International Journal of Pharmaceutical and Bio-Medical Science

ISSN(print): 2767-827X, ISSN(online): 2767-830X

Volume 05 Issue 04 April 2025

Page No : 272-289

DOI: https://doi.org/10.47191/ijpbms/v5-i4-09, Impact Factor: 8.163

Evaluation of Body Mass Index Among Medical Students

Dr. Alaa Mufaq Musleh
Tikrit University college of medicine Department of physiology
Orcid ID: https://orcid.org/0000-0002-5335-4377

ABSTRACT

Background: Body Mass Index (BMI) is a crucial indicator of health status, particularly among medical students who are future healthcare providers. Understanding BMI distribution and its associated factors within this population can inform targeted health interventions.

Objective: This study aimed to evaluate the BMI distribution among medical students at Tikrit University College of Medicine and examine its association with demographic factors, eating habits, and health-related behaviors.

Methods: A cross-sectional study was conducted from August 1st to August 25th, 2023. Data were collected using an online survey administered via Google Forms, with a total of 217 medical students participating. The survey gathered information on demographics, eating habits, and health behaviors. BMI was calculated from self-reported height and weight. Data were analyzed using SPSS version 27, with descriptive statistics and Chi-square tests used to assess associations between variables.

Results: 79.3% females and 20.7% males were recruited into the study The mean BMI among the students was 23.61 (SD = 4.27). The majority of students were in the normal weight category (61%), followed by overweight (23%), obese (8%), and underweight (8%). A significant association was found between marital status and BMI categories ($P < 0.05$), with being married linked to being overweight or obese. However, no significant associations were observed between BMI and other variables such as smoking, alcohol consumption, or dietary habits.

Conclusion: Most medical students at Tikrit University College of Medicine have a normal BMI, but a considerable proportion are overweight or obese, highlighting the need for health promotion strategies. These findings suggest that further interventions may be necessary to address overweight and obesity within this population.

ARTICLE DETAILS

Published On:
30 April 2025

Available on:
https://ijpbms.com/

INTRODUCTION

Global rates of overweight and obesity have more than doubled since 1980, with approximately one-third of the world's population now considered overweight or obese (1). Body Mass Index (BMI) is a measurement that categorizes adults into four groups: underweight, normal weight, overweight, and obese. BMI is used to identify potential future health risks and inform public health policies. The calculation involves dividing the person's weight in kilograms by their height squared in meters (2).

BMI is generally a reliable indicator of body fatness for most people. Research has shown that BMI values are linked to several factors, including a person's genetic predisposition to obesity, as indicated by their family history, which is strongly correlated with BMI in many studies (3,4). As the level and intensity of physical activity increase, there is a corresponding decrease in Body Mass Index (BMI). In other words, more exercise tends to lead to lower BMI (5).

Obesity is consistently linked to various health issues like heart disease, stroke, type II diabetes, several cancers (postmenopausal breast, colon, endometrium, and kidney), hypertension, high cholesterol, osteoarthritis, gallbladder disease, sleep apnea, mental health conditions (depression and anxiety), and poor quality of life (6). A BMI of 25 kg/m² or higher is considered overweight, a BMI of 30 kg/m² or higher is classified as obese, and severe obesity is defined as a BMI of 40 kg/m² or higher (7).

Although obesity is a widespread issue, certain groups, like medical students, may be especially susceptible. Despite being expected to serve as examples of healthy living,

medical students often encounter specific challenges that can lead to unhealthy habits. These challenges include long hours of study, high stress levels, and limited time for exercise and self-care (8). Additionally, medical students are at an increased risk of developing psychological issues, including feeding and eating disorders (FEDs) (9). A study estimated that around 17.35% of medical students exhibit symptoms of feeding and eating disorders (FEDs) (10).

The dietary habits commonly seen among medical students include irregular meal patterns, skipping meals, inadequate intake of fruits and vegetables, high consumption of candies and alcohol, and an excessive intake of fried and fast foods (11). Understanding the prevalence of obesity among medical students is essential for identifying potential risk factors and creating targeted interventions to encourage healthier lifestyles within this group. Various studies from different countries have reported on the prevalence of obesity among medical students, highlighting the importance of addressing this issue (12,13).

Body Fat

Body fat, also referred to as adipose tissue, is a type of loose connective tissue consisting mainly of adipocytes. The primary function of body fat is to store energy, primarily in the form of lipids, while also providing cushioning and insulation for the body (14,15). In humans, body fat is found in various locations, including under the skin, surrounding internal organs, within bone marrow, between muscles, and within breast tissue (16).

Visceral fat, also known as abdominal fat, surrounds internal organs within the abdominal cavity (17), distinct from subcutaneous fat under the skin and intramuscular fat between muscles. In contrast to subcutaneous fat, which is primarily found in the lower body, visceral fat is predominantly located in the abdominal area and has a semi-fluid consistency (18). High levels of visceral fat have been associated with an increased risk of developing type 2 diabetes (19), insulin resistance (20), and various inflammatory conditions (21), as well as other obesity-related health problems (22).

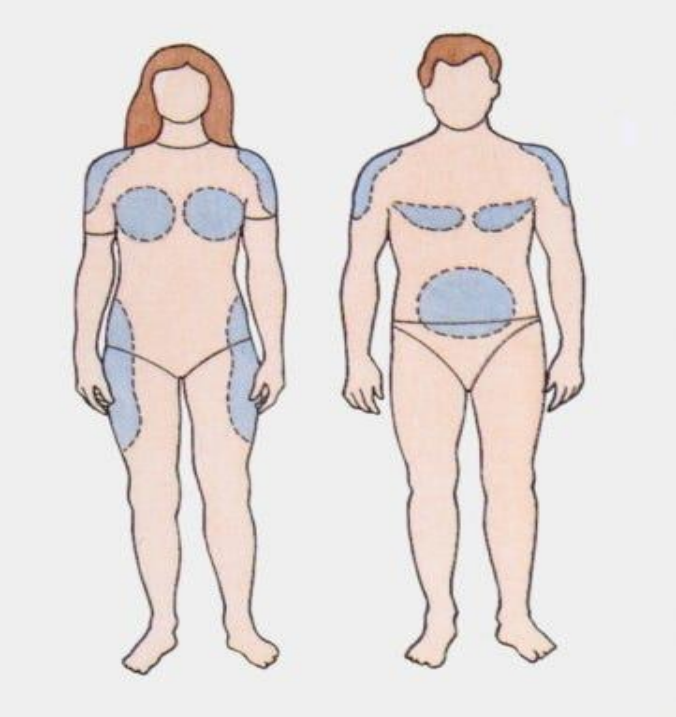

Figure 2.1: Fat Distribution in The Human Body (23).

Body Mass Index

BMI (Body Mass Index) is a calculation that uses an adult's height and weight to categorize them into four groups: underweight, normal weight, overweight, or obese. BMI is a useful tool for identifying potential future health risks and informs public health policies (2).

According to the World Health Organization (7), BMI categories are defined as follows:

Severely underweight: BMI <16 kg/m2
Underweight: 16-18.4 kg/m2
Normal weight: 18.5-24.9 kg/m2
Overweight: 25-29.9 kg/m2
Moderately obese: 30-34.9 kg/m2
Severely obese: 35-39.9 kg/m2
Morbidly obese: BMI ≥40 kg/m2

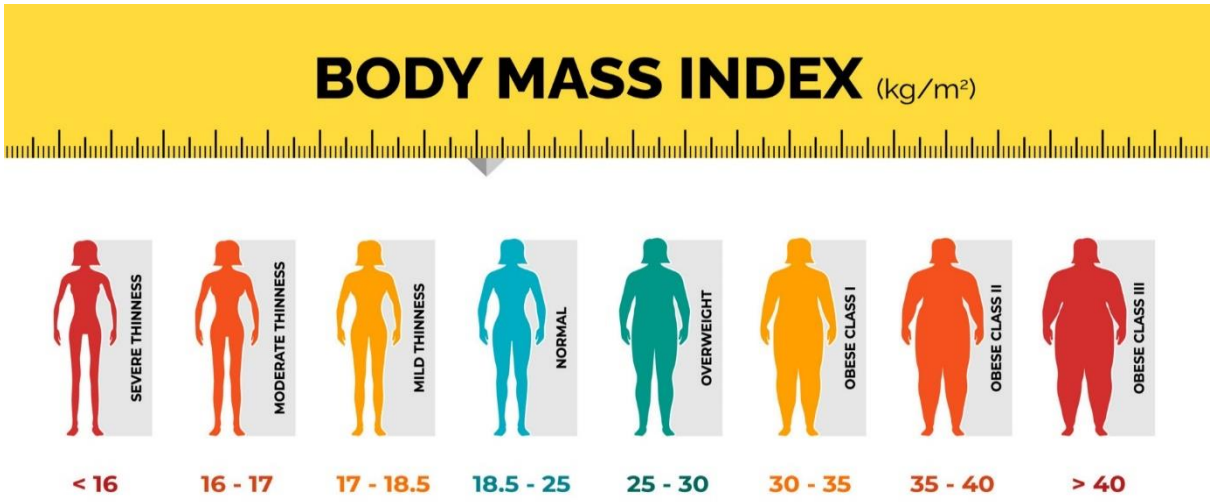

Figure 2.2: Body Mass Index categories (24).

