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A nutrition education program to increase the consumption of whole grains among college students at the University of New Hampshire dining halls

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A NUTRITION EDUCATION PROGRAM TO INCREASE THE CONSUMPTION OF
WHOLE GRAINS AMONG COLLEGE STUDENTS
AT THE UNIVERSITY OF NEW HAMPSHIRE DINING HALLS

BY

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B.S., Colby-Sawyer College, 2004

THESIS

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ABSTRACT

A NUTRITION EDUCATION PROGRAM TO INCREASE THE CONSUMPTION OF
WHOLE GRAINS AMONG COLLEGE STUDENTS
AT THE UNIVERSITY OF NEW HAMPSHIRE DINING HALLS

by

Katharine Rocheford

University of New Hampshire, May, 2009

The relationship between whole grain consumption and a reduced risk of some

chronic disease is prominent in the literature. Yet consumers and college students fail to

meet the current recommendations. This study investigated the impact of whole grain

education materials and whole grain labels placed in the UNH dining halls to improve

students' knowledge and whole grain consumption. Survey responses from 504 students

were analyzed for whole grain knowledge scores and consumption levels from before and

after this program. While overall knowledge score and whole grain consumption did not

increase due to this program, a significant positive relationship was seen between

knowledge and whole grain intake. Twenty percent of the post-survey respondents did

however report increasing whole grain intake due to the influence of the new point-of-

choice labels. A passive nutrition education program can be influential in increasing

whole grain intake in some college students, but more research is needed to determine the

most effective method.

CHAPTER I: LITERATURE REVIEW

Recommendations and Consumption of Whole Grains

According to both the *2005 Dietary Guidelines for Americans* and

MyPyrmaid.gov developed by the United States Department of Agriculture (USDA), the

current recommendation for whole grains is to consume at least half of the daily grain

servings as whole grains. A more specific recommendation suggests eating 3 ounce-

equivalents of whole grains per day, which corresponds to 48 grams of whole grain per

day (1, 2). An ounce-equivalent is equal to a 100% whole grain food in the following

portions: 1 slice of bread, 1 "mini" bagel, 1/2 an English muffin, 3 cups of popcorn, 1 cup

of cold cereal as well as 1/2 cup of cooked rice, pasta or hot cereal (2).

Despite these recommendations, consumers are failing to reach these goals and

are potentially missing out on the many health benefits associated with whole grain

intake. According to data from the USDA's *Continuing Survey of Food Intakes by*

Individuals (CSFII) in 1994-96 and 1998, Americans consumed on average 6.7 ounces of

grains each day, yet only 1.1 ounces were whole grain (34% of the recommended 3

ounce-equivalents). Only 7% of those surveyed actually met the current intake

recommendation (3). More recent data from the National Health and Examination

Survey (NHANES) 2001-2002 revealed that Americans appear to consume only 10% of

their grains as whole grains, instead of the suggested 50%. The majority of these whole

grains came from ready-to-eat cereals (29%), breads (25%) and hot cereals (14%).

Popcorn and crackers were minor contributors, 12% and 6% respectively, to total whole

grain intake (4). Data collected from 7-day diet records of college-aged students enrolled in a Virginia university introductory nutrition course highlights the fact that college students also fail to meet the recommendation. Among these students, the average intake level of total grain foods each day was 5.4 servings, but only 0.7 servings were whole grain (5). Another study from this same university analyzed 4-day diet records from college freshman that indicated a mean whole grain consumption level of 1.4 servings/day (6).

While consumption levels appear to typically fall well short of the recommendation, data from NHANES illustrates that people who do consume popcorn have a significantly higher mean intake of whole grains overall than non-popcorn consumers, 2.5 servings per day and 0.7 servings per day, respectively. From this large national cohort, of whom only 6% were popcorn consumers, the mean popcorn intake was approximately 39 grams per day or roughly 10 cups (7).

Definition of Whole Grains

Inconsistency in developing a definition of whole grains has led, in part, to the confusion identifying and labeling these products, which may be one explanation for the low level of consumption. Currently the Food and Drug Administration (FDA) does not have a formal definition in use, but provides guidance to manufacturers (8). The AACC International, formerly the American Association of Cereal Chemists, developed the currently accepted definition in 1999. The definition is as follows: "whole grains shall consist of the intact, ground, cracked, or flaked caryopsis, whose principal anatomical components – the starchy endosperm, germ, and bran – are present in the same relative proportions as they exist in the intact caryopsis"(9). The downside to this definition is

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the fact that it may exclude certain grains that have been minimally processed but no longer contain the appropriate ratio. For example pearled barley is processed to remove the inedible husk, but a small portion of the bran is also removed and therefore would not qualify as a whole grain using this definition. Hulled barley on the other hand is considered a whole grain (10).

In order to make it easier for consumers to understand and identify whole grains, The Whole Grains Council developed the following "consumer-friendly" definition: "whole grains or foods made from them contain all the essential parts and naturally occurring nutrients of the entire grain seed. If the grain has been processed (eg, cracked, crushed, rolled, extruded, lightly pearled, and/or cooked), the food product should deliver approximately the same rich balance of nutrients that are found in the original grain seed" (10).

Structure of Whole Grains

An individual grain kernel is comprised of three parts: the bran, the germ and the endosperm (Figure 1). In addition to these three components, the kernel also has a thick protective outer husk that is inedible and removed during processing. The bran is the outer layer that surrounds the germ and endosperm as a means of protection from environmental factors such as weather, insects, and bacteria. The germ is the plant's embryo that when nourished by the starchy endosperm will sprout into a new plant (11). These three components provide various nutrients to those who consume whole grain foods. The endosperm is predominately carbohydrates, with some protein and small amounts of B-vitamins. The germ is highly concentrated in minerals (Calcium, Magnesium, Potassium, Phosphorus, Sodium and Iron), B-vitamins (Thiamin, Riboflavin,

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Niacin and Pantothenic acid), vitamin E as well as selenium and phenolic acids. The outside bran layer contains the same B-vitamins, minerals, and phytochemicals as the germ, but also provides fiber and additional minerals (Copper, Zinc, Selenium, Manganese)(11-13). The synergistic action of these various nutrients may contribute to the potential health benefits of whole grains (14).
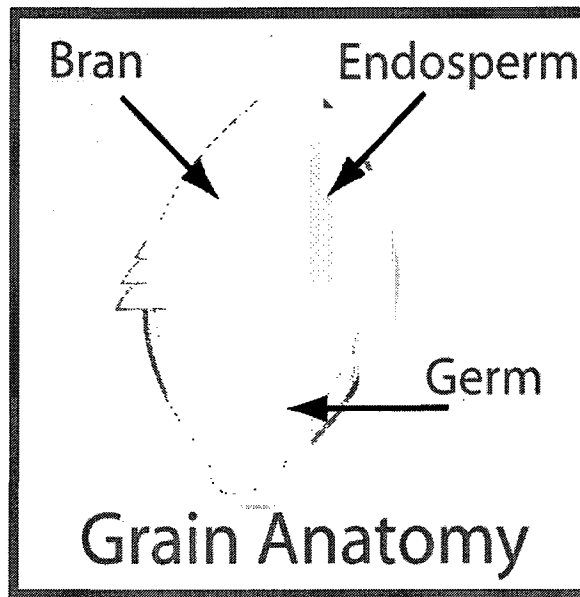
Figure 1. Components of a Whole Grain Kernel
Image use courtesy Bob's Red Mill

In comparison, refined grains have undergone processing in which both the bran and the germ have been removed. This process ultimately removes many of the desired nutrients from the grain product. Only some of these nutrients are typically added back into the refined product via enrichment and fortification practices (Figure 2) (15).

4
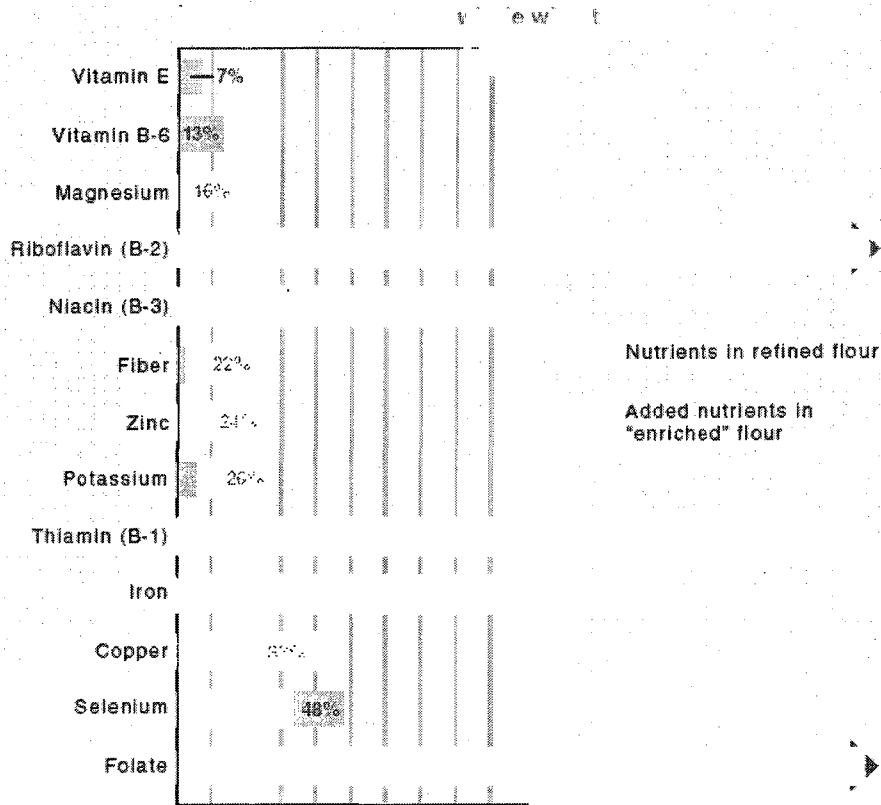
Figure 2. Nutrient Content of Whole vs. Refined Grains
(Liebman. Whole grains: the inside story. Nutrition Action Health Letter 2006;33:1-5.)

In addition to fiber, vitamins and minerals, whole grain foods contain a high level of antioxidants (Figure 3) that may provide various health benefits due to their protective nature against oxidative damage from free radicals. The level of antioxidants in the grain kernel yields a per serving capacity higher than some common fruits and vegetables, but not as high as berries. The level of antioxidant capacity within whole grains is compromised from a mixture of compounds including vitamin E, selenium, phenolic acids and flavonoids (16).

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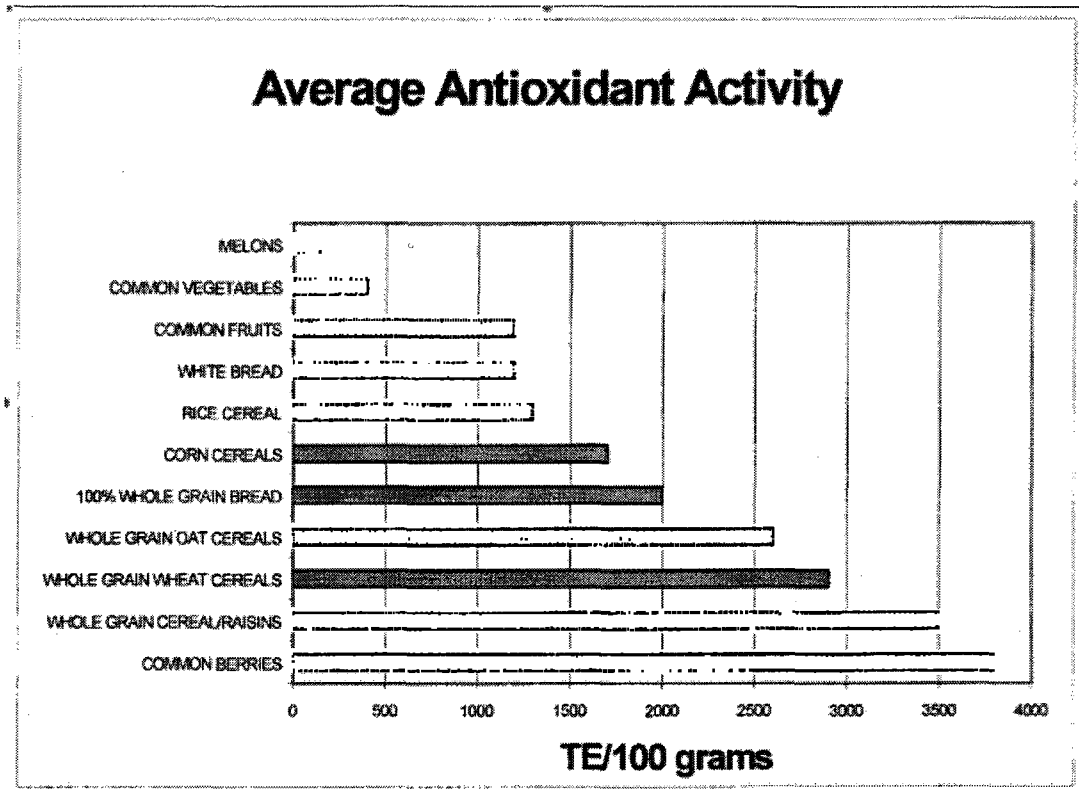
Figure 3. Average Antioxidant Activity of Whole Grains

TE: Trolox Equivalents
(Miller HE, Rigelhof F, Marquart L, Prakash A, Kanter M. Antioxidant content of whole grain breakfast cereals, fruits and vegetables. J Am Coll Nutr 2000;19:312S-9S.)

Health Benefits of Whole Grains

Cardiovascular Disease (CVD)

Whole grains are linked to a reduction in hypertension, total cholesterol levels and

low-density lipoprotein (LDL) cholesterol levels, which can decrease the risk of

developing CVD (17-21). Mildly hypercholesterolemic and hypertensive men and

women were able to significantly lower both systolic and diastolic blood pressure by

replacing white flour and white rice with their whole grain counterparts and adding

barley to their diet over a 5-week time span (18). Data from female health professionals

over the age of 45 participating in the Women's Health Study also illustrated that whole

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grain intake was associated with a significant reduction in hypertension risk. With each additional serving of whole grain per day these women consumed a 4% reduction in risk was calculated. Within this study whole grains were effective at reducing the risk of hypertension, but refined grains were not associated with an increased or decreased risk of hypertension (19).

A thorough review article examining evidence of the cholesterol lowering role of oats and oatmeal further supports that this relationship has held true throughout the past ten years (17). The multiple studies reviewed indicated significantly lower total and LDL cholesterol measurements after oatmeal consumption. The primary explanation for this occurrence is the soluble fiber in the oats that has the ability to bind bile acids in the intestine therefore increasing their excretion. The body is then forced to pull from its own cholesterol pools to make new bile acids for future lipid digestion. Not only does it seem that LDL cholesterol levels decrease, but oats also help decrease the concentration of small, dense LDL particles that appear to be more dangerous than large, dense LDL in regards to their susceptibility for oxidation that can further lead to cardiovascular damage (17). This evidence clearly supports the numerous other research studies claiming whole grains provide a reduction in the risk of developing cardiovascular disease.

A variety of large population-based observational studies have also focused on whole grains and cardiovascular disease, including the Nurses' Health Study, the Insulin Resistance Atherosclerosis Study, the Atherosclerosis Risk in Communities (ARIC) study, the Estrogen Replacement and Atherosclerosis trial, as well as the Multi-Ethnic Study of Atherosclerosis (MESA) Study. Results from all of these studies support the idea that consumption of whole grains may protect again coronary heart disease and the

risk of heart failure as well as may limit the development of coronary atherosclerosis and the progression of intimal medial thickness within the carotid artery (22-26). While much of the current research shows a protective relationship between whole grains and CVD, the MESA study concluded that whole grain consumption was unrelated to subclinical CVD among men and women ages 45 to 84 (27). All of these studies followed similar methods by using food frequency questionnaires (FFQ) to determine dietary intake and included middle to older aged subjects. Despite these similar methods, the MESA study results did not match that of the other studies and therefore illustrates a need for further research to fully understand this relationship.

Diabetes

Similarly to CVD, extensive research has been performed to examine the potential for whole grains to be protective against diabetes. The Health Professionals Follow-up Study and the Nurse's Health Study conducted data analysis over a long time span (10-12 years) among a large cohort of men and women, respectively. Both of these studies gathered dietary data via a self-reported semi-quantitative FFQ and sent out additional questionnaires and surveys to gather supplemental data on demographics, lifestyle behaviors, and health information related to blood glucose and diabetes (28, 29). Among the Health Professional subjects, the highest quintile of whole grain intake was 3.2 servings per day. Comparing this quintile to the lowest quintile (0.4 servings per day) a significant inverse association was found between whole grain consumption and risk of Type II diabetes. This association remained significant even after adjusting for potential confounding factors. While whole grain intake was clearly a protective factor, the intake of refined grains did not show any considerable association with risk of Type II diabetes

(28). The Nurses' Health Study yielded the same results when comparing the highest quintile of intake with the lowest. Additionally, this study did find a positive association between refined grain intake and risk of Type II diabetes. These findings also remained significant after confounding factors were taken into consideration (29).

