Effects of a Nutrition Education Intervention on Fruit and Vegetables Intakes in College Students

Norah Eid Aljohani*

Department of Nutrition and Food Science, College of Family Sciences, Taibah University, Al-Madinah Al-Munawarah, Kingdom of Saudi Arabia
*Corresponding author: norualrefael1@gmail.com

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Abstract

Background: Fruits and vegetables are necessary elements of a healthy diet to decrease the risk for chronic diseases, however, a Saudi college student’s intake of fruits and vegetables is less than the optimal everyday consumption. Nonetheless, an intervention might be beneficial in changing health behaviors among college students.

Aim: The aim of this study was to assess the efficiency of using nutrition educational interventions to enhance Saudi college students’ fruits and vegetables consumption.

Methods: Two hundred and thirty-seven participants were recruited in the nutrition educational intervention. Each participant was assigned to one of two groups (control and nutrition education intervention). The intervention group received weekly nutrition classes for 100 minutes focused on fruit and vegetable consumption benefits for 15 weeks. The control group had education classes which were not related to nutrition. Three-day food records were used to evaluate intake of fruits and vegetables twice during the study period and the change was evaluated by paired samples T-Test.

Results: Participants did not eat the recommended portions of fruits and vegetables. However, there were significant mean increases in frequency intakes of fruits and vegetables in the education group by 1.08 servings a day.

Conclusion: Nutrition education was an effective method to improve the intake of fruits and vegetables as the study finding suggests.

Keywords: fruit, vegetable, college students, nutrition intervention, habits

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1. Introduction

The transition from the developmental phase of adolescence to adulthood has been demonstrated in researches to be a stage for weight gain, increase in body fat, and for developing healthy or unhealthy lifestyles [1]. During college, students often do not follow the dietary recommendations for healthy eating, which might lead to a high body mass index (BMI) and the development of an unhealthy lifestyle [1,2]. Also, college students are faced with anxiety associated with a new academic life as well as food selection [3]. Anxiety and stress have been found to be associated with the consumption of high-calorie foods, and low fruit and vegetable intakes [4]. Also, an unhealthy lifestyle has been associated to chronic diseases, for instance diabetes, osteoporosis, as well as hyperlipidemia [5]. A consequence of unhealthy lifestyles may be increased healthcare costs [6].

While the above studies indicate that college students can develop poor eating and health habits during their university years, this same population may also be more responsive to healthy lifestyle interventions, such as maintaining normal weight and following the dietary guideline recommendations for healthy eating patterns [7]. Evidence indicates that intervention approaches have been successful in changing the students’ health behaviors in the higher educational setting such as colleges and universities [8,9]. Specifically, interventions designed to inspire students to achieve their academic goals and remain healthy at the same time through creating and learning within the community were effective [10]. However, the use of health interventions through nutrition education is a relatively new practice for the promotion of health in the college population at Taibah University in Saudi Arabia.

2. Method

2.1. Recruitment

Using G*Power statistical software, sample size of 160 was needed to reliably detect the effect size of 0.22 (larger effect sizes) with an alpha of 0.05 and acceptable statistical power level of 0.80 [11]. Participants were recruited from female colleges of Taibah University in Al-Madinah City. Participants were eligible if they were 18 to 23 years old. Participants were excluded if they were pregnant or lactating, had an eating disorder or bariatric surgery, or were following any special diet for weight loss.
However, two hundred and forty eight eligible participants were approached and successfully recruited in this study.

2.2. Study Protocol

The intervention was a 15-week study. The protocol was approved by Taibah University’s committee for the protection of human subjects (00010037).

