IMPACT OF SPORTS NUTRITION EDUCATION ON ADOLESCENTS' NUTRITIONAL KNOWLEDGE AND USE OF ERGOGENIC PRODUCTS

By

THERESA MARLENE HORINEK

Bachelor of Science in Dietetics

Kansas State University

Manhattan, Kansas

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Thesis Approved:

Thesis Adviser

Janice R Hermann

Sheila Borlus

Dean of the Graduate College

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CHAPTER I

INTRODUCTION

With an increased interest in health and nutrition, adolescents have become a prime target for nutrition and health-related misinformation and gimmicks. A major area of nutrition misinformation is athletic performance and appearance. One group of researchers believe adolescents "experiment" with nutrition practices and acquire nutritional behaviors that may persist for the rest of their lives (Sobal & Muncie, 1988). Increasing numbers of adolescents are experimenting with steroids and other ergogenic products (Buckley, Yesalis, Friedl, Anderson, Streit, & Wright, 1988). These products, which include vitamin and mineral supplements, protein and amino acid supplements, and a variety of stimulants, are mistakenly thought to enhance performance or increase energy levels of athletes (Krowchuk, Anglin, Goodfellow, Stancin, Williams, & Zimet, 1989).

For adolescents, sources of inaccurate nutrition information including media, such as television or magazines, peer pressure, busy schedules, and concern over physical appearance and desired athletic prowess, may take priority over their nutrition knowledge and influence their nutritional practices. For example, coaches and athletic trainers may be sources of nutrition information that influence adolescent athletes' beliefs and practices. However, coaches and trainers are sometimes inadequately prepared to provide guidance in nutrition

(Bedgood & Tuck, 1983; Graves, Farthing, Smith, & Turchi, 1991). Furthermore, adolescents' nutritional beliefs and practices may also be influenced by their peers (Farthing, 1991). In a study by Story and Resnick (1986), students identified busy schedules as a barrier that prevented them from acting upon their nutrition knowledge and practicing more healthful dietary behaviors. Consequently, a high level of nutrition knowledge may not necessarily lead to appropriate nutrition practices (Story & Resnick, 1986). Therefore, nutrition educators need to understand the level of adolescents' nutrition knowledge and also be aware of other characteristics that influence adolescent nutrition decisions.

Purpose

Nutrition misinformation and food faddism still abound, despite advances in nutrition science. To combat misinformation, the American Dietetic Association urges consumers to seek reliable sources of nutrition information (Ashley & Alfin-Slater, 1988). In addition, an effective nutrition educator needs to be more aware of internal and external factors that influence food behaviors, especially factors influencing adolescents.

Researchers have assessed adolescent nutrition knowledge and sources of nutrition information. One study suggested that American children lack important information or knowledge to make positive nutrition decisions (Resnicow & Reinhardt, 1991). Shoaf, McClellan, and Birskovich's (1986) study revealed the need for improved or increased nutrition and health education at the high school level. Thus, nutrition educators need more information about the characteristics

that influence adolescent nutrition decisions and choices.

The purpose of this study was to determine the impact of a nutrition education program on sports nutrition knowledge among adolescents. This study also evaluated variables which influence adolescents' nutrition knowledge and use of ergogenic products.

Objectives

1. To determine the effect of a sports nutrition education program on pre-test, post-test, and retest sports nutrition knowledge scores in adolescents.

2. To determine the difference between adolescents' age, gender, number of ergogenic products used, and sources of nutrition information, and sports nutrition knowledge pre-test scores.

3. To determine the relationship between age, gender, and number of ergogenic products used by adolescents, and the sources of nutrition information.

4. To determine the effect of a sports nutrition education program on the type and number of ergogenic products used by adolescents.

5. To determine the difference between age, gender, and sources of nutrition information, and pre-test category scores of adolescents sports nutrition knowledge.

Null Hypotheses

H_o1: There will be no significant difference as a result of a sports nutrition education program on adolescents' pre-test, post-test, and retest sports nutrition knowledge scores.

$H_0$2: There will be no significant difference between adolescents' age, gender, number of ergogenic products used, and sources of nutrition information and sports nutrition knowledge pre-test scores.

$H_0$3: There will be no significant relationship between age, gender, and number of ergogenic products used by adolescents, and sources of nutrition information.

$H_0$4: There will be no significant difference as a result of a sports nutrition education program on the type and number of ergogenic products used by adolescents.

$H_0$5: There will be no significant difference between age, gender, and sources of nutrition information, and pre-test category scores of sports nutrition knowledge.

Assumptions and Limitations

The Sports Nutrition Knowledge Test was developed by the researcher to assess the change in sports nutrition knowledge as a result of the sports nutrition education video tape developed and used with adolescents, age 13 to 18. Although the sports nutrition knowledge test was reviewed by faculty and a peer group of adolescents, age 13 to 15, for content and reliability, the test is limited by assessing only the information discussed on the sports nutrition education video tape. The test may not be reliable when used to test nutrition knowledge in other situations.

The second limitation results from the lack of randomization. Subjects participated on a voluntary basis and were taking an elected physical education class. The adolescents met once a week for six weeks to complete a nutrition curriculum provided by the Expanded Food

and Nutrition Program (EFNEP) Nutrition Assistants. The nutrition curriculum included a variety of nutrition topics. Therefore, sports nutrition knowledge scores may not apply to the adolescent population at large since these adolescents may have more exposure to nutrition information than typical adolescents.

Time was another limitation to the experimental study. Only 55 minutes were available for the sports nutrition education program in the experimental study while 90 minutes was used in the pilot study. Because the time was limited, discussion questions and time for adolescent comments was omitted in the experimental study.

Definitions

Ergogenic products are defined as products that give energy. Athletes may believe that any of the following are ergogenic products: vitamins, minerals, bee pollen, amino acid or protein supplements, caffeine, wheat germ, herbs, or salt tablets. Nutritionists' realize that products such as vitamins may help in the metabolism of energy, but in and of themselves vitamins or other so called ergogenic products do not provide large amounts of energy for the body.

Nutrition fraud is a comprehensive term used by the U.S. Food and Drug Administration to describe the abuses that occur as the result of the misleading claims for traditional foods, dietary supplements, and dietary products as well as the deceptive promotion of other food substances, processes, and devices (U.S. Department of Health and Human Services, 1988). Two types of nutrition fraud are food faddism and food quackery.

According to the U.S. Department of Health and Human Services (1988),

> Food faddism is a dietary practice based on an exaggerated belief in the effects of food or nutrition on health and disease. Food fads are derived from three beliefs: (a) that special attributes of a particular food may cure disease, (b) that certain foods should be eliminated from the diet because they are harmful, and (c) that certain foods convey special health benefits. (p. 696)

Food quackery involves the exploitive, entrepreneurial aspects of food faddism and is the promotion for profit of special foods, products, processes, or appliances with false or misleading health or therapeutic claims (Jarvis, 1984; U.S. Department of Health and Human Services, 1988).

An eating disorder has been defined as "a disturbance in eating behavior that jeopardizes a person's physical or psychological health" (Harris, 1991, p. 30). Kagan and Squires (1984) defined disordered eating as binging, highly restrictive dieting, emotional eating, or purging.

CHAPTER II

REVIEW OF LITERATURE

Introduction

Americans spend billions of dollars each year on fraudulent nutrition products with adolescents being a prime target (Jarvis, 1983). Studies indicate that belief in and acceptance of nutritional misinformation is high among adolescents (Dwyer, Felman, & Mayer, 1970). Adolescents use ergogenic products in an effort to enhance their athletic performance and appearance. Adolescents' growing independence and increased participation in social life have a large impact on their nutrition choices. Many receive nutrition misinformation from a variety of sources, including coaches, family, friends, and media. Major areas of nutrition misinformation for adolescents include athletic performance, appearance, and weight control.

Nutrition and Adolescents

Nutritional Needs

Adolescents require adequate amounts of calories, protein, fluids, calcium, iron, and other nutrients for growth and development (Brown, 1990). Males and females have different requirements as is seen in the Recommended Dietary Allowances (RDS's) Table I, and the Estimated Safe and Adequate Daily Dietary Intakes (1989), Table II (National Research Council, 1989; Anderson, 1991).

TABLE I

RECOMMENDED DIETARY ALLOWANCES (1989) FOR ADOLESCENTS AGES 11-18

			Fat-Soluble Vitamins			
Age (Yr)	Energy (kcal)	Protein (g)	Vitamin A (μg RE)	Vitamin D (μg)	Vitamin E (mg α-TE)	Vitamin K (μg)
Males						
11-14	2500	45	1000	10	10	45
15-18	3000	59	1000	10	10	65
Females						
11-14	2200	46	800	10	8	45
15-18	2200	44	800	10	8	55

	Water-Soluble Vitamins						
	Vitamin C (mg)	Thiamin (mg)	Riboflavin (mg)	Niacin (mg NE)	Vitamin B_6 (mg)	Folate (μg)	Vitamin B_{12} (μg)
Males							
11-14	50	1.3	1.5	17	1.7	150	2.0
15-18	60	1.5	1.8	20	2.0	200	2.0
Females							
11-14	50	1.1	1.3	15	1.4	150	2.0
15-18	60	1.1	1.3	15	1.5	180	2.0

	Minerals						
	Calcium (mg)	Phosphorus (mg)	Magnesium (mg)	Iron (mg)	Zinc (mg)	Iodine (μg)	Selenium (μg)
Males							
11-14	1200	1200	270	12	15	150	40
15-18	1200	1200	400	12	15	150	50
Females							
11-14	1200	1200	280	15	12	150	45
15-18	1200	1200	300	15	12	150	50

	Estimated Sodium Chloride and Potassium Minimum Requirements of Healthy Persons*			
	Weight (kg*)	Sodium (mg*†)	Chloride (mg*†)	Potassium (mg‡)
10-18§	50.0	500	750	2000

Source: Subcommittee on Tenth Edition of the RDAS, National Research Council. Recommended Dietary Allowances, 10th ed. Washington, DC: National Academy Press, 1989.

*No allowance has been included for large, prolonged losses from the skin through sweat.

†There is no evidence that higher intakes confer any health benefit.

‡Desirable intakes of potassium may considerably exceed these values (~3500 mg for adults).

§Values for those below 18 years assume a growth rate at the 50th percentile reported by the National Center Statistics and averaged for males and females.

TABLE II

ESTIMATED SAFE AND ADEQUATE DAILY DIETARY INTAKES (1989)

	Vitamins		Minerals				
	Biotin (µg)	Pantothenic Acid (mg)	Copper (mg)	Manganese (mg)	Flouride (mg)	Chromium (µg)	Molybdenum (µg)
Males 11-18	30-100	4-7	1.5-2.5	2.0-5.0	1.5-2.5	50-200	75-250
Females 11-18	30-100	4-7	1.5-2.5	2.0-5.0	1.5-2.5	50-200	75-250

Source: Subcommittee on Tenth Edition of the RDAS, National Research Council. Recommended Dietary Allowances, 10th ed. Washington, DC: National Academy Press, 1989.

Recommendations for adolescent males, both ages 11 to 14 years and 15 to 18 years, indicate an increased need for calories when compared to recommendations for adolescent females of the same ages, 2500 to 3000 calories versus 2200 calories, respectively. Calorie allowances need to be adjusted according to adolescent's body weight, activity, and rate of growth. The National Research Council also recommends a higher level of thiamin, riboflavin, and niacin, from food sources rather than supplements, for adolescent males compared to adolescent females since these nutrients are involved in the metabolism of energy and associated with the higher caloric intake of males (National Research Council, 1989).

Protein requirements are calculated according to the adolescent's weight. Recommendations for male adolescents per one kilogram of weight are 1.0 grams for 11 to 14 years and 0.9 grams for 15 to 18 year olds. Female adolescents' protein recommendations per kilogram of weight are 1.0 grams for 11 to 14 years and 0.8 grams for 15 to 18 years. Illnesses which include fever, infections or surgical trauma

will lead to increased needs of both protein and calories (National Research Council, 1989).

Fluids are also important for adolescents. Body fluids are used for several body functions including transportation of glucose to the muscles, elimination of waste products through the urine, and maintenance of body temperature through sweating. To maintain hydration, adolescents should consume a minimum of six to eight 8-ounce glasses of fluids each day (Whitney, Hamilton, & Rolfes, 1990). Fluids include water, fruit juices, milk, soft drinks, lemonade, decaffeinated coffee or tea.

Calcium is important in the formation and maintenance of bone and teeth and is essential in such functions as blood clotting, nerve conduction, and muscle contraction (Whitney, Hamilton, & Rolfes, 1990). The RDA for adolescents in all age categories is 1200 mg per day. The U. S. Department of Health and Human Services in "Healthy People 2000" has set an objective for increasing calcium intake so at least 50 percent of youth aged 12 to 24 years consume three or more servings daily of food rich in calcium. The number of servings in this objective will provide approximately three-fourths of the 1989 RDA's for calcium (U. S. Department of Health and Human Services, 1990a).

Adolescents need iron for maintenance of hemoglobin concentrations and to increase total body iron during periods of growth. Recommendations for iron are 12 mg for males 11 to 18 years of age and 15 mg for females 11 to 18 years of age. Females require more iron due to blood losses from menstruation (National Research Council, 1989).

The best way for adolescents to obtain the nutrients needed for growth and development is to follow the U.S.D.A. Food Guide Pyramid.

Adolescents hould have six to eleven servings from the bread, cereal, rice, and pasta group. The vegetable group should be included in the diet three to five times daily. Adolescents should include two to four servings of fruits daily. Two to three servings of both the milk, yogurt, and cheese group, and meat, poultry, fish, dry beans, eggs, and nuts group should be included in an adolescents' diet daily. Fats, oils, and sweets should be used sparingly.

Nutritional Status

Obesity is a prevalent nutrition problem among adolescents. For adolescents, obesity is defined as body mass index (BMI) equal to or greater than 23.0 for males ages 12 to 14, 24.3 for males aged 15 to 17, 25.8 for males aged 18 to 19, 23.4 for females aged 12 to 14, 24.8 for females aged 15 to 17, and 25.7 for females aged 18 to 19 (U. S. Department of Health and Human Services, 1990a). Approximately 5 to 10 percent of youth in the United States are obese (American Medical Association, 1990). Lack of activity or exercise is believed to compound the incidence of obesity. According to "Healthy Youth 2000," in 1984 only 66 percent of adolescents participated in a vigorous physical activity daily three or more times per week. A reduction in the numbers of adolescents who are overweight is also an objective targeted by "Healthy Youth 2000." Inactivity has been cited as a factor associated with obesity (Gortmaker, Dietz, & Cheung, 1990). Barriers to exercise in adolescents include wanting to do other things with time, lack of interest, unsuitable weather, school work, lack of equipment or facilities, and job responsibilities (Tappe, Duda, & Ehrnwald, 1989).

Obesity in adolescents may persist into adulthood and increase the risks of chronic diseases later in life. These chronic diseases include noninsulin-dependent diabetes, hypertension, coronary heart disease, and certain types of cancer. Researchers from Tufts University in Boston conducted a follow-up of men and women who participated in the Harvard Growth Study of 1922-1935. Of the 508 original subjects who were lean and obese at 13 to 18 years of age, 36 percent were interviewed, 32 percent had died, 16 percent were lost to follow-up, and 16 percent declined or were unable to respond. Fifty-two percent of the surviving subjects who had been overweight in adolescence were still overweight in 1988. Results indicated that in men mortality from all causes and coronary heart disease were two times higher among those overweight in adolescence than among those lean in adolescence. In women these effects were not seen. Women overweight in adolescence were eight times more likely to report difficulty with daily living activities than women lean in adolescence. In 1968 a mid-life follow-up of 309 subjects was conducted. This sub-group data was used to compare the effects of adolescent weight and adult weight on later health consequences. Researchers found that increased health risks associated with adolescent overweight were independent of adult body mass index for all outcomes except diabetes. Thus, being overweight in adolescence was a more powerful predictor of adverse health outcomes than overweight in adulthood (Must, Jacques, Dallal, Bajema, & Dietz, 1992).

Another problem area in adolescent nutrition is chronic overeating and undereating (Anderson, 1991), which may be related to the overemphasis of thinness during adolescence. Some researchers use the term

eating disorder to describe both undereating and overeating (Harris, 1991; Kagan & Squires, 1984; Moses, Banilivy, & Lifshitz, 1989). Kagan and Squires (1984) found that eating disorders are most often associated with feelings of inadequacy. To maintain a certain weight for sports such as gymnastics, wrestling, or cross-country running, many adolescent athletes will purge, limit food or beverage intake, and other destructive eating behaviors (Loosli & Benson, 1990). Eating disorders include anorexia nervosa and bulimia nervosa. These practices can lead to serious health conditions.

Medical complications associated with anorexia nervosa include abdominal pain, increased risk of fractures due to loss of body fat and bone loss, decreased heart size and abnormal blood flow due to loss of lean muscle mass, excessively dry skin, constipation, and occasionally edema around the ankles. Other medical consequences are associated with bulimia nervosa. The binge eating followed by self-induced vomiting can cause irritation or tears of the esophagus, erosion of dental enamel, enlarged parotid gland, and aspiration of vomit which may lead to a severe form of pneumonia. Other health consequences are associated with the use of drugs to induce vomiting or laxatives which may lead to dehydration, myocarditis, or changes in blood chemical values (Harris, 1991).

Nutrition for Adolescent Athletes

Nutrition is important for adolescent athletes. Weight is one factor that can affect performance in many sporting events. Adolescents can use sound nutritional practices to control their weight. The best way to lose weight is to increase exercise and moderately decrease food

intake. When cutting back food intake, maintaining a balance and variety of foods from the Food Guide Pyramid is recommended, with an emphasis on reducing calories from fat intake. Registered dietitians recommend no more than a one to two pound weight loss per week. Recommendations for adolescents who need to increase their weight are that they should do so over several months as well. Weight loss practices resulting from misinformation such as crash diets, laxatives, spitting or vomiting can decrease strength and energy resulting in poor athletic performance. For some athletes these misleading weight loss practices can lead to eating disorders (American Dietetic Association, 1980).

Vitamins and minerals make up a large portion of the more than 50 nutrients needed for proper body functions. A balanced diet with a variety of foods will provide the right amount of vitamins and minerals needed by most adolescent athletes (Whitney, Hamilton, & Rolfes, 1990). Most nutrition experts and sports physiologists agree that vitamin and mineral intakes beyond the Recommended Dietary Allowances are not necessary for athletes who eat a balanced diet. In fact, excessive amounts of some nutrients can lead to toxicity. For example, large doses of Vitamin A can cause nausea, blurred vision, skin rashes, hair loss, enlarged liver and spleen, and even death (Whitney, Hamilton, & Rolfes, 1990). More is not always better.