BMI is a useful indicator of relative body fatness, but it does not directly measure body fat percentage. It can be less accurate for individuals with high muscle mass (e.g., athletes or bodybuilders), as BMI tends to overestimate their body fat level. Conversely, it may underestimate excess body fat in those with higher overall body weight (25).

Obesity

Obesity is a medical condition, often classified as a disease, where an excessive amount of body fat accumulates to a level that may harm one's health (26). Individuals are classified as obese when their body mass index (BMI)—calculated by dividing a person's weight by the square of their height—exceeds 30 kg/m² (25).

Obesity is a leading cause of disability and is associated with numerous diseases and conditions, including cardiovascular diseases, type 2 diabetes, obstructive sleep apnea, certain cancers, and osteoarthritis (26,27). Obesity is one of the leading preventable causes of death globally, with rising prevalence among both adults and children (28).

Underweight

Research has shown that the prevalence of underweight among university students is a significant concern worldwide (29). A study found that 12.5% of university students were underweight, highlighting the need for attention to this issue (30).

A broader investigation involving students from 22 universities in low, middle-income, and emerging economy countries revealed an even higher prevalence of underweight among women students, with approximately 17.6% falling into this category (31).

Notably, a study conducted specifically in Malaysia found that 14.8% of medical students were underweight, with the prevalence being slightly lower among males (12.2%) than females (17.0%). This study emphasizes the importance of addressing underweight issues among university students, including those pursuing higher education in medical fields (32).

Epidemiology of Obesity

In 1997, the World Health Organization officially acknowledged obesity as a global epidemic (33). As of 2008, the World Health Organization estimated that over 500 million adults, or more than 10%, were obese, with higher prevalence observed among women compared to men (34).

Between 1980 and 2014, the global prevalence of obesity more than doubled. By 2014, over 600 million adults were obese, accounting for approximately 13% of the world's adult population (35). In 2022, over 1 billion people globally were classified as obese, including 879 million adults and 159 million children. This marks a significant increase, with adult obesity cases more than doubling and child obesity cases quadrupling since 1990 (36).

Risk Factors of Obesity

The "calorie is a calorie" model of obesity suggests that most cases of obesity are caused by a combination of excessive caloric intake and insufficient physical activity (37). Only a small number of obesity cases are primarily due to genetic factors, medical conditions, or psychiatric illnesses (38). In contrast, the rising rates of obesity at a societal level are attributed to the widespread availability of convenient and appealing foods, increased dependence on cars, and mechanized production methods (39–41).

Other factors proposed as contributing to the global rise in obesity include insufficient sleep, exposure to endocrine disruptors, and the increased use of certain medications, such as atypical antipsychotics (42). Additional factors contributing to the rise in obesity include increased ambient temperatures and reduced smoking rates (43). Other contributing factors include demographic changes, older maternal age at first childbirth, environmental impacts on epigenetic regulation, increased phenotypic diversity due to assortative mating, and social pressure to diet (44).

An excessive appetite for palatable, high-calorie foods—particularly those high in fat, sugar, and certain animal proteins—is considered a major driver of global obesity. This

is likely due to imbalances in neurotransmitters that influence the urge to eat (45).

A sedentary lifestyle is thought to be a significant factor in obesity (46). Globally, there has been a substantial shift toward less physically demanding jobs (47,48) and currently, at least 30% of the world's population does not get enough exercise (49). This shift is largely due to the increased use of mechanized transportation and the widespread adoption of labor-saving technologies in the home (47–49). In children, physical activity levels have declined, notably in walking and physical education, likely due to safety concerns, changes in social interactions (such as fewer connections with neighborhood peers), and insufficient urban design (such as a lack of safe public spaces for physical activity) (50).

Obesity, like many other medical conditions, arises from the interaction of genetic and environmental factors (51). It is a prominent characteristic in various syndromes, including Prader-Willi syndrome, Bardet-Biedl syndrome, Cohen syndrome, and MOMO syndrome. The term "non-syndromic obesity" is often used to refer to obesity that occurs without these specific conditions (52). In individuals with early-onset severe obesity—defined as onset before age 10 and a body mass index more than three standard deviations above the norm—7% have a single-point DNA mutation (53).

Obesity among Medical Students

Obesity among medical students is a growing concern globally, with various studies highlighting the prevalence and associated factors. A study in India found that 29.2% of medical students were obese, with 89% of those students skipping meals regularly, and 24.7% never engaging in exercise (54). In Saudi Arabia, a study at Al-Maarefa University revealed a 13.2% prevalence of obesity among medical students, with higher rates observed in clinical year students, particularly among males (55). Interestingly, another study in central India reported a lower obesity prevalence of 7.5%, but highlighted significant associations with male gender, inactivity, and upper socioeconomic status (56). In contrast, a study from North India indicated a much higher prevalence, with 39.09% of students classified as obese based on BMI measurements (57). A study conducted in Indonesia reported that 35.5% of medical students were either overweight or obese, with slightly higher rates observed in private medical schools compared to public ones (58).

Effects and Complications of Obesity

Obesity raises the risk of developing various metabolic disorders, cardiovascular disease, osteoarthritis, Alzheimer's disease, depression, and certain types of cancer (59). Depending on the severity of obesity and the presence of related health conditions, obesity is linked to a reduction in life expectancy by an estimated 2 to 20 years (60).

Compared to their normal-weight colleagues, obese workers generally experience higher rates of absenteeism and take more disability leave, which increases costs for employers and reduces overall productivity (61). Some studies indicate that obese individuals are less likely to be hired and are less frequently promoted compared to their non-obese counterparts (62). Obese individuals typically earn less than their non-obese counterparts for similar jobs. On average, obese women earn 6% less, while obese men make 3% less (46).

Obesity raises the risk of various physical and mental health conditions. These comorbidities are most frequently associated with metabolic syndrome (63). Metabolic syndrome is a combination of medical disorders that includes type 2 diabetes, high blood pressure, high cholesterol levels, and elevated triglycerides (64).

Health consequences of obesity can be categorized into two main groups: those related to increased fat mass, such as osteoarthritis, obstructive sleep apnea, and social stigmatization, and those linked to the higher number of fat cells, including diabetes, cancer, cardiovascular disease, and non-alcoholic fatty liver disease (65).

Increases in body fat can disrupt the body's insulin response, potentially resulting in insulin resistance (65). Additionally, excess fat contributes to a proinflammatory and prothrombotic state (66,67).

Figure 2.3: Diagram of Diseases associated with Obesity (68).

Management of Obesity

The primary treatment for obesity involves weight loss through lifestyle changes, such as following prescribed diets and engaging in physical exercise(37,69–71). Long-term lifestyle changes that reduce calorie intake or increase physical activity generally lead to sustained weight loss, although some gradual weight regain is common over time (72–74). In the short term, low-carbohydrate diets tend to be more effective for weight loss compared to low-fat diets (75). Over the long term, both low-carbohydrate and low-fat diets seem to offer similar benefits for weight loss (76). Encouraging the adoption of Mediterranean diets among individuals with obesity may reduce the risk of heart disease. Reducing the consumption of sugary beverages is also associated with weight loss (75).

Five medications that are beneficial for long-term use in treating obesity are: orlistat, lorcaserin, liraglutide, phentermine-topiramate, and naltrexone-bupropion . These medications result in weight loss ranging from 3.0 to 6.7 kg (6.6 to 14.8 lbs) more than what is achieved with a placebo after one year (77). Orlistat use is linked to a high incidence of gastrointestinal side effects, and there are concerns about potential negative effects on the kidneys (78,79).

In 2019, a systematic review evaluated the impact of different doses of fluoxetine (60 mg/day, 40 mg/day, 20 mg/day, and 10 mg/day) on weight in obese adults. Compared to placebo, all doses of fluoxetine were associated with weight loss but also an increased risk of side effects such as dizziness, drowsiness, fatigue, insomnia, and nausea during treatment (80).

The last effective approach to treating obesity is bariatric surgery (71,81). Surgery for severe obesity is linked to long-term weight loss, enhancement of obesity-related health conditions, and reduced overall mortality (82). However, the benefits to metabolic health primarily stem from the weight loss rather than the surgical procedure itself (83). One study reported weight loss ranging from 14% to 25% at 10 years, depending on the type of procedure, along with a 29% decrease in overall mortality compared to conventional weight loss methods (84). However, complications arise in approximately 17% of cases, and reoperation is required in 7% of cases (82).

Subjects and Methods

Study Design and Setting

The current study is a cross-sectional descriptive analysis conducted at Tikrit University College of Medicine from August 1st to August 25th to evaluate the Body Mass Index (BMI) among medical students and examine its association with various demographic factors, eating habits, and health-related behaviors.

Study Population

The study population consisted of medical students enrolled in Tikrit University College of Medicine. All students attending the college were eligible to participate in the survey. A total of 237 students participated, out of which 217 students fully completed the survey and were included in the analysis. Incomplete responses were excluded from the study. The sampling methods was convenience sampling.

