



THE UNIVERSITY OF THE WEST INDIES
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Submitted in partial requirements
for HUEC 3012
of
The University of the West Indies

Title: An investigation of the Association of BMI and Body Fat Percentage to Eating Behaviors as Measured by the Three Factors Eating Questionnaire-R18 in University Students

Student Name: Tonja Thomas

Project Supervisor: Dr. Neela Badrie

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Department of Agricultural Economics & Extension
Faculty of Food and Agricultural

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ABSTRACT

Objectives: To investigate the relationship between body mass index (BMI), body fat % and eating behaviors as measured by the Three Factor Eating Questionnaire TFEQ-R18 among university students.

Methods: Data were collected from October 18th to November 4th 2010 using a 39 item self completed questionnaire. A convenient sampling method was used. Students were approached in common student areas around campus and 120 students gave their informed consent. Variables measured were anthropometric, cognitive restraint, emotional eating and uncontrolled eating behaviors. Data were analysed using SPSS for Windows version 19.

Results: Analysis of cognitive restraint (CR) and emotional eating (EE) found no significant differences between male and female subjects. However for uncontrolled eating (UE) behavior male scores were significantly higher than female and UE scores were high among males all together. There was a greater incidence of overweight, obesity, high and very high body fat among males than females. Higher CR was associated with higher BMI ($p < 0.01$). There was an inverse relationship between BMI and UE that was not statistically significant; however the inverse relationship between BF% and UE ($p < 0.01$) was significant.

Conclusion: This study reveals novel findings of eating behavior, measured using TFEQ-R18 responses, and their association with BMI and BF% of young adult university students in Trinidad. Healthy eating behaviors exist in the majority of students, however high levels of body fat % and incidence of overweight in male students warrants continuous monitoring.

INTRODUCTION

1.1 *Background*

There is a lack of research concerning the psychological aspects of eating behavior of university students in the Caribbean. The Three Factor Eating Questionnaire Revised 18 item version (TFEQ-R18) is a self-administered questionnaire designed to measure 3 facet of human eating behavior: cognitive restraint (CR) (a tendency to constantly and consciously restrict one's food intake instead of using physiological cues, hunger and satiety, as regulators of food intake), uncontrolled eating (UE) (tendency to overeat, with the feeling of being out of control), and emotional eating (EE) (tendency to eat in response to negative emotions) Anglé (2009). These factors are associated with eating disorders and disease severity, thus the TFEQ- R18 is frequently used for examining eating behavior Harden et al. (2009).

The body mass index (BMI) is a measure of adiposity/fattiness used to identify obesity in individuals. It uses a calculation of weight (kg) ÷ height (m²) and a range in which it measures from underweight to obese. See Table 1. According to WHO (1995) the BMI has good validity with respect to morbidity and mortality from associated disease.

Body fat percentage (BF %) is a more accurate measure of adiposity because it differentiates between total body mass and actual fat mass Wellens (1996).

Globally the fast rising prevalence of overweight and obesity is of great concern WHO (2004). This change has been evident in the Caribbean also Henry (2004). These conditions of overweight and

obesity significantly increase risk of morbidity from hypertension, dyslipidemia, type 2 diabetes, coronary artery disease, stroke, gallbladder disease, osteoarthritis, as well as cancers of the endometrium, breast, prostate and colon, NIH (2000). Since obesity is considered a lifestyle disease, it is relevant to investigate the kinds of lifestyles or behaviors that may lead to this condition. This study may aid in the assessment of obesity a growing chronic non-communicable disease in the Caribbean.

1.2 Rationale

There is limited information available about the eating behaviors of young adults in the Caribbean. While there have been some studies that attempt to identify food consumption habits of Caribbean adults (Sharma et al. 2002, Zohoori et al. 2003, Jackson et al. 2003) psychological aspects of eating behavior in the Caribbean's young adults have not been studied. Essentially, the who, what, and where of eating have been the focus but not the why and when. Investigation of the risk factors for the development of excessive weight gain is important to identify target groups and determine strategies for the prevention and treatment of this condition. In developing countries such as those in the Caribbean there is limited research to give instruction or guidance to this process Jackson et al. (2003). The TFEQ-R18 has been used with a student sample and samples in France and Sweden, (Hyland et al. 1989, Elfhag et al. 2005, de Lauzon et al. 2004.) However, no studies have been published to date on the usage of the TFEQ-R18 in the Caribbean as an instrument of measurement of eating behavior. There is a need for valid and usable instruments for evaluating eating behavior, which can be applied to many different populations Anglé (2009). This study evaluated the validity and reliability of the TFEQ-R18 in a non-European, non-North American population.

1.3 Research Questions

- ◆ What is the association between the BMI of university students and the 3 eating behaviors cognitive restraint, uncontrolled eating, and emotional eating as defined by the TFEQ-R18?
- ◆ What is the association between cognitive restraint, uncontrolled eating, and emotional eating and the body fat% of university students?
- ◆ How do cognitive restraint, uncontrolled eating and emotional eating differ by gender?

1.4 Research Objective

This study seeks to investigate the association between behavioural patterns of eating, BMI and BF% in university students using the Three Factor Eating Questionnaire-Revised 18 Version (TFEQ-R18). Other objectives include investigating activity level and weight satisfaction.

1.5 Scope

This study covers the extent of cognitive restraint, uncontrolled eating and emotional eating behaviors and their effect on BMI and body fat %.

LITERATURE REVIEW

Topic: An Investigation into the Association Among BMI, Body Fat % and Eating Behavior as Measured by the Three Factor Eating Questionnaire-R18

2.1 Introduction

This literature review includes the subjects of eating behaviour, the three factor eating questionnaire and body mass index. The subtopics are the three factors of the questionnaire: cognitive restraint, emotional eating and uncontrolled eating. There has been a recent increase in research and general interest in the role of eating behaviours in the prevalence of overweight in the general population. Literature supports the association of an unhealthy Body Mass Index (BMI) with certain eating behaviours. There however has been little to no studies of this kind locally. None at a clinical level at least. There is a need to investigate if these unhealthy eating behaviours are prevalent in Trinidadians and if they are indeed associated with their BMI.

2.2 Eating Behaviour

Eating behaviour as defined by the American National Library of Medicine (2009) as behavioural responses or sequences associated with eating. Ruderman (1986) stated that eating behaviour is the outcome of internalised multidimensional constructs that include behavioural, cognitive and affective components. Similarly Anglé et al. (2009) described the psychology of eating behaviour as the cognitive, behavioural and emotional aspects of eating habits. Cappelleri et al. (2009) identified three types of eating behaviour: uncontrolled eating (UE), emotional eating (EE), and restrictive eating each have its own origin from theories such as externality theory, psychosomatic theory and restraint theory.

