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Web-Based Nutrition Education for University Middle-Aged Female Staff

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WEB-BASED NUTRITION EDUCATION
FOR UNIVERSITY MIDDLE-AGED FEMALE STAFF

by

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Researchers have described women as facing a dramatic increase in the risk of heart disease, osteoporosis, stroke, and Alzheimer's, the onset of these as the result of the impact of changing hormone levels, particularly the decline in estrogen. The purpose of this two-phase study was to determine if web-based nutrition education could be used to increase the consumption of food groups in MyPyramid, omega-3 fatty acids and self-efficacy in middle-aged female. Phase one was a qualitative study to identify middle-aged female's beliefs and interests around the topic of nutrition. Data were collected using audiotaped semi-structured individual interviews. Eight female staff (aged 45 to 65) in a Midwestern university were recruited using snowball sampling. Interviews were transcribed verbatim. Data were coded and themes developed by sorting and summarizing coded transcript segments. Three themes emerged: "Health" related to their individual conditions, such as avoiding illnesses and weight management, with aging; "Life style" described what occasions lead to participants' current dietary action; "Availability" described the factors that influenced participants' healthy eating behaviors. The results of this study provided a context to develop phase two for this target population. Phase two was a quantitative study to assess the effectiveness of MyPyramid to improve dietary intake and self-efficacy after a six-week online nutrition education intervention using a blog for university middle-aged female staff. The impact of additional omega-3 fatty acids education on food consumption and self-efficacy was also

assessed. Ninety-three participants (aged 45 to 65) were recruited at the beginning of the study and randomized into an intervention group or control group. Results indicated that a web-based nutrition education is acceptable for this target population. MyPyramid and additional omega-3 fatty acids information did not significantly effect participants' dietary consumption or self-efficacy to increase consumption from the food groups or to increase omega-3 fatty acid consumption. However, there was a trend that participants were less certain to include omega-3 fatty acids than whole grains in their diets.

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Wan-Ju Yen

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INTRODUCTION

Nutrition educators are looking for effective promotion of healthy eating practices to prevent chronic diseases and maintain health, especially in the postmenopausal population. Researchers have described women as facing a dramatic increase in the risk of heart disease, osteoporosis, stroke, and Alzheimer's, all as the result of the impact of changing hormone levels, particularly the decline in estrogen (Lock et al., 2001). Women are more prone to diseases than their male counterparts (Health stat, 2004). Outcomes from large scale health surveys suggest women's morbidity and medical care utilization to be higher than men's (Koopmans et al., 2007).

The median age at menopause is 51.3 years in the U.S. (Thomas et al., 2001). In a national survey, 31.46% of the female population was over 50 years of age (National Center for Health Statistics, 2005). Postmenopausal women may start to gain weight, which increases the risk of developing many chronic diseases such as coronary heart diseases, type 2 diabetes and osteoporosis (Asikainen et al., 2004). Data from the National Health and Nutrition Examination Survey (NHANES) obtained in 2003-2004 shows 68% of females 40 to 59 years of age and 69% of females over 60 years of age were overweight or obese (Ogden et al., 2006). Various studies have found that women after menopause have higher morbidity than men. The Framingham study found the new cases rate of cardiovascular diseases (CVD) per 1000 women after menopause was 6.5, compared with 3.6 prior to menopause (Masse et al., 2004).

Food-related health perceptions have been studied among older women (age 65 to 88) in Sweden (Gustafsson et al., 2002). Two themes arose from this qualitative

interview study. “A healthy slimming meal or the usual habit” describes the women’s perceptions of the disease-preventing health message and of their related health behavior. “Meals- a pleasure or an obligation” deals with the meaning of meals for their wellbeing and the delights of eating. Health information regarding post menopause is also available in different formats, such as books, internet and food companies. There are books focused on menopause, osteoporosis, hypertension and hormonal replacement therapies (Barbo, 1987; Bilezikian, 2003; Johnson, 1997; Messerli et al., 1996). In 2000, it has been estimated that 72% of regular internet users (over 70 million people) went online seeking health-related information (Millard et al., 2002). Some food companies have nutrition information for consumers on their websites. General Mills has a women’s heart health webpage. Kellogg’s also has heart health information on the website and a shape management focus for female consumers. But the nutrition information is not specific to the postmenopausal population.

As large numbers of women reach midlife, understanding their perceptions of health stability, opportunities for change in dietary attitudes and practices and the influences on them will become increasingly important to nutrition educators (Edstrom et al., 2001).

REVIEW OF LITERATURE

Omega-3 Fatty Acids

Omega-3 fatty acids are essential fatty acids because they are not synthesized by the body and must be obtained through diet or supplementation. The most common omega-3 fatty acids are alpha-linolenic acids (ALA, 18:3 n-3), eicosapentaenoic acids (EPA, 20:5 n-3) and docosahexaenoic acids (DHA, 22:6 n-3). The Institute of Medicine (2002) suggests that, for adults 19 and older, an adequate intake (AI) of ALA for males is 1.6 g/day and 1.1 g/day for females. American Heart Association recommends healthy people to consume fish two times per week and for people with coronary heart diseases (CHD) risk, 1 g/day of EPA and DHA is recommended (Kris-Etherton et al., 2003). ALA is present in flaxseeds or flaxseed oil, walnuts, green leafy vegetables and in some commonly used oils, including canola and soybean oil (Ratnesar et al., 2000). DHA, which is thought to be important for brain development and functioning, is present in significant amounts in limited food products including fish, fish liver oils and fish eggs (Özyurt et al., 2006).

Omega-3 fatty acids recently have been the focus of much attention. Besides cardiovascular diseases, hypertension (Woodman et al., 2003), rheumatoid arthritis (Berbert et al., 2005), diabetes mellitus (Tapsell et al., 2004), asthma (Mihrshahi et al., 2004), depression (Su et al., 2003) and some cancers (Sharma et al., 2005), it also possesses anti-inflammatory (Arrington et al., 2001), antiarrhythmic (Castaño et al, 2005) and anti-thrombotic (Mesa et al., 2004) properties. The influence of fish oils on cardiovascular disease risk is multifactorial. Fish oils reduce very-low-density lipoprotein

(VLDL) secretion, lower triacylglycerol transport and may enhance VLDL clearance. The net effect is a reduction of circulating triacylglycerol levels (Rivellese et al., 2003). Studies have reported that omega-3 fatty acids decrease triacylglycerides and VLDL in hypertriglyceridemic subjects, with a concomitant increase in high-density lipoprotein (HDL) (van Dam et al., 2001). However, they appear to have no effect on low-density lipoprotein (LDL) (Castaño et al, 2005).

Some studies have shown that ALA does not appear to be comparable with its biological effects, compared with EPA and DHA found in fish oil. It appears that the EPA and DHA from marine oils are more rapidly incorporated into plasma and membrane lipids than ALA (Simopoulos, 2002). A dietary ratio of 4:1 (linoleic acid (LA): ALA) or less is recommended for conversion of ALA to longer chain metabolites (EPA and DHA). Relatively large reserves of LA in body fat, as are found in vegans or in the diet of omnivores in Western societies, would tend to slow down the formation of long-chain omega-3 from ALA (Simopoulos, 2002). It has been shown that omega-3 fatty acids in fish lower serum triacylglycerol more effectively than does ALA (Bemelmans et al., 2002). Because ALA is a precursor for long-chain fatty acid synthesis, the increase in serum EPA may result in part from a conversion of ALA to EPA. However, ALA enrichment may not suffice for DHA because of the very limited conversion rate of ALA to DHA (Zhao et al., 2004).

Postmenopausal Women and Omega-3 Fatty Acids

Omega-3 fatty acids are associated with the physiological needs of women throughout life, from the fetus stage, through puberty, fertility and menopause (Saldeen et

al., 2004). Estrogens cause higher DHA concentrations in women than in men (Giltay et al., 2004). Women of reproductive age seem to have a greater capacity to convert ALA to DHA than do men (Burdge et al., 2002). After menopause, estrogen levels decrease and this leads to possible decreasing DHA concentrations in women. The Framingham Study found that the new cases rate of cardiovascular diseases (CVD) per 1000 women after menopause was 6.5, compared with 3.6 prior to menopause (Masse et al., 2004). In a case-control study on 45 to 75 years old Norwegian men and postmenopausal women, Yli-jama et al. (2002) found the content of very long-chain omega-3 fatty acids in serum free fatty acids fraction was inversely associated with risk of myocardial infarction. Women have the same cardiovascular risk rate as men after menopause. Therefore, it is very important for menopausal women, as well as men, to have sufficient omega-3 fatty acids intake in order to prevent cardiovascular diseases.

The considerably higher levels of DHA in the serum phospholipid of the Inuit women versus the Canadian women may contribute much lower rate of ischemic heart disease in Greenland Inuit compared with Western populations. The short-term supplementation of Canadian postmenopausal women with EPA and DHA can increase total omega-3 fatty acids PUFA and DHA in serum phospholipid to levels not significantly different from those of Inuit postmenopausal women (Stark et al., 2002).

The effect on hot flushes suffered by some women during menopause was found to be modulated when a soy isoflavone alone and with the addition of a polyunsaturated fatty acid (PUFA) supplement was on 28 postmenopausal women, age 45 to 58, indicated there was a progressive and highly significant reduction in the number of hot flushes due to a omega-3 PUFA supplement, independent of whether the women had begun with

isoflavones or with placebo (Campagnoli et al., 2005). Omega-3 fatty acids could reduce hot flushes through their influence on neuronal membrane and/or the modulation of the neurotransmitter function and the serotoninergic system.

In What We Eat in America (WWEIA) National Health and Examination Surveys (NHANES) 2001-2002 report, the average ALA usual intake from food is 1.3 g/day for females age 51-70. In the Iowa Women's Health Study, the mean respective intakes of EPA, DHA and total marine omega-3 fatty acids of women ages 55 to 69 were 53 mg, 135 mg, and 188 mg per day. Mean intake of ALA was 1.09 g per day (Folsom et al., 2004).

MyPyramid Recommendations

The US Department of Agriculture released MyPyramid in year 2005, the latest food guide for the general public (USDA). The MyPyramid replaced the Food Guide Pyramid and was designed to be broader in scope by providing guidance on food intake patterns for different gender and age groups that would meet the Dietary Guidelines and the Dietary Reference Intake recommendations (Britten et al., 2006a). New consumer messages and graphic presentations for MyPyramid were designed to be primarily a symbol or logo in materials, directing people to a web site where they could enter their personal data and receive personalized recommendations about what to eat (Britten et al., 2006b; Haven et al., 2006a). The messages were behaviorally focused (Contento, 2008). The MyPyramid recommendations thus became available to all people who have access to the Web (Haven et al., 2006b).

Small, practical changes in food choices that bring consumers closer to meeting MyPyramid recommendations result in gradual and dramatic improvements in diet quality (Hornick et al., 2008). The MyPyramid recommendations can provide diets that are nutritionally adequate and moderate in other dietary constituents that are important to controlling diet-related conditions (Krebs-Smith et al., 2007). A lesson incorporated into MyPyramid was developed by a nutrition education network and was tailored to the needs of learners in six age groups, from school-aged children to older adults (Kelley et al., 2008). It includes hands-on activities to help groups of learners become familiar with cups, ounces and ounce equivalents.

In the meat and beans group in MyPyramid, it states:

- Some fish (such as salmon, trout, and herring) are high in a type of PUFA called "omega-3 fatty acids." The omega-3 fatty acids in fish are commonly called "EPA" and "DHA." There is some limited evidence that suggests eating fish rich in EPA and DHA may reduce the risk for mortality from cardiovascular disease. (EPA is eicosapentaenoic acid and DHA is docosahexaeonoic acid.)

- Choose fish more often for lunch or dinner. Look for fish rich in omega-3 fatty acids, such as salmon, trout, and herring.
  Some ideas are:
  - Salmon steak or filet
  - Salmon loaf
  - Grilled or baked trout

It does not provide explicit information on the recommendation, dietary sources and other health benefits of omega-3 fatty acids.

Nutrition Education Research

The steps for behavior change research are essential for effective nutrition education interventions. It weakens nutrition education efforts if behavior change research is ignored. The Food and Nutrition Extension Educators (FNEE) Division of the Society for Nutrition Education (SNE) used theory to plan a workshop, which was designed, implemented and evaluated using a 6-step procedural model: Assessment of needs, interests and assets of the audience; Selecting the theoretical framework; Determining theory-based goals and objectives; Designing the theory-based nutrition education intervention; Implementing the nutrition education intervention; Evaluating the nutrition education intervention using theory (Townsend et al., 2003).

Tailoring services to meet nutrition and learning needs is a key action for nutrition education. The Special Supplemental Nutrition Program for Women, Infants, and Children (WIC) program in Washington State developed a module to be used at local WIC agencies to promote family meals (Johnson et al., 2006). Needs assessment and formative evaluation ensured that the module met the needs of WIC staff and clients. Based on the focus groups, key messages, materials and group activities were designed to appeal to parents' goals for their children and to help families plan ways to overcome barriers to family meals. In response to a web-based survey, WIC staff indicated what module components they would like. Six local agencies volunteered to pilot the module and pretest the materials. Researchers modified the materials to be short, to the point, colorful and attractive based on the pretesting.

Enhanced understanding of the beliefs and perceptions about diet can provide a context for dietitians in practice and researchers conducting behavioral interventions. A

qualitative approach was used to better understand and examine the perceptions of colorectal cancer survivors in North Carolina (Reedy et al., 2005). The use of in-depth interviews allows for a contextual exploration of the meanings and motivations behind the participants' decisions to select foods and/or dietary supplements since few qualitative data exist that describe perceptions about diet and dietary supplement use to help inform the design and implementation of interventions.

Tailoring a worksite nutrition education intervention for university staff was based on baseline assessment of nutrition knowledge and dietary behavior status (Abood et al., 2003). The assessment was used to guide content selection and determined the information to emphasize in each one-hour weekly educational session for eight weeks.

