



ORIGINAL RESEARCH

Promoting Health Literacy: Efficacy of an Obesity Focused Educational Intervention for Undergraduates

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Abstract

Introduction: Obesity is a progressive issue that affects 1 in 3 adults in the United States. Research shows that educational interventions can positively impact community knowledge levels and implementation of healthy lifestyle habits. Thus, the aim of this study was to determine the efficacy of an obesity focused interactive educational intervention on knowledge acquisition among undergraduate students. The correlation between personal exercise habits and baseline knowledge was also investigated.

Methods: An interactive educational lyceum was held at Wingate University. Study participants were undergraduate students at Wingate University. Participants were recruited via flyers, campus wide emails, and a university managed lyceum calendar. Pre- and post-surveys were used to collect demographics, lifestyle habits, and knowledge of obesity and obesity related topics, such as sleep, exercise, and diet. The pre-survey consisted of 10 knowledge-based questions, 2 demographic questions, and 4 questions pertaining to lifestyle habits. The post-survey consisted of the same 10 knowledge-based questions. Differences in mean scores were used to determine the efficacy of the educational intervention on improvement of knowledge. Statistical significance was determined using an unpaired t-test. A p-value less than 0.05 were considered statistically significant. A Pearson correlation coefficient was used to determine the relationship between self-reported exercise levels and baseline knowledge.

Results: A total of 127 students attended the lyceum. Of those in attendance, 97 completed the pre-survey and 96 completed the post-survey. The educational session improved knowledge of the participants, evident by the improvement in scores between the pre- and post-surveys (4.9 ± 1.67 vs. 7.1 ± 1.7 , respectively; $p < 0.0001$). There was no correlation found between exercise levels and

baseline knowledge ($r = 0.0856$; $n = 96$).

Conclusions: The results suggest that the interactive intervention was able to significantly improve undergraduate students' knowledge of obesity and obesity related topics. This research highlights the valuable role of targeted educational interventions in fostering health literacy and promoting healthy lifestyle choices among college students.

Keywords

Obesity, Health literacy, Health education, Health promotion, University, College education, Undergraduate students

Introduction

Obesity is a chronic disease state that is at the center of a global epidemic. In order to understand the center of the global epidemic, obesity is defined by the World Health Organization (WHO) as a Body Mass Index (BMI) equal to or greater than 30 kg/m^2 [1]. In particular, adult obesity impacts the United States' health, economy, and military readiness. It is the second-leading cause of preventable deaths in the USA [1]. Obesity increases the risk of developing heart disease, type 2 diabetes, and some cancer types [2]. In 2022, one in three adults struggled with obesity in the United States, and only two in five young adults were considered weight eligible and physically prepared for basic training [2]. In that same year, the country spent \$147 Billion on obesity-related health care [2]. The prevalence of this disease has steadily increased and it is now estimated that by the year 2030, 78% of adults in the United States will either be overweight or obese [1].



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Union County is, much like the rest of the United States, heavily burdened by the obesity epidemic. Adult obesity prevalence in Union County is approximately 31% [3]. This is slightly lower than the U.S. (32%) and North Carolina (34%) estimates, but still affecting more than three in ten adults as of 2022 [3]. Per the 2022 Union County health report, obesity was the most commonly noted health concern among surveyed adults, with 27.4% of those surveyed ranking obesity as one of their top three health concerns [3]. Teens shared a similar concern, with obesity being the 3rd most commonly identified health concern in that age group at 19.9% [3]. In addition, surveyed adults in Union County frequently identified key obesity risk factor behaviors as keeping them from being healthier. Adults cited poor eating habits (57.8%) and lack of exercise (50.4%), the two most prevalent responses, as behaviors keeping them from being healthy [3].

Interventions such as healthy eating habits, exercise, and sleep directly correlate with decreased obesity prevalence [4,5]. CDC data from 2022 showed that only one in ten children and adults ate the recommended daily amount of vegetables [2]. This data also showed that only one in four adults met the physical activity guidelines set by the CDC [2]. Additionally, Americans lack healthy, affordable foods and places to be active. Forty percent of all US households do not live within one mile of healthier food retailers, and more than half of Americans do not live within half a mile of a park [2]. Insufficient sleep has been associated with an increased risk of chronic disease states such as type 2 diabetes, cardiovascular disease, and obesity [6]. The CDC found that approximately 32.8% of people report a short sleep duration, defined as less than 7 hours of sleep per night [7]. Males, adult's age 25 to 44 years, non-Hispanic Native Hawaiian and Other Pacific Islander, and non-Hispanic Black or African Americans were most likely to report short sleep duration [7]. Short sleep durations are directly associated with excess body weight and have been shown to result in metabolic changes that may be linked to obesity [6].