Eating behaviour is typically measured by use of questionnaires. Stunkard and Messick's (1985) Three Factor Eating Questionnaire (TFEQ) is one of the most popular questionnaires used. Two other questionnaires are commonly used, the Dutch Eating Behaviour Questionnaire (DEBQ) and the Restraint Scale. These have been used in studies pertaining to obese populations. The TFEQ is a self-assessment scale used extensively in studies of eating behaviour in overweight and normal weight individuals Lindroos et al. (1997), Annunziato et al. (2007). The original version of the TFEQ was contained 51 questions. It was then shortened to an 18 question version (TFEQ-R18) with a revised three-factor structure on the basis of cognitive restraint (CR) (the conscious restriction of food intake in order to control body weight or to promote weight loss), UE (the tendency to eat more than usual because of loss of control over intake accompanied by subjective feelings of hunger), and EE (overeating during unhappy mood states/inability to resist emotional cues) Karlsson et al. (2000).

This was developed from a study in Sweden on severely obese subjects Karlsson et al. (2000), and has been used in Sweden and France Elfhag, Linne (2005), de Lauzon et al. (2004) and with a student sample Hyland et al. (1989), with evidence to suggest that the instrument can be used to distinguish eating behaviours in non-obese as well as obese populations Cappelleri et al. (2009).

2.3 The Three Factors of the TFEQ

2.3.1 Cognitive restraint/Dietary restraint

The term restraint, dietary restraint, restrained eating, or cognitive restraint, has been one of the most central and debated concepts in the study of human eating behavior since the restraint theory of obesity. Restraint refers to a tendency to constantly and consciously restrict one's food intake instead of using physiological cues of hunger and satiety as regulators of food intake. Dieting and restrained

eating are not one and the same. Restrained eaters consume less food than they would like to eat but not necessarily less than they need to maintain energy balance Anglé et al (2009). De Lauzon et al. (2006) noted that in modern societies characterized by abundant and easily accessible foods, restrained eating may become an adaptive behavior to limit weight gain. Many authors seem to speculate that this eating behavior's success may be short lived and may lead to long term excessive weight gain Herman and Mack (1975), Polivy (1999), Westenhoefer (1994), Lluich et al. (2000). Before the use of the TFEQ, Herman and Polivy's restraint scale (RS) was widely used to evaluate obese patients since there was a high correlation between restraint scores and severity of obesity Boschi et al. (2001). Many criticisms have since arisen concerning the RS's lack of differentiation between items of the scale pertaining to the anxiety of body weight fluctuation and the anxiety of dieting, and lack of distinction between restraint and disinhibition. The TFEQ overcomes these limitations by separating CR, UE and EE Boschi et al. (2001). In the original version of the TFEQ Bond et al. (2001) breaks down the restraint scale into three subscales: strategic dieting behavior, attitude to self-regulation, and avoidance of fattening foods. Westenhoefer (1999) offered a different break down of cognitive restraint, dividing it into 2 subscales depending on its relationships with both BMI and disinhibition or UE. The subscales were flexible control, a more relaxed version of restraint associated with both low UE and low BMI, and rigid control, a more severe restrictive state associated with both high UE and high BMI.

2.3.2 Uncontrolled Eating (UE) or Disinhibition

The term disinhibition means compulsive eating when one loses control. High disinhibition scores in the TFEQ have been associated with overeating and binge eating in obese subjects Laessle et al. (1989). According to Anglé et al (2009) uncontrolled eating refers to a tendency to overeat with the feeling of being out of control. De Lauzon et al. (2004) adds to this definition stating UE as the tendency to eat more than usual due to loss of control over intake accompanied by subjective feelings of hunger.

High disinhibition has been related to women with higher BMI's Boschi et al. (2001). Questions asked pertaining to UE in the questionnaire describe habitual and situational susceptibility to disinhibition Bond et al. (2001).

2.3.3 Emotional Eating

Cappelleri et al. (2009) described emotional eating (EE) as overeating during dysphoric mood states. De Lauzon et al. (2004) reported that the inability to resist emotional cues and has been associated with the consumption of snack foods especially fatty and salty foods. Karlsson et al. (2000) defines EE as the tendency to eat in response to negative emotions. Anglé et al. (2009) and Lluch et al. (2000) associate higher scores of EE with a higher BMI.

2.4 Body mass index (BMI)

Mahan and Escott-Stump (2008) define BMI as the degree of adiposity measured as weight (kg)/height (m)². It is a validated measure of nutrition status and can indicate over-nutrition and under-nutrition. The BMI does not measure body fat but correlates with the direct body fat measures such as underwater weighing and dual x-ray absorptiometry. The classification of BMI is standard for an adult as < 18.5 as underweight, 18.5-25.9 as normal, between 25 and 29 as overweight and ≥ 30 as obese. Obesity is broken down further into 3 classes: class 1 is 30-34.9, class 2 is 35-39.9 and extreme obesity class 3 is ≥40 NIH, NHLBI (1998). As mentioned above higher BMI is positively associated with high uncontrolled eating and emotional eating Anglé et al. (2009) and Lluch et al. (2000). Research has found that women with high restraint scores are similar to those with low restraint scores in terms of BMI and age, whereas those with low restraint and high disinhibition scores tend to have the highest BMIs Boschi et al. (2001).

2.5 Obesity

World Health Organization's (WHO) definition of obesity is having a BMI of over 30kg/m². BMI or body mass index is defined as the weight in kg divided by the square of the height in meters. This is an equation used to assess overweight and obesity and can also be used to assess underweight. According to Ravussin et al, (1993) the central tenet of the etiology of obesity is that excessive body weight is the result of long term positive energy balance caused by energy intake exceeding expenditure for physical activity and metabolic processes thereby leading to the deposition of excess body fat.

Globally obesity has reached epidemic proportions with more than 1 billion adults overweight, including over 300 million being clinically obese. This is a major contributor to the global burden of chronic disease and disability WHO (2010). Obesity is a major public health problem of affluent countries and is becoming increasingly prevalent in many developing societies James (1996). In the Caribbean obesity has increased by 400% in 2 decades, this swift increase is alarming. It is now the most significant underlying cause of death in the region and there is a wide range of consequent illnesses among those who survive Fitzroy (2004). Socioeconomic and demographic transformations have occurred in the Caribbean and this epidemiologic transition is typically accompanied by changes in dietary and nutrition patterns Popkin (1994). Superimposed onto a predisposed genotype are considerable increases in levels of obesity Bouchard (1996). The consequences of nutrition transition are increased levels of obesity and chronic degenerative conditions Jackson (2001), see Figure 1.