The "Worksite Wellness for Tompkins County" website demonstrated the steps for starting a worksite wellness program. Getting started for the planning steps is to conduct a formal survey of employees' needs and interests by asking employees what they're interested in and what needs they have. Fundamentally, a wellness program is behavioral change. People are much more willing to change if they are involved in the change process. Results of the survey were used to set goals (outcomes and expectations) and objectives (activities and programs) for the program. The wellness at work program of the Massachusetts' Bureau of Family and Community Health also stated obtaining input from employees by asking employees about their needs and interests. This increases the chances of employees' participation in wellness activities. The input could be gathered through informal conversations or by conducting a formal needs assessment among employees.

A community-based cardiovascular risk-reduction program was evaluated using

both quantitative and qualitative methods (Vander Wel et al., 2005). Qualitative evaluation gathered rich information to identify ways in which subjects were engaged in learning. This study demonstrated that qualitative data can be used to provide additional insight into the contextual elements why and how a nutrition intervention is successful.

A six-month healthy-lifestyle clinical-based weight management program followed for an additional 18 months was promoting long-term changes in diet and exercise behaviors on 144 overweight and obese adults (Riebe et al., 2005). The program began with an intensive three-month phase during which subjects attended 2 two-hour sessions each week. Each session involved one hour of behavior or dietary instruction and one hour of exercise. The dietary intervention focused on healthy eating rather than dietary restriction. Following the intensive phase, participants attended a tapering phase for a total of eight visits over three months. Participants were asked to submit food records four days per week. During the clinical program, subjects received three computer-generated individualized reports on Transtheoretical Model (TTM) mediator variables at baseline, three and six months, and constructs such as self-monitoring, goal setting, stimulus control and relapse prevention were reviewed. Decisional balance, process of change and self-efficacy were measured using 5-point Likert scales. At 24 months, subjects maintained decreases in weight, percent body fat, total caloric intake, percentage of calories from saturated fats and increases in weekly exercise minutes ($p<.05$).

An interactive computer-tailored physical activity and fat intake interventions on 771 adults was designed to help participants reach the current public health recommendations for physical activity and fat intake (Vandelanotte et al., 2005).

Participants received the computer-tailored interventions at a university computer lab. It took about 50 minutes to go through one intervention (physical activity or fat intake). Participants filled out an electronic questionnaire consisting of demographics, health behavior, and psychosocial variables after reading an introduction page. After completing the questionnaires, tailored feedback was displayed immediately on the screen. The feedback, consisted of a general introduction, normative feedback and tips and suggestions, was based on the Theory of Planned Behavior and the stage of change. After reading the tailored feedback from the computer screen, the advice was printed and taken home. For measuring fat intake, a 48-item food frequency questionnaire was used. Six month post baseline, tailored interventions produced significant higher physical activity scores and lower fat intake scores ($p<.001$).

Seventy-seven adult men and women who were at risk of recurrence for colorectal adenomas participated in a diet intervention study to explore the relationship between dietary changes and self-reported diet-related quality-of-life outcomes (Pakiz et al., 2005). Participants were randomly assigned to intervention or control groups and followed for one year. The primary method of collecting dietary intake data was through repeated 24-h dietary recalls obtained by telephone interview. The intervention group was asked to make changes in their usual eating patterns in order to meet 7-9 servings of vegetables, 3 servings of fruit, 3 servings of low-fat dairy products, at least 30-35 g fiber and 20-25% of energy intake from fat. Dietary intake data were collected at baseline and 6 and 12 months. Individual diet counseling for the intervention group involved telephone counseling and was based on the Social Cognitive Theory. The counselors provided encouraging feedback on subjects' dietary intakes and progress. The program started with

an introductory call of 45-60 minutes in length. The intensive phase that followed involved 3-10 daily calls lasting 30-60 minutes to analyze the results of 24-h dietary recalls. The following phase consisted of 3-7 weekly calls lasting 30-60 minutes that focused on personalized behavior modification. Based on repeated 24-h dietary recalls, the intervention group reported had significantly higher consumption of vegetables, fruit, low-fat dairy products, fiber, and calcium at 12 months.

A 12-week workplace e-mail intervention on knowledge, attitude and behavior change related to physical activity and nutrition was assessed in a sample of employees at five large workplaces in the providence of Alberta, Canada (Plotnikoff et al., 2005). E-mail-based questionnaires were administered one week before and one week after intervention. The intervention group received a weekly combined physical activity and nutrition message sent to their e-mail address. The control group completed the questionnaires at the same time points but did not receive any messages during the 12 week study period. The intervention group reported more favorable changes in practicing healthy eating, balancing food intake with activity level, cooking meals with techniques to reduce fat and avoiding eating high-fat foods.

A nutrition education intervention, “Omega-3 for Baby and Me”, was developed for WIC pregnant women in Denver, Colorado to promote an increase in their consumption of DHA (Troxell et al., 2005). The targeted daily dose of DHA for the intervention was 300 mg/day, which is a level that can be achieved by diet alone. Prior to any material development, focus groups were conducted to determine the needs and expectations of the target audience. Topics discussed in the focus groups included participant’s prior knowledge of foods during pregnancy, expectations of the foods, their

behavioral capabilities and self-efficacy relative to purchasing and preparing healthy foods. Process evaluation pilot testing was conducted to evaluate recipes and logos acceptance among the target audience. Recipes for the intervention were developed with several criteria, including achieve the targeted daily dose of DHA (300 mg) with one serving, be quick and easy to prepare, use inexpensive and widely available ingredients, cover a variety of ethnic flavors, and be delicious. Recipes were developed to provide meals for breakfast, lunch, dinner, and snacks so the women would have flexibility in planning meals using DHA-rich foods. Another consideration during the recipe development was to provide variety in the manner in which fish was used.

Nutrition Education Programs for Postmenopausal Women

Health Topics

The postmenopausal years are associated with the increased incidence of central obesity, hypercholesteroiemia, hypertension, reduced energy expenditure, and type 2 diabetes (Poehlman, 2002). Common nutrition-related health problems for postmenopausal women are bone health (osteoporosis), breast cancer, cardiovascular diseases and obesity.

There is a strong and possibly specific association between the severity of osteoporosis and the risk of cardiovascular events in generally healthy postmenopausal women with low bone mass that is independent of age and cardiovascular risk factors (Tanko et al., 2005). There are biological links between bone metabolism and atherosclerosis that suggests postmenopausal women with osteoporosis should also be considered for cardiovascular intervention to prevent adverse outcomes.

Hormone therapy is usually considered the first line of treatment for vasomotor symptoms in postmenopausal women. But in the Women's Health Initiative (WHI) study, researchers recommended stopping estrogen plus progestin because the test statistic for invasive breast cancer risks exceeded the benefits (Rossouw et al., 2002). Therefore, many postmenopausal women were trying out other ways of treatment, like dietary supplements. Dietary supplements with isoflavones from either soy or red clover have been two of the most commonly utilized botanicals for peri- and postmenopausal women (Geller et al., 2006). Soy foods and supplements as well as red clover have been of interest for the reduction of menopausal symptoms and conditions related to aging because of their high concentrations of phytoestrogens, specifically isoflavones, which are thought to be especially healthful. Isoflavone extracts of soy and red clover appear to have a small but positive health effect on plasma lipid concentrations and may improve bone mass density and cognitive abilities.

Approximately 70% of early postmenopausal women are classified as overweight or obese using body mass index (BMI) (Evans et al., 2006). Obese postmenopausal women with metabolic syndrome have higher carotid atherosclerosis prevalence than those without metabolic syndrome (Montalcini et al., 2007). Women with metabolic syndrome tend to have a high atherosclerosis burden compared with healthier obese women.

Many studies on postmenopausal women’s health have been investigated, such as the association between osteoporosis and cardiovascular risks, hormone therapy and the incidence of breast cancer, dietary supplement usage, and obesity problems.

Nutrition Education Delivery Methods

Nutrition education programs for postmenopausal women have included five different delivery methods, face-to-face, traditional mail, computer program and internet program.

Face-to-face nutrition education

Face to face, or in-class interventions are the popular and the most basic method for nutrition education. One interesting study examined whether a diet rich in dairy products followed by a nutrition education program for the prevention of osteoporosis could have any adverse effect on certain CVD risk factors for postmenopausal women in Greece (Manios et al., 2006). In the study, a biweekly nutrition education program of one hour each session for five months was provided. A total sample of 75 women (55–65 years old) was randomized to a dietary intervention group, who attended a biweekly nutrition education program and provided with low-fat, fortified dairy products, and to a control group. Changes in dietary, biochemical and clinical indices related to CVD were determined at the end of the 5-month intervention period. Dietary indices from a 24-hour recall, anthropometric indices, biochemical indices and blood pressure were measured. The findings of the study have indicated that calcium, phosphorus and magnesium intakes were increased for the intervention group and reaching or close to the recommended daily intake levels. Potassium was below daily intake recommendations, although its increase from baseline to follow-up was significant higher for the intervention group than the control group.

The Women's Wellness Program, a multimodal intervention, was designed to improve women's cardiovascular risk factors in Australia (Anderson et al., 2006). The

health education was provided with a 40-minute consultation with a registered nurse, which outlined the 12-week program and included an individual health education and goal setting session. Dietary habits, physical activity and tobacco use were assessed. Five biophysical outcomes, waist to hip ratio (WHR), BMI, blood pressure, resting heart rate and weight, were measured. This study found that women in the intervention group increased their aerobic exercise and decreased their smoking significantly compared with those in the control group. Results also showed that all five biophysical outcome measures supported the efficacy of the intervention, with significant decreases seen in the women's WHR, BMI, blood pressure, and measured weight.

Traditional mail

Gray et al. (2000) developed eight short messages on weight management and sent to female university employees to assess their responses to use of electronic mail (e-mail) compared to fact sheets sent by campus mail. The aim was to compare 181 employed women (mean age 48 years) responses to weight maintenance messages sent to their worksites electronically, by campus mail or by a combination of both. Reactions to delivery methods were determined and changes in knowledge and behavior that resulted from the series of messages were assessed. They found that there were no differences among the three groups.

Computer program

In West Virginia, a computer-based interactive nutrition intervention to reduce cardiovascular disease risk by promoting an increase in fruit and vegetable intake and a decrease in dietary fat consumption was conducted with 262 low-income rural females (average age 50 years old) (Tessaro et al., 2007). Fat, fruit and vegetable consumption,

stage of readiness to change, dietary behaviors (read food labels, dietary fats knowledge) and barriers to change were measured at baseline and at three-month follow-up. Findings showed that an interactive computer-based nutrition program can initiate the process of change by increasing knowledge, dietary behaviors, and readiness to change.

Internet program

An internet based nutrition education program is able to offer individually tailored dietary advice at any time, and it is considered a promising way to educate the public (Nakade et al., 2006).

Women's Interactive System about Decision On Menopause (WISDOM) is a web-based decision support tool designed to improve the quality of treatment decisions around menopause and hormone therapy (Col, 2007). Healthy menopausal women (age 45 to 65, the mean age was 53 years) were given unlimited access to WISDOM before their clinic appointment. WISDOM users appeared more likely to try exercise, diet and soy as compared to controls.

Multiple methods combination

Healthy women who were health maintenance organization members ages 40-70 participated in two 45-min counseling sessions with two to three weeks between (Stevens et al., 2003). The sessions included a 20-min interactive computer-based intervention using a touch-screen format. The intervention goals were to reduce dietary fat and increase fruit and vegetable consumption. The outcomes were measured by a food frequency questionnaire (FFQ) and the Fat and Fiber Behavior Questionnaire (FFBQ). Compared to the control group, intervention participants reported significantly less fat consumption (3.75 points less for percentage of energy from fat), significantly greater

consumption of fruit and vegetable combined (0.93 more servings per day), and a significant reduction of fat consumption (0.20 point change in the FFBQ).

A Health Works for Women intervention on improving multiple behaviors including nutrition and physical activity among rural female blue-collar employees in North Carolina was conducted (Campbell et al., 2002). Almost half of the participants (47%) were 40 years of age or older. The intervention group received computer-tailored magazines and joined a social support program. Health behaviors were measured and the measurements included diet (dietary total fat and fruit and vegetable consumption), physical activity, smoking, and cancer screening. The results showed an increase of 0.7 daily servings for fruit and vegetable consumption in the intervention group at the 18-month follow-up.

Computer and internet mediums are becoming more prevalent in nutrition education. To combine computer and face-to-face or mail delivery methods could be an approach to introduce technology to postmenopausal women.

Nutrition Education Theoretical Models

The most common nutrition education theories used in nutrition education for postmenopausal women are the Health Belief Model (HBM), the Theory of Planned Behavior (TPB), the Social Cognitive Theory (SCT), and the Transtheoretical Model (TTM)/Stages of Change theory.

In Florida, the Elder Nutrition and Food Safety (ENAFS) nutrition program included components of the HBM, self-efficacy and the Stages of Change, in lessons promoting the nutritional and overall health of elders (Bobroff et al., 2003). Clients at the congregate nutrition site ranged in age from 55 to 103 years and 89 percent of the

clientele at the meal site were at medium to high nutritional risk. Based on written lesson evaluations, the lessons were effective in promoting knowledge gain and encouraging behavior change among program participants. Manios et al. (2007) applied the combination of the HBM and the SCT in an intervention scheme to increase nutritional knowledge and self-efficacy of postmenopausal women to adopt and maintain healthy dietary choices.

Kim et al. (2003) used TPB to explain intention to consume dairy products and consumption of dairy products by older adults (mean age 75 years, 76% of the subjects were females) from seven community centers in the Minneapolis-St. Paul metropolitan area. Perceived behavioral control contributed to intention to consume and actual consumption of dairy products. Attitudes and perceived behavioral control were more significant than subjective norms in this study.