Taibah University offers nutrition courses to improve nutritional knowledge and to encourage dietary change. A general nutrition course is selected as the setting for this intervention. The general nutrition class meets twice a week for 100 minutes per class for the entire 15-week semester. Topics covered in the course include carbohydrates, fats, proteins, mineral substances and trace elements, vitamins, fruits and vegetables, modern nutrition, water, ideal nutrition and maintaining a healthy weight. Because the aim was to increase fruit and vegetable intakes, the instructor gave extra information to promote fruits and vegetables consumption. The control group received education from another general course, which was not related to nutrition. At the beginning of the intervention, students provided their informed consent to participate and received a brief introduction and instructions on how to fill out the three-day FR was given. Anthropometric measurements (height, weight) were obtained from the students at the beginning and end of the study. All procedures were explained to the participants before conducting the measurements. Weight and height measurements were taken by using SECA 703 Digital Medical Column Scale with a stadiometer attached to the scale. Participants were asked to remove all heavy clothing, their shoes, and any accessories from their hand, neck and hair. Weight was recorded in kilograms. Height was assessed to the closest 0.1 centimeter using the stadiometer attached to the scale. Then, the Body Mass Index (BMI) was computed. Participants were given pre and post nutrition assessment which was three-day FRs: at week 1 and at week 15. Extra questions were included in the three-day FRs to evaluate the impact of nutrition education on fruit and vegetable intakes and habits of the participants. For example: How many times do you eat fruits as a refreshment? How many times do you eat fruits as a sweet course? Figure 1

2.3. Nutritional Analysis

Dietary intake recorded in the three-day FRs were analyzed for nutrient content using the Food Processor Plus computer program software [12]. For foods that were not included in the software program, food composition tables for Saudi’s population were used [13], an approach that has been used in Saudi Arabian studies [14,15,16].

2.4. Statistical Analysis

Two hundred and forty eight participants enrolled in the study. Fruits and vegetables consumption were measured at week 1 and week 15 during the study period. Demographic information collected included age, marital status, income level, vitamin consumptions, health issues, and food allergies. The paired samples T-Test was applied to estimate the change in fruits and vegetables consumption from week 1 to week 15. Data analysis was performed using SPSS version 23 [17].

Figure 1. Flow diagram of the intervention
3. Results and Discussion

Transition to college has been characterized as a significant phase for increases in unhealthy lifestyles, poor-quality diets, physical inactivity, and an increase in overweight status and obesity [18]. Nutrition interventions aimed at improving dietary intakes, may be successful in this population, with the effects continuing into adulthood (4). Thus, the objective of this research was to explore the effects of a 15-week education intervention on changes in fruits and vegetables intakes and eating behaviors in female college students. Of the 248 subjects who enrolled in the study, 11 were excluded from data analysis due to missing and incomplete FRs. Thus, the final sample size for the study was 237 participants. Among them, 94 were in the control group and 143 were in the intervention group. Table 1 shows the demographics of the 237 subjects by group at the baseline.

The study found that there was a significant increase in caloric intake and fruits and vegetables consumption during the intervention for control and education groups, shown in Table 2. Also, there was a significant mean improvement in the post-intervention in participants’ fruits and vegetables consumption during the study from 3.76 servings to 4.84 servings in the education group. However, this study found that college students do not eat fruits and vegetables at the proposed average daily nutrient intakes, at both control, and education groups, according to dietary recommendations for Saudi Arabia’s population (The Healthy Food Palm) [19].

There is a concern regarding university students, who do not eat fruits and vegetables, because previous researchers found that there is an association between increased fruits and vegetables consumption and reduced risk of chronic diseases. University students perhaps will not be at risk when they become at the youth stage of their lives if they fulfilled the recommended serving of fruit and vegetables. Quadir & Akhtar-Danesh research found that after adjusting for age and gender, sufficient fruits and vegetables intakes, were correlated with decreased risk factors of coronary-heart-disease [20]. Among Saudi’s college population, AL-Qauhiz reported that 83% of the 799 female university students did not consume fruits and vegetables daily intakes as well as 70% of the 300 female nursing students [21]. The data collected by AL-Otaibi concluded that almost all of Saudi’s university students population did not consume fruits and vegetables consumption on a daily basis recommendation [22]. Thus, fruits and vegetable consumption barriers should be identified. In general, one reason might be due to economic barriers [23,24]. It has been shown that the price of fresh fruits and vegetables is an obstacle to consume recommended portions [24]. Also, limited time availability for food preparation may be another barrier to the implementation of healthy diets including preparation of fruits and vegetables during the school days [25]. Furthermore, time scarcity was common among the college population, thus there is high rate consumption of fast food such as chicken, burgers, and pizza instead of healthy food like fruits and vegetables [26].