Iron is an important mineral. It is a component of hemoglobin, which carries oxygen to the muscles. Athletes who are iron deficient will tire easily when exercising. Adolescent athletes may be at risk for iron deficiency if they fit any of the following categories: a) growing rapidly, b) female who is menstruating, c) vegetarian athletes, or d) endurance athletes.

According to the National Research Council, little evidence supports the need for increased protein due to muscular activity or sports training in athletes. Some adolescents are influenced by claims that muscles develop faster with extra amino acids or protein supplements. With the RDA's margin of safety, increased protein through protein or amino acid supplements is not recommended for healthy adolescent athletes. In fact excessive amounts of protein or amino acid supplements can lead to dehydration, diarrhea or loss of appetite (National Research Council, 1989). A study looking at two levels of protein intake showed that 100 grams of protein in men, age 20 to 23, maintained nitrogen equilibrium, which is the protein intake of the average American (Consolazio, Johnson, Nelson, Dramise, & Skala, 1975).

If adolescent athletes eat a balanced diet, they will obtain the protein and amino acids necessary for muscle development. Getting enough protein is not a problem for most adolescents. Most Americans consume twice the recommended daily amount of protein (National Research Council, 1989). A simple formula to figure protein needs of adolescent athletes is: one-half gram of protein for every pound of body weight or one gram of protein for every kilogram of body weight (National Research Council, 1989).

Some carbohydrate can be stored for extra energy needed by endurance events. Carbohydrate loading has proven beneficial in endurance events lasting longer than 90 minutes. Endurance events include marathon running, triathlon, cross-country skiing, or long-distance biking. Carbohydrate loading should start three to five days before an event, and involves eating 60 to 70 percent of calories as complex carbohydrates. Some energy will be stored as glycogen in

the liver and muscle and can be readily used during the event. To maintain these glycogen stores, training time is reduced several days prior to the event (American Dietetic Association, 1980; Clark, 1990).

Fluids are important for an athlete's performance. Fluids should be taken before, during, and after exercise to avoid dehydration. Athletes should weigh themselves before and after a workout. For every pound of weight lost, two cups of fluid should be consumed to replace the fluid loss (Squire, 1990; American Dietetic Association, 1980). Sports drinks are not normally necessary and offer no advantage over water for maintaining electrolyte concentration. However, in endurance events, carbohydrate solutions with five to ten percent glucose or sucrose concentrations may enhance performance. Cold water remains the preferred choice for fluid replacement in young athletes during exercise (Squire, 1990).

Pregame meals may enhance athletic performance. A pregame meal should include complex carbohydrate foods such as pasta, breads, fruits, and vegetables. Because fat delays stomach emptying time which is undesirable for competition, low-fat protein foods such as lean meat, skinned chicken, fish, dried beans, low-fat milk and milk products, should be included in a pregame meal. Fluids should also be included to insure hydration (American Dietetic Association, 1980; Clark, 1990). The Food Guide Pyramid is a guide for recommended amounts and serving sizes of foods to be eaten daily.

Nutrition Misinformation

Introduction

The incidence of misinformation, defined as wrong or inaccurate

information (Morris, 1981), and nutrition fraud has risen with increased interest in health and nutrition. In 1975, the American Dietetic Association published a position paper about nutrition misinformation on selected topics (American Dietetic Association, 1975). Several of the position statements recognized the misinformation among adolescent athletes and they still apply today. Again in 1988 the American Dietetic Association addressed the concern of nutrition misinformation in a position paper on identifying food and nutrition misinformation (Ashley & Alfin-Slater, 1988). To combat misinformation, the American Dietetic Association and the American Medical Association urge consumers to seek reliable sources of nutrition information and assume more responsibility for their own health (Ashley & Alfin-Slater, 1988; Cowart, 1988).

All age groups can fall victim to nutrition and health-related misinformation, with youth being a prime target group (Cowart, 1988). Adolescents are targeted because their concern for appearance and athletic performance may lead them to try unapproved or unrecommended nutrition products or diets. No specific dollar amount was found for adolescent purchases of fraudulent nutrition products. However, in 1989, adolescents spent nearly $31 billion on personal items, of which a portion was likely spent on experimenting with fraudulent nutrition products or ergogenic products (Department of Health and Human Services, 1990b). Adolescents are using anabolic steroids and other ergogenic products. For example, Buckley et al. (1988) reported that anabolic steroids were used by 6.64 percent of 12th grade male students, suggesting that 250,000 to 500,000 adolescents nation-wide have used or are currently using anabolic steroids.

Adolescents Major Target Group

Adolescents are a major target group for misinformation because of their desire for increased athletic performance or improved appearance. Because adolescents are ready to experiment with products promising to improve performance or appearance, many teens are targeted for fraudulent and sometime harmful products such as weight control devices, steroids, and various nutritional supplements (Grigg, 1988; U. S. Department of Health and Human Services, Public Health Service, 1990b). Adolescents also are targeted through teen magazines, mail order schemes, and television commercials. The desire to be independent also makes adolescents an easy target for quackery and fraudulent nutrition products.

Types and Risks of Misinformation for Adolescents

Ergogenic Products. Ergogenic products, such as steroids, amphetamines, protein and amino acid supplements, and vitamin and mineral supplements, are perceived to enhance athletic performance or provide additional energy (Krowchuk et al., 1989; Williams, 1989). The use of such products among adolescents is a concern because researchers believe adolescents "experiment with nutrition practices and acquire nutrition behaviors that may persist for the rest of their lives" (Sobal & Muncie, 1988, p. 314).

In a study by Krowchuk et al. (1989), 295 high school athletes were surveyed to determine their attitude toward and their use of ergogenic products. The results indicated that adolescent athletes (73%) believed anabolic steroids and amphetamines are dangerous when

used to improve performance. However, 14 percent of male athletes indicated they would consider using anabolic steroids, while none of the female athletes would consider using anabolic steroids.

Several authors (Dyment & Goldberg, 1989; Haupt & Rovere, 1984; Johnson, 1990) have reported on complications associated with the use of anabolic steroids. Steroids can interfere with the growth and development of adolescents. Other side effects of steroid use include: changes in facial appearance, aggressive behavior and mood swings, alterations in the reproductive system, liver damage, and increased risk of heart disease and cancer (Lamb, 1984). In one study (Buckley et al., 1988), researchers observed that 6.64 percent of male high school seniors have used or were currently using anabolic steroids to enhance performance or appearance. And, of those using steroids, 64.8 percent were participating in school-sponsored athletics. The study (Buckley et al., 1988) represents the first nationwide survey of steroid use among the general adolescent male population, and suggested that between 250,000 and 500,000 male adolescents have or currently are using steroids in the United States. Furthermore, Johnson, Jay, Shoup, and Rickert (1989) observed an incidence of 11 percent adolescent males reporting past or present use of anabolic steroids. Although there is little controversy about discouraging the use of anabolic steroids by adolescents, there is considerable controversy about the need for vitamin and mineral supplementation for adolescents.

Vitamin and Mineral Usage. Sobal and Muncie (1988) assessed the use of vitamin and mineral supplements among adolescents. They reported

the percentage of adolescents consuming vitamin and mineral supplements varies greatly, from less than 1 percent to 57 percent (Table III). However, the studies outlined in Table III all used varying definitions of supplement consumption. In addition, girls tend to use supplements more than boys, with girls increasing their use as they proceed through adolescence (Bowering & Claney, 1986; Sobal and Muncie, 1988).

Thompsen, Terry, and Amos (1987) administered a vitamin and minerals supplementation questionnaire to 163 subjects, ages 14 to 18 years, 58 percent were girls and 42 percent were boys. Fifty-six percent of the adolescents strongly agreed or agreed that most teenagers need vitamin and mineral supplements, and 50 percent strongly agreed or agreed that if a person feels tired, more vitamins and minerals are probably needed. However, 82 percent of the subjects strongly disagreed or disagreed that vitamins and minerals can be taken safely in any amounts. The subjects' responses to belief statements about supplements and reasons cited for using supplements indicated misconceptions and the prevalence of nutrition misinformation concerning vitamin and mineral supplements. In another study (Krowchuk et al., 1989), 75 percent of the athletes surveyed believed that vitamin supplements could improve their performance with little or no health risks.

Another study (Fleischer & Read, 1982) looked at food supplement use by adolescent males. Of the 568 adolescent males surveyed, 45.5 percent used food supplements on a regular basis. Multiple vitamins were consumed by 79.5 percent of the regular users and protein supplements were consumed by 35.5 percent of the regular users.

Amino Acids and Protein Supplements. Amino acid and protein supplements are inappropriately promoted by advertisers as the key

TABLE III

PREVALENCE OF VITAMIN/MINERAL SUPPLEMENT CONSUMPTION BY ADOLESCENTS IN SEVENTEEN STUDIES

Authors, Year (Literature Cited)	Use	n	Group, Site, Use Definition
Dibble, et al., 1965(10)	19%	404	Junior high school, New York, "taken occasionally"
Morse, et al., 1965(7)	35%	225	Junior high school, boys, Vermont, "sometimes taken"
	44%	176	Junior high school, girls, Vermont, "sometimes taken"
Hodges and Krehl, 1965(4)	1%	2,045	Grades 9-12, Iowa, "taken"
Huenemann, et al., 1968(8)	18%	51	Grades 11-12 boys, California, "taken in 4 weeks"
	31%	71	Grades 11-12 girls, California, "taken in 4 weeks"
Kirksey, et al., 1978(48)	3%	127	Junior high school, Indiana, "took supplements"
Cook and Payne, 1979(26)	50%	30	Grade 6, Illinois, "taken"
Fleisher and Read, 1982(12)	45%	568	High school, Nevada, "used on a regular basis"
Olsen, 1984(49)	25%	681	Age 12-19, California, "take regularlly"
McCoy, et al., 1984(11)	21%	1,247	Age 12-16, eight Southern states, "used"
Sharpe and Smith, 1985(50)	11%	1,616	Age 1-18, AFDC children, "used"
Driskell, et al., 1985(25)	15%	5,831	Age 11-17 girls, Alabama, Virginia, B-6, "consumed"
Kovar, 1985(51)	26%	22,713	Age 12-17, national data, "taken in prior 2 weeks"
Farris, et al., 1985(9)	12%	148	Age 13, Louisiana, "took daily"
Bowering and Clancy, 1986(6)	10%	747	Age 12-18 boys, national data, "regular users"
	16%	663	Age 12-18 girls, national data, "regular users"
Story and York, 1987(52)	28%	60	Age 14-18, Native Americans, "taken"
Thompsen, et al., 1987(5)	57%	163	Grades 9-12, Iowa, "used within current school year"
Driskell, et al., 1987(53)	21%	112	Age 11-15 girls, Alabama, Virginia, B-6 "consumed"

Source: Sobal, J., & Muncie, H. L. (1988). Vitamin/mineral supplement use among adolescents. Journal of Nutrition Education, 20(6), 314-318.

nutrient for better athletic performance and faster weight loss (Dubick, 1983a; Williams, 1989). Research data indicates that increased protein over the recommended amounts do not improve athletic performance (Consolazio et al., 1975). In one study, 83 percent of the adolescents surveyed believed protein supplements safe and effective. Furthermore, 56 percent of the adolescents reported that they would consider the use of supplemental protein and amino acids (Krowchuk et al., 1989).

Other Ergogenic Products. Ergogenic products such as caffeine, bee pollen, and herbs are also used to improve athletic performance or appearance. Caffeine is a product that has been used by athletes to increase strength and endurance. The few studies conducted on caffeine and athletic performance have been inconclusive. Caffeine has enhanced endurance in exercise lasting longer than one hour, however, caffeine was ineffective in shorter duration exercise. Risks or side effects of large doses of caffeine can include diuresis and cardiac arrhythmias. Caffeine as a aid to athletic performance is banned by the International Olympics Committee and the National Collegiate Athletic Association of the United States (Jacobson & Kulling, 1989).

Bee pollen is another ergogenic that is sometimes claimed to improve athletic performance (Dubick & Rucker, 1983). Research findings in 1975 showed no measurable difference in athletic performance in swimmers who took 10 bee pollen tablets each day and those who took 10 placebo tablets each day (Larkin, 1984). Other ergogenic products such as herbs and wheat germ have not been shown to enhance athletic performance (Dubick, 1983b).

Weight Control. The fear of becoming obese is prevalent among adolescent girls (Czajka-Narins & Parham, 1990. Researchers (Moses, Banilivy, & Lifshitz, 1989) observed that 72 percent of the adolescent girls surveyed had made attempts to lose weight regardless of their body weight. Storz and Green (1983) surveyed 203 adolescent girls and observed that 41.5 percent had tried fad diets for weight reduction. Fad diets are prevalent among adolescent girls but weight loss can be achieved without the gimmicks (Willis, 1985).

Eating disorders have been observed in studies of adolescents. Kagan and Squires (1984) surveyed 2,004 high school students. Eleven percent of the females were classified as emotional eaters. The prevalence of binge eating once or more per week was reported by 20 percent of the adolescents, while five percent reported purging. Twenty-seven percent reported feeling out of control about eating.

Eating disorders also include anorexia nervosa and bulimia nervosa. These are extreme ways of controlling weight. Anorexia nervosa is most frequently seen among white adolescent girls and the prevalence is estimated to be one percent among adolescent girls. For every 19 adolescent girls with anorexia nervosa only one male adolescent experiences this eating disorder. Medical complications can include abdominal pain, decreased heart size and abnormal blood flow due to loss of lean muscle mass, constipation, and excessively dry skin (Connolly & Corbett-Dick, 1990; Harris, 1991).

Bulimia nervosa is more common than anorexia nervosa among adolescent girls. Medical complications associated with bulimia nervosa include irritation and tears of esophagus due to induced vomiting, erosion of dental enamel, dehydration and changes in blood chemical

values due to use of drugs to induce vomiting or laxative (Harris, 1991).

Adolescent Nutrition Knowledge and Practice

Association Between Nutrition Knowledge and Practice with Sports

Douglas and Douglas (1984) assessed the nutrition knowledge and food practices of 943 male and female adolescent athletes. The mean nutrition score was 55 percent, with females scoring higher on the nutrition knowledge test. However, female athletes showed poorer food practices than the male athletes. A significant relationship was observed between sports form, seasons, nutrition knowledge, and food practices. Athletes participating in cross-country, football, lacrosse, soccer, swimming, and track-and-field had significantly higher nutrition scores than athletes in other sports forms. Also, those athletes participating in more than one season had higher nutrition knowledge and food practice scores. Searles, Terry, and Amos (1986) observed a similar level of nutrition knowledge, mean score 55 percent, in female adolescent athletes.

Dwyer, Feldman, and Mayer (1970) assessed the nutrition knowledge of 1,388 high school students using a nutrition knowledge questionnaire consisting of 100 multiple choice questions. The average nutrition score was 55 percent out of a possible 100 percent, indicating a poor knowledge of nutrition. However, the females scored higher on the test overall than the males, 58 percent versus 53 percent respectively, which may be explained by the fact that the females were required to

take a home economics course in junior high. Dwyer and associates concluded that belief in and acceptance of nutrition misconceptions in general is high among adolescents. In addition, they reported that there was a positive relationship between formal nutrition education and higher nutrition knowledge scores.

Perron and Endres (1985) assessed the nutrition knowledge of 31 female athletes, aged 13 to 17 years. The nutrition questionnaire consisted of 60 questions. The subjects correctly answered 46 percent of the general nutrition questions and 41 percent of the nutrition for the athlete section. Nutrition knowledge was lowest in these topics: protein, carbohydrate loading, sodium and calorie expenditure. The adolescents knew most about weight reduction diets, vitamin supplements, and the value of eating a variety of foods.

Factors that Influence Knowledge and Practice

Sources of Nutrition Misinformation. For adolescents, forces of inaccurate nutrition sources, peer pressure, and busy schedules, as well as concern over physical appearance and desired athletic performance may interfere with either their nutrition knowledge or nutrition practices. For example, coaches and athletic trainers may be sources of nutrition information that influence adolescent athletes' nutrition beliefs and practices. However, according to Graves et al. (1991), coaches and trainers may be inadequately prepared to provide accurate nutrition guidance. Furthermore, adolescents' nutrition beliefs and practices may be influenced by their peers (Farthing, 1991). Sobal and Muncie (1988) reported that a variety of sources including parents,

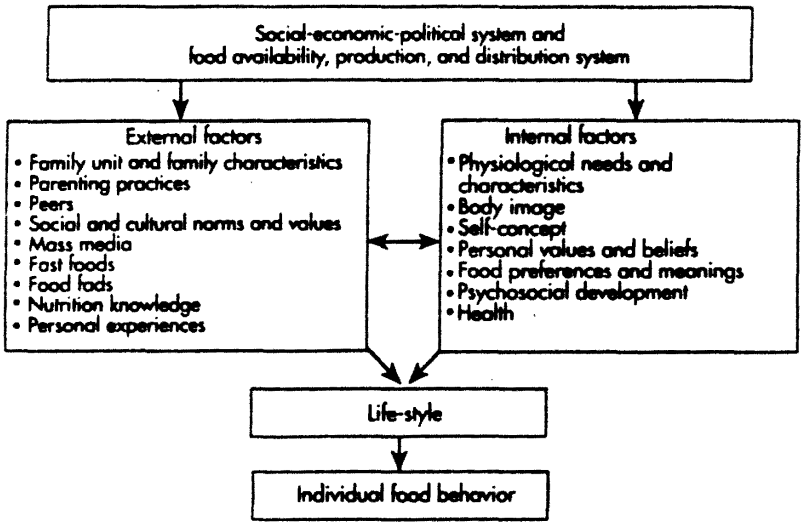
teachers and coaches, health professionals, peers, and the media, influence adolescents' use of vitamin and mineral supplements.

Studies have been conducted investigating nutrition knowledge and sources of nutrition information. In a study by Shoaf, McClellan, & Birskovich (1986), a three-part questionnaire, covering basic nutrition information, sources of nutrition information, and interests in nutrition and opinions, was administered to 75 male college athletes. These athletes frequently missed questions concerning carbohydrates and vitamins. Interestingly, the sources most frequently cited by the athletes as their main source of nutrition information were parents (34%), high school physical education/health courses (28%), college health courses (26%), and high school coaches (22%). The researchers (Shoaf, McClellan, & Birskovich, 1986) concluded that "findings seemed to indicate the need for improved or increased education at the high school level" (p. 245).