Conn (1997) applied the self-efficacy component of SCT to predict exercise, dietary and stress management health behavior among older women. The use of self-efficacy measures closely corresponded to the target behavior and may explain the stronger relationship between the construct and behavior as compared to research using less specific measures. Stevens et al. (2003) also used SCT combined with motivational interviewing and problem solving strategies to design the dietary intervention for healthy postmenopausal women in Oregon. The intervention addressed motivation, self-efficacy and stage of change by being patient-centered and negotiating gradual behavior change goals which participants were ready to accept.

The Health Works for Women intervention was based on SCT, the stages of change TTM and social support models (Campbell et al., 2002). The conceptual model of

the intervention was based on an ecological framework, which recognizes the link between individual behaviors and social and environmental support.

Women's Wellness Program, a multi-intervention program, used self-efficacy in promoting positive lifestyle behaviors (Anderson et al., 2006). The strategies included the behavioral and cognitive techniques of goal setting, health education to incorporate healthy choices and positive behaviors, and social support through registered nurse consultations, ongoing support and follow-up.

Among the studies reviewed here, self-efficacy has been used most frequently as a theory component. The social cognitive theory also has been broadly used in some of these studies.

Nutrition Education Intervention Duration

Postmenopausal women nutrition education interventions duration ranges from three months to 18 months. The actual intervention time varies from 20 minutes to 10 hours.

In the Women's Wellness Program, the intervention group was provided with a 40-minute consultation with a registered nurse, which outlined the three-month program and included an individual health education and goal setting session (Anderson et al., 2006). Two hundred women (mean age 50 years) were asked to view the "oven-fried chicken" program (about 20 minutes) first which contained the nutritional messages, then they were asked to choose to watch other recipes or explore links to learn more about increasing fruit and vegetable, reducing dietary fat, and reading nutrition labels (Tessaro et al., 2007). Participants were informed that they could come back to the clinic to view

the program again. Telephone interviews were conducted three months after the baseline survey.

Self-dependent postmenopausal women were invited to participate every two weeks in a nutrition education program (Manios et al., 2006). All intervention group participants attended at least 90% of the sessions, which were delivered over a total duration of about five months.

In another study (Stevens et al., 2003), participants received two 45-minute counseling sessions, two to three weeks apart. Additionally, two brief telephone follow-up contacts were made after the second intervention session. The two counseling sessions were each a 20-minute interactive computer-based intervention using a touch-screen format. All participants returned to the research clinic one year later for the follow-up.

After a baseline survey, an intervention consisting of two computer-tailored magazines and a natural helpers program was conducted over 18 months (Campbell et al., 2002). The first magazine was provided after participants filled out the baseline survey and the second magazine sent out after participants completed the 6-month follow-up survey. Forty-seven percent of the participants were 40 years of age or older.

Members in a university office personnel association were randomly assigned to one of three delivery groups, the campus mail group, the campus mail/e-mail byte group, and the e-mail group (Gray et al., 2000). The campus mail group received a printed fact sheet (with two back-to-back messages) once per week. The campus mail/e-mail byte group received the weekly printed fact sheet by campus mail along with a weekly e-mail. The e-mail group received each of the two messages electronically on two different days

each week. Listservs were developed for electronic delivery. Electronic mail messages and fact sheets were sent to each group for four weeks.

Nutrition education intervention duration for postmenopausal women is not long, usually less than one year. Results of the interventions appeared to be effective since they are tailored to the target population.

Theory-based Behavior/Theoretical Framework

Health Belief Model (HBM)

An eight-week worksite nutrition education intervention for university staff was based on HBM to promote healthful dietary behaviors to reduce cardiovascular disease and cancer risks (Abood et al., 2003). Even though all HBM constructs were addressed during the intervention, perceived benefits and perceived barriers were given priority because for a change in nutrition behavior to occur, the perceived benefits of the behavior must outweigh the perceived costs (barriers).

The materials designed for "Omega-3 for Baby and Me", a nutrition education intervention developed for WIC pregnant women in Denver, Colorado, were based on the constructs of the HBM, one of many educational theories used in preventive health care to design materials and strategies to change knowledge, attitudes and behaviors (Troxell et al., 2005). A person's decision to accept or reject a new behavior is based on the perceived motivators and barriers to accomplishing the behavior change. Low-income populations are especially susceptible to allowing barriers to deter them from making desirable health behavior changes.

Ali (2002) used the HBM to test predictors of CHD preventive behaviors in 178

women age 50 and above. He found the health education to promote CHD prevention in women needs to consider the multifactorial aspect of the disease and the beneficial effects of the adapted HBM construct.

Theory of Planned Behavior (TPB)

In the Illawarra region of New South Wales, Australia, researchers used a questionnaire based on the Theory of Planned Behavior explaining 72.5% of the variance in intention to consume foods enriched with omega-3 fatty acids (Patch et al., 2005). Attitude was found to be the sole significant predictor of intention to eat omega-3 fatty acids enriched foods. They concluded that to be initially effective in maintaining and encouraging positive intentions, a likely strategy would be to direct education toward changing of attitude, specifically underlying beliefs in achieving specific health benefits.

Self-efficacy

A study by Schwab (2000) showed postmenopausal women had moderate levels of self-efficacy for health-related diet behaviors and were in the maintenance stage of change for adopting a low-fat diet.

In a Liou et al. (2001) study, attitude, overall health concern and self-efficacy emerged as significant predictors in the regression of behavioral intention. Attitude is a more prominent determinant of behavior than that of subjective norm. Self-efficacy was found to be an important predictor of behavioral intention and behavior. In order for individuals to adopt a dietary behavior, concern for health and favorable attitudes toward the action need to be accompanied by sufficient levels of confidence to enact the behavior.

Carpenter et al. (2004) conducted a randomized, controlled pilot study to determine the effect of lifestyle education on dietary improvement. They used cognitive

and behavioral skills training to deliver information about improving dietary quality via face-to-face group meetings or by correspondence. The theoretical frameworks that guided the intervention design were TTM and Social Cognitive Theory (SCT). The constructs of self-efficacy, self-regulation and expectancies from the SCT were built into the curriculum by promoting small changes, frequent weighing of benefits and barriers of changing dietary habits, setting short-term goals and rewards, developing relapse prevention strategies, and identifying ways to making healthful eating fun.

Web Education Research

Population-specific, knowledge-based women's health education can be effectively delivered using a systematically designed web-curriculum (Zebrack et al., 2005). The web-based instruction met the needs of adult learners (with their motivation to learn topics they value and apply this knowledge in their daily work).

A study to train 600 people over age sixty using information and communication technology in Liguria, Italy showed fairly high levels of participation in network activities (Trentin, 2004). Seventy-eight percent of the participants stated highly satisfied and desired to follow a further distance training course. For people age 56 to 89, they expressed that learning new tasks and ideas by using computers is important and agreed that computers make life easier (Kiel, 2005).

E-mail based physical activity and dietary messages can produce small changes in physical activity attitudes and behavior and nutrition-related behavior (Plotnikoff et al., 2005). A sample of 2598 employees from five large workplaces in Alberta, Canada was studied in a 12-week e-mail intervention on physical activity and nutrition. The

intervention group increased their mean total physical activity levels were more confident in being able to participate in physical activity, perceived more advantages and fewer disadvantages of physical activity participation, and made favorable changes for the dietary variables.

WIC clients residing in seven states (Illinois, Indiana, Michigan, Minnesota, Ohio, Washington and Wisconsin) participated in a study to determine the usefulness and impact of wichealth.org, an internet-based intervention (Bensley et al., 2006). Users of wichealth.org were highly supportive of the method in terms of ease of use and understandability, helpfulness, belief in ability to make change based on what was learned, and belief that the site is helpful with regard to child eating habits and how parents feed their children. Measures of site usefulness were associated with users' belief that they could use what they had learned to change the way their children are fed. This finding indicates the measures of site usefulness are most positive when the users' belief in whether they will be able to change feeding behaviors is strongest.

A survey examined the percentage of Nebraska 4-H families who have access to computers and the internet at home indicated that 96 percent of Nebraska 4-H families have access to computers at home. Nearly 92 percent of families had a connection to the internet with a majority using dial-up connections (unpublished data) (University of Nebraska-Lincoln Extension).

Dietary Intake Assessment

The usual methods of evaluating nutrition intervention programs are 24-hour food recalls, food records or food frequency questionnaires (FFQ). Spoon et al (2002) used

Food Habits Questionnaire (FHQ), which was developed by Kristal et al, to examine the validity and reliability of a fat-related behavior scale and subscales in a worksite intervention program with both men and women from varying socioeconomic levels. Kristal et al. developed and evaluated an 18-item dietary patterns instrument FHQ based on the assumption that specific dietary behaviors are highly predictive of fat intake. The FHQ included five dimensions of dietary behavior: avoid fat as a seasoning, substitute high-fat foods with specially manufactured lower-fat foods, modify meat to be lower in fat, replace high-fat foods with low-fat alternatives, and replace high-fat foods with fruits and vegetables. Four-day food records provided comparison data to assess the validity of the FHQ. Data from the treatment and control subjects was for reliability analyses of the FHQ and data from the pre- and post-intervention food records was for validity analyses. Spoons et al. examined the internal consistency and test-retest reliability of the FHQ and they used an α level of 0.80 or greater as acceptable for reliability and for validity standards of at least moderate correlation coefficients, that is, $r \geq 0.40$.

In the Netherlands, twenty males and twenty-five females (mean age 45 years) completed The Fat List, a 35 questions FFQ, and 7-day diet records for assessing the relative validity of the Fat List (van Assema et al., 2001). Researchers compared Fat List results with those from multiple records and assessed the Pearson correlation between both measures. The correlation between the fat scores and intake as assessed by means of the 7-day diet records was 0.71, 0.69 and 0.71 for total fat, saturated fat and energy intake, respectively, which researchers stated if correlations are greater than $r=0.5$, a food frequency instrument can be regarded as a valid tool.

Bhakta et al. (2005) used a FFQ to measure habitual intake of phytoestrogens

among South Asian women in the UK relative to multiple 24-h recalls and multiple plasma samples. They concluded the FFQ proved to be the best assessment methods to estimate lignan intakes. FFQ also gave a better assessment of usual dietary intake than did the seven-day diet record of Samoans living in New Zealand (Bell at al., 1999).

University Health Services

Nutrition education at worksites, such as university campuses, may be effective in improving health-related behaviors so that insurance costs, sick days and turn over can be reduced (Abood et al., 2003). Most university health services focus on providing information and services to students, though they also address the services to the campus community (faculty and staff).

The Alice! Health Promotion Program in Columbia University offers healthy eating and eating behaviors workshops for students. Cornell University has nutrition resources web links on the Gannett health services website. Harvard University has wellness resources for nutrition services. The health services nutritionists also conduct workshops, presentations and group programs throughout the year. The Pennsylvania State (Penn State) University health services has links providing information and tips on nutrition and fitness topics. The Vaden Health Center at Stanford University offers presentations to groups on topics including body image, intuitive eating, and women's nutrition. These informative programs are available to student residences, community centers and student groups. The University of Nebraska-Lincoln (UNL) Health Center has nutrition resources and links. These university health services provide nutrition counseling and all of these websites include weight management information. Columbia

University and Harvard University health service websites mentioned omega-3 fatty acids and other nutrients information such as iron and calcium. These two health services also provide nutrition workshops. Almost all the health service websites have general nutrition tips or healthy eating tips, vegetarian advice and website links. UNL and Penn State University have posted nutrition downloadable files.

Summary

Omega-3 fatty acids is a popular topic in the nutrition field in recent years. Besides cardiovascular diseases, it also poses beneficial properties on other diseases. Females after menopause have possible decreasing DHA concentrations due to lower estrogen levels than before menopause. Most university health services focus on providing information and services to students, not addressing directly the services to the campus community (faculty and staff). Web-based interventions have been used in many studies and have positive outcomes. Health Belief Model and Theory of Planned Behavior have been used as the theoretical frameworks of nutrition education and behavior interventions. Prior to any intervention material development, focus groups or surveys were conducted to determine the needs and expectations of the target audience.

Postmenopausal population is not a common study group for nutrition education. Even theory-driven nutrition education for elderly is usually designed for both genders and not mainly focused on the postmenopausal population. Research topics regarding postmenopausal women's health are based on biochemical indices and many times don't focus on their dietary intake. Reducing dietary fat intake and increasing fruits and vegetables consumption are common nutrition education goals for postmenopausal

women. Dietary consumption, such as fat, fruits, vegetables and dairy are measured in nutrition education interventions. Anthropometry and biophysical outcomes are measured besides dietary consumption in some studies.

The topics and delivery methods must tailor to the needs of the postmenopausal population. Tailored nutrition education for other populations has shown that tailored information is more effective than just providing general information. Tailored interventions are now becoming popular for public health applications, as computer programs make the creation of these interventions more feasible for large-scale use (Hoelscher et al., 2002).

With extended longevity, nutrition education for postmenopausal women should be emphasized. Research is needed to document effective strategies applying to the postmenopausal population for nutrition educators.

