

Feasibility of Internet-based Post-secondary Nutrition Education: Incorporating Features of the Mediterranean Diet

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ABSTRACT

Background: The Internet continues to serve as an ideal venue for health education interventions promoting behavior change. Due to the progressive expansion in online education programs, new methodologies that contribute across health education and program planning continuums are needed.

Methods: This ecologic study investigated the change in student dietary behavior and food choices following an original online education intervention that introduced the Mediterranean diet (MD) in a community college in Houston, Texas. A non-probability convenience sample ($n=65$) provided pretest-posttest data measuring knowledge of and attitudes toward the MD. The intervention was incorporated into an undergraduate nutrition course, delivered entirely online and evaluated using the Mediterranean Diet Quality Index (KIDMED) survey.

Results: The intervention improved total participant population from a mean KIDMED score of poor (4.12) to a mean score of high (8.45) indicating an increase in knowledge of MD dietary guidelines and a positive shift in favorable attitude, particularly among men.

Conclusion: This study provides a unique pedagogical illustration of online learning that introduce a specific evidence-based dietary guideline to a college student population. A detailed discussion of findings and lessons learned is provided.

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Introduction

The Internet is an ideal venue for health education interventions promoting behavior change. A meta-analysis¹ investigated Internet-based interventions and identified characteristics best suited to health behavior change among college populations. Webb et al.¹ suggest three characteristics of successful interactive interventions: use of theory and predictors as a promotional basis, techniques used for behavior change, and mode of delivery. The authors found interventions that integrated

multiple techniques targeting behavior change tend to have more significant effects on behavior change and health outcomes.¹ These findings suggest contemporary delivery modes (SMS messaging, Internet-based deliveries, and other electronic-based delivery modes) to change health behavior.

With online learning emerging as an ideal nutrition education tool² and increases in online education enrollment, effective delivery of Internet-

based nutrition education is a key objective of public health educators and dietitians. A systematic literature review³ of the current state of research related to the design, implementation, and evaluation of postsecondary online nutrition credit courses found no significant differences in nutrition performance and knowledge between online and residential students. Franko et al.⁴ successfully delivered a nutrition education intervention using randomly assigned trials to measure increases in nutritious food choices. Participants in both the treatment and control groups responded positively to the Internet-based approach and the treatment successfully increased fruit and vegetable intake. Gow et al.⁵ followed with a similar methodology that used Internet-based health promotion learning modules to maintain lower body mass index versus a control group among first year college students.

Through strategic learning behaviors and activities, online nutrition courses could support and maintain predictable nutrition patterns conducive to student health and wellness outside the virtual setting. Previous authors⁶ agree that nutrition interventions tailored through online settings effectively promote healthy food behaviors and eating patterns. Given the 19.1% increase in online course offerings (compared to 2.6% increase in traditional course offerings) from 2000 to 2011 and their popularity among traditional and non-traditional college students,⁷ incorporating interventional nutrition programming presents as a strategic next step within college populations. One such nutrition program identified as a protective measure against overweight, obesity, diabetes, and heart disease (HD) is the Mediterranean Diet (MD).⁸

The MD is the dietary pattern traditionally consumed among the populations bordering the Mediterranean Basin. The MD includes a major focus on fruits, vegetables, unrefined whole grains, pulses and legumes, nuts, poultry, eggs, fish, low-fat dairy products, a low consumption of red meat, physical activity, and a liberal use of olive oil.⁸ A recent study⁹ continues to validate the MD as an ideal dietary model for weight management and a dietary guideline for healthy eating with a significant reduction in the risk of chronic diseases asso-

ciated with obesity such as HD and Diabetes. The foundation of the MD focuses on an abundance of plant-based foods (fruits, vegetables, whole grains, beans, nuts, and seeds), fish, and olive oil as the principle source of fat. The authors' primary objective was to design, implement, and evaluate a tailored online nutrition intervention by incorporating features of the MD and measure its effectiveness as a potential weight management tool.

