Short Research Article

Dietary Habits of Students in Bangladesh Agricultural University and their Association with Overweight and Obesity.

Abstract

Purpose: The dietary habits of young adults have been affected; thus, overweight and obesity are increasingly being observed among the young. The purpose of this study is to assess the prevalence of overweight and obesity on a sample of students from the Bangladesh Agricultural University(BAU) and to examine their eating habits.

Background: In the past year BAU has been experiencing a nutritional transition in food decisions from the everyday diet to the alimentation pattern. As a consequence, the dietary habits of young adults have been affected with progressive overweight and obesity .The purpose of this study is to assess the prevalence on a sample of MS stidents from BAU and to look at their uptake habits.

Methods: A cross-sectional survey of 146 students were chosen randomly from the BAU throughout the JJ/2018 semester. With a 7 Days twenty four Hour Food frequency questionnaire where their Height, weight, dietary habits, Body mass index (BMI) were recorded . Statistical analyses were performed exploitation the Statistical Package for Social Sciences computer code (version 22.0) to determine overweight and obesity among students and to categorize uptake habits of food.

Results:

This study showed that the majority of the students (80.4%) were of normal weight (80.8%male students compared to 80% female students). The prevalence of overweight and obesity was 9.1% and 2.3% respectively .In contrast, 15.0% female students were underweight as compared to 3.8% males. Eating habits of the students showed that the majority (61.4%) reported taking meals regularly. There was a colored vegetable and fruits was intake scarcity among students. A total of 30.5% reported daily intake of colored vegetables with gender differences (P=.003) (31.5% females vs. 29.2% males). These prevalence rates were greater in girls than boys. There were no clear associations observed between dietary habits and measures of overweight and obesity.

Keywords: Dietary habits, Obesity, BMI, Overweight, Fruits and Vegetables, Eating habits, University students, BAU.

Conclusion: The overall low prevalence of overweight and obesity in the studied sample, indicate that university students would possibly benefit from nutrition and health promotion program to improve student's eating habits. There is a Significant differences observed among food type and frequency of consumption.

Introduction:

The prevalence of overweight and obese youth is rising in Bangladesh. These trends are regarding as a result of raised considerably among Bangladeshi women[1].In South Asia has seen a steady increase in overweight and obesity since 1980, with the rate of overweight or obese adults rising from 16% to 21% in 2013. South Asia also has the lowest adult obesity prevalence among all regions (6%) and also the lowest Children avoirdupois prevalence (3%)[2].Within the region, Pakistan has the highest avoirdupois rate for adults (14%), and Bhutan has the highest prevalence rate for kids (6%)[3][1]. South Asia also has the smallest gender gap in adult prevalence among all regions (4.8% male, 5.2% female).The result of being healthy may be explained by any of the factors that influence energy intake. Over the last 33 years, rates of either being overweight or obese doubled among Bangladeshi adults however remained low among children[4][5][6], According to a replacement, first-of-its-kind analysis of trend data from 188 countries. Of the 17% of overweight or fat adults in Bangladesh, just four-dimensional obesity rates in Bangladesh area unit increasing at a slower pace[7][8]. From 1980 to 2013 obesity rates in adults grew from two to four-dimensional, and rates in children and adolescents remained at concerning one.5%. eating patterns, which describe feeding frequency, the temporal distribution of eating events across the day, breakfast skipping, and the frequency of eating meals aloof from home, may be associated with obesity[9][10].

The objectives of this study were to present estimation of the prevalence rates of overweight and avoirdupois for BAUian youth and to examine the associations among measures of over- weight with dietary habits. These results are primarily based on the BAUian food habits.

Methods

Design and sample

A cross-sectional survey of 146 students (43.5% male and 56.5% female), aged 25 ± 2 years, were chosen randomly from the Bangladesh Agricultural University (BAU) campus during the JJ/2018 semester. Students were asked to fill out a 7 Days 24 Hour Food frequency questionnaire that included questions on their Height, weight, dietary habits for specific prevalence rates of overweight and obesity. Body mass index (BMI) was used to assess students weight status. Statistical analyses were performed using the Statistical Package for

Social Sciences software (version 22.0) to determine overweight and obesity among students and to categorize eating habits.