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Author (year)	Population	Topic	Intervention goal	Measurement tools	Design	
					Intervention group	Control group
Anderson (2006)	Females in Queensland, Australia (age 50-65, 86% postmenopausal, N=90)	CVD	Improve cardiovascular risk factors	♦A questionnaire including sociodemographic factors, diet, PA, medication history ♦A daily diet and exercise record in "The women's wellness program journal"	♦IG[a] (n=36): verbal consultation, written health education materials	♦CG[b] (n=54): encouraged to continue their normal daily activities
Campbell (2002)	Rural female blue-collar workers in NC (53% age 40 or older, N=538)	Improve nutrition and PA[c]	Program assessment	♦fat (18-item) fruit vegetable (10-item) food frequency checklist ♦10-item PA checklist ♦Cancer screening of pap test, mammogram ♦Selections of Behavioral priority for change	♦IG (n=282): computer[d], discussion[e]	♦Delayed IG (n=256): Offer a menu of possible health education sessions[f]
Manios (2006)	Females in Athens, Greece (age 55-65, mean age 60, N=75)	CVD, osteoporosis	♦Osteoporosis awareness ♦Low fat	♦3-day dietary recalls ♦Blood analyzers ♦Mercury sphygmomanometer	IG (n=39): Power point presentation	CG (n=36): no intervention was delivered
Stevens (2003)	Health maintenance organization female members[g] in Portland, OR (N=616)	Cancer prevention	♦↑ fruit and veggie ♦↓ fat	♦FFQ ♦FFBQ	♦IG (n=308, mean age 53): Two sessions[h]	♦CG (n=308, mean age 54)[i]

Tessaro (2007)	Primary care clinics female patients in WV (age 40-65, mean age 50, 95% were white, N=262)	CVD	♦↑ fruit and veggie ♦↓ fat	♦FFQ ♦Stage of change questions (2 on fruit and vegetable intake, 2 on low-fat intake) ♦Dietary behavior questionnaire ♦Barriers scale	IG (n=131): View the video after the baseline survey	CG (n=131): view the video after the follow-up interview

Table 1. Study population, intervention topics, intervention goals, measurement tools, intervention design for postmenopausal women nutrition education programs

Author (year)	Theory model	Outcome measures	Significant findings			
			Fruit and vegetable	**Fat**	**Physical activity**	**Others**
Anderson (2006)	Self-efficacy	♦WHR[j] ♦BMI[k] ♦Blood pressure ♦Heart rate ♦Weight ♦Calcium foods, phytoestrogen foods, water intakes ♦Exercise levels ♦Smoking	Not reported	Not reported	♦Intervention significantly increase aerobic exercise activity and decrease smoking	♦IG significantly decrease WHR, BMI, diastolic blood pressure, weight
Campbell (2002)	♦*SCT* ♦*Stages of change TTM* ♦*Social support models*	♦Fruit, veggie, fat intakes ♦Physical activity ♦Smoking ♦Cancer screening ♦Behavioral priority for change	♦A significant increase (0.7 daily servings) for fruit and vegetable in the IG at the 18-mo follow-up	Not reported	♦At 18-mo, the difference in physical exercise of flexibility was significant in IG	Not Report
Manios (2006)	HBM, SCT	♦Macro-, micro-nutrients intake ♦Biochemical indices ♦Blood pressure	Not reported	♦IG has higher percentage of energy derived from protein , higher decrease in the percentage of energy from total fat and PUFA[l] than CG	Not reported	♦IG has higher Ca, P, Mg intake than CG

Stevens (2003)	SCT, motivational interviewing, problem-solving	♦Dietary patterns ♦Total serum cholesterol	Not reported	♦Significant decline in SFA[m], MUFA[n], PUFA in the IG	Not reported	♦IG has significant reduction in the serum cholesterol
Tessaro (2007)	Stage of change	♦Fat, fruit, veggie intake ♦Stage of readiness to change ♦Dietary behavior (how often they read and what they looked on food labels) ♦Barriers to change ♦Process measures (acceptability of the program)	♦On follow-up, both groups ate fewer servings of fruits and vegetables than at baseline	♦Both groups lowered their fat intake between baseline and follow-up	Not reported	♦At follow-up, intervention group had a significantly higher knowledge score than the control group ♦Intervention group were more likely to looked at calories and fat grams on food labels now

Table 2. Theory models, outcome measures and significant findings for postmenopausal women nutrition education programs

Author (year)	Intervention duration	Duration of follow-up	Actual intervention time	Intervention frequency
Anderson (2006)	3 mo		80 minutes	♦40-min individual consultation with a registered nurse ♦2nd consultation : at the end of 12-wk
Campbell (2002)	18 mo	Two follow-up surveys at 6-mo and 18-mo	Not reported	♦Worksite natural helper program: helpers' training sessions occurred approximately bimonthly over the 18-mo intervention
Manios (2006)	5 mo		10 hours	Biweekly nutrition education sessions (1 hour each session)
Stevens (2003)	One year	Two follow-up data collection at 4-mo and 12-mo	110 minutes	♦Two 45-min individual counseling[o] ♦Two 5- to 10-minute TEL support follow-up[p] ♦All participants return to the research clinic 4 and 12 months after randomization for follow-up data collection.
Tessaro (2007)	3 mo	TEL interview follow-up at 3-mo	20 minutes	♦Viewed a video (average time: 20 minutes). Intervention group could come back to the clinic to view the program again. ♦3 mo TEL follow-up interview

Table 3. Intervention duration and frequency for postmenopausal women nutrition education programs

[a]IG=Intervention group
[b]CG=Control group
[c]PA=Physical activity
[d]Two computer-tailored magazines (baseline and 6-mo follow-up): provide personalized feedback, strategies for change, and community resource information
[e]A natural helpers program (social support activities): train women in the workplace to diffuse information and provide support for healthy behavior changes
[f]Not directly related to study objectives during the first 6 mo of the study. After completing the 6-mo survey, received one individually tailored magazine identical to the magazines delivered to IG. No natural helpers program.
[g]age 40-70, had negative results on a recent screening mammogram, total cholesterol test in the past 2 years of 200 mg/dl or more
[h] -*1st session*:

a. Select dietary fat: Complete a touch-screen computer-assisted assessment followed by a discussion.
b. Not select dietary fat: Received an individually tailored counseling session focused on increasing fruits, vegetables and whole grains.

-*2nd session*:

a. Not select dietary fat as a target in the 1st session: complete the automated program.
b. Select dietary fat in the 1st session: focus on increasing fruit and vegetable consumption.

[i]Received an intervention focused on breast self-exam, consist of an individual counseling session at the research clinic plus 2 TEL follow-up. No dietary recommendations.
[j]WHR=Waist hip ratio
[k]BMI=Body mass index
[l]PUFA=Polyunsaturated fatty acids
[m]SFA=Saturated fatty acids
[n]MUFA=Monounsaturated fatty acids
[o]One counseling session consists of a 20-minute interactive, computer-based touch-screen format and a 25-minute discussion. Two sessions are two to three weeks apart.
[p]TEL follow-ups are two to three weeks after the second intervention session. The second TEL follow-up is two to three weeks after the first TEL follow-up

Phase I

Qualitative Study

Nutrition Education Interests and Health Needs of University Middle-Aged Female Staff

Objective: To identify university middle-aged female staff's health needs and interests in nutrition education.

Design: Audiotaped semi-structured in-person interviews were completed with self-selected female staff at a midwestern university.

Setting: A midwestern university in the United States.

Participants: Eight female university staff, with a mean age of 54 and who had computer access at work, participated in the interviews.

Phenomenon of Interest: Nutrition-related interest and health needs of middle-aged females.

Analysis: The interviews were transcribed verbatim. Data were coded and themes developed by sorting and summarizing coded transcript segments.

Results: After coding, three themes emerged. "Health" related to individual conditions with aging, such as avoiding illnesses and weight management. "Life style" described what occasions lead to participants' current dietary action. "Availability" described the factors that influenced participants' healthy eating behaviors. Participants' sources of nutrition information were magazines, websites and university newsletters. Participants either were not aware of MyPyramid or considered the MyPyramid website difficult to follow. Most participants were unaware of omega-3 fatty acids and their health benefits.

Conclusions and Implications: This group of middle-aged working females is interested in learning about nutrition, especially the topics that relate to their lives. Participants want to feel good and also be able to take care of themselves when getting old.

Key Words: nutrition, middle-aged university female staff, qualitative interviews

INTRODUCTION

Health is an important concern as people age (Sahyoun, 2002). This is especially important now that baby-boomers are at or approaching retirement. In July 2007, the estimated U.S. population of people age 45 and over was around 114 million, with 38% of the total population and 40% of the female population is in that age group (U.S. Census Bureau, 2008).

Older women's health priorities encompass a wide range of physical, functional and psychosocial concerns about aging, which remain fairly consistent in early and late postmenopausal years (Tannenbaum et al., 2005). Postmenopausal women tend to gain weight from the first year of menopause and experience a redistribution of body fat from a gynoid to an android pattern (Rosano et al., 2007). Following menopause, women increasingly tend to display features of the metabolic syndrome, which may partially explain their heightened cardiovascular risk (Rosano et al., 2006). Unfortunately, there are few nutrition education programs for middle-aged women. This is a potential target group for nutrition education.

Nutrition interests and health needs have been studied in different populations, such as cancer survivors (Stull et al., 2007), sighted and blind elderly (Gusi et al., 2008) and older women diagnosed with Parkinson's disease, stroke or rheumatoid arthritis (Gustafsson et al., 2005). Nutrition needs of university middle-aged female staff has received little attention.

Nutrition education has been targeted to the low-income population (Arnold et al.,

2001; McClelland et al., 2001), however, the upper and middle income population may be in need of nutrition knowledge as well (Guthrie et al., 2002).

When designing a nutrition education intervention, researchers should know the needs of the target population. Information tailored to the audience needs is more effective than providing general information (Latimer et al., 2005; Pomerleau et al., 2005; Trevena et al., 2006).

The most common nutrition education theories used in nutrition education for middle-aged women are the Health Belief Model, the Theory of Planned Behavior, the Social Cognitive Theory, and the Transtheoretical Model/Stages of Change Theory. The Social Cognitive Theory has been widely applied in nutrition education interventions (Campbell et al., 2002; Conn 1997; Manios et al., 2007; Stevens et al. 2003). The Health Belief Model has been used both to explain change and maintenance of health-related behaviors and as a guiding framework for health behavior intervention (Glanz et al., 2002). It is now believed that people will take action to prevent, to screen for, or to control ill-health conditions if they regard themselves as susceptible to the condition, if they believe it would have potentially serious consequences, if they believe that a course of action available to them would be beneficial in reducing either their susceptibility to or the severity of the condition, and if they believe that the anticipated barriers to taking the action are outweighed by its benefits (Glanz et al., 2002).

Qualitative methodology is useful for understanding complex personal and social issues such as eating and health behaviors (Dibsdall et al., 2002). Of 355 published qualitative studies (60,330 articles in healthcare journals were reviewed by McKibbon et al., 2004), approximately 37 percent were phenomenological studies, followed by

grounded theory (35 percent) and ethnography (18 percent) (McKibbon et al., 2004). The phenomenological approach can be used to understand the essence of experiences about a phenomenon and meanings from participants' perspectives (Creswell 2007). A number of studies published in nursing journals used phenomenology to explore meaning through people's experience (Grant et al., 2005; Martinsen et al., 2008; Nelson 2007; Roing et al., 2008).

The purpose of this qualitative study was to better understand postmenopausal women's general interests about healthful eating and nutrition.

METHODS

Five initial broad categories of questions based on the Health Belief Model were developed. These categories were: (1) Nutrition topics of interest to them; (2) Nutrition information sources; (3) Omega-3 and MyPyramid awareness; (4) Nutrition messages while grocery shopping and eating out; and (5) Motivators, barriers and promoters of healthy eating. Table 1 shows the interview categories and questions based on the Health Belief Model key concepts.

The phenomenological approach was used in this study. The procedures consist of identifying a phenomenon to study, bracketing out one's experiences, and collecting data from several persons who have experienced the phenomenon. The researcher then analyzes the data by reducing the information to significant statements, or quotes, and combines the statements into themes (Creswell 2007).

Participants recruited for the study were university female staff, at least 45 years of age who had computer access at work. The participants were recruited by snowball

sampling and contacted by e-mail. All components of the study were approved by the University Institutional Review Board. Informed consent by all participants was obtained prior to participation.

RESULTS

Interviews lasted from 30-55 minutes and were audiotaped and transcribed verbatim. Data were coded and themes developed by sorting and summarizing coded transcript segments (Creswell 2003).

After coding, three themes emerged: “health”, “life style” and “availability”. Table 2 shows the themes and sample quotes from interviews that illustrates the themes.

Health

“Health” related to participants’ individual conditions with aging, such as avoiding illnesses and weight management. Participants wanted to feel good and also be able to take care of themselves when getting old. They wanted to know how to feel better physically, what helped the energy levels and how to maintain body functioning at its best. They wanted to avoid and ward off illnesses.

Life Style

“Life style” described what occasions lead to participants’ current dietary action. Overall, participants had busy and hectic life styles. Time was a major issue and participants perceived that they had a little free time. Participants wanted simple, basic, easy and “people terms” information. They wanted to get the main point quickly.

Availability

"Availability" described the factors that influenced participants' healthy eating behaviors. They believed there were better choices available today than several years ago. Having a choice was important, especially when trying to make wiser food selections. Prepared food and schedules made eating healthy easier. Participants stated it was easier to eat healthy if food was convenient, easy and quick.

Nutrition information sources

Participants used online nutrition information sources, such as google and WebMD. For participants who joined Weight Watchers, they browsed the Weight Watchers website. Participants also obtained nutrition and health information from university newsletters and university flyers. Some participants received health information from magazines, TV news and doctors.

MyPyramid awareness, omega-3 fatty acids

For participants who accessed the MyPyramid website, they commented it was vague and not clear. It was also difficult to understand.

> "*I did go to look at the website a little bit, but I wasn't impressed by the website…..It was pretty vague, and it didn't really tell you anything till you're done….I just remembered looking at that and thinking, clicking and it wasn't clear to me where I was going."*

> "*It's a little difficult, I think that's why I haven't actually got through the whole thing to get a specific plan for me…..It seems to me it was a little difficult to get through everything, either I didn't have time for it or I just didn't want to do that.*"

Most participants had heard about the term “omega-3” from the University research on the omega egg, but they were not sure what the word omega-3 meant.

DISCUSSION

The findings from this study are similar to two other interview results. Vue et al. (2008) conducted a study to identify need states based on the eating occasions experienced by midlife women identified themes, such as “pursuing health”, “habitual”, and “low effort”. “Pursuing Health”, similar to the theme “Health” in this study, is to maintain or improve health. Individuals balance intake of food types to maintain or improve health. “Habitual”, similar to the theme “Life style”, represents women are looking for the right amount and type of food that could be eaten quickly. “Low effort”, similar to the theme “Availability”, means the individual wants to spend as little time and effort as possible. The need for convenience has been recognized as an important influence on food consumption behaviors of adults. Individuals are willing to trade price and healthfulness of the food for something fast and easy to prepare and eat.