Data Collection

Data were collected using an online survey administered via Google Forms. The survey link was distributed to the students through social media platforms commonly used by the student body. Participation in the survey was voluntary, and informed consent was obtained from all participants before they proceeded with the survey.

The survey was designed to collect data on the following variables:

Demographic Information: Including sex, age, marital status, family income, residence type, and academic year.

BMI Measurement: Students were required to self-report their height and weight, which were then used to calculate BMI using the following formula

$$\frac{\text{weight in kilograms}}{\text{height in meters}^2}$$

Eating Habits: The survey included questions on the number of meals per day, frequency of fast food consumption, primary source of food, consumption of sweets, and soft drinks.

Health and Habits: Questions addressed smoking status, alcohol consumption, presence of chronic diseases, gastrointestinal (GI) disorders, daily study hours, hours of sleep per day, daily physical activity, and exercise habits.

Data Organization and Management

The data collected through Google Forms were automatically recorded in a Google Sheets spreadsheet. Upon completion of the data collection period, the data were downloaded and organized in Microsoft Excel 2020 for preliminary cleaning and coding. The variables were labeled appropriately, and any inconsistencies or missing values were addressed. Descriptive statistics were calculated to summarize the characteristics of the study population.

Data Description and Analysis

Data analysis was performed using SPSS version 27. The analysis included both descriptive and inferential statistics:

Descriptive Statistics: Frequencies and percentages were calculated for categorical variables, such as sex, marital status, and BMI categories.

Inferential Statistics: The Chi-square test was used to assess the association between BMI categories and various demographic, dietary, and health-related factors. A P-value of less than 0.05 was considered statistically significant.

Ethical Considerations

The study was conducted in accordance with the ethical standards of the Tikrit University College of Medicine. Participation in the survey was anonymous, and no personally identifiable information was collected, all responses were kept confidential. The data were used solely for the purpose of this research and were not shared with any third parties.

RESULTS

As shown in table 4.1, the study included a total of 217 medical students. The demographic distribution of the study population is summarized in Table 4.1. Most of the participants were female, accounting for 79.3% (n=172) of the sample, while males represented 20.7% (n=45). In terms of age distribution, most participants were between 20-22 years old (38.7%, n=84) and 22-24 years old (38.2%, n=83). A smaller proportion of the population was aged 18-20 years (16.6%, n=36) and over 24 years (6.5%, n=14).

The marital status of the participants was predominantly single, with 96.3% (n=209) of the students reporting being unmarried, while 3.7% (n=8) were married. Regarding family income, a significant majority of the students reported moderate family income (85.7%, n=186). High family income was reported by 11.5% (n=25) of the participants, while a small percentage (2.8%, n=6) indicated low family income.

The residence type showed that 63.1% (n=137) of the students lived with their families. A further 34.1% (n=74) resided in dormitories, and only 2.8% (n=6) lived with relatives. The academic year distribution indicated that the largest group of students were in their fifth year (39.2%, n=85), followed by those in their fourth year (21.2%, n=46). Students in the sixth year made up 16.1% (n=35), while those in the second year comprised 14.7% (n=32). The third-year students accounted for 7.4% (n=16), and the smallest group was first-year students, constituting 1.4% (n=3) of the sample.

Table 4.1: Demographic data of study population (N=217)

Variable		Count	N %
Sex	Female	172	79.3%
	Male	45	20.7%
Age	18-20	36	16.6%
	20-22	84	38.7%
	22-24	83	38.2%
	>24	14	6.5%
Marital status	Single	209	96.3%
	Married	8	3.7%
Family income	Low	6	2.8%
	Moderate	186	85.7%
	High	25	11.5%
Residence type	With Family	137	63.1%
	With Relatives	6	2.8%
	Dorm	74	34.1%
Academic year	First	3	1.4%
	Second	32	14.7%
	Third	16	7.4%
	Forth	46	21.2%
	Fifth	85	39.2%
	Sixth	35	16.1%
Total		217	100%

The distribution of Body Mass Index (BMI) values among the study population is depicted in Figure 4.1. The histogram reveals a near-normal distribution of BMI values, with a mean BMI of 23.61 and a standard deviation of 4.27. The range of BMI values extends from approximately 15 to over 35 kg/m2.

The majority of students have BMI values clustered around the mean, with the highest frequency of students having a BMI between 20 and 25 indicating that most students fall within the normal weight categories.

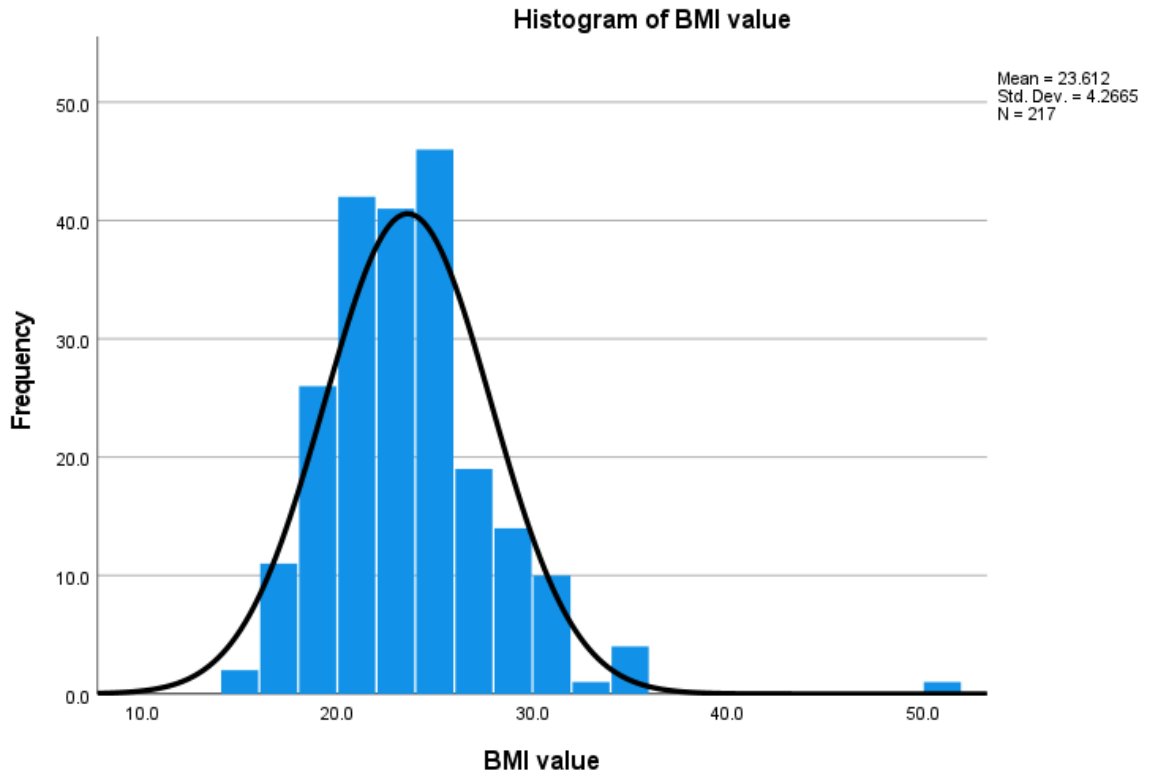

Figure 4.1: Histogram demonstrating the distribution of BMI values among medical students

Figure 4.2 illustrates the distribution of BMI categories among the medical students in the study. Many students, comprising 61% of the population, fall within the normal weight category (18.5 - 24.9 kg/m2). A significant portion, 23% of the students, are classified as overweight (25.0 - 29.9 kg/m2) and approximately 8% of the students are categorized as obese (≥ 30.0 kg/m2). Another 8% of the students are underweight (< 18.5 kg/m2).

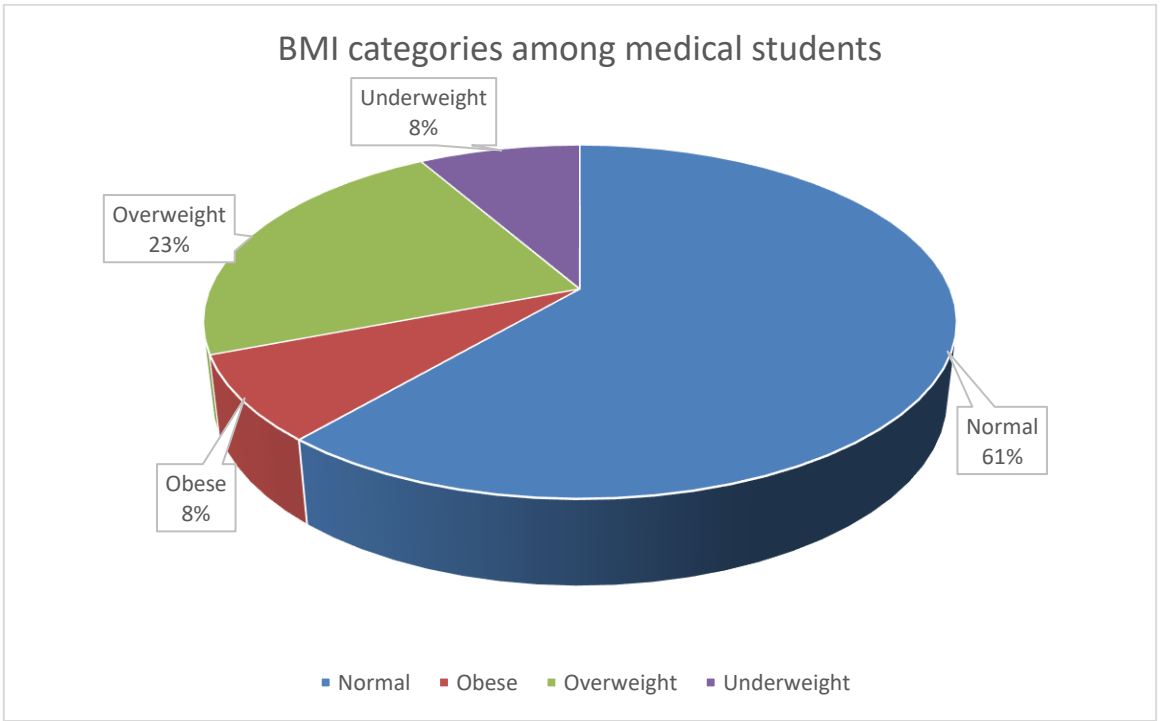

Figure 4.2: BMI Categories among Medical Students.

