personal things they share outside of the sessions.*



Can everyone agree to not repeat other people's personal experiences outside of this workshop?

Energy Balance and Low Energy Availability (20 minutes)

Let's get started on today's topic. Today we will focus on energy, energy balance and energy availability. In order to introduce this topic, we will start with a discussion of energy.



When I say the word "energy", what do you think this is referring to?

- *There are many different definitions of "energy", but in nutrition we often use the word energy interchangeably with calories. This is because the calories found in food are where we get our energy from. The reason for using the word energy is because the emphasis of this program is not on calorie counting or calculating exact numbers for the amount of food we eat or should be eating. The focus of the program is on improving athletic performance, and energy plays an important role in this!*
- *Turn to page 3 in your participant workbook. Fill in the answers to the worksheet as we discuss energy balance. Energy Balance means balancing energy "in" with energy "out". The basic equation for energy balance is energy in minus energy out.*

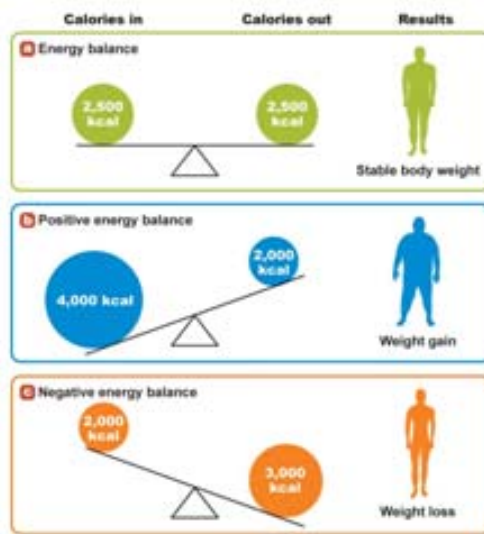


What is energy in referring to? (the food we eat)



What about energy out? (the amount of calories we expend for basic body functions, every day activities, and in exercise)

- Look at the image of a balance scale in your participant workbook on page 2. If energy in is equal to energy out, an individual is in energy balance because the two sides of the scale would be equal.



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- If one side of the balance has more than the other, the scale will be tipped to one side.



What would it be called if energy in was greater than energy out? (positive energy balance)



What would positive energy balance lead to? (weight gain)



If energy out was greater than energy in? (negative energy balance... leading to weight loss)

- If the energy we are putting out is more than the fuel we are taking in, we will also get tired more easily and may not perform as well as we would like at track practice.
- Not having enough energy can also affect performance. You might not see the effects immediately, but you cannot consistently perform at a top level if you do not have enough energy.

Energy Availability

- *Now that we know the idea behind energy balance, let's talk about energy availability. The equation is the energy you get from the food you eat minus the amount of energy used during exercise.*

Write this equation on the board: **Dietary Energy Intake – Exercise Energy Expenditure**

- *Energy availability is the amount of energy that is left over after you subtract the energy you expended in exercise. This left over energy is available to be used to help with other important body activities. These activities include:*
 - *Breathing*
 - *Maintaining body temperature*
 - *Recovering from hard training*
 - *Having normal periods*
 - *Building strong bones, etc.*
- *If you use a lot of energy in exercise and don't eat enough to cover this energy expenditure then you will have low energy availability.*
- *In low energy availability there is not enough energy to support many of the important body functions we just listed.*



What conditions may lead to low energy availability in an athlete?

The most basic answer is that the athlete is either:

- 1) Exercising too much*
- 2) Not eating enough or*
- 3) Both*

- *Many athletes simply do not eat enough to make up for the energy they use when they are exercising.*
- *Think about a time when your training has increased significantly. During these times you may not realize that your body requires more food to help give you enough energy for exercise and other activities, so your food intake may stay the same as usual.*
- *Because you are exercising more but not eating more, this could lead to low energy availability.*



What happens if you have low energy availability?

If they have a hard time answering this question, prompt them with responses such as:

- *Feeling sluggish and tired during practice*
- *Getting slower times at a competition*
- *Feeling more tired than usual doing normal everyday stuff like going to school*

Ok, please turn to page 1 in your participant workbook and fill in the Take Home Message for Energy Balance/Energy Availability. A Take Home Message is a brief summary of what we have discussed in a certain section. It is the main ideas you should be learning, remembering, and applying from what we discuss. Since this is our first take home message, I will read it to you and

you can write it in so you understand the idea behind the take home message icons. After this first time, you will all help decide what the take home message should be based on what we have learned in the section.



Take Home Message: We get energy from the food we eat, and we use energy in every day activities, basic body functions, and exercise. If we do not eat enough to make up for the energy we use in exercise, this is called low energy availability.

- *As part of this workshop, you will keep a record of what you eat, and all the exercise you do for 3 days. This will help you assess your habits to see if you have enough energy available to keep you healthy, growing, and performing well in your sport.*
- *An important reminder that will be especially helpful as you complete this record this upcoming week is portion sizes. When foods are entered into the online program that I will demonstrate at the end of the session, it is very important that the portion you record is actually the amount you ate. This will help you get a better picture of your overall diet, which will be helpful for activities in future sessions.*
- *The ideal situation would be to have you measure out exactly how much you eat using measuring cups and spoons. If you are eating in your kitchen and are able to do this, please do so.*
- *Sometimes it is necessary to estimate rather than measure out exactly how much you ate. To help you get a visual, and to show you a great resource for estimating portion sizes, we will take a look at the MyPlate SuperTracker. The website is www.choosemyplate.gov. Let's take a look.*
- *So when we get to the website, we are going to click the MyPlate tab, which will pull up several food group options. Let's click on vegetables. This brings up a menu with some helpful resources.*



Before we click on the "What counts as a cup" link, does anyone have a guess of what would count as a cup, or a serving, of vegetables?

If they are struggling, prompt them with statements such as "think about a raw tomato compared to tomato juice" or "what about leafy vegetables like lettuce?" After they have made some guesses and discussed a little, continue on with the demonstration.

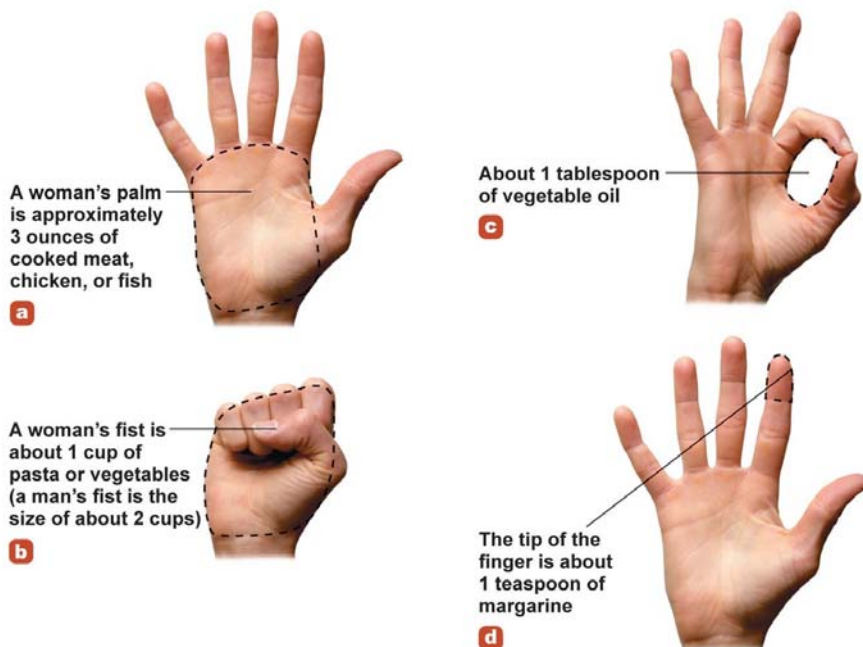
- *Let's click on the "What counts as a cup" link. This explains that 1 cup of raw or cooked vegetables or vegetable juice counts as one serving, and 2 cups of raw leafy greens counts as one serving. Let's get some visuals for these.*



Does anyone have a favorite vegetable they want us to look up?

Click the "View Vegetables Food Gallery" link to see the portion size pictures. Look up a few vegetables students choose. If they are not participating, choose a vegetable to show them so they get the idea of what they will be looking at, then ask again. Try at least one other food group and pull up a few foods in the food group.

- *Ok, let's turn to page 3 in your participant workbook. This shows some additional portion pointers to help you estimate portion sizes. I will demonstrate the hand estimations that are shown on your handout, and as I do so try it yourself.*



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So, what do you think the take home message would be for the portion size estimation section?

- Please turn to page 1 in your participant workbook and fill in the Take Home Message for Portion Size Estimation.



Take Home Message: Learning to estimate portion sizes will help you eat the appropriate amount of food to support your activity level and promote health. It will also make your food log more accurate, which will give a better picture of your current diet so you can see areas you are doing well, and areas that might need improvement.

Home Exercises (15 minutes)

- Please turn to page 4 in your participant workbook. This page has the instructions for completing your food and exercise log.

Food Record

- Please keep a food record for 2 weekdays and 1 weekend day using the form in your workbook.
- Make sure to review ALL of the instructions on this page before beginning your food record.
- I will highlight a few of these instructions, but is very important to follow all procedures exactly when completing the forms.
- Make sure you record everything you eat and drink, as well as the portion size for each item.
- There are also columns for recording the time you ate each item, the brand of the item, and the preparation method (such a toasted, grilled, etc).

- *The brand is important for analyzing your diet, because it helps make a more accurate estimate.*
- *Please try to record after every time you eat, because we forget otherwise.*

Activity Record

- *Please record the exercise/training that you do on the days that you are recording your food intake.*
 - *This would include any and all “training” as well as any significant lifestyle physical activity (e.g., riding your bike to school, walking to the grocery store, etc.)*
 - *Do not include small bits of physical activity such as walking between classes.*
- *On your activity log you should include:*
 - *The type of exercise (e.g., running, cycling, swimming, weight training)*
 - *The length of time you exercised (e.g., 30, 45, minutes etc.)*
 - *The distance you covered if appropriate (e.g., 3 miles, 20 miles, 1500 meters, etc.)*
 - *The intensity (e.g., 8 min/mile pace, 12 mph, moderate intensity, etc.)*

Once you have completed your food and exercise records, please enter the information on your logs in to the MyPlate SuperTracker. The website is www.choosemyplate.gov. Please follow the instructions found on the Choose MyPlate Instructions handout on page 11 of your participant handbooks. I will also demonstrate how to use the MyPlate SuperTracker website.

Pull up the Choose MyPlate (www.choosemyplate.gov) web page and click through the website, explaining out loud as you go. Follow the directions in the leader and participant manuals for entering items into the SuperTracker (see the instruction page following the end of the script). Demonstrate how to create a profile, then provide example food items and amounts using this standardized meal:

1 bowl cereal
1 cup milk
1 banana
Toast

As you are entering the sample menu above, discuss the problems associated with the recording of each of the food items.

- For the cereal, emphasize the importance of specifying the exact amount. Because bowl sizes can vary, they should record the amount of cereal in cups (i.e. 1 ½ cups). They also need to record the kind of cereal (Wheaties, Honey bunches of oats, etc.).
- 1 cup milk: when you enter this item, type in milk and see the options that pull up. Talk to the students about the importance of being specific with what kind of milk (skim, 2%, soy, etc) when they record it. Tell them to include brand names whenever possible as well as this might help when they are selecting the food item from the long list.
- 1 banana: when you type this is, it will pull up several options. Tell them they need to know the approximate size of the banana (small, large, etc.), so this should be noted on the food record as well.
- Toast: when this item is entered in, several options will come up so it is important to know what kind of bread (white, wheat, sourdough) and how much (1 slice, etc.) was eaten.

As you are entering your food items, notice that the box in the top right that shows the recommended number of servings for each food category will update based upon the food items you enter in. This provides a general guide as far as how you are doing on getting the recommended number of servings in each group.

Enter the following example into the physical activity tracker: Running

As you enter this item, discuss the following with the students:

- It is important to record as many details about your physical activity as possible when you are keeping your exercise logs. Record your pace (in minutes per mile, or miles per hour), how long you did the activity, and the intensity (although the tracker will estimate this for you based on the pace).

Address any questions they have as you explain the features of the MyPlate website.

Once you have finished entering the information from your food and activity records, please print the following forms from your MyPlate analysis:

- *Nutrient Report*
- *Physical Activity Report*

These reports are found under the “My Reports Tab”. You will need to select a time period for the report, so be sure to select a time period that includes all three of the days you entered. Bring these forms and your written food and activity records to the rest of the education sessions as they will be used for upcoming activities.



Ok, what do you think the take home message is for the food and activity records/using MyPlate section?



Take Home Message: Accurately writing down everything I eat and drink, as well as my activity throughout the day, will help me as I enter this information into the MyPlate SuperTracker. This will help me see how my diet and activity are right now, which will make the next three sessions of the program become more useful and applicable.

Choose MyPlate Super Tracker Instructions

- Go to www.choosemyplate.gov
- Under the “Popular Topics” menu, click “SuperTracker”
- Click the blue button on the right side of the screen that says “Create Your Profile”
- Under “Step 1” enter your profile name, age, gender, physical activity level, height, and weight
- Under “Step 2” enter your username, password, and email (optional)

- Under “Step 3” click “Submit”
- A box will pop up saying you are registered. Click “Ok”

Food Record

- Click on the center box titled “Food Tracker”
- Type in the first food item from your food log
- Modify your search as necessary to find an item that best fits the food you actually ate
- Select the most appropriate item, then choose the amount you ate from the drop down menu options
- Check the box next to the time of day you ate the food item
- Click the +Add button
- Continue to add meals, snacks, and beverages listed on your food log until all foods have been entered
- Remember to be as specific as possible when adding the food items. Choose the option from the list that best describes what you actually ate. If you wrote down or remember the brand of the food item, this can be helpful in making selections as well.

Exercise Record

- Click the tab at the top of the screen titled “Physical Activity Tracker”
- Enter your activity in to the search box
- Click the option from the list that best describes the type of activity you performed
- Enter the time you spent doing that activity
- Check the day(s) you did this activity
- Continue to add all activities on your exercise log

Printing Instructions

- Please print the following forms when you have completed your MyPlate SuperTracker analysis:
 - Nutrient Report
 - Physical Activity Report
- Bring these forms with you to all of the remaining education session

Helpful Tips

- If you can’t find an item you are looking for, try these tips:
 - Try making it plural (add an “s”) i.e.: type in tomatoes instead of tomato
 - Try changing a few words, i.e. type in “potato chips” instead of “Lays chips”
 - Try searching for mixed items instead of entering all of the individual ingredients
 - For example: if you ate a chicken enchilada, instead of entering in tortilla, shredded chicken, cheese, etc. try searching for “chicken enchilada” and see if anything comes up that describes what you actually ate.
 - If there is not a mixed item that describes exactly what you ate, it is important to enter all of the individual items so you get an accurate estimate.

Participant Workbook

Mountain Crest High School
Female Athlete Education Program

Session 1

Name _____

Notes Page

Session 1: Introduction to the Female Athlete Education Program

Session Outline

- Introduce the program goal and preview topics to cover.
- Discuss energy and define the terms energy and calories.
- Discuss energy balance and energy availability.
- Demonstrate how to measure portion sizes using an activity on the MyPlate website.
- Provide instruction on completing a three day diet and exercise log, and how to input these in to the MyPlate SuperTracker.

Take Home Messages

When directed by the peer leader, please write down the take home message for each section covered in today's session.