It is common knowledge now that obesity is the major risk factor for heart disease, cancer, stroke and diabetes, the top four causes of death in the Caribbean. In our region the ratio of deaths between chronic non-communicable and communicable diseases in 2001 was at 2:1, but in the following

10-15 years it is estimated that the ratio will increase depending on what interventions we put in place now to combat obesity and its co-morbidities Fitzroy (2001).

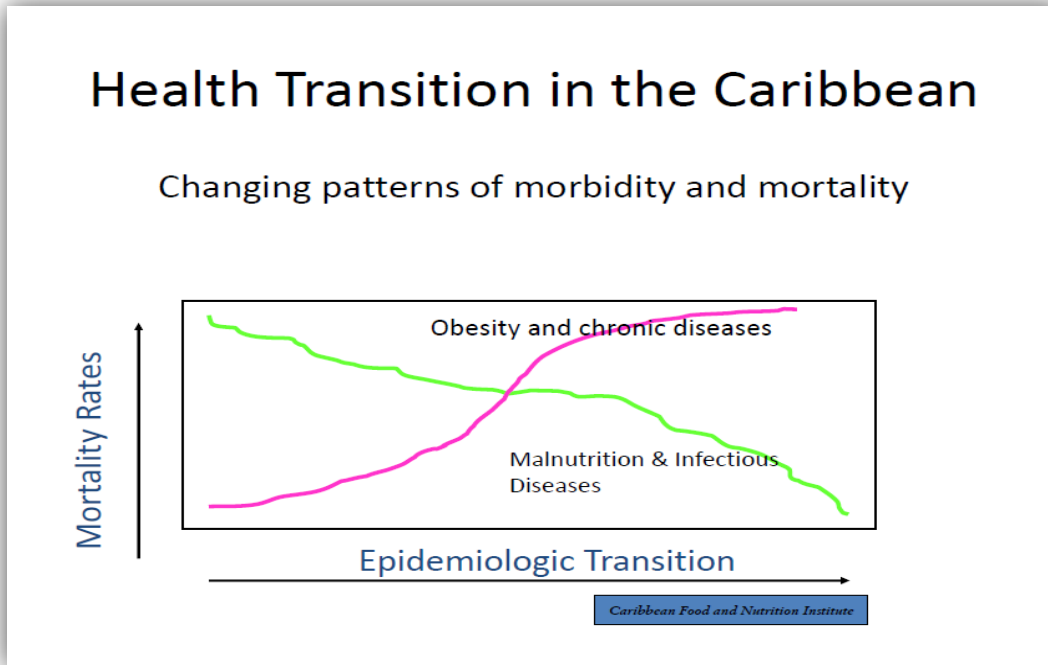


Figure 1. Health Transition in the Caribbean: Changing Patterns of Morbidity and Mortality

Source: Caribbean Food and Nutrition Institute

Ogden et al. (2007) said because of the dramatic increase of worldwide prevalence of obesity over the last decade, there is an urgent need to better understand the eating behaviors in humans and how obesity might be treated. De Lauzon et al. (2004) agreed suggesting that to better understand interactions between eating and health and to develop nutritional prevention programs in the context of the global obesity epidemic, better knowledge of the different eating behaviors and their prevalence in the general population would be helpful.

METHODS

3.1 Study Population

The target population for this study was university students in Trinidad. The study population consisted of the students of the University of the West Indies St. Augustine campus. UWI was chosen out of the 3 main tertiary education institutions in Trinidad because it has the largest population of students. The size of the population was 118 students. The study included both male (58) and female (60) students from 5 faculties whether fulltime, part-time, evening university, and post graduate students were not specified. Exclusion criteria: foreign nationals.

3.2 Sampling and Procedure

For the survey, the subjects were selected using probability proportional to size of each faculty by using UWI St. Augustine Student Statistics 2009/2010 Table 2 Total Enrolment by Faculty and Territory (including off-campus students). Data were collected during the month of October 2010 by use of a questionnaire. Students were approached in common student areas around campus and 120 students gave their informed consent. Two male participants were excluded due to the inability to get readings of body mass index (BMI) and body fat percentage (BF %) from the scale used to measure all participants. For both subjects the body composition values were outside the measurement range. All anthropometric data was measured by one person trained in the operation of the equipment.

3.3 Data Collection

3.3.1 Data Collection Instrument

A questionnaire of 39 items was the instrument used to collect data. (See Appendix I)

Three Factor Eating Questionnaire (TFEQ)

Eighteen of the 39 items on the questionnaire are from a frequently used questionnaire in the analysis of eating behaviors, the TFEQ-R18 (revised version 18) Karlsson et al. (2000). This is a shortened and revised version of the original 51 item instrument developed by Stunkard and Messick (1985). The questionnaire refers to current dietary practice and measures three aspects of eating behavior: restrained eating or cognitive restraint (CR), uncontrolled eating (UE) and emotional eating (EE). It consists of 18 items on a four point response scale consisting of the options (definitely true/ mostly true/ mostly false/definitely false) that measured for instance how true the statement was for the respondent or the frequency of a certain behavior Anglé et al (2009). Answers to each question are given a score between 1 and 4 and item scores are totalled into scale scores for each factor CR, UE and EE. These raw scale scores were converted as recommended by the scoring instructions of the TFEQ-R18 by use of a formula: $[(\text{raw score} - \text{lowest possible raw score}) \div \text{possible raw score range}] \times 100$. The converted scores represent the relative proportion (%) of highest possible raw scores, ranging from 0 to 100, with higher scores in the respective scales indicative of greater CR, UE, or EE.

For the present study a change was made to one question, the first item which read “When I smell a sizzling steak or a juicy piece of meat, I find it very difficult to keep from eating, even if I have just finished a meal.”, was modified to “When I smell a delicious mouth-watering food, I find it very difficult to keep from eating, even if I have just finished a meal.” This was to make the item more suitable to

vegetarians and those who do not eat beef that represent a significant percentage of the general population of Trinidad and Tobago.

The other 21 items consisted of anthropometric data, physical activity and weight loss strategy, weight and health satisfaction, missing breakfast and snacking patterns.

3.3.2 Anthropometric Data

A SECA floor-standing stadiometer was used to measure height in feet and inches with subjects being barefooted. The OMRON® Body Composition Monitor with Scale (model HBF-500) was used to measure weight in pounds, %body fat (%BF), skeletal muscle% and BMI (with values according to World Health Organization (WHO)), while the subjects were barefoot and in the correct body position according to the instruction manual. These were operated by one person trained in their use.