Table 4.2 presents the association between various demographic variables and BMI categories among the medical students. The analysis was conducted using the Chi-square test to determine the significance of the associations. The distribution of BMI categories between females and males did not show a statistically significant association ($X^2 = 2.7$, $P > 0.05$). Although a higher number of females (n=110) fell into the normal weight category compared to males (n=23), the proportions of overweight or obese individuals were relatively similar between the sexes.

The relationship between age groups and BMI categories was also not statistically significant ($X^2 = 7.3$, $P > 0.05$). The distribution of overweight or obese students was consistent across the different age groups.

There was no statistically significant association between family income and BMI categories ($X^2 = 2.6$, $P > 0.05$). The distribution of overweight or obese students did not differ significantly across income levels. The type of residence did not significantly influence BMI category distribution ($X^2 = 6.1$, $P > 0.05$). The association between academic year and BMI categories was not statistically significant ($X^2 = 11.6$, $P > 0.05$).

A significant association was observed between marital status and BMI categories ($X^2 = 12.8$, $P < 0.01$). All married students who were not in the normal BMI category fell into the overweight or obese category (n=7), while most single students were in the normal weight category (n=132) as demonstrated in figure 4.3.

Table 4.2: Association between Demographic Data and BMI categories (N=217)

Variable		BMI Category			Chi-square / P-value
		Underweight	Normal	Overweight or Obese	
Sex	Female	14	110	48	$X^2=2.7$ / P>0.05 N.S.
	Male	4	23	18	
Age	18-20	2	25	9	$X^2=7.3$ / P>0.05 N.S.
	20-22	9	49	26	
	22-24	7	53	23	
	>24	0	6	8	
Marital status	Married	0	1	7	$X^2=12.8$ / P<0.01**
	Single	18	132	59	
Family income	Low	0	3	3	$X^2=2.6$ / P>0.05 N.S.
	Moderate	15	117	54	
	High	3	13	9	
Residence type	Dorm	7	48	19	$X^2=6.1$ / P>0.05 N.S.
	With Family	10	84	43	
	With relatives	1	1	4	
Academic year	First	0	3	0	$X^2=11.6$ / P>0.05 N.S.
	Second	1	21	10	
	Third	1	12	3	
	Forth	5	24	17	
	Fifth	11	50	24	
	Sixth	0	23	12	

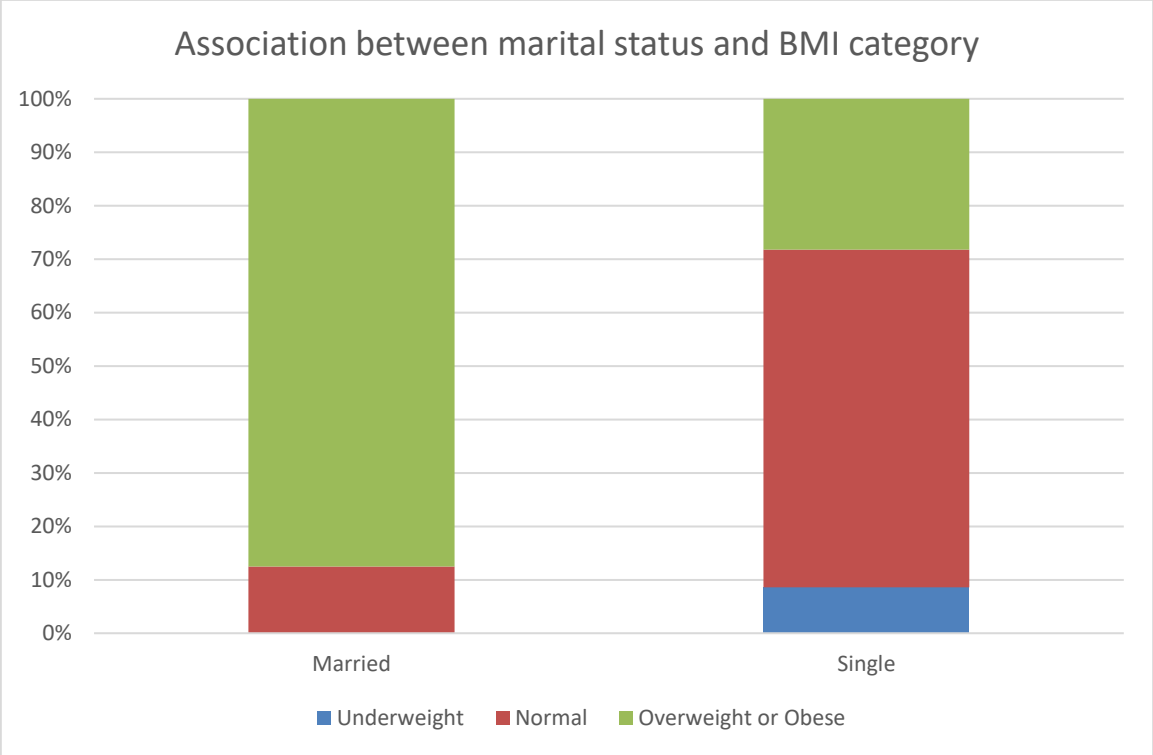

Figure 4.3: Association between marital status and BMI category

Table 4.3 provides an overview of the eating habits among the medical students in the study. Most students reported consuming three meals per day, with 49.3% (n=107) of the population falling into this category. A significant portion, 36.4% (n=79), consumed two meals per day. A significant majority of students consumed fast food 1 to 2 times per week, accounting for 55.8% (n=121) of the population. About 21.2% (n=46) reported consuming fast food multiple times per week, and a smaller group (20.7%, n=45) stated they rarely ate fast food. The students' primary dietary habits were almost evenly split between carnivorous and herbivorous diets. A large majority of students (86.6%, n=188) reported consuming sweets regularly. Soft drinks were regularly consumed by 70.5% (n=153) of the students.

Table 4.3: Eating habits of study population (N=217)

Variable		Count	N %
Number of meals per day	1 meal	2	0.9%
	2 meals	79	36.4%
	3 meals	107	49.3%
	>3 meals	29	13.4%
Fast food	Rarely	45	20.7%
	1 - 2 times per week	121	55.8%
	Multiple times per week	46	21.2%
	Daily	5	2.3%
Main source of food	Carnivore	119	54.8%
	Herbivore	98	45.2%
Sweets	No	29	13.4%
	Yes	188	86.6%
Soft drinks	No	64	29.5%
	Yes	153	70.5%

Table 4.4 presents the association between various eating habits and BMI categories. The distribution of BMI categories across different meal frequencies did not show a statistically significant association ($X^2 = 5.5$, $P > 0.05$). The same was observed with Fast food, no statistically significant association was found between fast food consumption and BMI categories ($X^2 = 10.5$, $P > 0.05$). The type of primary diet also showed no significant association with BMI categories ($X^2 = 3.6$, $P > 0.05$). The consumption of sweets did not show a statistically significant association with BMI categories ($X^2 = 2.1$, $P > 0.05$). Similar to sweets, soft drink consumption was not significantly associated with BMI categories ($X^2 = 2.1$, $P > 0.05$).

Table 4.4: Association eating habits of study population and BMI Categories (N=217)

Variable		BMI Category			Chi-square / P - value
		Underweight	Normal	Overweight or Obese	
Number of meals per day	1 meal	0	0	2	X^2= 5.5 / P>0.05 N.S.
	2 meals	5	51	23	
	3 meals	10	64	33	
	>3 meals	3	18	8	
Fast food	Rarely	5	28	12	X^2= 10.5 / P>0.05 N.S.
	1 - 2 times per week	8	67	46	
	Multiple times per week	4	34	8	
	Daily	1	4	0	
Main source of food	Carnivore	6	76	37	X^2= 3.6 / P>0.05 N.S.
	Herbivore	12	57	29	
Sweets	No	1	21	7	X^2= 2.1 / P>0.05 N.S.
	Yes	17	112	59	
Soft drinks	No	3	43	18	X^2= 2.1 / P>0.05 N.S.
	Yes	15	90	48	

Table 4.5 provides an overview of various health-related behaviors and habits among medical students. A large majority of the students reported not smoking (90.8%, n=197). A small percentage were passive smokers (5.5%, n=12), and 3.7% (n=8) reported active smoking. Almost all students (99.1%, n=215) reported not consuming alcohol, with only 0.9% (n=2) indicating that they do.