Take Home Message 1: Energy Balance and Energy Availability



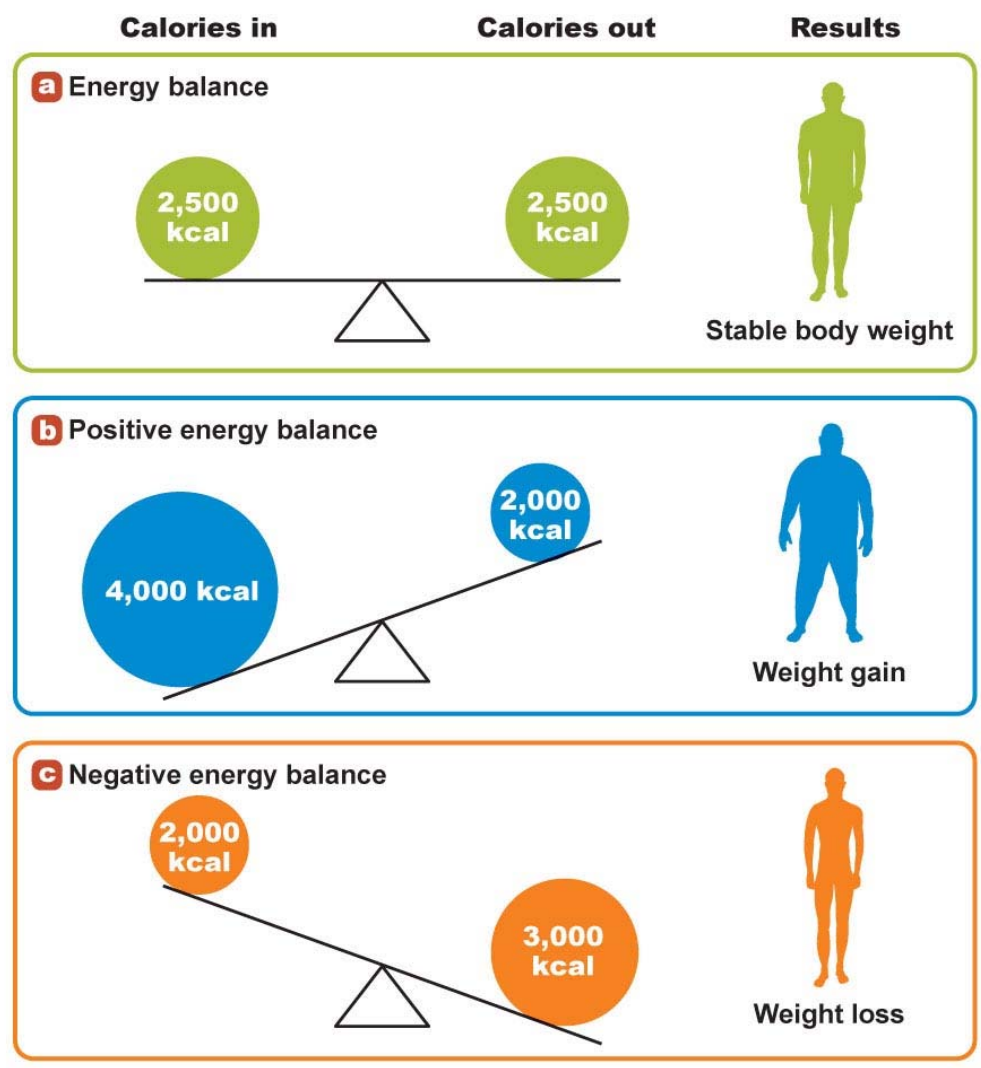
Take Home Message 2: Portion Size Estimation



Take Home Message 3: Food and Exercise Logs/Using MyPlate

Energy Balance Worksheet

1. Calories in = 1) _____
2. Calories out = 1) _____ 2) _____ 3) _____
3. Results of Negative Energy Balance
 - 1) _____
 - 2) _____



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Portion Pointers

It is important to make sure the portions you record in your food log, and the portions you enter in to the MyPlate Tracker, are the actual portions you ate. In addition to the resource we demonstrated in session 1 on the MyPlate website (www.choosemyplate.gov under the “MyPlate” tab), here are some quick guides to help you estimate how much you ate of a certain food item.



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3-day Food and Activity Log

FOOD INTAKE

1. You will need to record your intake for **3 days**. Please record **1 weekend day, and 2 weekdays**. The days do not need to be consecutive but they should be “typical” (i.e., typical in terms of your normal eating habits/patterns)
2. Please indicate the date and circle the day of the week that you are recording at the top of the food record.
3. Record each food and beverage you consumed on a separate line.
4. When eating combination foods (e.g., sandwich, lasagna, stew, casserole, etc.) please separate the food/dish into its individual components as much as possible.
5. Record food and beverages in reasonably exact amounts: liquids in cups or fluid ounces; grains, cereals, pasta in cups (please indicate if the measure is dry or cooked); meats, fish, chicken in ounces, fruits & vegetables in cups.
6. Please specify if the food was consumed raw or cooked (and indicate the type of cooking method used). Also indicate if it was prepared from fresh, canned or frozen products.
7. Please indicate how the food was prepared; e.g., fried, baked, boiled, grilled, steamed, etc.
8. List brand names or sources wherever possible. If the food item is unusual (fat-free, international food, supplement) please enclose a label if possible.
9. For fruits, potatoes, chicken etc. please indicate if the skin was removed before consumption
10. Please be sure to indicate if dairy products, (i.e., milk, cheese, yogurt, etc.) was whole, low-fat, non-fat, etc.
11. Be sure to include all the little extras (e.g., sauces, gravies, candy, gum, etc.)
12. Provide any other information you think might be helpful. Remember the more accurate/specific you are with recording the more accurate your analysis will be.

ACTIVITY

1. Please record the exercise/training that you do on the days that you are recording your food intake. This would include any and all “training” as well as any significant lifestyle physical activity (e.g., riding your bike to school, walking to the grocery store, etc.)
2. You should include:
 - the type of exercise (e.g., running, cycling, swimming, weight training)
 - the length of time you exercised in minutes (e.g., 30, 45, 55, 60 etc minutes)
 - the distance you covered if appropriate (e.g., 3 miles, 20 miles, 1500 yards)
 - the intensity (e.g., 8 min/ml pace, 18 mph, moderate intensity, etc)



Sample Food Record

Name: Jane Smith

Date: Feb 27

Day of Week: M T W Th F **Sa** Su
(circle one)

Please record as accurately as possible all food and beverages you consumed for one day. Please give as many details as possible regarding the food/beverage item. Please list all supplements consumed including sports foods/beverages, vitamins, minerals, herbs etc. You may use the back if necessary.

Time	Food/Beverage	Brand or Source	Type of Preparation	Amount
8:00 am	cinnamon raisin bagel	Lenders	Toasted	1 ea. (3 oz)
	Cream Cheese	Western Family		2 T
	Milk, 2%	Viva		1 cup
10:30 am	Swedish Fish candies			10 pieces
11:30 am	Roast Beef Sandwich			
	- Whole wheat bread	Grandma Sycamore		2 slices
	- Roast beef, sliced	Oscar Mayer		3 slices (2 oz)
	- Mayonnaise, light	Kraft		1 T
	- Mustard	French's		1 Tsp
	- Lettuce, leaf			1 leaf
	- tomato			2, 1" slices
	Sun Chips			1 small bag (1.5 oz)
	Baby Carrots			6 carrots
	Chocolate Milk, 1%	Meadow Gold		1 carton
3:00 pm	Green apple			1 medium
	Water, from the tap			2 cups
6:30 pm	Chicken		Grilled	1 breast
	Potatoes		Mashed. w/ butter	.75 cup
	Gravy	McCormick	From a packet, water added	¼ cup
	Salad, "Greener Selection"	Dole		1 cup
	Croutons, Onion and Garlic	Reese		¼ cup
	Ranch Salad Dressing	Hidden Valley		2 T
	Lemonade	Country Time		1, 12-oz can
9:00 pm	Brownie		Homemade	2" square
	Vanilla Ice-cream	Bryer's		1 cup

Choose MyPlate Super Tracker Instructions

- Go to www.choosemyplate.gov
- Under the “Popular Topics” menu, click “SuperTracker”
- Click the blue button on the right side of the screen that says “Create Your Profile”
- Under “Step 1” enter your profile name, age, gender, physical activity level, height, and weight
- Under “Step 2” enter your username, password, and email (optional)
- Under “Step 3” click “Submit”
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Food Record

- Click on the center box titled “Food Tracker”
- Type in the first food item from your food log
- Modify your search as necessary to find an item that best fits the food you actually ate
- Select the most appropriate item, then choose the amount you ate from the drop down menu options
- Check the box next to the time of day you ate the food item
- Click the +Add button
- Continue to add meals, snacks, and beverages listed on your food log until all foods have been entered
- Remember to be as specific as possible when adding the food items. Choose the option from the list that best describes what you actually ate. If you wrote down or remember the brand of the food item, this can be helpful in making selections as well.

Exercise Record

- Click the tab at the top of the screen titled “Physical Activity Tracker”
- Enter your activity in to the search box
- Click the option from the list that best describes the type of activity you performed
- Enter the time you spent doing that activity
- Check the day(s) you did this activity
- Continue to add all activities on your exercise log

Printing Instructions

- Please print the following forms when you have completed your MyPlate SuperTracker analysis:
 - Nutrient Report
 - Physical Activity Report
- Bring these forms with you to all of the remaining education sessions

Helpful Tips

- If you can't find an item you are looking for try these suggestions:
 - try making it plural (add an “s”), i.e.: type in tomatoes instead of tomato
 - changing a few words, i.e. “potato chips” instead of “Lays chips”
 - You can try searching for mixed items instead of entering all of the individual ingredients
 - For example: if you ate a chicken enchilada, instead of entering in tortilla, shredded chicken, cheese, etc. try searching for “chicken enchilada” and see if anything comes up that describes what you actually ate.
 - If there is not a mixed item that describes exactly what you ate, it is important to enter all of the individual items so you get an accurate estimate.

Peer Leader Manual

Mountain Crest High School Female Athlete Education Program

Session 2

Name_____

Session 2: The Female Athlete Triad

Session Outline

- Follow up on last week's activity of keeping a food and exercise log.
- Estimate energy availability based on the numbers generated by the MyPlate SuperTracker.
- Introduce the female athlete triad and each of its components.
- Define terms associated with normal and abnormal menstruation.
- Explain how nutrition can play a role in the Triad components of low energy availability and menstrual dysfunction.
- Provide videos with athlete testimonials about the female athlete triad.
- Set SMART goals related to nutrition, exercise, and other health-related behaviors.

Materials Needed

- Collegiate athlete testimonial videos (Brittany Fisher and Jessie Chugg)
- Computer/DVD player with screen to show videos
- Calculators
- Pens
- Participant Workbooks

Overview

The focus of session two is to explore the female athlete triad components of low energy availability and menstrual dysfunction. Menstrual function terms will be described, and the role of nutrition in both of these Triad components will be discussed, with two athlete testimonials to demonstrate. Students will set SMART goals to help them apply what they have learned.

Introduction and Energy Availability Assessment (10 minutes)

- *Welcome to session two everyone. Today we are going to be introducing the female athlete triad. This topic will tie in with our discussion of low energy availability from last week.*
- *This is an important topic to cover because it has an impact on our athletic performance and health.*
- *Before we get started with this discussion I wanted to check in with all of you on last week's activity.*



Did anyone have problems entering their food record information in to the MyPlate SuperTracker online?

Discuss any problems they had in this process. Make sure they all have their diet analysis from MyPlate SuperTracker.

- *If anyone has some specific questions they want to ask about entering information in to the tracker please come see me after the session today. It is important that*

everyone has these analyses for this session and the next two sessions because we will be using them for activities.

Energy Availability

- Please pull out your print-outs from the MyPlate SuperTracker. Last week we discussed energy availability and energy balance. Today we will use the analyses from the MyPlate website to help you estimate your energy availability.



Who remembers the equation for energy availability? (Hint: have them look on page 2 in their workbooks... **Dietary Energy Intake – Exercise Energy Expenditure = Energy Availability**)

- Turn to the “Nutrient Report” printout. Look at the total number of calories. Write down that number on the energy availability worksheet on page 2 in your workbook on the line labeled **Dietary Energy Intake**.
- Now turn to the “Physical Activity Report” and look at the “Estimated Calories Burned”. Write this number on your worksheet on the line labeled **Exercise Energy Expenditure**.
- Subtract **Exercise Energy Expenditure** from **Dietary Energy Intake**.



How do these two numbers compare?

- If this is a small number (less than 1000), this could mean that you are not eating enough for how much exercise you participate in
- If the day you are looking at represents a pretty typical eating pattern for you, this might be a sign you may need to make some changes. This might include increasing how much you eat.
- It is important to keep in mind, however, that these are just numbers and are only providing a rough estimate. It is also important to pay attention to how you feel. If you always have a hard time getting through practice, one possible reason could be that you are not eating enough to fuel your body.

Female Athlete Triad- Athlete Testimonial, Brittany Fisher (10 minutes)

- To help us see the importance of keeping our energy availability up, let’s take a look at a video interview of Brittany Fisher, a track athlete at Utah State University. She is going to talk to us about her experience with energy availability, and she will also introduce some topics related to the female athlete triad, which we will be discussing next.

Show the video clip by Brittany Fisher.



What are your thoughts about this video? Did you notice what she said about energy availability?

Listen to their responses, and guide a discussion about her experience and how it relates to energy availability and nutrition. Use the video to transition into the female athlete triad discussion.

The Female Athlete Triad (10 minutes)

- *One of the main goals of the program is to help increase knowledge of the female athlete triad, and to teach you how evaluate your habits and make changes that promote improvement in overall health and athletic performance.*
- *This is important for each of you as athletes, because the female athlete triad is most common among the athletic population, and can have a significant impact on both health and performance.*



Have any of your heard of the female athlete triad?



If so, do you know the three components of the triad?

- *I am going to go through a few different diagrams representing the female athlete triad. As I do so, look at page 3 in your participant workbook to see the figures I am describing.*

Slide 1: This diagram shows a simple version of the female athlete triad. This is also abbreviated as the Triad. The three components involved in the Triad are energy availability, bone health, and menstrual period function. A menstrual period simply refers to the period women have every month. When you have adequate energy available, you are more likely to have a normal menstrual periods, and healthy bones.

Slide 2: The second slide shows how each of these components are affected in the female athlete triad. The Triad refers to a state of low energy availability, as we talked about last week. It also includes low bone mineral density, such as in osteoporosis, and menstrual dysfunction, which would be skipping or losing your period, or not having a normal period about every 28 days. We will discuss this component more today. Next week we will look in to bone health in depth.

Slide 3: This slide shows a more detailed diagram of the female athlete triad. You can see the three components as we discussed before. Notice that the top triangle shows a healthy inter-relation between energy availability, menstrual function, and bone health. The bottom triangle shows the other extreme: low energy availability, menstrual dysfunction, and osteoporosis. However this diagram shows not only the two extreme ends of the spectrum, but also shows that not every athlete will be on one end or the other, and may fall in between somewhere.

Each of the components of the Triad will be discussed extensively throughout this program.



Can someone explain why learning about the Triad would be beneficial for athletes?

For ideas, remind them of the video clip where Brittany discusses her experience with the Triad as a college athlete.



What do you think the take home message would be for the female athlete triad section?

Please write down the take home message on page 1 in your participant workbook.



Take Home Message: The female athlete triad includes three components- low energy availability, menstrual dysfunction, and low bone mineral density.



Does anyone here actually keep track of their period? (such as writing it down on a calendar or in a notebook?)

- *A normal period would be having a period about every 28 days, or within the range of about 21-35 days. An irregular period means that you only have a period every 35 or more days. It can also refer to only having 4-9 periods per year instead of the normal 12.*
- *Amenorrhea, which is one of the components of the female athlete triad on the disease end, is the absence of a period. There are two kinds of amenorrhea- primary and secondary.*
 - *Primary- a delay in the age you have your first period. This would refer to not having your first period until age 15 or later.*
 - *Secondary- this is the absence of a menstrual cycle for more than three months*



Why might amenorrhea, or not having a period, be a problem?

If they have a hard time with this question, use these to help get them thinking:

- *Not having a period may sound like a great thing... you don't have to deal with that every month, right? Even though this may not seem like too bad of a deal, there are some problems that can come up if you are not having a regular period.*
 - *Infertility is a common problem, and can make it difficult to become pregnant later in life.*
 - *Bone loss can be another problem, and we will talk about this more in the next session.*
- *After you start having a period, it is fairly common to skip a period or not have a menstrual period every 28 days during the first couple of years. For most women, their period is fairly regular after that.*

- *It is important to monitor this because not having a period can have negative effects on your bones. Not having a period changes the hormone levels in your body, which results in weakened bones. This increases your risk for stress fractures (that could negatively impact your athletic performance) and can increase your risk for breaking bones when you are older.*
- *Sometimes female athletes lose their period when they are training. For most girls, not having a period for more than 3 months is NOT normal and it is NOT healthy.*
- *Many factors contribute to menstrual regularity. If you ever go more than 3 months without a period, take a look at how much you are eating in comparison to how much you exercise.*
 - *Do you have low Energy Availability?*
 - *Evaluate whether you eat 3 meals a day, and if you have meals as snacks as necessary.*
 - *If your menstrual cycle does not return you should discuss this with your doctor.*



For the menstrual function section, what is the take home message you learned?