While these results appear to support whole grain consumption, there were limitations in that the data was self-reported from the subjects and could be biased. Keeping this in mind and comparing the results to a recent randomized, crossover feeding trial shows that the link between whole grains and diabetes is not yet fully understood. A recent study conducted in Sweden examined the effect of a 6-week whole grain or refined grain diet on thirty subjects who were already moderately overweight. Within this study neither diet affected insulin sensitivity or blood glucose levels when comparing baseline to the 6-week time point. Additionally there was no difference in biochemical values between the diet groups after 6-weeks (30). Though this Swedish study did not show beneficial results of whole grains on diabetes, a recent German study concluded that a 4-week dietary intervention of a low calories whole grain product significantly improved fasting blood glucose and insulin resistance score over that of a low calorie meal replacement product (31). The discrepancy between these two clinical trials illustrates the need to further research the relationship between whole grains and diabetes.

Cancer

Whole grains' protective action against cancer is related to the benefits of dietary fiber, antioxidants and the controlled glycemic response whole grains elicit. The National Institute of Health – American Association of Retired Persons (NIH-AARP)Diet and Health Study followed subjects over a five-year span to gather whole grain intake

and cancer incidence data. While total dietary fiber was not associated with colon cancer, fiber exclusively from grains was associated with a lower risk of colorectal cancer. Specifically, an inverse association was revealed between whole grain intake and risk of colorectal cancer, with a significant 20% decrease in risk between subjects in the lowest quintile compared to the highest quintile. The reduction in risk for rectal cancer was stronger than that of colon cancer, as a 35% decrease in rectal cancer risk occurred between the highest and lowest quintiles (32). These researchers further analyzed this large study to conclude that dietary fiber from grains as well as whole grain intake was associated with a lower risk of small intestinal cancer, a much more rare form (33).

A large epidemiological study conducted in the San Francisco Bay Area examined grain intake among pancreatic cancer patients via a semi-quantitative FFQ. Consumption of at least two servings of whole grains per day resulted in a lower risk of pancreatic cancer compared to less than one serving per day. Consumption of brown rice and tortillas elicited similar results. As with other studies, dietary fiber as a whole was also inversely associated with a decreased risk of pancreatic cancer, therefore not ruling out the impact of fruits and vegetables in addition to whole grains (34).

A review compiling research on the potential mechanisms for whole grains' protective nature towards cancer highlights some of the current evidence. These potential mechanisms include: 1. fiber's role as a bulking agent to accelerate bowel transit time in the large intestine, 2. fiber's ability to bind and dilute harmful secondary bile acids, 3. whole grains' slower glycemic and insulin response upon absorption to control insulin levels that can increase cell growth of colon and tumor cells, as well as 4. the antioxidant capacity of whole grains to limit oxidative damage throughout the body (35).

Fiber, antioxidants and phytoestrogens have also been proposed as specific mechanisms for the protective role whole grains may have in reducing the risk of developing breast cancer (35). However, data from one large prospective epidemiological study of postmenopausal women found no interaction present between whole grain intake and the use of hormone replacement therapy on the risk of breast cancer (36). In another group of postmenopausal women from the Iowa Women's Health Study, whole grain consumption was unrelated to breast cancer risk (37). Although there is good evidence regarding whole grain and colon cancer, these findings suggest a need for further research in the area of whole grains and breast cancer.

Obesity

In the United States approximately one-third of the population, almost 72 million people, are considered obese and more than 60% are overweight or obese (38). The Youth Risk Behavior Surveillance System, a survey among high school students nationwide, further illuminates the obesity trend among adolescents. Data from 2007 revealed that 13% of the students surveyed were obese, while approximately 16% were considered overweight (39). As these high school students enter college there is a potential for further weight gain as unlimited dining hall meal plans allow students to eat as often and as much as they like. With obesity being a risk factor for many other chronic diseases, such as CVD and diabetes, it is important to educate young adults of practices that can control the development of such a major public health concern and prevent the development of negative health outcomes later on in life.

The consumption of whole grains is one recommended strategy for maintaining a healthy weight according to MyPyramid (2). The fiber within whole grains is digested

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much slower than those less complex sugars found in refined grains. This provides a delay in gastric emptying that allows for the full and satiated feeling to last longer, thereby limiting the desire to eat more food at that meal or snack quickly after the meal (11).

Researchers are currently examining whole grain consumption and the relationship to weight status and body mass index (BMI). BMI is a ratio comparing a person's height and weight to place them in a designated category of underweight, healthy weight, overweight or obese (40). Among a study population of 159 college students the average level of whole grain consumption was only 0.7 servings per day, coming mostly from ready-to-eat cereals and bread (5). While this consumption level was well below the current recommendation there was a significant difference among students in the healthy BMI category compared to those who were overweight or obese. Students with a healthy BMI had a significantly higher intake of whole grains (0.8 servings per day) compared to overweight or obese students (0.6 and 0.3 servings per day respectively). Among these healthy weight students 14.8% of their total grain intake came from whole grains, while only 9.1% and 5.9% of the overweight and obese student's total grain intake was from whole grains. Additionally, the fiber intake among normal weight students was significantly higher than those who were overweight or obese, despite the fiber level being well below the daily recommendation for all the students (5). This evidence supports the fact that whole grains may help maintain a healthy weight, but also indicates the need to increase the whole grain intake level among college students via nutrition education and other types of interventions.

Data from the Netherlands Cohort Study (NLCS) also indicated an inverse association between whole grain intake and BMI status. For both men and women, a high intake of whole grain foods correlated to a lower BMI and therefore a lower risk of being in the overweight or obese category (41). Both of the NLCS and college population study were of cross-sectional design, which prevents any type of causality conclusions to be made, leading to only correlations that are effected by other factors such as general lifestyle behaviors and other dietary choices.

NHANES data from 1999-2000 further strengthens the whole grain association with healthy weight. Adult women within this cohort consumed on average 0.76 servings of whole grains per day. Only 6% of this population actually met the current recommendation of 3 servings per day. Women who consumed at least one serving of whole grain per day were found to have a significantly lower BMI and waist circumference (WC) compared to those who consumed no whole grains. While whole grain intake in this population appeared to help reduce BMI and WC, both indicators of health status, the mean levels of each anthropometric measurement were still above the optimal ranges (42). Similar national cohort studies, including both male and female adults, also found an inverse association between BMI and weight gain and the consumption of whole grain foods (21, 43-46).

While this research offers support for the benefit of whole grain foods on weight control, one large epidemiological British study revealed conflicting results. Over 2000 male and female subjects of varying ages from the Dietary and Nutritional Survey of British Adults provided data on their eating habits as well as body weight, BMI and WC. The results from the 2000-2001 collection period indicated that there was no association

between whole grain intake and BMI, body weight or WC measurement. These results were unexpected as the 1986-1987 collection period of this study found similar results as the previous studies, indicating a beneficial relationship between whole grains and weight, BMI and WC (47). These unexpected results illustrate the need for further studies that follow consistent methods for determining actual whole grain consumption. The various techniques of collected dietary intake as well as the difficulty in accurately determining which foods are whole grains can lead to over- or underestimation of actual intake among subjects.

Other Health Concerns

In addition to these major chronic diseases, whole grains have also been beneficially linked to other health concerns such as metabolic syndrome and gastrointestinal health. However, the number of studies focused on these conditions is minimal compared to those analyzing whole grains and chronic disease.

Metabolic syndrome is a condition characterized as a clustering of metabolic risk factors that include: abdominal obesity, elevated triglycerides, elevated blood pressure, impaired fasting blood glucose, and low levels of high-density lipoproteins (HDL). The presence of these risk factors is associated with the potential for the future development of CVD and/or diabetes (48). In a recent study among older adults, only 16% of men and 7% of women ate at least 3 servings of whole grains per day, with the rest of the group falling short at approximately 1.6 and 1.3 servings per day, respectively. Within this cohort those subjects that consumed more whole grains had a significantly lower risk of having metabolic syndrome as well as a significantly lower risk of CVD mortality (49).

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While soluble fiber has been discussed as a potential mechanism for whole grains' role in lowering cholesterol levels, the insoluble fiber found in whole grain products, such as brown rice and whole wheat, is often the focus in regards to gastrointestinal health due to the function of improving overall bowel movements by increasing fecal weight and speeding up the transit time for which the fecal matter passes through the colon before excretion. Along with the insoluble fiber, whole grains also provide resistant starches and oliogosaccharides that move through the small intestine undigested that add to the fecal matter for better excretion. The microflora found in the colon thrive on fermenting these undigested carbohydrates to release short-chain fatty acids, such as butyrate. The butyrate formed is then used as an energy source for the mucosa cells along the colon wall that aid in the improved transit time (11).

Research suggests that oligosaccharides, in general, may provide prebiotic benefits by increasing the concentration of bifidobacteria while helping to limit the amount of *E. coli* found within the colon (11). Recently, research on the oligosaccharides found directly in whole grain products has been performed.. A group of thirty-two subjects participated in a double-blind, randomized, placebo-controlled crossover feeding trial using 100% whole grain breakfast cereal compared to a placebo of wheat bran cereal. Upon completion of the trial, consumption of the whole grain cereal resulted in significantly higher numbers of healthy bifidobacteria compared to baseline data as well as the wheat bran (50). This type of experimental research design is limited in the whole grain field and further studies must be completed to determine if this potential benefit is consistently seen among whole grain consumers.

While numerous health benefits do appear to be related to whole grain consumption, many of these same studies also indicate that people who consume whole grains tend to be well-educated and lead healthier lifestyles in regards to physical activity, not smoking, limiting alcohol consumption and making nutritious diet choices. Further research, preferably clinical trials, need to be performed to corroborate the whole grain health benefits found from these large epidemiological studies and minimize any of these confounding lifestyle factors from skewing the data.

Whole Grain Biomarker

One major limitation of many of the past whole grain research studies is the use of self-reported dietary intake data from FFQ, 24 hour recalls and/or 3-day diet records. The potential for subject bias is high using these data collection methods to determine actual whole grain consumption levels. The recent discovery of a potential whole grain biomarker, alkylresorcinols, will allow future researchers to determine whole grain consumption objectively.

Alkylresorcinols (ARs) are phenolic lipids found in the bran layer of wheat and rye (51, 52). These compounds are absorbed in the small intestine at 60% efficiency (53) and are then transported via the lymphatic system to be incorporated into red blood cells (54) and further carried throughout the body via very low density (VLDL) and high density lipoproteins (HDL)(55). More recent evidence has shown specific AR metabolites in human urine that can be used to further determine whole grain intake (56, 57). Promising research has shown that both plasma AR concentrations and urinary metabolites correlate with whole grain intake of wheat and rye products and therefore

could be used as a biochemical marker to determine whole grain consumption more accurately than methods used in the past (56-60).

Consumer Knowledge and Attitudes Towards Whole Grains

While the current recommendations and health benefits of whole grains are well established within the scientific literature and new scientific methods to test consumption are being discovered, consumer knowledge and attitudes are an important factor in increasing consumption among the general public. Common barriers consumers indicate that prevent them from eating whole grain foods include cost, taste, texture and lack of knowledge about preparation methods (61). Additionally, a lack of knowledge about whole grain health benefits and difficulty identifying which products are whole grain have also been shown to impact consumers' decision to buy and eat whole grains (61-63). Consumers are aware of the term "whole-grain", relate this term to breads and cereals, comment on the fiber content and describe these products as being less processed or containing the whole grain (64), however confusion arises when terms such as "multi-grain", "organic" and "dark brown" are found on package labels (61). A school-based intervention among elementary students, parents and teachers proved a step in the right direction as the adults and children responded positively to the taste and texture of the whole grain foods presented to them. Both adults and children suggested further taste testing and slowly incorporating whole grains into common foods served in the cafeteria, such as pizza and macaroni and cheese. However, knowledge in identifying these products were still limited among the adults (65).

Labeling and Identification

Much of the confusion among consumers stems from the inability to accurately identify whole grain foods and products. This confusion is partially due to the lack of consistent labeling regulations and clear definition use among manufacturers. While the AACC International and The Whole Grains Council both have definitions of whole grains, as previously mentioned, these are not listed directly on food labels. However, consumers are bombarded with a variety of items on food labels from an approved health claim, whole grain stamps and even individual symbols developed directly by each manufacturer.

The FDA set forth a standard definition in 1999 that foods are considered whole grain foods if they contain 51% or more whole grain ingredients by weight for the amount generally consumed. Based upon this standard, manufacturers can then utilize two FDA approved qualified health claims to help indicate their product is whole grain. These health claims include: "Diets high in plant foods--i.e., fruits, vegetables, legumes, and whole-grain cereals--are associated with a lower occurrence of coronary heart disease and cancers of the lung, colon, esophagus, and stomach" or "Diets rich in whole grain foods and other plant foods and low in total fat, saturated fat, and cholesterol, may help reduce the risk of heart disease and certain cancers." (66). Though these health claims may guide the consumer in the right direction, they do not provide information on the exact amount of whole grains in each product, nor do they differentiate 100% whole grain products from those that contain whole and refined grains.

The Whole Grains Council, a non-profit consumer advocacy group, developed whole grain stamps (Figure 4) which manufacturers can use on their products only after

passing eligibility based upon the product's formulation and becoming a dues paying

member of The Whole Grains Council. The amount of whole grain in each serving of the

product will determine which stamp will be placed on the product packaging. The 100%

whole grain stamp is used for products that have all of their grain ingredients in the whole

grain form. The basic stamp is used for any other product that has at least 8 grams of

whole grain per serving, but also contains some refined grain ingredients. All of these

stamps list the exact gram amount of whole grains per serving so the consumer can

determine exactly how much they are consuming from that product towards the

recommended 48 grams (67). While this stamp has all the necessary information the

consumer needs to determine if a product is whole grain, the use of the stamp is entirely

voluntary by each manufacturer. This once again leads to an inconsistency in labeling,

which can cause confusion for the consumer.
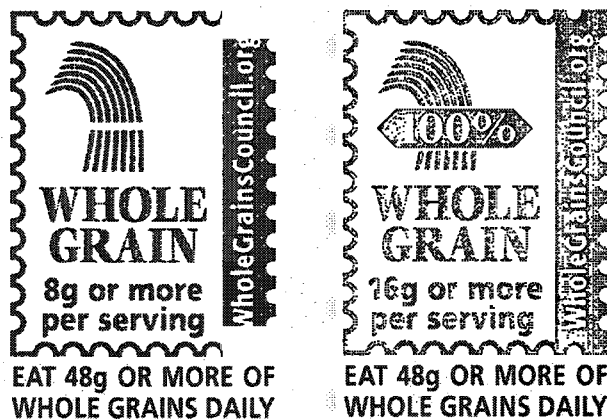
Figure 4. Whole Grains Council Stamps
Image use courtesy Oldways and the Whole Grains Council, wholegrainscouncil.org

To further confuse the consumer, some manufacturers have developed their own

whole grain identification markers. For example, General Mills recently reformulated

many of their cereals to contain as least some whole grain and promotes these cereals in

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the company's "Big G" line with their own whole grain indicator (Figure 5). While this

indicator does not reveal the amount of whole grain per serving, some of the "Big G"

cereals do use The Whole Grains Council Stamp, but not always (68). Many other

companies simply use the words "whole grain" or "made with whole grains" on the labels

of their products, but this does not provide all the details that consumers need to make an
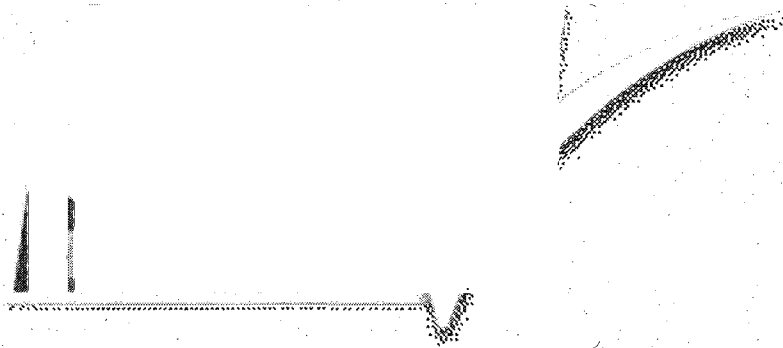
educated decision.

Figure 5. General Mills Whole Grain Cereal Label
Image use courtesy General Mills, www.eatbetteramerica.com/wholegrainnation

Nutrition Education Among College Students

College students are an important target population for nutrition education as they

are beginning to live away from their parents and are developing their own dietary and

lifestyle habits that they will carry throughout their adult lives. Developing health

promoting dietary habits at this stage of life may help their overall health and prevent the

development of chronic diseases in the future (6).