Other Factors which Influence Nutrition Practices. Adolescents have numerous influences on eating behaviors and the formation of eating habits are complex (Pipes & Trahms, 1993). See Figure 1, schematic diagram of factors influencing adolescents' food behaviors. Farthing (1991) indicates that nutrition educators need to be aware of the internal and external factors that can influence adolescent food behaviors.

External factors affecting adolescents' beliefs and practices include family, peers, social and cultural norms, mass media, fast foods, food fads, nutrition knowledge, and personal experiences. Internal factors include physiological needs and characteristics, body image, self-concept, personal values and beliefs, food preferences

and meanings, psychosocial development, and health. These external and internal factors can influence each other, but ultimately can affect lifestyle and individual food behaviors as referred to in Figure 1 (Pipes & Trahms, 1993).



Source: Developed by M. Story, University of Minnesota. Copyright Mahan, L.K., Rees, J.M.: Seattle, WA, 1989. Originally published in Mahan, L.K., Rees, J.M.: Nutrition in Adolescence, St. Louis, 1984, Mosby-Year Book.

Figure 1. Schematic Diagram of Factors Influencing Adolescent Food Behavior

In a study by Story and Resnick (1986), students also identified busy schedules as a barrier that prevented them "from acting upon their nutrition knowledge and practicing more healthful dietary behaviors" (p. 190). Thus, a high level of nutrition knowledge may not

necessarily lead to appropriate nutrition behaviors. Therefore, nutrition educators need to be aware of not only the level of nutrition knowledge, but also the other characteristics that influence adolescents' nutrition decisions.

Effect of Nutrition Education with Adolescents

General Studies

Researchers (Byrd-Bredbenner, Shannon, Hsu, & Holderness, 1988) utilized the nutrition education curriculum, Nutrition in a Changing World, Concerns of Young Adults, to assess 600 students in the 10th to 12th grades. The teacher instructed curriculum lasted five to six weeks. The nutrition knowledge test consisted of 60 multiple-choice questions. Nutrition knowledge scores improved after the nutrition education curriculum was presented.

Lewis, Brun, Talmage, and Rasher (1988) conducted a three year evaluation study of the National Dairy Council's Food...Your Choices for 1476 students in the 7th to 10th grades. The nutrition achievement test consisted of 47 multiple-choice questions measuring comprehensive nutrition knowledge, facts, and concepts. The nutrition program was incorporated into these four subject areas: health, home economics, science, and social studies. The nutrition knowledge increased significantly in those subjects taking a health or home economics course. To reinforce the classroom program, cooperation between food service, administration, and teachers was established.

Specific Education Program on Nutrition and Athletes

No nutrition education program studies focusing on changes in knowledge about nutrition for the adolescent athlete could be located.

Summary

With the increased desire to improve athletic performance, adolescents are willing to try any products or gimmicks that promise a quick fix. Use of some ergogenic products can be harmful for adolescents, but from nutrition knowledge studies adolescents are not aware of the dangers. Although studies have been conducted to assess nutrition knowledge and evaluate different nutrition education programs, no study was found which developed a nutrition program and assessed nutrition knowledge about sports nutrition for adolescents. Therefore, this study was conducted.

CHAPTER III

RESEARCH PROCEDURE

Introduction

This chapter describes the procedure used in the study including the development of the sports nutrition education program, development of evaluation instruments, pilot study, experimental study, and statistical analysis.

With the high incidence of nutrition misinformation adolescents are a prime target of gimmicks and quick "fixes" claiming to improve appearance and athletic performance. Adolescents are susceptible to faddism especially in the sports nutrition area. Media, family, friends, coaches, and other sources of nutrition information influence adolescents' nutritional practices and at times encourage misinformation. To combat nutrition misinformation and food faddism, nutrition educators need to discover how much adolescents know about nutrition, what ergogenic products are being used, and who is influencing adolescent nutrition practices.

The purpose of this study was to determine the impact of a nutrition education program on sports nutrition knowledge among adolescents and to determine the variables which influence adolescents' nutrition knowledge and use of ergogenic products. The objectives of the study are: 1) to determine the effect of a sports nutrition education program on pre-test, post-test, and retest sports nutrition

knowledge scores in adolescents, 2) to determine the difference between adolescents' age, gender, number of ergogenic products used, and sources of nutrition information and sports nutrition knowledge pre-test scores, 3) to determine the relationship between age, gender, and number of ergogenic products used by adolescents, and the sources of nutrition information, 4) to determine the effect of a sports nutrition education program on the type and number of ergogenic products used by adolescents, and 5) to determine the difference between age, gender, and sources of nutrition information, and pre-test category scores of adolescents' sports nutrition knowledge. The Oklahoma State University Institutional Review Board for Human Subjects Research approved this research project.

Development of Sports Nutrition Education Program

The sports nutrition education program for this study consisted of a sports nutrition video tape, handouts, discussion questions, and an instruction guide for nutrition educators.

Sports Nutrition Video Tape

The sports nutrition video tape, titled Nutrition Misinformation and Athletic Performance, was developed by the researcher, in cooperation with the Cooperative Extension Agricultural Communications at Oklahoma State University, using current literature regarding sports nutrition (American Dietetic Association, 1980; Buskirk, 1981; Dyment & Goldberg, 1989; Haupt & Rovere, 1984; Loosli & Benson, 1990; Rowland, 1990; Squire, 1990). The sports nutrition video tape script

(Appendix A) included seven sports nutrition topics as follows: Steroids and Ergogenic Products, Weight and Weight Control, Vitamin and Mineral Supplements, Amino Acid and Protein Supplements, Carbohydrate Loading and Sugar for Energy, Fluids and the Athlete, Eating for Performance. Two registered dietitians and a health educator, who participated in the video production, reviewed the sports nutrition video tape script for content accuracy. Several special effects, such as cut aways and write overs, made the sports nutrition video more appealing to adolescents. Also, adolescents and young adults participated in some of the scenes to spark the adolescents' interest. The sports nutrition video was 18:10 minutes in length. Nutrition educators will find the cut aways to be an advantage since each topic is separated and could be used without watching the entire tape.

Handouts

One handout, a crossword puzzle (Appendix B) was developed by the researcher to allow adolescents to review the sports nutrition education information. Another handout used in the sports nutrition education program was Nutrition for the Athlete, a fact sheet developed by the Home Economics Cooperative Extension Service at Oklahoma State University, T-3132. In addition, several handouts were obtained from the International Center for Sports Nutrition, Omaha, Nebraska. These handouts (Appendix B) were titled as follows: Vitamin and Mineral Supplements; Carbohydrates; Water, the Most Important Nutrient; and The Precompetition Meal. All of the handouts were sent home with the adolescents.

Discussion Questions

To stimulate discussion of the topics presented in the sports nutrition video, the researcher developed several discussion questions (Appendix C). The questions encouraged adolescents to think about their feelings and their opinions about the various topics presented in the sports nutrition education program.

Instruction Guide

The Instruction Guide was developed to help teachers or nutrition educators use the materials for their own classroom or program sessions. The Instruction Guide consists of objectives for the program, outline of the sports nutrition program, video script, activities, tests, references, and teacher evaluation. The Instruction Guide Index may be found in Appendix D.

Development of Evaluation Instruments

Sports Nutrition and Health Questionnaire

An instrument, the Sports Nutrition and Health Questionnaire (Appendix E), was developed to collect participants' background information. Information collected included the adolescent's age, gender, and sports participation. Adolescents selected from a list all the sports which they participated in, with the option of listing other sports. Next, the adolescents indicated the nutrition or health-related classes taken in the past, if any. Adolescents then indicated which, if any, ergogenic products they used and how often these ergogenic products were used. The sources of nutrition information

were also obtained from the adolescents in the study.

Sports Nutrition Knowledge Test

The Sports Nutrition Knowledge Pre-Test (Appendix F) consisted of 40 questions, 25 multiple-choice and 15 True/False items. Each question was worth 2.5 points to result in 100 percent as a perfect score. A Q-sort procedure was used by five Registration Eligible or Registered Dietitians to divide the test questions into eight categories. The categories are listed below.

Food Groups and Basic Nutrition	--- 10 questions
Carbohydrate Loading	--- 4 questions
Fluids and the Athlete	--- 4 questions
Vitamins and Minerals	--- 6 questions
Ergogenic Products	--- 5 questions
Amino Acids and Protein Supplements	--- 5 questions
Weight and Weight Control	--- 4 questions
Other	--- 2 questions

The Sports Nutrition Knowledge Post-test consisted of identical questions to the Sports Nutrition Knowledge Pre-test but in a different order. The Sports Nutrition Knowledge Retest consisted of the same 40 questions in the same order as the Sports Nutrition Knowledge Pre-test. The Sports Nutrition Knowledge Post-test and Retest questions were also worth 2.5 points to result in 100 percent as a perfect score. References used for suggested test writing techniques included Chamberlain and Kelly (1981) and Sax (1989).

Validity and Reliability

Validity and reliability tests included content validity on both the Sports Nutrition and Health Questionnaire and the Sports Nutrition Knowledge Test. A pilot study was conducted to test the validity and reliability of both instruments. To test for internal consistency, a Kuder-Richardson-8 coefficient was determined for the Sports Nutrition Knowledge Test and exceeded the recommended 0.70+ coefficient.

Pilot Study

Research Design

A pre-test, education, and post-test design was used for the pilot study, as seen in Figure 2 (Gay, 1987, p. 320).

Pre-test	Education	Post-test
O	X	O

Figure 2. Research Design of Pilot Study

Adolescents completed a Sports Nutrition and Health Questionnaire and the Sports Nutrition Knowledge Pre-test. Next, a sports nutrition education program which included the sports nutrition education video tape, discussion, and handouts was presented. Following the sports nutrition education program, the Sports Nutrition Knowledge Post-test was administered to the participants.

Population and Sample

The pilot study was conducted in late May 1992. Thirty-seven 4-H adolescents, 12 males and 25 females, ages 13 to 18 years participated in the pilot study. Adolescents were enrolled in the "Nutrition in the Nineties: What's In What's Not" class at 4-H Round-Up, Stillwater, Oklahoma. Participation in the study was voluntary. The adolescents were instructed in the study format and their rights were outlined in the Student Informed Consent (Appendix G). No incentive was given to the adolescents for participation in the study. Eight adolescents did not fully complete the instruments and their data was not included in the pilot study.

Sports Nutrition Education Program

The adolescents completed the Sports Nutrition and Health Questionnaire. Then the Sports Nutrition Knowledge Pre-test was explained and completed. Next, the sports nutrition education program including the sports nutrition education video tape, discussion questions and handouts were presented. The adolescents then completed the Sports Nutrition Knowledge Post-test. The pilot study results were used to determine the time to complete the instruments and present nutrition education. Several questions were removed from the Sports Nutrition and Health Questionnaire to cut down the time of the study.

Experimental Study

Research Design

A pre-test, education, post-test, and retest design was used for the experimental study, as seen in Figure 3 (Gay, 1987, p. 320).

Pre-test	Education	Post-test	Retest
0	A	0	0

Figure 3. Research Design of Experimental Study

Adolescents completed a Sports Nutrition and Health Questionnaire and the Sports Nutrition Knowledge Pre-test followed by a sports nutrition education program which included the sports nutrition education video tape and handouts. The Sports Nutrition Knowledge Post-test was administered to the adolescents following the sports nutrition education program. The Sports Nutrition Knowledge Retest was administered two months later.

Population and Sample

The sample consisted of 68 adolescent students, 51 males and 17 females, ages 15 to 18 years in three Midwest City high school physical education classes. The physical education classes had met once a week for six weeks for an Expanded Food and Nutrition Education Program (EFNEP) nutrition curriculum prior to the study. Participation in the study was voluntary. The adolescent students were instructed in the study format and their rights as outlined in the Student Informed Consent (Appendix G). No incentive was given to the students for participation in the study. Six students did not fully complete the instrument and their data was not included in the study.

Sports Nutrition Education Program

On December 3, 1992, adolescent students met as a group to

participate in the study. The Sports Nutrition and Health Questionnaire and the Sports Nutrition Knowledge Pre-test were explained and completed. Next, the sports nutrition education program including the sports nutrition education video tape and handouts were presented. Due to time constraints, no time was available for discussion or questions. Adolescent students then completed the Sports Nutrition Knowledge Post-test. Approximately two months later, 51 of the original 68 adolescent students again met as a group to complete the Sports Nutrition and Health Questionnaire and the Sports Nutrition Knowledge Retest. The purpose of the retesting was to determine nutrition knowledge levels and any changes in the use of ergogenic products.

Statistical Analyses

For the pilot and experimental studies, a paired t-test was used to determine if there were any significant differences between the means of the Sports Nutrition Knowledge pre-test and post-test, while the retest scores were included in the experimental study analysis. Analysis of variance was used to determine the difference between the pre-test scores and age, gender, number of products used, and source of nutrition information. In the experimental study, the number of ergogenic products used before and after nutrition education was also analyzed by a paired t-test. In both the pilot and experimental studies, all eight pre-test nutrition knowledge category scores were analyzed by age, gender, and source of nutrition information using analysis of variance. Criteria for significance was established at $p<0.05$ (Steel & Torrie, 1980).

In both the pilot and experimental studies chi-square analysis was used to determine the level of association between the source of information and age, gender, and number of ergogenic products used. For the experimental study, the type of ergogenic products used before and after nutrition education was analyzed by chi-square. Criteria for significance of the chi-square test was established at $p<0.05$ (Steel & Torrie, 1980). The analyses utilized the Statistical Analysis System (S.A.S.) at Oklahoma State University (Statistical Analysis System Institute, 1990).

CHAPTER IV

RESULTS AND DISCUSSION

Introduction

The purpose of this study was to determine the impact of a nutrition education program on sports nutrition knowledge among adolescents' nutrition knowledge and use of ergogenic products. The objectives of the study were 1) to determine the effect of a sports nutrition education program on pre-test, post-test, and retest sports nutrition knowledge scores in adolescents, 2) to determine the difference between adolescents' age, gender, number of ergogenic products used, and sources of nutrition information, and sports nutrition knowledge pre-test scores, 3) to determine the relationship between age, gender, and number of ergogenic products used by adolescents, and the sources of nutrition information, 4) to determine the effect of a sports nutrition education program on the type and number of ergogenic products used by adolescents, and 5) to determine the difference between age, gender, and sources of nutrition information, and pre-test category scores of adolescents sports nutrition knowledge.

Description of Pilot Study

The pilot study sample began with 45 adolescents who were enrolled in the "Nutrition in the Nineties: What's In What's Not" class at 4-H Round-Up in Stillwater, Oklahoma. The adolescents voluntarily

participated in the pilot study. Thirty-seven completed all of the required information and are included in the data. Eight subjects did not fully complete the instruments and are not included in the study. The pilot study subjects included 12 males and 25 females, ages 13 to 18 years, with the mean age being 14.7 years (Table IV). One hundred percent participated in sports. Pilot study subjects were not retested.

Pilot Study Results and Discussion

A significant difference between pre-test and post-test Sports Nutrition Knowledge scores was observed for the pilot study ($p<0.05$). The pilot study mean scores increased from 60.68 percent to 75.65 percent (Table V), with a perfect score being 100 percent. The Kuder-Richardson 8 coefficient for internal consistency was above 0.70, as is recommended, for the pilot study sports nutrition knowledge pre-test and post-test (Table V).

There was no significant difference between age and sports nutrition knowledge pre-test scores. The 16 years olds scored higher than other age groups with a mean score of 68.5 percent (Table VI), while the 18 year olds scored the lowest with a mean score of 53.50 percent (Table VI). Surprising, similar studies (Lindholm, Touliatos, & Wenberg, 1984; Resnicow & Reinhardt, 1991; Skinner & Wodburn, 1984) have shown older adolescents tend to score higher on nutrition knowledge tests.

In the pilot study, females tended to score higher with a mean score of 62.28 percent (Table VI). This finding is consistent with another study (Dwyer, Feldman, & Mayer, 1970) that found females scored higher on nutrition tests since they had more exposure to

TABLE IV

DESCRIPTION OF PILOT STUDY SUBJECTS

	Number of Subjects	Percent of Subjects
Age		
13	6	16
14	12	32
15	10	27
16	6	16
17	1	3
18	2	5
Gender		
Male	12	32
Female	25	68
Participation in Sports		
Yes	37	100
Sports Participation by Name		
Football		
Yes	4	11
No	33	89
Basketball		
Yes	28	76
No	9	24
Volleyball		
Yes	4	11
No	33	89
Track		
Yes	10	27
No	27	73
Tennis		
Yes	1	3
No	36	97
Wrestling		
Yes	1	3
No	33	97
Swimming		
Yes	10	27
No	27	73
Cross-country		
Yes	4	11
No	33	89
Ballet		
Yes	1	3
No	36	97
Dance		
Yes	2	5
No	35	95
Sports Participation by Name (Cont'd)		
Gymnastics		
Yes	0	0
No	37	100
Weight-lifting		
Yes	5	14
No	32	86
Running		
Yes	13	35
No	24	65
Ergogenic Products Used		
Vitamins		
Yes	20	54
No	17	46
Minerals		
Yes	2	5
No	35	95
Caffeine		
Yes	3	8
No	34	92
Muscle Building Products		
Yes	0	0
No	37	100
Protein Supplements		
Yes	0	0
No	37	100
Amino Acids		
Yes	1	3
No	36	97
Salt Tablets		
Yes	4	11
No	33	89
Honey		
Yes	1	3
No	36	97
Bee Pollen		
Yes	1	3
No	36	97
Wheat Germ		
Yes	1	3
No	36	97
Herbs		
Yes	0	0
No	37	100

TABLE V

COMPARISON OF SPORTS NUTRITION KNOWLEDGE TEST SCORES BETWEEN PRE-TEST, POST-TEST, AND RETEST

Variable Comparison	n	Mean Score +S.D.[1]	Reliability[2]
Pilot			
Pre-test	37	60.68 + 9.0033[a]	0.81*
Post-test	37	75.65 +14.6557[b]	0.91*
Experimental			
Pre-test	68	59.24 +11.8676	0.76*
Post-test	68	60.81 +17.0734	0.86*
Retest	51	59.22 +16.6305	0.85*

[1]Mean scores +Standard Deviation with different superscripts are significantly different, $p<0.05$.

[2]Kuder-Richardson 8 coefficient for internal consistency with a * are at or above the recommended 0.70+.

