Association Between Dietary Patterns and Chronic Disease Among Female Students, prince Sattam University, Al-Kharj, Saudi Arabia.

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Summary. Dietary patterns reflect food and nutrient consumption and may be an indicator to predict disease risk. The presence of nutrients in required quantities is a necessary part of the daily diet to maintain a healthy food consumption pattern and play a vital role in health balance determinants. The aim of this study is to investigate the behavior of dietary pattern, nutritional status associated with physical activity and related health diseases in university population. This cross-sectional study involved 368 female undergraduate university students. The data, gathered a pretested, organized self-administered questionnaires related to sociodemographic, anthropometric, eating attitudes, physical activity and health related issues. The study results showed that the mean age of 22.5 ± 2.4 years of student's response to the survey. More than half of the respondents 201 (54.4%) had skipped their breakfast. Majority of the students 324 (88.0%) ate snacks and juice every day. Moreover, two-third of the students 263 (71.4%) had normal BMI, whereas 56 (15.2%) were underweight, and 49 (13.4%) were overweight. Over half of the respondents 203 (55.1%) had high dietary diversity whereas, 67 (18.2%) had moderate diet and 98 (26.6%) had low dietary diversity. One fourth of the respondents 87 (23.6%) performed physical activity every day. Related to health issues most of the students 95 (28%) had anemia and 52 (14.8%) of them were facing problems with hormonal imbalance. In conclusion, food consumption is associated with BMI that is dependent on physical activity and so, nutrition related disorders have become a health issue in the world. Therefore, it has become imperative to encourage students to improve their eating behavior, engage in physical activity and incorporate as part of the regular nutrition education program by the institution.

Key words: Food Diversity, Dietary Pattern, Nutritional Status, Physical Activity, Nutrition-related health diseases.

Introduction

In recent decades' human lifestyle has substantially changed worldwide. These changes emerged in the form of different foods, diet intake, cooking time, time of food consumption, etc., as well as consumption of highly processed foods and increased dependence on fast food restaurants. Food of good nutritional value is found to be a major visible feature of lifestyle (1). Epidemiological evidence illustrates that there is an augmented incidence of various diseases such as (anemia, obesity, high-blood pressure, hormonal imbalance, cardiovascular diseases, diabetes, and cancer), attributed to changes in nutritional habits and lifestyle (2). Nutritional education is an important attitude that plays a major role in knowledge and to boost awareness about nutrition that eventually contributes to the health of the society (3). To maintain health, physically activity is essential to attain proper nutritional awareness.

Nutritional awareness, practice and attitude have to be considered in people to encourage public health awareness (4). Considerably, the major aim of universities are to extend knowledge to the society, by improving the nutrition knowledge, attitudes, and practice that will guide the community progressing to nutrition-consciousness and contribute towards healthier people (5). Students tend to more frequently transform positively, imbibe nutritional knowledge and education to enhance their nutritional awareness which can be helpful for the society. Understanding about food safety, healthy and food choices can influence improving towards a healthy diet and implementing good eating habits, (6) while it is inadequate to encourage healthy consumption.

Dietary patterns and nutritional behaviors adopted in childhood become habituated and establish behavioral patterns in adult life that leads to increased risk factor for chronic diseases and long-term health related problem (6). A study found that college students were habituated by their nutritional behavior changes (7) which includes; 1) repeated exposure of unhealthy dietary habits, 2) youth are specifically vulnerable to poor eating habits or prone to junk foods, 3) drastic changes of lifestyle and resources available, 4) lack of knowledge about nutritional diet and 5) increased number in fast food centers. Most of the undergraduate students encounter different nutrition related health issues which may affect the quality of life and life expectancy. Therefore, proper guidance on dietary choices may help to circumvent these issues (8).

The eating lifestyle of students starts from childhood that paves the way for their present dietary habits. These habits have diverged them from traditional eating habits due to the impact of globalization that have led to changes in nutritional habits and life style not only in Saudi Arabia but also worldwide. Due to the tremendous impact of the media or social media that may deliver mixed messages to the society about what to consume, via advertisement of products (9) has led to the rapid increased in the number of fast food restaurants that divert people to such places and have moved them away from eating at home. The lack of nutritional awareness, getting swayed by modern, 'westernized' and fast lifestyle have turned the Saudi nationals mainly university students to adopt junk/fast foods as their diet (10).