Methods

This study included registered students taking a 3-credit hour undergraduate online nutrition course at San Jacinto College in Houston, Texas. The course, HECO 1322 Nutrition and Diet Therapy, focused on fundamental principles of human nutrition and metabolic processes. Each nutrition course accommodated 20-30 students per semester and demographics varied significantly regarding sex, ethnicity, age, choice of study, and year of study. Information on the study and voluntary consent was provided to all potential participants during the first week of the course. Students were free to decline participation without consequence at any time prior to or during the study. Pre-intervention survey data ($n=65$) was collected during the first week of class and post-intervention survey data ($n=65$) the last week of class using the Mediterranean Diet Quality Index (KIDMED) developed and validated by Serra-Majem et al.¹⁰ The nutrition intervention was based on the MD as a weight management guideline and incorporated assigned readings, article reviews, recipe analysis, weekly discussion forums, asynchronous presentations, writing assignments, and exams.

Ethical Issues

Expedited Institutional Review Board approval was secured from San Jacinto College and A.T. Still University of Health Sciences.

Data Collection

The nutrition intervention was administered via the e-learning management system Blackboard Learn Release 9.1, Service Pack 8. The KIDMED

survey, administered as a pretest and posttest, is a 16-item questionnaire and classifies participants according to perceived quality and value of the MD categorized as: ≤ 3 (low), 4–7 (medium), and ≥ 8 (high).¹⁰ The KIDMED index ranges from 0 to 12 and includes 12 positive questions and 4 negative questions. Each answer is given a value of +1 or 0 (for positive behaviors) or -1 or 0 (for negative behaviors), and responses to all items are summed. Sahingoz and Sanlier¹¹ validated the KIDMED index to assess adherence, compliance, and attitudinal change ($\alpha \geq 0.84$). Demographic data including sex, ethnicity, and family history of HD were also collected during the pre-test.

Data Analysis

Participant demographics were assessed for sex, ethnicity, and familial HD history using descriptive statistics. Results were expressed in frequencies and percentages of the total population. Pre-test scores were analyzed for normality using the graphical method. For normal distribution, an ANOVA was used to compare pre-intervention KIDMED scores with sex, ethnicity, and familial HD history to detect pre-existing associations pri-

or to the health education intervention. Lastly, the difference between pretest and posttest scores for each participant was analyzed for normality using the graphical method. When found to be normally distributed, a paired *t*-Test was used to compare differences between pre-intervention and post-intervention KIDMED scores based on sex, ethnicity, and familial HD history. Data was analyzed using SAS Enterprise Guide 4.3. The results were expressed as frequencies and percentages of the categorical variables of KIDMED scores (≤ 3 [low], 4–7 [medium], and ≥ 8 [high]). Comparisons between groups were expressed as a *P*-value where < 0.05 was considered statistically significant.

Results

All participants demonstrated a statistically significant and positive attitudinal shift following the nutrition intervention as measured by the KIDMED tool; males demonstrated a significantly larger shift (+6.00, ± 2.00 , $P=0.005$) compared to females (+3.82, ± 2.00 , $P=0.005$) (Table 1).

Table 1: Pretest Score Comparison by Sex using one-way ANOVA

Sex	Pre-test Mean (SD)	Post-test Mean (SD)	Std Error	KIDMED Min. Score	KIDMED Max. Score
F ($n=50$)	4.86 (2.81)	8.68 (2.12)	0.40	0.00	9.00
M ($n=15$)	1.67 (2.16)	7.67 (2.06)	0.56	-2.00	5.00
<i>P</i> -value	0.001	0.108			

Participants with a family history of HD (Table 2), particularly Caucasians, experienced a larger attitudinal shift compared to the entire sample (+5.58, $P=1.89$). No statistically significant conclusions emerged among non-Caucasian males due to the

low number of participants ($n=2$). Results indicated a successful attitudinal shift towards a well-defined dietary guideline known to affect positively overweight, obesity, and HD risk.

Table 2: Self-Reported History of HD by Sex, Ethnicity, and Change in KIDMED Score

Ethnicity	Family HD History	No Family HD History
Female:	Caucasian ($n=18$)	8 (45%)
	Non-Caucasian ($n=32$)	4 (12%)
Male:	Caucasian ($n=13$)	28 (88%)
	Non-Caucasian ($n=2$)	2 (15%)
KIDMED Score ($P=0.002$)		0.00
		+5.58 (1.89)
		+3.60 (2.02)

Discussion

The objective was to deliver a healthy diet and weight management strategy enclosed within a standard online nutrition course. The MD served as a novel approach within this population; to date there are no known methodologies that used these specific variables and methodology. The intervention did not collect participant height, weight, or BMI. Although this information may have been useful in correlational observations, identification of extraneous variables, and in search of unintended findings, avoiding these metrics was necessary to preserve the authenticity of the nutrition course versus the look and feel of a research setting. A primary focus of the study was change attitude towards the MD dietary guideline. The success of that guideline has previously been established in the literature and changes in weight or BMI within a study of this size would not affect that result.