TABLE VI

PILOT STUDY NUTRITION KNOWLEDGE PRE-TEST MEAN SCORES ACCORDING TO AGE, GENDER, AND NUMBER OF ERGOGENIC PRODUCTS USED (N=37)

Variable	n	Mean Pre-Test Score ±S.E.[1]
Age		
13	6	58.83 ±3.5400
14	12	58.50 ±2.5029
15	10	60.50 ±2.7418
16	6	68.50 ±3.5396
17	1	67.00 ±8.6702
18	2	53.50 ±6.1307
Gender		
Male	12	57.33 ±2.5447
Female	25	62.28 ±1.7630
Number of Ergogenic Products Used		
2	6	62.83 ±3.5883
3	3	65.67 ±5.0746
4	1	62.00 ±8.7894

[1]Mean Pre-test Score ±Standard Error with different superscripts are significantly different, $p< 0.05$. A perfect score equals 100 percent.

nutrition through home economics classes. In the pilot study, adolescents who used three ergogenic products tended to score higher, mean score 65.67 percent (Table VI). Interestingly, but not significant, adolescents who used television as a source of nutrition information tended to score higher, mean score 64.67 percent (Table VII). The adolescents used family most as a source of nutrition information with 13 (35%) yes responses (Table VII). The next most used source of nutrition information was coach/teacher, nine (24%) yes responses.

A significant relationship (χ^2=14.183, df 5, P=0.014) was indicated between age and friend as a source of nutrition information. Thirty-two out of 37 (86%) subjects did not use friend as a source of nutrition information, with none of the adolescents aged 13, 15, or 16 using friend as a source of nutrition information (Table VIII). This observation was interesting since factors affecting nutrition knowledge and behaviors indicates peers as an influential force in adolescence. A significant relationship (χ^2=12.168, df 4, P=0.016) between family and number of ergogenic products used (Table VIII and Appendix I) was observed. Family was a source of nutrition information most often when zero to two ergogenic products were used by adolescents surveyed, as compared to those who did not use family as a source of nutrition information.

In the pilot study (Table VIII), a significant relationship (χ^2=16.268, df 4, P=0.003) was observed between friend as a source of nutrition information and the number of ergogenic products used. Adolescents who used friends as a source of nutrition information tended to use three or four products as compared to those who did not use friends as a source of nutrition information. This would support

TABLE VII

PILOT STUDY PRE-TEST MEAN SCORES ACCORDING TO SOURCES OF NUTRITION INFORMATION (N=37)

Varable	n	Mean Pre-Test Score ±S.E.[1]
Sources of Nutrition Information		
Friend		
No	32	60.28 ±1.6049
Yes	5	63.20 ±4.0576
Family		
No	24	59.21 ±1.8163
Yes	13	63.38 ±2.4678
Television		
No	34	60.33 ±1.5519
Yes	3	64.67 ±5.2246
Radio		
No	36	60.64 ±1.5214
Yes	1	62.00 ±9.1281
Newspaper		
No	36	60.64 ±1.5214
Yes	1	62.00 ±9.1281
Magazine		
No	36	60.64 ±1.5214
Yes	1	62.00 ±9.1281
Health Food Store		
No	34	60.53 ±1.5635
Yes	3	62.33 ±5.2637
Coach/Teacher		
No	28	60.61 ±1.7254
Yes	9	60.89 ±3.0434
Health Professional		
No	36	60.64 ±1.5214
Yes	1	62.00 ±9.1281
Other		
No	34	61.78 ±1.4416[a]
Yes	3	49.00 ±4.8531

[1]Mean Pre-test Score ±Standard Error with different superscripts are significantly different, $p<0.05$. A perfect score equals 100 percent.

[a]Use and nonuse of source of nutrition information are significantly different, $p<0.05$.

TABLE VIII

RELATIONSHIP BETWEEN AGE, GENDER, AND NUMBER OF ERGOGENIC PRODUCTS USED, AND SOURCES OF NUTRITION INFORMATION IN PILOT STUDY

Parameter	Age	Gender	Number of Products[1]
Friend			
df	5	1	4
Chi-Square	14.183[a]	2.005	16.268[b]
Family			
df	5	1	4
Chi-Square	2.190	0.800	12.168[a]
Television			
df	5	1	4
Chi-Square	3.446	0.001	5.339
Radio			
df	5	1	4
Chi-Square	2.141	0.493	1.897
Newspaper			
df	5	1	4
Chi-Square	2.141	0.493	1.897
Magazine			
df	5	1	4
Chi-Square	2.141	0.493	1.897
Health Food Store			
df	5	1	4
Chi-Square	3.446	0.001	16.868[b]
Coach/Teacher			
df	5	1	4
Chi-Square	8.389	2.902	12.693[b]
Health Professional			
df	5	1	4
Chi-Square	2.775	0.493	1.897

[1]Number of ergogenic products used compared to sources of nutrition information.

[a]Chi-Square value is significantly different, $p<0.05$

[b]Chi-Square value is significantly different, $p<0.01$.

the factor that peers influence nutrition behavior. A significant relationship (χ^2=12.693, df 4, P=0.013) was observed between coach/teacher as a source of nutrition information and number of ergogenic products used. Adolescents who did not use coach/teacher as source of nutrition information used zero to two ergogenic products, compared to coach/teacher as a source of nutrition information.

No significant relationship was observed between the pre-test category scores and age, gender, or sources of nutrition information (Tables IX and X). Adolescents tended to score highest (81.8%) in the weight control category and lowest (37.0%) in the amino acids/protein supplements category (Table XI).

Description of Experimental Study

The experimental study sample began with 74 students who were brought together for an Expanded Food and Nutrition Education Program (EFNEP) at Midwest City High School. The adolescents voluntarily participated in the study. Sixty-eight completed all of the required information and are included in the data. Six subjects did not complete all the information, such as age, gender, and incomplete tests and their data is not included in the study. The experimental subjects included 51 males and 17 females, ages 15 to 18 years with the mean age being 16.6 years (Table XII). Sixty-two subjects (91%) participated in sports. The retest subjects included 51 adolescents from the 68 subjects who began the study and completed all of the information required.

TABLE IX

PILOT STUDY MEAN PRE-TEST CATEGORY SCORES OF SPORTS NUTRITION KNOWLEDGE ACCORDING TO AGE AND GENDER

Pre-Test Category Scores[1]	Parameters: Age 13 n=6	14 n=12	15 n=10	16 n=6	17 n=1	18 n=2	Gender: Male n=12	Female n=25
Food Groups								
Mean[2]	45.0	45.0	49.0	60.0	50.0	25.0	45.0	48.8
S.E.	6.30	4.46	4.88	6.30	15.4	10.9	4.72	3.27
Carbohydrates								
Mean	55.5	45.8	55.0	75.0	75.0	50.0	58.3	54.3
S.E.	7.80	5.51	6.04	7.80	19.1	13.5	5.98	4.14
Fluids								
Mean	79.2	75.0	72.5	83.3	100.0	87.5	79.2	77.0
S.E.	9.62	6.81	7.46	9.62	23.6	16.7	6.63	4.59
Vitamin/Mineral								
Mean	66.8	73.3	63.3	69.3	67.0	58.5	62.3	70.6
S.E.	7.07	5.00	5.48	7.07	17.3	12.2	4.75	3.29
Ergogenics								
Mean	73.3	71.7	76.0	73.3	60.0	80.0	66.7	76.8
S.E.	7.92	5.60	6.14	7.92	19.4	13.7	5.17	3.58
Amino Acid/ Protein Supplements								
Mean	36.7	35.8	40.0	36.7	60.0	20.0	37.5	36.8
S.E.	8.09	5.72	6.26	8.09	19.8	14.0	5.64	3.91
Weight Control								
Mean	75.0	77.1	85.0	91.7	75.0	87.5	72.9	86.0
S.E.	9.19	6.50	7.12	9.19	22.5	15.9	6.11	4.23
Other								
Mean	75.0	68.2	75.0	91.7	100.0	75.0	63.6	82.0
S.E.	12.8	9.49	9.95	12.8	31.5	22.2	8.93	5.93

[1]A perfect pre-test category score equals 100 percent.

[2]Mean Pre-test Category Score ±Standard Error.

TABLE X

RELATION BETWEEN SOURCES OF NUTRITION INFORMATION AND PRE-TEST CATEGORY SCORES OF SPORTS NUTRITION KNOWLEDGE IN PILOT STUDY

Sources of Nutrition Information	n	Food Groups Mean ±S.E.[1]	Carbohydrates Mean ±S.E.	Fluids Mean ±S.E.	Vit./Min.[2] Mean ±S.E.	Ergogenics Mean ±S.E.	AA/Pro.[3] Mean ±S.E.	Wt. Cont.[4] Mean ±S.E.	Other[5] Mean ±S.E.
Friend									
No	32	47.2 ±2.90	56.5 ±3.65	75.0 ±3.86	66.6 ±2.93	73.1 ±3.27	35.9 ±3.41	82.8 ±3.87	77.4 ±5.53
Yes	5	50.0 ±7.35	50.0 ±9.25	95.0 ±9.78	76.6 ±7.41	76.0 ±8.28	44.0 ±8.65	75.0 ±9.80	70.0 ±13.76
Family									
No	24	46.3 ±3.34	56.6 ±4.24	74.0 ±4.57	70.0 ±3.41	69.2 ±3.58[a]	37.1 ±3.99	77.0 ±4.31	73.9 ±6.40
Yes	13	50.0 ±4.54	53.8 ±5.76	84.6 ±6.20	64.1 ±4.63	81.5 ±4.86[b]	36.9 ±5.42	90.4 ±5.85	80.8 ±8.51
Television									
No	34	47.7 ±2.82	56.9 ±3.49	75.7 ±3.76	67.5 ±2.90	72.9 ±3.16	36.2 ±3.31	80.9 ±3.75	75.8 ±5.36
Yes	3	46.7 ±9.50	41.7 ±11.76	100.0 ±12.67	72.3 ±9.75	80.0 ±10.65	46.7 ±11.16	91.7 ±12.63	83.3 ±17.79
Radio									
No	36	47.8 ±2.73	56.5 ±3.35	77.1 ±3.77	67.5 ±2.79	73.9 ±3.07	36.9 ±3.26	81.3 ±3.64	75.7 ±5.17
Yes	1	40.0 ±16.41	25.0 ±20.13	100.0 ±22.66	83.0 ±16.74	60.0 ±18.40	40.0 ±19.54	100.0 ±21.86	100.0 ±30.61
Newspaper									
No	36	47.8 ±2.73	56.5 ±3.35	77.1 ±3.77	67.5 ±2.79	73.9 ±3.07	36.9 ±3.26	81.3 ±3.64	75.7 ±5.17
Yes	1	40.0 ±16.41	25.0 ±20.13	100.0 ±22.66	83.0 ±16.74	60.0 ±18.41	40.0 ±19.54	100.0 ±21.86	100.0 ±30.61
Magazine									
No	36	47.8 ±2.73	56.5 ±3.35	77.1 ±3.77	67.5 ±2.79	73.9 ±3.07	36.9 ±3.26	81.3 ±3.64	75.7 ±5.17
Yes	1	40.0 ±16.41	25.0 ±20.13	100.0 ±22.66	83.0 ±16.74	60.0 ±18.40	40.0 ±19.54	100.0 ±21.86	100.0 ±30.61
Health Food Store									
No	34	47.6 ±2.82	56.1 ±3.56	76.5 ±3.87	66.6 ±2.80	73.5 ±3.18	36.8 ±3.35	82.4 ±3.77	77.3 ±5.35
Yes	3	46.7 ±9.50	50.0 ±11.97	91.7 ±13.04	83.0 ±9.41	73.3 ±10.71	40.0 ±11.27	75.0 ±12.69	66.7 ±17.75
Coach									
No	28	49.3 ±3.05	55.6 ±3.93	75.0 ±4.24	67.1 ±3.19	74.3 ±3.50	33.9 ±3.54	83.0 ±4.15	75.9 ±5.94
Yes	9	42.2 ±5.39	55.6 ±6.93	86.1 ±7.48	70.3 ±5.63	71.1 ±6.17	46.7 ±6.24	77.8 ±7.32	77.8 ±10.29
Health Professional									
No	36	47.5 ±2.74	56.5 ±3.35	77.8 ±3.83	67.9 ±2.82	73.9 ±3.07	36.4 ±3.19	81.3 ±3.64	75.7 ±5.17
Yes	1	50.0 ±16.45	25.0 ±20.13	75.0 ±22.97	67.0 ±16.94	60.0 ±18.40	60.0 ±19.15	100.0 ±21.86	100.0 ±30.61

[1]Mean Pre-test Category Score ±Standard Error with different superscripts are significantly different, $p<0.05$. A perfect score equals 100%.

[2]Vitamin and Mineral Category scores.

[3]Amino Acids and Protein Supplements Category scores.

[4]Weight Control Category scores.

[5]Other Category scores included these questions: Which health professional would you talk to about nutrition information? And how can misinformation be defined?

TABLE XI

PILOT STUDY PRE-TEST CATEGORY SCORES
(N=37)

Category	Mean Score	+S.D.
Food Group	47.6	+16.23
Carbohydrates	55.6	+20.51
Fluids	77.7	+22.66
Vitamin/Minerals	67.9	+16.70
Ergogenics	73.5	+18.29
Amino Acids/Protein Supplements	37.0	+19.27
Weight Control	81.8	+21.77
Other	76.4	+30.44

TABLE XII

DESCRIPTION OF EXPERIMENTAL STUDY SUBJECTS

	Number of Subjects	Percent of Subjects
Age		
15	8	12
16	19	28
17	32	47
18	9	13
Gender		
Male	51	75
Female	17	25
Participation in Sports		
Yes	62	91
No	6	9
Sports Participation by Name		
Football		
Yes	36	53
No	32	47
Basketball		
Yes	20	29
No	48	71
Volleyball		
Yes	10	15
No	58	85
Track		
Yes	20	29
No	48	71
Tennis		
Yes	6	9
No	62	91
Wrestling		
Yes	6	9
No	62	91
Swimming		
Yes	13	19
No	55	81
Cross-country		
Yes	2	3
No	66	97
Ballet		
Yes	1	2
No	67	98
Dance		
Yes	5	7
No	63	93
Sports Participation by Name (Cont'd)		
Gymnastics		
Yes	2	3
No	66	97
Weight-lifting		
Yes	43	63
No	25	37
Running		
Yes	17	25
No	51	75
Ergogenic Products Used		
Vitamins		
Yes	41	60
No	27	40
Minerals		
Yes	12	18
No	56	82
Caffeine		
Yes	4	6
No	64	94
Muscle Building Products		
Yes	9	13
No	59	87
Protein Supplements		
Yes	17	25
No	51	75
Amino Acids		
Yes	20	29
No	48	71
Salt Tablets		
Yes	2	3
No	66	97
Honey		
Yes	4	6
No	64	94
Bee Pollen		
Yes	2	3
No	66	97
Wheat Germ		
Yes	1	2
No	67	98
Herbs		
Yes	4	6
No	64	94

Findings and Discussion of Hypothesis One

Hypothesis one stated: There will be no significant difference as a result of a sports nutrition education program on adolescents' pre-test, post-test, and retest Sports Nutrition Knowledge test scores. A paired t-test was used to compare the pre- and post-, post- and retest, and pre- and retest Sports Nutrition Knowledge scores. However, no significant difference was observed between pre-test, post-test, and retest in the experimental study at the 0.05 level. The Kuder-Richardson 8 coefficient for internal consistency was above 0.70, as is recommended, for all sports nutrition knowledge tests (Table V). H_o1: The null hypothesis is accepted.

Findings and Discussion of Hypothesis Two

Hypothesis two stated: There will be no significant difference between adolescents' age, gender, number of ergogenic products used, and sources of nutrition information, and pre-test sports nutrition knowledge scores. Analysis of variance was used to determine the differences between the pre-test scores and age, gender, number of products used, and source of nutrition information.

There was no significant difference between age and sports nutrition knowledge pre-test scores for the experimental study (Table XIII). In the experimental study, 17 year olds tended to score higher than other age groups with a mean score of 63.19 percent (Table XIII). The 15 year old adolescents in the experimental study tended to score lower with a mean score of 55.38 percent.

There was also no significant difference between gender and sports nutrition knowledge pre-test scores. In the experimental study males

tended to score higher, mean score of 60.61 percent (Table XIII). In past studies, females were found to score higher on nutrition tests since they had more exposure to nutrition through home economics classes.

TABLE XIII

EXPERIMENTAL STUDY NUTRITION KNOWLEDGE PRE-TEST MEAN SCORES ACCORDING TO AGE, GENDER, AND NUMBER OF ERGOGENIC PRODUCTS USED (N=68)

Variable	n	Mean Pre-test Score ±S.E.[1]
Age		
15	8	55.38 ±4.0700
16	19	55.42 ±2.6410
17	32	63.19 ±2.0350
18	9	56.67 ±3.8373
Gender		
Male	51	60.61 ±1.6399
Female	17	55.12 ±2.8404
Number of Ergogenic Products Used		
0	19	54.47 ±2.6818
1	15	58.80 ±3.0183
2	14	62.21 ±3.1242
3	11	59.82 ±3.5246
4-6	9	64.67 ±3.8966

[1]Mean Pre-test Score ±Standard Error with different superscripts are significantly different, $p<0.05$. A perfect score equals 100 percent.

There was no significant difference between number of ergogenic products used and sports nutrition knowledge pre-test scores. Surprisingly, in the experimental study the adolescents who used four

to six ergogenic products tended to score higher, mean score 64.67 percent (Table XIII). Mean sports nutrition knowledge scores tended to be low for all variables. Had the scores been ranked with the customary scoring, 90 percent and above equals an A, 80 to 89 percent equals a B, 70 to 79 percent equals a C, 60 to 69 percent equals a D, and 59 percent and below equals an F, all of the adolescents would have a D ranking or below.

There was no significant difference between sources of nutrition information and sports nutrition knowledge pre-test scores in the experimental study. Interesting, but not significant, the adolescents who used television as a source of nutrition information tended to score higher in the experimental study with mean scores of 64.67 percent (Table XIV). In the experimental study, adolescents used family the most as a source of nutrition information with 29 (43%) yes responses. After family, the experimental study subjects used the health food store with 22 (32%) yes responses. $H_0 2$: The null hypothesis is accepted.

Findings and Discussion of Hypothesis Three

Hypothesis three stated: There will be no significant relationship between age, gender, and number of ergogenic products used by adolescents, and the sources of nutrition information. A chi-square analysis was performed to determine the association between the sources of information and age, gender, and number of ergogenic products used.