Take Home Message: It is important to have a regular period about every 28 days. Low energy availability can lead to lost or skipped periods, and both low energy availability and loss of a menstrual cycle can contribute to weakening of the bones.

Athlete Testimonial Video- Jessie Chugg (10 minutes)

Now that we have discussed these components of the female athlete triad, let's take a look at a video of a female athlete in college that experienced the female athlete triad. Notice the aspects of the Triad that she discusses, including menstrual dysfunction when she lost her period and how it affected her performance.

Show the video clip by Jessie Chugg.



What are the consequences on health and performance that Jessie mentions when she talks about losing her period?



What would the take home message be for this athlete's testimonial about the Triad?



Take Home Message: Though some irregularity with your period is common, it is not normal or healthy to stop having a period during sports participation.

Home Exercises (10 minutes)

- *Now that we have had two sessions of instruction, let's set some goals.*
- *Please turn to page 4 in your participant workbook and take a look at the goal setting worksheet.*
- *We will be setting two goals today- one related to nutrition, and the other for any health-related behavior.*
- *It is important to set SMART goals.*



What are the components of a SMART goal? (Specific, Measureable, Achievable, Relevant, and Timely)

- *Make sure to keep all of those components in mind as you set your goals.*
- *It may be helpful for you to use the food and exercise records you kept, or your MyPlate analysis as you set goals.*
- *For example, if you see on your analysis that you have low energy availability, check to see if you are eating 3 meals a day and including snacks as needed. A good goal might be to have a pre-workout snack before each practice this week.*
- *If you are only getting 1 serving of vegetables per day, a good goal might be to increase to 3 servings of vegetables per day.*
- *Whatever goal you set, make sure it meets the guidelines of a "SMART" goal.*

If you as a peer leader are comfortable sharing a goal you have set, feel free to do that while they are thinking and writing their own goals.

- *Please take a few minutes and write your goals in the space provided on page 5 in your participant book. When everyone has finished, we will share our goals with each other.*

Give them about 2-3 minutes to write down their goals.



Who would like to share the goals that they set first?

Go around the circle until everyone has shared at least one of their goals.

- *We will report on the progress of our goals at the beginning of the session next week.*



Who would like to summarize the take home message for the goal setting section of today's class?

Take Home Message: Goals should be specific, measurable, achievable, relevant, and timely (SMART).

- *Thank you all for participating today. Get started on your goals, and get excited for next week's session on bone health!*

Participant Workbook

Mountain Crest High School Female Athlete Education Program

Session 2

Name_____

Session 2: The Female Athlete Triad

Session Outline

- Follow-up on last week's activity of keeping a food and exercise record.
- Estimate energy availability based on the numbers generated by the MyPlate SuperTracker.
- Introduce the female athlete triad and each of its components.
- Define terms associated with normal and abnormal menstruation.
- Explain how nutrition can play a role in the Triad components of low energy availability and menstrual dysfunction.
- Provide a video with an athlete testimonial about the female athlete triad.
- Set SMART goals related to nutrition, exercise, and other health-related behaviors.

Take Home Messages

When directed by the peer leader, please write down the take home message for each section covered in today's session.



Take Home Message 1: The Female Athlete Triad



Take Home Message 2: Menstrual Function



Take Home Message 3: Athlete Testimonial Video



Take Home Message 4: Goal Setting

Energy Availability Worksheet

Energy availability is the amount of energy that is left over after you subtract the energy you expended in exercise. This left over energy is available to be used to help with other important body activities. These activities include

- *breathing*
- *maintaining body temperature*
- *recovering from hard training*
- *having normal periods*
- *building strong bones, etc.*

Here is the equation to determine energy availability:

$$\text{Dietary Energy Intake} - \text{Exercise Energy Expenditure} = \text{Energy Availability}$$

Activity: Estimate Energy Availability

1. Turn to your “Nutrients Report” printout. The first nutrient is calories. Look in the “Average Eaten” column. That number is your Dietary Energy Intake.

Dietary Energy Intake = _____

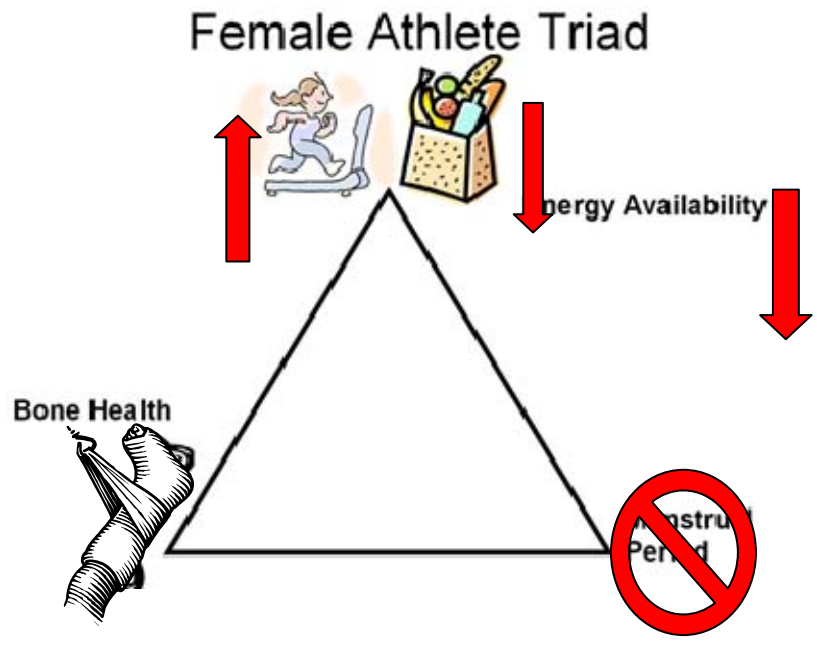
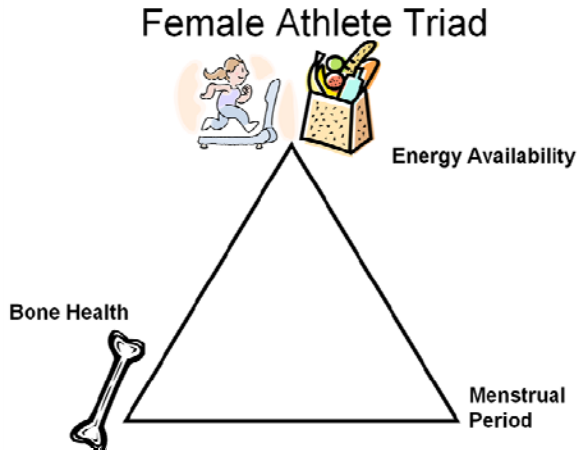
2. Turn to your “Physical Activity Report” printout. Look at the “Estimated Calories Burned” column. That number is your Exercise Energy Expenditure.

Exercise Energy Expenditure = _____

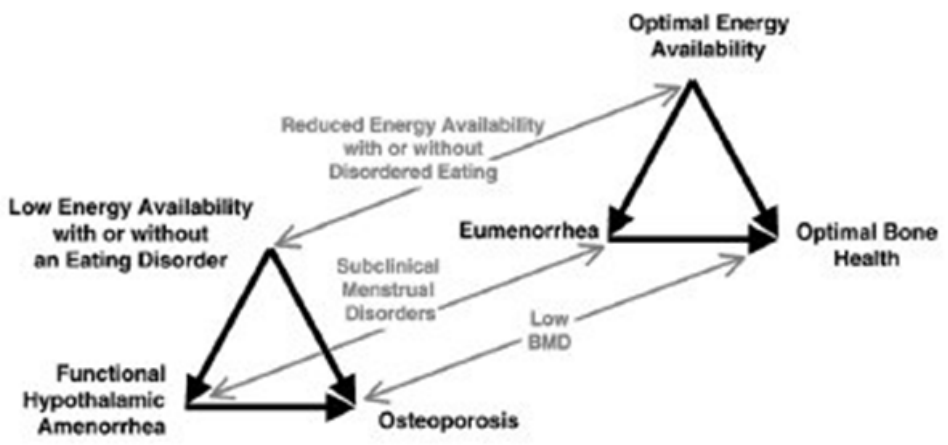
3. Now calculate your Energy Availability

$$\underline{\hspace{10em}} - \underline{\hspace{10em}} = \underline{\hspace{10em}}$$

Dietary Energy Intake **Exercise Energy Expenditure** **Energy Availability**
 (answer from 1) (answer from 2)



Female Athlete Triad Spectrum



Nattiv A, Loucks AB, Manore MM, et al. American College of Sports Medicine position stand. The female athlete triad. Med Sci Sports Exerc 2007 Oct;39(10):1867-1882. Figure 1, The Female Athlete Triad. 'promotional and commercial use of the material in print, digital or mobile device format is prohibited without the permission from the publisher Lippincott Williams & Wilkins. Please contact journalpermissions@lww.com for further information.

SMART Goal Setting Worksheet

SMART Goals are **S**pecific, **M**easurable, **A**chievable, **R**ealistic, and **T**imely. Your task is to set two SMART goals that will help improve your health and athletic performance. Make sure that one goal is nutrition-related (fruit and vegetable intake, eating breakfast, etc.). The other goal can be any other health-related goal (sleep, exercise, stretching, etc.).

SMART Goals	
S: Specific	Make sure your goal is specific <i>Instead of making generic goal to “eat healthy”, provide specific details.</i>
M: Measurable	Make sure there is some way to measure your progress (how much, how long, how many, etc.)
A: Achievable	Is this goal something that you are able to accomplish? <i>If you never eat breakfast, making a goal to eat breakfast everyday this week may not be realistic. Setting a goal to eat breakfast 1 or 2 times this week may be more realistic.</i>
R: Relevant	Set a goal that will help improve your health and athletic performance.
T: Timely	Make sure your goal has a time frame (this week).

Examples of SMART goals:

1. I will eat breakfast 3 times this week.
2. I will get 8 hours of sleep 3 times this week.

1. Nutrition-related goal

I will _____ times
this week. (behavior you plan on changing) (number of times)

2. Other health-related goal

I will _____ times
this week. (behavior you plan on changing) (number of times)

Peer Leader Manual

Mountain Crest High School Female Athlete Education Program

Session 3

Name_____

Session 3: The Benefits of Bone Health- Now and Later

Materials Needed

- Participant Workbooks
- Each participant should bring their completed food and activity record forms and their MyPlate SuperTracker print- out of the nutrition analysis.
- Pens

Session Outline

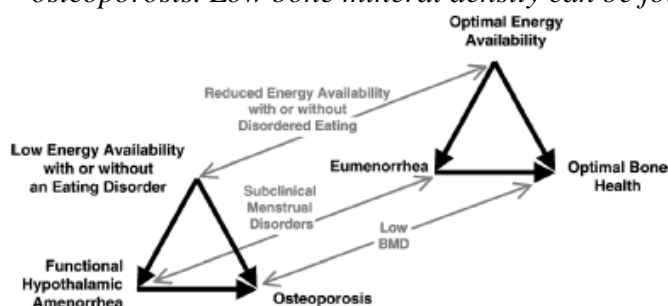
- Discuss the female athlete triad, specifically highlighting the component of bone health.
- Emphasize the importance of attaining and maintaining optimal bone mineral density.
- Discuss factors that affect bone mineral density (dietary, exercise, lifestyle, environmental).
- Identify foods rich in calcium and vitamin D using food labels.
- Discuss the impact of bone health on the risk of injuries and fractures, and the implications for athletic performance.

Overview

The focus of session three is to provide a more in depth introduction to the female athlete triad component of bone health. Students will participate in class activities in order to identify ways by which they can improve their bone health, which has important implications for health and athletic performance, both now and in the future.

The Female Athlete Triad- Bone Health Component (10 minutes)

- *In previous sessions we looked at the female athlete triad components of energy availability and menstrual function. Today we will focus on the bone health aspect of the Triad.*
- *On the Triad spectrum the aspect of bone health ranges from optimal bone health to osteoporosis. Low bone mineral density can be found between these two extremes.*



Nattiv A, Loucks AB, Manore MM, et al. American College of Sports Medicine position stand. The female athlete triad. *Med Sci Sports Exerc* 2007 Oct;39(10):1867-1882. Figure 1, The Female Athlete Triad. 'promotional and commercial use of the material in print, digital or mobile device format is prohibited without the permission from the publisher Lippincott Williams & Wilkins. Please contact journalpermissions@lww.com for further information.

- *Bone mineral density refers to amount of mineral, like calcium, found within a given area of bone, and the amount of mineral reflects the strength of the bones and their ability to resist breaking (i.e., fracture). Bone mineral density tests can detect bone loss conditions such as weak bones, and can help identify the extent of fracture risk.*
- *Osteoporosis is a disease that is characterized by severe bone loss, and with this condition the bones become very weak and can break easily.*
- *This is a big concern for all of us as athletes. An increased fracture risk could lead to a broken bone, which would mean not participating in track for the rest of the season, or maybe even longer.*
- *To help you visualize how the bones become weaker, let's look at the pictures on page 2 in your workbook.*
- *These pictures show the differences between a normal, healthy bone and a bone from someone who has osteoporosis. The word osteoporosis means "porous bone".*
- *As you can see in these pictures, when you look at the bone under a microscope, parts of the bone structure look like a honeycomb.*
- *In the osteoporosis pictures you can see that the holes and spaces in this honeycomb structure are a lot bigger than in the normal, healthy bone. This loss of structure means your bones have lost density or mass, which weakens the bones.*
- *As you can see in the pictures, the bones of people with osteoporosis are much weaker and can break quite easily. Simple actions like bending down to pick something up, bumping into furniture, or even sneezing can lead to a broken bone in people with severe osteoporosis.*



Does anyone know if there are signs or symptoms of osteoporosis?

- *Osteoporosis is sometimes called a "silent disease" because it develops gradually over time, and the first sign that a person has osteoporosis may be when they break a bone. There are tests that can be done to identify osteoporosis.*



Who is at risk for low bone mineral density or osteoporosis?

- *One of the first things that usually comes to mind when we hear "osteoporosis" is grandma bones. As teenagers we probably don't think about how this grandma bone disease could affect us right now.*
- *Even though osteoporosis is more common in older people, it can happen in younger people too. Low bone mineral density can even happen in teenagers such as all of us.*



What are some risk factors, other than age, for low bone mineral density?

If these are not mentioned by the students, highlight these risk factors. Also, elaborate on any of these that students mention but do not explain:

- **Sex:** females are more likely than males to have low bone mineral density. This is partially because women have lighter, thinner bones than men, and women also lose bone density more quickly as they age than men.
- **Family History:** if someone in your family has low bone mineral density or osteoporosis, you are at increased risk of having it.
- **Ethnicity:** white and Asian females are at greatest risk, but women of all ethnicities are at risk.
- **Body size:** women who are smaller, have thin bones, or weigh less are at greatest risk, but low bone mineral density can occur in women of all sizes.
- **Diet:** diets low in calcium and vitamin D can lead to decreased bone health. Getting enough of these nutrients is essential for promoting optimal bone mineral density. We are going to discuss these two important nutrients more in the activity at the end of the session.
- It is also important to note that low energy availability is just as important, if not more important for bone health than calcium and Vitamin D. So keep in mind as we continue to our discussion today that all aspects of the triad can play a role in bone health.
- **Exercise:** individuals that do not participate in weight-bearing exercise are at increased risk of having weak bones.

*Note: clarify what weight bearing exercise is: *weight bearing exercise is exercise that puts force on the bones. Running or jumping would be examples, however biking or swimming would not be weight bearing exercise.*



Which of these risk factors do we have control over? (diet and exercise)



What would the take home message be for the triad component of osteoporosis? Please turn to page 1 in your workbook and fill in the take home message.



Take Home Message 1: Having a healthy and adequate diet, and doing weight-bearing exercise will help me have strong bones.

Importance and Implications of Optimal Bone Mineral Density (5 minutes)



Why is it important to think about bone health now?

- As teenagers we are still building up bone mass. However, this build up of bone mineral density ends before or around age 30. After this time bone mass will start to decline. Because of this, it is especially important to build up as much bone mass as we can during our teenage years.



How are the Triad components interrelated when it comes to bone health?