The majority of students (88.0%, n=191) did not report having any chronic diseases, while 12.0% (n=26) did report having a chronic condition. A significant portion of the students reported no GI disorders (73.7%, n=160), while 26.3% (n=57) indicated that they have such conditions.

Most students reported studying between 1-4 hours per day (42.9%, n=93). A smaller proportion studied for 4-6 hours (34.1%, n=74), 6-8 hours (13.4%, n=29), and more than 8 hours per day (9.7%, n=21). The majority of students slept for 7-8 hours per day (46.1%, n=100), while 36.4% (n=79) slept for more than 8 hours.

Most students described their daily physical activity as light (65.4%, n=142). A smaller proportion reported being active (16.6%, n=36), while others described their activity level as little (12.9%, n=28) or felt too tired to engage in physical activity (5.1%, n=11). Regular exercise was reported by 10.6% (n=23) of students, while 49.3% (n=107) exercised irregularly, and 40.1% (n=87) did not exercise at all

.

Table 4.5: Health and habits of study population (N=217)

Variable		Count	N %
Smoking	No	197	90.8%
	Passive smoker	12	5.5%
	Yes	8	3.7%
Alcohol	No	215	99.1%
	Yes	2	0.9%
Chronic disease	No	191	88.0%
	Yes	26	12.0%
GI disorders	No	160	73.7%
	Yes	57	26.3%
Study hours	1-4 hrs.	93	42.9%
	4-6 hrs.	74	34.1%
	6-8 hrs.	29	13.4%
	>8 hrs.	21	9.7%
Hours of sleep per day	5-6 hrs.	38	17.5%
	7-8 hrs.	100	46.1%
	>8 hrs.	79	36.4%
Daily physical activity	Too tired	11	5.1%
	Little	28	12.9%
	Light	142	65.4%
	Active	36	16.6%
Exercise	Non	87	40.1%
	Irregularly	107	49.3%
	Regularly	23	10.6%

Table 4.6 presents the association between various health-related behaviors, habits, and BMI categories among the medical students. The association between smoking status and BMI categories was not statistically significant ($X^2 = 7.9$, $P > 0.05$). Most non-smokers were in the normal weight category (n=125). Among those who smoked, most were in the overweight or obese category, although the numbers were small.

No statistically significant association was found between alcohol consumption and BMI categories ($X^2 = 0.46$, $P > 0.05$). Almost all students reported no alcohol consumption.

The presence of chronic diseases did not show a statistically significant association with BMI categories ($X^2 = 0.87$, $P > 0.05$). Both students with and without chronic diseases were more commonly in the normal weight category. Similarly, there was no significant association between GI disorders and BMI categories ($X^2 = 0.85$, $P > 0.05$).

Study hours were not significantly associated with BMI categories ($X^2 = 5.6$, $P > 0.05$). Students studying 1-4 hours per day had the highest representation in the overweight or obese category, though this was not statistically significant.

The number of hours of sleep per day was not significantly associated with BMI categories ($X^2 = 1.2$, $P > 0.05$). Students who slept 7-8 hours per day were more likely to be in the normal weight category.

There was no statistically significant association between levels of daily physical activity and BMI categories ($X^2 = 10.2$, $P > 0.05$). Most students who reported light activity were in the normal weight category. However, those who were more active had a higher representation in the overweight or obese categories.

A significant association was found between exercise habits and BMI categories ($X^2 = 10.4$, $P < 0.05$). Students who exercised regularly were more likely to be in the normal weight category (n=11) or the overweight or obese category (n=12), whereas those who did not exercise were more likely to be underweight (n=7) or in the normal weight category (n=61).

Table 4.6: Association Health and habits of study population and BMI Categories (N=217)

Variable		BMI Category			Chi-square / P - value
		Underweight	Normal	Overweight or Obese	
Smoking	No	17	125	55	X^2= 7.9 / P>0.05 N.S.
	Passive smoker	0	6	6	
	Yes	1	2	5	
Alcohol	No	18	132	65	X^2= 0.46 / P>0.05 N.S.
	Yes	0	1	1	

Chronic disease	No	17	117	57	X^2= 0.87 / P>0.05 N.S.
	Yes	1	16	9	
GI disorders	No	14	100	46	X^2= 0.85 / P>0.05 N.S.
	Yes	4	33	20	
Study hours	1-4 hrs.	6	54	33	X^2= 5.6 / P>0.05 N.S.
	4-6 hrs.	7	43	24	
	6-8 hrs.	3	20	6	
	>8 hrs.	2	16	3	
Hours of sleep per day	5-6 hrs.	2	26	10	X^2= 1.2 / P>0.05 N.S.
	7-8 hrs.	9	60	31	
	>8 hrs.	7	47	25	
Daily physical activity	Too tired	1	6	4	X^2= 10.2 / P>0.05 N.S.
	little	0	21	7	
	light	12	91	39	
	Active	5	15	16	
Exercise	Non	7	61	19	X^2= 10.4 / P<0.05*
	Irregularly	11	61	35	
	Regularly	0	11	12	

DISCUSSION

High Prevalence of Overweight and Obese Students

The current study demonstrated almost a third of the students in Tikrit university are either overweight (23%) or obese (8%). This is a consistent phenomenon across different regions of the globe. a study conducted in the Bundelkhand region found that 22.31% of medical students were overweight, and 23.18% were obese (85). Similarly, in Indonesia, the prevalence of overweight and obesity was reported to be 35.5%, with higher rates observed in private medical schools compared to public ones (58). research from the Western Balkans found that 12% of medical students were overweight, and 2.3% were obese (86). In other regions, such as Saudi Arabia, a study at Umm Al-Qura University in Makkah reported that 12.6% of female medical students were overweight, and 3.9% were obese (87).

Demographic Factors and BMI

In the current study, the main demographic determinant of BMI was marital status. As almost all married individuals in the study were overweight or obese. This is consistent with other studies that found that BMI is generally higher in married women compared to unmarried women. Additionally, a notable and significant correlation between marriage and BMI was found among women under 40 years old (88). In a systemic review that analyzed 105 studies, 76 of them indicated that married individuals face a higher risk of obesity compared to their unmarried counterparts (89). As couples live together over time, they tend to develop common routines, eating habits, and preferred activities. This increases the likelihood of adopting unhealthy habits together. If one partner gains weight, the other is more likely to gain weight as well (90).

Health and Daily habits and BMI

The findings of this study indicate that eating habits, as measured by the questionnaire, did not show a significant association with BMI among medical students. This result contrasts with other studies that have found strong links between dietary habits and BMI (91). Eating plant-based foods and fish is linked to a lower body mass index (92) Consumption of meat and foods high in carbohydrates is associated with a higher body mass index (93). The discrepancy is likely due to limitations in the study design, particularly the reliance on self-reported data, which did not account for total calorie intake—the primary dietary determinant of BMI.

The cross-sectional design of the study presents inherent challenges, as participants often overestimate or underestimate their caloric intake (94). This makes it difficult to accurately assess the relationship between eating habits and BMI. Self-reported data on diet can be unreliable (95), as it is subject to recall bias and social desirability bias (96), complicating the interpretation for both researchers and participants.

Given these limitations, it is unlikely that significant associations between eating habits and BMI can be observed in a cross-sectional study. Controlled clinical trials, which allow for precise measurement of dietary intake and more rigorous control of variables, are better suited for investigating the impact of eating habits on BMI (97). Such trials can provide a clearer understanding of how specific dietary factors influence weight and help guide more effective interventions.

BMI and Exercise

The study revealed a counterintuitive association between exercise and BMI, where students who self-reported regular exercise were more likely to fall into the overweight

or obese categories. This finding highlights the limitations of using BMI as the sole measure of fitness. BMI does not distinguish between lean body mass and fat mass, meaning that individuals with high muscle mass may have the same BMI as those with higher fat mass (98).

For example, a muscular individual who engages in regular exercise might have a higher BMI due to increased lean body mass, which is actually a positive health outcome. In contrast, an obese individual with the same BMI would have a significantly different body composition, characterized by higher fat content. Therefore, a higher BMI in individuals who exercise regularly may not indicate poor health but rather a greater proportion of muscle, which is beneficial for overall health and fitness.

This limitation suggests that while BMI is a useful general indicator, it should not be relied upon exclusively to assess an individual's health or fitness level (99). More comprehensive measures, such as body composition analysis, would provide a clearer picture of an individual's physical condition and the true impact of exercise on their health (100).

CONCLUSION AND RECOMMENDATIONS

Conclusion

Most students (61%) were within the normal BMI range, while 31% were classified as overweight or obese, and 8% as underweight.

Among the demographic variables, only marital status showed a significant association with BMI categories, with married students more likely to be overweight or obese.