In the experimental study, there was no significant relationship between age and the sources of nutrition information (Table XV). However, a significant relationship was indicated between gender and

TABLE XIV

EXPERIMENTAL STUDY PRE-TEST MEAN SCORES ACCORDING TO SOURCES OF NUTRITION INFORMATION (N=68)

Variable	n	Mean Pre-test Score ±S.E.[1]
Sources of Nutrition Information		
Friend		
No	48	58.88 ±1.7239
Yes	20	60.10 ±2.6707
Family		
No	39	58.72 ±1.9122
Yes	29	59.93 ±2.2175
Television		
No	59	58.41 ±1.5312
Yes	9	64.67 ±3.9206
Radio		
No	65	59.06 ±1.4796
Yes	3	63.00 ±6.8871
Newspaper		
No	64	59.22 ±1.4946
Yes	4	59.50 ±5.9785
Magazine		
No	58	58.31 ±1.5417
Yes	10	64.60 ±3.7130
Health Food Store		
No	46	58.74 ±1.7597
Yes	22	60.27 ±2.5445
Coach/Teacher		
No	57	58.84 ±1.5792
Yes	11	61.27 ±3.5948
Health Professional		
No	61	59.10 ±1.5300
Yes	7	60.43 ±4.5170
Other		
No	65	59.45 ±1.4780
Yes	3	54.67 ±6.8795

[1]Mean Pre-test Score ±Standard Error with different superscripts are significantly different, $p<0.05$. A perfect score equals 100 percent.

source of nutrition information in the experimental study (Table XV).

A significant relationship (χ^2=3.908, df 4, P=0.0001) was observed between magazines as a source of information and gender. Females never used magazines as a source of nutrition information, while 10 out of 51 (20%) males used magazines as a source of nutrition information. A significant relationship (χ^2=4.390, df 1, P=0.036) was also observed between health food store as a source of nutrition information and gender. Males used health food store as a source of nutrition information more often (29.4%) as compared to females (2.9%) (Table XV).

There also was a significant relationship between source of nutrition information and number of ergogenic products used by the adolescents. A significant relationship (χ^2=21.614, df 4, P=0.0001) was observed between family as a source of nutrition information and the number of ergogenic products used (Table XV). Family was a source most often when one to three ergogenic products were used compared to zero to two products when family was not a source. Twenty-nine out of 68 (42%) subjects used family as a source of nutrition information (Appendix H).

A significant relationship (χ^2=9.365, df 4, P=0.053) was observed between magazines as a source of nutrition information and number of ergogenic products used (Table XV). Adolescents who did not use magazines as a source of nutrition information used zero to three ergogenic products. Adolescents who did use magazines as a source used three to six ergogenic products.

A significant relationship (χ^2=20.691, df 4, P=0.0001) also was observed between health food store used as a source of nutrition information and number of ergogenic products used (Table XV). Adolescents

TABLE XV

RELATIONSHIP BETWEEN AGE, GENDER, AND NUMBER OF ERGOGENIC PRODUCTS USED, AND SOURCES OF NUTRITION INFORMATION IN EXPERIMENTAL STUDY

Parameter	Age	Gender	Number of Products[1]
Friend			
df	3	1	4
Chi-Square	2.397	1.511	8.616
Family			
df	3	1	4
Chi-Square	2.525	0.020	21.614[b]
Television			
df	3	1	4
Chi-Square	1.847	1.067	9.110
Radio			
df	3	1	4
Chi-Square	3.201	0.116	2.900
Newspaper			
df	3	1	4
Chi-Square	1.530	0.000	6.019
Magazine			
df	3	1	4
Chi-Square	2.536	3.908[a]	9.365[a]
Health Food Store			
df	3	1	4
Chi-Square	1.012	4.390[a]	20.691[b]
Coach/Teacher			
df	3	1	4
Chi-Square	2.355	0.036	5.355
Health Professional			
df	3	1	4
Chi-Square	2.335	0.478	7.365

[1]Number of ergogenic products used compared to sources of nutrition information.

[a]Chi-square value is significantly different, $p<0.05$.

[b]Chi-square value is significantly different, $p<0.001$.

who did not use the store as a source of nutrition information used zero to two ergogenic products while the adolescents who used the health food stores used one to six ergogenic products (Table XV and Appendix H). $H_0$3: The null hypothesis for relationship between age and sources of nutrition information is accepted. $H_0$3: The null hypothesis for relationship between gender and number of ergogenic products used, and sources of nutrition information is rejected.

Findings and Discussion of Hypothesis Four

Hypothesis four stated: There will be no significant difference as a result of a sports nutrition education program on the type and number of ergogenic products used by adolescents. A chi-square analysis was performed to compare the type of ergogenic products used before and two months after nutrition education. A paired t-test was performed to compare the number of ergogenic products used before and two months after nutrition education.

There was a significant difference between type of ergogenic used before and two months after the nutrition education program (Table XVI). Significant differences were observed for all types of ergogenic products except for herbs and other products. A significant decrease was observed in the number of vitamins, minerals, muscle building products, protein supplements, amino acids and salt tablets used by adolescents two months after the nutrition education program. Use of other ergogenic products stayed the same or increased slightly (Table XVI and Appendix I).

There was no significant difference in the number of ergogenic products used before and after nutrition education (Table XVII). $H_0$4:

TABLE XVI

TYPE OF ERGOGENIC PRODUCTS USED BEFORE AND TWO MONTHS AFTER THE SPORTS NUTRITION EDUCATION PROGRAM IN EXPERIMENTAL STUDY

Type of Ergogenic Products	Number Used Before[1]	Number Used After[2]	df	Chi-Square Value
Vitamin Supplements	41	28	1	21.158[a]
Mineral Supplements	12	10	1	18.469[a]
Caffeine	4	5	1	11.655[a]
Muscle Building Products	9	8	1	13.363[a]
Honey	4	5	1	3.804[b]
Bee Pollen	2	3	1	33.306[a]
Wheat Germ	1	2	1	24.990[a]
Protein Supplements	17	12	1	21.976[a]
Herbs	2	2	1	0.042[a]
Amino Acids	20	18	1	21.560[a]
Salt Tablets	2	1	1	51.000[a]
Other	3	3	1	0.199

[1]Number of ergogenic products used by 68 subjects before the sports nutrition education program.

[2]Number of ergogenic products used by 51 subjects after the sports nutrition education program.

[a]Chi-Square value is significantly different, $p<0.001$.

[b]Chi-Square value is significantly different, $p<0.05$.

The null hypothesis for type of ergogenic products used before and after nutrition education is rejected. H_o4: The null hypothesis for number of ergogenic products used after nutrition education is accepted.

TABLE XVII

NUMBER OF ERGOGENIC PRODUCTS USED BEFORE AND TWO MONTHS AFTER A SPORTS NUTRITION EDUCATION PROGRAM IN EXPERIMENTAL STUDY

Variable	n	Mean Number Products Used ±S.D.[1]
Number of Ergogenic Products Used Before	68	1.72 1.55
Number of Ergogenic Products Used After	51	1.90 1.81

[1]Mean number of products used ±Standard Deviation.

Findings and Discussion of Hypothesis Five

Hypothesis five stated: There will be no significant difference between age, gender, and sources of nutrition information, and pre-test category scores of sports nutrition knowledge. Analysis of variance was performed to determine the difference between category scores of sports nutrition knowledge and age, gender, and sources of nutrition information.

In the experimental study, a significant difference was observed between age and gender, and pre-test category scores. A significant difference was observed between the food groups category scores and

both age and gender (Table XVIII and Appendix J). Adolescents who were 17 years old scored significantly higher on the food groups category, mean score 54.1 percent, than other age groups. Adolescent males scored significantly higher on the food groups category questions when compared to females, means 49.2 percent versus 39.4 percent, respectively.

There was also a significant difference observed between amino acids/protein supplements category scores and both age and gender. Again, 17 year olds scored significantly higher (54.1%) than other age groups (Table XVIII). The males also scored significantly higher on the amino acids/protein supplements category scores when compared to females, mean amino acid/protein supplements category scores 45.5 percent versus 34.1 percent, respectively.

In the experimental study, a significant relationship was observed between magazines as a source of nutrition information and fluids pre-test category scores. Adolescents who used magazines as a source of nutrition information scored significantly higher on the fluids pre-test category questions, mean 92.5 percent, than those adolescents who did not use magazines as a source of nutrition information (Table XIX). Adolescents scored the highest on weight control category questions, mean score 81.3 percent. In addition, they tended to know the least about category questions related to amino acids/protein supplements, mean pre-test category score 42.6 percent (Table XX).

H_o5: The null hypothesis is rejected.

TABLE XVIII

DIFFERENCE BETWEEN AGE, GENDER, AND PRE-TEST CATEGORY SCORES OF SPORTS NUTRITION KNOWLEDGE IN EXPERIMENTAL STUDY

Pre-test Category Scores[1]	Parameters: Age 15 n=8	Age 16 n=19	Age 17 n=32	Age 18 n=9	Gender Male n=51	Gender Female n=17
Food Groups						
Mean	38.8[a]	40.5	54.1	41.1	49.2[b]	39.4
S.E.	5.56	3.61	2.78	5.24	2.30	3.99
Carbohydrates						
Mean	53.1	55.3	59.4	55.6	59.8	48.5
S.E.	7.90	5.12	3.95	7.45	3.02	5.23
Fluids						
Mean	59.4	69.7	79.7	66.7	76.5	61.8
S.E.	10.12	6.57	5.06	9.54	3.97	6.88
Vitamin/Mineral						
Mean	70.8	58.9	63.5	73.9	64.7	63.8
S.E.	6.56	4.26	3.28	6.19	2.66	4.60
Ergogenics						
Mean	75.0	65.3	70.6	62.2	68.2	69.4
S.E.	7.50	4.87	3.75	7.07	2.98	5.16
Amino Acid/ Protein Supplements						
Mean	27.5[b]	38.9	48.1	44.4	45.5[b]	34.1
S.E.	6.00	3.89	3.00	5.66	2.43	4.21
Weight Control						
Mean	87.5	77.6	82.8	77.8	80.9	82.4
S.E.	8.38	5.44	4.19	7.90	3.30	5.72
Other						
Mean	56.3	68.4	71.9	55.6	64.7	73.5
S.E.	12.12	7.68	6.06	11.42	4.78	8.29

[1]A perfect pre-test category score equals 100 percent.

[a]Mean Pre-test Category Score ±Standard Error is significantly different for that parameter, $p<0.01$.

[b]Mean Pre-test Category Score ±Standard Error is significantly different for that parameter, $p<0.05$.

TABLE XIX

RELATION BETWEEN SOURCES OF NUTRITION INFORMATION AND PRE-TEST CATEGORY SCORES OF SPORTS NUTRITION KNOWLEDGE IN EXPERIMENTAL STUDY

Sources of Nutrition Information	n	Food Groups Mean ±S.E.[1]	Carbohydrates Mean ±S.E.	Fluids Mean ±S.E.	Vit./Min.[2] Mean ±S.E.	Ergogenics Mean ±S.E.	AA/Pro.[3] Mean ±S.E.	Wt. Cont.[4] Mean ±S.E.	Other[5] Mean ±S.E.
Friend									
No	48	44.6 ±2.40	58.3 ±3.18	71.9 ±4.20	65.3 ±2.73	69.2 ±3.07	41.7 ±2.60	80.2 ±3.40	68.8 ±4.95
Yes	20	52.0 ±3.72	53.8 ±4.92	75.0 ±6.50	62.3 ±4.23	76.0 ±4.75	45.0 ±4.02	83.8 ±5.26	62.5 ±7.66
Family									
No	39	47.4 ±2.72	57.1 ±3.54	72.4 ±4.66	64.2 ±3.04	70.3 ±3.39	39.5 ±2.83	77.6 ±3.71	69.2 ±5.49
Yes	29	45.9 ±3.15	56.9 ±4.11	73.3 ±5.40	64.9 ±3.52	66.2 ±3.93	46.9 ±3.28	86.2 ±4.31	63.8 ±6.37
Television									
No	59	45.4 ±2.17	55.9 ±2.86	72.0 ±3.78	63.0 ±2.42	68.1 ±2.77	43.1 ±2.35	80.5 ±3.06	66.1 ±4.47
Yes	9	55.6 ±5.55	63.9 ±7.32	77.8 ±9.68	74.0 ±6.20	71.1 ±7.08	40.0 ±6.01	86.1 ±7.84	72.2 ±11.44
Radio									
No	65	46.5 ±2.10	57.3 ±2.74	73.1 ±3.61	63.8 ±2.33	68.0 ±2.62	42.8 ±2.24	80.8 ±2.91	66.9 ±4.27
Yes	3	53.3 ±9.78	50.0 ±12.74	66.7 ±16.79	77.7 ±10.83	80.0 ±12.19	40.0 ±10.42	91.7 ±13.55	66.7 ±19.85
Newspaper									
No	64	47.0 ±2.12	56.6 ±2.76	73.4 ±3.62	64.3 ±2.37	67.8 ±2.63	43.1 ±2.24	80.5 ±2.92	67.2 ±4.30
Yes	4	42.5 ±8.49	62.5 ±11.04	62.5 ±14.50	66.5 ±9.49	80.0 ±10.53	35.0 ±8.98	93.8 ±11.69	62.5 ±17.19
Magazine									
No	58	46.4 ±2.23	55.6 ±2.87	69.4 ±3.66[a]	63.5 ±2.47	67.6 ±2.78	42.1 ±2.36	79.3 ±3.03	68.1 ±4.50
Yes	10	49.0 ±5.37	65.0 ±6.91	92.5 ±8.82[b]	70.0 ±5.96	74.0 ±6.69	46.0 ±5.69	92.5 ±7.31	60.0 ±10.84
Health Food Store									
No	46	45.7 ±2.50	57.1 ±3.26	70.1 ±4.25	64.2 ±2.80	68.7 ±3.14	42.6 ±2.66	80.4 ±3.47	69.6 ±5.04
Yes	22	49.1 ±3.61	56.8 ±4.72	78.4 ±6.15	65.1 ±4.05	68.2 ±4.53	42.7 ±3.85	83.0 ±5.02	61.4 ±7.28
Coach									
No	57	46.1 ±2.24	57.5 ±2.93	71.5 ±3.83	63.8 ±2.50	66.7 ±2.76	43.9 ±2.36	80.7 ±3.12	68.4 ±4.53
Yes	11	50.0 ±5.11	54.5 ±6.66	79.5 ±8.73	68.1 ±5.70	78.2 ±6.28	36.4 ±5.38	84.1 ±7.10	59.1 ±10.32
Health Professional									
No	61	46.7 ±2.18	57.0 ±2.83	73.4 ±3.72	64.8 ±2.43	68.2 ±2.72	42.0 ±2.30	81.1 ±3.02	66.4 ±4.40
Yes	7	47.1 ±6.43	57.1 ±8.36	67.9 ±10.98	61.9 ±7.17	71.4 ±8.03	48.6 ±6.78	82.1 ±8.91	71.4 ±13.00

[1]Mean Pre-test Category Score ±Standard Error with different superscripts are significantly different, $p<0.05$. A perfect score equals 100%.

[2]Vitamin and Mineral Category scores.

[3]Amino Acids and Protein Supplements Category scores.

[4]Weight Control Category scores

[5]Other Category scores included these questions: Which health professional would you talk to about nutrition information? And how can misinformation be defined?

TABLE XX

EXPERIMENTAL STUDY PRE-TEST CATEGORY SCORES
(N=68)

Category	Mean Score ±S.D.
Food Group	46.8 ±16.88
Carbohydrates	57.0 ±21.96
Fluids	72.8 ±28.89
Vitamin/Minerals	64.5 ±18.84
Ergogenics	68.5 ±21.11
Amino Acids/Protein Supplements	42.6 ±17.92
Weight Control	81.3 ±23.41
Other	66.9 ±34.13

CHAPTER V

SUMMARY, CONCLUSIONS, AND RECOMMENDATIONS

Summary of Findings

The purpose of this study was to determine the impact of a sports nutrition program on sports nutrition knowledge among adolescents and evaluate variables which influence adolescents' nutrition knowledge and use of ergogenic products. The following objectives were met: 1) to determine the effect of a sports nutrition education program on pre-test, post-test, and retest sports nutrition knowledge scores in adolescents, 2) to determine the difference between adolescents' age, gender, number of ergogenic products used, and sources of nutrition information, and sports nutrition knowledge pre-test scores, 3) to determine the relationship between age, gender, and number of ergogenic products used by adolescents, and the sources of nutrition information, 4) to determine the effect of a sports nutrition education program on the type and number of ergogenic products used by adolescents, and 5) to determine the difference between age, gender, and sources of nutrition information, and pre-test category scores of adolescents' sports nutrition knowledge.

Adolescents seem to have limited knowledge about sports nutrition. Mean test scores in the experimental study were low, with no significant changes in nutrition knowledge. No significant difference was observed in mean pre-test score by age or gender. The number of ergogenic

products used by the adolescents was also not related to mean pre-test scores. In addition, the source of nutrition information did not appear to influence adolescents' sports nutrition knowledge.

In the experimental study, source of nutrition information did not influence any age group. The source of nutrition information was however related to gender. Males used magazines as a source of nutrition information, while females never used magazines as a source of nutrition information. Males also used health food stores more often than females.

Source of nutrition information also influenced the number of ergogenic products used by adolescents. Adolescents who used family as a source of nutrition information used one to three ergogenic products compared to zero to two products used by those who did not use family as a source. Magazines also as a source of nutrition information influenced the number of ergogenic products adolescents used. Adolescents used three to six ergogenic products when magazines were used as a source of nutrition information compared to zero to three ergogenic products for those who did not use magazines as a source of nutrition information.

A significant difference in the type of ergogenic products used was observed in the experimental study. Adolescents decreased the number of vitamins, minerals, muscle building products, protein supplements, amino acids, and salt tablets used two months after the sports nutrition education program. However, no significant difference was observed in the number of ergogenic products used by adolescents.

Pre-test category mean scores were significantly different by age and gender. In the food group pre-test category, males scored

significantly higher than females, and 17 year olds scored significantly higher than other age groups. In the amino acid and protein supplements pre-test category, 17 year olds scored significantly higher than other age groups, and males scored significantly higher than females.

A significant relationship was also observed between sources of nutrition information and pre-test category scores. Adolescents who used magazines as a source of nutrition information scored significantly higher on the fluids pre-test category.