- *Not having your period can cause you to have weak bones.*
- *When we have low energy availability and/or don't have a period – we are missing out on maximizing our bone mineral density. Some research shows that even when we start having adequate energy availability and normal periods again, our bone mineral density doesn't get to where it would have been had we had adequate energy availability and normal periods all along. For this reason, prevention is important.*
- *Think about your grandmas.*



Do any of them have osteoporosis? Or have any of them broken a hip?

- *Osteoporosis and bone fractures are more common in grandmas because they have gone through menopause. This means that they no longer have a menstrual period. Not having a period changes the amount of hormones in your body. This change can weaken your bones.*
- *So, if you are a high school athlete and are not having a period, you and your bones may be in the same boat as your grandma.*
- *Another important thing to remember is the right side of the triangle ...if you have low energy availability, even if you have a normal menstrual period, you can still experience bone loss.*



What would the take home message be for the Importance of Bone Health section?



Take Home Message 2: During the teenage years it is important to build up strong bones. If you are not having a period, you are at greater risk for osteoporosis and weak bones.

Injuries and Bone Health (5 minutes)

- *An important topic to discuss, especially for athletes like us, is bone injuries.*
- *Many of you have probably experienced at least some kind of injury related to your athletic training, and know how difficult this can be. It is important to do all that we can to prevent injuries.*
- *Having adequate energy availability is critical to bone health. Another way to help prevent bone injuries such as broken bones or stress fractures is eating foods high in calcium and vitamin D, or taking a supplement of these nutrients if you don't eat foods high in these nutrients.*
- *Each of you also participates in weight bearing exercise as part of being on the track team, and this is another good way to help strengthen bones.*



Have any of you had a bone injury during training or competition? How did this affect your training and performance?

If you as a peer leader have had a bone injury feel free to also tell about your experience here. This can help students see the importance of maintaining good bone health.

- *As we can see from these examples, bone health is not just a concern for older people, but can affect us even as teenagers. Because of this it is important to do all we can to*

build and keep our bones strong. This will help our health and performance now and when we are older.



This was a short section, but an important one. What should we remember as the take home message for the injuries and bone health section?



Take Home Message 3: A bone injury can mean not training or competing for a season, or even longer.

Evaluating Energy Availability (10 minutes)

- *An important thing to remember is that if you are eating enough food to keep your energy availability up, you will likely increase your calcium and vitamin D intake automatically.*
- *We are going to talk about these two nutrients in more detail at the end of the session, but first let's take a look at energy availability. Pull out your print-outs from the MyPlate SuperTracker, or the worksheet you used to calculate your energy availability in session 2.*



If your energy availability is low, what are some things you can do to increase your energy availability?

- *Remember that as your training and physical activity go up, so does your need for fuel. Eating more food on the days you train, especially on hard training days, will help keep your body's energy level where it should be.*
- *Let's take a minute and strategize a few ways to help increase your energy availability if it is low:*



If you are not eating 3 meals per day, how could you make this happen?

- *Eating 3 meals per day is a good start to keeping energy available in your body. Remember, with a heavy training schedule, you will need some snacks throughout the day too.*



What are some nutrient-packed foods you could include throughout the day? And how will you make sure that happens?

- *Strategize with them on how to pack snacks in their backpacks and track bags (granola bars, little bags of nuts, dry or fresh fruit, peanut butter crackers or fruit, etc.)*



How will making sure your energy availability is up help your bone health? (This is the take home message...)



Take Home Message 4: If you have low energy availability because you are not eating enough for your activity level, this may lead to weaker bones and increased risk for bone fractures.

Activity: Estimating Calcium and Food Sources of Calcium and Vitamin D (30 Minutes)

- *As I mentioned earlier, energy availability is probably even more important to bone health than calcium or vitamin D, but these nutrients do play a very important role in overall health and bone health. Let's discuss both of them now.*
- *Calcium helps strengthen bones and it is important to eat foods with calcium daily..*



Does anyone know what age group needs the most calcium?

- *Children and teenagers need the most calcium because they are still growing. People between the ages of 9 and 18, such as all of us, need the most calcium every day because bones are growing faster at this time than at any other.*
- *Once you get past the growth spurts that happen during these years, you can't make up for the calcium you didn't eat during this important time. This is why it is so important to eat foods that have calcium.*



What foods are good sources of calcium?

Listen to responses, and prompt with these suggestions if students are not responding:

- *Dairy products such as milk, yogurt, and cheese are all good sources of calcium.*

Students will probably list these foods first, because they are the most obvious choices and the most calcium rich foods.



What foods can people eat to get calcium if they do not eat or do not tolerate dairy?

- *Many food companies make products that are fortified with calcium, such as orange juice, soy milk, and breakfast cereals. These can be good options for people who do not eat dairy products.*



Are there any other food sources of calcium?

- *Yes, some non-dairy foods that naturally have calcium in them are dark green leafy vegetables such as broccoli and spinach, cooked dried beans such as white beans, soy beans, and garbanzo beans, almonds, and figs.*
- *Keep in mind that these foods contain less calcium than dairy products, and in some of them the calcium is not absorbed as well as it is from dairy foods.*



How much calcium do teenagers need to eat every day?

- *It is recommended that teenagers get 1,300 milligrams of calcium every day. To help us better understand how much this is, please pull out your food records and your diet analysis from MyPlate that we did for homework after session 1.*



After looking at the foods you wrote down for your 3-day log, and at the number on your Nutrient Report print-out, how are you doing on your calcium and vitamin D intake?

- *In session two we estimated our energy availability using the print-outs from the MyPlate SuperTracker. If you had low energy availability and need to add more food and energy into your diet, it would be a good idea to choose foods rich in calcium and vitamin D (especially if you are not getting enough of these nutrients).*



Look at your meals and snacks. How could you include more calcium in your meals and snacks during the day?

- Provide suggestions if they do not provide any. Suggest that they have a glass of milk or fortified orange juice with their breakfast. If they eat cereal, make sure it is cereal that is fortified with calcium, and that they have milk with the cereal.
- Other ideas are that they could snack on almonds during the day, or drink low fat milk instead of soda or energy drinks. Chocolate milk also has a lot of calcium, and can be a great choice for after practices or competitions.

Nutrition Facts Labels

- *A good way to know how much calcium a food item has in it is to look at the Nutrition Facts label. This label is found on all food products, and all of these labels have to show the percent Daily Value (%DV) of calcium for the food product.*
- *The percent Daily Value shows what percent of the recommended amount of calcium for one day that the food provides. This is based on the calcium needs of an adult. Because teens like you need more calcium every day, we need to adjust the percent daily value for teens.*
- *Adults need 1,000 milligrams of calcium every day, so 100% daily value on the food label means that one serving of the food product provides 1,000 milligrams of calcium.*



Does anyone remember how much calcium teens need every day?

- *Teenagers need 1,300 milligrams of calcium every day. So, to meet the requirements you would need 130% of the daily value.*
- *It is important to remember that because we aren't just eating one food item during the day, we can reach the total of 1,300 milligrams of calcium by eating many different foods. It isn't reasonable to expect that one serving of one food will give us all of the calcium we need for a day.*
- *Let's look at an example of a food label now and see if we can interpret how much calcium is in it.*

1% Lowfat Milk	
Nutrition Facts	
Serving Size 1 cup (236 mL)	
Amount Per Serving	
Calories 110	Calories from Fat 20
% Daily Values*	
Total Fat 2.5g	4%
Saturated Fat 1.5g	8%
Trans Fat 0g	
Cholesterol 10mg	4%
Sodium 125mg	5%
Total Carbohydrate 13g	4%
Dietary Fiber 0g	0%
Sugars 12g	
Protein 8g	
Vitamin A 10%	Vitamin C 4%
Calcium 30%	Iron 0%
	Vitamin D 25%

- Please turn to page 3 in your workbook and fill it out as we go.
- This food label shows that the 1% milk has 30% daily value for calcium. Remember that this is based on the adult requirement of 1,000 milligrams of calcium.
- A quick way to know how many milligrams of calcium are in the food is to multiply the % DV by 10. So in this example, 30% times 10 would be 300 milligrams of calcium in one serving of milk.

Partner Activity

- Now let's all try finding foods that are high in calcium by looking at some food labels
- Everyone find a partner, and turn to page 4 in your workbook.
 - Group 1 please do the Greek yogurt label
 - Group 2- cottage cheese
 - Group 3- spinach
 - Group 4- almonds
 - Group 5- orange juice
- Please look at the percent daily value for calcium on the label with your partner, and answer the four questions on page 4 in your workbook

For reference, the questions are:

1. What is the % daily value for calcium for one serving of your food item?
2. How many milligrams of calcium would this be?
3. Would this food be a good source of calcium?
4. If yes, how could you include it in your diet? Look at your food record and identify a specific meal or snack you can start including either this food item or another food that his high in calcium.

Give them about 5 minutes to complete the assignment.

- Ok everyone, let's finish up and come back together as a group.



Group 1 will you start us off and tell us the answers you found for Greek yogurt?

Continue to have all of the groups share their findings.

- *Great! Thank you all for sharing your answers. I hope you all are comfortable estimating how much calcium is in a food by looking at the label.*

Rule of 300s

- *Another good way to estimate the amount of calcium you are getting is called the Rule of 300s. This rule says that 3 servings of dairy will give you about 900 mg of calcium, and if you are eating a normal diet you will get about 300 mg of calcium from the foods you eat. This is equal to about 1200 mg of calcium.*

Vitamin D

- *Another important nutrient for bone health is Vitamin D. Vitamin D helps your body absorb the calcium you eat.*
- *Many foods that are good sources of calcium also have Vitamin D, or are fortified with Vitamin D.*
- *Some food labels do not list vitamin D on the label, so it is important to know which foods have vitamin D.*



What foods have vitamin D?

- *Most milk is fortified with vitamin D, and some milk products such as yogurt are sometimes fortified with vitamin D as well. Other food sources of vitamin D include fish such as salmon or tuna, and fish liver oils.*



Where can we get vitamin D other than from food?

- *The sun helps our bodies make vitamin D. Since we are all track athletes, we spend a lot of time training outside. This can help us get the vitamin D we need.*
- *However, because of where we live, we are not as exposed to the sun as some people are in other places that are closer to the equator, so it is important to get vitamin D from food and/or from a supplement.*
- *It may be difficult to get all of the vitamin D you need from food alone. This is especially true if you aren't eating very many of the foods we listed as being good sources of vitamin D. If you are using sunscreen when you are outside, this also decreases the amount of vitamin D you will make from the sun. For these reasons, some people may benefit from a vitamin D supplement.*
- *The recommendation for vitamin D is 600 International Units (IU) per day (this is equal to 15 micrograms per day), so keep these amounts in mind if you do decide to take a vitamin D supplement.*



Ok, we covered a lot in this section... what would be the take home message for the calcium and vitamin D section?



Take Home Message 5: Eating enough calcium and vitamin D can help our bones be strong. If I get 3 servings of dairy products and eat a normal diet, I'll probably get most of the calcium I need. Calcium is found in dairy products, fortified foods, and green leafy vegetables. Vitamin D is found in fish and from the sun.

Home Exercises (2 minutes)

- *Thank you for all of your participation today. To get ready for our last session next week, please turn to page 5 in your participant workbook.*
- *Please create a plan for increasing your energy availability, or set some specific goals of how to include more foods in your diet that have calcium and vitamin D.*
- *If you are already doing ok as far as energy availability and getting enough calcium and vitamin D, set a goal relating to another topic we have discussed in the last three sessions.*
- *Think about how these goals can help improve your health and athletic performance.*
- *Bring these goals with you next week and we will discuss them as a group.*

Participant Workbook

Mountain Crest High School Female Athlete Education Program

Session 3

Name _____

Session 3: The Benefits of Bone Health- Now and Later

Session Outline

- Discuss the female athlete triad, specifically highlighting the component of bone health.
- Emphasize the importance of attaining and maintaining optimal bone mineral density.
- Discuss factors that affect bone mineral density (dietary, exercise, lifestyle, environmental).
- Discuss the impact of bone health on the risk of injuries and fractures, and the implications for athletic performance.
- Identify foods rich in calcium and vitamin D using food labels, food logs, and MyPlate SuperTracker print- outs.

Take Home Messages

When directed by the peer leader, please write down the take home message for each section covered in today's session.



Take Home Message 1: Bone Health and Osteoporosis



Take Home Message 2: Bone Health Importance Now



Take Home Message 3: Injuries and Bone Health

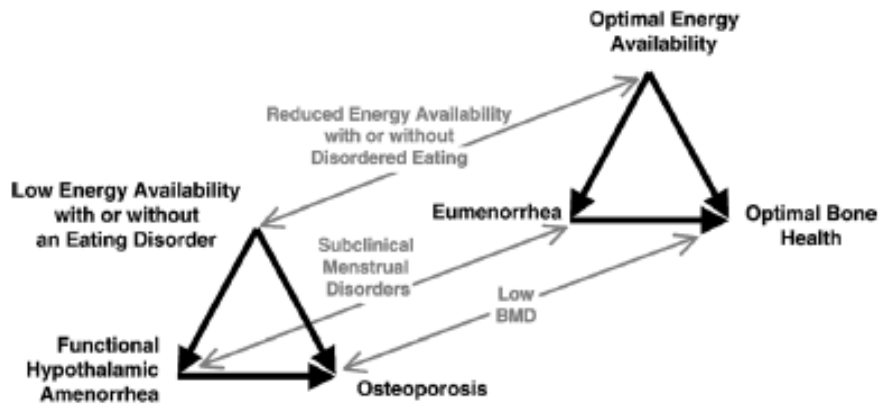


Take Home Message 4: Energy Availability and Bone Health



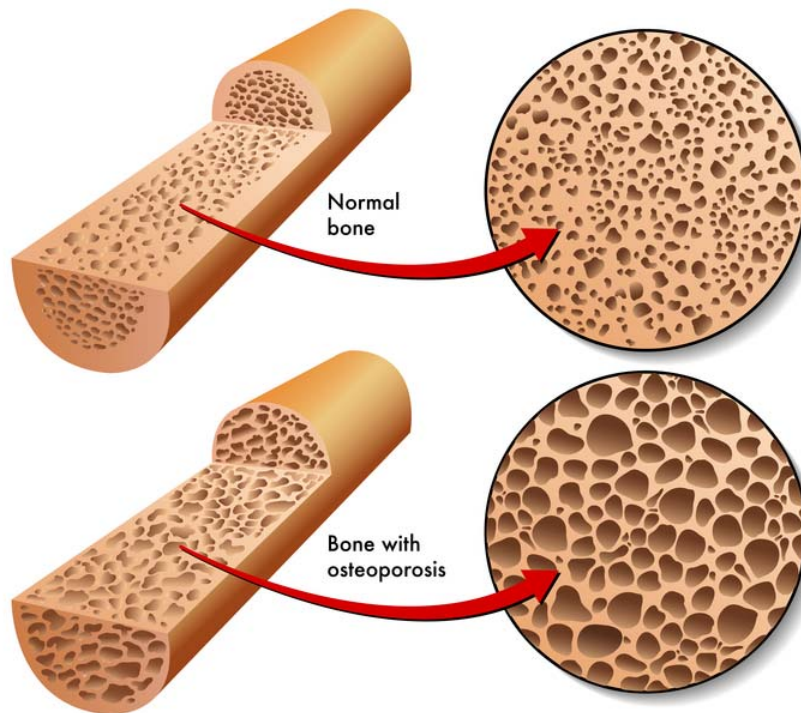
Take Home Message 5: Calcium and Vitamin D

Female Athlete Triad



Nattiv A, Loucks AB, Manore MM, et al. American College of Sports Medicine position stand. The female athlete triad. Med Sci Sports Exerc 2007 Oct;39(10):1867-1882. Figure 1, The Female Athlete Triad. 'promotional and commercial use of the material in print, digital or mobile device format is prohibited without the permission from the publisher Lippincott Williams & Wilkins. Please contact journalpermissions@lww.com for further information.

Bone Health Pictures



Food Label Reading- Calcium

1% Lowfat Milk	
Nutrition Facts	
Serving Size 1 cup (236 mL)	
Amount Per Serving	
Calories 110	Calories from Fat 20
% Daily Values*	
Total Fat 2.5g	4%
Saturated Fat 1.5g	8%
<i>Trans Fat</i> 0g	
Cholesterol 10mg	4%
Sodium 125mg	5%
Total Carbohydrate 13g	4%
Dietary Fiber 0g	0%
Sugars 12g	
Protein 8g	
Vitamin A 10%	Vitamin C 4%
Calcium 30%	Iron 0% • Vitamin D 25%

Calcium

1. What is the % Daily Value (%DV) for calcium for this item? _____

2. Multiply the % DV by 10 to get an estimate of the milligrams (mg) of calcium:

$$\underline{\hspace{2cm}} \times 10 = \underline{\hspace{2cm}} \text{ mg calcium}$$

% DV

3. How many milligrams of calcium do teenagers need every day? _____

Food Label Activity

Your peer leader will assign you and your partner to answer the following questions about one of the food labels below. Complete the questions, then share your answers with the class.