%BF was used as a more accurate measurement of body fat than BMI which is a measure of the entire body weight against height (kg/m^2).

3.4 Statistical Analysis

The SPSS for Windows version 19.0 was used in performing the statistical analyses. Questionnaires were all analyzed by the same researcher. The reliability of the instrument was pre tested for internal consistency using a Cronbach's α coefficient. Pearson's correlation coefficient was used to measure linear relationships among variables. Chi square statistics were used for between group differences of categorical variables. Body mass index and body fat percentage were used as continuous variables individually or as categorical variables when presented as ranges. Before examining the connections between TFEQ-R18 scores and BMI, raw scores of Cognitive Restraint, Uncontrolled Eating and Emotional Eating were converted, as recommended in the scoring instructions of the TFEQ-R18. One-way ANOVAs were used to examine connections between converted Cognitive Restraint, Uncontrolled Eating and Emotional Eating scores and classified BMI.

RESULTS

4.1 Reliability

The reliability coefficients of internal consistency (Cronbach's α) for 2 of the 3 eating behavior scales (Cognitive Restraint and Uncontrolled Eating) were above the 0.70 standard and below the 0.90 upper limit recommended for individual assessment by Karlsson et al.(2000). The scale of Emotional Eating was approaching good internal consistency at Cronbach's α coefficient of 0.697. The lower figure may be due to the small number of items in that scale, being 3 items.

4.2 Characteristics of the study population

Demographic, anthropometric and activity level of the study population by sex are shown in Table 1.1-1.2. The sample consisted of 60 females and 58 males who were all students of the University of the West Indies. Students from the faculty of Law were excluded because they represented less than 1% of the population. The population age ranged from 18-30 years, with 55.1% being 18-20 years old. The majority of the study population were of mixed ethnicity representing 42.4 %, with those of African descent being 39%, East Indian 16.9%, and Caucasian 1.7%.

Table 1.1 Demographics of Study Population

Characteristics	Male (n=58)	Female (n=60)
Age		
18-20 years	56.9	53.3
21-23 years	34.5	30
24-26 years	6.9	10
27-30 years	1.7	6.7
Ethnicity		
African	36.2	41.7
East Indian	25.9	8.3
Caucasian	1.7	1.7
Mixed	36.2	48.3
Religion		
Christian	74.1	76.7
Muslim	1.7	6.7
Hindu	12.1	5.0
Other	12.1	10
Faculty		
Social Sciences	32.8	36.7
Humanities & Education	19	18.3
Science & Agriculture	24.1	21.7
Engineering	15.5	11.7
Medical Science	8.6	11.7

Table 1.2 Body Mass Index, Body Fat%, and Physical Activity by Gender

Characteristics	Male (n=58)	Female (n=60)
BMI		
Underweight	8.6	20.0
Normal	60.3	65.0
Overweight	22.4	8.3
Obese	8.6	6.7
Body Fat%		
Low	6.9	10.0
Normal	48.3	51.3
High	15.5	23.3
Very High	29.3	15.0
Physical Activity/Exercise		
Yes	75.9	48.3
No	24.1	51.7
Level of Exercise		
Vigorous	44.8	13.3
Moderate	34.5	35.0
Sedentary	1.7	10.0
Days per Week Exercise		
Once or Twice/week	32.8	40.0
3 times/week	39.7	25.0
4-5 times/week	6.9	6.7
>5 times/week	1.7	1.7
Never	19.0	26.7

4.3 Body Mass Index (BMI) and Body Fat percentage (BF%)

Body Mass Index (BMI) for 14.4% (n=17) of the study population were in the underweight range (BMI <18.5). The majority of the study population 62.7% (n=74) were of normal weight (BMI 18.5-24.9). BMI of 15.3% (n=18) were in the overweight range (25.0-29.9), and 7.6% (n=9) of the subjects filled the criteria of obesity (BMI ≥30.0). The mean BMI for the total sample was $22.78 \pm \text{s.d. } 4.74$ which is within the normal range.

The mean body fat % of the total sample was $24.99 \pm \text{s.d. } 10.31$, with the means for both male and females being within the normal/healthy percentage of body fat.

Within the sample 20.2% (n = 12) of females and 8.6% (n = 5) of males were underweight. The majority of females in the study 65.0% (n = 39) were of normal weight as well as the majority of males 60.3% (n = 35). There were more overweight males 22.4 % (n = 13) than females 8.3% (n = 5) in the study. The least amount of participants were in the obese group, males making up 8.6% (n = 5) and females 6.7% (n = 4). An Independent sample T test revealed a significant difference between male and female BMIs $p = 0.036$.

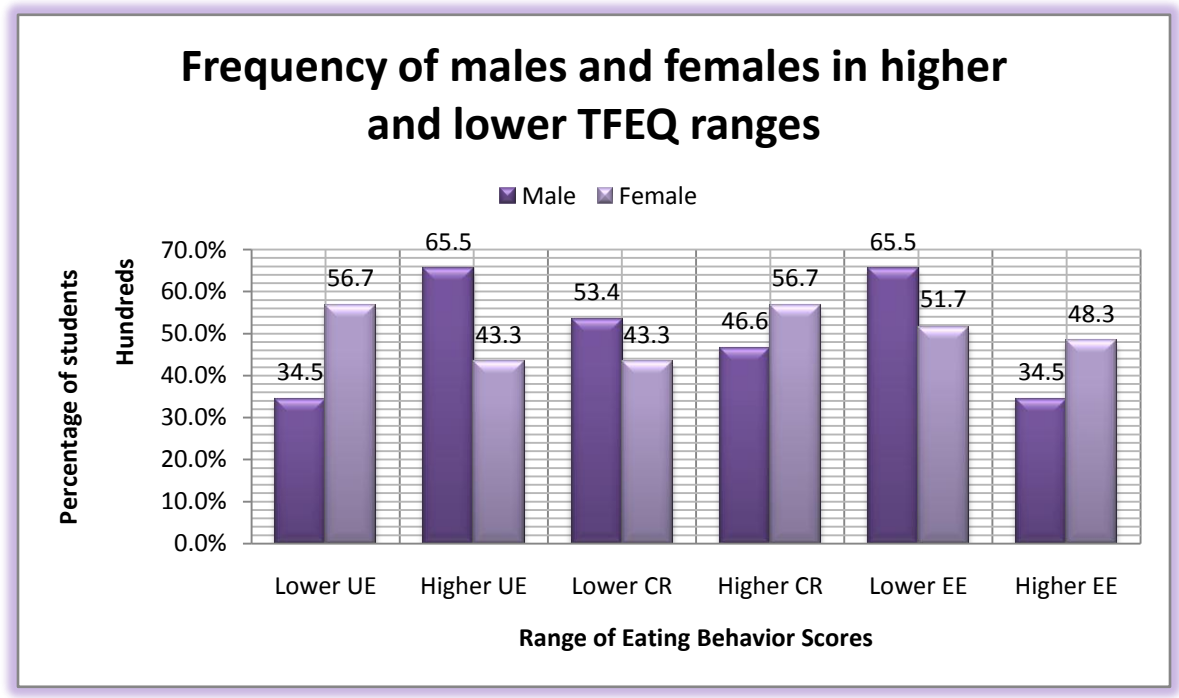
Concerning body fat, 10.0 % (n = 6) of females and 6.9 % (n = 4) of males had a low BF %. Like BMI, the majority of the study population fell into the normal body fat group consisting of 48.3% (n = 28) males and 51.7% (n = 31) females. In the high body fat group there were 23.3% (n = 14) of the females and 15.5% (n = 9) of the males in the study. Finally the very high body fat group was made up of 29.3% (n = 17) of the males and 15.0% (n = 9) of the females in the sample.