Conclusions

Adolescents' sports nutrition knowledge level is limited. The time allowed for nutrition education may have influenced the sports nutrition knowledge test scores. In the pilot study, adolescents had the opportunity to ask questions and discuss the information presented while the experimental study time was limited. Many adolescents are using ergogenic products that may be detrimental to their athletic performance and health. Sources of nutrition information also appears to influence the number of ergogenic products used by adolescents.

Nutrition education can influence the type and number of ergogenic products used and can influence sports nutrition knowledge scores when time is allowed for discussion and questions. Specific categories of sports nutrition should be emphasized to increase the nutrition knowledge and awareness of nutrition misinformation for parents, coaches, teachers, and adolescents.

Recommendations

Additional research should be conducted to determine the relationship between nutrition knowledge and behaviors among adolescents. Nutrition educators should provide nutrition information and programs to specific sources of nutrition information that influence adolescents. For example, magazine articles targeting adolescents and young adults should be written or edited by registered dietitians to promote accurate sports nutrition information. Families need to be targeted for nutrition education, along with the adolescents, to reinforce the accurate nutrition information. Sports nutrition should be required by physical education majors' college courses so coaches will be more knowledgeable about sports nutrition. High schools should provide a sports nutrition course or invite registered dietitians to speak about sports nutrition.

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APPENDICES

APPENDIX A

SPORTS NUTRITION VIDEO TAPE SCRIPT

VIDEO SCRIPT

Part 1: Introduction

You are probably the most active, most fit generation ever. There's so much pressure to feel good, look good. If there are short-cuts making it easier, or faster to develop a trim, in-shape body, would you use them? What if those methods just plain don't work, or even worse, could harm your body? Would it be worth it?

Good nutrition is the way to develop and maintain a healthy body. But there are many myths out there that may convince you otherwise. Nutrition misinformation is dangerous. It's information based on truth, but makes claims that just aren't true. For example, you hear that taking amino acids or protein supplements will help build your muscles. The grain of the truth here is that amino acids are building blocks for muscles, but it's exercise, not excess protein that cause muscle growth.

Nutrition information and athletic performance can be found everywhere, from newspapers, books, magazines, TV, even well-meaning friends and family. A variety of products are available that claim to enhance athletic performance. But look closer, scientific studies do not prove or validate those claims. You need to know the facts, so you can make the right decisions. With this videotape series, we will try to dispel some of the nutrition misinformation directed toward teen athletes.

Part 2: Steroids and Ergogenic Products

Isn't there an easier way to build your muscles? Some athletes have used anabolic steroids as a shortcut way to get bigger muscles faster. Even though steroids have been widely used, they are illegal, and they are dangerous. Let's take a look at some of the side effects of steroid use. First, steroids can damage your liver with tumor growth possible. Steroids can alter the reproductive system of both males and females. Steroid use can alter facial appearance. Your chances of developing cancer increase with steroid use. You run the risk of developing heart disease as steroids can change blood lipid levels. Finally, steroids can cause mood swings and aggressive behavior.

The Academy of Pediatrics and the American College of Sports Medicine condemn the use of steroids for three reasons. First, there are known toxic effects from steroid use. Second, steroids are a form of cheating, and finally, "clean" athletes, those who don't use steroids, are put in a difficult position, and face a disadvantage. There are two things to remember about steroids. First, they are illegal and, second, they can harm you.

Now let's talk about another type of product that claims to enhance an athlete's performance. Have you ever heard of taking bee pollen, or caffeine for extra energy? Brewer's yeast is another example of a supposed energy-giving substance. The truth is these products will provide a small amount of energy but it's not significant for athletic performance. You'll be spending money for little or no gain. The bottom line is, if it sounds too good to be true, you'd be better off avoiding it.

Part 3: Weight Loss and Weight Control

Weight can affect performance in many sporting events. However, weight control with gradual weight changes is most effective for enhancing athletic performance. Many athletes believe rapid weight loss will improve their performance. They try to drop pounds quickly using crash diets, laxatives, spitting, or vomiting.

Yet, these practices lead to decreased strength and decreased energy, resulting in poor athletic performance. Some athletes who continue such practices may end up with eating disorders like anorexia or bulimia. To avoid possible eating disorders and poor athletic performance, athletes should concentrate on weight control with gradual weight changes. Usually 1 to 2 pounds of weight loss per week is recommended by registered dietitians.

If you are an athlete, and you need to either maintain or gain weight, plan to do so over a period of several months. The best way to lose weight is to increase exercise, and decrease food intake. But even though you are cutting back, you still need to eat a balanced diet which includes foods from all the food groups. To maintain, or control your weight, you need balance of exercise and food intake. Remember, moderation is the key to controlling your weight.

Part 4: Vitamins and Mineral Supplements

Do you take vitamins every day? Many people do. But, if you eat a balanced diet, you are getting the right amount of vitamins and minerals that you need for good health. Your body can produce many of the things it needs, but it can't produce vitamins and minerals. That's why it's important to eat a variety of foods that can provide your body with the right amounts of vitamins and minerals.

But why are they so important? Vitamins are needed to assist with bio-chemical reactions in your body. For example, each mineral plays a unique role in the body. Calcium, which is found in milk, is important for strong bones, and iron, which is found in meats makes sure oxygen is adequately distributed throughout the body.

Iron is one of the most important minerals we need. It is component of hemoglobin, which carries oxygen from the lungs to the muscles. If you are iron deficient, you'll tire quickly when you are exercising. Teen athletes may be at risk for iron deficiency anemia. See if you fit the following risk categories.

If you are growing quickly, as many teens do, you may not be eating enough iron-rich foods to meet your needs. Females are especially at risk as they are losing iron through menstrual bleeding. Vegetarian athletes who do not eat red meats are also at risk. Endurance athletes, those who exercise or compete for more than 90 minutes at a time, will lose iron through heavy sweating.

As you can see, it is important to consume adequate amounts of vitamins and minerals. But too much of a good thing can be dangerous. For example, Vitamin A can lead to nausea, blurred vision, hair loss, enlarged liver and spleen, and even death. More is not always better. Most nutrition experts and exercise physiologists agree that vitamin and mineral supplements do not give an extra edge to athletes who already eat a balanced diet. The key point to remember is the balanced diet. That's the only way to obtain the more than 50 nutrients necessary for proper body functions.

Part 5: Amino Acid and Protein Supplements

Building muscle requires a combination of good nutrition habits and exercise. If you eat a balanced diet, you will get the protein and amino acids necessary for muscle growth. Amino acids play an important role in muscle development. More than 20 amino acids serve as protein building blocks.

Amino acids are involved in building and repairing muscle tissue, maintaining fluid balance, they make up antibodies that fight disease, and act as carriers of other nutrients into and out of cells. Getting enough protein is not a problem. The average American consumes twice the recommended daily allowance for his or her protein needs. The recommended daily allowance of protein for teens is as follows: for males 11-14 years old,, 45 grams of protein are needed daily, for males 15-18 years old, the number increases to 56 grams per day, females from 11-14 years old need 46 grams, but then that number drops. Girls from 15-18 years old should get only 44 grams of protein per day.

You can follow a simple formula to determine your protein needs. You need approximately 1/2 gram of protein per pound of body weight. So, if you weigh one hundred pounds, you need 50 grams of protein per day. Even though you need amino acids and protein to build muscle, the two substances don't do it alone. Don't be influenced by claims that you can develop muscles faster by taking extra amino acids or protein supplements. Exercise is still the key to muscle development.

If you take supplements, they may be unbalanced in the types of amino acids offered, and the excess protein will be stored as fat. It doesn't increase muscle growth. Also, amino acid and protein supplements are more expensive than food sources of protein. As I said, your body knows how much protein it needs, and won't use extra for muscle development. In fact, if you consume a high protein diet, there are some side effects. You can become dehydrated because excess water is needed to eliminate protein by-products in the urine. Excessive amounts of protein supplements can also cause diarrhea or loss of appetite.

The best way to obtain protein from foods is to follow the basic food groups, with a balance of meats, milk, bread and cereals, fruits, and vegetables.

Part 6: Carbohydrate Loading and Sugar for Energy

Is it a good idea to eat a candy bar when you are exercising, or competing? Is it possible to store reserves of energy for athletic performance? In some cases you can store energy in the form of carbohydrates for later use. Some examples of carbohydrates are pasta, bread, crackers, rice, potatoes, vegetables and fruits.

Carbohydrate loading has been proven beneficial for endurance events, that is, events that last longer than 90 minutes. Examples of endurance events are marathon running, triathlon, cross-country skiing, or long-distance biking.

How does carbohydrate loading work? Start three to five days before you participate in an endurance event. Eat 60 to 70 percent of your calories from complex carbohydrates. The energy will be stored as glycogen in the liver and muscle, and can be readily used during the event. To maintain these energy stores, you should reduce training for several days prior to the competition.

What about eating sugar, like a candy-bar, for quick, on-the-spot energy? Sugar is a simple carbohydrate, and can be used for energy. However, dietitians usually discourage athletes from eating high-sugar foods thirty minutes to one hour before exercising or competing. You could end up with low blood sugar with symptoms of shakiness or light-headedness. You can eliminate the need for quick-fix energy snacks, and reduce the chances of low blood sugar reactions, by increasing calorie intake earlier in the day.

Part 7: Fluids and the Athlete

A good long drink of water, that's just what you need when you've been working out. Fluids are very important to an athlete and his or her performance. Body fluids are responsible for several functions. First, your blood transports glucose, or energy to muscles, and carries waste away from muscles. Second, urine eliminates waste products. And third, sweat keeps your bodily temperature balanced by dissipating heat through your skin.

If you don't drink enough water or fluids, or you are sweating too much, those key bodily functions will be affected. You can become dehydrated, and it will decrease your performance in athletic activities. Fluids should be taken before, during and after exercise to avoid dehydration.

A minimum of 8 glasses of fluids should be consumed daily. Beverages could include: water, fruit juice, soft drinks, milk, lemonade, decaffeinated coffee or tea. Sports drinks can be used, but they are usually not necessary unless you are competing in an endurance event. Remember to make fluids a key part of your athletic training.

Part 8: Eating for Performance

You know that you should be eating a balanced diet if you want to compete in athletics. So what makes up a balanced diet? We have prepared the basic Daily Food Guide to help you. You should have 3 to 5 servings of vegetables a day, a serving is a half cup cooked vegetable, or one cup raw. Have 2 to 4 servings of fruits, that's a half cup cooked, or one cup raw. Breads and cereals are an important group so have 6 to 11 servings. Milk is especially important for teens, drink at least 4 cups a day or you could choose cheese or yogurt. And finally choose 2 to 3 servings of meat a day.

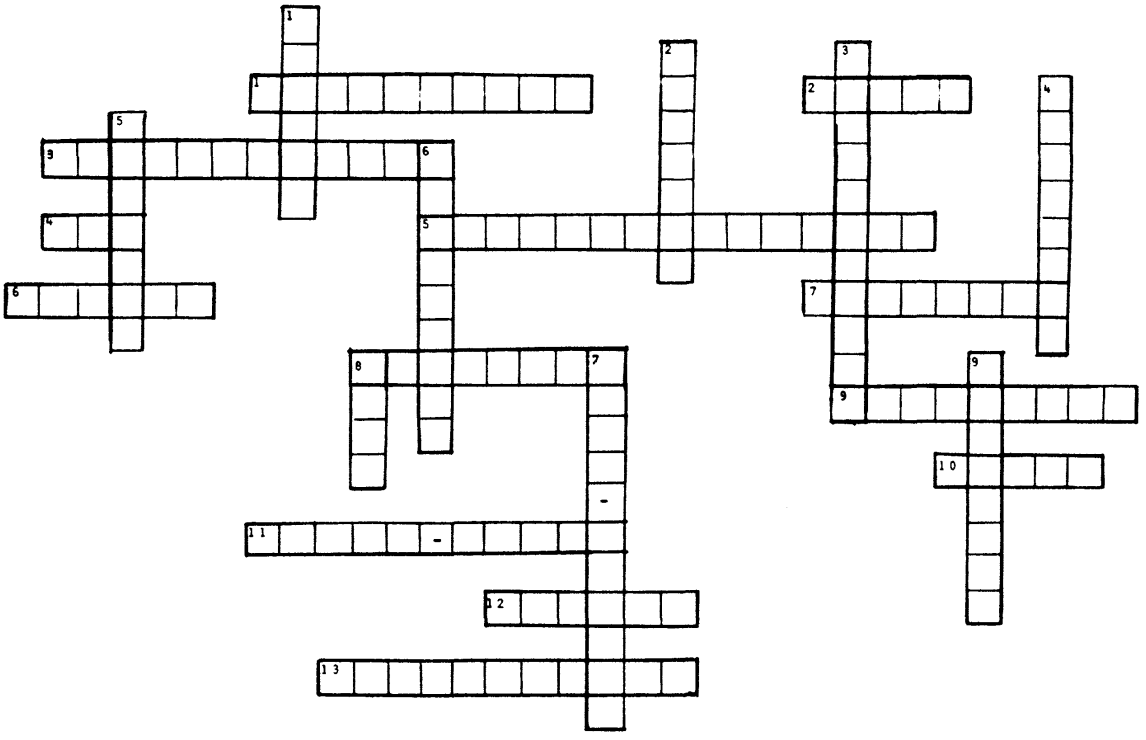
Now some special eating tips for performance. Always eat a variety of foods. Pregame meals should include complex carbohydrate foods such as pasta, breads, fruits, and vegetables. Choices will vary for different events and individual tolerances. And be sure to allow time for food to digest before competing. Include low-fat protein foods such as lean meat, skinned chicken, fish, dried beans, low-fat milk and milk products. And don't forget fluids, choose water, juices, lemonade, milk or others.

Remember that vitamins and minerals can be obtained from a balanced diet. Supplements are not usually necessary however, if you have any questions, consult your physician or registered dietitian. Also, avoid loading up on expensive amino acids, or protein supplements. You are better off getting the needed protein from food sources. Remember, to do your best in any athletic event, follow the suggested Daily Food Guide, and choose from a variety of foods.

APPENDIX B

NUTRITION MISINFORMATION CROSSWORD PUZZLE AND NUTRITION HANDOUTS

Nutrition Misinformation Crossword Puzzle



ACROSS

1. Eat 3-5 servings of these
2. Eat 2-3 servings of these
3. Are both simple and complex
4. Has 9 calories per gram
5. Storage of energy, especially carbohydrates
6. Eat 2-4 servings of these
7. Illegal and harmful to use
8. Examples are calcium, zinc, and iron
9. Over 55 _____ are needed for growth, repair, and maintenance
10. Drink 6-8 cups of _____ daily
11. Building blocks of muscle or powder supplements that are not necessary to use
12. Drink _____ before, during, and after a sporting practice/event
13. Are not necessary to take when eating a balanced diet

DOWN

1. Eat 6-11 servings of these
2. Carbohydrate _____ allows for energy to be stored in the muscle
3. Occurs when decreased fluids are drank
4. Helps burn calories and keep you in shape
5. Building material for muscles
6. Means "energy-giving"
7. Winter exercise
8. Eat 3 servings of this (teens)
9. Examples are _____C, _____A, niacin, and thiamin

THE PRECOMPETITION MEAL

Athletes are not above believing that a "lucky charm" might help their performance. For some, eating a particular food before competition is like carrying a four-leaf clover. A football player may always insist on a pregame Porterhouse steak, while the runner psyching up for a marathon might demand a large serving of pasta.

Is there a "magic" precompetition meal that might help you perform your best?

RESEARCH

Scientists have researched both the timing and the content of the precompetition meal to a great extent and have found that there really is no one menu for all to follow. A nutritionally sound precompetition meal will not compensate for an inadequate training diet. Performance depends more on the foods and beverages you consume for days, even weeks, before an event.

However, nutritionists suggest that the psychological benefits of the precompetition meal should not be taken lightly. Performance depends on feeling at your peak physically, mentally and emotionally. The camaraderie of dining with teammates and the pleasure of eating familiar, well-liked foods may give your mind and spirit the needed edge.

WHAT TO EAT

Nutritionists offer this "golden rule" for athletes preparing to compete: eat familiar foods and drink plenty of water.

When planning your precompetition meal, first select foods and beverages you both like and tolerate well. The meal should also be foods you are accustomed to eating. The day of a competition is not the time to try a new food or diet. For instance, a Midwestern athlete who normally eats meat and potatoes may be tempted to eat fresh exotic fruit when competing in California. It's best, however, to wait until after the competition to try any local specialties. Any time you eat new foods you risk getting gastrointestinal distress such as diarrhea.

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THE PRECOMPETITION MEAL (cont.)

Another consideration is planning a meal that won't interfere with the physical stress you will put on your body during competition. The precompetition meal for a baseball player may be quite different from that of a distance runner. Most endurance athletes, such as marathoners, distance cyclists and triathletes, prefer a high-carbohydrate diet – sometimes referred to as "carbo loading" – several days before competition. Carbohydrates help provide the store of energy needed for hours of continuous activity.

Athletes taking part in stop-start sports, such as football, basketball, swimming and volleyball, should eat a precompetition meal that is moderately high in carbohydrate foods, such as bread, potatoes, rice and pasta, but low in fat. Fluids – water, milk or juice – should also be a part of the meal.

The mental stress that accompanies the "big" game or an important match may influence your stomach, too. The gastrointestinal track reacts to stress in one of two extremes – it speeds up or it slows down. Either way, your performance and comfort level can be upset. The physical stress of competing in an all-day meet or tournament can also leave you little time or inclination to eat. Whether it's physical or mental stress, you still need to maintain energy and fluid balance to perform your best. Even if you don't "feel" hungry, be sure to drink plenty of water and eat small carbohydrate-rich snacks. This will help ease hunger pangs, provide energy and meet your fluid needs.

THE RIGHT TIME TO EAT

Practically every set of guidelines for precompetition meals also recommends a time to eat. Although there are exceptions, a common suggestion is to eat two to four hours before an event. This time frame usually ensures that you will have an empty stomach at the time of competition, yet won't be feeling hungry or weak. Of course, the size and content of the meal also influences how quickly the stomach empties.

You may be confused by accounts of athletes who ate huge meals just minutes before breaking a world record or winning a gold medal. Wouldn't a full stomach slow an athlete down? Not necessarily, report nutritionists. What they have discovered is that consuming a liquid or solid meal as close as 30 minutes before an event may cause stomach distention but, apparently, has no negative impact on performance.

Just remember that the timing of the precompetition meal really is an individual matter. Although most athletes find that eating two to three hours before competing works best for them, others may need to allow as much as six hours between the meal and the competition.