While in high school, many students rely on their parents to cook meals for them

that are healthful and well balanced. As students progress to living alone at college with

a wide variety of food choices available in the dining halls, research has indicated these

students believe they begin to eat more food overall and make less healthy choices. Though students have indicated that they are interested in learning more about healthful eating and could make a dietary change for the better if they wanted to, many feel that the onset of a diet-related disease or illness would be the major incentive and motivation to make such a change (6). Unfortunately, by the time a diet-related illness occurs it may be too late to reverse the damage already accrued. Educating young adults about dietary changes that can prevent the onset of such chronic conditions should be the focus of future nutrition programs.

There are few published research studies examining college students' whole grain knowledge, whole grain identification ability, and understanding of the whole grain health benefits. However research has been performed to test general nutrition and dietary guideline knowledge among this population as well as the students' use and understanding of food labels. A cross-sectional study at the University of Vermont, surveyed 200 students about nutrition knowledge and eating behaviors. Overall, nutrition knowledge was related to better food choices and eating behaviors. In regards to whole grains, those students consuming the recommended amount of whole grains had significantly better nutrition knowledge scores than those students eating less than recommended (69). In addition to knowledge, college students have also been shown to use and have a positive attitude towards nutritional labels in regards to making dietary choices (70, 71), with females using labels more often than males (72).

As previously stated, whole grains provide numerous health benefits and protection against certain chronic diseases. Despite this evidence consumers are failing to reach the current recommendation of 3 servings per day due to a variety of barriers

such as taste, texture and the inability to correctly identify whole grain products.

Nutrition knowledge among college students has been shown to positively impact dietary

choices. Therefore the focus of this research project was to educate college students

about whole grains and provide information to enhance their ability to identify whole

grain products and therefore incorporate these foods into their daily dietary choices.

CHAPTER II: OBJECTIVES

With many health benefits associated with whole grain intake and people falling short of the recommendation, research must focus on educating people about all aspects of whole grains in hopes it will encourage a change in dietary habits and an increase in whole grain consumption. A limited amount of research has focused on college students and their whole grain intake in a dining hall environment (5, 6, 69), but evidence has shown these students are likely to read and use product labels for help in making dietary choices (70-72). Therefore the goal of this nutrition education project was to provide education and labeling information to the University of New Hampshire (UNH) students to help them identify the whole grain products offered in each dining hall and ultimately influence these students to increase their daily consumption of whole grains. The specific objectives for this project include:

1. Develop a whole grain labeling system to be initiated within UNH Dining Halls.

2. Survey students to determine their understanding of the new whole grain label and its influence on personal whole grain choices.

CHAPTER III: MATERIALS AND METHODS

Prior to the start of this project the use of human subjects was reviewed and approved by the UNH Institutional Review Board (Appendix A).

Focus Groups

During the Spring 2008 semester, three focus groups were conducted in order to gain feedback from UNH undergraduate students about proposed nutrition education materials and the protocol for displaying these materials. A total of 21 students volunteered to be focus group participants. Based upon their schedules the students were divided up and attended one of three 45-minute sessions, . Recruitment flyers displayed throughout campus were unsuccessful and yielded no volunteers for focus group participants. Therefore a direct recruitment approach was utilized via a sophomore level nutrition course. The professor of this course announced the recruitment flyer information during class and interested volunteers were able to sign up at the end of class. The topics discussed during these groups included: knowledge of whole grains, influences of dining hall food choices, preferred methods of receiving nutrition education as well as feedback on proposed material developed for this study. All participants signed a consent form (Appendix B) prior to beginning the discussion and were provided with snacks and drinks during the focus group as well as a coupon for one free ice cream at a local ice cream shop.

Focus group discussions were tape recorded and later transcribed to determine patterns and summaries of student comments. This information was used to update the

proposed nutrition education materials in order to best fit the needs of UNH

undergraduate students and be as effective as possible once the study was implemented.

Material Development/Implementation

The purpose of the educational material was two-fold. First the new whole grain

label system was designed and implemented to clearly indicate every whole grain product

available in the dining halls. Secondly, the material provided whole grain information to

the students as a method of nutrition education in regards to serving sizes, number of

servings per day and potential health benefits associated with whole grains.

All of the whole grain products in the dining halls were identified with the use of

two whole grain labels. Whole grain foods were distinguished either as an "excellent"

source or a "good" source based upon the number of grams of whole grains per serving.

The Whole Grains Council standard of at least 16 grams of whole grain per serving

classified as an "excellent" source and at least 8 grams of whole grain per serving

classified as a "good" source, all the foods were categorized accordingly (67). The grams

of whole grains per serving for each food were determined by gathering information

directly from the product manufacturer or information listed on the food packaging.

However, this approach was not available for all products. When grams of whole grains

were unattainable the researcher used the ingredient list alone to determine the

appropriate label to use. For this alternative method, "excellent" sources were foods that

listed whole grain as the first ingredient and the only grain in the product. "Good"

sources were those with a whole grain as the first or second ingredient, but also had a

mixture of refined grain ingredients. To distinguish the different labels, the "excellent"

label contained two wheat stalk images on a green background and the "good" label contained one wheat stalk image on an orange background (Appendix C)

All educational materials developed for this project were made via Microsoft Office Publisher™ (version 2007) and printed at UNH printing services. The materials developed for this project ranged in a variety of sizes and location of display (Appendix D). Hot line item labels (3.5" x 2") were displayed next to products such as oatmeal, brown rice and whole grain pastas. The bulk cereal containers at each dining hall were individually labeled with a 3" x 3" sign indicating the type of cereal and corresponding whole grain label. Additionally large posters (24" x 18") containing whole grain education information were displayed at each designated nutrition bulletin board area. Each bread rack area received a poster (17" x 11" or 8.5" x 11") indicating the available whole grain bread, roll, bagel and wrap choices. Within each of the three dining halls, a flyer (6" x 8") was displayed on each napkin dispenser that was rotated weekly by the researcher for a total of seven different flyers used throughout the duration of the education program. These flyers contained both information about the new whole grain label and how to use it as well as overall whole grain education information.

At the start of the program, the materials for the cereal dispensers, bread racks and napkin dispensers were permanently affixed to the appropriate areas. The researcher met with each dining hall manager to provide instructions on displaying the hot line item labels daily as each food item was put out. The dining hall managers were then asked to relay this information to their staff members working at that particular food station. The researcher checked each dining hall periodically every week to ensure that all materials remained properly displayed. Occasionally, extra labels were provided to the dining hall

managers for the hot line items to replace any that may have been lost during the course of the week and during cleanings.

In addition, space was purchased from the UNH Dining Senior Marketing Coordinator for two color table tents (4" x 6.25") (Appendix E). The tents ran for one week each and were displayed in small plastic stands on every table in all three dining halls. The first table tent, displayed on week one of the project, included information about the new labeling system and how to use it to make whole grain choices. The second table tent, displayed during week three of the project, included information about the potential health benefits of whole grains.

Whole Grain Food List

A variety of whole grain foods were already available in UNH dining halls at the start of this project and were therefore included in this program. These foods received one of the new whole grain labels as indicated in Table 1.

Table 1. Whole Grain Products Offered in UNH Dining Halls

	Excellent	**Good**
Cereals	Oatmeal Cheerios Wheaties Total Raisin Bran Life Cracklin' Oat Bran Frosted Mini Spooners Low Fat Granola Kashi Heart to Heart	Trix Reese's Puffs Honey Nut Cheerios Cinnamon Toast Crunch Cookie Crisp Honey Bunches of Oats Honey Graham Squares Marshmallow Mateys
Rice and Pasta	Brown Rice Whole wheat pasta	
Breads, Bagels, Rolls	100% whole wheat bread Whole wheat wrap Whole wheat pita Whole wheat roll Whole wheat English muffin	Hearty 5 Grain Bread Honey whole wheat bagel Wheat English muffin Honey wheat English muffin

Survey Development

A 24-question pre-survey and 34-question post-survey were developed to assess demographics, whole grain knowledge, grain consumption patterns, as well as influences on food choices within the student population. The post-survey further assessed familiarity with the new whole grain label, knowledge of the label's meaning as well as the impact the label had on the food choices of the individual respondents. A group of seven nutrition and research professionals evaluated the survey for content validity and accuracy. Comments from this review were used to revise the survey. Upon revision, 10 undergraduate students and 7 graduate students pilot-tested the survey to refine the language used, clarify confusing questions and/or response options. A final revision of each survey was transformed into an online format via Survey Monkey (Copyright ©1999-2009 SurveyMonkey.com, Portland OR) (Appendix F).

Survey Implementation

Students from large general education classes, those over 100 students, were the focus of recruitment for potential volunteers to complete the surveys. Freshman and sophomores primarily enroll in these courses, with some upper level students also registered. During the 2008-2009 academic year, 92% of freshman lived in college-affiliated housing (73). Since UNH students living on campus must also have a meal plan the distribution of freshman and sophomores in the general education classes were the target group, as these students were likely to attend the dining halls more frequently than upperclassmen and therefore be exposed to this program.

Prior to the start of the semester, professors from 12 general education courses were contacted individually via email to request permission to use their students as

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potential volunteers (Appendix G). Seven professors from five different courses agreed to participate. The professors that agreed to participate taught the following courses: Principles of Biology, Making Babies, Finite Math, Introduction to Sociology and Recreation and Leisure in Society.

One week prior to sending out the survey to these students, the researcher visited each of the five courses. During the first five minutes of class, the researcher was introduced and made the students aware they would soon be receiving an email from their professor containing a nutrition survey (Appendix G). At this time the students were told that participation was voluntary and that all survey information would remain completely anonymous. From these five courses a total of 1,324 students received the survey link via email based upon the course rosters. For the post-survey, the professors themselves made an announcement in class that another nutrition survey, similar to the earlier one, would be sent to the students and that they could fill it out whether or not they completed the survey from earlier in the semester. Reminders were given that this process was strictly voluntary and anonymous.

In addition, both survey links were displayed on the UNH dining website at the same time they were distributed to the students in the participating courses. Visitors to the UNH dining website who chose to complete the survey received written directions and consent information listed on the first page of the survey, but did not receive any information in person from the researcher.

Data Collection

Data from each survey were automatically collected onto the Survey Monkey™ website. Upon completion of the pre-survey, the data was downloaded into Microsoft

Office Excel™ (version 2007) and coded into numerical responses. The five specific questions relating to whole grain knowledge (Questions 17-19, 22 and 23) were graded in order to give each respondent a knowledge score. Knowledge scores could range from 0-25 as correct answers were given one point and incorrect answers were given zero points. The final coded data was uploaded into the Statistical Package for the Social Sciences (SPSS version 17.0 for WINDOWS; SPSS Inc, Chicago, IL) for statistical analysis. This same procedure was replicated with the post-survey data.

University Hospitality Services (UHS) Ordering Data

Food ordering data from each dining hall, provided directly from UHS, was received via Microsoft Office Excel™ (version 2007). The information technologist from UHS provided the researcher with a complete spreadsheet of the pounds of grain foods ordered during the time periods before and during the nutrition education program for the Fall 2008 semester. The same information was also obtained for the Fall 2007 semester.

Project Timeline

<u>April 2, 17, and 24 2008</u>: Focus Groups held
<u>September 2 – October 22, 2008</u>: Control Period (no whole grain information displayed)
<u>October 6-9, 2008</u>: Pre-survey announcements made by researcher
<u>October 15 – 22, 2008</u>: Pre Survey distributed and collected
<u>October 23, 2008</u>: Start date – all materials displayed
   • Napkin dispenser flyers rotated every Thursday morning before breakfast
<u>December 9, 2008</u>: End date – all materials removed
   • Post-survey announcement made by professors
<u>December 10 – 19, 2008</u>: Post Survey distributed and collected

Statistical Analysis

Surveys were excluded if incomplete answers were provided for knowledge and/or consumption questions. Survey response rates were calculated based upon included surveys only.

Self reported height and weight values were used to calculate a BMI for each respondent based upon the standard equation of wt kg/ ht m^2. Continuous BMI data were categorized into standard BMI groups (< 18.5 underweight, 18.5 – 24.9 healthy, 25.0 – 29.9 overweight and > 30.0 obese). BMI data yielded outliers beyond two standard deviations from the mean. These specific BMI outliers were excluded from the BMI data. Responses to the five knowledge questions were scored to provide an overall whole grain knowledge score for each respondent, with a perfect score being 25. The knowledge score was further divided into tertiles. Self-reported consumption data were transformed from categorical data into continuous data by scoring each category into number of times each grain product was consumed per month. Given the assumption of 4 weeks per month and 30 days per month, the average number of times grains were consumed per day was calculated. Post-survey questions about each WG label were transformed into a new variable of the total number of labels correctly identified.

Initial histograms were developed for all continuous variables (BMI, age, knowledge scale, average intake of refined and whole grains). Bivariate and partial correlations were run on all continuous variables to determine relationships and any potential confounding factors. Independent t-tests were run to compare age, BMI, days of exercise, knowledge score, and grain intake from pre-survey to post-survey. Knowledge and grain intake between males and females were also compared with an independent t-test. Chi-squared

analysis was performed to compare all non-parametric categorical variables. Lastly, a univariate analysis of variance (ANOVA) was used to compare whole grain knowledge score tertiles with grain consumption and to compare the number of tags correctly identified with grain consumption. The standard for determining statistical significance was set at $p \leq 0.05$.

CHAPTER IV: RESULTS

Focus Groups

A total of 21 college-aged students, 20 female and 1 male, participated in the focus group sessions. Sixteen of the students were nutrition majors and 5 were non-nutrition majors. Overall, the focus group students had a general understanding of whole grains and referred to them as "having more nutrients" and being "less processed" than refined grains. Breads, pastas and cereals were most often specified as types of foods the students would place in the whole grain category. The focus group students reported eating foods from these groups on a daily basis, however many consumed refined versions and only some whole grain versions.

The students reported an inconsistency in nutrition information within the dining halls. The students described that certain foods have the product packaging on display so that students can read the front label, ingredient list and nutrition facts panel, such as breads. It was also reported that the cereal nutrition information is provided at each dining hall, but that it is in a 3-ring binder that is not prominently displayed or easy to access. Other products, such as oatmeal, rice and pasta, have a small nutrition information card displayed next to the food. The students recalled that this card provides calories, fat and protein content as well as allergy information, but does not offer information about whole grain content. A conversation with the dining hall Registered Dietitian confirmed that the food display cards have this basic nutrient information, but do not contain any whole grain content information.

Students in the focus group did report looking at the current nutrition information on the food cards as well as using the online menu provided by the dining hall, but it was apparent that each student gathered information differently from one another. The focus group also explained that nutrition pamphlets are available and located near the exit door in each dining hall. However, the students also commented that they are very unlikely to take these pamphlets and read the information. The students commented that their friends and roommates also have this same feeling. Placing the pamphlets near the exit is not an effective method for providing nutrition information to UNH students. The students suggested information should be posted at the point-of-choice food display and not at the exit where they are leaving and no longer thinking about their meal choices.

Feedback about the proposed education material samples led to modifications to be made that would better suit the students' needs. Suggestions from the focus groups included displaying information on table tents and popular areas such as near the toasters or stir-fry station. When a variety of potential whole grain label options were presented to the focus group, the students preferred bright bold colors and the use of the terms "excellent" and "good". It was indicated that references to grams of whole grain is not helpful to students as many do not understand this measurement and cannot relate it to their actual intake. Students also liked the use of wheat stalks to indicate whole grains and supported the use of the health benefits of whole grains to teach other students to understand why they should be consuming more whole grains.

Ordering Data

UHS ordering data was provided as total pounds ordered for each given grain product. Due to the nature of this data, statistical analysis could not be performed. The

amount of whole grain products ordered by UHS for the Fall 2008 semester was 76,000

pounds during the control period and 67,000 pounds during the implementation period of

this program. A total of 106,000 pounds of refined grains were ordered during the

control period and 80,000 pounds during the implementation period. In comparison,

ordering levels from the Fall 2007 semester were 56,000 pounds of whole grains and

98,000 pounds of refined grains during the corresponding control months followed by

48,000 pounds of whole grains and 74,000 pounds of refined grains during the

implementation months. This pattern was similar within each individual dining hall for

the Fall 2008 semester, with more refined grains being ordered as compared to whole

grains (Figure 6 & 7). Throughout the entire Fall 2008 semester 4,400 pounds of white

rice, 1,300 pounds of brown rice, 20,500 pounds of refined pasta, 840 pounds of whole

grain pasta, 155,000 pounds of refined breads and 122,000 pounds of whole grain breads

were ordered. As for cereals, 5,800 pounds of refined cereals and 18,600 pounds of

whole grain cereals were ordered (Figure 8).

Online Survey

A total of 1324 UNH students received the contact email containing the pre-

survey and 405 of these students volunteered to take the survey. The same 1324 UNH

students received the post-survey email link, with 198 choosing to take this survey.