In this study, there was a significant mean improvement in the intake of vegetables, starchy vegetables, vegetable juice, fruit, fresh fruit, canned and fruit juice in the education group, but no significant mean variations were detected in the control group (Table 3). Also, Table 4 reflects significant differences between pre and post consumptions in the education group regarding fruit and vegetable habits, as they reported consuming fruits as a refreshment from 0.4 to 1.3 times a day, fruits as a sweet course from 0.9 to 1.15 times a day, and consuming fruit juice instead of soda or fruit punch from 0.9 to 1.15 times a day. This finding is consistent with Meredith et al, who suggested that nutrition education was effective in enhancing the intake of fruits and vegetables among men and women. Nevertheless, the participants did not reach every day recommended fruits and vegetables portions [27].

Among college students, nutrition education interventions to enhance fruits and vegetables consumption are limited when it comes to research. However, a study of Richards et al, showed that education newsletters, among college students, were an effective method for improving fruits and vegetables intakes by one serving a day [28]. Also, Mitchell’s study results indicated that nutrition courses enhanced college students’ healthy food choices, yet unsuccessful to demonstrate any improvement in fruits and vegetables intakes [29]. Additionally, Ha, and Caine-Bish study concluded that class-based nutrition intervention is a cost-effective method to increase fruits and vegetables intakes in college populations and is similar to this study funding that nutrition education improved intakes of fruits and vegetables [30]. On the other hand, Mitchell found that general nutrition courses changed college students’ food preferences, but there were no increases in fruits and vegetables consumption. Furthermore, after reviewing results of nutrition education on fruits and vegetables intakes, researchers have found that nutrition education was an effective approach in enhancing the intake in general [29,31,32].

According to studies, nutrition education has a positive impact, however, intervention effects may be various depending on the results that need to be measured, besides gender. Optimistic results were accomplished in several component interventions and in some large communities. Generally, interventions using educational approaches directed at behavioural change were more efficient than those concentrating on the dissemination of information, which assumed attitude and behavioural changes would ensue [4]. Also, numerous studies have shown that women tended to prioritize a healthy food intake of fruits and vegetables as well as are more aware of their health than men [31].

Some of the limitations of this study are that the three days of food records were self-reported, which may lead to a potential for reporting biases, as well as unrepresentative student samples of the college population. Additionally, female and male students differed on responses to nutrition education interventions, therefore future researches must concentrate on gender-tailored nutrition interventions.
### Table 1. Demographics at baseline, N=237

|                        | Control group N=94 | Education group N=143 |
|------------------------|---------------------|-----------------------|
| Age (years): mean (SD) | 18.2 (0.51)         | 18.8 (0.76)           |
| BMI: mean (SD)         | 22.27 (2.4)         | 23.04 (2.7)           |
| Marital status         |                     |                       |
| Not married            | 87 (92.5)           | 137 (95.8)            |
| Married                | 7 (7.4)             | 6 (4.2)               |
| Income                 |                     |                       |
| <5000                  | 6 (6.3)             | 4 (2.8)               |
| 5001-7000              | 5 (5.3)             | 12 (8.4)              |
| 7001-9000              | 12 (12.7)           | 25 (17.5)             |
| >9000                  | 41 (43.6)           | 8 (5.6)               |
| No answer              | 30 (31.9)           | 94 (65.7)             |
| Taking vitamin         |                     |                       |
| No                     | 58 (61.7)           | 88 (61.5)             |
| Yes                    | 36 (38.29)          | 55 (38.5)             |
| Food allergy           |                     |                       |
| No                     | 66 (70.2)           | 128 (89.5)            |
| Yes                    | 29 (29.7)           | 10 (4.8)              |
| Health issue           |                     |                       |
| No                     | 75 (79.7)           | 118 (82.5)            |
| Yes                    | 19 (20.3)           | 25 (17.5)             |
| BMI category           |                     |                       |
| Underweight            | 6 (6.3)             | 12 (8.3)              |
| Normal weight          | 77 (81.9)           | 98 (68.5)             |
| Overweight             | 9 (9.5)             | 32 (22.3)             |
| Obesity                | 2 (2.1)             | 1 (0.6)               |

