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The effect of nutritional education intervention on knowledge and fat consumption among students at Maragheh University of medical sciences

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ABSTRACT

Introduction: Healthy nutrition is the main aspect of obesity prevention and management. Lack of nutrition knowledge is one of the leading causes of unhealthy food choices. In this regard, nutritional education interventions can be a noteworthy approach in boosting students' dietary habits. The objective of the current study was to assess the effect of a nutritional education intervention on knowledge, fat intake, anthropometric indices and dietary intake among students.

Methods: This randomized controlled study was carried out on a sample of 68 university students aged 18-26 years, in Maragheh University of Medical Sciences. Demographic characteristics, anthropometric indices, dietary intake, physical activity levels, and nutritional knowledge, were collected via face-to-face. The nutritional education intervention consisted of four on-site sessions education applied by two independent PhD-level nutritionists. Following the intervention, the nutritional knowledge questionnaire was re-administered to all participants.

Results: Based on body mass index, the majority of students were classified as as normal or overweight. The mean dietary macronutrient distribution was 57% carbohydrate, 13.81% protein, and 31.65% fat. The findings showed no statistically significant change in knowledge score before and after the intervention. Also, no significant associations were observed between changes in nutritional knowledge score and demographic characteristics and anthropometric indices, or fat intake when comparing the two groups ($p>0.05$).

Conclusion: Given the findings that students exhibited adequate nutritional knowledge and acceptable fat intake levels, yet a moderate prevalence of overweight persisted, future studies should focus on bridging the gap between knowledge and practice through targeted behavioral interventions.

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Introduction

Obesity is a complex and multifactorial disorder linked to numerous serious health conditions, including diabetes mellitus type 2, cardiovascular diseases, hypertension, and certain cancers (1). Obesogenic environments, unhealthy eating habits, psycho-social factors and genetic variants, have been mentioned as the main causes of obesity (2). Given the global prevalence of overweight and obesity and their significant impact on individuals and healthcare systems, these conditions have become a major public health priority. In 2022, for instance, 43% of adults aged 18 years and over were overweight, and 16% were living with obesity (1).

Healthy nutrition is a fundamental aspect of obesity prevention and management, as energy balance and

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metabolic rate are directly influenced by dietary patterns (3). In contrast, a diet high in ultra-processed foods, refined sugars, and unhealthy fats, including trans fats and excessive saturated fatty acids (SFA), is strongly correlated with obesity, metabolic dysfunction, and systemic inflammation (4). Consequently, the consumption of excessive unhealthy fat, particularly from saturated and trans fats, is a major contributor to obesity and a key driver of metabolic dysfunction (5). Furthermore, replacing unhealthy fats with unsaturated fats has been shown to be efficient in improving lipid profiles, and other metabolic parameters effectively. Thus, moderating fat intake, prioritizing healthier fat sources and implementing appropriate dietary interventions are critical strategies for promoting healthy nutrition (6).

Lack of nutritional knowledge is a leading cause of unhealthy food choices. Young adults entering university begin an independent life phase, exploring the opportunity to make their own dietary choices and establish life habits that may persist into adulthood (7, 8). Previous studies have reported a significantly higher intake of total and saturated fat and a lower intake of polyunsaturated and monounsaturated fats among university students (9). Thus, this period represents a critical opportunity to instill proper dietary habits. Nutritional education programs can provide students with the ability to select healthier food choices and understand food labels, leading to the selection of healthier options. In this regard, nutritional education interventions can be a noteworthy approach in boosting students' dietary habits and particularly those related to high-fat foods. Significant reductions in the intake of fat, saturated fat, and cholesterol levels following nutrition education interventions have been reported in previous studies (10-12). In addition to the beneficial effects on knowledge and healthy food choices, the long-term effects on anthropometric indices, metabolic parameters, and obesity risk, are also considerable (3, 13). A recent randomized controlled trial showed that five-week nutrition education intervention based on the transtheoretical model, resulted in significant decline in weight, body mass index (BMI), waist circumference and fat mass in a female population (14).

Given the considerable prevalence of obesity in adults and the important impact of dietary behaviors on overall health, developing suitable nutrition education interventions to establish health eating habits is imperative. Hence, the present study aimed to assess the effect of nutritional education intervention on nutritional knowledge and fat consumption among students at Maragheh university of medical sciences.