Another study on food-related experiences and beliefs from low-income United Kingdom women also concludes with similar findings (Dibsdall et al., 2002). Most participants worry about developing specific illnesses and some participants are very health conscious. Participants generally felt they were exposed to vast amounts of information on food and health, most of which they find complicated, confusing, or contradictory. Information about food and health is generally obtained from television and radio programs, magazines, or newspapers. This coincides to the description from the participants in this study that the MyPyramid website information is vague and hard to

understand.

Bull et al. (2001) explored the effectiveness of different features of persuasive communication in written materials on weight loss. Their results were similar to the results of this study. Application to one's life was significantly associated with participants' attention and keeps them in the health education program.

IMPLICATIONS FOR RESEARCH AND PRACTICE

Results of this study support the need for nutrition education programs for middle-aged females. Middle-aged females want to obtain more nutrition information which is simple and aimed to meet their needs. Nutrition information from the internet is one of the main information sources. The findings presented here can be used to develop a targeted nutrition education intervention for middle-aged women.

Health Belief Model Key Concept	Interview Questions Category	Interview Question
Perceived susceptibility	• Nutrition topics that are interested in • Nutrition information sources • Nutrition messages while grocery shopping and eating out	• Are you interested in learning about nutrition? • During the past year, have you read or looked for info about nutrition? • How important is nutrition to you? Scale from 1 to 10. 1 is not important, 10 is very important. • While grocery shopping and eating out, what nutrition info would you like to know? • What is your usual diet/food in a typical day? How about start from the breakfast.
Perceived severity	• Omega-3 and MyPyramid awareness	• Have you heard about omega-3? Are you familiar with omega-3? • Have you heard about MyPyramid? Are you familiar with MyPyramid?
Perceived benefits	• Motivators, barriers and promoters of healthy eating.	• The main reason that you try to eat healthy are:
Perceived barriers	• Motivators, barriers and promoters of healthy eating.	• Sometimes eating healthy can be *hard* to do. For you, the *main reasons why you sometimes don't eat healthy are*: • Sometimes eating healthy can be *easy* to do. For you, the *main things that make it easy to eat healthy are*:

Table 1. Interview questions and categories based on Health Belief Model concept for university middle-aged female staff

Themes	Quotes
Health	▪ "*I want to become healthier because there's just me to take care of myself. I don't want to have to worry about, I don't like the kids to take care of me or anything. I want to be able to take care of myself as long as I can."* ▪ "*Feel better, function better, hopefully live longer. And just be able to, have fun, especially if you do live longer. And I don't really want to make my family have to take care of me when I'm old. I'm hoping to avoid just die able days and be done with it.*"
Life style	▪ "*As simple as possible. Easy to understand for a lay person that's not scientifically inclined. I've seen some stuffs where they talk about how the body react to different things. I know you can put it in pretty in a basically a simplistic vocabulary where it makes sense to the common person that's how I need it to lay down."*
Availability	▪ "*It's expensive to buy good quality foods and sometimes I just don't have the money to do that. So I buy cheaper items or things that cost less probably aren't as nutritious."*

Table 2. Nutrition related themes and quotes resulting from interviews with university middle-aged female staff

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Phase II

Quantitative Study

Web-based Nutrition Education Intervention for University Middle-Aged Female Staff

INTRODUCTION

There is a growing awareness of providing nutrition education for employees (Abood et al., 2003; Cousineau et al., 2008; Plotnikoff et al., 2005). Nutrition education at worksites, such as university campuses, may be effective in improving health-related behaviors so that insurance costs, sick days and turnover can be reduced (Abood et al., 2003). Most university health services focus on providing information and services to students, though some may also address the services to the campus community (faculty and staff).

Older women's health priorities encompass a wide range of physical, functional and psychosocial concerns about aging and these remain fairly consistent in early and late postmenopausal years (Tannenbaum et al., 2005). Postmenopausal women tend to gain weight from the first year of menopause and experience a redistribution of body fat from a gynoid to an android pattern (Rosano et al., 2007). Following menopause, many women increasingly tend to display features of the metabolic syndrome, which may partially explain their heightened cardiovascular risk (Rosano et al., 2006). Unfortunately, there are few nutrition education programs for middle-aged women. This is a potential target group for nutrition education.

Technology has been used for nutrition education in recent years (Brug et al., 2005). The common media for disseminating nutrition information are e-mail (Plotnikoff et al., 2005), websites (Clark et al., 2009; Cousineau et al., 2008) and computer-based

intervention (Vandelanotte et al., 2005). One of the delivery modes that has not been implemented is using blogs.

The duration of intervention has an important role in web-based nutrition education. Adolescents who received five hours of web-based nutrition education over three weeks significantly reduced fat consumption (Long et al., 2006). Adult women who had a body mass index between 25 and 40 participated in an online weight loss intervention and the average weight loss was 4.5±4.6 kg (Webber et al., 2008). The intervention included weekly one-hour sessions for 16 weeks.

The US Department of Agriculture released MyPyramid in 2005, the latest food guide for the general public (USDA). The MyPyramid recommendations can provide diets that are nutritionally adequate and yet moderate in dietary constituents that are important to controlling diet-related conditions (Krebs-Smith et al., 2007). A lesson incorporated into MyPyramid was developed by a nutrition education network and was tailored to the needs of learners in six age groups, from school-aged children to older adults (Kelley et al., 2008). However, there was no nutrition education intervention based on MyPyramid for middle-aged females.

The purpose of this study was to assess the effectiveness of MyPyramid to improve dietary intake and self-efficacy after a six-week online nutrition education intervention using a blog for university middle-aged female staff. A secondary objective was to assess the impact of additional education on omega-3 fatty acids on food consumption and self-efficacy.

METHODS

Participants

Participants were university female staff, at least 45 years of age, who had computer access at work. The participants were recruited from the College of Education and Human Sciences, a University staff organization and the University staff e-news. All communication was conducted by e-mail. Participants were randomized into an intervention group or control group.

Intervention

The web-based intervention utilized the blog format, which the modules were displayed in reverse-chronological order. The modules were developed from a qualitative study on the same target group. Health Belief Model (Table 1) was used and the contents were based on the MyPyramid. The control group received information focused on the MyPyramid. The intervention group received MyPyramid information and additional information on omega-3 fatty acids. Each module also incorporated recipes that included foods from the module. The control group received recipes from a nutrition education program's cookbook (University of Nebraska-Lincoln Extension) and the intervention group received recipes from the Omega-3 Cookbook (Heidal et al., 2004). Module content in portable document format (PDF) was also provided at the end of each module.

The nutrition education program was divided into six weekly modules (Table 2). Participants received weekly e-mails with the module web link every Monday for six weeks from early November to mid December. The first module was the introduction of MyPyramid, nutrition facts label and portion size charts. The second and third modules described the six food groups in MyPyramid and the number of servings recommended in

each group for postmenopausal women. The fourth to sixth modules were reinforcing information in modules one to three, respectively. The reinforcing modules were tips to include fruits, vegetables and whole grains in the diet and make wise choices for protein and dairy products. In the intervention group, the omega-3 fatty acid information was included in the dietary recommendation, food sources and health implications sections of the blogs.

The study was approved by the Institutional Review Board and informed consent was obtained from participants prior to participation.

Instruments

Online assessment tools included a demographic questionnaire, a food frequency questionnaire (FFQ), a self-efficacy questionnaire and an evaluation. The questionnaires were administered through an online survey system. The FFQ was a modified version from a previous FFQ (Ritter-Gooder et al., 2006) and MyPyramid food groups were also included. The self-efficacy questionnaire was adapted from a healthy food efficacy scale for children (Perry et al., 2008). The FFQ and self-efficacy questionnaires were reviewed by two people in the target group and minor changes were made to improve clarity.

Participants filled out the demographic questionnaire, the FFQ and the self-efficacy questionnaire in the first week. The second and third FFQ and self-efficacy questionnaires were sent to the participants at the end of the third week and the sixth week, respectively. A reminder to non corresponding participants was sent from the online survey system on Mondays of the fourth and seventh week. An evaluation was sent to the participants at the end of the sixth week.

Statistical Analysis

All data analyses were conducted with the SAS System (version 9.0, 2008, SAS Institute, Cary, NC). Mixed-model analysis (PROC MIXED, in SAS) was used to take advantage of the multilevel and longitudinal nature of the data. Mixed models contain both fixed and random effects and adjust for the correlation among time points within the group. A probability value of 0.05 ($p<0.05$) was considered statistically significant.

RESULTS

There were 93 participants recruited at the beginning of the study. Six participants withdrew during the first three weeks due to unforeseen shifts in work, no extra time to work on the intervention or family emergency (n=88 at baseline, 82 at the 3rd week, 77 at the 6th week).

Demographics

Table 3 shows the demographic characteristics. Average participants' age was 53.74±5.99 (mean± standard deviation) years and their body mass index (BMI) was 27.8±6.26 (n=85). Approximately two-thirds of the participants worked on the computer one or more hours per day. Half of the participants in both control and intervention groups had at least a bachelor's degree. About one-third of the participants were on a diet, which included diets low in carbohydrate (16%, n=4), low sugar (20%, n=5) or they had joined the Weight Watcher program (20%, n=5). Among the participants who took supplements (88%, n=75), 54 (72%) took multivitamins, 27 (36%) took calcium, 12 (16%) took Vitamin D, 6 (8%) took omega-3 fatty acids, 12 (16%) took fish oil and 2

(3%) took flaxseed oil. There were no significant demographic differences between the control group and the intervention group.

Dietary Intake

The mean frequency of consumption of servings from the food groups at baseline, the end of the third week and sixth week are presented in Table 4. Because there were no differences between groups, the two groups were combined for analysis. The consumption of food groups, except the meat and beans group, was lower than MyPyramid recommendation. There were no significant changes in food group consumption during the study. Table 5 shows the consumption of omega-3 fatty acids from food groups. The difference in consumption of omega-3 fatty acids from the dairy group between the control group and the intervention group tended to be significant different ($p<0.10$). The major omega-3 fatty acids foods consumed included flaxseed, canola oil, flaxseed oil, beef, walnut, loose-leaf lettuce, salmon and almond.

Self-efficacy

Tables 6 and 7 describe the changes in self-efficacy to include whole grain and omega-3 fatty acids in various settings over time, respectively. Because there were no differences between groups, the two groups were combined for analysis. There was no difference in participants' self-efficacy over time to include whole grains or omega-3 fatty acids in the diet. There were trends that participants were more certain to include whole grain than omega-3 fatty acids and more certain to include both whole grain and omega-3 fatty acids at the end of the intervention in the settings ($p<0.10$). The lowest self-efficacy in both groups was when eating out.

Intervention Evaluation Outcomes

Seventy-two participants completed the intervention evaluation. At least half of the participants (54.2%) spent 1-15 minutes per module, and 43.1% participants spent 16-30 minutes. The average time spent on weekly modules was 15.5±9.08 minutes. The majority of the participants (86.15%) rated the web format preference as "excellent" or "good". Some participants commented the modules were informative and helpful to refresh their nutrition knowledge. Few participants enjoyed the recipes and were be able to print them, but did not try the recipes.

DISCUSSION

This study evaluated a six-week web-based nutrition education intervention to increase food groups and omega-3 fatty acids consumption and self-efficacy for university middle-aged female staff. There were no significant changes in the dietary consumption and self-efficacy from baseline to post intervention. However, there was a trend that participants were less certain to include omega-3 fatty acids than whole grain. This indicates there is a need to include omega-3 fatty acids education to promote omega-3 fatty acids consumption in this population.

The consumption of food groups, except the meat and beans group, was lower than MyPyramid recommendations. In the modules, the recommendations were based on the 1600 and 1800 calorie levels. Walker et al. (2006) also reported mean daily intakes in a group of rural women aged 50 to 69 from the Midwest were within the recommended serving ranges of 2 to 3 for the meat group and dairy servings were below the

recommended targets of 2 to 3. One-third of the participants in this study were on diet and 16% of them were on a low carbohydrate diet. This may have influenced consumption.

The omega-3 fatty acids consumption was higher than previous research studies conducted on Midwestern omega-3 fatty acids intake (Lewis et al., 1995; Lewis et al, 2000; Sindelar et al, 2004), although estimates of intake using FFQs are generally higher than when food recalls are used (Ritter-Gooder et al., 2006). The meat and beans group is the main food group from where participants obtained their omega-3 fatty acids. Sixty-three percent of the major omega-3 fatty acids foods consumed by the participants were from this group.

Walker et al. (2006) reported that greater perceived self-efficacy was associated with desirable healthy lifestyle behaviors. Conn (1998) found that self-efficacy was a strong predictor of dietary behavior among community-dwelling women aged 65 to 92. In the present study, self-efficacy to include whole grain and omega-3 fatty acids in different settings did not change during the intervention. Long-term, repeated exposure to nutrition education is usually necessary to achieve lasting improvement in food choice behaviors, and education may have greater measurable impact on short- and medium- than on long-term outcomes (Devine et al., 2006). In this study, the fourth module to the sixth module summarized the first three modules. The duration of the study (six weeks) and the total exposure time (1.5 hours) may have been too short to see significant changes in dietary behavior and self-efficacy.

Some other variables that may have caused lack of effect included the intervention time of the year was close to the holiday season. This might have made it

difficult to incorporate and modify the diet. Secondly, the majority of the participants have bachelor's degree or higher. Achieving the dietary recommendation is positively related to education level (Estaquio et al., 2008). The MyPyramid information might need to be modified to meet the needs of this group. Thirdly, this study included participants who were on a diet and the mean BMI was high. This may have impacted the dietary behavior of participants.