The major component of energy balance is spending calorie which depends mainly on physical activity by the students. Physical activity is basically body movement executed by skeletal muscle that generates energy expenditure. World Health Organization (WHO) suggested that adults should practice at least 150 minutes of physical activity during the week (11). Research has shown that students' lifestyle, particularly breakfast consumption has a direct impact on their behavior and mental abilities that reflected in their academic performance (12). Since modern lifestyle changes leads to poor dietary habits among undergraduate students, this study assesses the association of dietary pattern with nutritional status and physical activity of non-clinical adult population belonging to undergraduate students of Saudi University.

Materials and Methods

Study design

The present study used a descriptive cross-sectional, quantitative approach based survey to pursue the trend of random convenience sampling on a sample size of 368 female graduate students.

Study Setting

The present study was carried out among female undergraduate university students enrolled at Prince Sattam bin Abdulaziz University, Saudi Arabia.

Study Participants and sample size determination

Study participants were recruited from a population of 368 female university students. In addition, a multi-stage sampling method was executed that included 1st to 5th year students.

a. **Inclusion criteria:** Students' registered for undergraduate studies who provided informed consent participated in the study.
b. **Exclusion criteria:** The students who did not give consent, pregnant and those taking medication for chronic diseases were excluded.

c. **Sample size:** Sample size (n = 368) was determined by n = z2pq/d2 according to Fischer's formula (13).

Data Analysis Method

The data was analyzed with a structured questionnaire on dietary pattern. Information was collected through a self-administered questionnaire made in Arabic and English on socio-demographic factors, eating patterns and practices, physical activity and health related issues.

Socio-demographic factors: Complete information on age, marital status, nationality, year of study and education level of parents which provide students' background information.

Assessment of dietary practices or eating habits*:* Information was collected about diet patterns, amount of water consumed every day, frequency of meals consumed every day, snacking habits (snacks and energy drinks) source of meals (college cafeteria or house), variety of food consumed (nine food groups) and assessment of meals consumed in a day based on WHO recommendation (14).

Anthropometric measurements: Self-report of height (cm) and body weight (kg) were requested from study population to calculate the body mass index (BMI) and classified as underweight (<18.5), normal (18.5–24.99), overweight (25.0–29.99) according to Strong *et al*. (2008).

Dietary diversity score based on food consumption*:* To calculate dietary diversity score (DDS) - a factor to calculate varieties of food groups consumed). There are nine food groups that include fruits, vegetables, eggs, meat, fish/sea food, legumes/nuts, milk and milk products, oils/butter/cheese/fats and cereals. According to WHO recommendation, DDS was calculated based on the number of food groups consumed and classified as low score (food groups ≤3), medium score (food groups 4–6), and high score (food groups ≥6) (14).

Physical Activity: Physical activity was assessed based on International Physical Activity Questionnaire (IPAQ) and classified into three categories. Study individuals were grouped based on performance of physical activities as insufficiently active (continuous 10 minutes/week), active (total physical activity 150 minutes/week) and very active (210 minutes/week).

Health Issues: Self-report regarding student's health issues was requested that includes anemia, hormonal imbalance, obesity, diabetes, thyroid issue and hypertension.

Data analysis

The completed questionnaires were collected and analyzed using descriptive statistics that include frequency counts and percentages by SPSS software version 20.0 (mean and standard deviation $p < 0.05$). Furthermore, informed consent was obtained from all participants involved in the study. The confidentiality of the study participants was maintained throughout the study.

Results

A total of 368 female undergraduate University students, were evaluated using a structured self-administered questionnaire. Data on socio-demographic features, eating habits and dietary practices, anthropometric assessment, physical activity and health related issues were measured.

Socio-demographic features

Age: Among the 368 study participants, 104 (28.2%) students belonged to the age group of 18-20 years while 80 (21.7%) participants were in the age group of 17-18 years, 95 (25.8%) participants were among 21-23 years and the rest 89 (24.3%) were between 23-25 years. The mean age of the study population was 20.5 ± 2.5 years.