Dietary variables

The subjects were asked how many times in a typical week they consumed each of the following food items: rice, bread, chira, meat, fish, green leafy vegetable, other vegetable, egg, fruit, milk dhal, snack food, tea/coffee, cooking oil. The possible responses were "never," "less than once a week," "once a week," "2– 4 days a week," "5– 6 days a week," "once a day," "2 times/day" and "3 times/day."

Data Collection

Data collection took place in two steps. The first step was to fill out the questionnaire and the second step was to perform the anthropometric measurements. Recruited students were asked to fill out a questionnaire related to their eating habits. The questionnaire was adopted from a pilot survey among university students. Prior to questionnaire administration, students were informed by an BAU professor about the study. They were given instructions on how to fill out the questionnaire completely and truthfully. After filling out the questionnaire, anthropometric measurements, such as weight and height, and body mass index, were done. Weight, percentage body mass index measurements were determined. Height and body mass (without shoes) were based on self- reports of the adult. Body mass index (BMI) was calculated as body mass/height^2 (kg/m^2). The international age and gender specific BMI cut-points for adult was used.[9] .According to guidelines stated by the World Health Organization[11], weight status was classified into four categories: under- weight (BMI ≤ 18.5),Healthy weight (BMI between 18.5 – 24.9), over weight (BMI between 25–29.9), and obese (BMI ≥ 30).

Data Analysis

Statistical analyses were performed using the Statistical Package for Social Sciences (version 22.0, SPSS, Inc) software. Results were expressed as means ± SD (standard deviation). Parametric variables were analyzed using student's Cross Table Correlation analyses were conducted for non-parametric variables. All reported value compared to a significance level of both 5% and 1%. All reported P values were made on the basis of 2-sided tests and compared to a significance level of 5%; differences were considered statistically significant at $P < 0.05$ and .01.

Results

Characteristics of the students and BMI values:

This study showed that the Relation between gender and BMI is Significant (P=.018) Mean BMI (22.65) majority of the students (80.4%) were within normal weight (80.8% male students compared to 80% female students). The prevalence of overweight and obesity was 8.7% and 2.2% respectively (3.8% and 3.5% vs. 15.0% and 0.0%, male and Female respectively). In contrast, 5.0% female students were underweight as compared to 3.8% males.

Table 1: Characteristics of the participants

Health status	Male (%)	Female (%)	Average (%)
Under weight	3.8	5.0	4.5
Healthy	80.8	80.0	84.1
Over weight	3.8	15.0	9.1
Obese	3.8	0.0	2.3

Prevalence of Overweight/Obesity among University Students:

The median body weight of the respondents was 59.28 kg and the mean self-report height was 1.61 meters .The median BMI was 22.12 kg/m^2 .The BMI category according to WHO [11],84.1% university students was in the normal weight category and 9.1% and 2.3% were overweight and obese, respectively (Table 1).The prevalence of overweight/obesity among the students was 11.4% .

Eating Habits of University Students

Fruit consumption is lower in the individuals as 30.4% do not eat fruit in a week and 34.8% students eat fruit 1 day per week. On the other hand 54.3% students do not drink milk in a week. More than 50% students consume egg once per day. 54.3% students consume leafy vegetables 2– 4 days/wk. other vegetables consumption is not so high as 52.2% in 1day per week .University students reported Rice eating regularly on a daily basis nearly twice or thrice a day. The majority (54.3%) consumed three meals per day, while (45.7%) of university students consumed Twice meals. Bread is intake by 39.1% respondent once per week and by 32.6% respondent 2– 4 days per week. Chira is not taken by majority (63%) of respondents. meat is consumed by over all students as 2– 4 days/wk (34.8%) and 1 time/day (23.9%). Fish consumption scenario is also as like as meat that 2– 4 days/wk (30.4%) and 1 time/day (32.6%). Dhal is usually consumed by the students as 2 times/day (34.8%). Snack food also a risk factor avoided by only 8.7% students result in morbidity and premature mortality are prevalent among adulthood[3] and Tea/Coffee is taken by 47.8% in 1 time/day and 41.3% in 2 times/day. Maximum students (82.6%) take

Cooking Oil 3 times/day.