1. What is the % daily value for calcium for one serving of your food item?
2. How many milligrams of calcium would this be?
3. Would this food be a good source of calcium?
4. If yes, how could you include it in your diet? Look at your food record and identify a specific meal or snack you can start including either this food item or another food that his high in calcium.

Greek Yogurt

Nutrition Facts	
Serving Size 1 container 8 oz 227g (227) T	
Amount Per Serving	
Calories 238	Calories from Fat 28
% Daily Value*	
Total Fat 3g	5%
Saturated Fat 2g	10%
Trans Fat	
Cholesterol 14mg	5%
Sodium 148mg	6%
Total Carbohydrate 42g	14%
Dietary Fiber 0g	0%
Sugars	
Protein 11g	
Vitamin A 3%	Vitamin C 3%
Calcium 38%	Iron 1%

Cottage Cheese

Nutrition Facts	
Serving size: 4 oz (226g)	
Servings Per Container 1	
Amount Per Serving	
Calories 163	Cal. from Fat 21
% Daily Value*	
Total Fat 2g	4%
Saturated Fat 1g	8%
Trans Fats 0g	
Cholesterol 9mg	4%
Sodium 918mg	40%
Total Carbohydrate 6g	2%
Dietary Fiber 0g	0%
Sugars 6g	
Protein 28g	
Vitamin A 2%	Vitamin C 0%
Calcium 15%	Iron 2%

Spinach

Fortified Orange Juice

Nutrition Facts	
Serving Size 1 1/2 cups shredded (85g)	
Amount Per Serving	
Calories 40	Calories from Fat 0
%Daily Value*	
Total Fat 0g	0%
Saturated Fat 0g	0%
Trans Fat 0g	0%
Cholesterol 0mg	0%
Sodium 160mg	7%
Total Carbohydrate 10g	3%
Dietary Fiber 5g	19%
Sugars 0g	
Protein 2g	
Vitamin A 70%	Vitamin C 25%
Calcium 6%	Iron 20%

Almonds

Nutrition Facts	
Serving Size 1 ounce, about 22 nuts (28g)	
Servings Per Container	
Amount Per Serving	
Calories 170	Calories from Fat 130
% Daily Value*	
Total Fat 15g	23%
Saturated Fat 1g	5%
Trans Fat 0g	
Cholesterol 0mg	0%
Sodium 0mg	0%
Total Carbohydrate 5g	2%
Dietary Fiber 3g	12%
Sugars 1g	
Protein 6g	
Vitamin A 0%	Vitamin C 0%
Calcium 8%	Iron 8%

Nutrition Facts	
Serving Size 8 fl oz (249g)	
Servings Per Container 8	
Amount Per Serving	
Calories 110	
%Daily Value*	
Total Fat 0g	0 %
Saturated Fat 0g	0 %
Trans Fat 0g	
Cholesterol 0mg	0 %
Sodium 0mg	0 %
Total Carbohydrate 26g	9 %
Dietary Fiber 0g	0 %
Sugars 22g	
Protein 2g	
Vitamin A 0%	Vitamin C 180%
Calcium 35%	Iron 0%

Take Home Activity

To help you apply what we learned today, let's set some goals!

Your Task:

- If your energy availability is low... Create a plan for increasing your energy availability:
 - WHAT foods/food groups does your analysis show you should be eating more of?
 - HOW much of these foods will you eat per day?
 - WHEN during the day will you eat these foods? (breakfast, snack, after practice, etc.)

- If you are not getting enough calcium or vitamin D... Make a plan to fix this:
 - WHAT foods can you start including in your diet that will help you get more of these nutrients?
 - HOW much of these foods will you eat?
 - WHEN are you going to eat these foods? (breakfast, snack, after practice, etc.)

- If your analysis from MyPlate shows your energy availability is good, and you are getting enough calcium and vitamin D... Do you agree with the numbers?
 - If NO, follow the instructions for one of the first two options above
 - If YES, set a goal relating to something else we have talked about in the past three sessions. It might be a good idea to follow up on a goal you set after session 2.

Note: Make sure your goals are SMART! (see session 2 for a description of SMART goals)

MY GOAL:

I will _____ times
 this week. _____
 (behavior you plan on changing) (number of times)

Peer Leader Manual

Mountain Crest High School Female Athlete Education Program

Session 4

Name_____

Session 4: Bringing it All Together- A Focus on Health

Materials Needed

- Popular magazines and sport/exercise magazines for the body image activity
- Scissors
- Pens

Session Outline

- Activity to encourage discussion of the sport-specific ideal body pressures female athletes may face. Discuss the ideal body portrayed by the media, and the conflict this causes with sport-specific ideal.
- Emphasize the Athlete Specific Healthy Ideal Body, which is very individualized.
- Discuss the importance of fueling the body using appropriate nutrition before, during, and after exercise.
- Review session topics and the female athlete triad, and determine a game plan for athletic success and optimal health.

Overview

Session four will tie all of the sessions together and provide some concluding discussions. Body image concerns will be addressed, with the emphasis on the healthy ideal for promoting improved well-being and better athletic performance. The importance of appropriate eating around and during exercise will be discussed. All of the topics discussed will be tied back to the female athlete triad, and students will brainstorm together to determine a game plan for staying on the healthy end of the Triad spectrum.

Introduction (5 minutes)

- Attention activity: Go to <http://www.howardschatz.com/books.php?galleryID=40> . This is a photographer's website. The book *Athlete* has a great picture that demonstrates that female athletes have many different body shapes. Click on the picture that has many athletes standing next to each other. (Note: be aware that other images in the book have nude pictures of athletes, so don't explore the website. Just show the picture described above).



What thoughts do you have as you look at this picture?

If necessary, use prompting questions such as:



These are considered to be elite athletes in their particular sport, yet they all look very different. Why might this be so?

- *The females shown in these pictures all look different, yet their bodies seem appropriate for the specific sport that they specialize in. This might be considered to be the sport-specific ideal body. This is one of the pressures that is placed on female athletes- the idea that they must look like this ideal in order to compete at their best.*

- *Today we are going to discuss some of the different pressure female athletes face, both from their sport and from the media. We will also discuss the conflicts between different body ideals, and how to combat these as female athletes. We are also going to discuss the importance of nutrition in achieving maximal athletic performance in your sport.*



What would the take home message be for our introduction to body image section?



Take Home Message 1: All female athletes look unique and different. It is important to recognize that this is healthy, and not try to meet unrealistic expectations.

Body Image (25 minutes)

Media- Ideal Female Body Activity

- *Everyone grab a popular magazine from the front. If you brought your favorite popular magazine go ahead and pull that out. Take five minutes to flip through the magazine and cut out any pictures you think show the ideal female body that is promoted by the media.*

After 5 minutes, call the group back and lead the discussion on the ideal female body.

- *Ok everyone let's come back together and share what we found. Let's start here, then go around and have everyone show their pictures and explain why you thought it looked like the ideal female body.*



Use prompting questions throughout such as:

- *Is it realistic for every female to try and look like the models found in these magazines?*
- *Why might it be impossible to reach the ideal that the media portrays? (photoshop, airbrush, professional team doing hair, makeup, wardrobe, etc.)*

Sport-Specific Ideal Body Activity

- *Now let's take a look at some popular sport, exercise, and fitness magazines. Since we are all track and field athletes, try and find what is considered an ideal female body for this sport.*
- *If you compete in a particular event such as sprinting, long jump, shot put, etc. try and find the ideal body for your event. Take five minutes to look through and cut out pictures.*

After five minutes, lead the discussion on what pictures the students found.

- *Ok, let's go around and have everyone show the pictures they found in the magazines.*



Use these questions either during or after everyone discusses their pictures:

- *Why would that be considered to be the sport-specific ideal body for your sport?*
- *It is realistic to try and look exactly like the magazine model or athlete in the picture?*
- *How does the sport-specific ideal differ from the ideal female body pictures you found in the popular magazine?*
- *How might these differences cause internal conflict among athletes such as all of us?*
- *What can we conclude about the ideal female body?*

Video Clip- Ema Thake

- *Now that we have taken a look at the images presented in the media for different ideal body types for females, let's take a look at a video clip that relates to the pressures placed on a college track athlete to look a certain way as she competed at a collegiate level.*

Show the video clip with Ema Thake.



What were the consequences of giving in to the pressure from her coaches to lose weight and look a certain way as a track athlete?

Athlete Specific Healthy Ideal Body

- *As you can see from our discussion and from the video clip, the ideal female body must be very individualized. Look around- we all look different from one another and it is unrealistic for all of us to try and look the same. Athletes face an especially hard challenge because we have pressures from both the media's ideal female body and the sport-specific ideal body.*
- *This can cause conflict, and leads to the conclusion that the ideal body is actually the healthy ideal. You probably won't find pictures of this in popular magazines, because it doesn't have specific physical characteristics like the other two ideals we discussed.*
- *The healthy female body depends on each individual's characteristics. It can't be described by a jean size, a specific number on a scale, or a certain body fat percentage. These things are not required for athletic success.*
- *The healthy ideal means you have an appropriate body shape, size, and weight for your particular needs and body type.*
- *Keeping this in mind during training and with the expectations you have for yourself can be very helpful, and can promote health and also help improve your performance.*
- *One definition of the Athlete Specific Healthy Ideal Body Image is:
"Whatever your unique body looks like when you are doing all the things necessary to appropriately AND SIMULTANEOUSLY maximize physical health, mental health, quality of life and athletic performance." [1]*



What does it mean to maximize physical health, mental health, quality of life, and athletic performance?

Use prompting answers if necessary, such as:

- *When we reject the other ideals and focus on the athlete-specific healthy ideal, we can maximize our physical health because we do not have to worry about looking a certain way or losing a certain amount of weight.*
 - *When we set unhealthy goals like that we set ourselves up for failure, because we will probably never reach the ideals we are looking for, and even if we do we will probably still not be satisfied. Thus, to help maximize our mental health, we should remember the athlete-specific healthy ideal, and not try to achieve something we cannot (and should not, for health reasons) achieve.*
 - *By avoiding the unhealthy behaviors such as dieting, medications, excessive exercise, etc. we are able to focus on behaviors that will help improve our performance.*
 - *As we train appropriately, our health, quality of life, and performance will all be improved.*
- *An important part of this has to do with fueling your body for success. Let's talk about some of the nutrition basics that are essential for athletes.*
 - *But first, let's decide on the take home message for the Athlete-Specific Healthy Ideal Body section.*



Take Home Message 2: There is no set weight or body fat percentage that is required to be successful in sports. The athlete-specific healthy ideal body optimizes physical and mental health, improves quality of life, and optimizes performance.

Food=Fuel Video Clip (5 minutes)

Eating Disorders

Peer leaders- please keep this section brief, as it is not designed to be a discussion point. The goal is to provide a brief description of eating disorders to the girls know what the terms listed mean. We do NOT want the girls to provide testimonials about eating disorders.

We are briefly going to mention eating disorders before moving on to the next topic. Please do not share any person experiences with eating disorders at this time. I will provide some basic information about eating disorders. If you have concerns about eating disorders please contact your school counselor.

- *Eating disorders: a clinical mental disorder characterized by abnormal eating behaviors, an irrational fear of gaining weight, and false beliefs about eating, weight, and shape.*
- *Anorexia: an eating disorder characterized by restrictive eating, and a self-view that they are overweight and need to lose weight even though they are at least 15% below the expected weight for their age and height.*

- ***Bulimia:** an eating disorder in which affected individuals, usually in the normal weight range, repeat a cycle of overeating or binge-eating, then purging.*
- ***Binging:** characterized by loss of control over eating, and periods of eating very large amounts of food in a short amount of time.*
- ***Purging:** Compensatory behaviors such as fasting, vomiting, laxatives, or excessive exercise.*

Video Clip

- *To introduce the sports nutrition section, let's start with a video clip about the importance of using food as a fuel for your body.*

Play the Food=Fuel video clip.



What is the comparison she makes about fueling your body being like fueling a car?

- *Keep the ideas she talked about in mind as we discuss the important topic of sports nutrition.*

Sports Nutrition... Making a Game Plan for Success (20 minutes)

- *To start off, let's go over the very basics of nutrition. We have already discussed calories when we talked about energy earlier. We know that it is important to eat enough calories so we will have energy for every day activities, and for training.*



Where do we get calories from in our diet?

- *Carbohydrates, protein, and fat all provide calories, or energy. Vitamins and minerals do not provide calories (energy), but do give us important nutrients that our body needs.*
- *As an athlete, it is important to make sure you are getting not only enough calories, but also the right amounts of carbohydrate, protein, and fat to fuel your performance.*
- *As an athlete, your diet should be about*
 - *45-65% carbohydrate*
 - *10-35% protein*
 - *20-35% fat*
- *You can see that you need to be getting most of your calories from carbohydrates, and this is especially true for athletes. Your body is fueled best by carbohydrates, although the protein and fat have important functions in the body as well.*
- *We are going to be discussing some specific guidelines for eating for athletic training, but it is important to remember that ALL foods can fit in to a healthy diet. The key is balancing what you eat, and making sure the timing and portions of what you eat will help maximize your health and performance. This doesn't mean that you can't have a treat occasionally or that you need to avoid certain foods, just remember that food=fuel, so what you put in your body is what your body will have available to draw from when you need energy. There are no "good" or "bad" foods- all foods can fit into your diet if you make a plan, and that is one of the goals of this session.*
- *As an athlete, a really important thing to keep in mind is timing your eating around practice.*

Before Practice: *it is important to eat a high carbohydrate meal or snack with protein 1-3 hours before practice*



What would be some good meals ideas to eat at lunch to help fuel you for your afternoon practice?

Listen to their ideas and highlight where the carbohydrate and the protein would be coming from in the food items they list. Mention a few of these ideas that are listed to help point out how to get both carbohydrate and protein at lunch.

Meals that have both carbohydrate and protein, as well as a fruit or vegetable:

- *Turkey sandwich, apple, low-fat milk*
 - *Tuna with crackers, grapes, carrot sticks*
 - *Chicken noodle soup, bread, orange*
 - *Spaghetti with meat sauce, green salad*
- *For those of you that have first lunch starting at 11:00, you are probably going to need to eat a snack between lunch and practice. Between 4th and 5th period would probably be the best time.*



What are some snacks you could keep in your backpack or your locker to eat between classes?

Again, point out where the carbohydrate and protein are coming from in the foods they suggest. If the food item they list only has carbohydrate, ask what protein containing food they could add with it to help fuel for success. A few ideas to help them out:

- *Almonds and an apple*
 - *Low fat chocolate milk and a banana*
 - *Protein bar and a clementine orange*
 - *String cheese and whole grain crackers*
- *These would also be good snack ideas for those of you that have second lunch to have as a morning snack between classes.*
 - *Now that we have discussed some ideas for eating before practice, let's talk about **during practice**.*



What do you usually do as far as hydration and nutrition during practice?

- *Water is usually best in most situations for during practice.*
- *Sports drinks like Gatorade might be a better choice than just water if you are exercising more than 60-90 minutes, especially when it is hot outside and you are sweating a lot. This can help you replace fluid, electrolytes, and carbohydrates.*

After practice, *it is important to eat a high carbohydrate meal that also has some protein. This helps you recover from your workout, replenish the carbohydrate stores in your body, and build muscle.*

- *What are some dinner or snack ideas that you could have after practice?*

Dinner:

- *Stir fry with beef, rice, and vegetables*
- *Baked potato with cottage cheese on top, green salad, peaches*
- *Quesadilla with chicken, cheese, tomato, green peppers, salsa; pear*

Snacks:

- *Yogurt with granola and berries*
- *Cottage cheese and pineapple*
- *Low-fat chocolate milk and a bagel*

- *Now that we have a general idea of how we should be fueling our bodies before, during, and after practice, let's make a more personalized plan for success.*
- *Turn to pages 3 and 4 in your workbook and look at the "Scheduling for Success" worksheet. On page 3 you see the assignment, and on page 4 there is an example of what to do.*
- *So here you can see a breakdown of your school schedule, but we need to fill in everything else in addition to your classes. As we do this, there are some important things to keep in mind.*



Can someone read the first bullet listed on the worksheet? How about the next bullet?