Methods and Materials

2.1. Participants and study design

This randomized controlled trial was conducted with 68 university students aged 18-26 years at Maragheh University of Medical Sciences, Iran, in 2024. The study protocol was approved by the regional Ethics Committee in Maragheh University of Medical Sciences (IR.MARAGHEHPHC.REC.1403.061). After a complete explanation of the study protocol, a written informed consent form was obtianed from all eligible participants. The sample size was determined based on information from a similar study, with %80 power and α=0.05 (15). The participants were students enrolled at Maragheh University of Medical Sciences in Maragheh, Iran. Participation in the study was voluntary. Data on demographic characteristics (including age, gender, academic field, education level, ethnicity, dormitory residence), anthropometric indices, dietary intake, physical activity levels and nutritional knowledge were collected via face-to-face interviews. The inclusion criteria were: age between 18-26 years, both genders, and enrollment in a bachelor's degree program. Students studying nutritional sciences were not included in the study.

2.2. Assessments

Anthropometric indices and body composition including weight, abdominal circumference (AC), waist to hip ratio (WHR), fat mass and BMI, calculated as weight (kg)/height^2 (m) were assessed using a body composition analyzer (ACCUNIQ, BC510). Participants were measured in light clothing. Height was measured using a stadiometer to the nearest 0.5 cm. The validated International Physical Activity Questionnaire-Short Form (IPAQ-SF) was used to assess the physical activity (PA) level of the participants. Responses were converted to Metabolic Equivalent Task minutes per week (MET-min/week). Based on the IPAQ-SF guidelines, individuals with PA below 600 MET-min/week were classified as having low activity, 600-3000 MET-min/week as moderate, and above 3000 MET-min/week as high (16).

Dietary intake was assessed using a 147 items food frequency questionnaire (FFQ), the validity and reliability of which have been established in a previous study (17). In order to facilitate the interpretation of dietary habit data, all items were divided into six food groups: cereals, milk and dairy products, meats, vegetables, fruits, and oils. Students nutritional knowledge was assessed using the nutritional knowledge questionnaire developed by K Parmenter & J Wardle (18). This questionnaire consists of 50 questions related to nutritional knowledge, divided into

four sections (Dietary Recommendations, Nutrient Sources, Daily Food Choices, and Diet-Disease Relationships), each assessing a distinct aspect of general nutrition knowledge. The sections were defined as follows: Section 1: Awareness of recommendations for increasing or decreasing consumption of different food groups (awareness of guidelines for food group consumption). Section 2: Knowledge of nutrient sources (knowledge of which foods contain specific nutrients). Section 3: Food choices (understanding of healthier food selection in everyday contexts). Section 4: Relationships between diet and disease (knowledge of links between diet and major chronic diseases). Questions were presented in multiple-choice, fill-in-the-blank, and checkmark formats. Each correct answer carried 1 point. Students responses were scored according to the Nutritional Knowledge Questionnaire scoring scale, and the total score was calculated to determine nutritional knowledge level (19).

The nutritional education intervention consisted of four weekly on-site sessions and two follow-up virtual sessions (each lasting 60 minutes), facilitated by two PhD-level nutritionists. Each on-site session was structured around a didactic lecture (30 minutes) supported by custom-designed PowerPoint slides. The slide content visually detailed core topics, including: graphical representations of macronutrient and micronutrient functions; comparisons of national food guides and dietary recommendations; and specific modules distinguishing between saturated, unsaturated, and trans fats, complete with diagrams of their chemical structures and common food sources. The lectures were followed by a practical, hands-on component (30 minutes) where students applied the concepts through activities such as interpreting nutrition labels and planning balanced meals using food models. The two virtual sessions reinforced these topics via interactive problem-solving exercises and the review of selected slide content. Following the intervention, the nutritional knowledge questionnaire was re-administered to all participants.