Fig 1: Relation between Fruit intake and Health Status

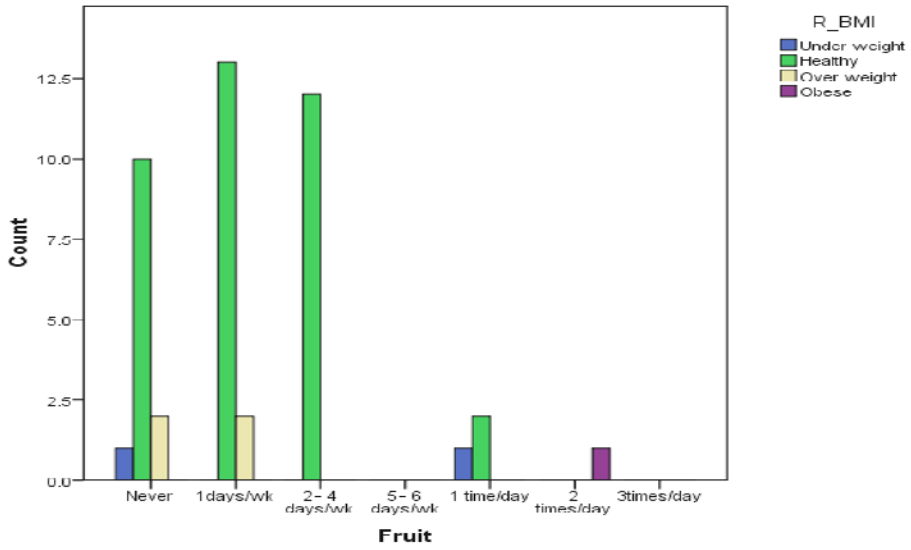

Table 2: Pearson Correlations between gender and food type

		Fish	Green leafy veg.	Other vegetables	Milk	Dhal
Gender	Pearson Correlation	-.567**	.426**	.317*	.370*	-.300*
	Sig. (2-tailed)	.001	.003	.032	.011	.043

. Correlation is significant at the 0.01 level (2-tailed).
. Correlation is significant at the 0.05 level (2-tailed).

The relation Between gender and fish consumption is positively significant Whereas with dhal the significant is negative, for Milk (P=.011) that is highly significant. The consumption of vegetables also lower is all students group. The Association of “Dhal” Consumption among male and female students of Bangladesh Agricultural University was negatively significant.

Table3: Average intake of food according to variable dietary

Dietary Variable	Average Intake(%)				
Rice		**Bread**			
			2times/day	54.3	
			3times/day	45.7	
					Never 6.5
					1days/wk 39.1
					2– 4 days/wk 32.6

	5– 6 days/wk	4.3
	1 time/day	17.4
Chira		
	Never	63.0
	1days/wk	21.7
	2– 4 days/wk	13.0
	1 time/day	2.2
Meat		
	Never	4.3
	1days/wk	21.7
	2– 4 days/wk	34.8
	5– 6 days/wk	13.0
	1 time/day	23.9
	2 times/day	2.2
Fish		
	Never	2.2
	1days/wk	19.6
	2– 4 days/wk	30.4
	5– 6 days/wk	6.5
	1 time/day	32.6
	2 times/day	8.7

Food Type	**Dietary Variable**	**Average Intake**(%)
Egg		
	Never	2.2
	1days/wk	4.3
	2– 4 days/wk	26.1
	5– 6 days/wk	10.9
	1 time/day	56.5
Green Leafy Veg.		
	1days/wk	13.0
	2– 4 days/wk	54.3
	5– 6 days/wk	8.7
	1 time/day	8.7
	2 time/day	15.2
Other Vegetables		
	Never	6.5
	1days/wk	52.2
	2– 4 days/wk	19.6
	5– 6 days/wk	4.3
	1 time/day	4.3
	2 times/day	13.0
Fruits		
	Never	30.4
	1days/wk	34.8
	2– 4 days/wk	26.1
	1 time/day	6.5
	2 times/day	2.2