These results yielded a response rate of 30.5% and 15.0% respectively. Fifty-five

respondents were excluded from the pre-survey and 44 respondents from the post-survey

so that all subsequent analysis was performed on 350 and 154 completed surveys from

the pre- and post-survey sample. Upon visual inspection of SPSS generated histograms

all continuous variables appeared to follow a normal distribution and warranted parametric analysis.

Comparison of demographic and descriptive characteristics from pre-survey to post-survey samples revealed no significant differences (Table 2). The respondents were on average 19 years old, predominately female, had a BMI ≤ 25 kg/m^2, mostly freshman and sophomores, on-campus residents with unlimited meal plans, non-smokers and had not taken a college level nutrition course. While pre-survey respondents were not the only students asked to complete the post-survey, 77.5% of post-survey respondents did in fact report completing the first survey.

Mean whole grain knowledge score from the pre-survey sample (16.6 $\pm$ 0.1) was not significantly different from the post-survey sample (16.7 $\pm$ 0.2) at p = 0.670. Though no change in overall whole grain knowledge was observed, the percentage of correct answers for recommended serving size questions for WG breads and WG pasta/rice significantly improved (Table 3). Thirty-seven percent of the pre-survey respondents correctly identified the serving size for whole grain pasta/rice while 51.3% correctly answered this question on the post-survey (p = 0.027). In regards to the serving size for whole grain bread, 53.7% and 58.4% correctly answered this question on the pre-survey and post-survey, respectively (p = 0.018).

As an overall sample the students from both surveys were knowledgeable in the concept that whole grains help to reduce the risk of heart disease (95% answered correctly), obesity (80%), diabetes (66%), high cholesterol (88%) and high blood pressure (71%), but only 21% and 41% knew that whole grains are protective towards certain cancers and gastrointestinal issues (Table 3). The overall group of respondents

from both surveys did correctly identify the following foods as whole grain: brown rice (87% correctly answered), 100% whole wheat bread (95%), whole-wheat pasta (96%), and oatmeal (72%). However, 86% and 83% of the respondents did not correctly identify popcorn or corn tortillas as whole grain, yet 59% and 67% claimed that 'wheat' bread and bran muffins are whole grains (Table 4). No significant difference was found between males and females in regards to whole grain knowledge score (p = 0.375). Students who had previously or were currently taking a college level nutrition course had a significantly higher whole grain knowledge score than those students who did not take such a course (17.6 ± 2.3 vs. 16.3 ± 2.2; p < 0.0001).

No significant difference was found between pre-survey and post-survey results for either average whole grain consumption or average refined grain consumption (Table 5: p < 0.058; p < 0.131 respectively). The average consumption of whole grains from both survey samples was 1.5 servings per day and 0.8 servings per day for refined grains. Seven percent of the sample surveyed from both the pre- and post-survey met the current MyPyramid recommendation of at least 3 servings of whole grains per day. Whole grain breads comprised 23% of the daily whole grain intake and 19% of the total consumption came from whole grain cereals (Table 6). Males ate significantly more refined grains than females (p < 0.0001, equal variances not assumed), with no significant difference in consumption between sexes for whole grains (p < 0.833, equal variances not assumed).

Bivariate correlations revealed a significant positive, but weak, relationship between knowledge score and whole grain intake (p < 0.01, r = 0.147). Additionally, a significant negative, but weak, relationship was found between knowledge score and refined grain intake (p < 0.01, r = -0.163). Based upon the significant different in whole

grain knowledge score between enrolled and non-enrolled nutrition course students further adjustment to these correlations was made. The adjusted results indicate that taking a college nutrition course did not alter the relationship as the correlations remained weak, but significant (whole grain intake $p < 0.001$, $r = 0.152$; refined grain intake $p < 0.01$, $r = -0.163$). Both whole and refined grain consumption were significantly different across the whole grain knowledge score tertiles ($p < 0.03$ and $p < 0.001$, respectively). Students in the highest knowledge tertile consumed significantly more whole grains than students in the lowest knowledge tertile (1.6 whole grain servings/day to 1.3 whole grain servings/day, $p < 0.05$). The significant difference between tertile 3 and tertile 1 held true for refined grains, with the highest tertile consuming significantly less refined grains than the lowest knowledge tertile (0.6 refined grain/day to 0.9 refined grain/day, $p < 0.05$). No differences were seen for either type of grain intake between tertile 1 and 2 or tertile 2 and 3 (Table 7, Figure 9 and Figure 10).

Among students responding to the post-survey, 58.9% claimed to have seen the "excellent" label and 48.3% claimed to have seen the "good" label in the dining halls during the time frame they were posted. Further analysis to determine the actual understanding and knowledge these students had of the labels revealed that 25.3% correctly identified the meaning of both labels and 22.7% correctly identified only one label. This left 52% of the post-survey students not being able to correctly indicate the definitions of either label. There was no significant correlation between the number of tags correctly identified and knowledge or average intake.

From the post-survey sample, 20.5 % (n = 31) of the students were influenced in their food choices by the whole grain labels. These students reported being influenced to

consume more whole grain cereals and breads. When asked specifically if they consumed more whole grains during the second half of the semester (corresponding to the experimental period) than the first half, 25.0% of the students reported yes. These students further indicated that this increase was due to the newly displayed whole grain labels as well as information from news and/or other people. Of the people who did not consume more whole grains during the second half of the semester, common barriers reported were a dislike in taste or texture, not caring about nutrition, and being unable to identify whole grain products. For 11 people, they answered no to consuming more during this time period because they already ate whole grains so did not have an actual increase in consumption.

CHAPTER V: DISCUSSION

Many epidemiological studies have displayed a relationship between whole grain consumption and a decrease in chronic disease risk (11). This research supported the decision to develop the current recommendation of consuming at least 3 servings of whole grains per day set forth by the USDA and MyPyramid (1, 2). Despite the recommendation and evidence for improved health, survey data from the USDA's *Continuing Survey of Food Intakes by Individuals* indicate only 7% of Americans reach this goal and that the national average is only 1.1 servings of whole grains per day (3). Barriers that have appeared to be leading to this disconnect include a dislike for the taste and texture of whole grains, but also include a lack of knowledge among consumers to accurately identify whole grain products (62).

This thesis project aimed to implement a whole grain education program within the UNH dining halls with a specific whole grain label system to help college students properly identify whole grain foods available in the dining halls. The objectives of implementing such a program were to increase the students' whole grain knowledge and therefore influence their dietary choices to increase their consumption of whole grains. An online pre- and post-survey was administered in an anonymous fashion to determine the students' whole grain knowledge, self-reported grain consumption, knowledge of the new whole grain labels, and any influence the labels had on their whole grain intake.

The major findings from this survey data were that neither whole grain consumption nor overall whole grain knowledge significantly increased from before to

after the program was implemented. This may have occurred because the survey used was not sensitive enough to pick up a significant difference. Additionally, the students volunteering to participate in the nutrition surveys may have had an interest in nutrition. It may have been possible to pick up on a larger impact of this project if more students were surveyed, especially those without a strong interest in nutrition to begin with. A positive correlation between whole grain knowledge score and whole grain intake was determined within the overall group of respondents as was a negative correlation between the knowledge score and refined grain intake. It was determined that 20.5% of the post-survey students were influenced to eat more whole grains due to the whole grain labels.

This group of UNH students did report consuming on average 1.5 whole grain servings per day, which is only half the recommendation for 3 servings per day, but was higher than the 0.8 servings of refined grains per day. With a total grain consumption of 2.3 servings per day, the UNH students did "make half their grains whole". The whole grain intake consisted of 65% of the total intake, yet this percentage is deceiving due to a low intake of total grain foods. These data indicate that these students are not achieving the recommendations for whole grains or total grains, but an underestimation could have occurred due to the FFQ survey method used for this study. The whole grain intake results are similar to a study among college freshman at a large Virginia university, in which a 4-day diet record revealed an average intake of 1.4 whole grains per day. Total grain intake was not reported within this study (6).

Another study performed at this same Virginia university collected dietary intake data via a 7-day food record from 159 college students enrolled in an introductory nutrition course. This group of students reported an average whole grain intake of 0.7

servings per day and 5.4 servings of total grain products, which is only 13% of the total

grain intake (5). While UNH students may not be reaching the current recommendation,

they did report twice as much whole grain intake compared to this group of college

students. One potential explanation for this difference is the manner in which the dietary

intake was collected; a modified FFQ type approach in this project versus a multi-day

food record. The difference may also be due to the manner in which students interpret

the meaning of the term "whole grain". A misunderstanding in identifying whole grains

can lead to the students filling out the FFQ survey incorrectly to under- or overestimate

their intake. While the students contacted for this project were not enrolled in a nutrition

course, those students who chose to voluntarily complete the survey may have had a

biased interested in nutrition and health that increased their whole grain intake above that

of other college students. Therefore the students from this study may not be a true

representation of the entire UNH student body. The reported intake level from this

project is also higher than that of the national average, 1.1 servings per day, from 24-hour

recall data of adults over the age of 20. However it is important to note that in both this

study and the national USDA study only 7% of the respondents met the recommendation

for at least 3 servings per day (3).

The same USDA national data indicate that breakfast is the most common meal in

which to consume whole grains, with Americans consuming 40% of their daily whole

grains at breakfast (3). Similarly, in this study whole grain cereals made up 19% of the

daily whole grain intake among the survey respondents. The popularity of cereal among

these students provides a strong avenue for further increasing whole grain intake in the

UNH dining halls. Currently, of the 23 cereals offered in each dining hall 15 are either

an "excellent" or "good" source of whole grain. This large variety of whole grain cereals provides easy substitution options for students to transition from refined to whole grains. The maintenance of these cereal options as well as the inclusion of more whole grain breads and bagels will provide students with alternative options for whole grain breakfast food. The popularity of whole grain cereals and breads is something that the UNH nutrition and dining hall staff can work with to further promote these products during future nutrition education programs. Additionally, the less popular brown rice and whole grain pasta are offered at the dining halls, but could be incorporated into more entree recipes to entice students to try them. For example offering a whole grain pasta lasagna or chicken rice soup with brown rice may be appealing to certain students. Simply having more whole grain options and increasing the students' exposure to these products may help to change their dietary choices. This exposure to more whole grain products may further improve the students' knowledge of whole grain foods and enhance the positive relationship between knowledge and consumption.

According to NHANES data the consumption of popcorn appears to be a positive choice towards increasing daily whole grain servings. People who ate popcorn had a significantly higher total whole grain intake than non-popcorn eaters (7). While, popcorn is not currently offered at the UNH dining halls, students still reported that 6% of their whole grain intake was from popcorn. The consumption of microwave popcorn is an easy way for college students to eat more whole grains when living in a dormitory setting without any major kitchen appliances. However, nutrition professionals still must advocate that popcorn be consumed with limited amounts of added fat and salt to help maintain an overall healthy diet. A suggestion to help increase whole grain consumption

would be for the UNH dining halls to further promote popcorn consumption by offering

this food occasionally or reminding students through nutrition education, such as a

popcorn poster, that microwave popcorn is a practical option to help increase their whole

grain intake.

Examining the UHS ordering data corroborated the overall finding that whole

grain consumption did not increase during this program time period. It is likely that the

amount of grains ordered at the beginning of the semester was adequate to carry over to

the end of the semester time frame. Grains such as rice and cereal are fairly shelf stable

and could have easily remained in the inventory throughout the semester without a need

to order more. The total ordering data may have not been sensitive enough to capture any

changes within the grain intake for the 8-week time period of this study. The number of

patrons at the dining halls decreased from the control period (541,592) to the

experimental period (426,818). This change in meals served may also help explain the

reason for less grain products overall being ordered during the end of the semester (74).

Specifically, the number of patrons attending the dining halls during breakfast hours also

decreased during the second half of the semester. During the first two months of the

semester 107,807 patrons visited the dining halls, while only 88,170 patrons visited

during the last two months. This decrease in breakfast attendance and the fact that

breakfast foods, such as cereals and bagels, were popular whole grain choices may offer

further justification for why the consumption of whole grain servings per day did not

significantly increase from the pre-survey to post-survey (p < 0.058). Additionally, the

experimental period of the semester contains the 4-day Thanksgiving break, which are

days that students are not eating at the dining halls. While the data shows that the total

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amount of grain products ordered was higher in 2008 than 2007 by 7%, it is unlikely due to an increase in consumption, but more so a response to the increase in patrons in 2008. A total of 968,410 people went to the dining halls in the Fall 2008 semester and 919,571 in the Fall 2007 semester, for a 5% increase in patrons. The percentage of whole grain products ordered from the total amount of grain foods ordered did increase from the Fall 2007 semester to the Fall 2008 semester, 38% and 41% respectively. This increase illustrates that there is a demand for larger amounts of whole grain products and smaller amounts of refined grain products within the UNH dining halls (74).

Even though the overall whole grain knowledge score did not increase from before to after the program, students did improve their knowledge of whole grain serving sizes. The percent of correct answers about whole grain serving sizes for bread and pasta/rice did significantly increase after the program was implemented. This is a valuable step towards students understanding how much they actually need to consume in order to achieve the recommended three servings per day. Also, the majority of the students who completed the pre-survey started out with an adequate understanding of the major whole grain health benefits and types of whole grains so there was less room for an increase in knowledge score. This result relates back to the idea that the students who chose to complete the survey may have had a higher level of interest in nutrition and nutrition knowledge than the general UNH student body. This general knowledge base was also apparent in the post-survey data, as expected, but the survey did not show evidence of an increase in knowledge for some of the lesser known health benefits and whole grain products, such as cancer and popcorn, respectively.

While overall knowledge and consumption did not increase, a positive correlation was found between these two variables. Those students in the third tertile for knowledge score consumed significantly more whole grains than those in the first tertile, 1.6 whole grains per day versus 1.3 whole grains per day. However, it is important to recognize that students in the highest tertile of knowledge were still 1.4 servings short of reaching the daily recommendation. Though the correlations were not altered when adjusted for enrollment in a nutrition course, those students who did take a nutrition course scored significantly higher on the whole grain knowledge questions and were therefore likely to have a higher whole grain intake. While knowledge appears to correlate with consumption, perhaps other foods offered at the dining halls are chosen more often and therefore replacing grain consumption in general. Nutrition knowledge and proper dietary choices have also been evaluated in other research studies among college students. An ongoing study at the University of Vermont used a convenience sample of 200 college students to complete an online survey. The researchers from this study found that students with more nutrition knowledge made healthier food choices and were more likely to meet the dietary guidelines for fruit, diary, protein and whole grains. Those students who did consume the recommended amount of whole grains had a higher level of knowledge than the students who ate less than recommended (69). Based on these findings, future nutrition education programs among college students should focus on improving the knowledge base of the students. The respondents in this study had an adequate knowledge level of whole grains to begin with. Perhaps future programs could see a more robust effect if a broader range of students participate in the study. Recruiting students that do not necessarily already have an interest in nutrition and health would be

more representative of the overall college population. Designing future program to increase knowledge will empower the students to make proper nutrition choices for themselves and change their intake level if they choose to do so.

Almost 50% of the post-survey respondents were able to correctly identify at least one of the whole grain labels. However, 20.5% of the post-survey students reported that they were influenced to actually eat more whole grains from this education program. This illustrates that these UNH students did look at and understand the labels while making food choices in the dining halls and were able to retain this information, but not all of the students found the information influential enough to make a dietary change or simply chose to not apply the information to their food choices. Other studies have also shown that college students do read and tend to have a positive attitude towards nutrition labels. These students tended to primarily read information about calories and fat on the labels (70-72). One survey of 553 college students revealed that females are more likely to use food labels than males and that those students who do use labels feel that nutrition information is important (72). Another group of 208 college students reported that food labels are useful, but they felt that the nutrition claims made on food packaging may not always be trustworthy. Those students with a positive attitude towards food labels are more likely to use them when making food purchases (71). Even student responses from preliminary focus groups show that college students notice food labels in food-court and cafeteria areas and do often use these labels to make decisions (70). All of this evidence suggests that improvement and consistency among food labels in dining hall setting can benefit the dietary choices made by college students. Future programs should focus on providing nutrition information at all food stations in the dining halls as well as making

sure the labels are easy to see and displayed consistently so that students have a chance to see them and begin to use the labels to make dietary choices. Students may become overwhelmed with too much information being presented to them all at once; so one primary message should be determined for the nutrition education program. That single message should be clearly offered to the students so that they can process it at their own pace and incorporate it into their nutrition knowledge if they choose to do so.