Community health outreach can be effective in lowering obesity rates. Poirier F, et al. studied the efficacy of several community and national level interventions. The interventions found to have the highest level of efficacy included the establishment of farmers markets within the communities. This intervention allowed bohemian families access to healthy, locally grown food while also supporting local farmers' businesses. The farmer's market program grew by 120% over one year [5]. It was concluded that, collectively, community interventions have the efficacy to reverse over two decades of continued increase in obesity prevalence rates through increased exposure to education and access to resources [5].

Estradé M, et al. researched the change in diet quality following exposure to a multilevel, multicomponent obesity prevention intervention (OPREVENT2). OPREVENT2 consisted of interventions such as educational displays, posters, and handouts delivered in food stores [8]. Efficacy of the intervention was measured using the Healthy Eating Index Score (HEI-2015), a 100-point scale based on how closely a diet aligns with the United States Department of Agriculture (USDA) 2015-2020 Dietary Guidelines for Americans (DGA). Exposure to OPREVENT2 was associated with a positive change in HEI-2015 [8]. Participants in the study with the highest OPREVENT2 exposure showed an average increase in HEI-2015 of 3.61 points from baseline [8]. There were four intervention exposure sub-components that yielded significant associations with an increase in HEI-2015 scores from baseline: educational displays, handouts, posters, and radio announcements [8].

Since community health outreach interventions have been shown to be an effective means for improving healthy habits, the primary aim of this study was to determine if an interactive health education outreach intervention could improve obesity related knowledge in undergraduate students among a college community. In educating this specific population, who are likely to be making their own lifestyle choices for the first time, researchers hoped to increase students' awareness of obesity and increase their ability and willingness to adopt an anti-obesity lifestyle.

Methods

Study design

A quasi-experimental study was conducted to investigate the level of knowledge surrounding adult obesity in the undergraduate student population at Wingate University before and after an interactive educational lyceum. The study consisted of a 90-minute educational event in the form of a Powerpoint presentation that included multiple student engagement activities. Participant knowledge was assessed via pre- and post-surveys. All methods and materials were approved by the institutional Research Review Board.

The efficacy of the interactive educational session to improve participants' knowledge was determined by the change in mean scores between the pre- and post-surveys. The secondary endpoint explored the relationship between exercise habits and baseline health literacy, which was determined by the correlation between the amount of self-reported weekly exercise and the percentage of correct responses to knowledge-based questions on the pre-survey.

Subjects

Participants were undergraduate students enrolled at Wingate University who were 18 years of age or older.

Subjects were recruited via campus flyers, campus-wide email announcements, and event listing on the university's lyceum calendar. Lyceums are co-curricular graduation requirements for undergraduate students at Wingate University, designed to enrich students in one of 5 ways: Faith, lecture or academic, personal or professional growth, elective, or arts focused materials. Students receive credit for the lyceums they attend and are required to obtain a total of 24 credits from the four domains to be eligible for graduation. Student attendance at each lyceum is tracked via student identification number. Therefore, subjects did receive lyceum credit toward graduation by attending our event.

Presentation

The 90-minute educational session included a brief presentation about obesity including information regarding nutrition, physical activity, and sleep. Specific topics included obesity related health issues, information on BMI, how to build a balanced meal, adequate water intake, CDC recommendations for exercise, benefits of exercise, CDC recommendations for sleep, the connection between poor sleep habits and obesity, and recommendations to improve sleep habits.

Interactive activities

During the presentation, participants had the opportunity to participate in three engaging activities. The first activity focused on utilizing USDA MyPlate Plan [9] to determine caloric requirements and then create a personalized nutritional plan, including target food groups and respective quantities. The second activity tasked participants with creating an exercise routine and comparing it to CDC recommendations for exercise [10] discussed in the presentation. The third activity, pertaining to sleep, required participants to match sleep cycle descriptions to the correlating stage of the sleep cycle. Breaks for each activity were built into the presentation, with the activity focusing on the area of education that was to be presented immediately after.