The FFQ used in this study is a simplified version of a previous FFQ (Ritter-Gooder et al., 2006). This might not have incorporated many other common foods consumed by these participants. In addition, one-fourth of the participants took omega-3 fatty acids supplements. The participants may have counted the supplements as their omega-3 fatty acids sources instead of foods. In future study, the recruiting criteria might exclude people on diets or those taking supplements.

For behavior change to succeed, people must feel threatened by their current behavioral patterns and believe that change of a specific kind will result in a valued outcome at acceptable cost (Glanz et al., 2002). They also must feel themselves competent to overcome perceived barriers to taking action. Participants in this study might not have encountered the immediate threat to their health that they need to change their dietary behavior, therefore, the behavior change was not significant in this study.

CONCLUSION

Web-based nutrition education is acceptable for this target population. MyPyramid and additional omega-3 fatty acids information did not significantly effect on their dietary consumption or self-efficacy to increase consumption from the food groups

or to increase omega-3 fatty acids consumption. The duration and intensity of the intervention may need to be modified to have a significant effect on eating behavior and self-efficacy.

Table 1. Module components based on the Health Belief Model concept for university middle-aged female staff

Health Belief Model key concept	Definition	Module component
Perceived susceptibility	One's belief regarding the chance of getting a condition	• Describing that postmenopausal women are prone to some diseases compared with younger females
Perceived severity	One's belief of how serious a condition and its sequences are	• Discussing health implications in each food group if not eating enough or intake too much of some foods
Perceived benefits	One's belief in the efficacy of the advised action to reduce risk or seriousness of impact	• Showing dietary benefits such as eating whole grains, fruits, vegetables and omega-3 fatty acids may reduce the risk of chronic diseases
Perceived barriers	One's belief about the tangible and psychological costs of the advised action	• Providing recipes to overcome the barrier of not having time to cook and shop

Table 2. Weekly module content

	Module content
Week 1	**Introduction to MyPyramid** **Nutrition facts label** **Portion size** **Recipe**
Week 2	**Grain group** ***Meat and beans group** **Oil group** **MyPyramid tracker, MyPyramid menu planner** **Recipe**
Week 3	**Fruit group** **Vegetable group** **Dairy group** **Five review questions on MyPyramid** **Recipe**
Week 4	**Tips on what to look for on the food label** **3 Recipes**
Week 5	**Tips on how to include whole grains in your diet** ***Tips on how to choose your protein sources** **3 Recipes**
Week 6	**Tips to include fruits in your diet** **Tips to include vegetables in your diet** **Tips for making wise choices on dairy products** **3 Recipes**

***includes information on omega-3 fatty acids in the intervention group**

Table 3. Demographic characteristics of employed middle-aged females participating in an online nutrition education program

Characteristic		Control group (n=44)	Intervention group (n=41)
Mean age (yr) [a]		54.05±5.383	53.41±6.629
Body Mass Index [a]		27.9±6.362	27.7±6.23
Length employment at University (yr)	**< 1**	2 (4.5%)	2 (4.9%)
	1-10	9 (20.5%)	18 (43.9%)
	11-20	19 (43.2%)	12 (29.3%)
	≥ 20	14 (31.8%)	9 (22%)
At work, working on the computer (hr/day)	**< 1**	17 (38.6%)	13 (31.7%)
	1-3	21 (47.7%)	16 (39%)
	4-6	3 (6.8%)	9 (22%)
	≥ 7	3 (6.8%)	2 (4.9%)
Working on the computer, other than at work (hr/day)	**none**	4 (9.1%)	3 (7.3%)
	< 1	33 (75%)	31 (75.6%)
	1-3	7 (15.9%)	7 (17.1%)
Ethnicity	**Caucasian**	42 (95.5 %)	41 (100%)
	African American	1 (2.3 %)	
	Hispanic	1 (2.3%)	
Education	**High school graduate or GED**	3 (6.8%)	3 (7.3%)
	Some college	9 (20.5%)	9 (22%)
	Bachelor's degree	21 (47.7%)	9 (22%)
	Graduate degree	7 (15.9%)	13 (31.7%)
Meal preparation	**Self-prepared**	43 (97.7%)	37 (90.2%)

(multiple choice)	**Husband/significant other** **Child/children**	12 (27.3%) 1 (5%)	12 (29.3%) 1 (2.4%)
Eat out (time/week)	**None** **1-5** **6-10**	5 (11.4%) 34 (77.3%) 5 (11.4%)	4 (9.8%) 35 (85.4%) 2 (4.9%)
On diet	**No** **Yes**	32 (72.7%) 12 (27.3%)	28 (68.3%) 13 (31.7%)
Take supplements (vitamin/mineral/herbal)	**No** **Yes**	5 (11.4%) 39 (88.6%)	5 (12.2%) 36 (87.85)
Health condition (multiple choice)	**Diabetes** **Hypertension** **Osteoporosis** **Heart diseases** **No disease conditions**	2 (4.5%) 8 (18.2%) 4 (9.1%) 1 (2.3%) 27 (61.4%)	2 (4.9%) 8 (19.5%) 0 0 28 (68.3%)

[a]**Mean ± standard deviation**

Table 4. Frequency of consumption of food groups at baseline, third week and sixth week (n=87)

Food group (Recommendation)	**Baseline**	**3rd week**	**6th week**
	← *Servings/day (Mean ± standard deviation)* →		
Grain (5-6 oz. equivalent; 5 servings)	2.18±1.66	2.07±2.18	1.79±1.58
Vegetable (2-2.5 cups; 4-5 servings)	1.54±2.04	1.51±2.02	1.23±1.25
Fruit (1.5 cups; 3 servings)	1.76±1.49	1.51±1.40	1.64±1.66
Dairy (3 cups; 3 servings)	1.91±1.57	1.65±1.45	1.92±1.80
Meat and beans (5 oz. equivalent; 1-2 servings)	2.67±2.27	2.25±2.17	2.09±1.85
Oil (5 tsp; 5 servings)	.92±1.32	.86±1.09	.79±.89

Table 5. Mean consumption of omega-3 fatty acids from foods in different food groups at baseline, third week and sixth week

Food group	Control group (n=44)			Intervention group (n=43)		
	Baseline	**3rd week**	**6th week**	**Baseline**	**3rd week**	**6th week**
	← *g/month (Mean ± standard deviation)* →					
All grain	1.59±1.49	1.43±1.85	1.13±1.50	1.72±2.04	1.35±2.23	1.27±1.05
All vegetable	2.47±2.17	2.71±3.61	2±2.33	3.44±5.6	2.52±2.28	2.42±2.45
All fruit	1.94±1.58	1.43±1.52	1.62±1.85	1.71±1.56	1.56±1.37	1.56±1.61
All dairy	1.08±.9	.91±.86	.94±.85	1.26±1.02	1.12±.91	1.49±1.32*
All meat and beans	31.66±58.51	30.26±43.96	29.11±46.17	72.31±193.25	39.9±75.64	45.79±82.77
All oils	7.27±17.93	8.33±13.68	8.33±17.86	17.1±69.52	6.36±10.97	8.04±15.97
Total	46.01±73.85	45.08±54.06	43.14±59.77	97.53±257.4	52.81±78.45	60.57±87

*$p<.10$

Table 6. Self-efficacy to include whole grain in various settings at baseline, third week and sixth week

Setting	**Baseline** (n=88)	**3rd week** (n=82)	**6th week** (n=77)
	← *Mean ± standard deviation* →		
At meals	3.24±.84	3.24±.76	3.51±.60
Cooking	3.15±.89	3.13±.84	3.40±.69
Eating out	2.28±.82	2.33±.79	2.56±.79
Purchasing foods	3.37±.70	3.43±.70	3.58±.57

1=completely uncertain
2=somewhat uncertain
3=somewhat certain
4=completely certain

Table 7. Self-efficacy to include omega-3 fatty acids in various settings at baseline, third week and sixth week

Setting	Control group (n=44)			Intervention group (n=43)		
	Baseline	**3rd week**	**6th week**	**Baseline**	**3rd week**	**6th week**
	← *Mean ± standard deviation* →					
At meals	2.39±.97	2.49±.86	2.81±.80	2.65±1.04	2.62±1.04	2.74±1.01
Cooking	2.27±.97	2.44±.88	2.76±.85	2.56±1.03	2.54±1.07	2.69±1.02
Eating out	1.95±.83	1.98±.74	2.40±.80	1.88±.91	2.10±.88	1.97±.75
Purchasing foods	2.55±.95	2.51±.91	2.86±.87	2.70±1.06	2.85±1.14	2.83±1.07

1=completely uncertain
2=somewhat uncertain
3=somewhat certain
4=completely certain

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APPENDICES

APPENDIX A

Institutional Review Board Approval Letters

IRB# 200702240 EP
Date Approved: 10/22/2008
Valid Until: 06/05/2009

INFORMED CONSENT FORM

IRB# _____

Title of Project: **Web-based Nutrition Education for University Female Staff**

You are invited to participate in an interview. The purpose of this interview is to assess the nutrition needs for women. This interview is being done for research. You are being asked to participate because you are a female staff member working in University of Nebraska-Lincoln, age over 45 and have internet access at work.

This interview will take approximately 30 minutes at 312 Ruth Leverton Hall, East Campus, UNL. There is no risk or discomfort associated with this interview. Participants will be instructed to answer questions regarding their nutrition concerns. Audio taping will be using during the interview. Any information obtained during this study which could identify you will be kept strictly confidential. The information will be stored in a locked cabinet in the investigators' office and will only be seen by the investigators during the study and for five years after the study is complete. The information obtained in this study may be published in scientific journals or presented at scientific meetings but the data will be reported as aggregated data.

We can not offer any compensation for your participation in this interview. You may ask any nutrition questions you concerned about at the end of the interview. We will also provide some nutrition tips for your daily life. You may ask any questions concerning this interview and have those questions answered before agreeing to participate in or during the interview. Or you may call the investigator at any time, office phone, (402) 472-7984, e-mail NutrResearch@gmail.com or the project supervisor, office phone, (402) 472-4633, e-mail nlewis2@unl.edu. If you have questions concerning your rights as an interview participant that have not been answered by the investigator or to report any concerns about the study, you may contact the University of Nebraska-Lincoln Institutional Review Board, telephone (402) 472-6965.

Participation in this interview is voluntary. You are free to decide not to participate in this interview or to withdraw at any time without adversely affecting your relationship with the investigators or the University of Nebraska-Lincoln. Your decision will not result in any loss or benefits to which you are otherwise entitled.

Please initial here _____

You are voluntarily making a decision whether or not to participate in this research study. Your signature certifies that you have decided to participate having read and understood the information presented. You will be given a copy of this consent form to keep.

_____ Check if you agree to be audio taped during the interview.

Name and Phone number of investigators

Wan-ju Yen, M.S., Principal Investigator — Office: (402) 472-7984
Nancy M. Lewis, Ph.D., R.D., Project Supervisor — Office: (402) 472-4633

Signature of Participant:

_____ _____

Signature of Research Participant — Date

INFORMED CONSENT FORM

IRB# _____

Title of Project: **Web-based Nutrition Education for University Female Staff**

You are invited to participate in a research study for university female staff on web-based nutrition education. The purpose of this study is to increase your understanding of the important role of nutrition. You are being asked to participate because you are a female staff member working in University of Nebraska-Lincoln, age over 45 and have internet access at work.

This intervention study will take six weeks. All participants will be randomly assigned to either the control group or the experimental group. You will be asked to complete three sets of questionnaires including a food frequency questionnaire and a self-efficacy questionnaire from the links in e-mails. The first set of questionnaires and a demographic questionnaire will be available the first week of the intervention. There will be six modules, one module per week. You will receive one e-mail per week for six weeks. Each module will take approximately 15 to 20 minutes to complete. At the end of the third week and the sixth week, you will be asked to complete the second and the third set of questionnaires, respectively. The total time to participate over the course of the project is approximately three hours. If you intend on completing the weekly web surveys from your work computer, you should first get the approval of your supervisor.

There is no risk or discomfort associated with this research. Participants will learn about the benefits of nutrition to maintain health and prevent diseases. Any information obtained during this study which could identify you will be kept strictly confidential. The information will be stored in a secure server database system and will only be seen by the investigators during the study and for five years after the study is complete. The information obtained in this study may be published in scientific journals or presented at scientific meetings but the data will be reported as aggregated data.

We can not offer any compensation for your participation in this research. You may ask any questions concerning this research and have those questions answered before agreeing to participate in or during the study. Or you may call the investigator at any time, office phone, (402) 472-7984, e-mail NutrResearch@gmail.com or the project supervisor, office phone, (402) 472-4633, e-mail nlewis2@unl.edu. If you have questions concerning your rights as a research participant that have not been answered by the investigator or to report any concerns about the study, you may contact the University of Nebraska-Lincoln Institutional Review Board, telephone (402) 472-6965.

Participation in this study is voluntary. You are free to decide not to participate in this study or to withdraw at any time without adversely affecting your relationship with the investigators or the University of Nebraska-Lincoln. Your decision will not result in any loss or benefits to which you are otherwise entitled.

Please initial here _____

You are voluntarily making a decision whether or not to participate in this research study. Your signature certifies that you have decided to participate having read and understood the information presented. You will be given a copy of this consent form to keep.

Name and Phone number of investigators

Wan-ju Yen, M.S., Principal Investigator — Office: (402) 472-7984
Nancy M. Lewis, Ph.D., R.D., Project Supervisor — Office: (402) 472-4633

Signature of Participant:

_____ _____

Signature of Research Participant — Date

APPENDIX B

Interview Demographic Questionnaire

Demographic Information

Interview Date:_____

Participant's Name: _____

Position Title: _____Years in Position: _____

What is your age? _____ years

Height _____ feet _____inches
Weight _____ pounds

Are you taking any vitamin/mineral supplements? _____ Yes ____ No
If Yes, what type of vitamin/mineral supplements _____

Are you taking any herbal supplements? _____ Yes ____ No
If Yes, what type of herbal supplements _____

Are you on any diet now? _____ Yes ____ No
If Yes, please describe _____

Who prepares most of your meals?
____ Self prepared
____ Husband/significant other
____ Child/children
____ Other. Please describe _____

How often do you eat at restaurants (fast food, sit in) in a typical week?
_____ times/wk

Are you diagnosed of any disease listed below? (Check any apply)
____ Osteoporosis
____ Diabetes
____ High blood pressure
____ Heart diseases
____ Cancer
____ Other. Please describe _____
____ None

Are you on any nutrition counseling sessions now? _____ Yes ____ No

In a typical *work day*, how many hours do you work at the computer? _____ hr/day

In a typical day, how many hours do you access computer (<u>other than at work</u>)?
_____ hr/day

Thank you!