Even though the students did not significantly increase their whole grain consumption there are still strengths to this project. No significant difference was seen between the students completing the pre or post-survey in regards to demographics and general descriptive statistics. These similarities between each sample of respondents were expected as the same 1324 students were recruited to receive both the pre- and post-survey. More than three quarters of the post-survey respondents indicated also taking the pre-survey. These results illustrate the idea that the comparison of pre and post-survey data likely includes similar respondents even though that fact cannot be determined. The passive approach of displaying nutrition information and whole grain labels influenced 20.5% of the students to eat more whole grains while only taking a small amount of preparation time on the part of the researcher and low expense to print all of the education materials. The use of an online anonymous survey was convenient for students to respond on their time and potentially limit subject bias, as their identity would not be related to the answers. The online survey design allowed for a large number of students to be contacted simultaneously and simplified the data collection process as all answers were downloaded directly from the survey website into a database. This limited potential data entry errors that may have occurred if the information was entered into the database

by hand from a paper and pencil survey. The educational materials were edited from the feedback gained at the focus groups so that they would appeal to the students as much as possible. The individual whole grain labels were produced specifically for each food offered at the dining hall and contained the actual product name. This limited any confusion that may have occurred as to which food the label was referring too. Lastly, all three dining halls were treated the same so that students were exposed to consistent information no matter which dining hall they decided to attend.

Limitations of this thesis project must be taken into consideration. While a survey can gather a large amount of data relatively easily, the anonymous approach used in this study did not allow for concrete follow up with specific students. Therefore only generalized data was collected to describe the students surveyed as a population. The student respondents were similar to the UNH population as a whole, but these results cannot be generalized to all UNH students or to other college students at different universities that may have different demographics or dining hall options. Additionally, the survey design and 8-week time frame may not have been sensitive enough to accurately test their knowledge and determine actual intake or a change in dietary intake. The FFQ type approach may have underestimated the actual intake of grains and whole grain for this population surveyed. The students that did choose to complete the survey may have had an increased interest in nutrition and therefore the impact of this program on the entire student body may have been underestimated. The survey used in this study was developed, reviewed by professionals and pre-tested specifically to capture the general and overall picture of the student population that volunteered to participate. A future program may benefit from attempting to validate the knowledge and consumption

questions to ensure greater accuracy of the data. Comparing the consumption data from this survey with a 3-day food record may aid in determining if this modified FFQ type approach accurately captures the student's true intake.

It cannot be determined from the survey responses if the nutrition education program was the only reason for the answers given and that other outside influences did not have a confounding impact. The researcher checked on materials frequently each week, however the employees at each dining hall were responsible for putting the hot line item tags on display and therefore the consistency was dependent on these employees. Occasionally the researcher found tags were not displayed and needed to remind employees to put them out for students to see. This potential for inconsistency may have impacted the number of times students viewed the labels in association with each hot food being served. However, the bread and cereal tags were permanently affixed to the serving area and therefore were displayed 100% of the time. While the ordering data was not statistically analyzed, it should be noted that this data is for total ordering amounts and does not directly indicate consumption. With approximately 2% waste at the dining halls, this data can only estimate the consumption levels for the grain products.

Even with these limitations taken into consideration the impact of this nutrition education program did have promising results. Twenty percent of the students did increase their whole grain consumption and approximately 50% recognized and correctly identified at least one of the whole grain tags. The dietary changes made by these students will hopefully be maintained past college when they move on to shopping and cooking on their own. Proper dietary choices at this age will influence health later on in life.

CHAPTER VI: CONCLUSION

In conclusion, this passive nutrition education approach and point-of-choice whole grain labeling system was not associated with significantly improving whole grain knowledge score or consumption among college students at UNH based upon the data captured by the survey tool designed for this study. However, the survey tool did capture data indicting a significant positive correlation between knowledge score and whole grain intake and a significant negative correlation between knowledge score and refined grain intake. Students in the highest tertile for whole grain knowledge consumed significantly more whole grains and less refined grains than students in the lowest tertile. The assessment approach for determining knowledge and consumption could not control for potential confounders and therefore these results may not be specifically due to the whole grain education program displayed within the dining halls. The results from this study suggest that an inexpensive education program that does not require large amounts of time to implement may be a beneficial approach for nutrition educators to use in the future when paired with other hands-on education activities for the college students. Prioritizing nutrition education efforts in order to improve whole grain knowledge appears to be an effective means in helping students increase consumption of whole grains. College students do notice and understand whole grain labels in the dining halls, therefore these labels should be used in the future for a longer time span to offer further exposure of this information to the college students. Increased exposure may give them the time to process the education information begin offered to them and therefore allow

them to relate this knowledge to dietary choices and an increase in whole grain

consumption. Whole grain knowledge is positively related to intake, so future programs

should be primarily focused on methods to increase knowledge. Given that breakfast

foods such as cereals, bagels and breads are popular whole grain items among college

students, future programs should have a clear focus for promoting whole grains as

breakfast. These foods can be used as suggestions for students to choose as a

replacement for refined grains they may already be consuming. Subsequent programs

can further promote whole grains at lunch and dinner along with alternative whole grain

items such as barley, quinoa and brown rice.

Table 2. Demographic and Descriptive Characteristics of Respondent Samples

Variable[1]	Pre-Survey (N = 350)	Post-Survey (N = 154)	p value[2]	Chi-squared[2]
Age	19.4 ± 0.1	19.7 ± 0.3	0.164	
Sex				
Male	20.6 (72)	14.3 (22)		0.092
Female	79.4 (277)	85.7 (132)		
BMI	23.8 ± 0.2	24.4 ± 0.4	0.636	
BMI Category				
Underweight	2.6 (9)	4.2 (6)		0.368
Healthy	67.2 (229)	66.2 (94)		
Overweight	23.2 (79)	19.0 (27)		
Obese	7.0 (24)	10.6 (15)		
Grade				
Freshman	36.6 (127)	32.5 (50)		0.631
Sophomore	34.6 (121)	39.6 (61)		
Junior	18.9 (66)	20.1 (31)		
Senior	9.4 (33)	6.5 (10)		
Graduate/Other	0.9 (3)	1.3 (2)		
Living Status				
On Campus	76.3 (267)	77.3 (119)		0.810
Off Campus	23.7 (83)	22.7 (35)		
Exercise (days/wk)	3.6 ± 0.1	3.6 ± 0.2	0.926	
Exercise (minutes/day)				
None	5.7 (20)	6.5 (10)		0.977
Less than 30	24.0 (84)	23.4 (36)		
30-59	49.4 (173)	48.1 (74)		
60 or more	20.8 (73)	22.0 (34)		
Smoking Status				
Not at all	87.1 (305)	87.0 (134)		0.908
Some days	8.3 (29)	9.1 (14)		
Everyday	4.6 (16)	3.9 (6)		
Unlimited Meal Plan				
Yes	66.6 (233)	64.3 (99)		0.618
No	33.4 (117)	35.7 (55)		
Nutrition Course				
Yes	22.9 (80)	29.2 (45)		0.132
No	77.1 (269)	70.8 (109)		
Times at Dining Hall				
Never/Rarely	23.1 (81)	19.5 (30)		0.698
1	14.0 (49)	16.9 (26)		
2	32.6 (114)	35.7 (55)		
3	28.9 (101)	27.3 (42)		
More than 3	1.4 (5)	0.6 (1)		

1. Continuous variables reported as mean ± SEM (independent t test), categorical variables reported as % (n) (chi-squared test)
2. No statistically significant difference between pre-survey and post-survey

Table 3. Whole Grain Knowledge Questions: Servings and Health Benefits

Question[1]	Pre-Survey (N = 350)	Post-Survey (N = 154)	Chi-squared
Recommended WG servings/day[2]	20.0 (70)	20.8 (32)	0.841
WG pasta/rice serving size	37.0 (129)	51.3 (79)	0.027
WG bread serving size	53.7 (188)	58.4 (90)	0.018
Reduce risk of cancer[3]	18.6 (65)	22.7 (35)	0.281
Reduce risk of heart disease	94.3 (330)	95.5 (147)	0.591
Reduce risk of GI issues	38.9 (136)	42.4 (65)	0.479
Reduce risk of obesity	81.1 (284)	78.6 (121)	0.503
Reduce risk of diabetes	63.1 (221)	68.2 (105)	0.276
Reduce risk of high cholesterol	90.3 (316)	86.4 (133)	0.193
Reduce risk of high blood pressure	69.7 (244)	72.7 (112)	0.494
Reduce risk of common cold	88.9 (311)	86.4 (133)	0.426
Reduce risk of alzheimer's	90.6 (317)	90.9 (140)	0.904
Reduce risk of influenza	92.0 (322)	91.6 (141)	0.867
Reduce risk of schizophrenia	94.3 (330)	94.8 (146)	0.815

1. Reported as % (n) correctly answered the question
2. Pre-survey mean response (5.3 ± 0.12) not significantly different from post-survey mean response (5.2 ± 0.17) for recommended WG servings/day (independent t-test with equal variances not assumed)
3. Questions in bold refer to true statements about the benefits of whole grains

Table 4. Whole Grain Knowledge Questions: Identification of Whole Grain Products

Question[1]	Pre-Survey (N = 350)	Post-Survey (N = 154)	Chi-squared
Is white rice WG?	95.7 (335)	97.4 (150)	0.359
Are corn tortillas WG?[2]	21.4 (75)	13.6 (21)	0.040
Is brown rice WG?	87.7 (307)	85.7 (132)	0.537
Is pumpernickel bread WG?	70.9 (248)	67.5 (104)	0.454
Is 100% whole wheat bread WG?	96.9 (339)	93.5 (144)	0.083
Is enriched white bread WG?	96.6 (338)	94.2 (145)	0.211
Is whole wheat pasta WG?	97.4 (341)	95.5 (147)	0.244
Is oatmeal WG?	72.6 (254)	72.1 (111)	0.909
Is wheat bread WG?	40.9 (143)	41.6 (64)	0.883
Is popcorn WG?	14.0 (49)	13.6 (21)	0.913
Are bran muffins WG?	32.3 (113)	33.1 (51)	0.854

1. Reported as % (n) correctly answered the question
2. Questions in bold are whole grain products.

Table 5. Average Daily Consumption of Grains

Variable[1]	Pre-Survey (N = 350)	Post-Survey (N = 154)	p value[2]
Whole Grains	1.5 ± 0.06	1.4 ± 0.07	0.058
Refined Grains	0.8 ± 0.03	0.7 ± 0.04	0.131

1. Mean ± SEM for number of times per day grain is consumed (independent t test)
2. No statistically significant difference between pre-survey and post-survey

Table 6. Composition of Total Whole Grain Consumption

Whole Grain Food	% Total Whole Grain Intake
Whole grain bread	22.9
Whole grain cereals	18.8
Whole grain bagels/muffins	10.0
Whole grain crackers	7.3
Oatmeal	6.9
Tortilla chips	6.5
Whole grain wrap	6.4
Whole grain pasta	6.4
Popcorn	6.1
Brown rice	4.4
Barley and Quinoa[1]	2.2

1. Combined due to low percentages of each (Barley 1.7%, Quinoa 0.5%)

Table 7. Grain Consumption Across Whole Grain Knowledge Score Tertiles

	Tertile 1 13.9 (9-15)[1]	Tertile 2 16.6 (16-17)	Tertile 3 18.9 (18-23)	P for trend
Whole Grains	1.3[2]	1.4	1.6	0.030
Refined Grains	0.9[2]	0.8	0.6	0.001

1. Mean Knowledge Score (Range)
2. Mean servings per day

Figure 6. UHS Grain Food Ordering Data – All Dining Halls
(September indicates control period. December indicates implementation period)
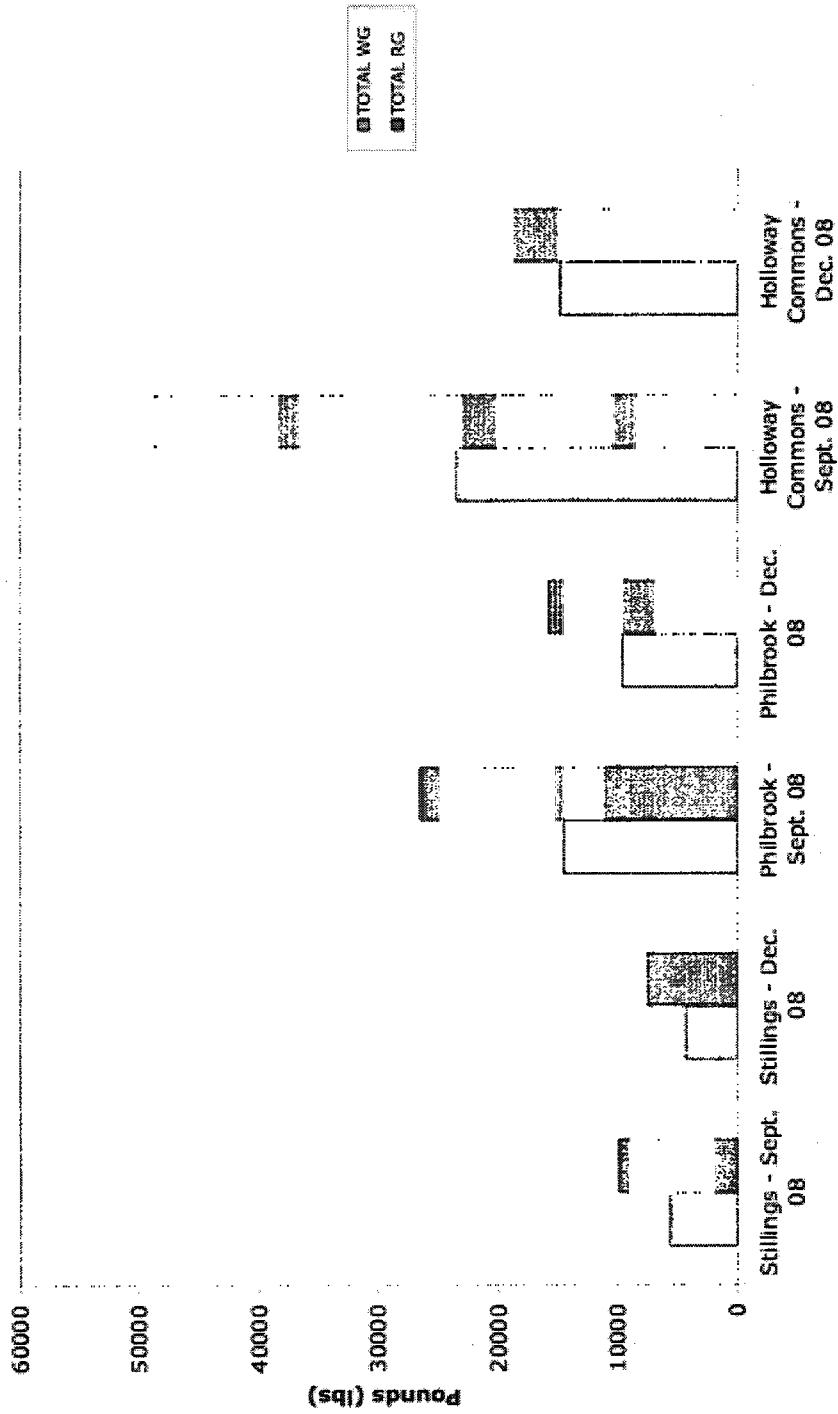
Figure 7. UHS Grain Food Ordering Data – Individual Halls
(September indicates control period. December indicates implementation period)
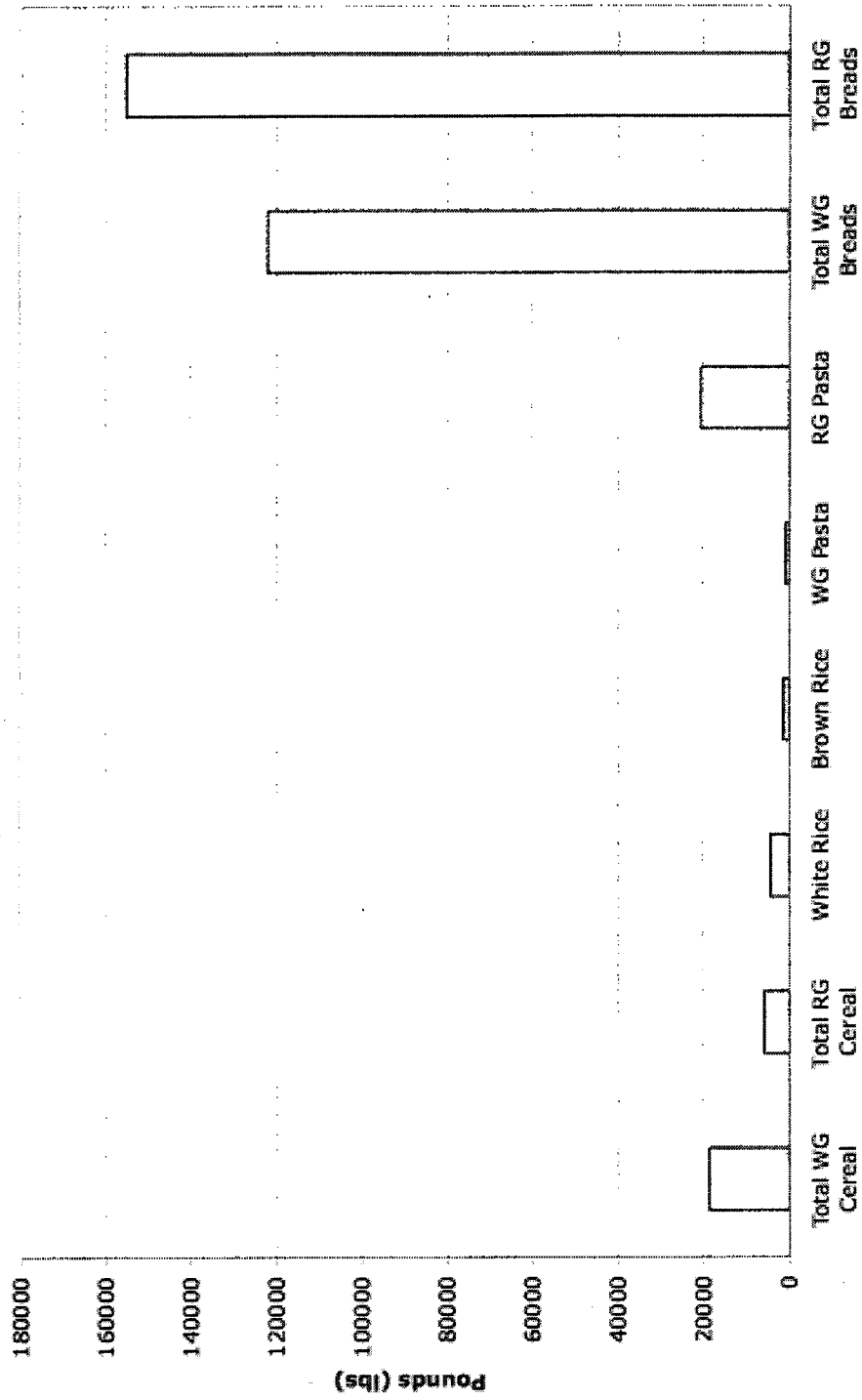
Figure 8. UHS Specific Grain Food Ordering Data