Food Type	**Dietary Variable**	**Average Intake**(%)
Milk		
	Never	54.3
	1days/wk	19.6
	2– 4 days/wk	21.7
	1 time/day	4.3
Dhal		
	Never	4.3
	1days/wk	19.6
	2– 4 days/wk	28.3
	5– 6 days/wk	6.5
	1 time/day	4.3
	2 times/day	34.8
Snacks Food		
	Never	8.7
	1days/wk	23.9
	2– 4 days/wk	26.1
	5– 6 days/wk	8.7
	1 time/day	10.9
	2 times/day	19.6
	3 times/day	2.2
Tea/Coffee		
	1 days/wk	2.2
	2– 4 days/wk	4.3
	5-6 days/wk	2.2
	1 time/day	47.8
	2 times/day	41.3
	3 times/day	2.2
CookingOil		
	2 times/day	17.4
	3 times/day	82.6

In our study it is found that most of the healthy students consume rice 2 times per day(87.5%) or 3 times per day (80.0%).prevalence of healthy condition is 100% in those who never consume or consume bread 2-4 times per week. Students eat chira 1 time pre day are 100% obese. prevalence of healthy condition is 100% in those who never consume or consume meat 2 times per day. Young adults are at risk of developing obesity, especially when transitioning into university life as they become responsible for their daily eating[4]. Among the respondents consuming fish never or 5-6 days per week are 100% healthy but consuming 1 time per day are under weight(7.1%).students, consuming egg 1 time per day are overweight (16.0%). High intake of green vegetables influence healthy condition but consuming 1 day per week can occur under weight(16.5%),over weight(16.5%), and obese(16.5%). High intake of other vegetables also influence healthy condition but never consuming can occur under weight(33.3%). Consume fruit 2-4 days per week indicates healthy status but eat 2