Ethnicity: Among the study participants, 340 (92.3%) were Saudis and 28 (7.6%) were non-Saudis. The proportion of Saudis were found to be more (p > 0.05) significant than the non-Saudis.

Educational status of parents: Paternal educational status was slightly higher among fathers than mothers. Overall, the mother's of 159 (43.2%) students had secondary level of education that was significantly higher than father's of 94 (25.5%) participants

(p > 0.05). Out of 368 participants, father's of 98 (26.6%) participants and mothers of 68 (18.4%) participants were post-graduate, whereas father's and mother's of 176 (47.8%) and 141 (38.3%) students respectively had graduate degrees. This shows that the number of participants' with father's bearing graduate and post-graduate education was significantly higher than the proportion of students' mother's education (p > 0.05).

Marital status: Over three-fourth of respondents 269 (73%) were single and significantly higher than 99 (26.9%) of married participants (p > 0.05) married.

Family income: In the study group, the income of the family <2500 riyals per month included 124 (33.6%), between 2500-6000 riyals were 97 (26.3%) and ≥ 6000 riyals were147 (39.9%). It was observed that almost equal numbers of study participants were distributed among these three categories. These socio-demographic features data were shown in Table 1.

Nutritional Practice and Eating Habits

One hundred and sixty-two students (46%) stated, that they skip breakfast, 81 students (20.1%) mentioned that they skip lunch and 56 (15.2%) stated omitting dinner in a day. The response rates of 69 (18.7%) students reported not skipping their meals. Through the questionnaire, students revealed that they do not have ample knowledge about the harmful effects of skipping meals. Over half of the students 170 (46.2%) drink 5-7 glasses of water while, one fourth of the students 89 (24.2%) consume ≥ 8 glasses of water daily. Seventy-one students drink 2-4 glasses of water daily, while 38 (10.2%) students' take ≤ 2 glasses of water in a day. Majority of the students 206 (55.9%) usually purchased their food and only a few respondents 72 (19.5%) prepared food at home. Majority of the individuals, 346 (94.1%) ate snacks and soft drinks every day (Figure 1).

Dietary Diversity Score of Food Consumption

Of the 368 students, one-ninth of the students (342, 92.6%) consume meat, 271 (73.6%) and 186 (50.5%) students ate vegetables and cereals respectively whereas, cereals food group ≥3 times. Two hundred and sixty (70.6%) and 232 (63.0%) ate milk

and milk products and oil/butter/cheese/fat, respectively, <3 times (Table. 2) in a week. More than half of the individuals 202 (54.8 %), 240 (65.2%) and 216 (58.5%) ate fruits, egg and meat, respectively, ≥3 times (Table 3). Mostly half of the respondents had a high dietary diversity score 176 (47.8%), 98 (26.6%) of the individuals had a medium DDS and 94 (25.5%) had a low DDS (Figure 2).

Anthropometric measurements

Over half of the individuals 182 (49.4%) had a normal BMI, 82 (22.2%) were underweight and 104 (28.2%) were overweight (Table. 3).

Physical Activity

Over one-fourth of the students 78 (21.1%) were very highly active during the week. More than half of the respondents 201 (54.6%) were sedentary and the rest of the students 89 (24.1%) were moderately active (Figure. 3).

Health Issues

Most of the students stated health issues for self and family members. Anemia was commonly observed in majority of the students 95 (28%) and 52 (14.8%) students were facing problems with hormonal imbalance. Diabetes was prevalent in Sixty-one (17.8%) students, 30 (8.5%) suffered from thyroid disorders, 40 (11.3%) reported obesity, 22 (6.5%) had heart disease, 4 (1%) had arthritis, while very few were identified with hypertension and osteoporosis (3, 0.85%) as shown in Figure. 4.