4.4 Eating Behaviors :

Cognitive Restraint, Uncontrolled Eating, and Emotional Eating

The frequency of males and females who's scores where either higher or lower in the range for the different eating behaviors is shown in Table 2.

Table 2. Frequency of males and females in higher and lower ranges of cognitive restraint, uncontrolled eating and emotional eating



UE: Uncontrolled Eating, CR: Cognitive Restraint, EE: Emotional Eating

The mean (\pm s.d.) CR score of the study population was 36.1 ± 21.1 , females mean was 37.1 ± 23.1 and males 35.0 ± 19.0 . The mean (\pm s.d.) UE score of the study population was 37.5 ± 18.9 , with females having a mean score of 32.8 ± 17.8 and males 42.3 ± 18.8 . The mean (\pm s.d.) EE score of the study population was 23.9 ± 1.9 , with females having means of 27.6 ± 24.6 and males 20.1 ± 20.5 . Table 3 shows the ranges of scores for each eating behavior factor by gender.

In an Independent sample T test for equality of means between TFEQ converted scores and sex the only significant difference was found between males and females in the uncontrolled eating group $p = 0.005$ (Sig. 2-tailed) mean difference 9.56 ± 3.38 .

Table 3. Ranges of TFEQ scores by gender

Eating Behavior	Minimum Score	Maximum Score	Range
<u>Cognitive Restraint</u>			
Male	0.00	100.00	77.78
Female	0.00	77.78	100.00
Total	0.00	100.00	100.00
<u>Uncontrolled Eating</u>			
Male	7.41	92.59	85.19
Female	3.70	81.48	77.78
Total	3.70	92.59	88.89
<u>Emotional Eating</u>			
Male	0.00	77.78	77.78
Female	0.00	77.78	77.78
Total	0.00	77.78	77.78
<u>Combined Behaviors</u>			
Male	9.26	64.81	55.56
Female	11.11	64.81	53.70
Total	9.26	64.81	55.56

F = female, M = male

4.5 Relationship between BMI and Eating Behaviors

When examining BMI and BF% as continuous variables, BMI, BF% and TFEQ-R18 scores were correlated among the entire sample: the higher the BMI and BF%, the higher the cognitive restraint score ($r = 0.270$, $p < 0.01$ and $r = 0.372$, $p < 0.01$). BMI and BF% were also positively correlated ($r = 0.627$, $p < 0.01$). The negative correlation between BMI and uncontrolled eating was weak and was not statistically significant ($r = -0.128$, $p = 0.167$). However there was a strong negative correlation between BF% and uncontrolled eating behavior ($r = -0.314$, $p < 0.01$).

The results were comparable when BMI was analysed by category, dividing the sample into the underweight (BMI <18.5), the normal weight (BMI $18.5 - 24.9$), the overweight (BMI $25.0 - 29.9$), and the obese (BMI ≥ 30). Among these BMI categories, a significant difference was found only in the mean scores of cognitive restraint (see Table 4). The level of cognitive restraint increased with increasing BMI. Pair-wise comparisons of restraint scores between the BMI categories only reached statistical significance for the comparison of underweight and overweight. The mean scores for emotional eating and uncontrolled eating did not differ significantly between the BMI categories.

Table 4. TFEQ-R18 – scores (mean, s.d.) in the BMI weight categories of Underweight (I), Normal weight (II), Overweight (III), and Obese (IV)

	<i>I</i>	<i>II</i>	<i>III</i>	<i>IV</i>	<i>p-value</i> †	<i>Pair-wise comparisons</i>
	<i>BMI</i>	<i>BMI</i>	<i>BMI</i>	<i>BMI</i>		
	< 18.5	18.5-24.9	25.0-29.9	≥30.0		
	<i>n</i> = 17	<i>n</i> = 74	<i>n</i> = 18	<i>n</i> = 9		
<i>Cognitive Restraint</i>	25.2 (16.1)	35.2 (21.6)	47.2 (22.6)	41.9 (7.4)	0.05	I vs.III* All other pair-wise comparisons NS
<i>Uncontrolled Eating</i>	44.2 (17.4)	35.2 (20.7)	43.6 (12.2)	31.3 (10.2)		All pair-wise comparisons NS
<i>Emotional Eating</i>	31.4 (28.9)	20.8 (20.5)	30.8 (26.3)	20.9 (18.8)		All pair-wise comparisons NS

Cognitive Restraint, Uncontrolled Eating and Emotional Eating each get scores from 0 to100, with higher values indicating more of the behavior.

(N=118)

†= One way ANOVA, * = $p < 0.05$,

NS = (not statistically significant)

There were some different results when BF % was analysed by category. The study population was divided into those with low (BF % female {f} = < 21, male {m} = < 8), normal (BF % f = 21-32.9, m = 8-19.9), high (BF % f = 33-38.9, m = 20-24.9), and very high (BF% f = ≥ 39, m = ≥ 25). Among these four BF % categories, mean scores of uncontrolled eating and cognitive restraint differed significantly (see Table 5). Uncontrolled eating scores were lowest in the normal BF % category and highest in the low BF %

category and the pair-wise difference in this behavioural factor was only significant between these two BF % categories. The connection between cognitive restraint and BF % categories differed to that of uncontrolled eating. Mean scores of cognitive restraint were lowest in the low BF % category and highest in the very high BF % category. Pair-wise comparisons of restraint scores between all BF % categories and the low BF % group reached statistical significance. Also the level of cognitive restraint increased with increasing BF % similar to BMI. The mean scores of emotional eating behavior did not differ significantly between BF % categories.