APPENDIX C

E-news Announcements

****
** To submit an announcement to E-News or to read this **
** issue or past issues on the web go to: **
** **
** http://www.unl.edu/e-news **
****

In this Issue of UNL E-News: Oct 14, 2008

ANNOUNCEMENTS:

****

5. Invitation to participate in a nutrition study

Interested in learning about the benefits of nutrition to maintain health and prevent diseases? A nutrition education intervention to increase females' knowledge and understanding of the important role of nutrition is looking for participants. If you are a UNL female staff member, at least 45 years old, have computer access at work and are interested in participating in this intervention, reply to wyen1@unlserve.unl.edu for more information.

****

****
** To submit an announcement to E-News or to read this **
** issue or past issues on the web go to: **
** **
** http://www.unl.edu/e-news **
****

In this Issue of UNL E-News: Oct 28, 2008

ANNOUNCEMENTS:

****

4. Invitation to participate in a nutrition research study

A nutrition education intervention is looking for UNL female staff members, at least 45 years of age, having computer access at work and interested in participating in a nutrition research study. It's a great chance for females to receive nutrition information on how to maintain health and prevent diseases. Reply to wyen1@unlserve.unl.edu for more information.

****

Nutrition study seeks campus volunteers

March, 2008 | By **admin** | Category: **Employee News**, **November 6, 2008**

Female staff are sought to take part in a nutrition research study. Applicants must be at least 45 years old, have computer access at work and be interested in participating in a nutrition research study.

The study will provide nutrition information on how to maintain health and prevent diseases.

For more information, send e-mail to **wyen1@unlserve.unl.edu**.

Tags: nutrition research study

Leave Comment

APPENDIX D

Intervention Demographic Questionnaire

The following are 10 demographic questions. All questions are required.
Thank you for your time to fill it out.

1. How long have you been working in UNL?

- ☐ Less than 1 year
- ☐ 1 to 10 years
- ☐ 11 to 20 years
- ☐ More than 20 years

2. In a typical day, how many hours do you spend on the internet?

	None	Less than one hour	One to three hours	Four to Six hours	Seven hours and more
Work	☐	☐	☐	☐	☐
Other than at work	☐	☐	☐	☐	☐

3. Your age, height and weight

years of age
feet
inches
pounds

4. Race/ethnicity

- ☐ Caucasian
- ☐ African American
- ☐ Asian or pacific
- ☐ American Indian
- ☐ Hispanic
- ☐ Other (please specify)

5. Education level

- ☐ Less than high school
- ☐ High school graduate or GED

- [ ] Some college
- [ ] Bachelor's degree (4 year)
- [ ] Graduate degree
- [ ] Other (please specify)

6. Who prepares your meals? (Check any apply)

- [ ] Self prepared
- [ ] Husband/significant other
- [ ] Child/children
- [ ] Other (please specify)

7. How often do you eat out in a typical week?

- [ ] None
- [ ] 1 to 5 times
- [ ] 6 to 10 times
- [ ] More than 10 times

8. Are you on any diet now?

- [ ] No
- [ ] Yes. Please describe

9. Are you taking any supplements (vitamin/mineral/herbal)?

- [ ] None
- [ ] Yes. What type?

10. Are you diagnosed of any disease listed below? (Check any apply)

- [ ] Osteoporosis
- [ ] Diabetes
- [ ] High blood pressure
- [ ] Heart diseases

- [ ] Cancer
- [ ] None
- [ ] Other (please specify)

APPENDIX E

Food Frequency Questionnaire

Food Frequency Questionnaire

Date_____

This form asks about your usual dietary intake and purchasing over the past month. It takes about 10-15 minutes to complete. Please use the following instruction.

1. **Read each food item. If you have not eaten this food in the past month, mark "none".**

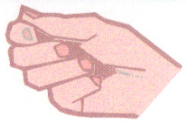
2. **Indicate whether you think your usual serving size is small (S), medium (M), or large (L) by marking the correct serving size box. Please refer to the handout on "*Portion Size: A Handy Guide*" for a visual reference on medium serving sizes.**

   NOTE: A small (S) serving is equal to half (½) the usual serving.
   A medium (M) is equal to the medium servings listed on the form.
   A large (L) is equal to one and a half (1 ½) times as much or more of the medium serving.

3. **Think over the past month. How often do you usually eat each of the following food items? Again, mark the box under the correct heading. Answer each question as best you can; estimate if you are not sure.**

4. **On the last two columns, mark if you have or have not purchased this food in the past month. (Yes or No)**

Portion Size: A Handy Guide



Fist - about 1 cup or 1 medium fruit

Palm - (minus fingers) About 3 oz cooked poultry, fish, or lean meat

Cupped Hand - about 1 to 2 oz pretzels (15 small twist, 7 regular)

Thumb - about 1 oz cheese

Thumbtip - about 1 tablespoon

Fingertip - about 1 teaspoon

Food Groups	**Medium Serving**	**None**	**S**	**M**	**L**	**Once a month**	**2-3 times a month**	**1-2 times a week**	**3-4 times a week**	**5-6 times a week**	**1-2 times a day**	**3-4 times a day**	**5-6 times a day**	**6+ times a day**	**Purchase**	
															Yes	**No**
Whole Grains (whole wheat bread, pasta, oatmeal, brown rice, popcorn)	**½ cup**															
Vegetables	**½ cup**															
Fruits	**½ cup**															
Dairy (milk, yogurt, cheese)	**1 cup**															
Meat and Beans (beef, pork, poultry, seafoods, nuts, seeds, legumes)	**3 ounce**															
Oil (margarine, vegetable oils, salad dressing	**1 tsp**															

Breads/cereals/ grains	Medium Serving	None	S	M	L	Once a month	2-3 times a month	1-2 times a week	3-4 times a week	5-6 times a week	1-2 times a day	3-4 times a day	5-6 times a day	6+ times a day	Purchase	
															Yes	No
Oatmeal (cooked)	½ cup															
Brown rice (cooked)	½ cup															
Whole wheat pasta (cooked)	½ cup															
Whole wheat bread	1 slice															
White bread	1 slice															
Whole grain cereal	1 cup															
Popcorn (popped)	3 cups															
ALL GRAINS	½ cup															

Vegetables	Medium Serving	None	S	M	L	Once a month	2-3 times a month	1-2 times a week	3-4 times a week	5-6 times a week	1-2 times a day	3-4 times a day	5-6 times a day	6+ times a day	Purchase	
															Yes	No
Carrot	½ cup															
Sweet potato	medium or ½ cup															
Broccoli	½ cup															
Spinach	½ cup															
Loose-leaf lettuce	½ cup															
ALL VEGETABLES	½ cup															

Fruits	Medium Serving	None	S	M	L	Once a month	2-3 times a month	1-2 times a week	3-4 times a week	5-6 times a week	1-2 times a day	3-4 times a day	5-6 times a day	6+ times a day	Purchase	
															Yes	No
Cranberries	½ cup															
Cranberry Juice	3/4 cup															
Apple	1 medium															
Apple Juice	3/4 cup															
Orange	1 medium															
Orange Juice	3/4 cup															
Cantaloupe/ muskmelon	½ cup															
Banana	1 medium															
ALL FRUITS	½ cup															

Dairy products	Medium Serving	None	S	M	L	Once a month	2-3 times a month	1-2 times a week	3-4 times a week	5-6 times a week	1-2 times a day	3-4 times a day	5-6 times a day	6+ times a day	Purchase	
															Yes	No
Yogurt- fat-free or low-fat	8 ounces															
1% or fat-free milk	1 cup															
Cheese- low-fat	¼ cup															
ALL DAIRY	1 cup															

Meat	Medium Serving	None	S	M	L	Once a month	2-3 times a month	1-2 times a week	3-4 times a week	5-6 times a week	1-2 times a day	3-4 times a day	5-6 times a day	6+ times a day	Purchase	
															Yes	No
Beef	3 ounces															
Chicken	3 ounces															
n-3 egg	1 egg															

*** 3 ounces is about the size of a deck of cards**

Seafood	Medium Serving	None	S	M	L	Once a month	2-3 times a month	1-2 times a week	3-4 times a week	5-6 times a week	1-2 times a day	3-4 times a day	5-6 times a day	6+ times a day	Purchase	
															Yes	No
Salmon	3 ounces															
Tuna	3 ounces															
Whitefish	3 ounces															
Catfish	3 ounces															
Sardines	3 ounces															
Shrimp	3 ounces															

Nuts/seeds	Medium Serving	None	S	M	L	Once a month	2-3 times a month	1-2 times a week	3-4 times a week	5-6 times a week	1-2 times a day	3-4 times a day	5-6 times a day	6+ times a day	Purchase	
															Yes	No
Walnuts	**1 ounce**															
Flaxseeds	**1 ounce**															
Almonds	**1 ounce**															

Legumes and products	Medium Serving	None	S	M	L	Once a month	2-3 times a month	1-2 times a week	3-4 times a week	5-6 times a week	1-2 times a day	3-4 times a day	5-6 times a day	6+ times a day	Purchase	
															Yes	No
Soybeans	½ cup															
Soy nuts	1 ounce															
Soy milk	1 cup															
Baked beans	½ cup															
Tofu	½ cup															
Peanut butter	2 Tbsp															
ALL MEAT& BEANS	3 ounce															

Fats and oil	Medium Serving	None	S	M	L	Once a month	2-3 times a month	1-2 times a week	3-4 times a week	5-6 times a week	1-2 times a day	3-4 times a day	5-6 times a day	6+ times a day	Purchase	
															Yes	No
Canola oil	1 tsp															
Olive oil	1 tsp															
Flaxseed oil	1 tsp															
Walnut oil	1 tsp															
Soybean oil	1 tsp															
Salad dressing made with canola oil	1 tsp															
Salad dressing made with flaxseed oil	1 tsp															
Salad dressing made with walnut oil	1 tsp															
Salad dressing made with soybean oil	1 tsp															
ALL OILS	1 tsp															

APPENDIX F

Self-efficacy Questionnaire

Self-efficacy questionnaire

1. **In a typical day, how confident are you that you include whole grains (for example, oatmeal, popcorn, brown rice, whole wheat flour, whole wheat bread):**

	Completely Certain	**Somewhat Certain**	**Somewhat Uncertain**	**Completely Uncertain**
At meals	□	□	□	□
Cooking	□	□	□	□
Eating out	□	□	□	□
Purchasing foods	□	□	□	□

2. **In a typical day, how confident are you that you include foods that provide omega-3 fatty acids (for example, fish, walnut, flax):**

	Completely Certain	**Somewhat Certain**	**Somewhat Uncertain**	**Completely Uncertain**
At meals	□	□	□	□
Cooking	□	□	□	□
Eating out	□	□	□	□
Purchasing foods	□	□	□	□

APPENDIX G

Intervention Evaluation Form

Evaluation

Exit this survey

Thank you so much for helping me finishing the nutrition study. Please feel free to give me any feedback.

1. How much time (on average) did you spend on one weekly module?

- 1-15 minutes
- 16-30 minutes
- 31-45 minutes
- 46-60 minutes
- More than 1 hour
- I didn't read the modules

2. What is the difficulty level of the module content?

	Very easy	Easy	Difficult	Very difficult	Not applicable
Module content					

3. Are the modules useful/helpful?

	Excellent	Good	Fair	Poor	Not applicable
Module content					
Review modules (Modules 4 to 6)					

4. Did you print off the provided module printouts at the end of the modules?

- Yes
- No
- Not applicable

5. Is 6 weeks/modules an appropriate study duration?

- Yes
- No. How many modules would you prefer?