Continue until all of the bulleted instructions have been read.

- *Ok, go ahead and take 5 minutes to complete this schedule for yourself. Make sure to keep the things we have discussed in mind as you fill in your schedule.*
- *All right everyone, let's wrap it up. If you haven't quite finished filling in your schedule make sure you finish it up when you get home.*



So, what would the take home message be for the sports nutrition section?



Take Home Message 3: Fueling your body for success takes some planning and effort, but the performance and health benefits are well worth it.

Review of the Program- Key Points to Remember (5 Minutes)

- *We have covered a lot in these four sessions, so let's do a quick recap of what we have learned.*
- *At the beginning of the program we discussed energy balance and energy availability. We used the MyPlate supertracker print-outs from your diet assessments to estimate your energy availability, and set goals to help improve health and athletic performance.*
- *We discussed the female athlete triad, one of the main focuses of this program.*



Who remembers what the components of the female athlete triad are?

- **Low energy availability**
 - To help prevent low energy availability, make sure you are eating enough to support your activity level.
- **Menstrual dysfunction**
 - We discussed that having a normal period is important for your health, including the health of your bones. Low energy availability can contribute to menstrual dysfunction.
- **Low bone mineral density**
 - Even if you don't have osteoporosis, if you are not eating enough (especially of calcium and vitamin D-rich foods) and do not have a regular period, you could be at risk of having weaker bones. This is a very important time to focus on strengthening your bones, and you will see the benefits of doing so both now and in the future.
- Today we have discussed the importance of attaining the Athlete-Specific Ideal Healthy Body. This is very individualized, and is whatever your body looks like when you are doing everything necessary to maximize health in all aspects of your life.
- You also created an individualized plan for how you are going to fuel your body for success. This will help you accomplish the goals of this program, which are to help you improve both your overall health and your athletic performance.
- If you use the skills and knowledge you have gained in this program, you will be well on your way to a healthy experience as a well-fueled athlete. Nutrition plays a very important role in your athletic success, and incorporating what you have learned in this program will help you see the benefits of optimizing your health to achieve your personal and athletic goals.



Overall Take Home Message: Applying the skills and knowledge you have gained from this program will help you use nutrition and exercise to promote both improved health and athletic performance.

1. Becker CB, McDaniel L, Bull S, et al. Can we reduce eating disorder risk factors in female college athletes? A randomized exploratory investigation of two peer-led interventions. *Body Image* 2012;9(1):31-42.

Participant Workbook

Mountain Crest High School Female Athlete Education Program

Session 4

Name_____

NOTES PAGE

Session 4: Bringing it All Together- A Focus on Health

Session Outline

- Activity to encourage discussion of the sport-specific ideal body pressures female athletes may face. Discuss the ideal body portrayed by the media, and the conflict this causes with sport-specific ideal.
- Emphasize the Athlete Specific Healthy Ideal Body, which is very individualized.
- Discuss the importance of fueling the body using appropriate nutrition before, during, and after exercise.
- Review session topics and the female athlete triad, and determine a game plan for athletic success and optimal health.

Take Home Messages

When directed by the peer leader, please write down the take home message for each section covered in today's session.



Take Home Message 1: Introduction to Body Image



Take Home Message 2: Athlete Specific Healthy Ideal Body



Take Home Message 3: Sports Nutrition- Fueling for Success



Take Home Message 4: Overall Program Message

Scheduling for Success!

Eating healthy doesn't just happen- it takes some planning. To help you make a plan for how to fuel your performance, fill in the schedule below. Make sure to include the following:

- Meal ideas for breakfast, lunch, and dinner (include food items and approximate times you will be eating)
- Schedule in your snacks! What times during the day can you fit in a snack? Think about between classes, after school, after practice, evening, etc.
- Write in the time of your practice. Think about fueling during practice, if necessary. This will probably mostly be water, but might include things like sports drinks and small carbohydrate-rich snacks.
- Timing is essential! Making sure you eat enough (but not too much) before practice will help you perform at your best. And don't forget to refuel after practice!
- Think about carbohydrates, protein, and fat. Remember the timing and amounts we discussed for these nutrients.

See sample schedule on the next page for an example

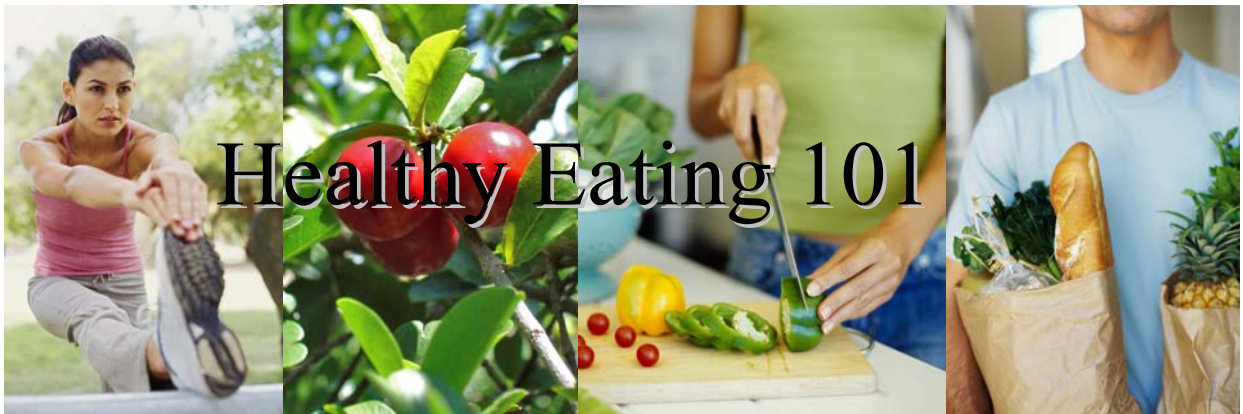
HOUR	START	END	FOOD ITEMS
1	8:00	9:00	
FLEX	9:05	9:55	
2	10:00	11:00	
1st Lunch	11:00	11:30	
3rd	11:35	12:35	
3rd	11:05	12:05	
2nd Lunch	12:05	12:35	
4	12:40	1:40	
5	1:45	2:45	

Sample Schedule			
HOUR	START	END	FOOD ITEMS
Breakfast	7:00	7:15	Oatmeal, toast, banana, 1% milk
1	8:00	9:00	
FLEX	9:05	9:55	
2	10:00	11:00	
1st Lunch	11:00	11:30	Turkey sandwich with cheese, lettuce, tomato
3rd	11:35	12:35	Orange, carrot sticks, chocolate milk
3rd	11:05	12:05	
2nd Lunch	12:05	12:35	
4	12:40	1:40	
Snack	1:40	1:45	Apple slices dipped in peanut butter
5	1:45	2:45	
Track Practice	3:00	5:00	Water, Gatorade
Dinner	6:00	6:30	Spaghetti, meat sauce, garlic bread, green beans, apple juice
Snack	8:00	8:10	Yogurt with granola and berries

Appendix E. Healthy Eating 101 Surveys and Curriculum

Survey (including Food Frequency Questionnaire)

https://nfssurveys.usu.edu/remark/rws4.pl?FORM=Connections_Health_Survey_2009



Brought to you by USU Dietetics and the USU Department of Nutrition, Dietetics and Food Sciences

The goal of the *Healthy Eating 101* is to provide interactive, practical, student-to-student nutrition/health education aimed at helping USU freshmen make a healthy transition to college life.

Objectives:

1. Students will discuss why eating balanced meals is important for health and success.
2. Students will describe how they can apply the MyPyramid guidelines to a college student's life.
3. Students will determine feasible options for physical activity.
4. Students will gain confidence in planning meals and snacks.

Total Time: 12 minutes

Materials

- 1 copy of the "Which meal would you rather have?" picture
- 1 MyPyramid Poster
- 2 sectioned plates
- Assorted food models

LESSON PLAN

Intro/ Objective 1: Students will discuss why eating balanced meals is important for their health and success.

Activity: *Which meal would you rather eat?*

Time: 1 minute

- Show the students the pictures of the ramen noodles and the chicken stir-fry.
- Ask the students which dish they would choose to have for dinner or lunch.
- Ask the students why (flavor, appearance, etc).

- Discuss other reasons such as:
 - Getting all the nutrients your body needs
 - Variety
 - Feel full (can give example of when you are on a road trip, and you have snacks, but you don't feel satisfied because you feel like you want real food...a real balanced meal).
 - Enjoyment
 - When they are satisfied they can better focus on other things like school.

Objectives 2: *Students will describe how the MyPyramid guidelines can fit into a college student's life.*

Activity: MyPyramid discussion

Time: 7 minutes

- Show the students the poster of my Pyramid. Explain that you understand that they already know the basics of what they should eat.
- Ask the students which food group is hardest for them to get enough of.
- Explain to the students that the group is going to discuss how to make simple changes that will help their diets meet the MyPyramid recommendations.
- **The following are suggestions of tips for making simple changes to incorporate more of the food items in each food group. This section is meant to be a discussion, so the suggestions you provide will be based on the students' input and dietary habits. Feel free to guide the discussion to emphasize ways to get whole grains, low-fat dairy (most females do not get enough), or any other nutrition principles. Also, be prepared with suggestions for vegan/vegetarians.**
 - **Example: What is something you usually eat for breakfast?**
 - **Granola bar**
 - **Suggestion: Try crumbling your granola bar on some yogurt and add some sliced bananas or berries.**

Tips/suggestions for each food group

Vegetables

- Bulk up your sandwiches or wraps with vegetables
- Add vegetables to your eggs
- Add to pasta dishes (even Ramen noodles)
- Try having sliced carrots or celery instead of chips as a snack
- There are recipes on the Healthy Eating 101 Website which include:
 - Cauliflower popcorn
 - Curried tomato soup
 - Sweet potato fries

Grains

- Most people get enough grains – but not whole grains.
- Tell the students the recommendation is to *make half your grains whole.*

- You could give an example of a whole grain you don't prefer (i.e. brown rice). Tell them that all of their grains don't have to be whole, but provide some suggestions of how to increase their whole-grain intake.
- Wheat bread (not whole wheat)
 - You could discuss how to identify a whole grain (look on the label, the first ingredient has to say whole grain, whole wheat, 100% whole wheat etc.)
- Popcorn
- Instant brown rice (it cooks really quickly and is good)
 - You could also suggest mixing white and brown rice
- Oatmeal
- Try whole wheat pasta
- Try whole wheat bread or tortillas for your sandwiches
- Recipes on the website
- Discuss ways to get whole grains
 - Cereals
 - Oatmeal
 - Brown rice (it comes in instant, too)
 - Whole grain noodles
 - Probably the easiest are bread and tortillas
 - Other recipes on the website

Fruit

- Slice fruit on your cereal
- Pack an apple or orange in your backpack
- - *Easy on fruit juices*

Meat and Beans

- The leanest types of protein are often the least-expensive and easiest to cook as well.
 - Beans
 - Chicken
 - Low-fat lunch meat like sliced turkey
 - Tuna
 - Eggs (a little higher in fat)
- Provide them with more ideas:
 - Omelets for breakfast
 - Tuna sandwiches/wraps/pasta salads
 - Bean salsa
 - Bean burritos
 - Chicken enchiladas
 - Chicken salad
- Dairy
 - 3 servings daily
 - *Focus on low-fat calcium-rich foods*
 - **Why? Milk and other dairy products are good sources of calcium. Calcium is important for building strong**

bones. Most of your bone mass for your whole life is determined by your calcium intake up until your twenties!

- **How?** The least-expensive way is milk – 12 cents a glass! Other sources include cheese, cottage cheese yogurt, etc. If you don't drink milk, soy milk and dark-green vegetables also have calcium.
 - Drink milk with your meals/instead of soda
 - Smoothies
 - Yogurt parfaits
 - Include low-fat cheeses on your sandwiches
 - Cottage cheese with fruit, or as a dip veggies or crackers

Foods not on the pyramid

- Desserts, fried foods, fast-foods etc. can still be part of a healthy diet.

Objective 3: *Students will determine feasible options for physical activity.*

Activity: Running Man

Time: 2 minutes

Physical Activity

- Ask the students if they are familiar with the dance move the running man.
- Ask for a volunteer to demonstrate the running man dance move.
- As the student comes to the front of the group, point out the running man on the side of the pyramid which emphasizes the importance of exercise as a component of a healthy lifestyle.
- Tell the students that the recommendation is at least 30 minutes of physical activity 5 days/week
- Instruct the student to hold out 3 fingers on his/her left hand and 5 fingers on his/her right hand as he/she demonstrates the dance move.
- Provide a few examples of resources/activities they can utilize to meet the recommendations for exercise
 - WALK TO CLASS instead of riding the bus
 - Field House
 - Elliptical machines – study while you exercise
 - HPER
 - Swimming
 - Racquetball
 - Tennis
 - Intramural sports
 - ORC
 - Rent snow shoes, canoes etc
 - Hiking/biking trails
- Tell the students they can find more information on our Website.
- Encourage them to visit MyPyramid.org for more information on diet and exercise.

Objective 4: *Students will gain confidence in planning healthy meals and snacks.*

Activity: *Healthy Snack Relay*

Time: 2 minutes

- Recommend the students that whenever possible to align their snacks and meals as follows
 - Meal
 - 3 food groups
 - Snack
 - 2 food groups
 - Protein with a carbohydrate
 - Helps you feel full longer
- Ask for two volunteers to compete in a meal and snack relay.
 - The students will each get a plate and a basket of food in which they will assemble one meal (that will include 3 items from different food groups) and one snack (with two items from different food groups).

Which would you rather eat?





Brought to you by USU Dietetics and the Department of Nutrition, Dietetics & Food Sciences

The goal of the *Healthy Eating 101* is to provide interactive, student-to-student nutrition/health education and practical tips to help USU students make a healthy transition to college life.

Objectives:

5. Students will identify health benefits and cost savings of shopping the perimeter of the grocery store.
6. Students will identify how well-balanced meals decrease money spent on food.
7. Students will identify benefits of shopping in season and buying food locally (gardener's market/organic farm).

Total Time: 12 minutes

Materials

- Paper and pencils
- Poster portraying the perimeter of Lee's Marketplace
- Image of Macaroni & Cheese
- Image of Lean Cuisine Frozen Dinner
- Image of Wendy's single combo meal
- Image of homemade stir-fry

LESSON PLAN

Intro: How can I afford to eat healthy and delicious food?

Time: 1 minute

- Welcome the students and acknowledge the difficulty of having enough money to buy healthy meals and snacks.
- Focus on the importance of buying healthy and filling food that tastes great and benefits intellectual and physical abilities.

Objective 1: Students will identify health benefits and cost savings of shopping the perimeter of the grocery store.

Activity: Have students draw the perimeter of a well-known store. What kinds of foods are found along outside walls (remind them to be general such as ‘vegetables’ NOT specific such as ‘broccoli or celery’)?

Time: 3 minutes

- Ask student’s to identify the foods that are found along the perimeter (walls) of the grocery store:
 - a. Produce – Fresh fruits and vegetables
 - b. Dairy – Milk, eggs, cheese, yogurt
 - c. Fresh meats
 - d. Breads – wheat, white and everything in-between
- What is the common thread (show Lee’s Marketplace poster)?
 - a. All are perishable items
 - b. Most fall into specific groups of the food pyramid
 - c. Relatively healthy and cheap
 - Using current food costs from Lee’s Marketplace (a local grocery store), the calculated cost of a well-balanced homemade meal is about \$2.25-\$2.75. Many frozen & processed dinners are comparable in pricing, but provide you with less food, are higher in fat and sodium and have decreased quality of taste and texture. Homemade meals typically have better flavor, are more balanced and have greater nutritional quality.

Objective 2: Students will identify how well balanced meals decrease money spent on food.