While trends were observed between certain eating habits such as meal frequency and fast food consumption and BMI, these did not reach statistical significance.

Other health-related behaviors, such as smoking, alcohol consumption, and sleep patterns, did not show significant associations with BMI.

Recommendations

Implement targeted health promotion programs that emphasize balanced nutrition, regular physical activity, and the risks associated with obesity.

Offer seminars on meal planning, reducing fast food intake, and understanding nutritional content.

Encourage regular physical activity by providing access to on-campus fitness facilities and organizing group exercise sessions or sports activities.

Include nutrition and self-care topics in the medical curriculum to prepare future healthcare professionals to manage their health and advise patients effectively.

REFERENCES

I. The GBD 2015 Obesity Collaborators. Health Effects of Overweight and Obesity in 195 Countries over 25 Years. *New England Journal of Medicine*. 2017;377(1): 13–27. https://doi.org/10.1056/NEJMoa1614362.

II. Nuttall FQ. Body Mass Index: Obesity, BMI, and Health: A Critical Review. *Nutrition Today*. 2015;50(3): 117. https://doi.org/10.1097/NT.0000000000000092.

III. Corica D, Aversa T, Valenzise M, Messina MF, Alibrandi A, De Luca F, et al. Does Family History of Obesity, Cardiovascular, and Metabolic Diseases Influence Onset and Severity of Childhood Obesity? *Frontiers in Endocrinology*. 2018;9. https://doi.org/10.3389/fendo.2018.00187.

IV. Sattar A, Baig S, Rehman NU, Bashir MB. FACTORS AFFECTING BMI: Assessment of the effect of sociodemographic factors on BMI In the population of Ghulam Mohammad Abad Faisalabad. *The Professional Medical Journal*. 2013;20(06): 956–964. https://doi.org/10.29309/TPMJ/2013.20.06.1827.

V. Slattery M, McDonald A, Bild D, Caan B, Hilner J, Jacobs D, et al. Associations of body fat and its distribution with dietary intake, physical activity, alcohol, and smoking in blacks and whites. *The American Journal of Clinical Nutrition*. 2000;55(5): 943–949. https://doi.org/10.1093/ajcn/55.5.943.

VI. Markowitz JS. Body Mass Index (BMI). In: Markowitz JS (ed.) *Mortality and Its Risk Factors Among Professional Athletes: A Comparison Between Former NBA and NFL Players*. Cham: Springer International Publishing; 2018. p. 39–49. https://doi.org/10.1007/978-3-319-77203-5_5. [Accessed 21st August 2024].

VII. WHO. *Obesity and overweight*. https://www.who.int/news-room/fact-sheets/detail/obesity-and-overweight [Accessed 21st August 2024].

VIII. Cruz-Domínguez M del P, González-Márquez F, Ayala-López EA, Vera-Lastra OL, Rendón GHV, Zarate-Amador A, et al. Overweigth, obesity, metabolic syndrome and waist/height index in health staff. *Revista Médica del Instituto Mexicano del Seguro Social*. 2015;53(S1): 36–41.

IX. Fekih-Romdhane F, Daher-Nashif S, Alhuwailah AH, Al Gahtani HMS, Hubail SA, Shuwiekh HAM, et al. The prevalence of feeding and eating disorders symptomology in medical students: an updated systematic review, meta-analysis, and meta-regression. *Eating and weight disorders: EWD*. 2022;27(6): 1991–2010. https://doi.org/10.1007/s40519-021-01351-w.

X. Alzahrani SH, Saeedi AA, Baamer MK, Shalabi AF, Alzahrani AM. Eating Habits Among Medical Students at King Abdulaziz University, Jeddah, Saudi Arabia. *International Journal of General Medicine*. 2020;13: 77–88. https://doi.org/10.2147/IJGM.S246296.

XI. Bede F, Cumber SN, Nkfusai CN, Venyuy MA, Ijang YP, Wepngong EN, et al. Dietary habits and nutritional status of medical school students: the case of three state universities in Cameroon. *The Pan African Medical Journal*. 2020;35(15). https://doi.org/10.11604/pamj.2020.35.15.18818.

XII. Thomas E, M G. Prevalence and Determinants of Overweight and Obesity among Medical Students. *National Journal of Physiology, Pharmacy and Pharmacology*. 2019;10(1): 42–42. https://doi.org/10.5455/njppp.2020.10.1035506112019.

XIII. Asghar A, Masood Shah A, Ali Hussain A, Tahir A, Asghar H. Frequency of Pre-obesity and Obesity in Medical Students of Karachi and the Predisposing Lifestyle Habits. *Cureus*. 2019;11(1): e3948. https://doi.org/10.7759/cureus.3948.

XIV. Ye RZ, Richard G, Gévry N, Tchernof A, Carpentier AC. Fat Cell Size: Measurement Methods, Pathophysiological Origins, and Relationships With Metabolic Dysregulations. *Endocrine Reviews*. 2022;43(1): 35–60. https://doi.org/10.1210/endrev/bnab018.

XV. Birbrair A, Zhang T, Wang ZM, Messi ML, Enikolopov GN, Mintz A, et al. Role of Pericytes in Skeletal Muscle Regeneration and Fat Accumulation. *Stem Cells and Development*. 2013;22(16): 2298–2314. https://doi.org/10.1089/scd.2012.0647.

XVI. Aarsland A, Chinkes D, Wolfe R. Hepatic and whole-body fat synthesis in humans during carbohydrate overfeeding. *The American Journal of Clinical Nutrition*. 2000;65(6): 1774–1782. https://doi.org/10.1093/ajcn/65.6.1774.

XVII. Frey M. *How to Use Quick Body Measurements to Calculate Body Fat Percentage*. Verywell Fit. https://www.verywellfit.com/how-to-use-body-fat-percentage-calculator-3858855 [Accessed 22nd August 2024].

XVIII. LeWine HE. *Abdominal fat and what to do about it*. Harvard Health. https://www.health.harvard.edu/staying-healthy/abdominal-fat-and-what-to-do-about-it [Accessed 22nd August 2024].

XIX. Montague CT, O'Rahilly S. The perils of portliness: causes and consequences of visceral adiposity. *Diabetes*. 2000;49(6): 883–888. https://doi.org/10.2337/diabetes.49.6.883.

XX. Kern PA, Ranganathan S, Li C, Wood L, Ranganathan G. Adipose tissue tumor necrosis factor and interleukin-6 expression in human obesity and insulin resistance. *American Journal of Physiology-Endocrinology and Metabolism*. 2001;280(5): E745–E751. https://doi.org/10.1152/ajpendo.2001.280.5.E745.

XXI. Marette A. Molecular mechanisms of inflammation in obesity-linked insulin resistance. *International Journal of Obesity*. 2003;27(S3): S46–S48. https://doi.org/10.1038/sj.ijo.0802500.

XXII. Mokdad AH, Ford ES, Bowman BA, Dietz WH, Vinicor F, Bales VS, et al. Prevalence of Obesity, Diabetes, and Obesity-Related Health Risk Factors, 2001. *JAMA*. 2003;289(1): 76. https://doi.org/10.1001/jama.289.1.76.

XXIII. Strumos S. *The Real Way To Lose Fat (Men Vs Women!)*. Medium. 2019. https://medium.com/@sstrumos/the-real-way-to-lose-fat-men-vs-women-b368372cbee7 [Accessed 16th December 2024].

XXIV. *BMI Calculator - Calculate Body Mass Index | How to Use BMI Calculator*. beatXP Blog. https://www.beatxp.com/blog/bmi-calculator-online-and-how-to-use-bmi-calculator/ [Accessed 16th December 2024].

XXV. Zierle-Ghosh A, Jan A. Physiology, Body Mass Index. In: *StatPearls*. Treasure Island (FL): StatPearls Publishing; 2024. http://www.ncbi.nlm.nih.gov/books/NBK535456/ [Accessed 21st August 2024].

XXVI. Powell-Wiley TM, Poirier P, Burke LE, Després JP, Gordon-Larsen P, Lavie CJ, et al. Obesity and Cardiovascular Disease: A Scientific Statement From the American Heart Association. *Circulation*. 2021;143(21): e984–e1010. https://doi.org/10.1161/CIR.0000000000000973.

XXVII. Chiolero A. Why causality, and not prediction, should guide obesity prevention policy. *The Lancet Public Health*. 2018;3(10): e461–e462. https://doi.org/10.1016/S2468-2667(18)30158-0.

XXVIII. *Encyclopedia of Mental Health*. Academic Press; 2015.

XXIX. Cutillas AB, Herrero E, de San Eustaquio A, Zamora S, Perez-Llamas F. Prevalence of underweight, overweight and obesity, energy intake and dietary caloric profile in university students from the region of Murcia (Spain). *Nutrición Hospitalaria*. 2013;28(3): 683–689.

XXX. Olearo B, Del Castillo JMS, Boselli PM, Micó L. Assessment of body composition, through anthropometric and non-anthropometric methods, of university students from Valencia (Spain). *Nutricion hospitalaria*. 2014;30(4): 911–918.

XXXI. Peltzer K, Pengpid S, Samuels TA, Özcan NK, Mantilla C, Rahamefy OH, et al. Prevalence of overweight/obesity and its associated factors among university students from 22 countries. *International journal of environmental research and public health*. 2014;11(7): 7425–7441.