2.3. Statistical analysis

Statistical analysis was performed using the Statistical Package for the Social Sciences (SPSS) version 25.0 (Chicago, IL, USA). The normality of data distribution was assessed using the Kolmogorov-Smirnov test. Continuous variables are expressed as mean ± standard deviation (SD), and categorical data are presented as frequency (percentage). The Chi-square test was used to compare categorical variables. An independent samples t-test was used for comparisons of continuous variables between two independent groups. To assess the effect of the educational intervention, a paired samples t-test was used to compare pre- and post-intervention values within the same group. One-way ANOVA was used to compare differences in nutritional knowledge scores across categories of fat consumption. A p-value of less than 0.05 ($p < 0.05$) was considered statistically significant.

Results

The demographic characteristics of the study population are presented in table 1. As can be seen, there were no significant differences between two groups at baseline, except for dormitory residence. The mean age of the participants was 20.35±1.32 years in the intervention group and 20.97±1.24 years in the control group. Table 1 displays the distribution of participants' gender, ethnicity, residence in dormitory, adherence to a specific diet, physical activity and nutritional knowledge level according to the intervention and control group. Given that Maragheh is located in East Azerbaijan Province in northwestern Iran which mainly consists of Turk residence and is adjacent to Kurdistan Province, the majority of the students were Turk. Accordingly, the majority of students had moderate or high physical activity levels. Moreover, based on the standard Parmenter and Wardle Nutrition Knowledge Questionnaire, the majority of the students demonstrated a moderate or high level of nutritional knowledge at baseline.

Table 1. Comparison of demographic charecteristics between the intervention and control group

Variable	Intervention (n=34) mean±SD	Control (n=34) mean±SD	p-value
Age	20.35±1.32	20.97±1.24	0.51[a]
Gender			
Male	20 (58.82%)	19 (55.88%)	1[b]
Female	14 (41.17%)	15 (44.11%)	
Ethnicity			
Turk	32 (94.11%)	33 (97.05%)	1[b]
Kurd	2 (5.88%)	1 (2.94%)	
Dormitory			
Yes	25 (73.52%)	33 (97.05%)	0.013[b]
No	9 (26.47%)	1 (2.94%)	
Diet			
Yes	3 (8.82%)	4 (11.76%)	1[b]
No	31 (91.17%)	30 (88.23%)	
Physical activity			

Mild	7 (20.58%)	8 (23.52%)	0.946[b]
Moderate	15 (44.11%)	15 (44.11%)	
severe	12 (32.29)	11 (32.35%)	
Nutritional knowledge			
High	16 (47.05%)	15 (44.11%)	1[b]
moderate	18 (52.94%)	19 (55.88%)	

[a]p-value based on independent-t test, [b]p-value based on Chi-square

Table 2 presents the anthropometric measures (weight, BMI, abdominal circumference, weight to hip ratio and fat mass) of the study population. As shown, there were no significant differences between two groups. Based on BMI classifications, the majority of students were classified as having normal weight or overweight. Table 3 shows the comparison of dietary intake (energy, protein, carbohydrate, fat, cholesterol, SFA, monounsaturated fatty acids (MUFA), Polyunsaturated fatty acids (PUFA), omega 9, omega 6, omega 3 alpha-linoleic acid (ALA), omega 3 Eicosapentaenoic acid (EPA), and omega 3 Docosahexaenoic Acid (DHA)) of participants in both groups. Findings showed no statistical significant change in nutritional knowledge before and after the intervention. Also, no significant associations were observed between the change in nutritional knowledge score and demographic and anthropometric indices, and fat intake, when comparing the two groups (p>0.05).

Table 2. Comparison of anthropometric indices between the intervention and control group

Variable	Intervention (n=34) mean±SD	Control (n=34) mean±SD	p-value
Weight	71.39±20.04	70.71±15.40	0.876[a]
BMI	24.36±5.12	23.79±3.69	0.604[a]
BMI category			
Underweight	2 (5.88%)	2 (5.88%)	
Normal	20 (58.82%)	16 (47.05%)	0.768[b]
Overweight	11 (32.35%)	14 (41.17%)	
obese	1 (2.94%)	2 (5.88%)	
Abdominal circumference	84.66±14.13	83.22±11.06	0.641[a]
Waist to hip ratio	0.80±0.06	0.79±0.05	0.408[a]
Fat mass	18.51±10.10	17.48±6.86	0.626[a]