6. What is your preference of this web format?

	Excellent	Good	Fair	Poor
Format	○	○	○	○

7. How would you rate this nutrition study overall?

	Excellent	Good	Fair	Poor
Nutrition study	○	○	○	○

8. Please give me any suggestions on the modules

9. Please give me any comments on the questionnaires

Thank you for taking the time to share your views on the nutrition intervention study. Wish you a wonderful holiday season! :)

Done

APPENDIX H

Relationship between Demographic Data and Food Consumption

		Change in intake (mean ± SD)	*P* value
All oils	Time	1.76±3.41	.6075
	diet	19.27±10.29	.0647
	Time x on diet	-12.54±6.24	.0479*
All dairy	Time x intervention group	.20±.12	.0846
	Time x on diet	1.17±.55	.0334*
	Time x take supplement	-.09±.21	.6756
	Time x on diet x take supplement	-1.08±.56	.0565
All fruits	Time x BMI x on diet	-.09±.03	.0033**
	Time x BMI x take supplement	.19±.08	.0229*
All vegetables	Time x BMI	.06±.02	.0126**
All grains	Intervention group x BMI x take supplement	-.56±.25	.032*
	Time x intervention group x BMI	-.098±.03	.0024**
Salad dressing made with flaxseed oil	Time x on diet x take supplement	-3.15±.8	.0002**
	Time x intervention group x take supplement	-3.13±.58	<.0001***
Flaxseed oil	Time x on diet	-19.70±10.85	.0731
Soynuts	On diet x take supplement	-3.61±2.11	.0906
Soybeans	Time x on diet x take supplement	-2.49±1.33	.0654
Flaxseeds	Time x on diet	-22.41±15.37	.1486

Sardines	Time x on diet	.35±.196	.0753
Whitefish	BMI x on diet	.14±.07	.0488*
	Intervention group x take supplement	-2.22±1.28	.0872
Tuna	Time x intervention group x BMI x on diet	-.15±.08	.0709
	Intervention group x BMI x on diet	.35±.13	.0073**
	Time x BMI x on diet	.02±.05	.735
	Time x intervention group x on diet	.19±.51	.7167
	Time x intervention group x BMI	.09±.06	.1781
Salmon	Time x on diet x take supplement	-3.39±1.18	.0052**
	Diet x supplement	.66±3.05	.829
	Time x supplement	.25±.43	.5672
	Time x diet	3.60±1.15	.0024**

***p*< .05**
** ***p*< .01**
****p*< .0001**

APPENDIX I

Major Contributions to Omega-3 fatty Acid Intake

Food	Control group (n=44)		
	Baseline	3rd week	6th week
	← *g/month (Mean ± standard deviation)* →		
Flaxseed	17.45±53.8	16.52±40.65	16.95±42.96
Canola oil	3.07±5.33	4.08±7.15	2.99±4.58
Beef	2.77±4.4	2.58±3.04	1.9±2.24
Flaxseed oil	2.57±17.03	1.34±8.71	3.12±17.52
Walnut	2.1±3.91	2.14±5.14	2.83±5.49
Loose- leaf lettuce	2.03±1.96	1.9±2.92	1.56±2.06
Salmon	1.72±3.11	1.28±2.53	1.32±2.41
Almond	1.19±2.84	1.05±1.76	.82±1.49
White fish	1.1±2.33	.96±1.88	1.04±2.31
Chicken	1.07±.84	1.16±1.18	.83±.64

Food (g/month)	Intervention group (n=43)		
	Baseline	3rd week	6th week
	← *g/month (Mean ± standard deviation)* →		
Flaxseed	57.82±189.78	28.18±70.76	31.49±76.45
Flaxseed oil	11.54±68.95	1.09±4.98	1.52±6.58
Loose-leaf lettuce	2.65±4.31	1.88±2.01	1.66±1.69
Beef	2.64±4.31	1.66±2.31	1.86±1.94
Canola oil	2.44±4.24	2.94±4.5	3.26±5.06
Walnut	2.29±6.95	1.96±4.89	3.4±8.69
Almond	1.61±2.31	1.34±1.65	1.31±1.89
Salmon	1.48±2.41	1.59±2.6	.87±1.7
Salad dressing made with canola oil	1.19±4.24	.95±1.94	1.41±3.08
Tuna	1.1±2.85	.78±1.94	.97±2.47

APPENDIX J

Self-efficacy Results

Self-efficacy to include whole grain in various settings at baseline, third week and sixth week

Baseline (n=88)	**Completely uncertain**	**Somewhat uncertain**	**Somewhat certain**	**Completely certain**
At meals	4 (4.5%)	11 (12.5%)	33 (37.5%)	40 (45.5%)
Cooking	6 (6.8%)	11 (12.5%)	35 (39.8%)	36 (40.9%)
Eating out	14 (15.9%)	41 (46.6%)	27 (30.7%)	6 (6.8%)
Purchasing foods	1 (1.1%)	8 (9.1%)	36 (40.9%)	43 (48.9%)

3rd week (n=82)	**Completely uncertain**	**Somewhat uncertain**	**Somewhat certain**	**Completely certain**
At meals	2 (2.4%)	10 (12.2%)	36 (43.9%)	34 (41.5%)
Cooking	4 (4.9%)	12 (14.6%)	35 (42.7%)	31 (37.8%)
Eating out	11 (13.4%)	38 (46.3%)	28 (34.1%)	5 (6.1%)
Purchasing foods	1 (1.2%)	7 (8.5%)	30 (36.6%)	44 (53.7%)

6th week (n=77)	**Completely uncertain**	**Somewhat uncertain**	**Somewhat certain**	**Completely certain**
At meals	0	4 (5.2%)	30 (39%)	43 (55.8%)
Cooking	1 (1.3%)	6 (7.8%)	31 (40.3%)	39 (50.6%)
Eating out	5 (6.5%)	33 (42.9%)	30 (39%)	9 (11.7%)
Purchasing foods	0	3 (3.9%)	26 (33.8%)	48 (62.3%)

Self-efficacy to include omega-3 fatty acids in various settings at baseline, third week and sixth week

Baseline (n=87)	**Completely uncertain**	**Somewhat uncertain**	**Somewhat certain**	**Completely certain**
At meals	15 (17.2%)	30 (34.5%)	24 (27.6%)	18 (20.7%)
Cooking	18 (20.7%)	30 (34.5%)	24 (27.6%)	15 (17.2%)
Eating out	33 (37.9%)	31 (35.6%)	20 (23%)	3 (3.4%)
Purchasing foods	14 (16.1%)	24 (27.6%)	30 (34.5%)	19 (21.8%)

3rd week (n=82)	**Completely uncertain**	**Somewhat uncertain**	**Somewhat certain**	**Completely certain**
At meals	12 (14.6%)	27 (32.9%)	29 (35.4%)	14 (17.1%)
Cooking	14 (17.1%)	28 (34.1%)	26 (31.7%)	14 (17.1%)
Eating out	24 (29.3%)	32 (39%)	25 (30.5%)	1 (1.2%)
Purchasing foods	13 (15.9%)	22 (26.8%)	26 (31.7%)	21 (25.6%)

6th week (n=77)	**Completely uncertain**	**Somewhat uncertain**	**Somewhat certain**	**Completely certain**
At meals	6 (7.8%)	23 (29.9%)	30 (39%)	18 (23.4%)
Cooking	7 (9.1%)	25 (32.5%)	27 (35.1%)	18 (23.4%)
Eating out	15 (19.5%)	34 (44.2%)	25 (32.5%)	3 (3.9%)
Purchasing foods	7 (9.1%)	21 (27.3%)	26 (33.8%)	23 (29.9%)

Self-efficacy to include whole grain in various settings in control group at baseline, third week and sixth week

Baseline (n=44)	**Completely uncertain**	**Somewhat uncertain**	**Somewhat certain**	**Completely certain**
At meals	2 (4.5%)	7 (15.9%)	16 (36.4%)	19 (43.2%)
Cooking	3 (6.8%)	7 (15.9%)	16 (36.4%)	18 (40.9%)
Eating out	8 (18.2%)	18 (40.9%)	14 (31.8%)	4 (9.1%)
Purchasing foods	0	4 (9.1%)	19 (43.2%)	21 (47.7%)

3rd week (n=43)	**Completely uncertain**	**Somewhat uncertain**	**Somewhat certain**	**Completely certain**
At meals	1 (2.3%)	5 (11.6%)	21 (48.8%)	16 (37.2%)
Cooking	2 (4.7%)	6 (14%)	21 (48.8%)	14 (32.6%)
Eating out	4 (9.3%)	22 (51.2%)	14 (32.6%)	3 (7%)
Purchasing foods	0	4 (9.3%)	15 (34.9%)	24 (55.8%)

6th week (n=42)	**Completely uncertain**	**Somewhat uncertain**	**Somewhat certain**	**Completely certain**
At meals	0	2 (4.8%)	16 (38.1%)	24 (57.1%)
Cooking	0	3 (7.1%)	16 (38.1%)	23 (54.8%)
Eating out	2 (4.8%)	16 (38.1%)	17 (40.5%)	7 (16.7%)
Purchasing foods	0	1 (2.4%)	14 (33.3%)	27 (64.3%)

Self-efficacy to include omega-3 fatty acids in various settings in control group at baseline, third week and sixth week

Baseline (n=44)	**Completely uncertain**	**Somewhat uncertain**	**Somewhat certain**	**Completely certain**
At meals	8 (18.2%)	18 (40.9%)	11 (25%)	7 (15.9%)
Cooking	10 (22.7%)	18 (40.9%)	10 (22.7%)	6 (13.6%)
Eating out	15 (34.1%)	17 (38.6%)	11 (25%)	1 (2.3%)
Purchasing foods	7 (15.9%)	13 (29.5%)	17 (38.6%)	7 (15.9%)

3rd week (n=43)	**Completely uncertain**	**Somewhat uncertain**	**Somewhat certain**	**Completely certain**
At meals	5 (11.6%)	17 (39.5%)	16 (37.2%)	5 (11.6%)
Cooking	6 (14%)	17 (39.5%)	15 (34.9%)	5 (11.6%)
Eating out	12 (27.9%)	20 (46.5%)	11 (25.6%)	0
Purchasing foods	6 (14%)	15 (34.9%)	16 (37.2%)	6 (14%)

6th week (n=42)	**Completely uncertain**	**Somewhat uncertain**	**Somewhat certain**	**Completely certain**
At meals	1 (2.4%)	15 (35.7%)	17 (40.5%)	9 (21.4%)
Cooking	2 (4.8%)	15 (35.7%)	16 (38.1%)	9 (21.4%)
Eating out	5 (11.9%)	18 (42.9%)	16 (38.1%)	3 (7.1%)
Purchasing foods	2 (4.8%)	13 (31%)	16 (38.1%)	11 (26.2%)

Self-efficacy to include whole grain in various settings in intervention group at baseline, third week and sixth week

Baseline (n=44)	**Completely uncertain**	**Somewhat uncertain**	**Somewhat certain**	**Completely certain**
At meals	2 (4.5%)	4 (9.1%)	17 (38.6%)	21 (47.7%)
Cooking	3 (6.8%)	4 (9.1%)	19 (43.2%)	18 (40.9%)
Eating out	6 (13.6%)	23 (52.3%)	13 (29.5%)	2 (4.5%)
Purchasing foods	1 (2.3%)	4 (9.1%)	17 (38.6%)	22 (50%)

3rd week (n=39)	**Completely uncertain**	**Somewhat uncertain**	**Somewhat certain**	**Completely certain**
At meals	1 (2.6%)	5 (12.8%)	15 (38.5%)	18 (46.2%)
Cooking	2 (5.1%)	6 (15.4%)	14 (35.9%)	17 (43.6%)
Eating out	7 (17.9%)	16 (41%)	14 (35.9%)	2 (5.1%)
Purchasing foods	1 (2.6%)	3 (7.7%)	15 (38.5%)	20 (51.3%)

6th week (n=35)	**Completely uncertain**	**Somewhat uncertain**	**Somewhat certain**	**Completely certain**
At meals	0	2 (5.7%)	14 (40%)	19 (54.3%)
Cooking	1 (2.9%)	3 (8.6%)	15 (42.9%)	16 (45.7%)
Eating out	3 (8.6%)	17 (48.6%)	13 (37.1%)	2 (5.7%)
Purchasing foods	0	2 (5.7%)	12 (34.3%)	21 (60%)

Self-efficacy to include omega-3 fatty acids in various settings in intervention group at baseline, third week and sixth week

Baseline (n=43)	**Completely uncertain**	**Somewhat uncertain**	**Somewhat certain**	**Completely certain**
At meals	7 (16.3%)	12 (27.9%)	13 (30.2%)	11 (25.6%)
Cooking	8 (18.6%)	12 (27.9%)	14 (32.6%)	9 (20.9%)
Eating out	18 (41.9%)	14 (32.6%)	9 (20.9%)	2 (4.7%)
Purchasing foods	7 (16.3%)	11 (25.6%)	13 (30.2%)	12 (27.9%)

3rd week (n=43)	**Completely uncertain**	**Somewhat uncertain**	**Somewhat certain**	**Completely certain**
At meals	7 (17.9%)	10 (25.6%)	13 (33.3%)	9 (23.1%)
Cooking	8 (20.5%)	11 (28.2%)	11 (28.2%)	9 (23.1%)
Eating out	12 (30.8%)	12 (30.8%)	14 (35.9%)	1 (2.6%)
Purchasing foods	7 (17.9%)	7 (17.9%)	10 (25.6%)	15 (38.5%)

6th week (n=35)	**Completely uncertain**	**Somewhat uncertain**	**Somewhat certain**	**Completely certain**
At meals	5 (14.3%)	8 (22.9%)	13 (37.1%)	9 (25.7%)
Cooking	5 (14.3%)	10 (28.6%)	11 (31.4%)	9 (25.7%)
Eating out	10 (28.6%)	16 (45.7%)	9 (25.7%)	0
Purchasing foods	5 (14.3%)	8 (22.9%)	10 (28.6%)	12 (34.3%)

Self-efficacy to include omega-3 fatty acids in various settings at baseline, third week and sixth week

Setting	**Baseline** (n=88)	**3rd week** (n=82)	**6th week** (n=77)
At meals	2.52±1.01	2.55±.95	2.78±.90
Cooking	2.41±1.01	2.49±.97	2.73±.93
Eating out	1.92±.87	2.04±.81	2.21±.80
Purchasing foods	2.62±1.00	2.67±1.03	2.84±.96

1=completely uncertain
2=somewhat uncertain
3=somewhat certain
4=completely certain

APPENDIX K

Intervention Evaluation

		Responses (n=72)
Time spent on weekly module (minutes/module)	**1-15** **16-30** **31-45** **46-60**	39 (54.2%) 31 (43.1%) 1 (1.4%) 1 (1.4%)
Module content difficulty level	**Very easy** **Easy** **Difficult**	31 (43.1%) 39 (54.2%) 2 (2.8%)
Module content usefulness	**Excellent** **Good** **Fair**	23 (31.9%) 42 (58.3%) 7 (9.7%)
Review module (Module 4 to 6) content usefulness*	**Excellent** **Good** **Fair**	18 (29 %) 37 (59.7 %) 6 (9.7%)
Print off the module printouts	**Yes** **No**	30 (41.7%) 42 (58.3%)
6 weeks/modules appropriate study duration	**Yes**	67 (93.1%)
Web format preference	**Excellent** **Good** **Fair** **Poor**	29 (40.3%) 33 (45.8%) 6 (8.3%) 4 (5.6%)

Overall	**Excellent**	25 (34.7%)
	Good	34 (47.2%)
	Fair	12 (16.7%)

***n=62**