Surveys

Utilizing the Healthy Eating Index of 2015 [11] as a reference, 2 surveys were designed to assess demographic information, personal lifestyle habits, and knowledge of obesity and obesity related topics including: sleep, nutrition, and physical activity. The pre-survey consisted of 10 knowledge-based questions, 2 demographic questions, and 4 questions pertaining to personal habits. The post-survey consisted of the same 10 knowledge-based questions. Of the 10 knowledge-based questions, 8 had a single correct answer, and 2 were "select all that apply" in which participants had to select all correct answer choices for the question to be counted as correct.

Statistical analysis

Mean scores on knowledge-based questions were compared to determine differences in knowledge levels between the pre-survey and post-survey. Statistical significance was determined using an unpaired t-test. A p-value less than 0.05 were considered statistically significant.

A Pearson correlation coefficient was used to determine the correlation between self-reported hours spent exercising per week and baseline knowledge (performance on the pre-survey). Answer choices from the pre-survey regarding exercise frequency were coded to a single digit score as follows: "Less than one hour" = score of 1; "1-2 hours" = score of 2; "3-4 hours" = score of 3; and "4 or more hours" = score of 4.

Results

A total of 127 students at Wingate University attended the interactive educational lyceum. Of those in attendance, 97 completed the pre-survey and 96 completed the post-survey, with response rates of 76.4% and 75.6%, respectively. Data from two respondents were excluded prior to final data analysis as they did not meet the inclusion criteria. Approximately 46% of respondents were male and 54% female. The majority of respondents (95.8%) were 18-22 years of age. See Table 1 for baseline characteristics.

The educational session improved knowledge of the participants, evident by the improvement in scores between the pre- and post-surveys (4.9 ± 1.67 vs. 7.1 ± 1.7 , respectively; $p < 0.0001$). The scores ranged from

Table 1: Baseline characteristics.

		Responses No. (%)
Sex	Male	44 (46.3%)
	Female	51 (53.7%)
Age	18-22 Years Old	91 (95.8%)
	23 Years or Older	4 (4.2%)
Self-reported hours of physical activity per week	< 1 Hour	17 (17.9%)
	1-2 Hours	14 (14.7%)
	3-4 Hours	19 (20%)
	> 4 Hours	45 (47.4%)
Self-reported average hours of sleep per night	≤ 4 Hours	5 (5.3%)
	5-6 Hours	40 (42.1%)
	7-8 Hours	46 (48.4%)
	≥ 9 Hours	3 (3.2%)
	Unsure	1 (1.1%)
Self-reported average fruit and vegetable consumption	< 10% of Diet	14 (14.7%)
	10-25% of Diet	47 (49.5%)
	25-50% of Diet	31 (32.6%)
	> 50% of Diet	0 (0%)
	Unsure	3 (3.2%)
Self-reported protein consumption per day	< 50 Grams	7 (7.4%)
	50-100 Grams	43 (45.3%)
	100-150 Grams	26 (27.4%)
	> 150 Grams	10 (10.5%)
	Unsure	9 (9.5%)

Table 2: Knowledge-based questions and responses. Correct answer choices are indicated in bold font.