RECIPE FOR SUCCESS

In general, the precompetition meal should be moderately high in carbohydrates and low in fat. It should also provide enough fluid so that you enter competition well hydrated. After this formula is followed, precompetition eating really becomes an individual matter. Most importantly, the meal should include foods that you think will help you win, whether that food is a meatball sandwich, a favorite snack food or a mushroom pizza.

If you are concerned about how food consumption enhances or hinders performance, keeping a diary may prove to be helpful. Simply record the types and amounts of foods you eat, when they were consumed and how you felt before, during and after competition.

Once a pattern is determined, the recipe for "your" perfect precompetition meal can be concocted.

VITAMIN AND MINERAL SUPPLEMENTS

Forty percent of all Americans self-dose with one or more nutrients, in multiple and single doses, in natural and synthetic formulations. These purchases add up to more than $3 billion a year.

Surveys of athletes at all levels indicate that from 54 to 84 percent use supplements. Many factors influence athletes in the use of nutrition supplements. One is the attitude that nutrients are "good" and therefore are harmless.

CLAIMS VS. REALITY

The popularity of vitamins and minerals is due not so much to what they do but rather to what people claim they do. They are credited with a variety of alleged functions ranging from curing acne to cancer. Most of the claims are unfounded or misleading. Athletes appear to be vulnerable to many of these marketing ploys. Some will consume a small fortune in supplements.

Nutritionists and medical doctors declare that a balanced diet supplies more than enough nutrients for good health. Taking supplements is not necessary for most people. The only thing a vitamin or mineral will cure is a deficiency of that particular vitamin or mineral.

Athletes are often led to believe that one specific formulation is designed for them and will provide that extra spark needed in competitive events. Some athletes will take supplements "just to make sure."

Think about vitamins in relation to changing the spark plugs in your car. If your auto engine calls for six plugs, you install six. Laying two extra plugs on the motor block will not make the engine work any better. The six spark plugs are the balanced diet, the two extra plugs are the vitamin pills.

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VITAMIN AND MINERAL SUPPLEMENTS (cont.)

Some vitamins are involved in energy metabolism (converting food to energy). Amounts above what the body can use do not provide more energy or make the process more efficient. The need for some vitamins will increase during intense exercise. This increase is small and is easily met by the increased food intake demanded by such exercise.

WHAT IS ENOUGH?

Supplement usage may be indicated in some circumstances. Vegetarians, and people with extremely low calorie intake, and those people who leave out certain food groups, may not meet adequate levels for all nutrients. However, supplements should not exceed the 100% USRDA. Tables are included on labels which indicate dosage amount and USRDA.

Consolation should be gained by knowing that the Recommended Dietary Allowance (RDA) is not our minimal need but is significantly higher for protein, vitamins and minerals. USRDA has a margin of safety built in which allows for individual differences and other factors.

Intakes of vitamins above and beyond the USRDA are not necessary. Nutrients are potentially toxic when taken in sufficiently large amounts. High-dosage vitamin and mineral supplements can interfere with the normal metabolism of other nutrients. Toxicity and other bad side effects of large amounts of several vitamins and minerals are well documented.

Vitamin A toxicity can result in dry flaky skin, severe headaches, bone and joint pains, and liver damage. Overdoses of niacin, vitamin B6, vitamin C, vitamin D, iron, magnesium, zinc and others have also been shown to be harmful.

All the vitamins and minerals needed by the human body -- athlete or non-athlete -- can be obtained in the right amounts by eating a balanced diet. There are no added benefits to taking more!

CARBOHYDRATES

For most of us, the foods that make us feel warm and satisfied -- a baked potato, a bowl of hot cereal or a slice of toast -- are carbohydrates. It's no wonder such foods have been nicknamed "comfort foods."

If you are an athlete, however, there's a very good reason why your body needs such comforting foods. Carbohydrates are the most readily available source of food energy.

When you're training or competing, your muscles need energy to perform. The major source of energy for working muscles is glycogen, a substance produced by your body and stored in your muscles and liver.

REPLENISHING GLYCOGEN STORES

Your body can only manufacture glycogen from dietary carbohydrates. Every time you work out -- or expend energy -- you use up some of your glycogen. Therefore, it is important to replenish this important energy source by eating enough carbohydrates every day. Fasting, dieting or adopting a high-protein diet may reduce muscle glycogen to inadequate levels. This can lead to fatigue and weakness.

QUANTITY AND QUALITY

How much carbohydrate should you eat each day to replace muscle glycogen? It depends on your size. While 400 grams is appropriate for someone weighing 150 pounds, it would be too much for a 75-pound gymnast.

A rule of thumb is to eat 5 to 6 grams of carbohydrate per kilogram of body weight. For the gymnast, that's around 200 grams; the 200-pound football player may consume around 550 grams. (To convert your body weight into kilograms, simply divide your weight in pounds by 2.2).

Most of us think of bread or pasta as good sources of

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CARBOHYDRATES (cont.)

carbohydrates. However, a milk shake, a pear, a glass of tomato juice and a candy bar also contain carbohydrate. Carbohydrate foods come in several forms -- starches, sugars, or a combination of the two. Starches, such as in potatoes, rice, pasta, breads and cereals, are good sources of **complex carbohydrates.** Table sugar, or sucrose, the lactose in milk products and the fructose in fruits and fruit juices are all **simple carbohydrates. Mixed carbohydrates,** such as an oatmeal raisin cookie or a piece of cake, contain both complex and simple carbohydrates.

SOURCES OF CARBOHYDRATE

30-40 GRAMS
of Carbohydrate
1 bagel
2 slices of bread
1 cup fruit-flavored yogurt
1 burrito
1 cup pasta
1 12-ounce carbonated soft drink

15-20 GRAMS
of Carbohydrate
1/2 cup oatmeal
3/4 to 1 cup ready-to-eat cereal
1/2 cup pork and beans
1 ounce chocolate
1 pancake
1 donut
1 ounce raisins
6 saltines
1 ear of corn
1 slice of pizza

5-10 GRAMS
of Carbohydrate
1/2 cup asparagus, carrots, spinach, string beans or tomato juice
1 small apple or orange
1 cup milk

WHAT IS CARBOHYDRATE LOADING?

Carbohydrate, or glycogen, loading is a diet-exercise technique that can increase muscle glycogen levels to above normal. For three to five days prior to competition, the athlete eats a high-carbohydrate diet (7 to 10 grams of carbohydrate per kilogram of body weight) and tapers off the exercise program. The final day before the event requires total rest and maintaining the same high-carbohydrate diet.

Although this regimen may be beneficial for athletes participating in endurance sports which require 90 minutes or more of non-stop effort, most athletes -- especially those in stop-start sports -- needn't worry about carbohydrate loading. For these athletes, consuming 55 to 60 percent of total calories as carbohydrates stores enough glycogen to provide the energy needed. Consuming 5 to 6 grams of carbohydrate per kilogram of body weight will provide adequate carbohydrates.

You needn't be a world-class athlete to enjoy the benefits of a high- carbohydrate diet. Besides energy, foods high in carbohydrate provide essential nutrients, fiber and pure satisfaction.

WATER, THE MOST IMPORTANT NUTRIENT

You could live without food for 30 days but, depending upon various conditions, you could survive only 4 to 10 days without water. Water is second only to oxygen as essential for life.

Water is without doubt the most important nutrient for an athlete. Odd as it may sound, your body is made up primarily of water. A muscular athlete is about 70 percent water.

Body cells function best when well hydrated (have adequate water). In exercise, your muscles work extremely hard and create energy. A by-product of that energy is heat. Your body needs to get rid of the heat and, to do so, your blood circulates to the muscles, picks up the heat, and circulates to the top of the skin. Sweating takes place, you lose water, it evaporates, cooling the blood, and in turn circulates back again and the process is repeated. It's similar to the cooling system of a car.

TRAINING OR COMPETING

When training or competing, you can lose a lot of water by sweating ... which must be replaced to perform your best. Losing as little as two to three percent of your body weight by sweat can cause a decrease in concentration, coordination, strength, and stamina.

You should drink at least eight glasses (two liters) of water a day. During heavy physical activity you will need to drink more. Some athletes lose three to five liters of water ... more in hot, humid weather.

If you sweat off one pound, this is equal to a half-liter (two cups) of water. You should drink water before, during, and after practice or competition. Keep an eye on the scale for weight changes. Weigh in naked before and

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WATER, THE MOST IMPORTANT NUTRIENT (cont.)

after the activity and be guided accordingly.

RISKS OF DEHYDRATION

If the water you lose through sweat is not replaced, blood volume decreases. In the milder forms of heat illness, dizziness or fainting may occur. If you continue to exercise unaware of the symptoms, the sweating mechanism can shut down. If this happens, normal body temperature will rise. Heat stroke can follow.

Heat stroke is the most serious form of heat illness. Death can result if critical areas of the brain are damaged due to high body temperature. Replacing the water you lose is essential.

Don't take salt tablets. Water will be pulled into the stomach to dilute the salt so it can be absorbed. If the team physician believes extra salt is needed, it should be added to meals or through salty foods such as ham, pizza, nuts and chips.

HOW MUCH?

There is no single answer to "How much water do I need?" It varies among athletes and depends on the situation. Some athletes don't sweat much, and body temperature is maintained even in hot weather. Others are "heavy sweaters." They may drop from 8 to 10 pounds during a competition or practice session.

A heavy sweater will lose more water by sweating and consequently will need to replace more. The loss of a pound of body weight equals a half-liter of water. So, the weigh-in, weigh-out process will provide the formula.

MYTHS

Myths about drinking water during training or competition are rampant. Some of the more frequently heard myths are:

"Taking water prior to exercise will cause stomach cramps."

"Working out in the heat without water makes you tough."

"Drinking water before competition will make you waterlogged."

It has been proven that consuming water, even in large amounts, prior to and during activity has no adverse effects upon performance.

Water is the life-blood of an athlete. Keep it flowing for the best performance. The importance of water cannot be overstated.

APPENDIX C

DISCUSSION QUESTIONS FOR NUTRITION MISINFORMATION LESSON

DISCUSSION QUESTIONS FOR NUTRITION MISINFORMATION LESSON

1. What do you think about steroid use? Do you think it's fair for those who do not use steroids to compete with those that do?

2. Who has a special pregame meal that they just have to have before a competition? What do those special meals include?

3. What nutrition information would you like to know more about?

4. How do you make sure you are eating the "right" foods for athletic performance?

5. How many of you have to make weight? What is the safest way to maintain a certain weight? Do you think that limited nutrients can cause slower growth?

APPENDIX D

NUTRITION MISINFORMATION

LESSON PLAN INDEX

NUTRITION MISINFORMATION LESSON PLAN INDEX

APPENDIX E

SPORTS NUTRITION AND HEALTH QUESTIONNAIRE

SPORTS NUTRITION AND HEALTH QUESTIONNAIRE

Please fill in the blanks or circle the correct answer.

Student number: _____ Age: _____ Gender: Male or Female

1. Do you participate in sports or exercise? YES or NO

2. Please circle all sports activities or exercise in which you participate:

Football	Basketball	Volleyball	Track	Tennis
Ballet	Dance	Gymnastics	Running	Swimming
Wrestling	Weight-lifting	Cross-country running		None

Other (please list): _____

3. What nutrition or health-related classes have you taken in the past?

Home Economics	Health education	4-H nutrition projects
Community nutrition or health class(es)		None

Other (please name)_____

4. Which of the following products have you used or do you currently use to enhance your athletic performance?

Vitamins	Minerals	Caffeine	Muscle building products
Honey	Bee pollen	Wheat germ	Protein supplements
Herbs	Amino acids	Salt tablets	None

Any other products (please name):_____

5. How often do you use this (these) products (s) to enhance your athletic performance?

Never	Daily	2 times per week	3 times per week
4 or more times per week	Monthly	Other:_____	

6. If you have used any of the products listed in the above questions, how did you find out about the product(s)? Please circle all that apply.

Friend	Family	Television	Radio	Newspaper
Magazine	Health food store	Teacher/coach	Health Professional	

Other (please name):_____

7. Where do you obtain **most** of your nutrition information? Circle one.

Friend	Family	Television	Radio	Newspaper
Magazine	Health food store	Teacher/coach	Health Professional	

Other (please name):_____

APPENDIX F

SPORTS NUTRITION KNOWLEDGE TEST

Nutrition and Health Knowledge Questionnaire--

Directions: Select the one answer that best completes each statement. Fill in the oval on the answer sheet that corresponds with the letter of your answer and the question number.

1. The key component in developing larger muscles is _____.
   a. amino acid supplements.
   b. increased exercise.
   c. protein supplements.
   d. steroids.

2. On the average, the amount of protein that teens consume is _____.
   a. inadequate
   b. adequate
   c. more than is recommended.
   d. unknown

3. Ergogenic could be defined as _____.
   a. energy-giving
   b. no energy
   c. energy used by athletes
   d. none of the above

4. When losing weight, the recommended weight loss per week is _____.
   a. 3-6 pounds
   b. 1-2 pounds
   c. more than 9 pounds
   d. 7-8 pounds

5. The best method for weight loss includes _____.
   a. inceased protein and increased exercise
   b. decreased calories and decreased protein
   c. decreased calories and decreased exercise
   d. decreased calories and increased exercise

6. Rapid weight loss due to crash diets, laxative, or vomiting can lead to _____.
   a. increased strength and appropriate weight
   b. improved athletic performance
   c. decreased strength and decreased energy
   d. decreased strength and increased energy

7. Carbohydrate loading can be helpful for endurance events lasting longer than _____.
   a. 30 minutes
   b. 60 minutes
   c. 90 minutes
   d. 120 minutes

8. When training for an athletic event, fluids should be taken _____.
    a. only before the training session
    b. before, during, and after the training session
    c. during and after the training session
    d. only after the training session

9. If inadequate amounts of fluids are consumed, this will occur _____.
    a. overhydration
    b. dehydration
    c. nothing occurs
    d. improved athletic performance

10. A teenager should consume _____ of fluid daily.
    a. 3 glasses
    b. 4 glasses
    c. 6 glasses
    d. 8 glasses

11. Balanced amounts of amino acids can be achieved when including the following foods in your daily diet.
    a. milk, meats, and breads
    b. fruits and vegetables
    c. breads and cereals
    d. sweet and fat foods

12. When choosing foods from the vegetable group, a minimum of _____ servings should be eaten daily.
    a. 1-2
    b. 2-4
    c. 3-5
    d. none of the above

13. When choosing foods from the fruit group, a minimum of _____ servings should be eaten daily.
    a. 0-1
    b. 1-2
    c. 2-4
    d. none of the above

14. When choosing foods from the meat group, a minimum of _____ servings should be eaten daily.
    a. 0-1
    b. 1-2
    c. 2-3
    d. 3-5

15. When choosing foods from the milk group, a minimum of _____ servings should be eaten daily.
    a. 2
    b. 3
    c. 4
    d. 5

16. When choosing foods from the breads and cereals group, a minimum of _____ servings should be eaten daily.
    a. 3-4
    b. 5-8
    c. 6-11
    d. 8-12

17. Misinformation can be defined as _____.
    a. information based on a truth but having false or misleading claims
    b. information that is missed
    c. information that can no longer be found
    d. none of the above

18. Which health professional would you talk to about nutrition information?
    a. doctor
    b. dietitian
    c. nurse
    d. physical therapist

19. Which of the following is <u>not</u> a possible side effects of amino acid or protein supplements use?
    a. dehydration
    b. diarrhea
    c. loss of appetite
    d. weight loss

20. Which of the following is <u>not</u> a side effect of steroid use?
    a. damage to the liver
    b. improved health
    c. altered reproduction system
    d. increased risk of tumor growth

21. Which of the following sports is <u>not</u> an endurance event?
    a. marathon running
    b. triathon
    c. cross-country skiing
    d. basketball

22. Which of the following foods is <u>not</u> a high-carbohydrate source?
    a. spaghetti
    b. baked potato
    c. roast beef
    d. crackers

23. Which of the following foods is <u>not</u> a high protein food source?
    a. apple
    b. milk
    c. cheese
    d. hamburger

24. Which of the following products is not sold as an ergogenic product?
    a. vitamins
    b. minerals
    c. caffeine
    d. milk

25. Which of these body functions does not involve amino acids?
    a. building and repairing tissue
    b. maintaining fluid balance
    c. carriers of other nutrients
    d. main source of energy for the body

Directions: If the statement is true, fill in oval A corresponding with the question number. If the statement is false, fill in oval B correspondeing with the question number.

26. Amino acid supplements are more expensive than food sources of amino acids.

27. Vitamins and minerals do not have a specific function in the body.

28. Excessive vitamins can be dangerous.

29. Scientists know about all the nutrients in our foods.

30. The mineral, iron, is important for growth and development of teenagers.

31. Sports drinks are required for good athletic performance.

32. Pregame meals should include high-carbohydrate foods.

33. It is a myth that vitamins will increase strength.

34. The body can make its own vitamins.

35. Nutrition experts and exercise physiologist agree that vitamin and mineral supplements do not help the performance of a well-nourished person.

36. There are more than 50 nutrients that the body needs to function properly.

37. Steroids are illegal to use for enhancement of athletic performance.

38. Steroids are safe for teenage athletes to use.

39. Crash dieting is a safe way to rapidly lose weight.

40. Sugar can be used for energy but may cause low blood sugar if eaten just before exercising.

APPENDIX G

STUDENT CONSENT FORM

STUDENT CONSENT FORM

You have been chosen to participate in a research study sponsored by Oklahoma State University. Before you can participate, you must read and sign this consent form which explains what will be involved in the study.

As part of the study, you will be asked to participate in the following activities:

1. Fill out a personal information sheet
2. Complete two questionnaires regarding nutrition
3. View a video
4. Interact with other students through discussion and group learning activities.

All of these activities should not take more than one class period on the day that you sign this consent form. In addition, the teacher or researcher may remove you from the study at any time with just cause. Personal information and questionnaire answers that you provide for the researcher will be kept strictly confidential. The results that are published publicly will not refer to you or any individual students since the study will only look at relationships among groups of information.

The purpose of this form is to allow you to participate in the study. This consent form also allows the researcher to use the information obtained and to analyze the outcomes of the study. Participation in this study is voluntary with no penalty for refusal to participate. Consent may be withdrawn at any time by telling the researcher. Your signature below indicates that you understand and agree to willingly participate in this study.

If you have any questions regarding this study, please ask the researcher now. Her name is Theresa Horinek.