Table 4: Association between dietary habits and health status

	Dietary Variable	Under weight (%)	Healthy (%)	Overweight (%)	Obese (%)
Rice					
	2times/day	4.2	87.5	4.2	4.2
	3times/day	5.0	80.0	15.0	0.0
Bread					
	Never	0.0	100.0	0.0	0.0
	1days/wk	6.2	68.8	18.8	6.2
	2– 4 days/wk	0.0	100.0	0.0	0.0
	5– 6 days/wk	00.0	50.0	50.0	0.0
	1 time/day	12.5	87.5	0.0	0.0
Chira					
	Never	7.4	81.5	11.1	0.0
	1days/wk	0.0	100.0	0.0	0.0
	2– 4 days/wk	0.0	83.3	16.7	0.0
	1 time/day	0.0	0.0	0.0	100.0
Meat					
	Never	0.0	100.0	0.0	0.0
	1days/wk	0.0	70.0	20.0	10.0
	2– 4 days/wk	6.7	86.7	6.7	0.0
	5– 6 days/wk	0.0	83.3	16.7	0.0
	1 time/day	10.0	90.0	0.0	0.0
	2 times/day	00	100.0	0.0	0.0
Fish					
	Never	0.0	100.0	0.0	0.0
	1days/wk	0.0	55.6	33.3	11.1
	2– 4 days/wk	7.7	92.3	0.0	0.0
	5– 6 days/wk	0.0	100.0	0.0	0.0
	1 time/day	7.1	92.9	0.0	0.0
	2 times/day	0.0	75.0	25.0	0.0
Egg					
	Never	0.0	100	0.0	0.0
	1days/wk	0.0	50	0.0	50
	2– 4 days/wk	18.2	81.8	8.0	0.0
	5– 6 days/wk	0.0	100	0.0	0.0
	1 time/day	0.0	84.0	16.0	0.0
Green Leafy Veg.					
	1days/wk	16.7	50.0	16.74	16.7
	2– 4 days/wk	0.0	874	13	0.0
	5– 6 days/wk	0.0	100	0.0	0.0
	1 time/day	25	75	0.0	0.0
	2 time/day	0.0	100	0.0	0.0
Other Vegetables					
	Never	33.3	66.7	0.0	0.0
	1days/wk	0.0	81.8	13.6	4.5
	2– 4 days/wk	0.0	88.9	11.1	0.0
	5– 6 days/wk	0.0	100	0.0	0.0
	1 time/day	50	50	0.0	0.0
	2 times/day	0.0	100	0.0	0.0
Fruits					
	Never	7.7	76.9	15.4	0.0
	1days/wk	0.0	86.7	13.3	0.0
	2– 4 days/wk	0.0	100	0.0	0.0
	1 time/day	33.3	66.7	0.0	0.0
	2 times/day	0.0	0.0	0.0	100
Milk					
	Never	4.2	75	16.7	4.2
	1days/wk	0.0	100	0.0	0.0
	2– 4 days/wk	10	90	0.0	0.0
	1 time/day	0.0	100	0.0	0.0
Dhal					
	Never	0.0	100	0.0	0.0
	1days/wk	0.0	66.7	22.2	11.1
	2– 4 days/wk	8.3	83.3	8.3	0.0
	5– 6 days/wk	0.0	100	0.0	0.0
	1 time/day	0.0	100	0.0	0.0
	2 times/day	6.7	86.7	6.7	0.0
Snacks Food					
	Never	0.0	100	0.0	0.0
	1days/wk	0.0	60	30	10
	1 time/day	0.0	80	20	0.0
	2 times/day	11.1	88.9	0.0	0.0
	3 times/day	0.0	100	0.0	0.0
Tea/Coffee					
	1 days/wk	0.0	100	0.0	0.0
	2– 4 days/wk	0.0	50	50	0.0
	1 time/day	9.5	81	4.8	4.8
	2 times/day	0.0	89.5	10.5	0.0
	3 times/day	0.0	100	0.0	0.0
Cooking Oil					
	2 times/day	0.0	71.4	14.3	14.3
	3 times/day	5.4	86.5	8.1	0.0

times per day indicates obese condition[5]. Students drinking milk once per day or week are healthy(100%).consuming dhal 2 times per day are over weight(6.7%).students consuming snack food never or 3 times per day both are healthy (100%).the students , take tea/coffee 2 times per day are overweight(10.5%). Cooking Oil consumption 2 times per day cause overweight(16.3%) and obese (16.3%).

Discussion

The most important factors underlying the obesity epidemic are the current opportunities of excessive energy intake coupled with limited energy expenditure. The purpose of this study was to assess the prevalence of overweight and obesity and examine eating habits in a sample of Bangladesh University students. Body mass indexwas used to assess weight status. In this study, 9.1% of participants were overweight or obese, and 2.3% of the populations were obese. Although this percentage is lower but the university obesity rate can still be worrying considering the younger age of participants[15]. The prevalence of overweight/obesity: 15.0% female