Table 5. TFEQ-R18 – scores (mean, s.d.) in the body fat % categories of Low (I), Normal (II), High (III), and Very High (IV)

	I	II	III	IV	p-value	Pair-wise comparisons
	BF %	BF %	BF %	BF %		
	f : < 21	f: 21-32.9	f: 33-38.9	f: ≥ 39		
	m : < 8	m : 8-19.9	m : 20-24.9	m : ≥ 25		
	n = 10	n = 59	n = 23	n = 26		
Cognitive Restraint	12.2 (11.9)	34.2 (21.1)	41.5 (18.9)	41.9 (18.5)	<0.01 <0.01 <0.01	I vs. II** I vs. III** I vs. IV** All other Pair-wise comparisons NS
Uncontrolled Eating	52.6 (15.8)	34.6 (19.1)	37.4 (22.1)	38.3 (13.9)	< 0.05	I vs. II* All other Pair-wise comparisons NS
Emotional Eating	30.0 (32.3)	20.2 (21.3)	26.6 (22.9)	27.8 (22.3)		All pair-wise comparisons NS

Cognitive Restraint, Uncontrolled Eating and Emotional Eating each get scores from 0 to100, with higher values indicating more of the behavior. †=One way ANOVA, * = p < 0.05, ** = p < 0.01

(N=118), NS = (not statistically significant)

4.6 Correlations among TFEQ scales

Correlations among the Three Factor Eating Questionnaire scales are presented in Table 6. Cognitive restraint was negatively correlated with uncontrolled eating $r = -0.303$ ($p < 0.01$). Emotional eating was positively correlated with both uncontrolled eating $r = 0.196$ and cognitive restraint $r = 0.193$ with both having a significance level of $p < 0.05$.

Table 6. Intercorrelations among Three Factor Eating Questionnaire scales

<i>TFEQ Scales</i>	<i>Cognitive Restraint</i>	<i>Uncontrolled Eating</i>	<i>Emotional Eating</i>
<i>Cognitive Restraint</i>		$r = -0.303$ 0.001**	$r = 0.193$ 0.036*
<i>Uncontrolled Eating</i>	$r = -0.303$ 0.001**		$r = 0.196$ 0.033*
<i>Emotional Eating</i>	$r = 0.193$ 0.036*	$r = 0.196$ 0.033*	

* $p = 0.05$ (2-tailed), ** $p = 0.01$ (2-tailed)

Pearson's Correlation

4.7 Weight Satisfaction and Current Exercise Level

Forty five percent of the study population stated that they were satisfied with their current weight while 45.8% reported weight dissatisfaction, and 9.3% showed no concern about their weight. Table 7 presents the state of satisfaction with current weight, body fat % and exercise levels between genders. There were no significant relationships among these variables.

Table 7. Satisfaction with current weight, gender, BF%, and exercise level

<i>Variables/Sample</i>	F (46.7%) Satisfied	F (43.3%) Dissatisfied	F (10.0%) Not concerned	M (43.1%) Satisfied	M (48.3%) Dissatisfied	M (8.6%) Not Concerned
<u>Do you exercise?</u>						
Yes	44.8%	41.4%	13.8%	45.5%	45.5%	9.1%
No	48.4%	45.2%	6.5%	35.7%	57.1%	7.1%
<u>Level of Exercise</u>						
Vigorous	62.5%	12.5%	25.0%	53.8%	42.3%	3.8%
Moderate	42.9%	47.6%	9.5%	35.0%	50.0%	15.0%
Sedentary	66.7%	33.3%	0.0%	0.0%	100.0%	0.0%
<u>Exercise times/week</u>						
Once/Twice	50.0%	41.7%	8.3%	31.6%	52.6%	15.8%
3 times	46.7%	33.3%	20.0%	52.2%	43.5%	4.3%
4-5 times	75.0%	25.0%	0.0%	75.0%	25.0%	0.0%
>5 times	100.0%	0.0%	0.0%	0.0%	100.0%	0.0%
Never	31.3%	62.5%	6.3%	36.4%	54.5%	9.1%
<u>Body fat %</u>						
Low	7.1%	15.4%	0.0%	12.0%	3.6%	0.0%
Normal	53.6%	46.2%	66.7%	44.0%	50.0%	60.0%
High	35.7%	11.5%	16.7%	16.0%	17.9%	0.0%
Very High	3.6%	26.9%	16.7%	28.0%	28.6%	40.0%

DISCUSSION

This study examines three aspects of eating behavior (cognitive restraint, uncontrolled eating and emotional eating) of university students and their association to BMI and body fat percentage. The eating behavior of this group is poorly understood particularly in the Caribbean Simpson (2003). The Three Factor Eating Questionnaire- Revised version 18 (TFEQ-R18) was applied as a brief measure of eating behavior. Primarily based on psychometric analyses using data from a Swedish obesity study, Karlsson et al developed a revised version (containing 18 items) of the original 51 question TFEQ. The analysis of TFEQ-R18 data from 118 university students, with varying BMIs produced an internal consistency for 2 of the 3 factors (CR and UE) comparable with that of Karlsson et al (2000). The third factor (EE) was approaching the standard acceptable lower limit of 0.70 Cronbach's α coefficient for reliability. This was similar to reports from the French and Finnish studies Anglé (2009).

The 118 responses collected in this study represented < 1 % of the target population. However the study sample was able to generally reflect the distribution among faculties and equally represent gender.

Eating Behaviors, the TFEQ

The original TFEQ was developed by Stunkard and Messick (1985), consisting of 3 scales of measure for eating behavior namely restraint, disinhibition and susceptibility to hunger. Bond et al. (2001) suggested that the 3 factors of the TFEQ could be broken down into 3 subscales for restraint and disinhibition and 2 for hunger (emotional eating). Preliminary evidence of the validity of these subscales has been available, however relatively few authors have applied them and this study was not suitably powered to make use of subscales Harden et al (2009).

Karlsson (2000) revised the TFEQ, shortening it and defining the factors as cognitive restraint, uncontrolled eating and emotional eating. In the current study, the TFEQ was applied only to study the eating behaviors of university students and not for diagnostic purposes.

There are no definite cut off values for the scales of the TFEQ, it does not define high or low levels of eating behaviors. However it measures continuous variables of eating behavior in a range from a minimum to a maximum. No values with adequate specificity and sensitivity have been found so far to define the presence or absence of a pathologic behavior Boschi et al. (2001).