SD = Standard Deviation. BMI categorized: underweight (BMI < 18.5), normal (18.5 ≤ BMI < 25), overweight (25 ≤ BMI < 30), and obese (BMI ≥ 30) (33). P ≤ 0.05.

### Table 2. Descriptive statistics of energy, fruits and vegetables, and energy consumptions

| Consumptions                      | Control group (N=94) | Education group (N = 143) |
|-----------------------------------|----------------------|---------------------------|
| Fruits and vegetables (Serving)   | Mean±SD P value      | Mean±SD P value           |
| Pre                               | 3.65±0.38 0.03 *     | 3.76±0.29 0.03 *          |
| Post                              | 3.77±0.25 0.009      | 4.84±0.30 0.01 *          |
| Energy (Calories)                 |                      |                           |
| Pre                               | 2288±291.2 0.05 *    | 2073±348.8 0.05 *         |
| Post                              | 2339±342.7 0.04 *    | 2157±355.3 0.05 *         |

SD = Standard Deviation. a Significantly different p ≤ 0.05.

### Table 3. Pre and post consumption of fruits and vegetables

| Consumption (serving / day)       | Control group (N=94) | Intervention group (N = 143) |
|-----------------------------------|----------------------|-----------------------------|
| Fruits as a refreshment           | 0.67±0.46 0.41       | 0.70±0.30 0.41              |
| Fresh vegetables                  | 0.24±0.17 0.10       | 0.20±0.01 0.10              |
| Starchy vegetables                | 0.12±0.05 0.22       | 0.22±0.01 0.22              |
| French fries                      | 0.49±0.18 0.62       | 0.72±0.51 0.62              |
| Vegetable juice                   | 0.05±0.02 0.09       | 0.07±0.01 0.09              |
| Fruit                             | 0.81±0.35 0.06       | 0.74±0.32 0.06              |
| Fresh fruit                       | 0.41±0.15 0.08       | 0.36±0.11 0.08              |
| Canned fruit                      | 0.05±0.01 0.92       | 0.03±0.01 0.92              |
| Fruit juice                       | 0.83±0.44 0.23       | 0.61±0.36 0.23              |

Standard Deviations (SD). a Significantly different p ≤ 0.05.

### Table 4. Pre and post consumption (means ± standard deviations (SD)) of student’s habits related to fruits and vegetables

| Consumption (time / day)      | Control group (N=94) | Intervention group (N = 143) |
|-------------------------------|----------------------|-----------------------------|
| Fruits as a refreshment       | 0.5±0.01 0.57±0.02   | 0.05 *                      |
| Fruits as a sweet course      | 0.8±0.05 0.5±0.01    | 0.07                        |
| Consume fruit juice instead of soda or fruit punch | 0.6±0.01 0.7±0.01 | 0.40                        |
| Vegetables as a refreshment   | 0.3±0.01 0.5±0.01    | 0.40                        |
| Including fruits & vegetables in lunch meal most days | 0.9±0.60 1.10±0.80 | 0.10                        |
| Including fruits & vegetables in meal when eating out at restaurants and university | 0.6±0.01 0.5±0.01 | 0.09                        |

Standard Deviations (SD). *Significantly different p ≤ 0.05.
4. Conclusion

Nutrition education plays an essential part in helping individuals to establish healthy eating behaviors [34]. Current study results suggest that nutrition education was useful in enhancing fruits and vegetables intakes. Follow-ups on participants regarding long-term effects were not involved in this study. Thus, additional investigation is required to determine the effectiveness of nutrition education on long-term health behavior changes.

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