Discussion

Adolescence is a transitional stage of psychological and physical growth. During this transitional stage, with the body's specific nutritional necessities, alterations in one's lifestyle may change diet patterns and eating habits. Majority of the students lack knowledge about nutrition like foods to be consumed, specific foods that contain fiber, major components, calcium,

Table 1. Socio Demographic Factors of Female University Students

Variable	No. of Participants (n=368)	Percentage (%)
Age		
Below 18	80	21.7
18-20	104	28.2
21-23	95	25.8
Above 23	89	24.3
Gender		
Male	0	0
Female	368	100
Ethnicity		
Saudis	340	92.3*
Non-Saudis	28	7.6
Education level of Mother		
Post-graduate	68	18.4
Graduate	141	38.3
School level	159	42.3*
Education level of Father		
Post-graduate	98	25.5*
Graduate	176	47.8*
School level	94	26.6
Family Income (Monthly basis)		
<2500 SAR	124	33.6
2500-6000 SAR	97	26.3
>6000 SAR	147	39.9
Marital status		
Married	99	26.7
Single	269	73.3*

*Means indicate the $p > 0.05$ significant level.

protein, carbohydrates, fat, vitamin and iron that will be beneficial to the demands of a growing body. Some individuals avoid particular types of food due to cultural and social pressure, personal dislikes, peer pressure etc. A correlation has been demonstrated between dietary patterns, food consumed, eating habits and obesity in adolescents (15). Adolescents' have some common dietary patterns that includes; irregular meals, skipping meals especially breakfast, snacking, wide use of fast food, energy-dense foods, less intake of vegetables and fruits and regular intake of purchased food.

Unhealthy lifestyle in adolescents' leads to under or over nourishment that results in enhanced susceptibility to chronic diseases. Dietary pattern of the students revealed that most of them ate two main meals a day which is necessary for good health. Surprisingly, the most common skipped meal among young girls was breakfast and a minority of them sometimes skipped lunch or dinner. This data has also been supported by studies among Japanese and Korean University students. Furthermore, a Croatian university report also revealed that, breakfast was the most
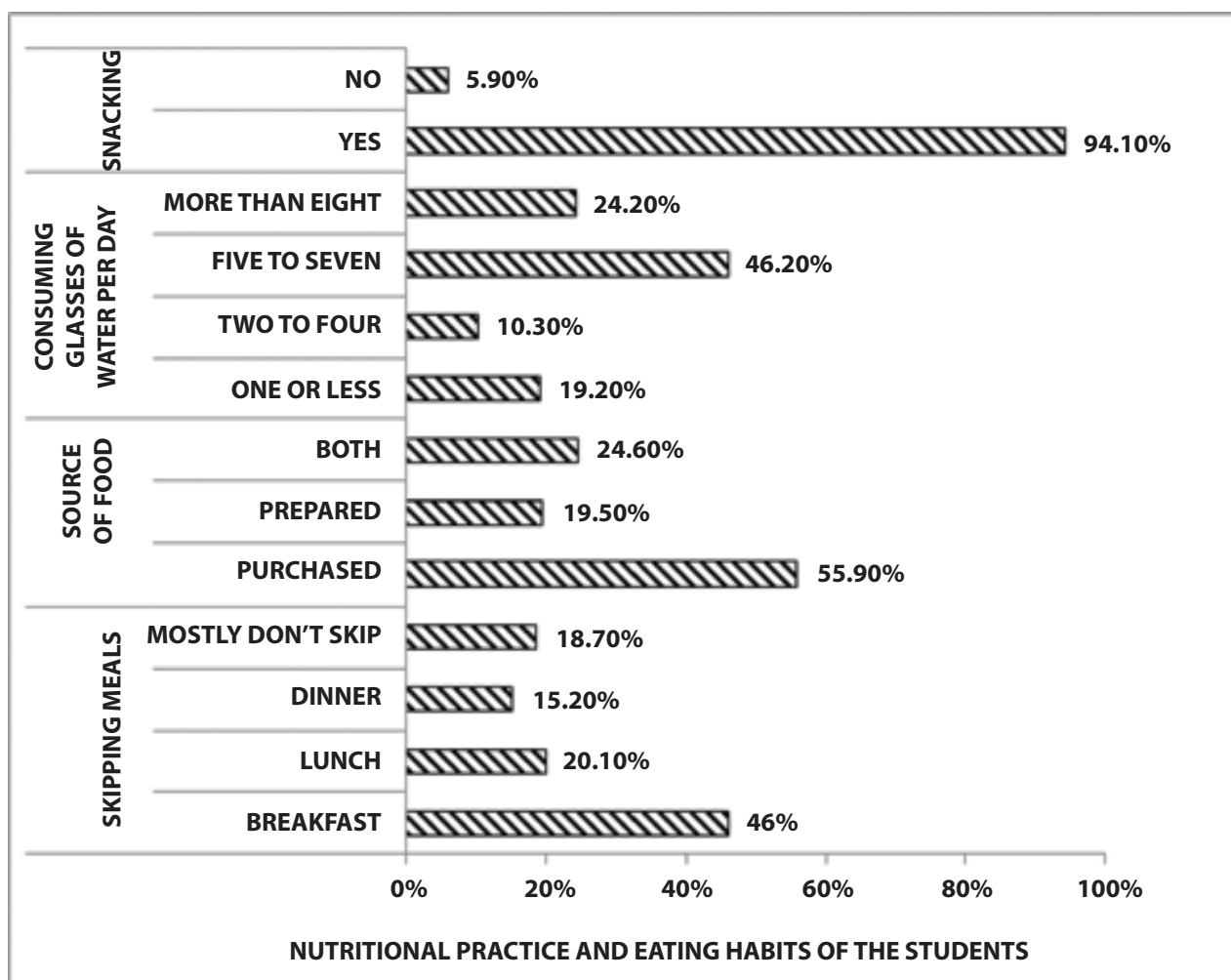
Figure 1. Nutritional Practice and Eating Habits of the Respondents