students were overweight as compared to 3.8% males and 0.0% are obese as compared to 3.8% males This percentage is lower than the normal obesity rate can still be worrying considering the younger age [6]. 15.0% female students either obese or overweight as compared to 3.8% males (Table1) is less compare to 10.8% of the students were overweight and 30.6% were obese in UAE[7] Among adults, it was reported that 68.7% of Saudi women were obese, and the rest (31.3%) were nonobese higher than lebanease women [3][8] The lower rate of obesity among female students in the current study can be explained by the fact that dieting is a common practice among young women, irrespective of weight .While the prevalence of obesity increased with age . University students reported Rice eating regularly on a daily basis nearly twice or thrice a day and show no obesity in comparison to other vitamin and mineral sources like green leafy vegetables or other seasonal fruits and vegetables[9][10][11]. Chira is not taken by majority of respondents as we found from other study that students intake chira as not alternative of staple but due to their lazyness, not enough money at the end of month, distance between residential area and meal area Almost same percentage of Lebanese males (32.2%) and females(31.5%) university students consumed their breakfast daily, while the rest either consumed it irregularly or did not consume it., and most probably due to their late rising from bed is also a important cause for inaking Chira. [12] Most students intake fish (P=.001)as regular basis with staple food due to traditional “Mache Vaate Bangali” and recent surplus production of fish in our country. Vegetables (green,Others), milk and fruit consumption level *P value (“**.003**”, “**.032**” “**.011**” , “**.129**”)* is too low than on need RDA though adult need milk as a calcium sources , a nutrient dense food rich in mineral nutrient on the other hand vegetable processing is tiresome so students not take adequately from their dining in addition these food sources (fruits,milk) are comparatively costly than the previous one. Dhal as a traditional food intake twice or more a day and easy to processing, consumption. Tea or coffee intaking frequency is increasing day by day among young people.oil consumption is regular and or with snacks. Consuming egg one per day and over weight is higher than consuming 5-6 per week. Eating fruit and vegetables is mostly associated with healthy condition. Never eating milk can cause Nutrition Deficiency[13][14]. Dhal consuming 2/3 per day is associated with obesity and overweight (**P=.043**). Consuming high frequency of tea, coffee, snack food are not directly impaired healthy status but cause a long chronic consequence associated with obesity and overweight[1].

Our findings indicate that 8.7 percent of BAUian adult were overweight (preobese) and 2.2% were obese. These prevalence rates were greater in girls than boys. There were no clear associations observed between dietary habits and measures of overweight and obesity. However, there was no consistency in the pattern for these observations. It is possible that the lack of consistent associations is explained by the fact that overweight and obese individuals are more likely than normal weight individuals to misreport food intake . In addition, because we obtained information only on the frequency of food consumption, it is possible that the portion sizes of bulk foods were greater in the youth, which would have been reflected healthy weight in their questionnaire responses[16].

This study reported that female participants were more concerned about physical size and appearance, and slightly more females tried dieting compared to males. Similar results were also seen in a previous study , where being overweight was more of a fear among female students.

Limitations

The major limitation of this study was that the heights and body mass values used to calculate BMI were derived from selfreports. Although this raises questions about the validity of the BMI values and the applicability of the BMI cut-points, others have shown that self-reported heights and body mass values are fairly reliable. Finally, the questions on dietary patterns was also self-reported and there were limitations to the reporting methods of the diet (frequency only).

Conclusion:

The study reveal two third of students were classified into the normal BMI group, with the prevalence of BMI > among Varsity students in (BAU), infrequent intake fruits and vegetables were the most common nearly all healthy as well as over or under weight students. Significant differences were observed among food type and frequency of consumption. In spite of the overall low prevalence of overweight and obesity in the studied sample, results indicate that university students would possibly benefit from a nutrition and health promotion program to improve students eating habits. Overweight and obesity increased among Bangladeshi women of reproductive [20], Socio- demographic factors[21] including age, education, wealth index[22], marital status whatever university students are more Concious about their weight rather than health.

Disclaimer regarding Consent and Ethical Approval:

As per university standard guideline participant consent and ethical approval has been collected and preserved by the authors.

References

[1] M. A. B. Chowdhury, M. M. Adnan, and M. Z. Hassan, 'Trends, prevalence and risk factors of overweight and obesity among women of reproductive age in Bangladesh: A pooled analysis of five national cross-sectional surveys', *BMJ Open*, vol. 8, no. 7, pp. 1–12, 2018.

[2] IHME, 'Adult rates of overweight and obesity rise in Bangladesh', 2016.

[3] B. M. Popkin and P. Gordon-Larsen, 'The nutrition transition: Worldwide obesity dynamics and their determinants', *Int. J. Obes.*, 2004.

[4] I. Janssen, P. T. Katzmarzyk, W. F. Boyce, M. A. King, and W. Pickett, 'Overweight and obesity in Canadian adolescents and their associations with dietary habits and physical activity patterns', *J. Adolesc. Heal.*, 2004.