Activity: *The Price Is right* – Shoot off from “Easy az 123” (rank in order of expense)

Time: 6 minutes

- Play “Easy az 123” from *The Price is Right* between Macaroni & Cheese, Lean Cuisine Frozen Dinner, Wendy’s Combo Meal and Homemade Stir-Fry
 - a. Play game by asking students to rank the following dinners: Mac & Cheese (\$1.25), Lean Cuisine Frozen Dinner (\$2.20), Wendy’s combo meal (\$5.03) and Homemade Chicken Stir-Fry with rice (\$ 1.46) from cheapest to most expensive.
 - b. Point out that a balanced meal contains fruit, vegetables, protein, and grains, which increase nutrient density. A nutrient dense food provides greater amounts of key nutrients such as fiber, vitamins and minerals (specifically A & C) from fresh fruits & vegetables & whole grains, protein from lean meats & milk etc.
 - c. Focus on the fact that Mac & Cheese is not balanced, Wendy’s combo lacks on the fruits & vegetables, and adding Milk and fruit to be eaten with the Chicken Stir-Fry would not increase the price of the meal to any more than \$2.25; in fact it would be closer to \$2.00.
 - d. Often healthy foods are on sale and many grocery stores have easy recipes online. Lee’s Marketplace even links recipes to their sale items in their online

weekly sales to shop according to recipe as is suggested to save money (www.leesmarketplace.com). Smith's marketplace also offers some easy recipes (www.smithsfoodanddrug.com).

Objective 3: Students will identify benefits of shopping in season and buying food locally (gardener's market/student organic farms).

Activity: Short presentation

Time: 3 minutes

- Present a choice of a tomato in the winter versus the middle of summer. Which is cheaper? Which looks better? Which tastes better? (Possibility of taste test: store bought vs. farmer's market vs. canned tomatoes; Description/discussion of tomatoes (light red/pink in winter with no taste vs deep red and flavorful in summer) will be used if taste test forfeited).
- Local food is guaranteed to be in season, and will stay fresh longer as it is picked weekly and not shipped long distances prior to purchase.
- Student Organic Farm – Will sell produce throughout summer and fall semesters outside the TSC for \$2 per unit every Wednesday (11 am – 1 pm).
 - a. 1 unit is equal to 1 bunch carrots or beets, 2 lbs tomatoes or potatoes or 5 summer squash
 - b. Stop by each week for easy and convenient purchase of fresh fruits and vegetables.
- Gardener's markets - <http://www.saabra.org/pages/GM.htm>
 1. Merlin Olsen/Pioneer Park located at 100 S 200 E Logan, UT
 - a. This year from May 9 – October 17, 2009
 - b. Every Saturday morning from 9am – 1pm
 2. Historic Courthouse at 199 N Main Logan, UT
 - a. Every Wednesday evening from 4-7 pm
 - b. This year begins July 15, 2009
 3. Characteristics specific to all Gardner's markets
 - a. Available food items dependent on growing season and individual gardens
 - b. Go EARLY for the best selection (food runs out quick)
 - c. Compare prices! They are usually cheaper than the grocery store, but not always!



Brought to you by USU Dietetics and the Department of Nutrition and Food Science

The goal of the *Healthy Eating 101* is to provide interactive, practical, student-to-student nutrition education aimed at helping freshmen make a healthy transition to college life.

Objectives:

8. Students will explain how making time for meals helps them develop healthy eating habits
9. Students will identify key elements of effective meal planning and will understand how making an effective meal plan can help them save time in food preparation
10. Students will participate in the preparation of a simple, quick, and well-balanced meal

Total Time: 12 minutes

Materials Needed:

- Sample meal plan for everyone in class
- Example of grocery list to pass around to class
- Timer
- Directions for making Southwestern wrap
- Ingredients for food demo in containers: 1 whole wheat tortilla, 2 pieces of deli meat, ½ cup fiesta salad, 1 -2 tsp cilantro lime mayo
- Plastic utensil for spreading
- Surface to prepare wrap on
- Wrap samples
- Hand sanitizer for volunteer
- Plate to show “finished” meal

LESSON PLAN

Intro: *Making Time for Meals*

Time: 30 seconds

- Presenters introduce themselves then ask students to raise their hands if they believe it is going to be a challenge to find the time to prepare their own meals throughout the semester.
 - Acknowledge that college life is busy; students juggle classes, study, socialize, participate in extracurricular activities, work, spend time with family, etc. It is not unusual for college students to resort to eating-on-the-run or opt to skip meals all together, which, is not conducive to establishing healthy eating habits.
-

Objective 1: *Students will explain reasons why making time for meals may help them develop healthy eating habits*

Activity: Brief discussion by class about why making time for meals may benefit their health; JADA findings

Time: 1 minute

- Mention study* recently published in JADA that found young adults and adolescents who spend more time in food preparation have better quality diets than those who consistently eat-on-the-run.

*Article reference: Larson L, Nelson M, Neumark-Sztainer D, et al. Making time for meals: Meal structure and associations with dietary intake in young adults. *Journal of the American Dietetic Association*. 2009;109:72-79.

- Ask students why they think making time for meals may help them eat healthier.
- Summarize all suggestions and emphasize that the importance of making time for meals has been established, and then take a moment to mention some ways that eating healthy will improve health and performance in school—(i.e. more energy, better concentration, etc.)
- Explain that we are going to use the rest of the time to discuss two strategies that can help create more time for meals: planning ahead and keeping meal preparation quick-n-simple.

Objective 2: *Students will identify key elements of effective meal planning and how an effective meal plan can help save time in food preparation.*

Activity: Sample week-long meal plan is provided and key elements are explained

Time: 5.5 minutes

- Hand out and introduce sample 7-day meal plan
- Make note:
 - Made assuming grocery shopping was done on a Saturday

- Numbers at the bottom of the table are estimated prep times (all 20 minutes or less!)
- Only contains planning for one meal/day, either lunch or dinner. Breakfast usually doesn't require much preparation or planning. Having just one sit-down meal a day is realistic and can make a big difference.
- Recipes for all the meals can be found on the website
- Acknowledge the elements of the meal plan that allow it to effectively save time in food preparation, thereby creating more time to focus on meals:
 1. Utilizes the principle of "Cook once, eat twice!"
 2. The benefits of maximizing the value of every minute spent in food preparation.
 3. Plan for the shortest preparation times on busiest days
 4. Written so it can be re-used
 5. Meals are quick, simple, and provide a balance of different healthy foods (or something that explains "well-balanced").
- Highlight additional benefits of effective meal planning:
 1. Eliminates time wasted on figuring out what to eat when you are in a hurry
 2. Planning meals makes them harder to miss
 3. Makes grocery lists a breeze to write and, consequently, shopping quick and effective
 4. Reduces wasted food & money

If time allows, this would be a great place to share experiences. Have you every gone to the grocery store starving? What happens? You buy whatever looks good at the time. Other examples for the points above.

Objective 3: *Students will participate in the preparation of a simple, quick, and well-balanced meal*

Activity: Student volunteers race to create a meal in front of the class while being timed



Time: 5 minutes

-
- Ensure ingredients for wraps are in place at focal point in room
 - Ask for student volunteers and have them sanitize their hands
 - Explain to students that they will be preparing the Southwestern turkey wrap recipe from the sample meal plan while being timed.
 - Get timer ready and say go! When students are finished, announce the amount of time it took them to make the wrap
 - Mention that taking another 30-seconds or so to add a half a banana, (or whatever fruit you want), and a glass of milk would make this a well-balanced meal.
 - Pass out sample while explaining that creating a well-balanced meal does not necessarily have to be time consuming and mention website with other quick-fix meal ideas. Also, make note we elected to serve our samples with cilantro-lime mayo (recipe is online) instead of just plain reduced-fat mayo.

Directions for making Southwestern Wrap:

1. Spread a small amount of reduced-fat mayo onto tortilla
2. Top with fiesta salad and deli meat
3. Roll up and enjoy!

Making Time for Meals

Sunday	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday
Fiesta Salad <i>Yield:</i> 1 entrée salad + leftover salad for wrap + diced veggies for pizza/pasta salad Serve with fruit and milk of choice 10-20 minutes	Southwestern Turkey Wrap <i>Yield:</i> 1 wrap Serve with carrot/celery sticks, fruit, & milk  5-10 minutes	Pasta-n-Sauce <i>Yield:</i> 1 serving + enough for leftovers + pasta rinsed and set aside for pasta salad Serve with tossed salad and whole- wheat garlic toast 10-20 minutes	Supreme Pita Pizza* <i>Yield:</i> 1 pita pizza + chopped veggies for pasta salad Serve with leftover tossed salad & fruit salad *Make a beef taco if tortilla is used 10-15 minutes	Leftovers from Tuesday <i>Yield:</i> 1-2 servings pasta-n-sauce Serve with fruit of choice and microwave- steamed veggies 4-5 minutes	Everything-but- the-kitchen-sink Pasta Salad <i>Yield:</i> 1- entrée salad Serve with fruit and milk of choice 5-7 minutes	Eating out with friends  N/A

Ingredients:
 1 whole- wheat tortilla or pita
 1 drizzle oil (canola or olive oil)
 1/2-can beans (pinto or black)
 2-2 ½ cups chopped romaine
 lettuce
 ½ cup frozen corn
 ½ lime
As desired, chopped...
 -Tomato
 -Avocado
 -Peppers
 -Carrots
 -Red onion
 -Cilantro
 -Ham
 -Cooked chicken

Ingredients:
 8oz pasta
 ½ 16oz jar pasta sauce
 ½ lb lean ground beef OR
 ½ can white beans
As desired:
 Grated cheese

Ingredients:
 1 whole-wheat pita or tortilla
 ½ cup fiesta salad
 4 slices deli turkey (or ham)
 2 tsp reduced-fat mayonnaise

Ingredients:
 1 whole-wheat pita
 TT leftover pasta sauce
 1 handful shredded mozzarella
 Cooking oil
Toppings of choice...
 -Pepperoni
 -Leftover lean ground beef
 -Ham
 -Peppers
 -Olives
 -Diced tomato
 -Red onion
 -Mushrooms
 -Etc.

Ingredients:
 1 cup cooked, chilled pasta
 ¼ cup Italian vinaigrette
 Leftover chopped veggies
 Leftover sliced olives
 Handful shredded mozzarella
 TT Parmesan cheese (optional)
Meat/bean of choice....
 White, pinto, or garbanzo beans
 Pepperoni, ham, or boiled
 chicken



Visit our website for recipes and other great information <http://nfs.usu.edu/dietetics/> (click on "Healthy Eating 101" on the menu on the left side)

Grocery List & Estimated Meal Costs

A time-saver's secret weapon

- | | |
|---|--|
| <p>Produce</p> <ul style="list-style-type: none"> 1 head romaine lettuce 1-2 tomatoes 2 bell peppers 2 limes 1 bunch cilantro 3 carrots 1 bunch broccoli 1 red onion Seasonal fruit as needed <p>Breads/Grains/Pasta</p> <ul style="list-style-type: none"> 1 package whole wheat pitas 1-16oz package whole-wheat pasta 1 loaf bread <p>Meats</p> <ul style="list-style-type: none"> ½-1 lb lean ground beef 1 package deli meat <p>Canned Goods</p> <ul style="list-style-type: none"> 1-can black or pinto beans 1-can garbanzo or white beans 1-can black olives | <p>Frozen</p> <ul style="list-style-type: none"> 1 small bag frozen corn <p>Dairy</p> <ul style="list-style-type: none"> 2-cups shredded mozzarella cheese Small block of cheddar or Monterey jack cheese 1-gallon skim milk <p>Misc</p> <ul style="list-style-type: none"> Italian vinaigrette salad dressing |
|---|--|



FYI: Nutritious, well-balanced meals can be affordable! Take a look....

Meal	Approximate price per serving	Approximate total meal cost*
Fiesta Salad	\$1.50	\$1.95 Side: Banana
Southwestern Turkey Wrap	\$1.71	\$2.05 Side: Apple
Pasta-n-Sauce	\$.90 (includes beef)	\$1.59 Side: Salad and garlic toast
Supreme Pita Pizza	\$1.60 (includes meat)	\$2.85 Side: Tossed and fruit salads
Pasta Salad	\$1.95	\$2.29 Side: Black plum

*Price per serving + cost of 1 cup milk + cost of indicated side dish

Appendix F. Viva Vegetables Surveys and Curriculum

Surveys (including Food Frequency Questionnaire)

https://nfssurveys.usu.edu/remark/rws4.pl?FORM=NFS1020FFQ_wave2_Spring09

Curriculum (Viva Vegetables Movies)

<http://vimeo.com/album/238583>

Vegetable Surveys

Asparagus

<https://nfssurveys.usu.edu/remark/rws4.pl?FORM=Asparaguspost-tasting>

<https://nfssurveys.usu.edu/remark/rws4.pl?FORM=Asparaguspost-viewingeval>

Potatoes

<https://nfssurveys.usu.edu/remark/rws4.pl?FORM=PotatoPost-tastingevaluation>

<https://nfssurveys.usu.edu/remark/rws4.pl?FORM=PotatoPost-viewingevaluation>

Onions

https://nfssurveys.usu.edu/remark/rws4.pl?FORM=Onions_tasting

https://nfssurveys.usu.edu/remark/rws4.pl?FORM=Onion_post_viewing

Salad Greens

<https://nfssurveys.usu.edu/remark/rws4.pl?FORM=Saladgreenspost-tasting>

<https://nfssurveys.usu.edu/remark/rws4.pl?FORM=WinterGreenspost-viewingeval>

Appendix G. Co-Author Releases



COLLEGE OF AGRICULTURE

May 11, 2012

To Whom It May Concern:

I hereby release the use of:

(Brown KN, Wengreen HJ, Vitale TS, Anderson JB. Increased self-efficacy for vegetable preparation following an online, skill-based intervention and in-class tasting experience as a part of a general education college nutrition course. Am J Health Promot.26:14-20.) to Katie Brown for use in her dissertation at Utah State University.

Sincerely,

Tamara Steinitz (Vitale)
Director, Didactic Program in Dietetics



COLLEGE OF AGRICULTURE

May 11, 2012

Katie,

I give you permission to use the article, Brown KN, Wengreen HJ, Vitale TS, Anderson JB. Increased self-efficacy for vegetable preparation following an online, skill-based intervention and in-class tasting experience as a part of a general education college nutrition course. Am J Health Promot.26:14-20., that you wrote (and I served as an author) for part of your dissertation.

J. Anderson

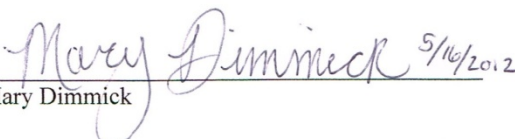
Janet B. Anderson, MS, RD
Associate Dean, College of Agriculture | Clinical Professor of Nutrition, Dietetics and Food Sciences
Utah State University | 4800 Old Main Hill | Logan, Utah 84322-4800

Release Letter

I, Mary Dimmick, give Katie Brown permission as a co-author to use the following publication as part of her dissertation work:

Brown KN, Wengreen HJ, Dimmick M, Eller K, Frampton A, Heaton E, Staheli T, Christensen N. Improving diets of college students: Survey of dietary habits and focus group perspectives on how to best teach students. *Journal of Health Behavior and Public Health*. Vol 1, No 1, (2011).

Release date: 5/16/2012.

 ^{5/16/2012}
Mary Dimmick

May 18, 2012

To whom it may concern,

I hereby release the use of

Brown KN, Wengreen HJ, Dimmick M, Eller K, Frampton A, Heaton E, Staheli T, Christensen N. Improving diets of college students: Survey of dietary habits and focus group perspectives on how to best teach students. *Journal of Health Behavior and Public Health*. Vol 1, No 1, (2011)

to Katie Brown for use in her dissertation at Utah State University.

A handwritten signature in blue ink that reads "Ashley Frampton". The signature is written in a cursive style with a long, sweeping tail on the final letter.

Ashley Frampton, MS, RD/LD
2229 Churchill Place
Oklahoma City, OK 73120
(801) 897-9443

May 10, 2012

To whom it may concern,

I hereby release the use of

Brown KN, Wengreen HJ, Dimmick M, Eller K, Frampton A, Heaton E, Staheli T, Christensen N. Improving diets of college students: Survey of dietary habits and focus group perspectives on how to best teach students. *Journal of Health Behavior and Public Health*. Vol 1, No 1, (2011).

to Katie Brown for use in her dissertation at Utah State University.

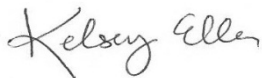


Tiffany Staheli, RD
2583 North 550 East
North Ogden, UT 84414
801-388-8102

May 16, 2012

To whom it may concern,

I release the use of "Improving diets of college students: Survey of dietary habits and focus group perspectives on how to best teach students" written by Brown KN, Wengreen HJ, Dimmick M, Eller K, Frampton A, Heaton E, Staheli T, Christensen N in the *Journal of Health Behavior and Public Health*. Vol 1, No 1, (2011) to Katie Brown for use in her dissertation at Utah State University.