Table 2. Frequency of different food groups' intake by individuals

Food groups	Frequency/week (n = 368)	
	<3 times Frequency (%)	≥3 times Frequency (%)
Fruits	202 (54.8)	166 (55.2)
Vegetables	271 (73.6)	97 (26.3)
Eggs	240 (65.2)	128 (37.7)
Meat	341 (92.6)	27 (7.4)
Fish/sea food	216 (58.6)	152 (41.3)
Legumes/nuts/dry fruits	201 (54.6)	167 (45.4)
Milk and milk products	260 (70.6)	108 (29.3)
Oils/butter/cheese/fats	232 (63.0)	136 (36.9)
Cereals	186 (50.50)	182 (49.4)

Table 3. BMI classification of Individual based on dietary diversity Score (DDS)

| Variables | BMI Classification (n=368) | | |
DDS	Underweight (n=82) Frequency (%)	Normal (n=182) Frequency (%)	Overweight (n=104) Frequency (%)
Low	16 (4.34)	44 (11.9)	30 (8.15)
Medium	18 (4.8)	52 (14.1)	28 (7.6)
High	48 (13)	86 (23.3)	46 (12.5)
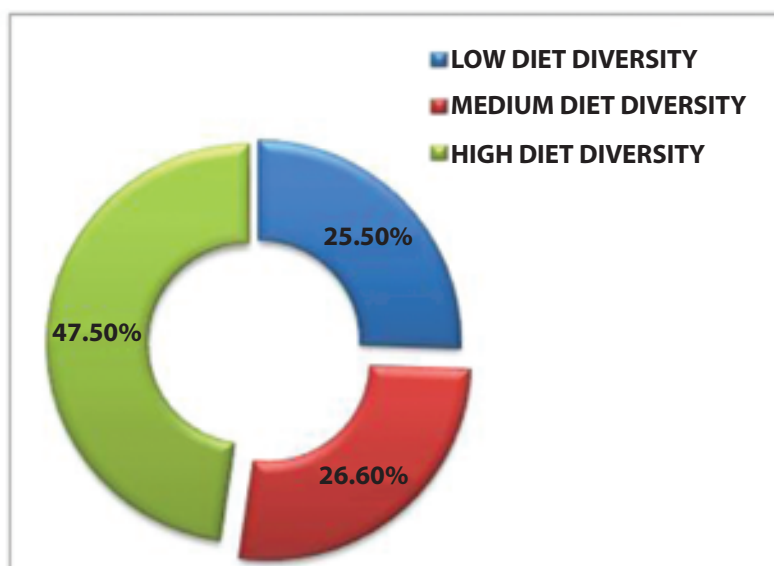
Figure 2. Dietary diversity Score of Individuals in the week earlier