The study was limited in sample size and scope (3 sections of the same nutrition course) and would need to be expanded to increase the power of the results. All course sections were delivered during the same summer session. An expanded period would have increased the sample population and broadened the sample base – some students do not take classes during summer sessions and others might only take classes during the summer. A study methodology that included a full academic year and summer session would have enriched the sample population and data collected.

Demographic questions in the data collection tool included sex, ethnicity, and familial HD history. Additional demographic data associated with a larger sample of participants would provide a more detailed statistical portrait of the target population. Online instruction is closely associated with the non-traditional student demographic that lacks characteristics typical of traditional college students: 18-24, normality between sex and ethnicity, and geographically close. Had this study included additional demographic measurement items coupled with a significantly larger sample population, additional inferences associated with

non-traditional and 100% online students might be possible. Finally, a third data collection period well after course/intervention completion would provide additional evaluation of internal validity.

Recommendations

For many young adults, the college environment represents one of their first opportunities to establish individual nutrition behaviors and manage their own independent dietary habits. The literature suggests a need for greater attention to dietary preventive measures and interventions for college students.¹² During transitional years, establishing healthful nutrition behaviors can have a long-lasting effect on health. This developmental period serves as an opportunity for cost-effective, efficient, and flexible health education programs.

Historically, initial behavior change is a poor predictor of sustained behavior change within nutrition and dietary programs. Therefore, the primary metric for success in this study was change in awareness of and attitude towards a novel dietary guideline. Whether or not a participant actively adopts the MD following this program was not considered a measure of success. Including nutritional programming designed to assist dietary offers value to the participants and should be considered in addition to programs designed to produce objective results such as weight loss (or prevention of weight gain).

Many colleges and universities have taken steps to reduce public health concerns among college students. Partnering relationships add recognition, value, and extended reach. Student services departments represent ideal partners moving forward with information generated via an Internet-based nutrition intervention embedded in the curriculum. Access to campus health initiatives (face-to-face and virtual), traditional campus publications, and social mediums present potential inroads to student emersion and inclusion. University-based campaigns have targeted their respective student populations by advocating the MD.¹³ These universities have published e-newsletters and online editorials addressing student health and advocating the MD. The method of health program delivery was embedded in and secondary

to an established nutrition curriculum. In this fashion the interventional strategy avoided clear lines of demarcation between standard course activities and research activities leaving the student/participant experience in a continuum. The authors took steps to avoid programmatic situations clearly labeled class activity and research activity. A study assumption is this approach produced more authentic learning opportunities, course assessments, and research data. Lack of overt observational periods was a key element when measuring attitudinal shifts. Any of these programs mentioned here in addition to the methodology presented in this study could serve a college population in need.

Conclusion

If this methodology were repeated, the authors recommend including a stages of behavior change component following the intervention. Because the MD does not represent a popular or strategically advertised dietary guideline, a pre-intervention behavior stage assessment might be necessary. Having access to this information on a larger scale provides new avenues toward conventional health education programs and initiatives targeting nutrition knowledge and behavior. Stratifying students by intentions and actions using a stage model allows health educators to tailor segments of the same nutrition program to multiple subsets of a target population.

Online class events that include experiential activities such as cooking demonstrations, journaling, demonstrational videos, and Photovoice presentations can help students understand and develop nutritional practices and habits indicative of healthy dietary behaviors. These attitude and behavior changes are important in a population that might otherwise experience significant declines in nutrition habits and behaviors as they transition into adulthood. Exposing student populations to an Internet-based pedagogical intervention could increase student self-efficacy, readiness, and motivation towards a healthful dietary pattern such as the MD.

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Competing Interests

The authors declare no potential conflict of interest pertaining to this article.

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