Association between Whole Grain Knowledge and Consumption
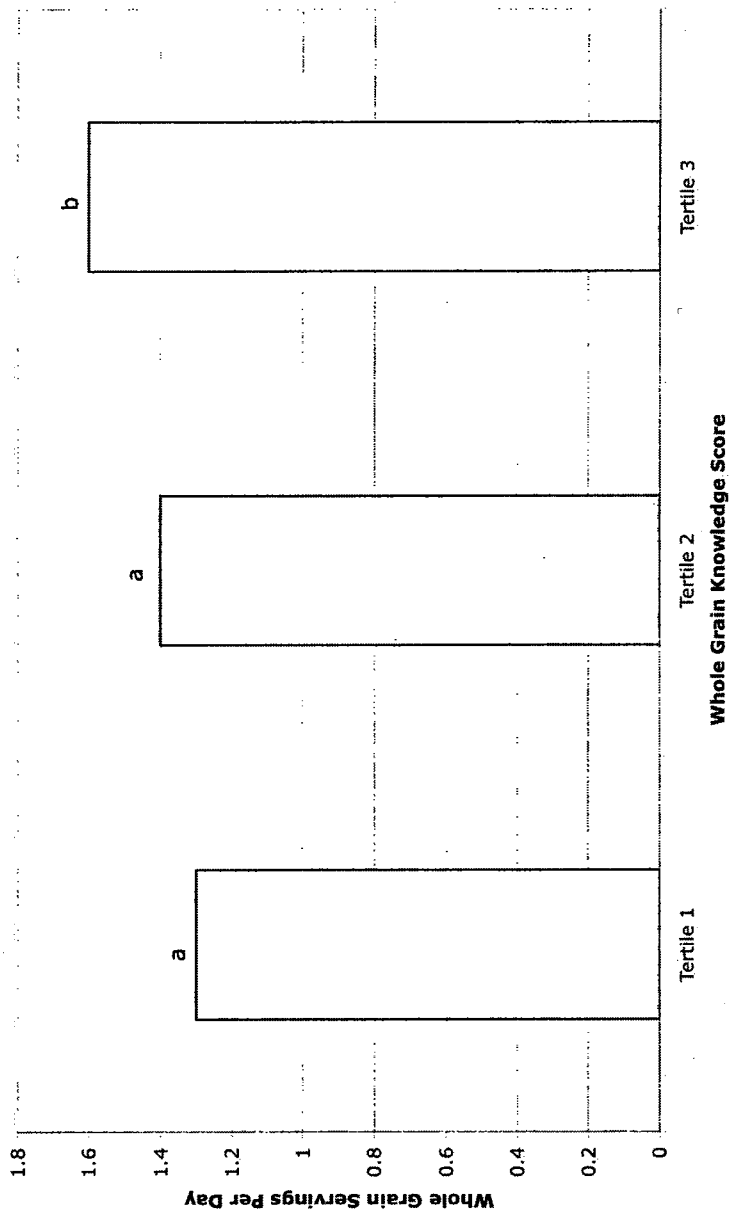
Figure 9. ANOVA Comparing Knowledge Tertile and Whole Grain Intake
Different superscripts indicate a significant difference at $p \leq 0.05$

Association between Whole Grain Knowledge and Consumption
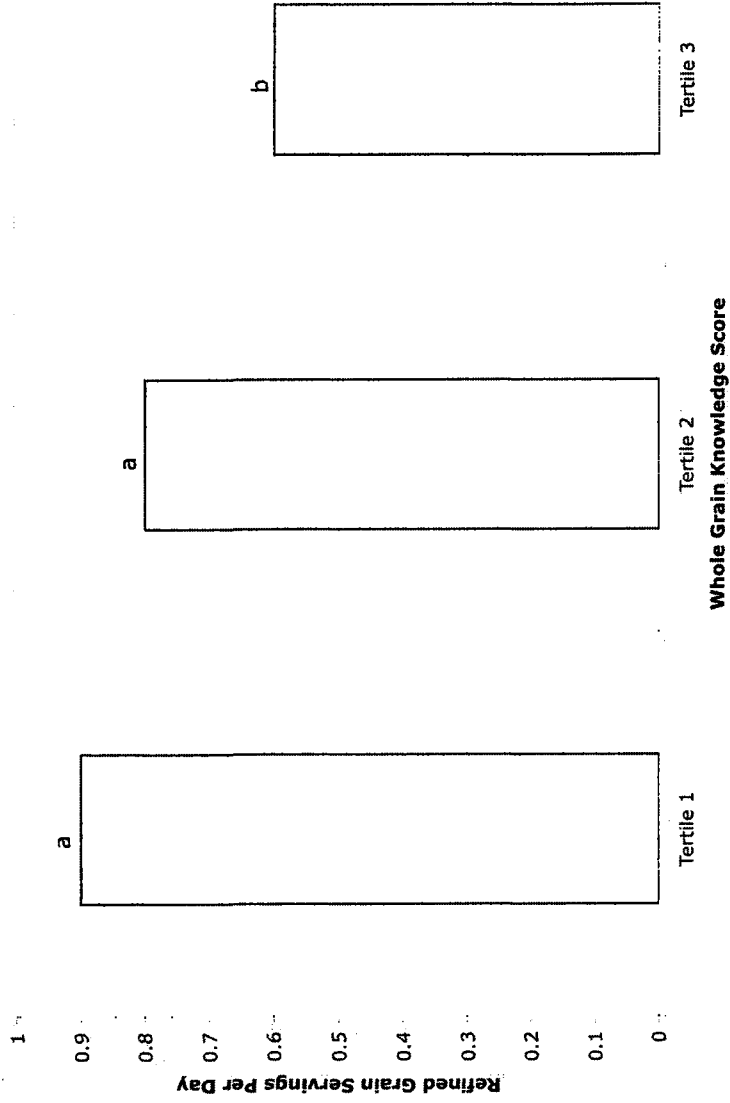
Figure 10. ANOVA Comparing Knowledge Tertiles and Refined Grain Intake
Different superscripts indicate a significant difference at $p \leq 0.05$

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APPENDIX A: INSTITUTIONAL REVIEW BOARD APPROVAL

University of New Hampshire

Research Conduct and Compliance Services, Office of Sponsored Research
Service Building, 51 College Road, Durham, . . . ~ -3585
Fax: 603-862-3564

17-Mar-2008

Rocheford, Katharine
Animal & Nutritional Sciences, Kendall Hall
678 Central Ave., #1
Dover, NH 03820

IRB #: 4211
Study: Increasing the Consumption of Whole Grain Foods within UNH Dining Halls
Approval Date: 17-Mar-2008

The Institutional Review Board for the Protection of Human Subjects in Research (IRB) has reviewed and approved the protocol for your study as E:. .. ̄ .. as described in Title 45, Code of Federal Regulations (CFR), Part 46, Subsection 110.

Approval is granted to conduct your study as described in your protocol for one year from the approval date above. At the end of the approval period, you will be asked to submit a report with regard to the involvement of human subjects in this study. If your study is still active, you may request an extension of IRB approval.

Researchers who conduct studies involving human subjects have ̄:- ̄ ̄ ̄ ̄ ̄ - as outlined in the attached document, ̄: . . -: ̄ ̄: :: *of Directors of Research Studies Involving Human Subjects.* (This document is also available at http://www.unh. .̄ osr/t ̄ . e/irb.html.) Please read this document carefully before commencing your work involving human subjects.

If you have questions or concerns about your study or this approval, please feel free to contact me at 603-862-2003 or ̄ . .: . . . . Please refer to the IRB # above in all correspondence related to this study. The IRB wishes you success with your research.

For the IRB,

Julie F. Simpson
Manager

cc: File
    Curran-Celentano, Joanne

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University of New Hampshire

28-Aug-2008

Rocheford, Katharine
Animal & Nutritional Sciences, Kendall Hall
678 Central Ave., #1
Dover, NH 03820

IRB #: 4211
Study: Increasing the Consumption of Whole Grain Foods within UNH Dining Halls
Approval Expiration Date: 17-Mar-2009
Modification Approval Date: 27-Aug-2008
Modification: Change in Survey Method to Web-based

The Institutional Review Board for the Protection of Human Subjects in Research (IRB) has reviewed and approved your mo.   n to this study, as indicated above. Further changes in your study must be submitted to the IRB for review and approval prior to implementation.

Approval for this protocol expires on the date indicated above. At the end of the approval period you will be asked to submit a report with regard to the involvement of human subjects in this study. If your study is still active, you may request an extension of IRB approval.

Researchers who conduct studies involving human subjects have responsibilities as outlined in the document, *Responsibilities of Directors of Research* *Involving Human Subjects*. This document is available at http   at   b   from me.

If you have questions or concerns about your study or this approval, please feel free to contact me at 603-862-2003 or Ji   Please refer to the IRB # above in all correspondence related to this study. The IRB wishes you success with your research.

For the IRB,

Julie F. Simpson
Manager

cc: File
    Curran-Celentano, Joanne

71

17-Mar-2009

Rocheford, Katharine
Animal & Nutritional Sciences, Kendall Hall
678 Central Ave., #1
Dover, NH 03820

IRB #: 4211
Study: Increasing the Consumption of Whole Grain Foods within UNH Dining Halls
Review Level: Expedited
Approval Expiration Date: 17-Mar-2010

The Institutional Review Board for the Protection of Human Subjects in Research (IRB) has
reviewed and approved your request for time extension for this study. Approval for this study
expires on the date indicated above. At the end of the approval period you will be asked to submit
a report with regard to the involvement of human subjects. If your study is still active, you may
apply for extension of IRB approval through this office.

Researchers who conduct studies involving human subjects have respc ̄ ̄ ̄ ̄ ̄ ̄ ̄ :1 in the
document, *Responsibilities of Directors of Research Studies Involving Human Subjects.* This
document is available at http://www.unh.edu/osr/complianc : ̄ ̄ ̄ ̄ or from me.

If you have questions or concerns about your study or this approval, please feel free to contact me
at 603-862-2003 or Julie.simpson@unh.edu. Please refer to the IRB # above in all correspondence
related to this study. The IRB wishes you success with your research.

For the IRB,

Julie F. Simpson
Manager

cc: File

APPENDIX B: FOCUS GROUP CONSENT FORM AND DISCUSSION QUESTIONS

Increasing the Consumption of Whole Grain Foods in UNH Dining Halls
Conducted by: Kate Rocheford, Nutritional Sciences Graduate Student

Focus Group Consent Form

The purpose of this focus group is to gather information from UNH students about whole grains, influences on food choices and preferred methods of receiving educational material while at the dining hall.

Your participation in this focus group involves answering some basic questions. The focus group leader will ask a question and then members of the group will freely respond and share their opinion. The goal is to learn about the opinions students have towards these topics. All responses will be tape-recorded and transcribed for the researcher to use in the future. All the responses will be kept confidential and names will not be associated with the answers given, however the researcher cannot control for other focus group participants reiterating responses outside of this session. This process should take about 45 minutes.

There are no apparent risks to participating in this study. If you consent to participate in this focus group, you are free to stop your participation at any time without prejudice, penalty, or loss of benefits to which you would otherwise be entitled

Each participant will be compensated for their time with a coupon for one free ice cream from the UNH Dairy Bar as well as with food during the focus group.

The researcher seeks to maintain the confidentiality of all data associated with your participation in this research. However, the researcher cannot control for focus group participants repeating this discussion outside of this meeting. The audio recording will be transcribed by Kate Rocheford. The records will be kept in a locked file cabinet within the Celentano Lab in Kendall Hall, room 407. All computer documents will be given a password access code that only the researcher knows. The original tape recorded data from the focus group will be destroyed after the research is completed.

If you have any questions pertaining to the research you can contact Kate Rocheford at (603) 862-0665 or kcw3@unh.edu. Dr. Joanne Curran-Celentano is also available at (603) 862-2573 or joanne.celentano@unh.edu.

If you have questions about your rights as a research subject you can contact Julie Simpson in the UNH Office of Sponsored Research, 603-862-2003 or Julie.simpson@unh.edu to discuss them.

I, _____, give my consent to participate in this focus group.

_____ Signature   _____ Date

Focus Group Topics

Whole Grain Information

What is a whole grain food?
What types of foods are whole grains?
Do you eat these foods daily?
What information do you use to tell if a product is a whole grain?
If you had to incorporate more whole grains into your diet, what types of food would you eat?
What additional information about whole grains you would like to learn?

Food Choices

What impacts/influences your food choices at the dining hall?
Are you likely to try new foods at the dining hall?
How will learning more about a certain food change what you choose to eat?

Delivery of Educational Material

Of the current nutrition information provided at the dining halls, which do you use?
Is any of the current educational information helpful?
What are better places educational information could be displayed in the dinning halls?
If you would like more education information about food, how would you like to receive it?

Proposed Materials

From these labels – which one would mostly likely attract your attention in the dining hall?
Would these posters and flyers catch your eye in the dining halls?
Would you stop to read them in the dining hall?

**Excellent Source of
Whole Grain**

**Good Source of
Whole Grain**

Large Poster (24" x 18")

Whole grains: Eat More!
It's Easier Than You Think

Health Benefits of Whole Grains!

- Weight control - feel fuller longer
- Protect against heart disease
- Protect against certain cancers
- Help lower cholesterol and blood pressure
- Protect against diabetes
- Contains antioxidants, vitamins and minerals

Follow the labels to find whole grain foods!

3 whole grain servings = 6 total wheat stalks

Example: Eat 3 serving sizes of "excellent" foods

OR

Eat 6 serving sizes of "good" foods

Examples of Whole Grain Products

Whole grain bread, tortillas or wraps
Whole grain pasta
Oatmeal
Whole grain bagels or English muffins
Brown Rice
Popcorn
Whole grain cereals

Eat at least 3 servings every day!