ap-value based on independent-t test, bp-value based on Chi-square

Table 3. Comparison of dietary intake between the intervention and control group

Variable	Intervention (n=34) mean±SD	Control (n=34) mean±SD	p-value
Energy	3087.07±792.09	3160.92±891.75	0.719
Carbohydrate (g)	439.92±123.69	448.87±448.87	0.137
Protein (g)	106.60±28.57	119.34±40.26	0.776
Fat (g)	108.57±35.02	106.86±36.05	0.844
Cholesterol (mg)	364.13±336.36	412.70±375.58	0.576
SFA (mg)	28.27±9.00	29.17±11.04	0.715
MUFA (mg)	34.46±12.97	34.27±12.76	0.951
PUFA (mg)	25.02±12.28	23.88±10.39	0.680
omega 9 (mg)	31.25±12.55	30.63±11.97	0.836
omega 6 (mg)	21.74±11.29	20.43±9.59	0.608
omega 3 ALA (mg)	1.68±0.94	1.66±1.01	0.926
omega 3 EPA (mg)	0.02±0.02	0.04±0.06	0.270
omega 3 DHA (mg)	0.11±0.06	0.17±0.24	0.161

p-value based on independent-t test

Discussion

The objective of the current study was to assess the effect of a nutritional education on nutritional knowledge of students studying at Maragheh University of medical sciences and its relationship with fat intake, anthropometric indices and body composition. According to the findings, the mean age of the participants was 20.35±1.32 years and 20.97±1.24 years in the intervention group and control group, respectively. Furthermore, 58.82% of the the intervention group and 55.88% of the control group were male students. Based on BMI, the majority of students were classified as having normal weight or being overweight.

Findings also showed no statistically significant changes in nutritional knowledge before and after the intervention. Furthermore, no significant associations were observed between changes in nutritional knowledge score and demographic characteristics and anthropometric indices, or fat intake when comparing the two groups ($p>0.05$).

Although more than half of the students had a normal BMI, a considerable proportion of students were overweight which is concerning. Overweight individuals (BMI 25–29.9 kg/m^2) exhibit a significantly elevated risk of progressing to obesity (BMI ≥30 kg/m^2) due to sustained positive energy balance, metabolic adaptations, and behavioral factors. Longitudinal studies indicate that without intervention, approximately 30–50% of overweight adults develop obesity within 5–10 years (20). In 2023, a meta-analysis of the prevalence of over weight and obesity among university students in Iran showed that 5.1% of students were obese and 17.7% were overweight (21). Our results were inconsistent with those of a cross-sectional study in Turkey, which reported that 69.6% of female and 71.6% of male in the university had a normal BMI (7). Comparing the prevalence of overweight and obesity in the present study and previous studies indicates that although the prevalence of obesity was slightly lower, the relatively high prevalence of overweight is concerning. The students' BMI may be explained by the level of physical activity (mainly moderate or severe). During interviews, it was noted that a number of students were not engaged with any type of physical activity, but a number of male students attended fitness clubs several days of the week. Students with low physical activity cited a lack of exercise facilities in the dormitory or on campus, as well as their reliance on bus transport due to the distance between the dormitory and the university. However, given that other indices of body composition were within normal ranges, the slightly elevated prevalence of overweight may be less concerning.

The assessment of dietary intake of students showed that in the intervention group the distribution of macronutrient intake was 57% for carbohydrates, 13.81% protein, and 31.65% fat. In the control group, the distribution was 56.8% carbohydrate, 15.10% protein and 30.42% fat. As can be seen, according to the World Health Organization (WHO) recommendations, the students' dietary macronutrient intake fell in the normal range (22). Since the majority of students resided in the dormitory and consumed homogeneous foods, their dietary intake was similar. In fact, even the students who lived in Maragheh, ate their lunch meal in the university. Regarding the other components of fat, all measured variables were in normal range, except for EPA and DHA. This finding can be primarily attributed to the fact that fish is not regularly served in the university cafeteria. Furthermore, individuals living in Azerbaijan Provine have a lower tendency to consume seafood. Furthermore, most students reported not using omega-3 supplements. Considering the partialy low intake of protein, compared to reference recommendations (10-35%), students may not be consuming sufficient amounts of protein, particularly fish. One study suggests that the percentage of students' dietary energy from saturated fat was higher than the recommended levels regardless of the education method (23). The total fat intake in our study population was also moderately lower than other studies such as a study a study of Belgian university students, with a mean total fat intake of 35.4 ± 7.1% of total energy (24). Similar results were also observed among United Kingdom university students (25). A study among Turkish university students showed that the daily mean intake of total fat was higher in females (92 g/day) than in males (85.9 g/day) ($P < 0.001$). However, saturated fat and cholesterol consumptions were lower in females (23.5 g/day) than in males (28.9 g/day) (7).