		Responses		No. (%)	% Change in Correct Answer from Pre-Survey to Post-Survey
		Pre-Survey (n = 95)	Post-Survey (n = 94)		
1) Approximately how many adults in the United States struggle with obesity?	70%	56 (58.9%)	27 (28.7%)	+27.8	
	50%	22 (23.2%)	23 (24.5%)		
	40%	17 (17.9%)	43 (45.7%)		
	20%	0 (0 %)	1 (1.1%)		
2) What is obesity generally defined as?	BMI ≥ 40	17 (17.9%)	13 (13.8%)	+32.3	
	BMI ≥ 35	37 (38.9%)	11 (11.7%)		
	BMI ≥ 30	34 (35.8%)	64 (68.1%)		
	BMI ≥ 25	7 (7.4%)	6 (6.4%)		
3) What other diseases is obesity a risk factor for? Select all that apply:	Type 2 Diabetes	92 (96.8%)	90 (95.7%)	+15.4	
	Some Cancers	58 (61.1%)	85 (90.4%)		
	Heart Disease	88 (92.6%)	91 (96.8%)		
	Osteoarthritis	58 (61.1%)	69 (73.4%)		
	Reproductive Issues	61 (64.2%)	76 (80.9%)		
	High Blood Pressure	88 (92.6%)	90 (95.7%)		
4) Which of the following is a useful tool that can be used to create a balanced meal?	Dish Method	5 (5.3%)	2 (2.1%)	+6.2	
	Bowl Method	5 (5.3%)	2 (2.1%)		
	Plate Method	85 (89.5%)	90 (95.7%)		
5) Using the plate method, which of the following is the recommended percentage for fruit and non-starchy vegetable consumption?	50%	18 (18.9%)	53 (56.4%)	+37.5	
	20%	30 (31.6%)	20 (21.3%)		
	15%	12 (12.6%)	7 (7.5%)		
	30%	35 (36.8%)	14 (14.9%)		
6) According to the CDC, how many hours of sleep should the average adult get each night to decrease the risk of developing obesity?	≥ 5 Hours	2 (2.1%)	5 (5.3%)	+3.0	
	≥ 6 Hours	14 (14.7%)	7 (7.4%)		
	≥ 7 Hours	76 (80%)	78 (83%)		
	≥ 10 Hours	3 (3.2%)	4 (4.3%)		
7) Which of the following can lead to sleep disruptions?	Drinking Alcohol	73 (76.8%)	90 (95.7%)	+18.9	
	Exercising in the Morning	0 (0%)	2 (2.1%)		
	Eating Light Meals for Dinner	22 (23.2%)	2 (2.1%)		
8) The CDC recommends adults partake in how many minutes of moderate exercise each week?	150 Minutes	23 (24.2%)	76 (80.9%)	+56.7	
	60 Minutes	21 (22.1%)	7 (7.4%)		
	180 Minutes	39 (41.1%)	10 (10.6%)		
	30 Minutes	12 (12.6%)	1 (1.1%)		
9) What percentage of US adults meet the CDC recommendations for both aerobic and muscle-strengthening activities?	40%	9 (9.5%)	13 (13.8%)	+7.8	
	35%	34 (35.8%)	14 (14.9%)		
	30%	23 (24.2%)	31 (33%)		
	25%	29 (30.5%)	36 (38.3%)		
10) How can partaking in regular exercise be beneficial to our health? Select all that apply:	Reduced Anxiety	85 (89.5%)	86 (91.5%)	+10.3	
	Promoting Bone Health	81 (85.3%)	87 (92.6%)		
	Prevention of Weight Gain	80 (84.2%)	89 (94.7%)		
	Reduced Risk of Developing Dementia	70 (73.7%)	74 (78.7%)		
	Improved Sleep Quality	83 (87.4%)	88 (93.6%)		

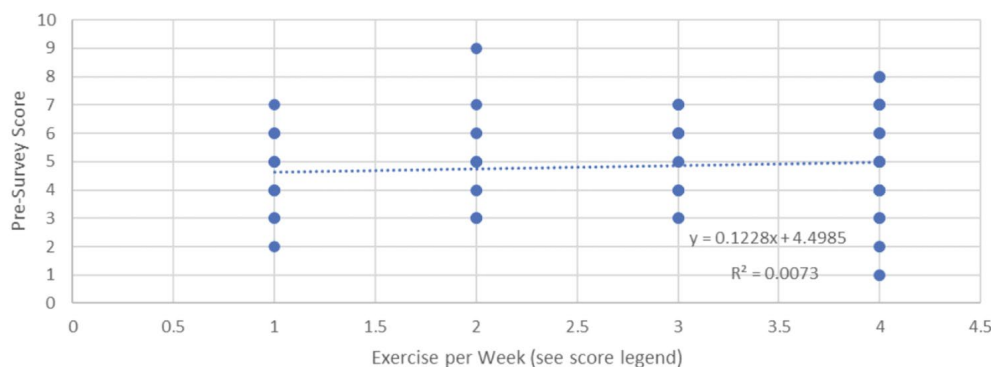


Figure 1: Correlation between exercise frequency and baseline knowledge.

X-axis legend: 1 = Less than 1 hour of exercise per week; 2 = 1-2 hours of exercise per week; 3 = 3-4 hours of exercise per week; 4 = More than 4 hours of exercise per week

1-9 and 3-10, respectively. Additionally, the mode doubled from 4 to 8, respectively. All 10 questions showed improvement in the percentage of respondents who answered correctly from pre- to post-survey. For question 3, a select all that apply, 48.4% and 63.8% of respondents selected every correct answer choice on the pre-survey and post-survey, respectively. For question 10, 64.2% and 74.5% of respondents selected every correct answer choice on the pre-survey and post-survey, respectively. See [Table 2](#) for knowledge-based survey questions and responses.