_____ _____

Signature of the Participant Date

APPENDIX H

SIGNIFICANT CHI-SQUARE RESULTS FOR EXPERIMENTAL STUDY

TABLE OF FAMILY BY SUMPRD

FAMILY SUMPRD

Frequency Percent Row Pct Col Pct	0	1	2	3	4	Total
0	18 26.47 46.15 94.74	5 7.35 12.82 33.33	8 11.76 20.51 57.14	2 2.94 5.13 18.18	6 8.82 15.38 66.67	39 57.35
1	1 1.47 3.45 5.26	10 14.71 34.48 66.67	6 8.82 20.69 42.86	9 13.24 31.03 81.82	3 4.41 10.34 33.33	29 42.65
Total	19 27.94	15 22.06	14 20.59	11 16.18	9 13.24	68 100.00

STATISTICS FOR TABLE OF FAMILY BY SUMPRD

Statistic	DF	Value	Prob
Chi-Square	4	21.614	0.000

TABLE OF MAG BY GENDER

MAG GENDER

Frequency Percent Row Pct Col Pct	0	1	Total
0	41 60.29 70.69 80.39	17 25.00 29.31 100.00	58 85.29
1	10 14.71 100.00 19.61	0 0.00 0.00 0.00	10 14.71
Total	51 75.00	17 25.00	68 100.00

STATISTICS FOR TABLE OF MAG BY GENDER

Statistic	DF	Value	Prob
Chi-Square	1	3.908	0.048

TABLE OF MAG BY SUMPRD

MAG SUMPRD

Frequency Percent Row Pct Col Pct	0	1	2	3	4	Total
0	18 26.47 31.03 94.74	14 20.59 24.14 93.33	13 19.12 22.41 92.86	7 10.29 12.07 63.64	6 8.82 10.34 66.67	58 85.29
1	1 1.47 10.00 5.26	1 1.47 10.00 6.67	1 1.47 10.00 7.14	4 5.88 40.00 36.36	3 4.41 30.00 33.33	10 14.71
Total	19 27.94	15 22.06	14 20.59	11 16.18	9 13.24	68 100.00

STATISTICS FOR TABLE OF MAG BY SUMPRD

Statistic	DF	Value	Prob
Chi-Square	4	9.365	0.053

TABLE OF STORE BY GENDER

STORE	GENDER		
Frequency Percent Row Pct Col Pct	0	1	Total
0	31 45.59 67.39 60.78	15 22.06 32.61 88.24	46 67.65
1	20 29.41 90.91 39.22	2 2.94 9.09 11.76	22 32.35
Total	51 75.00	17 25.00	68 100.00

STATISTICS FOR TABLE OF STORE BY GENDER

Statistic	DF	Value	Prob
Chi-Square	1	4.390	0.036

TABLE OF STORE BY SUMPRD

STORE	SUMPRD					
Frequency Percent Row Pct Col Pct	0	1	2	3	4	Total
0	18 26.47 39.13 94.74	11 16.18 23.91 73.33	10 14.71 21.74 71.43	6 8.82 13.04 54.55	1 1.47 2.17 11.11	46 67.65
1	1 1.47 4.55 5.26	4 5.88 18.18 26.67	4 5.88 18.18 28.57	5 7.35 22.73 45.45	8 11.76 36.36 88.89	22 32.35
Total	19 27.94	15 22.06	14 20.59	11 16.18	9 13.24	68 100.00

STATISTICS FOR TABLE OF STORE BY SUMPRD

Statistic	DF	Value	Prob
Chi-Square	4	20.691	0.000

TABLE OF TV BY SUMPRD

TV	SUMPRD					
Frequency Percent Row Pct Col Pct	0	1	2	3	4	Total
0	18 26.47 30.51 94.74	15 22.06 25.42 100.00	12 17.65 20.34 85.71	7 10.29 11.86 63.64	7 10.29 11.86 77.78	59 86.76
1	1 1.47 11.11 5.26	0 0.00 0.00 0.00	2 2.94 22.22 14.29	4 5.88 44.44 36.36	2 2.94 22.22 22.22	9 13.24
Total	19 27.94	15 22.06	14 20.59	11 16.18	9 13.24	68 100.00

STATISTICS FOR TABLE OF TV BY SUMPRD

Statistic	DF	Value	Prob
Chi-Square	4	9.110	0.058

TABLE OF VIT BY FVIT

VIT FVIT

Frequency Percent Row Pct Col Pct	0	1	Total
0	17 33.33 85.00 73.91	3 5.88 15.00 10.71	20 39.22
1	6 11.76 19.35 26.09	25 49.02 80.65 89.29	31 60.78
Total	23 45.10	28 54.90	51 100.00

Frequency Missing = 17

STATISTICS FOR TABLE OF VIT BY FVIT

Statistic	DF	Value	Prob
Chi-Square	1	21.158	0.000

TABLE OF MIN BY FMIN

MIN FMIN

Frequency Percent Row Pct Col Pct	0	1	Total
0	39 76.47 90.70 95.12	4 7.84 9.30 40.00	43 84.31
1	2 3.92 25.00 4.88	6 11.76 75.00 60.00	8 15.69
Total	41 80.39	10 19.61	51 100.00

Frequency Missing = 17

STATISTICS FOR TABLE OF MIN BY FMIN

Statistic	DF	Value	Prob
Chi-Square	1	18.469	0.000

TABLE OF CAFF BY FCAFF

CAFF FCAFF

Frequency Percent Row Pct Col Pct	0	1	Total
0	45 88.24 93.75 97.83	3 5.88 6.25 60.00	48 94.12
1	1 1.96 33.33 2.17	2 3.92 66.67 40.00	3 5.88
Total	46 90.20	5 9.80	51 100.00

Frequency Missing = 17

STATISTICS FOR TABLE OF CAFF BY FCAFF

Statistic	DF	Value	Prob
Chi-Square	1	11.655	0.001

TABLE OF MUSCLE BY FMUSCLE

MUSCLE	FMUSCLE		
Frequency Percent Row Pct Col Pct	0	1	Total
0	41 80.39 91.11 95.35	4 7.84 8.89 50.00	45 88.24
1	2 3.92 33.33 4.65	4 7.84 66.67 50.00	6 11.76
Total	43 84.31	8 15.69	51 100.00

Frequency Missing = 17

STATISTICS FOR TABLE OF MUSCLE BY FMUSCLE

Statistic	DF	Value	Prob
Chi-Square	1	13.363	0.000

TABLE OF HONEY BY FHONEY

HONEY	FHONEY		
Frequency Percent Row Pct Col Pct	0	1	Total
0	45 88.24 91.84 97.83	4 7.84 8.16 80.00	49 96.08
1	1 1.96 50.00 2.17	1 1.96 50.00 20.00	2 3.92
Total	46 90.20	5 9.80	51 100.00

Frequency Missing = 17

STATISTICS FOR TABLE OF HONEY BY FHONEY

Statistic	DF	Value	Prob
Chi-Square	1	3.804	0.051

TABLE OF BEE BY FBEE

BEE	FBEE		
Frequency Percent Row Pct Col Pct	0	1	Total
0	48 94.12 97.96 100.00	1 1.96 2.04 33.33	49 96.08
1	0 0.00 0.00 0.00	2 3.92 100.00 66.67	2 3.92
Total	48 94.12	3 5.88	51 100.00

Frequency Missing = 17

STATISTICS FOR TABLE OF BEE BY FBEE

Statistic	DF	Value	Prob
Chi-Square	1	33.306	0.000

TABLE OF WHEAT BY FWHEAT

WHEAT	FWHEAT		
Frequency Percent Row Pct Col Pct	0	1	Total
0	49 96.08 98.00 100.00	1 1.96 2.00 50.00	50 98.04
1	0 0.00 0.00 0.00	1 1.96 100.00 50.00	1 1.96
Total	49 96.08	2 3.92	51 100.00

Frequency Missing = 17

STATISTICS FOR TABLE OF WHEAT BY FWHEAT

Statistic	DF	Value	Prob
Chi-Square	1	24.990	0.000

TABLE OF PROSUPP BY FPROSUPP

PROSUPP	FPROSUPP		
Frequency Percent Row Pct Col Pct	0	1	Total
0	34 66.67 84.44 87.18	2 3.92 5.56 16.67	36 70.59
1	5 9.80 33.33 12.82	10 19.61 66.67 83.33	15 29.41
Total	39 76.47	12 23.53	51 100.00

Frequency Missing = 17

STATISTICS FOR TABLE OF PROSUPP BY FPROSUPP

Statistic	DF	Value	Prob
Chi-Square	1	21.876	0.000

TABLE OF AA BY FAA

AA	FAA		
Frequency Percent Row Pct Col Pct	0	1	Total
0	30 58.82 85.71 90.91	5 9.80 14.29 27.78	35 68.63
1	3 5.88 18.75 9.09	13 25.49 81.25 72.22	16 31.37
Total	33 64.71	18 35.29	51 100.00

Frequency Missing = 17

STATISTICS FOR TABLE OF AA BY FAA

Statistic	DF	Value	Prob
Chi-Square	1	21.560	0.000

TABLE OF SALT BY FSALT

SALT FSALT

Frequency Percent Row Pct Col Pct	0	1	Total
0	50 98.04 100.00 100.00	0 0.00 0.00 0.00	50 98.04
1	0 0.00 0.00 0.00	1 1.96 100.00 100.00	1 1.96
Total	50 98.04	1 1.96	51 100.00

Frequency Missing = 17

STATISTICS FOR TABLE OF SALT BY FSALT

Statistic	DF	Value	Prob
Chi-Square	1	51.000	0.000

APPENDIX I

SIGNIFICANT CHI-SQUARE RESULTS FOR PILOT STUDY

TABLE OF FRIEND BY AGE

FRIEND	AGE						
FREQUENCY / PERCENT / ROW PCT / COL PCT	13	14	15	16	17	18	TOTAL
0	6 16.22 18.75 100.00	8 21.62 25.00 66.67	10 27.03 31.25 100.00	6 16.22 18.75 100.00	0 0.00 0.00 0.00	2 5.41 6.25 100.00	32 86.49
1	0 0.00 0.00 0.00	4 10.81 80.00 33.33	0 0.00 0.00 0.00	0 0.00 0.00 0.00	1 2.70 20.00 100.00	0 0.00 0.00 0.00	5 13.51
TOTAL	6 16.22	12 32.43	10 27.03	6 16.22	1 2.70	2 5.41	37 100.00

STATISTICS FOR TABLE OF FRIEND BY AGE

STATISTIC	DF	VALUE	PROB
CHI-SQUARE	5	14.183	0.014

TABLE OF FRIEND BY OSNUMPRD

FRIEND	OSNUMPRD					
FREQUENCY / PERCENT / ROW PCT / COL PCT	0	1	2	3	4	TOTAL
0	14 37.84 43.75 100.00	12 32.43 37.50 92.31	5 13.51 15.63 83.33	1 2.70 3.13 33.33	0 0.00 0.00 0.00	32 86.49
1	0 0.00 0.00 0.00	1 2.70 20.00 7.69	1 2.70 20.00 16.67	2 5.41 40.00 66.67	1 2.70 20.00 100.00	5 13.51
TOTAL	14 37.84	13 35.14	6 16.22	3 8.11	1 2.70	37 100.00

STATISTICS FOR TABLE OF FRIEND BY OSNUMPRD

STATISTIC	DF	VALUE	PROB
CHI-SQUARE	4	16.268	0.003

TABLE OF FAMILY BY OSNUMPRD

FAMILY	OSNUMPRD					
FREQUENCY / PERCENT / ROW PCT / COL PCT	0	1	2	3	4	TOTAL
0	13 35.14 54.17 92.86	7 18.92 29.17 53.85	3 8.11 12.50 50.00	0 0.00 0.00 0.00	1 2.70 4.17 100.00	24 64.86
1	1 2.70 7.69 7.14	6 16.22 46.15 46.15	3 8.11 23.08 50.00	3 8.11 23.08 100.00	0 0.00 0.00 0.00	13 35.14
TOTAL	14 37.84	13 35.14	6 16.22	3 8.11	1 2.70	37 100.00

STATISTICS FOR TABLE OF FAMILY BY OSNUMPRD

STATISTIC	DF	VALUE	PROB
CHI-SQUARE	4	12.168	0.016

TABLE OF STORE BY Q5NUMPRD

STORE Q5NUMPRD

FREQUENCY / PERCENT / ROW PCT / COL PCT	0	1	2	3	4	TOTAL
0	14	13	5	2	0	34
	37.84	35.14	13.51	5.41	0.00	91.89
	41.18	38.24	14.71	5.88	0.00	
	100.00	100.00	83.33	66.67	0.00	
1	0	0	1	1	1	3
	0.00	0.00	2.70	2.70	2.70	8.11
	0.00	0.00	33.33	33.33	33.33	
	0.00	0.00	16.67	33.33	100.00	
TOTAL	14	13	6	3	1	37
	37.84	35.14	16.22	8.11	2.70	100.00

STATISTICS FOR TABLE OF STORE BY Q5NUMPRD

STATISTIC	DF	VALUE	PROB
CHI-SQUARE	4	16.868	0.002

TABLE OF COACH BY Q5NUMPRD

COACH Q5NUMPRD

FREQUENCY / PERCENT / ROW PCT / COL PCT	0	1	2	3	4	TOTAL
0	14	10	3	1	0	28
	37.84	27.03	8.11	2.70	0.00	75.68
	50.00	35.71	10.71	3.57	0.00	
	100.00	76.92	50.00	33.33	0.00	
1	0	3	3	2	1	9
	0.00	8.11	8.11	5.41	2.70	24.32
	0.00	33.33	33.33	22.22	11.11	
	0.00	23.08	50.00	66.67	100.00	
TOTAL	14	13	6	3	1	37
	37.84	35.14	16.22	8.11	2.70	100.00

STATISTICS FOR TABLE OF COACH BY Q5NUMPRD

STATISTIC	DF	VALUE	PROB
CHI-SQUARE	4	12.693	0.013

APPENDIX J

SIGNIFICANT ANALYSIS OF VARIANCE RESULTS FOR EXPERIMENTAL STUDY

General Linear Models Procedure
Least Squares Means

AGE	CAT1 LSMEAN	Std Err LSMEAN	Pr > |T| HO:LSMEAN=0	Pr > |T| HO: LSMEAN(i)=LSMEAN(j) i/j	1	2	3	4
15	38.7500000	5.5626757	0.0001	1	.	0.7897	0.0165	0.7584
16	40.5263158	3.6095406	0.0001	2	0.7897	.	0.0042	0.9271
17	54.0625000	2.7813378	0.0001	3	0.0165	0.0042	.	0.0328
18	41.1111111	5.2445409	0.0001	4	0.7584	0.9271	0.0328	.

AGE	CAT6 LSMEAN	Std Err LSMEAN	Pr > |T| HO:LSMEAN=0	Pr > |T| HO: LSMEAN(i)=LSMEAN(j) i/j	1	2	3	4
15	27.5000000	6.0010854	0.0001	1	.	0.1145	0.0031	0.0440
16	38.9473684	3.8940184	0.0001	2	0.1145	.	0.0665	0.4265
17	48.1250000	3.0005427	0.0001	3	0.0031	0.0665	.	0.5675
18	44.4444444	5.6578776	0.0001	4	0.0440	0.4265	0.5675	.

General Linear Models Procedure
Least Squares Means

GENDER	CAT1 LSMEAN	Std Err LSMEAN	Pr > |T| HO:LSMEAN=0	Pr > |T| HO: LSMEAN1=LSMEAN2
0	49.2156863	2.3036529	0.0001	0.0371
1	39.4117647	3.9900439	0.0001	

GENDER	CAT6 LSMEAN	Std Err LSMEAN	Pr > |T| HO:LSMEAN=0	Pr > |T| HO: LSMEAN1=LSMEAN2
0	45.4901961	2.4299154	0.0001	0.0223
1	34.1176471	4.2087370	0.0001	

General Linear Models Procedure
Least Squares Means

MAG	CAT3 LSMEAN	Std Err LSMEAN	Pr > |T| HO:LSMEAN=0	Pr > |T| HO: LSMEAN1=LSMEAN2
0	69.3965517	3.6631400	0.0001	0.0183
1	92.5000000	8.8220093	0.0001	

APPENDIX K

SIGNIFICANT ANALYSIS OF VARIANCE RESULTS FOR PILOT STUDY

GENERAL LINEAR MODELS PROCEDURE
LEAST SQUARES MEANS

Q9OTHER	PRETEST LSMEAN	STD ERR LSMEAN	PR > |T| HO:LSMEAN=0	PR > |T| HO: LSMEAN1=LSMEAN2
0	61.7058824	1.4415966	0.0001	0.0169
1	49.0000000	4.8531373	0.0001	

FAMILY	CAT5 LSMEAN	STD ERR LSMEAN	PR > |T| HO:LSMEAN=0	PR > |T| HO: LSMEAN1=LSMEAN2
0	69.1666667	3.5778026	0.0001	0.0479
1	81.5384615	4.8612765	0.0001	

VITA

Theresa Marlene Horinek

Candidate for the Degree of

Master of Science

Thesis: IMPACT OF SPORTS NUTRITION EDUCATION ON ADOLESCENTS' NUTRITIONAL KNOWLEDGE AND USE OF ERGOGENIC PRODUCTS

Major Field: Nutritional Sciences

Biographical:

Personal Data: Born in Garnett, Kansas, January 14, 1964, the daughter of Leo R. and Mary L. Wiederholt.

Education: Graduated from Central Heights High School, Richmond, Kansas, in May 1982; received Bachelor of Science Degree in Dietetics from Kansas State University at Manhattan in December, 1986; completed requirements for the Master of Science degree at Oklahoma State University in December, 1993.

Professional Experience: Outpatient Dietitian/Lifelinks Coordinator, Arkansas City Memorial Hospital, Arkansas City, Kansas, January, 1987, to August, 1988; Chief Clinical Nutrition Manager, Jackson County Memorial Hospital, Altus, Oklahoma, August, 1988, to May, 1991; Consultant Dietitian, English Village Nursing Home, Altus, Oklahoma, September, 1990, to February, 1991; Graduate Research Associate, Cooperative Extension, Department of Nutritional Sciences, Oklahoma State University, May, 1991, to December, 1992; Consultant Dietitian, Otoe-Missouria Tribe WIC Program, Red Rock, Oklahoma, February, 1992 to present.

Professional Organizations: American Dietetic Association; Oklahoma Dietetic Association; Society of Nutrition Education.