Females scored in the lower score range of uncontrolled eating, the higher score range of cognitive restraint and the higher score range of emotional eating as compared with males. Males scored in the higher score range of uncontrolled eating, the lower score range of cognitive restraint and the lower score range of emotional eating than females.

The only significant difference was found between genders in the uncontrolled eating group. Sixty six percent of males scored in the higher range compared to forty three percent of females. Findings disagreed with other studies. This may be due to cultural and lifestyle differences among populations. Previous studies showed approximately equal mean scores for uncontrolled eating Cappelleri et al. (2009), Lulch et al. (2000). Higher levels of uncontrolled eating were found to be the most prevalent eating behavior.

The findings were not significant between gender and mean cognitive restraint and emotional eating scores. It should be noted however, that in previous studies there have been significant differences between genders with females scoring higher on the emotional eating and cognitive restraint scales Lulch et al. (2000), Cappelleri et al. (2009), Karlsson et al. (2000), and De Lauzon et al. (2004). Higher restraint scores in women may be related to tendency for dieting De Lauzon et al. (2004).

Intercorrelations among TFEQ scales

The negative association between cognitive restraint and uncontrolled eating was consistent with the literature that provides a greater consensus that any adverse effects of restrained eating are mediated by the disinhibition (uncontrolled eating) effect De Lauzon et al. (2006), Lowe (2002), Polivy and Herman (2002).

Emotional eating was positively related to both uncontrolled eating and cognitive restraint. This was also consistent with the reports by many previous studies De Lauzon et al (2004).

BMI and BF%

The mean BMI findings were in the normal weight range based on WHO criteria; this is comparable with the findings of a similar study of university students by Simpson (2003). Sixty three percent of the sample was in the normal range, fifteen percent were overweight and seven percent were obese. A similar study by Simpson (2003) had comparable results with 60 % normal, 16 % overweight and 10% of subjects being obese.

Males had a greater incidence of overweight (22.4%) and obesity (8.6%) than females (8.3%) and (6.7%) respectively. This was a significant difference and is also comparable to the findings in Simpson's (2003) study where males exhibited significantly higher BMIs than females. However this is not consistent with other Caribbean studies which reported females as consistently having higher BMIs than males (Jackson 2003, Wilks 1999). Though the difference in BF% between genders was not significant it was noted that in the high and very high body fat % categories incidence for males was greater. This

may be related to the majority of males in the study scoring higher in the uncontrolled eating range. These results may be an indicator of rising incidence of overweight and obesity in Caribbean men.

The findings for underweight were also closely related to those of the Mona study, the current study reporting 14 % of students and their study 13%. Simpson (2003) stated that this was twice the amount reported by Monneussee (1997) in a French study. The low prevalence of eating disorders in the Caribbean makes these conditions a questionable suspect for the higher incidence of underweight present here (White and Gardner 2002). Because this finding is similar in two university student studies, the age, sociodemographic status and social characteristics of the sample does not completely exclude the possibility of eating disorders as well as it may suggest that other factors e.g. food insecurity may be causal Simpson (2003). Further studies should be done to investigate if eating disorders are also increasing in the Caribbean.

TFEQ-R18 scores and BMI vs. BF%

Associations between eating behavior and body weight have been researched broadly particularly in the study of obesity. Studies have examined this association in populations with varying weights and have used the TFEQ-R18 as a measure of eating behavior. De Lauzon et al (2006) analysed TFEQ-R18 responses and different measures of adiposity in a French population, over a period of 2 years. Elfhag and Linné (2005) researched eating behavior and relative weight of a Swedish population. Anglé et al (2009) evaluated eating behaviors of a sample of Finnish young adults of varying weights using the TFEQ-R18. However, as far as I am aware there have been no studies of this kind in the Caribbean region that have applied this instrument.

Results showed that of the 3 factors of the TFEQ-R18, cognitive restraint and uncontrolled eating were connected with BMI and BF % respectively. Higher scores of cognitive restraint were associated with a higher BMI. These results are comparable to the Finnish study by Anglé et al. (2009) and the cross-sectional study by Elfhag and Linné (2005). De Lauzon et al. (2006) also had similar results in their cross sectional study on restraint eating and weight gain, it was found that a higher initial BMI was associated with a greater increase in cognitive restraint scores. Restrained eating may be defined as a self-initiated attempt to restrict food intake for the purpose of weight control De Lauzon et al. (2006). This strategy to prevent weight gain may be more prominent in subjects who are prone to put on weight and this has been evident in De Lauzon et al. (2006) study where restrained eating was higher in those with greater adiposity. This was also in line with the results of Lulch et al. (2000). Lulch et al. (2000) suggests that these results may be due to unsuccessful attempts to lose or maintain weight. Dietary restraint does not necessarily have positive dieting outcomes. There is no reason to believe otherwise in this study.

There was a significant difference between underweight and overweight participants pertaining to cognitive restraint. Underweight subjects scored lower in CR and overweight subjects had the highest scores in CR. This may be due to weight dissatisfaction in both groups. These subjects may also have eating disorders that are characterised by bingeing and purging.

An inverse relationship was found uncontrolled eating and BF %. These findings are in contrast to those of Anglé et al. (2009), Boschi et al. (2001) who found no connection between BMI and UE and a positive connection between them respectively. This seems to be the general finding in most of the literature except for Lulch et al. (2000) who also found a negative relationship between overweight and UE only in the girls of the study, and one other study by Wardel et al. (1992). In terms of actual BF % and UE as opposed to BMI, Lawson et al. (1995) found correlation between UE and fat mass. Lawson et al

stated that these conflicting results may reflect the diversity of characteristics of the populations studied.

Among the four body fat % categories mean scores of uncontrolled eating and cognitive restraint differed significantly. The relationships between low BF% and normal BF % were significant in uncontrolled eating behavior category. The normal BF % group had the lowest scores while the low BF% group had the highest. This relates to the previous discussion.

The relationships between all BF % categories and low BF % were significant in the cognitive restraint factor of eating behavior, compared to BMI with only underweight and overweight groups having significant association. This is not supported in other studies. Possible explanations for this are difficult to conceptualize.

Limitations

This study had some limitations. The major limitation was the time constraint for the study which influenced the sample size of 120 subjects. This was not representative of the target population of university students. The scale used to obtain the various body measurements, was only available between the hours of 8:00-3:45 from Monday to Friday. This made the study population limited to the students who could be assessed during those hours, which excluded the majority of evening university students. Therefore the type of student was not specified. Within the literature some comparisons could not be made due to the use of older versions of the questionnaire. This limited some aspects of the discussion. There were also no comparable studies of this kind within the Caribbean region; therefore differences in culture may have lead to ambiguous conclusions.