XXXII. Gopalakrishnan S, Ganeshkumar P, Prakash M, Amalraj V. Prevalence of overweight/obesity among

the medical students, Malaysia. *The Medical Journal of Malaysia*. 2012;67(4): 442–444.

XXXIII. Caballero B. The Global Epidemic of Obesity: An Overview. *Epidemiologic Reviews*. 2007;29(1): 1–5. https://doi.org/10.1093/epirev/mxm012.

XXXIV. World Health Organization. *Obesity and overweight*. 2009.

XXXV. FAO, IFAD, UNICEF, WFP, WHO. *The State of Food Security and Nutrition in the World 2017. Building Resilience for Peace and Food Security |Policy Support and Governance| Food and Agriculture Organization of the United Nations*. https://www.fao.org/policy-support/tools-and-publications/resources-details/en/c/1107528/ [Accessed 22nd August 2024].

XXXVI. WHO. *One in eight people are now living with obesity*. https://www.who.int/news/item/01-03-2024-one-in-eight-people-are-now-living-with-obesity [Accessed 21st August 2024].

XXXVII. Lau DCW, Douketis JD, Morrison KM, Hramiak IM, Sharma AM, Ur E, et al. 2006 Canadian clinical practice guidelines on the management and prevention of obesity in adults and children [summary]. *Canadian Medical Association Journal*. 2007;176(8): S1–S13. https://doi.org/10.1503/cmaj.061409.

XXXVIII. Bleich SN, Cutler D, Murray C, Adams A. Why Is the Developed World Obese? *Annual Review of Public Health*. 2008;29(Volume 29, 2008): 273–295. https://doi.org/10.1146/annurev.publhealth.29.020907.090954.

XXXIX. Drewnowski A, Specter S. Poverty and obesity: the role of energy density and energy costs. *The American Journal of Clinical Nutrition*. 2004;79(1): 6–16. https://doi.org/10.1093/ajcn/79.1.6.

XL. Nestle M. Obesity. Halting the obesity epidemic: a public health policy approach. *Public Health Reports*. 2000;115(1): 12–24. https://doi.org/10.1093/phr/115.1.12.

XLI. James WPT. The fundamental drivers of the obesity epidemic. *Obesity Reviews*. 2008;9(s1): 6–13. https://doi.org/10.1111/j.1467-789X.2007.00432.x.

XLII. Masand PS. Weight gain associated with psychotropic drugs. *Expert Opinion on Pharmacotherapy*. 2000;1(3): 377–389. https://doi.org/10.1517/14656566.1.3.377.

XLIII. Baum CL. The effects of cigarette costs on BMI and obesity. *Health Economics*. 2009;18(1): 3–19. https://doi.org/10.1002/hec.1340.

XLIV. Memon AN, Gowda AS, Rallabhandi B, Bidika E, Fayyaz H, Salib M, et al. Have Our Attempts to Curb Obesity Done More Harm Than Good? *Cureus*. 2020; https://doi.org/10.7759/cureus.10275.

XLV. Bojanowska E, Ciosek J. Can We Selectively Reduce Appetite for Energy-Dense Foods? An Overview of Pharmacological Strategies for Modification of Food Preference Behavior. *Current Neuropharmacology*. 2016;14(2): 118–142. https://doi.org/10.2174/1570159X14666151109103147.

XLVI. Kopelman PG, Stock MJ, [eds.]. *Clinical obesity in adults and children*.. 2nd ed. Malden, Mass: Blackwell Pub; 2005.

XLVII. WHO. *WHO | Obesity and overweight*. https://web.archive.org/web/20081218104805/http://www.who.int/dietphysicalactivity/publications/facts/obesity/en/ [Accessed 22nd August 2024].

XLVIII. Ding Y, Zou R, Judd RL, Zhong J. Effects of Gender Difference on Cardiac Myocyte Dysfunction in Streptozotocin-Induced Diabetic Rats. *Endocrine*. 2006;29(1): 135–142. https://doi.org/10.1385/ENDO:29:1:135.

XLIX. WHO. *WHO | Physical Inactivity: A Global Public Health Problem*. https://web.archive.org/web/20140213190030/http://www.who.int/dietphysicalactivity/factsheet_inactivity/en/index.html [Accessed 22nd August 2024].

L. Salmon J, Timperio A. Prevalence, Trends and Environmental Influences on Child and Youth Physical Activity. In: Tomkinson GR, Olds TS (eds.) *Medicine and Sport Science*. Basel: KARGER; 2007. p. 183–199. https://doi.org/10.1159/000101391. [Accessed 22nd August 2024].

LI. Albuquerque D, Nóbrega C, Manco L, Padez C. The contribution of genetics and environment to obesity. *British Medical Bulletin*. 2017;123(1): 159–173. https://doi.org/10.1093/bmb/ldx022.

LII. Walley AJ, Asher JE, Froguel P. The genetic contribution to non-syndromic human obesity. *Nature Reviews Genetics*. 2009;10(7): 431–442. https://doi.org/10.1038/nrg2594.

LIII. Farooqi IS, O'Rahilly S. Genetics of Obesity in Humans. *Endocrine Reviews*. 2006;27(7): 710–718. https://doi.org/10.1210/er.2006-0040.

LIV. Mehta MD. A STUDY OF PREVALENCE OF OBESITY AMONG MEDICAL STUDENTS AND ITS RELATION WITH FOOD HABITS AND EXERCISE. *INDIAN JOURNAL OF APPLIED RESEARCH*. 2023;

LV. Almadani M, Zeen MA, Alanazi MM, Alshebaily AK, Alhayyaf HH. Prevalence and determinants of obesity among medical students at Al Maarefa University, Saudi Arabia, 2022. *Medical Science*. 2023;27(132): 1–7. https://doi.org/10.54905/disssi/v27i132/e114ms2864.

LVI. Verma A, Chauhan S, Lazarus A, Kale S. A cross-sectional assessment of obesity among medical

students of central India. *Asian Journal of Medical Sciences*. 2024;15(5): 168–172. https://doi.org/10.3126/ajms.v15i5.63561.

LVII. Sharma S, Nuzhat Q, Kumar S. Prevalence of obesity among undergraduate medical students at the tertiary care center of North India. *National Journal of Physiology, Pharmacy and Pharmacology*. 2023;14(5): 1. https://doi.org/10.5455/njppp.2023.13.0946520230 4102023.

LVIII. Diani YH, Novelyn S, Cing JM, Suryowati T, Aritonang CRL, Daroedono E, et al. Prevalence of Overweight and Obesity among Medical Students across Indonesia: A Literature Review. *Asian Journal of Biology*. 2023;18(2): 34–45. https://doi.org/10.9734/ajob/2023/v18i2341.

LIX. Blüher M. Obesity: global epidemiology and pathogenesis. *Nature Reviews Endocrinology*. 2019;15(5): 288–298. https://doi.org/10.1038/s41574-019-0176-8.

LX. Collaboration PS. Body-mass index and cause-specific mortality in 900 000 adults: collaborative analyses of 57 prospective studies. *The Lancet*. 2009;373(9669): 1083–1096. https://doi.org/10.1016/S0140-6736(09)60318-4.

LXI. Neovius K, Johansson K, Kark M, Neovius M. Obesity status and sick leave: a systematic review. *Obesity Reviews*. 2009;10(1): 17–27. https://doi.org/10.1111/j.1467-789X.2008.00521.x.

LXII. Puhl R, Brownell KD. Bias, Discrimination, and Obesity. *Obesity Research*. 2001;9(12): 788–805. https://doi.org/10.1038/oby.2001.108.

LXIII. Haslam DW, James WPT. Obesity. *The Lancet*. 2005;366(9492): 1197–1209. https://doi.org/10.1016/S0140-6736(05)67483-1.

LXIV. Grundy SM. Obesity, Metabolic Syndrome, and Cardiovascular Disease. *The Journal of Clinical Endocrinology & Metabolism*. 2004;89(6): 2595–2600. https://doi.org/10.1210/jc.2004-0372.

LXV. Bray GA. Medical Consequences of Obesity. *The Journal of Clinical Endocrinology & Metabolism*. 2004;89(6): 2583–2589. https://doi.org/10.1210/jc.2004-0535.

LXVI. Dentali F, Squizzato A, Ageno W. The Metabolic Syndrome as a Risk Factor for Venous and Arterial Thrombosis. *Seminars in Thrombosis and Hemostasis*. 2009;35: 451–457. https://doi.org/10.1055/s-0029-1234140.

LXVII. Shoelson SE, Herrero L, Naaz A. Obesity, Inflammation, and Insulin Resistance. *Gastroenterology*. 2007;132(6): 2169–2180. https://doi.org/10.1053/j.gastro.2007.03.059.

LXVIII. Bazire P. *Obesity-related disease*. Dr Bazire. https://drbazire.uk/blog/obesity-related-disease/ [Accessed 16th December 2024].