Based on the nutritional knowledge assessment, students' baseline nutritional knowledge was mainly moderate and high in both groups, and no statistically significant changes were observed following the educational intervention. Almasi et al., also reported a non-significant relationship between nutrition knowledge level and fat intake (7). In contrast, Yahia et al, claimed that nutrition knowledge was negatively correlated with fat and cholesterol intake (5). These conflicting findings indicate that while students' nutritional knowledge was acceptable, this knowledge did not fully translate into dietary practices, as their reported fat intake remained slightly higher than recommended levels(26-28). This discrepancy suggests a gap between knowledge and actual eating behaviors, highlighting the need for interventions that specifically promote healthier fat consumption and align dietary choices with nutritional guidelines. This may be due to the relatively high baseline knowledge among participants, where the majority of students already demonstrated moderate to high nutritional literacy. Also, the intervention duration may have been insufficient to instigate meaningful behavioral change, particularly regarding ingrained dietary habits such as fat consumption. Furthermore, the small sample size may have been underpowered to identify smaller, yet clinically meaningful, changes. The observed prevalence of overweight, despite moderate fat intake, indicates that factors beyond the proportion of dietary fat are responsible for the frequency of overweight in this population. Several

potential explanations emerge from this finding. First, while the relative proportion of fat in the diet may be within range, excessive total caloric intake—potentially from refined carbohydrates, added sugars, or oversized portions—could lead to a positive energy balance. Second, low physical activity levels likely play a critical role; even with controlled fat intake, a sedentary lifestyle can create a positive energy balance, leading to weight gain over time. In this regard, the lack of exercise facilities in the campus may have limited the effectiveness of education alone. Furthermore, underreporting of high-calorie foods or misestimation of portion sizes may obscure true energy intake in dietary assessments. Psychological and lifestyle factors, including stress-related eating, irregular meal patterns, and poor sleep quality, can further disrupt energy homeostasis and promote fat storage. In this study, although there were significant differences between two groups regarding dormitory residence, since the campus is out of town, the majority of the students spent most of the day in the university and ate in the cafeteria. Finally, socioeconomic constraints, such as limited budgets, may restrict access to fresh, whole foods, pushing students toward more affordable, energy-dense, and nutritionally poor options. The findings of this study highlight a critical need to evolve the paradigm of nutritional intervention for young adults. While traditional classroom-style education effectively conveys knowledge, it may be insufficient alone to translate awareness into sustained behavioral change. Future research should therefore prioritize the development and evaluation of longer-term, theory-driven behavioral interventions.

Conclusion

Given the findings that students exhibited adequate nutritional knowledge and acceptable fat intake yet still faced a moderate prevalence of overweight, future studies should focus on bridging the gap between knowledge and practice through targeted behavior-focused interventions. To address this disconnect, future research should move beyond traditional knowledge-based education and instead prioritize actionable, environment-based solutions. By improving access to healthy foods, teaching practical low-fat cooking skills, and fostering supportive campus policies, students may be better equipped to translate their nutritional knowledge into sustainable habits. Such multi-faceted interventions could serve as a model for preventing obesity in young adults populations.

Ethics approval and consent to participate

The ethics committee of Maragheh University of Medical Sciences approved this research (ethics code: IR.MARAGHEHPHC.REC.1403.061).

Consent for publication

Written informed consent was obtained from all participant at the beginning of the study.

Availability of data and materials

Further required data may be available upon reasonable request.

Competing interests

The authors declare no competing interests.

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Authors' contributions

Writing original draft: F Ghalichi, MT Khodayari, T Ebrahim Hesari and A FarajollahiReviewing: F Ghalichi, MT KhodayariConceptualization: F GhalichiFigure design: MT Khodayari

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