[5] V. Fedirko *et al.*, 'Glycemic index, glycemic load, dietary carbohydrate, and dietary fiber intake and risk of liver and biliary tract cancers in s', *Ann. Oncol.*, 2013.

[6] T. Biswas, A. Islam, M. S. Islam, S. Pervin, and L. B. Rawal, 'Overweight and obesity among children and adolescents in Bangladesh: a systematic review and meta-analysis', *Public Health*, vol. 142, pp. 94–101, Jan. 2017.

[7] T. Biswas, S. P. Garnett, S. Pervin, and L. B. Rawal, ‘The prevalence of underweight, overweight and obesity in Bangladeshi adults: Data from a national survey’, *PLoS One*, vol. 12, no. 5, pp. 1–12, 2017.

[8] R. Çitozi and D. Bozo, ‘Habits in healthy nutrition, obesity, alcohol, smoking, among students of the faculty of physical activity and recreation’, in *Journal of Human Sport and Exercise*, 2014.

[9] Y. Ma *et al.*, ‘Association between eating patterns and obesity in a free-living US adult population’, *Am. J. Epidemiol.*, 2003.

[10] F. N. Jacka *et al.*, ‘Association of western and traditional diets with depression and anxiety in women’, *Am. J. Psychiatry*, 2010.

[11] WHO, ‘WHO | Mean Body Mass Index (BMI)’, *WHO*, 2017. .

[12] F. S. AlBuhairan *et al.*, ‘Time for an Adolescent Health Surveillance System in Saudi Arabia: Findings from “jeeluna”’, *J. Adolesc. Heal.*, 2015.

[13] T. C.Y., A. S.R., and K. D.S.Q., ‘Dietary habits and lifestyle practices among university students in universiti Brunei Darussalam’, *Malaysian J. Med. Sci.*, vol. 25, no. 3, pp. 56–66, 2018.

[14] C. Arcan *et al.*, ‘Associations of home food availability, dietary intake, screen time and physical activity with BMI in young American-Indian children’, *Public Health Nutr.*, 2014.

[15] P. Rozin, C. Fischler, S. Imada, A. Sarubin, and A. Wrzesniewski, ‘Attitudes to food and the role of food in life in the U.S.A., Japan, Flemish Belgium and France: Possible implications for the diet-health debate’, *Appetite*, 1999.

[16] J. J. Reilly, A. El-Hamdouchi, A. Diouf, A. Monyeki, and S. A. Somda, ‘Determining the worldwide prevalence of obesity’, *The Lancet*, vol. 391, no. 10132. pp. 1773–1774, 2018.

[17] S. N. Bleich, E. B. Rimm, and K. D. Brownell, ‘U.S. Nutrition Assistance, 2018 — Modifying SNAP to Promote Population Health’, *N. Engl. J. Med.*, vol. 376, no. 13, pp. 1205–1207, Mar. 2017.

[18] L. Abarca-Gómez *et al.*, ‘Worldwide trends in body-mass index, underweight, overweight, and obesity from 1975 to 2016: a pooled analysis of 2416 population-based measurement studies in 128·9 million children, adolescents, and adults’, *Lancet*, vol. 390, no. 10113, pp. 2627–2642, Dec. 2017.

[19] K. P. Baran, ‘Dietary Supplements’, in *Encyclopedia of Toxicology: Third Edition*, 2014.

[20] B. M. Popkin, ‘Relationship between shifts in food system dynamics and acceleration of the global nutrition transition’, *Nutr. Rev.*, vol. 75, no. 2, pp. 73–82, Feb. 2017.

[21] C. B. Ebbeling *et al.*, ‘Effects of dietary composition on energy expenditure during weight-loss maintenance’, *JAMA - J. Am. Med. Assoc.*, 2012.

[22] A. J. Gaskins, D. S. Colaci, J. Mendiola, S. H. Swan, and J. E. Chavarro, ‘Dietary patterns and semen quality in young men’, *Hum. Reprod.*, 2012.