LXIX. Arnett DK, Blumenthal RS, Albert MA, Buroker AB, Goldberger ZD, Hahn EJ, et al. 2019 ACC/AHA Guideline on the Primary Prevention of Cardiovascular Disease: A Report of the American College of Cardiology/American Heart Association Task Force on Clinical Practice Guidelines. *Circulation*. 2019;140(11). https://doi.org/10.1161/CIR.0000000000000678.

LXX. U.S. Department of Health and Human Services. *2015-2020 Dietary Guidelines | health.gov*. https://health.gov/our-work/nutrition-physical-activity/dietary-guidelines/previous-dietary-guidelines/2015 [Accessed 22nd August 2024].

LXXI. Jensen MD, Ryan DH, Apovian CM, Ard JD, Comuzzie AG, Donato KA, et al. 2013 AHA/ACC/TOS Guideline for the Management of Overweight and Obesity in Adults: A Report of the American College of Cardiology/American Heart Association Task Force on Practice Guidelines and The Obesity Society. *Circulation*. 2014;129(25_suppl_2). https://doi.org/10.1161/01.cir.0000437739.71477.ee.

LXXII. Tate DF, Jeffery RW, Sherwood NE, Wing RR. Long-term weight losses associated with prescription of higher physical activity goals. Are higher levels of physical activity protective against weight regain?2. *The American Journal of Clinical Nutrition*. 2007;85(4): 954–959. https://doi.org/10.1093/ajcn/85.4.954.

LXXIII. Shick SM, Wing RR, Klem ML, McGUIRE MT, Hill JO, Seagle H. Persons Successful at Long-term Weight Loss and Maintenance Continue to Consume a Low-energy, Low-fat Diet. *Journal of the American Dietetic Association*. 2000;98(4): 408–413. https://doi.org/10.1016/S0002-8223(98)00093-5.

LXXIV. Strychar I. Diet in the management of weight loss. *Canadian Medical Association Journal*. 2006;174(1): 56–63. https://doi.org/10.1503/cmaj.045037.

LXXV. Bennett W. Dietary Treatments of Obesity. *Annals of the New York Academy of Sciences*. 2000;499(1): 250–263.https://doi.org/10.1111/j.1749-6632.1987.tb36216.x.

LXXVI. Johnston BC, Kanters S, Bandayrel K, Wu P, Naji F, Siemieniuk RA, et al. Comparison of Weight Loss Among Named Diet Programs in Overweight and Obese Adults: A Meta-analysis. *JAMA*. 2014;312(9): 923. https://doi.org/10.1001/jama.2014.10397.

LXXVII. Heymsfield SB, Wadden TA. Mechanisms, Pathophysiology, and Management of Obesity. Longo DL (ed.) *New England Journal of Medicine*. 2017;376(3): 254–266. https://doi.org/10.1056/NEJMra1514009.

LXXVIII. Wood S. *Diet Drug Orlistat Linked to Kidney, Pancreas Injuries*. Medscape. https://www.medscape.com/viewarticle/740855 [Accessed 22nd August 2024].

LXXIX. Rucker D, Padwal R, Li SK, Curioni C, Lau DCW. Long term pharmacotherapy for obesity and overweight: updated meta-analysis. *BMJ*. 2007;335(7631): 1194–1199. https://doi.org/10.1136/bmj.39385.413113.25.

LXXX. Serralde-Zúñiga AE, Gonzalez Garay AG, Rodríguez-Carmona Y, Melendez G. Fluoxetine for adults who are overweight or obese. Cochrane Metabolic and Endocrine Disorders Group (ed.) *Cochrane Database of Systematic Reviews*. 2019;2022(8). https://doi.org/10.1002/14651858.CD011688.pub2.

LXXXI. Colquitt JL, Pickett K, Loveman E, Frampton GK. Surgery for weight loss in adults. Cochrane Metabolic and Endocrine Disorders Group (ed.) *Cochrane Database of Systematic Reviews*. 2014;2014(10). https://doi.org/10.1002/14651858.CD003641.pub4.

LXXXII. Chang SH, Stoll CRT, Song J, Varela JE, Eagon CJ, Colditz GA. The Effectiveness and Risks of Bariatric Surgery: An Updated Systematic Review and Meta-analysis, 2003-2012. *JAMA Surgery*. 2014;149(3): 275. https://doi.org/10.1001/jamasurg.2013.3654.

LXXXIII. Yoshino M, Kayser BD, Yoshino J, Stein RI, Reeds D, Eagon JC, et al. Effects of Diet versus Gastric Bypass on Metabolic Function in Diabetes. *New England Journal of Medicine*. 2020;383(8): 721–732. https://doi.org/10.1056/NEJMoa2003697.

LXXXIV. Sjöström L, Narbro K, Sjöström CD, Karason K, Larsson B, Wedel H, et al. Effects of bariatric surgery on mortality in Swedish obese subjects. *The New England Journal of Medicine*. 2007;357(8): 741–752. https://doi.org/10.1056/NEJMoa066254.

LXXXV. Niranjan A, Pandey A, Arya V, Takhelchangbam N. Prevalence of obesity and overweight and factors associated with it among medical students of Bundelkhand region: A cross-sectional study. *Asian Journal of Medical Sciences*. 2023;14(10): 96–102. https://doi.org/10.3126/ajms.v14i10.55869.

LXXXVI. Ilić M, Pang H, Vlaški T, Grujičić M, Novaković B. Prevalence and associated factors of overweight and obesity among medical students from the Western Balkans (South-East Europe Region). *BMC Public Health*. 2024;24(1): 29. https://doi.org/10.1186/s12889-023-17389-7.

LXXXVII. Hamed M, Zaghloul A, Halawani SH, Fatani BA, Alshareef B, Almalki A, et al. Prevalence of Overweight/Obesity Associated With Anemia Among Female Medical Students at Umm Al-Qura University in Makkah, Saudi Arabia: A Cross-Sectional Study. *Cureus*. 2024; https://doi.org/10.7759/cureus.57081.

LXXXVIII. Sato K. Relationship between marital status and body mass index in Japan. *Review of Economics of the Household*. 2021;19(3): 813–841. https://doi.org/10.1007/s11150-020-09503-0.

LXXXIX. Nikolic Turnic T, Jakovljevic V, Strizhkova Z, Polukhin N, Ryaboy D, Kartashova M, et al. The Association between Marital Status and Obesity: A Systematic Review and Meta-Analysis. *Diseases*. 2024;12(7): 146. https://doi.org/10.3390/diseases12070146.

XC. Jeffery RW, Rick AM. Cross-Sectional and Longitudinal Associations between Body Mass Index and Marriage-Related Factors. *Obesity Research*. 2002;10(8): 809–815. https://doi.org/10.1038/oby.2002.109.

XCI. Platikanova M, Yordanova A, Hristova P. Dependence of Body Mass Index on Some Dietary Habits: An Application of Classification and Regression Tree. *Iranian Journal of Public Health*. 2022;51(6): 1283–1294. https://doi.org/10.18502/ijph.v51i6.9672.

XCII. Mõttus R, Realo A, Allik J, Deary IJ, Esko T, Metspalu A. Personality traits and eating habits in a large sample of Estonians. *Health Psychology: Official Journal of the Division of Health Psychology, American Psychological Association*. 2012;31(6): 806–814 https://doi.org/10.1037/a0027041.

XCIII. Pfeiler TM, Egloff B. Personality and eating habits revisited: Associations between the big five, food choices, and Body Mass Index in a representative Australian sample. *Appetite*. 2020;149: 104607. https://doi.org/10.1016/j.appet.2020.104607.

XCIV. Brown RE, Canning KL, Fung M, Jiandani D, Riddell MC, Macpherson AK, et al. Calorie Estimation in Adults Differing in Body Weight Class and Weight Loss Status. *Medicine and science in sports and exercise*. 2016;48(3): 521–526. https://doi.org/10.1249/MSS.0000000000000796.

XCV. Ravelli MN, Schoeller DA. Traditional Self-Reported Dietary Instruments Are Prone to Inaccuracies and New Approaches Are Needed. *Frontiers in Nutrition*. 2020;7: 90. https://doi.org/10.3389/fnut.2020.00090.

XCVI. Ottawa (Emeritus) JMLP of EU of. *A Dictionary of Epidemiology*. Oxford University Press, USA; 2000.

XCVII. Mirmiran P, Bahadoran Z, Gaeini Z. Common Limitations and Challenges of Dietary Clinical Trials for Translation into Clinical Practices. *International Journal of Endocrinology and Metabolism*. 2021;19(3). https://doi.org/10.5812/ijem.108170.

XCVIII. Jeong SM, Lee DH, Rezende LFM, Giovannucci EL. Different correlation of body mass index with body fatness and obesity-related biomarker according to age, sex and race-ethnicity. *Scientific Reports*. 2023;13: 3472. https://doi.org/10.1038/s41598-023-30527-w.

XCIX. Davidson K. *Is BMI an Accurate Predictor of Health?*. Healthline. https://www.healthline.com/nutrition/is-bmi-accurate [Accessed 25th August 2024].

C. Duren DL, Sherwood RJ, Czerwinski SA, Lee M, Choh AC, Siervogel RM, et al. Body Composition Methods: Comparisons and Interpretation. *Journal of diabetes science and technology (Online)*. 2008;2(6): 1139–1146.