A handwritten signature in cursive script that reads "Kelsey Eller".

Kelsey Eller, MS RD
928 Comish Circle
Kaysville, UT 84037
801-309-1095

Erika Heaton
239 S 200 E #15
St. George, UT 84770
(435) 467-8068
eheaton87@gmail.com

May 11, 2012

To whom it may concern,

I, Erika Heaton, release to Katie Brown my consent to use the following publication for her dissertation at Utah State University:

Brown KN, Wengreen HJ, Dimmick M, Eller K, Frampton A, Heaton E, Staheli T, Christensen N. Improving diets of college students: Survey of dietary habits and focus group perspectives on how to best teach students. *Journal of Health Behavior and Public Health*. Vol 1, No 1, (2011).

Sincerely,



Erika Heaton, RD. CD

Appendix H. Permission to Reprint

May 11, 2012
 Katie Brown
 8700 Old Main Hill
 Logan, UT 84322
 Phone: 801-643-4855
 Fax: 435-797-2379
 Email: katie.brown@aggiemail.usu.edu

Tetsuji Yamada, Ph.D.
 Editor-in-Chief, Journal of Health Behavior and Public Health
 Department of Economics, Chairperson
 Center for Children and Childhood Studies
 Rutgers University, the State University of New Jersey
 Office Telephone: 1- 856-225-6025 (U.S.A.)
 Email: editor.hbph@academyjournals.net, tyamada@crab.rutgers.edu

Dear Dr. Yamada:

I am preparing my dissertation in the Department of Nutrition, Dietetics, and Food Sciences at Utah State University. I hope to complete my degree in the summer of 2012.

An article, "Brown KN, Wengreen HJ, Dimmick M, Eller K, Frampton A, Heaton E, Staheli T, Christensen N. Improving diets of college students: Survey of dietary habits and focus group perspectives on how to best teach students.", of which I am first author, and which appeared in your journal July 2011, Volume 1, No 1, pages 23-29, reports an essential part of my dissertation research. I would like permission to reprint it as a chapter in my dissertation. Please note that USU sends dissertations to Bell & Howell Dissertation Services to be made available for reproduction.

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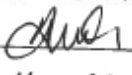
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Katie Brown

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This article was originally published in Health Behavior and Public Health in July of 2011. Brown KN, Wengreen HJ, Dimmick M, Eller K, Frampton A, Heaton E, Staheli T, Christensen N. Improving diets of college students: Survey of dietary habits and focus group perspectives on how to best teach students. *Journal of Health Behavior and Public Health*. Vol 1, No 1, (2011).

Signed  Kathy A. CANLI President - Academy Journals

Date May 27, 2012

Fee Ø

May 9, 2012
 Katie Brown
 8700 Old Main Hill
 Logan, UT 84322
 Phone: 801-643-4855
 Fax: 435-797-2379
katie.brown@aggiemail.usu.edu

American Journal of Health Promotion
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 Lawrence, KS 66044

To Permissions Editor:

I am preparing my dissertation in the Department of Nutrition, Dietetics, and Food Sciences at Utah State University. I hope to complete my degree in the summer of 2012.

An article, "Increased Self-Efficacy for Vegetable Preparation Following an Online, Skill-Based Intervention and In-Class Tasting Experience as a Part of a General Education College Nutrition Course", of which I am first author, and which appeared in your journal September 2011, volume 26, pages 14-20, reports an essential part of my dissertation research. I would like permission to reprint it as a chapter in my dissertation. Please note that USU sends dissertations to Bell & Howell Dissertation Services to be made available for reproduction.

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This article was originally published in the American Journal of Health Promotion in September of 2011. Brown KN, Wengreen HJ, Vitale TS, Anderson JB. Increased self-efficacy for vegetable preparation following an online, skill-based intervention and in-class tasting experience as a part of a general education college nutrition course. *Am J Health Promot.* 26:14-20.

Signed Daleio Ojames, Office Manager

Date 5-9-12

Fee Ø



Katie Brown <katie.brown@aggiemail.usu.edu>

EAT-26

1 message

eat26_reproduce_permission@eat-26.com <eat26_reproduce_permission@eat-26.com>

Wed, Sep 5, 2012 at 11:24 AM

To: katie.brown@aggiemail.usu.edu

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You can download a copy of the scoring instructions and the test on the homepage of the EAT-26 website. If you use the written version of the test, it is recommended that you provide respondents with the link to the EAT-26 website (www.eat-26.com) so that they can learn more about the test.

Again, thank you for requesting permission to reproduce and use the EAT-26. If you intend on publishing your work, please send me your results so that they can be included in a research database being developed on the EAT-26 website (www.eat-26.com).

Best wishes,

David M. Garner, Ph.D.
Administrative Director
River Centre Clinic
5465 Main Street
Sylvania, OH 43560
dm.garner@gmail.com



Katie Brown <katie.brown@aggiemail.usu.edu>

BMI silhouettes

3 messages

Katie Brown <katie.brown@aggiemail.usu.edu>

Tue, Dec 6, 2011 at 10:55 AM

To: pmpeter@udel.edu

Hi Dr. Peterson,

My name is Katie Brown. I am a Registered Dietitian, and I am currently working on my Ph.D in Nutrition Science at Utah State University. My current research focus involves body image among female high school athletes. In my review of the literature, the use of the silhouettes included in your 2003 publication in the *American Journal of Health Behavior* seems to be the best option. I am requesting permission to use the silhouettes in a survey, as well as the reference you would like us to use in the survey in the event that you allow us to use it. Thank you for your time and consideration.

Sincerely,

Katie Brown, RD
 Graduate Research Assistant
 Department of Nutrition, Dietetics, and Food Sciences
 Utah State University.

Michael Peterson <pmpeter@udel.edu>
 To: Katie Brown <katie.brown@aggiemail.usu.edu>

Mon, Dec 12, 2011 at 2:05 PM

Hi Katie,

You have my permission to use the BMI-SMT. I also included the camera-ready scale for your use. I recommend that you cite the following references:

Peterson M, Orsega-Smith E, Tholstrup L. (2004). Validity of the BMI-based Silhouette Matching Test. *American Journal of Health Behavior.* 28(5);437-443.

Peterson M, Ellenberg D, Crossan S. (2003) Body image perceptions: reliability of a BMI based silhouette matching test. *American Journal of Health Behavior.* 27(4), 355-363.

Good luck on your study.

Dr. Peterson
 [Quoted text hidden]

 Michael Peterson, EdD
 Senior Fellow, Jefferson School of Population Health
 Professor, Chair
 Department of Behavioral Health and Nutrition
 025 Carpenter Sports Building
 University of Delaware
 Newark, DE 19716
 Email: pmpeter@udel.edu
 Phone: 302-831-1014

final BMI.ppt
 3972K

Katie Brown <katie.brown@aggiemail.usu.edu>
 To: Michael Peterson <pmpeter@udel.edu>

Mon, Dec 12, 2011 at 3:03 PM

10/11/2012 9:51:12 AM

prentice hall

Fax: (201) 236-3290

Page 2



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One Lake Street
Upper Saddle River, NJ 07458
Fax: 201-236-3290
Phone: 201-236-3275
Celia.Traverso@pearson.com

Sep 14, 2012

PE Ref # 172832

UTAH STATE UNIVERSITY
8700 Old Man Hill
Logan, UT 84322

Fax #: 435-797-2379

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Content to be included is:
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Permission Administrator

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Feb 06, 2013

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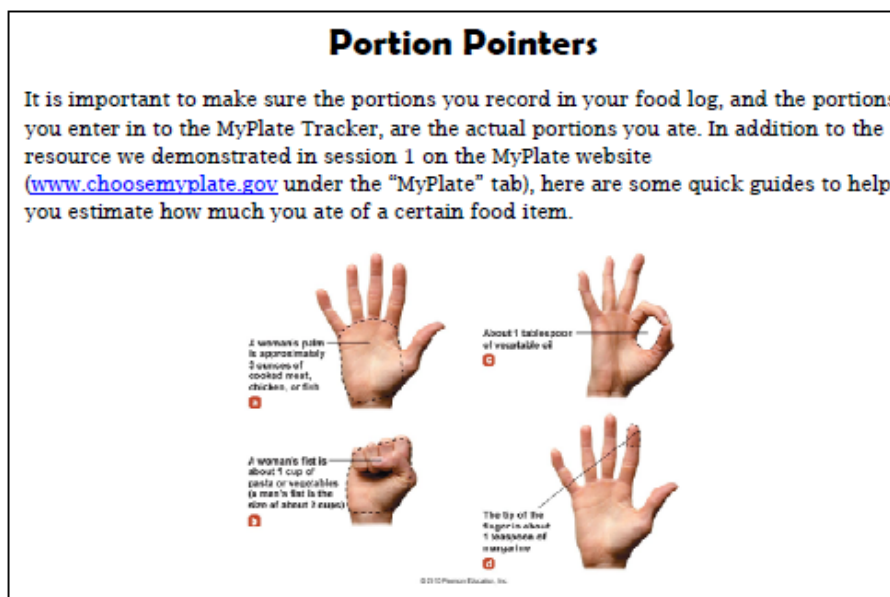
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To Whom It May Concern:

I am preparing my dissertation in the Department of Nutrition, Dietetics, and Food Sciences at Utah State University. I hope to complete my degree in Fall of 2012.

I would like permission to include Figure 2.1 What's a Portion Size? Eat with Your Hands! from the book Nutrition From Science to You by Blake, Munoz, and Volpe, 2010 in a curriculum about sports nutrition that will be a part of my dissertation. The figure would be included as shown:



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Date _____

Fee _____

CURRICULUM VITAE

Katie Nicole Brown
(January 2013)

EDUCATION

- | | | |
|-------------|-------|--|
| 2009 – 2012 | Ph.D. | Utah State University, Logan, UT
Department of Nutrition and Food Sciences
Emphasis: Nutrition Science
Graduation date: December 2012
Dissertation: <i>Nutrition education to minimize health risk: Approaches for teaching college students and female high school athletes.</i>
Major Professor: Heidi J. Wengreen, Ph.D., R.D. |
| 2005 – 2009 | B.S. | Utah State University, Logan, UT
Department of Nutrition and Food Sciences
Emphasis: Medical Dietetics |

HONORS AND AWARDS

- | | |
|------|---|
| 2009 | Graduated Magna Cum Laude, Department of Nutrition, Dietetics, and Food Sciences, Utah State University, Logan, UT. |
| 2008 | Undergraduate Researcher of the Year Award, College of Agriculture, Utah State University, Logan, UT, 2008-2009. |
| 2006 | Governor's Scholar, State of Utah, 2006-2007. |
| 2005 | Undergraduate Researcher of the Year Award, College of Agriculture, Utah State University, Logan, UT, 2005-2006. |
| 2005 | Undergraduate Research Fellowship, Utah State University, Logan, UT. |
| 2005 | Presidential Academic Scholarship, Utah State University, Logan, UT. |

PROFESSIONAL EXPERIENCE

- 8/2012 – 4/2013 Lecturer, Department of Nutrition, Dietetics, and Food Sciences. Utah State University, Logan, UT.
Taught nutrition courses to undergraduate students, both nutrition majors and non-nutrition majors
- 8/2011 – 5/2012 Trainee, Utah Regional Leadership Education in Neurodevelopmental Disabilities (URLEND), Center for Persons with Disabilities, Utah State University, Logan, UT.
Gained knowledge, experience, and skills in preparation to become a contributing member of an interdisciplinary team to help children with special health care needs
- 10/2010 – 7/2012 Graduate Research Assistant, Cache County School District Carol M. White Physical Education Program Grant, Department of Nutrition, Dietetics and Food Sciences, Utah State University, Logan, UT.
Coordinated nutrition promotion and programming in the 25 schools in cache county school district by recruiting, training and supervising undergraduate students to serve as “nutrition coaches” on the school health committee of each school (K-12)
- 5/2009 – 5/2012 Teaching Assistant, Department of Nutrition and Food Sciences, Utah State University, Logan, UT.
Graded assessments, participated in curriculum development, and delivered occasional in-person and online lectures for multiple undergraduate classes including The Science and Application of Nutrition (NDFS 1020) and Sports Nutrition (NDFS 3020)
- 8/2008 – 12/2008 Dietetic Internship, Coordinated Dietetics Program, Nutrition and Food Sciences, Utah State University, Logan, UT.
Conducted nutrition assessments for patients and clients in all areas of McKay-Dee Hospital including intensive care, newborn intensive care, medical/surgical, rehabilitation, outpatient, and diabetes outpatient

PROFESSIONAL MEMBERSHIPS and CREDENTIALS

2011 – Present	American College of Sports Medicine Health Fitness Specialist
2010 – Present	Member; American College of Sports Medicine
2009 – Present	Registered Dietitian
2009 – Present	Member; Academy of Nutrition and Dietetics
2009 – Present	Member; Utah Academy of Nutrition and Dietetics

PROFESSIONAL PRESENTATIONS

Brown KN, Wengreen HJ, Beals KA. *Screening for Risk of the Female Athlete Triad Among High School Athletes*. Presented at the Annual Meeting and 3rd World Congress on Exercise is Medicine of the American College of Sports Medicine. San Francisco, CA. May 2012.

Brown, KN. Wengreen HJ. *How can we help college students eat healthier? Survey results of dietary habits and focus group perspectives on how to best teach students*. Presented at the Graduate Research Symposium, Utah State University. Logan, Utah. March 2011.

Brown KN, Wengreen HJ. *Diet quality and activity level of college freshmen*. Presented at South West Chapter of the American College of Sports Medicine annual meeting. San Diego, CA. October, 2010.

Brown KN, Wengreen HJ. *Peer Instruction: Efficacy and implications for freshman nutrition promotion and dietetics education*. Presented at the Utah Dietetic Association annual meeting. Ogden, UT. April 2010.

Dimmick M, Heaton E, Swenson A, Eller K, Parkinson T, Brown KN, Wengreen HJ, Christensen N. *Use of a focus group to determine ideal nutrition interventions for educating college freshmen at Utah State University*. Presented at the Utah Dietetic Association annual meeting. Ogden, UT. April 2010.

Wengreen HJ, Brown KN, Vitale T, Anderson J. *Increasing vegetable intake among college students: A model for change*. Presented at the Food and Nutrition Conference and Expo. American Dietetic Association. Denver, CO. October, 2009.

Nisson WB, Brown KN, Call M, Wengreen HJ. *Taming the Freshmen-15*. Presented at the Food and Nutrition Conference and Expo. Presented at the annual conference of the American Dietetic Association. Chicago, IL. October, 2008.

Brown KN, Call M, Nisson WB, Wengreen HJ. *Vegetable preference and intake among Freshman Health Study participants*. Presented at the Food and Nutrition Conference and Expo. Presented at the annual conference of the American Dietetic Association. Chicago, IL. October, 2008.

Brown KN, Wengreen HJ. *Deferral rates of American Red Cross Registrants in Utah – is low iron an issue?* Presented at the annual Posters on the Hill event. Utah State Capitol. January, 2007.

Wengreen HJ, Moncur C, Brown, KN. *Change in weight among freshmen attending USU*. Presented at the Food and Nutrition Conference and Expo. Annual conference of the American Dietetic Association. Honolulu, HI. September, 2006.

PUBLICATIONS

Brown KN, Wengreen HJ, Vitale T, Anderson J. Skill-based nutrition education increase vegetable preparation self-efficacy and readiness to increase vegetable consumption among college students. *American Journal of Health Promotion*. 2011;26:14-20.

Brown KN, Wengreen HJ, Dimmick M, Eller K, Frampton A, Heaton E, Staheli T, Christensen N. Improving diets of college students: Survey of dietary habits and focus group perspectives on how to best teach students. *Journal of Health Behavior and Public Health*. 2011;1(1):23-29.

TEACHING

NDFS 4480, Community Nutrition (3 credits) The purpose of this course is to provide an introduction to public health nutrition, nutrition assistance programs, and national nutrition monitoring.

NDFS 1020, The Science and Application of Human Nutrition (3 credits) The purpose of this course is for students to gain a general understanding of basic nutrition principles including macro and micronutrient function, metabolism, diet planning, and critical evaluation of sources of nutrition information. Students learn to evaluate their own diet by recording and analyzing a 3-day food log.