As part of the pre-survey, participants were asked to report information about their personal habits regarding exercise, diet, and sleep. Approximately 67.4% of respondents had an established exercise routine of 3 or more hours per week. The CDC recommends a minimum of 150 minutes per week for adults [10]. In regards to diet, 45.4% of respondents reported consuming 50-100 grams of protein per day. According to the Mayo Clinic, it is recommended that the average sedentary adult should consume 0.8 grams of protein per kilogram of body weight per day [12]. This recommendation increases to 1.11-1.5 grams of protein per kilogram of body weight if the person is physically active, with an excessive protein intake being characterized as 2 grams of protein per kilogram of body weight per day [12]. Forty-seven respondents (49.5%) reported that 10% to 25% of their diet consists of fruit and vegetables. The United States Department of Agriculture's program, MyPlate, makes the general recommendation that fruits and vegetables should make up a combined 50% of each meal consumed [9]. Specific fruit and vegetable consumption recommendations should be tailored to each individual's age, sex, height, weight, physical activity and pregnancy or breastfeeding status [9]. Forty-six respondents (48.4%) reported getting the minimum of 7-8 hours of sleep on average every night that is recommended by the CDC [6]. An additional 3.2% of respondents reported getting more than the minimally recommended amount. See [Table 1](#).

Finally, there was no correlation between self-reported weekly hours of exercise and baseline knowledge ($r = 0.0856$; $n = 96$). See [Figure 1](#).

Discussion

Undergraduate students are at a key junction in their lives and many are living on their own for the first time. This newfound freedom comes with newfound control over aspects of their lives such as diet, exercise, and sleep schedule. In this study, it was assessed whether an interactive educational intervention regarding obesity and relevant lifestyle habits could improve knowledge in this population. The results of this study reflected knowledge acquisition due to the educational intervention. There were four survey questions that showed at least a 25% improvement from pre- to post-survey. Notably, these questions had lower than 25% correct responses on the pre-survey. All other knowledge-based questions had an increase in correct responses from the pre- to post-survey as well, varying from a 3% increase to a 56.7% increase.

The question that respondents correctly answered the most on the pre-survey was associated with using the plate method as a tool in creating a balanced meal (89.5% correct responses). This helped reinforce the idea that existing health education intervention strategies involved with nutrition have utility for students in the higher educational setting [13,14]. The most commonly missed question on the pre-survey was related to the prevalence of obesity in America, which only 17.9% of respondents answered correctly. Most of the participants answered that obesity in America impacted around 70% of adults as opposed to the correct answer of 40%. This result showed that in the undergraduate student population, obesity prevalence was at a high bias before any educational intervention was provided.

Secondary endpoint analysis of self-reported exercise frequency and pre-survey performance revealed no correlation between the two data sets. Students who exercised more did not have more baseline knowledge

of CDC recommendations on obesity, nutrition, exercise, and sleep compared to those who exercised less as the researchers expected. Possible reasons for a lack of correlation could be the sparsity of questions gauging health literacy, the lack of using a validated health literacy survey, and/or the use of self-reported data regarding exercise frequency [15]. However, our findings were consistent with Rababah, et al. in that there was no significant difference in health literacy levels between college students who went to the gym and those who did not [16]. In contrast, Chu-Ko, et al. revealed that participants who exercised more than three times per week had better health literacy, a health-promoting lifestyle profile, and greater emotional stability [17].

A limitation of this study is the poor enrollment of undergraduate students who are 23 years or older (4.2%). This low percentage in the study doesn't compare to the United States average, which includes 20.4% of college students who are 25 years and older in 2021 [18]. Due to study demographics, the population may not be representative of all undergraduate students nationwide.

Conclusions

This study demonstrated the efficacy of an interactive educational intervention in improving undergraduate students' knowledge of obesity and related lifestyle factors. The intervention significantly increased participants' knowledge scores, showcasing the potential of such programs to promote healthier choices among this population. This awareness can empower students to make informed choices regarding diet, exercise, and sleep, potentially reducing their risk of developing obesity and associated health complications. Targeting college students during this critical period of life can potentially promote healthy habits early on and contribute to long-term well-being. However, future interventions should address limitations identified in this study.

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