1 serving is equal to:

1 slice of whole grain bread
1 cup of whole grain cereal
1/2 cup of whole grain pasta
1/2 cup of brown rice
1/2 cup of oatmeal
3 cups of popcorn

Whole grains: Eat More!
It's Easier Than You Think

Breads

- 100% Whole Wheat bread ⟶

- Hearty 5 grain bread ⟶

Rolls and Wraps/Tortillas

- Whole wheat wrap
- Whole wheat pita ⟶
- Whole wheat roll
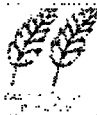
Bagels and English Muffins

- Honey whole wheat bagel ⟶

- Whole wheat English muffin ⟶

- Wheat English muffin ⟶
- Honey wheat English muffin ⟶

Hot Line Item Labels
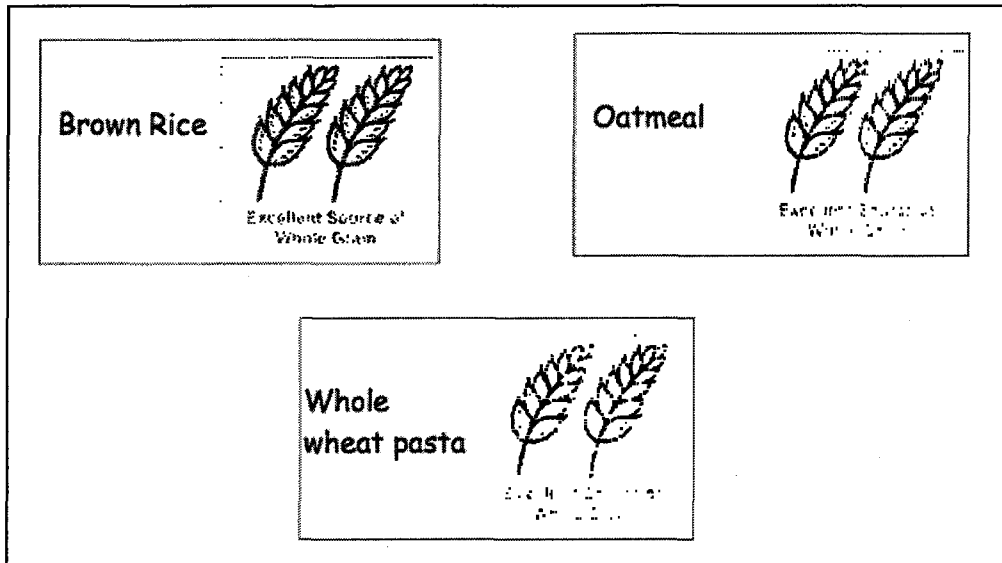
Example Cereal Dispenser Labels
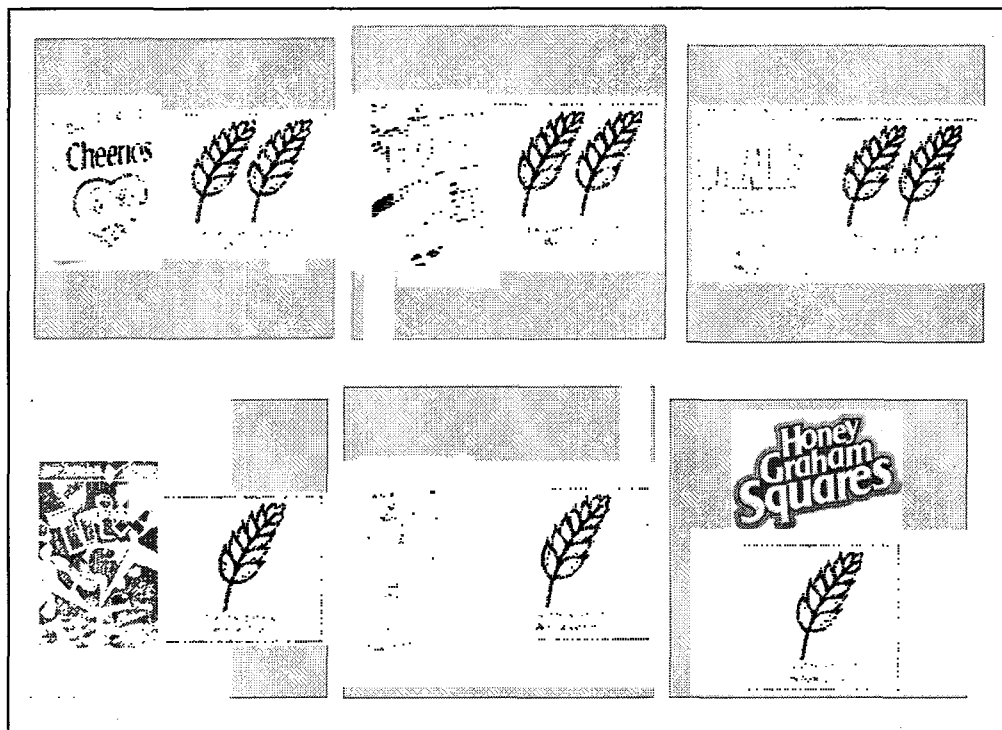
Example Napkin Dispenser Flyer

Whole Grains: Eat More!
It's Easier Than You Think

These new labels indicate whole grain
foods in the dining halls

Excellent Source of   Good Source of
Whole Grain   Whole Grain

Eat at least 3 servings
of whole grains per day

3 servings = 6 total wheat stalks

Example: 3 "Excellent" servings
Or
6 "Good" servings

Whole Grains: Eat More!
It's Easier Than You Think

Looking for new ways to get whole grains in
your diet?

* Try brown rice with your stir fry

* Start each day with a bowl of oatmeal

* Use whole wheat tortillas for burritos

Eat at least 3
servings each day!

Serving Sizes = 1 slice of bread
1 cup of cold cereal
1/2 cup rice, pasta or oatmeal

Table tent #1

Table tent #2

APPENDIX F: PRE-SURVEY AND POST-SURVEY

(Correct answers indicated where applicable)

WG Pre-Survey

Dear Participant,

By completing this online survey you are giving your unwritten consent to be a participant in this nutrition research study. This consent indicates you are willing to share your honest answers to the survey questions and understand that these responses will be incorporated into a master's degree thesis study.

There are no apparent risks to participating in this survey. If you consent to participate in this survey, you are free to stop your participation at any time without prejudice or penalty.

In order to maintain anonymity of all participants, please do not put your name anywhere on this survey. All responses will be kept strictly anonymous. All responses will go directly to a Survey Monkey™ account that can only be accessed by the researcher. The compiled data will be held as a password locked Excel file on a computer within the researcher's laboratory.

Please read each question carefully and answer as truthfully as possible. Please note, that once you answer a question you will not be allowed to go back and change your answers.

Thank you for your participation.

If you have any questions or concerns about this research study please contact:
Kate Rocheford
Graduate Student Researcher
Phone: 862-0665

If you have any questions or concerns about your rights as a research subject please contact:
Julie Simpson, Ph.D.
Office of Sponsored Research
Phone: 603-862-2003 Email: julie.simpson@unh.edu

1. Sex:
◯ Male
◯ Female

2. Age at last birthday:
Age (years)

3. Current Height and Weight:
Height (inches)
Weight (pounds)

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4. Current Grade:

○ Freshman

○ Sophomore

○ Junior

○ Senior

○ Graduate/Other

5. Where do you currently live?

○ UNH affiliated dorm (no kitchen)

○ UNH affiliated apartment (with kitchen)

○ Apartment (with kitchen)

○ At home (permanent residence)

Other (please specify)

[   ]

6. How were you contacted to complete this survey?

○ Bio 411 (Principles of Biology)

○ HHS 450 (Making Babies)

○ Math 420 (Finite Math)

○ Rec. Manag. 490 (Rec. & Leisure in Society)

○ Soc 400 (Intro to Sociology)

○ UNH Dining Hall website

7. What UNH college/school do you currently belong to?

○ College of Engineering and Physical Sciences (CEPS)

○ College of Health and Human Services (CHHS)

○ College of Liberal Arts (COLA)

○ College of Life Sciences and Agriculture (COLSA)

○ Thompson School of Applied Science

○ Whittemore School of Business and Economics (WSBE)

8. Do you currently smoke cigarettes every day, some days, or not at all?

◯ Every day

◯ Some days

◯ Not at all

9. On average, how many DAYS per week do you engage in moderate-intense physical activity (above normal daily activity)?

Example activities include brisk walking, jogging, swimming, nautilus and hiking.

Number of days per week [   ]

10. On an average day, how many MINUTES per day do you engage in moderate-intense physical activity (over your normal daily activity)?

Example activities include brisk walks, nautilus, swimming, jogging or hiking.

◯ None

◯ Less than 30 minutes

◯ 30-59 minutes

◯ 60-89 minutes

◯ 90 minutes or more

11. Do you currently have an unlimited dining hall meal plan?

◯ Yes

◯ No

12. Have you ever or are you currently taking a college level nutrition course?

◯ Yes

◯ No

13. How many times do you eat at the dining hall on an average day?

(Dining halls are considered Stillings, Philbrook or Holloway Commons)

- ○ Never/Rarely
- ○ 1
- ○ 2
- ○ 3
- ○ More than 3

14. Do you eat at one dining hall more often than the others?

(Dining halls are considered Stillings, Philbrook and Holloway Commons)

- ○ Yes
- ○ No

15. If yes, which dining hall do you eat at most often?
(Dining halls are considered Stillings, Philbrook and Holloway Commons)

- ○ Stillings
- ○ Philbrook
- ○ Holloway Commons

16. For each of the following statements, please check the one box that best indicates how strongly you agree or disagree with the statement

	Strongly Disagree	Disagree	Neither disagree nor agree	Agree	Strongly Agree
I am interested in learning about whole grain foods	○	○	○	○	○
My food choices are influenced mainly by taste	○	○	○	○	○
My food choices are influenced mainly by nutrition	○	○	○	○	○
My food choices are influenced mainly by what my friends like to eat	○	○	○	○	○
My food choices are influenced mainly by what is most convenient to eat or select	○	○	○	○	○
My food choices are influenced mainly by my religion/culture	○	○	○	○	○
My food choices are influenced mainly by my familiarity with that food	○	○	○	○	○

17. Nutrition experts recommend that you eat at least _____ serving(s) of WHOLE GRAIN foods each day.

Fill in your answer in the box provided   **3**

18. One whole grain serving of bread is equal to _____?

◉ 1 slice

○ 2 slices

○ 3 slices

○ I don't know

19. One serving of whole grain pasta, rice, or cooked cereal is equal to _____?

- ◉ 1/2 cup
- ◯ 3/4 cup
- ◯ 1 cup
- ◯ I don't know

Questions #20 & #21 are about foods you've eaten since the BEGINNING OF THIS SEMESTER (FALL 2008).

20. Mark the appropriate column to show HOW OFTEN on average you eat the following foods:

	Never/ Rarely	1 time a month	2-3 times a month	1 time a week	2 times a week	3-4 times a week	5-6 times a week	1 time a day	2 times a day	3 or more times a day
White rice	◯	◯	◯	◯	◯	◯	◯	◯	◯	◯
Brown rice	◯	◯	◯	◯	◯	◯	◯	◯	◯	◯
White bread	◯	◯	◯	◯	◯	◯	◯	◯	◯	◯
Whole grain bread	◯	◯	◯	◯	◯	◯	◯	◯	◯	◯
Whole grain bagel/English muffin	◯	◯	◯	◯	◯	◯	◯	◯	◯	◯
White bagel/English muffin	◯	◯	◯	◯	◯	◯	◯	◯	◯	◯
Oatmeal	◯	◯	◯	◯	◯	◯	◯	◯	◯	◯
Whole grain cereal (ex: Wheaties, Cheerios, Shredded wheat)	◯	◯	◯	◯	◯	◯	◯	◯	◯	◯
Refined cereal (ex: Apple Jacks, Frosted Flakes, Special K)	◯	◯	◯	◯	◯	◯	◯	◯	◯	◯
White pasta	◯	◯	◯	◯	◯	◯	◯	◯	◯	◯
Whole grain pasta	◯	◯	◯	◯	◯	◯	◯	◯	◯	◯
Quinoa	◯	◯	◯	◯	◯	◯	◯	◯	◯	◯
Barley	◯	◯	◯	◯	◯	◯	◯	◯	◯	◯
Popcorn	◯	◯	◯	◯	◯	◯	◯	◯	◯	◯
Tortilla chips	◯	◯	◯	◯	◯	◯	◯	◯	◯	◯
White tortilla/wrap	◯	◯	◯	◯	◯	◯	◯	◯	◯	◯
Whole grain tortilla/wrap	◯	◯	◯	◯	◯	◯	◯	◯	◯	◯
Refined crackers (ex: Ritz)	◯	◯	◯	◯	◯	◯	◯	◯	◯	◯
Whole grain crackers (ex: Triscuits)	◯	◯	◯	◯	◯	◯	◯	◯	◯	◯

21. When you eat these foods, HOW MANY SERVINGS do you have at a TYPICAL meal?

HELPFUL SERVING SIZE INFORMATION!

Bread: 1 serving = 1 slice
English muffins: 1 serving = 1/2 English muffin (1 full English muffin = 2 servings)
Bagels: 1 serving = 1/4 bagel (Dining hall & Bagelry bagels are 4 servings)
Wraps & tortillas: 1 serving = 1 small 6 inch tortilla
Cold cereal: 1 serving = 1 cup
Hot cereal (ex: oatmeal): 1 serving = 1/2 cup
Cooked rice, pasta, quinoa, barley: 1 serving = 1/2 cup
Popcorn: 1 serving = 3 cups
Crackers/tortilla chips: 1 serving = 5-7 crackers

	I don't eat this food	1/2 serving	1 serving	1 1/2 servings	2 servings	2 1/2 servings	3 servings	3 1/2 servings	4 servings	More than 4 servings
White rice	O	O	O	O	O	O	O	O	O	O
Brown rice	O	O	O	O	O	O	O	O	O	O
White bread	O	O	O	O	O	O	O	O	O	O
Whole grain bread	O	O	O	O	O	O	O	O	O	O
Whole grain bagel	O	O	O	O	O	O	O	O	O	O
Whole grain English muffin	O	O	O	O	O	O	O	O	O	O
White bagel	O	O	O	O	O	O	O	O	O	O
White English muffin	O	O	O	O	O	O	O	O	O	O
Oatmeal	O	O	O	O	O	O	O	O	O	O
Whole grain cereal (ex: Wheaties, Cheerios, Shredded wheat)	O	O	O	O	O	O	O	O	O	O
Refined cereal (ex: Apple Jacks, Frosted Flakes, Special K)	O	O	O	O	O	O	O	O	O	O
White pasta	O	O	O	O	O	O	O	O	O	O
Whole grain pasta	O	O	O	O	O	O	O	O	O	O
Quinoa	O	O	O	O	O	O	O	O	O	O
Barley	O	O	O	O	O	O	O	O	O	O
Popcorn	O	O	O	O	O	O	O	O	O	O
White tortilla/wrap	O	O	O	O	O	O	O	O	O	O
Whole grain tortilla/wrap	O	O	O	O	O	O	O	O	O	O
Tortilla chips	O	O	O	O	O	O	O	O	O	O
Refined crackers (ex:	O	O	O	O	O	O	O	O	O	O

Kitz)
Whole grain crackers (ex: ○ ○ ○ ○ ○ ○ ○ ○ ○ ○
Triscuits)

22. Whole grain foods are helpful in reducing the risk of developing which health conditions (Check all that apply)

☑ Heart disease

☑ Diabetes

☐ Common Cold

☑ Cancer

☑ High Cholesterol

☐ Alzheimer's

☑ Gastrointestinal distress

☑ High blood pressure

☐ Influenza

☑ Obesity/weight gain

☐ Schizophrenia

23. Please indicate which of the following foods are whole grain foods (Check all that apply)

☐ White rice

☑ 100% Corn tortillas

☑ Brown rice

☐ Pumpernickel bread

☑ 100% whole wheat bread

☐ Enriched white bread

☑ Whole wheat pasta

☑ Oatmeal

☐ Wheat bread

☑ Popcorn

☐ Bran muffin

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24. If I wanted to know if a food was whole grain, I would: (Check all that apply to you)

☐ Look at the front of the package

☐ Look at the color of the food

☐ Read the Nutrition Facts Panel

☐ Read the ingredient list

☐ Look for a rough texture to the food

Other (please specify)

Thank you for taking the time to complete this survey. It will be very helpful towards a successful research project.

If you have any questions or concerns about this research study please contact:
Kate Rocheford
Graduate Student Researcher
Phone: 862-0665

If you have any questions or concerns about your rights as a research subject please contact:
Julie Simpson, Ph.D.
Office of Sponsored Research
Phone: 603-862-2003 Email: julie.simpson@unh.edu

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WG Post-Survey

Dear Participant,

By completing this online survey you are giving your unwritten consent to be a participant in this nutrition research study. This consent indicates you are willing to share your honest answers to the survey questions and understand that these responses will be incorporated into a master's degree thesis study.

There are no apparent risks to participating in this survey. If you consent to participate in this survey, you are free to stop your participation at any time without prejudice or penalty.

In order to maintain anonymity of all participants, please do not put your name anywhere on this survey. All responses will be kept strictly anonymous. All responses will go directly to a Survey Monkey™ account that can only be accessed by the researcher. The compiled data will be held as a password locked Excel file on a computer within the researcher's laboratory.

Please read each question carefully and answer as truthfully as possible. Please note, once you answer a question you will not be allowed to go back and change your answers.

Thank you for your participation.

If you have any questions or concerns about this research study please contact:
Kate Rocheford
Graduate Student Researcher
Phone: 862-0665

If you have any questions or concerns about your rights as a research subject please contact:
Julie Simpson, Ph.D.
Office of Sponsored Research
Phone: 603-862-2003 Email: julie.simpson@unh.edu

This survey may look similar to one given earlier in the semester, BUT IT IS SLIGHTLY DIFFERENT.

Please FULLY complete this survey WHETHER OR NOT you did the earlier survey. All answers are appreciated!