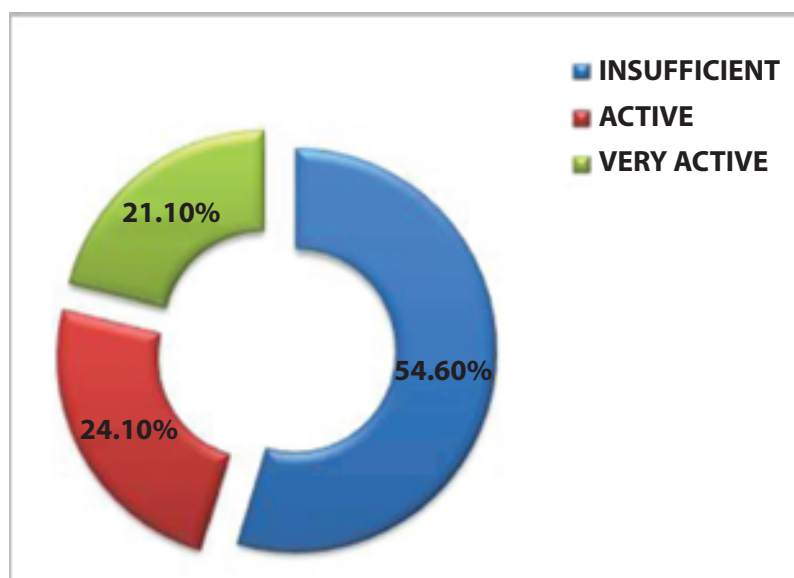
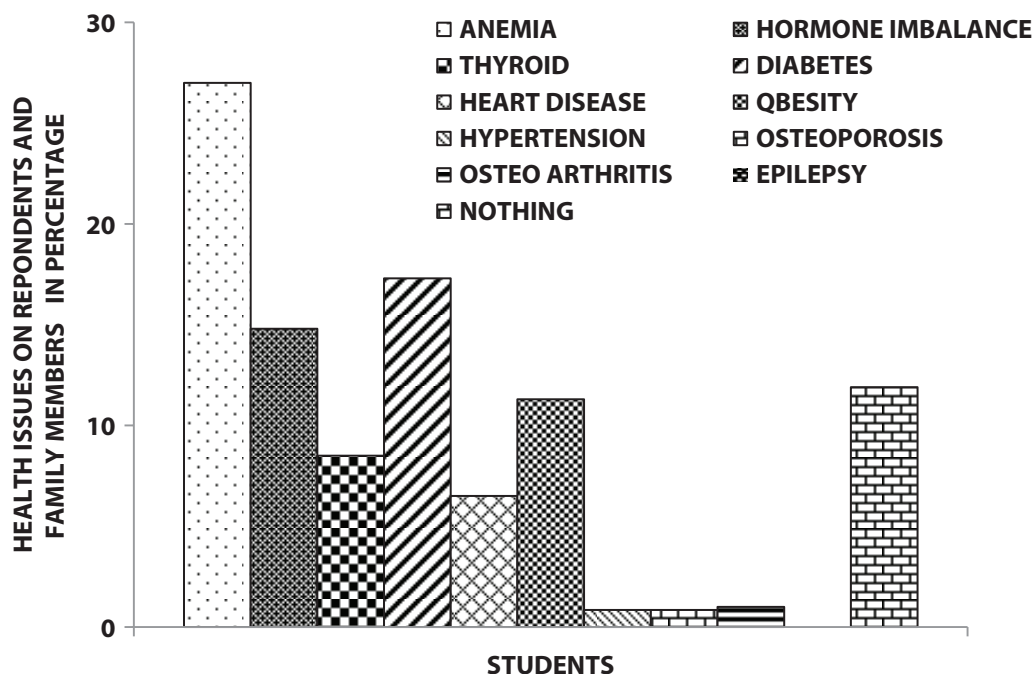**Figure 3.** Physical activities of the respondents for the week

Figure 4. Health issues on the respondents and family members

common frequently skipped meal (16, 17). This report suggests that students usually do not have sufficient time between morning classes to eat breakfast and few of them skip due to the misinformed notion for maintaining their appearance and body weight (18). These reports indicate that omitting meals due to lack of knowledge by the students have significant long-term consequences on their health. More than half of the students (66.2%) take snacks daily that facilitate them to manage the energy necessities of the body. This study also found that most of the students purchase their foods. Majority of the respondents purchased their breakfast in cafeteria. Eating outside the cafeteria is a common activity among college students.