CONCLUSION and RECCOMENDATIONS

This study reveals novel findings of eating behavior, measured using TFEQ-R18 responses, and their association with BMI and BF% of young adult university students in Trinidad. Healthy eating behaviors exist in the majority of students, however high levels of body fat % and incidence of overweight in male students warrants continuous monitoring. Male university students have a higher incidence of overweight, obesity and very high body fat % than females and this is related to higher uncontrolled eating levels. Uncontrolled eating is the most prevalent eating behavior in this student population. Finding regarding associations of specific eating behaviors with unhealthy weights and body fat percentages can be used in the development of preventative measures for obesity, since they are known to have implications on health status of university students.

Further studies should be designed to investigate the occurrence of eating disorders in the Caribbean since findings indicate increasing trends. Additional studies are needed in the area of eating behaviors in the Caribbean concerning the psychological aspects as well as physiological. Also more research is needed to investigate the possible emerging trend of increased obesity in young male Trinidadians. Initiatives for research and education of students and health promotion activities/programs are recommended.

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APPENDICES

APPENDIX I: Questionnaire

The Three Factor Eating Behaviour Questionnaire and BMI

The Three-Factor Eating Questionnaire—Revised 18-Item

(Place a tick on or circle the answer that best describes you)

1. When I smell a delicious mouth-watering food, I find it very difficult to keep from eating, even if I have just finished a meal.

Definitely true (4)/ mostly true (3)/ mostly false (2)/ definitely false (1)

2. I deliberately take small helpings as a means of controlling my weight.

Definitely true (4)/ mostly true (3)/ mostly false (2)/ definitely false (1)

3. When I feel anxious (worried), I find myself eating.

Definitely true (4)/ mostly true (3)/ mostly false (2)/ definitely false (1)

4. Sometimes when I start eating, I just can't seem to stop.

Definitely true (4)/ mostly true (3)/ mostly false (2)/ definitely false (1)

5. Being with someone who is eating often makes me hungry enough to eat also.

Definitely true (4)/ mostly true (3)/ mostly false (2)/ definitely false (1)

6. When I feel sad, I often overeat.

Definitely true (4)/ mostly true (3)/ mostly false (2)/ definitely false (1)

7. When I see a real delicacy, I often get so hungry that I have to eat right away.

Definitely true (4)/ mostly true (3)/ mostly false (2)/ definitely false (1)

8. I get so hungry that my stomach often seems like a bottomless pit.

Definitely true (4)/ mostly true (3)/ mostly false (2)/ definitely false (1)

9. I am always hungry so it is hard for me to stop eating before I finish the food on my plate.

Definitely true (4)/ mostly true (3)/ mostly false (2)/ definitely false (1)

10. When I feel lonely, I console myself by eating.

Definitely true (4)/ mostly true (3)/ mostly false (2)/ definitely false (1)

11. I consciously hold back at meals in order not to gain weight.

Definitely true (4)/ mostly true (3)/ mostly false (2)/ definitely false (1)

12. I do not eat some foods because they make me fat.

Definitely true (4)/ mostly true (3)/ mostly false (2)/ definitely false (1)

13. I am always hungry enough to eat at any time.

Definitely true (4)/ mostly true (3)/ mostly false (2)/ definitely false (1)

14. How often do you feel hungry?

Only at meal times (1)/ sometimes between meals (2)/ often between meals (3)

/ almost always (4)

15. How frequently do you avoid “stocking up” on tempting foods?

Almost never (1)/ seldom (2)/ usually (3)/ almost always (4)

16. How likely are you to consciously eat less than you want?

Unlikely (1)/ slightly likely (2)/ moderately likely (3)/ very likely (4)

17. Do you go on eating binges though you are not hungry?

Never (1)/ rarely (2)/ sometimes (3)/ at least once a week (4)

18. On a scale of 1 to 8, where 1 means no restraint in eating (eating whatever you want, whenever you want it) and 8 means total restraint (constantly limiting food intake and never “giving in”), what number would you give yourself?

Anthropometric Data/ SES

1. **Faculty:** Social Sciences Humanities & Education Engineering
Science & Agriculture Medical Sciences
2. **Age:** _____
3. **Sex:** Male Female
4. **Ethnicity:** African East Indian Chinese Caucasian Mixed
5. **Religion:** Christian Muslim Hindu Other _____
6. **Height:** _____
7. **Weight:** _____
8. **BMI:** _____
9. **Body Fat %** _____
10. **Skeletal Muscle %** _____

Physical Activity/ Weight Loss

1. Do you engage in regular physical activity/exercise: Yes No

2. If yes what level of exercise?

Vigorous (heavy sweating or a large increase in breathing or heart rate)

Moderate (light sweating with a slight to moderate increase in breathing or heart rate)

Sedentary (Little/No activity)

3. How many days per week do you exercise?

Once/week 3 times/week 5times/week >5 times/week Never

4. How would you describe your current state of health?

Excellent Very good Good Fair Poor

5. Are you satisfied with your current weight?

My weight is ok Too fat Too skinny I don't think of my weight

6. Which of the following are you trying to do?

Lose weight Gain weight Maintain weight Nothing

7. What is your weight loss strategy?

Exercise Diet Diet pills Tried to vomit

Never tried to lose weight

Missed Breakfast/ Snacking

1. Over the past week how many times did you miss breakfast?

Never 1-2 times 3-4 times 5 times or more

2. On the days you missed breakfast what was your reason?

No food at home Don't like eating early Didn't have time to eat

Didn't like what was prepared at home Other _____

3. How often do you usually snack between meals?

Almost never seldom usually almost always

4. When do you snack most?

When I'm with friends (liming) When watching TV

When I'm bored or depressed Just before going to bed

When I'm reading/ studying I don't snack between meals

APPENDIX II: BMI Chart by WHO

Standard Classification of Overweight in Adults by BMI (WHO)

CLASSIFICATION	BMI KG/M²	RISK OF CO-MORBIDITIES
Underweight	<18.5	Low (but risk of other clinical problems increased)
Normal range	18.5–24.9	Average
Overweight	≥25	
Pre-obese	25–29.9	Increased
Obese class I	30.0–34.9	Moderate
Obese class II	35.0–39.9	Severe
Obese class III	≥ 40.0	Very severe

Source: Obesity: preventing and managing the global epidemic: report of a WHO consultation. WHO technical report series; 89, Geneva 2000