1. Sex:

○ Male

○ Female

2. Age at last birthday:

Age (years)

3. Current Height and Weight:

Height (inches)

Weight (pounds)

4. Current Grade:

○ Freshman

○ Sophomore

○ Junior

○ Senior

○ Graduate/Other

5. Where do you live?

○ UNH affiliated dorm (no kitchen)

○ UNH affiliated apartment (with kitchen)

○ Apartment (with kitchen)

○ At home (permanent residence)

Other (please specify)

6. How were you contacted to complete this survey?

○ Bio 411 (Principles of Biology)

○ HHS 450 (Making Babies)

○ Math 420 (Finite Math)

○ Rec. Manag. 490 (Rec. & Lesiure in Society)

○ Soc 400 (Intro to Sociology)

○ UNH Dining Hall website

7. What UNH college/school do you currently belong to?

○ College of Engineering and Physical Sciences (CEPS)

○ College of Health and Human Services (CHHS)

○ College of Liberal Arts (COLA)

○ College of Life Sciences and Agriculture (COLSA)

○ Thompson School of Applied Science

○ Whittemore School of Business and Economics (WSBE)

8. Do you currently smoke cigarettes every day, some days, or not at all?

○ Every day

○ Some days

○ Not at all

9. On average, how many DAYS per week do you engage in moderate-intense physical activity (above normal daily activity)? Example activities include brisk walking, jogging, swimming, nautilus and hiking.

Number of days per week [   ]

10. On an average day, how many MINUTES per day do you engage in moderate-intense physical activity (over your normal daily activity)? Example activities include brisk walks, nautilus, swimming, jogging or hiking.

○ None

○ Less than 30 minutes

○ 30-59 minutes

○ 60-89 minutes

○ 90 minutes or more

11. Do you currently have an unlimited dining hall meal plan?

○ Yes

○ No

12. Have you ever or are you currently taking a college level nutrition course?

○ Yes

○ No

13. How many times do you eat at the dining hall on an average day?

(Dining halls are considered Stilings, Philbrook or Holloway Commons)

○ Never/Rarely

○ 1

○ 2

○ 3

○ More than 3

14. Do you eat at one dining hall more often than the others?

(Dining halls are considered Stillings, Philbrook and Holloway Commons)

○ Yes

○ No

15. If yes, which dining hall do you eat at most often?
(Dining halls are considered Stillings, Philbrook and Holloway Commons)

○ Stillings

○ Philbrook

○ Holloway Commons

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16. For each of the following statements, please check the one box that best indicates how strongly you agree or disagree with the statement

	Strongly Disagree	Disagree	Neither disagree nor agree	Agree	Strongly Agree
I am interested in learning about whole grain foods	○	○	○	○	○
My food choices are influenced mainly by taste	○	○	○	○	○
My food choices are influenced mainly by nutrition	○	○	○	○	○
My food choices are influenced mainly by what my friends like to eat	○	○	○	○	○
My food choices are influenced mainly by what is most convenient to eat or select	○	○	○	○	○
My food choices are influenced mainly by my religion/culture	○	○	○	○	○
My food choices are influenced mainly by my familiarity with that food	○	○	○	○	○

17. Nutrition experts recommend that you eat at least _____ serving(s) of _WHOLE GRAIN_ foods each day.

Fill in your answer in the box provided   **3**

18. One whole grain serving of bread is equal to _____?

◉ 1 slice

○ 2 slices

○ 3 slices

○ I don't know

19. One serving of whole grain pasta, rice, or cooked cereal is equal to _____?

- ⦿ 1/2 cup
- ◯ 3/4 cup
- ◯ 1 cup
- ◯ I don't know

Questions #20 & #21 are about foods you've eaten in the past **8 WEEKS (THE LAST 2 MONTHS)**.

20. Mark the appropriate column to show _HOW OFTEN_ on average you eat the following foods:

	Never/ Rarely	1 time a month	2-3 times a month	1 time a week	2 times a week	3-4 times a week	5-6 times a week	1 time a day	2 times a day	3 or more times a day
White rice	◯	◯	◯	◯	◯	◯	◯	◯	◯	◯
Brown rice	◯	◯	◯	◯	◯	◯	◯	◯	◯	◯
White bread	◯	◯	◯	◯	◯	◯	◯	◯	◯	◯
Whole grain bread	◯	◯	◯	◯	◯	◯	◯	◯	◯	◯
Whole grain bagel/English muffin	◯	◯	◯	◯	◯	◯	◯	◯	◯	◯
White bagel/English muffin	◯	◯	◯	◯	◯	◯	◯	◯	◯	◯
Oatmeal	◯	◯	◯	◯	◯	◯	◯	◯	◯	◯
Whole grain cereal (ex: Wheaties, Cheerios, Shredded wheat)	◯	◯	◯	◯	◯	◯	◯	◯	◯	◯
Refined cereal (ex: Apple Jacks, Frosted Flakes, Special K)	◯	◯	◯	◯	◯	◯	◯	◯	◯	◯
White pasta	◯	◯	◯	◯	◯	◯	◯	◯	◯	◯
Whole grain pasta	◯	◯	◯	◯	◯	◯	◯	◯	◯	◯
Quinoa	◯	◯	◯	◯	◯	◯	◯	◯	◯	◯
Barley	◯	◯	◯	◯	◯	◯	◯	◯	◯	◯
Popcorn	◯	◯	◯	◯	◯	◯	◯	◯	◯	◯
Tortilla chips	◯	◯	◯	◯	◯	◯	◯	◯	◯	◯
White tortilla/wrap	◯	◯	◯	◯	◯	◯	◯	◯	◯	◯
Whole grain tortilla/wrap	◯	◯	◯	◯	◯	◯	◯	◯	◯	◯
Refined crackers (ex: Ritz)	◯	◯	◯	◯	◯	◯	◯	◯	◯	◯
Whole grain crackers (ex: Triscuits)	◯	◯	◯	◯	◯	◯	◯	◯	◯	◯

21. When you eat these foods, _HOW MANY SERVINGS_ do you have at a typical meal?

HELPFUL SERVING SIZE INFORMATION!

Bread: 1 serving = 1 slice
English muffins: 1 serving = 1/2 English muffin (1 full English muffin would be 2 servings)
Bagels: 1 serving = 1/4 bagel (Dining hall & Bagelry bagels are 4 servings)
Wraps & tortillas: 1 serving = 1 small 6 inch tortilla
Cold cereal: 1 serving = 1 cup
Hot cereal (ex: oatmeal): 1 serving = 1/2 cup
Cooked rice, pasta, quinoa, barley: 1 serving = 1/2 cup
Popcorn: 1 serving = 3 cups
Crackers/tortilla chips: 1 serving = 5-7 crackers

	I don't eat this food	1/2 serving	1 serving	1 1/2 servings	2 servings	2 1/2 servings	3 servings	3 1/2 servings	4 servings	More than 4 servings
White rice	O	O	O	O	O	O	O	O	O	O
Brown rice	O	O	O	O	O	O	O	O	O	O
White bread	O	O	O	O	O	O	O	O	O	O
Whole grain bread	O	O	O	O	O	O	O	O	O	O
Whole grain bagel	O	O	O	O	O	O	O	O	O	O
Whole grain English muffin	O	O	O	O	O	O	O	O	O	O
White bagel	O	O	O	O	O	O	O	O	O	O
White English muffin	O	O	O	O	O	O	O	O	O	O
Oatmeal	O	O	O	O	O	O	O	O	O	O
Whole grain cereal (ex: Wheaties, Cheerios, Shredded wheat)	O	O	O	O	O	O	O	O	O	O
Refined cereal (ex: Apple Jacks, Frosted Flakes, Special K)	O	O	O	O	O	O	O	O	O	O
White pasta	O	O	O	O	O	O	O	O	O	O
Whole grain pasta	O	O	O	O	O	O	O	O	O	O
Quinoa	O	O	O	O	O	O	O	O	O	O
Barley	O	O	O	O	O	O	O	O	O	O
Popcorn	O	O	O	O	O	O	O	O	O	O
White tortilla/wrap	O	O	O	O	O	O	O	O	O	O
Whole grain tortilla/wrap	O	O	O	O	O	O	O	O	O	O
Tortilla chips	O	O	O	O	O	O	O	O	O	O
Refined crackers (ex: Ritz)	O	O	O	O	O	O	O	O	O	O
Whole grain crackers (ex: Triscuits)	O	O	O	O	O	O	O	O	O	O

22. Whole grain foods are helpful in reducing the risk of developing which health conditions (Check all that apply)

- ☑ Heart disease
- ☑ Diabetes
- ☐ Common Cold
- ☑ Cancer
- ☑ High Cholesterol
- ☐ Alzheimer's
- ☑ Gastrointestinal distress
- ☑ High blood pressure
- ☐ Influenza
- ☑ Obesity/weight gain
- ☐ Schizophrenia

23. Please indicate which of the following foods are whole grain foods (Check all that apply)

- ☐ White rice
- ☑ Corn tortillas
- ☑ Brown rice
- ☐ Pumpernickel bread
- ☑ 100% whole wheat bread
- ☐ Enriched white bread
- ☑ Whole wheat pasta
- ☑ Oatmeal
- ☐ Wheat bread
- ☑ Popcorn
- ☐ Bran muffin

24. If I wanted to know if a food was whole grain, I would: (Check all that apply to you)

☐ Look at the front of the package

☐ Look at the color of the food

☐ Read the Nutrition Facts Panel

☐ Read the ingredient list

☐ Look for a rough texture to the food

Other (please specify)

25. Have you seen this label in the dining halls this semester?

○ Yes

○ No

○ Unsure

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26. If yes, what does this label tell you about a food item?

○ High Fiber

◉ Excellent Source of Whole Grain

○ Gluten Free

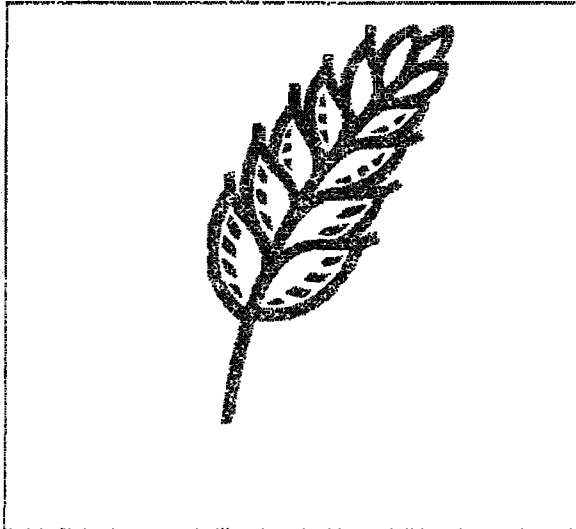○ Low Calorie

○ Low Carbohydrate

○ Good Source of Whole Grain

27. Have you seen this label in the dining halls this semester?

○ Yes

○ No

○ Unsure

28. If yes, what does this label tell you about a food item?

○ Excellent Source of Whole Grain

○ High Fiber

○ Gluten Free

◉ Good Source of Whole Grain

○ Low Carbohydrate

○ Low Calorie

29. Has this label influenced your food choices in the past semester?

○ Yes

○ No

○ Unsure

30. If yes, what food(s) did you consume more of because of this label? (Check all that apply)

☐ Whole grain cereals

☐ Oatmeal

☐ Whole grain Breads/Wraps/Rolls/tortillas

☐ Whole grain Bagels

☐ Whole grain English Muffins

☐ Brown Rice

☐ Whole wheat pastas

Other (please specify)

31. Compared to the first 8 weeks of this Fall semester, did you eat more whole grain foods in the LAST 8 weeks of this Fall semester?

○ Yes

○ No

○ Unsure

32. If yes, what factor(s) influenced you to eat more whole grains? (Check all the apply)

☐ Whole grain label in the dining halls

☐ Education material in the dining halls

☐ I heard about whole grains in Nutrition 400

☐ I heard about them on the news or from other people

Other (please specify)

[   ]

33. If no, what factors limited you from choosing whole grains? (Check all that apply)

☐ I don't like the taste

☐ I can't tell which products are whole grains

☐ I don't like the texture

☐ I don't even know what whole grains are

☐ I don't care much about nutrition

Other (please specify)

[   ]

34. Did you participate in taking a survey similar to this one earlier this semester?

○ Yes

○ No

○ I don't know

Thank you for taking the time to complete this survey. It will be very helpful towards a successful research project.

WG Post-Survey

If you have any questions or concerns about this research study please contact:
Kate Rocheford
Graduate Student Researcher
Phone: 862-0665

If you have any questions or concerns about your rights as a research subject please contact:
Julie Simpson, Ph.D.
Office of Sponsored Research
Phone: 603-862-2003 Email: julie.simpson@unh.edu

APPENDIX G: EMAIL COMMUNICATIONS

From: Katharine Rocheford <kcw3@unh.edu>
Date: August 20, 2008 9:50:39 AM EDT
To:
Subject: Thesis research help

Dear Professor _____

My name is Kate Rocheford and I am a graduate student in the Nutrition department. My thesis project focuses on increasing the consumption of whole grain foods by UNH students. The project is based upon a nutrition education program that will take place this Fall 2008 semester. In order to assess the effectiveness of this program I plan to perform an online survey both before and after the program.

To reach the largest number of potential students from diverse fields of study, I am contacting you as the professors of a large general education course. I am wondering if it is possible to recruit the students in your _____ class as potential participants for these surveys. Both surveys are conducted online via Survey Monkey and can be completed in 10-15 minutes each.

If you would like to help, the following tasks will be asked of you:

- Reply to this email and I will add you to my contact list.

- I will contact you once in mid October with an email containing the "pre" survey link for you to simply forward to your entire class roster.

- Again in early December I will contact you with a similar email containing the "post" survey link for you to again forward to your entire class roster

- These emails will contain all the necessary instructions for the students and all results will come back to me directly in an anonymous database. All I ask of you is to forward them to your class and let each student decide if they are willing to participate.

If you have any questions please feel free to contact me at 862-0665 or kcw3@unh.edu. My advisor, Dr. Joanne Curran-Celentano can also be reached at 862-2573 or joanne.celentano@unh.edu.

Sincerely,

Kate Rocheford

--

Kate Rocheford
Graduate Student, Nutritional Sciences
University of New Hampshire
Kendall Hall, 211

Pre-Survey Email Communication

From: Katharine Rocheford <kcw3@unh.edu>
Date: October 14, 2008 11:46:25 AM EDT
To: Survey Professors
Bcc: kcw3@unh.edu
Subject: **Nutrition Research Survey**

Hello Professors,

Please find below the standard email with the survey link to be forwarded to your gen. ed. rosters tomorrow morning (Wed, Oct 15). Please let me know if there are any questions or concerns. I appreciate all your efforts.

Thank you,
Kate Rocheford

Dear Students,

My name is Kate Rocheford and I am a graduate student in the UNH Nutrition program. I am conducting a research project that involves asking students to complete a short nutrition survey. As a member of a large general education course, you have been chosen to receive this survey.

The survey takes about 10 minutes to complete and is strictly anonymous. It is voluntary for you to choose to take the survey, but I greatly appreciate your help. The more surveys that are completed the better my research will be.

To access the survey, simply go to this link.

http://www.surveymonkey.com/s.aspx?sm=1XuqsB8H8SYIAU_2fy8sPr7Q_3d_3d

Sincerely,

Kate Rocheford
Graduate Student, Nutritional Sciences Program
Department of Molecular, Cellular and Biomedical Sciences
University of New Hampshire
Kendall Hall, 211

Post-Survey Email Communication

From: Katharine Rocheford <kcw3@unh.edu>
Date: December 9, 2008 9:10:48 PM EST
To: Survey Professors
Bcc: kcw3@unh.edu
Subject: End of Semester Nutrition Survey

Hello again Professors,

Please find below the standard email with the new survey link. Please forward this part
of the email to your gen. ed. rosters tomorrow morning (Wed, Dec 10). It may also be
posted on your Blackboard site if you wish.

Please let me know if there are any questions or concerns. I again appreciate all your
efforts and hope to have as good a response as before. This survey is very similar to the
first one but slightly different in some of the questions (in case your students ask). They
are allowed to fill out this one whether or not they took the first one.

Thank you,
Kate Rocheford

Dear Students,

My name is Kate Rocheford and I am a graduate student in the UNH Nutrition program.
I am conducting a research project that involves asking students to complete a short
nutrition survey. As a member of a large general education course, you have been chosen
to receive this survey.

This survey is similar (but different) to one sent out earlier in the semester, but you are
free to fill out this survey whether you did the first one or NOT.

The survey takes about 10 minutes to complete and is strictly anonymous. It is
voluntary for you to choose to take the survey, but I greatly appreciate your help. The
more surveys that are completed the better my research will be.

To access the survey, simply go to this link.

http://www.surveymonkey.com/s.aspx?sm=CDx8q89wv3Y5ygwg_2fKhPZg_3d_3d

Happy Holidays!
--
Kate Rocheford
Graduate Student, Nutritional Sciences Program
Department of Molecular, Cellular and Biomedical Sciences
University of New Hampshire
Kendall Hall, 211