Dietary pattern of the individuals indicated that most of the students consumed more of meat, vegetables, milk and milk products and oil/butter/cheese/fat foods group whereas, cereals were less consumed. This may impact the accessibility of inherent nutritional value (i.e., proteins, vitamins and minerals) in this food group, to the students. Dietary diversity score of the students reveals that most of them consumed more than four food types, which may provide essential nutrients for their health needs. Majority

of the students who were in this study had a normal BMI, and the proportion of overweight may be due to avoidance of particular food types, skipping their meals, snacking and eating outside foods. Predominance of obesity and overweight among the students may be due to excessive eating of specific food groups which are mostly low energy, low concentration of essential minerals and vitamins, energy-dense and avoidance of nutritional value food groups. The lack of energy balance can lead to overweight or obesity that exposes them to the risk of *Non-Communicable Diseases* (*NCDs*) *(*19).

This study suggested that students were not aware about severe health issues due to low intake of fruits and vegetables (20). Due to modernization and prevalence of westernized diet nowadays, which has driven the youth lifestyle far away from healthy diet/organic food towards unhealthy foods/fast foods that contain more carbohydrates and fat. The results also highlighted that one fourth of the students attempt to eat healthy diet, while few students do not attempt to eat or try for a healthy diet due to lack of information. Additionally, the results have also supported an Australian study of behavioral changes (21). Moreover, the

responses about students do not attempt to consume a healthy diet should not be taken lightly.

The present study further highlighted that young people drink 2-4 glasses of water daily, whereas, nearly half of the student's drink 5-7 glasses of water. This data strongly supports that the students were not aware of the problems of consuming less water resulting in dehydration and altering the normal functions of human system (22). Not only the dietary pattern, nutritional food consuming habits but also physical activity is necessary and influence health (23). Report on physical activity of the students shows insufficient active for majority of the students (Figure. 2). The analysis of physical activity (analyzed by IPAQ) reveals that one-fourth of the respondents show very active physical activity. These reports show a general trend of not spending time on physical activity and not having knowledge of healthy lifestyle and disease prevention. A study highlighted diet variation and central obesity and found that DDS was inversely related to central obesity and, even after correcting for BMI, DDS was inversely related to abdominal adiposity (24). This means that greater variety contributes to higher consumption of both nutritious and unhealthy foods. As a result, we can conclude that increasing DDS without increasing calories can slow the progression of metabolic disorders by concentrating on a particular food group (e.g., vegetables) rather than all food products.

Health issues among students, found anemia in majority of the students followed by hormonal imbalance. Some of them reported diabetes, followed by thyroid disorders, obesity, and the least of them had hypertension and osteoporosis. Commonly lack of work out, physical activity, the pattern of inactive lifestyle and effect of fast foods may contribute towards health issues on students. Furthermore, unhealthy dietary patterns affect the nutrition value and healthy life, with a harmful effect on health issues and metabolism resulting in health concerns. A previous study also stated the risk factors for unhealthy diet that are connected to greater risk of nutrition disorders, obesity, hormonal imbalance, anemia, high density lipoprotein cholesterol, high triglyceride, hypertension and elevated glucose levels which are known as metabolic syndrome (25). The emerging trend of girls towards dieting programs recently hoists concerns about

nutritional diseases and eating disorders (26). In the past, Saudi lifestyle urged females are healthy and well cared (27) but current scenario of being influenced by media, girls are under tremendous pressure to lose their weight including abdominal fat.

Conclusion

Consuming an unbalanced diet is a more common practice among the university students and young people. Students need health education on nutrient benefits, preparation of nutritious foods, consequences of omitting meals, insufficient intake of water and lack of physical activity. Furthermore, the study concluded an urgent need for counseling not only the students but their families too on the importance of nutrition and its impact on healthy lifestyle. This study augments importance of nutrition course must be a part of the university requirements.

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