

Mutual Effects of Obesity and Eating Speed on Chewing, Appetite, and Body Mass Index: A Cross-Sectional Study in Iraqi Adults

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Abstract:

Background:

Obesity is a global health crisis linked to chronic diseases and eating disorders. Rapid eating (characterized by insufficient chewing and rapid swallowing) is believed to contribute to weight gain by weakening satiety signals and increasing calorie consumption; however, evidence in Arab societies remains limited. This study aims to compare chewing and swallowing patterns among obese and non-obese Iraqi adults. It analyzes the relationship between eating speed and body mass index (BMI), appetite, and hunger. It explores gender differences in obesity-related behaviors.

Methodology:

A cross-sectional study was conducted on 600 Iraqi volunteers (323 males, 277 females), divided into two groups: obese (BMI ≥ 30) and non-obese (BMI = 18.5–24.9). Measurements included: Chewing behavior: average chewing times/mouthful and swallowing time (seconds/mouthful). Appetite and hunger: Likert-type questionnaire (1–10). Anthropometric measurements: height, weight, waist-to-height ratio. Data were analyzed using SPSS (version 26) with t-tests and regression ($p < 0.05$ statistical significance).

Results:

Obese individuals showed reduced chewing/bolus and swallowing times compared to non-obese individuals. An inverse relationship was found between chewing/bolus times and body mass index (BMI). Obesity was 36.5% more prevalent among females than males, with a stronger correlation between eating speed and appetite in females ($P < 0.05$). Chronic diseases (such as diabetes) were more common among obese individuals.

Conclusion:

Rapid eating patterns (reduced chewing, accelerated swallowing) are strongly associated with higher BMI and appetite disturbances in Iraqi adults. Slowing down eating speed may help promote satiety and weight control, with the need for gender-sensitive interventions, especially for females who are more prone to obesity.

Keywords: Obesity, Eating speed, Swallowing time, Appetite, Iraqi obese

Introduction

Overweight and related diseases have become a prominent problem of our time. Rates of chronic diseases (such as diabetes, cardiovascular disease, and some types of cancer) are increasing among overweight and obese individuals. Statistics also indicate that mortality rates among this group are higher than among those of normal weight. This epidemiological reality makes understanding the causative factors of obesity and intervening to prevent and treat it a fundamental focus of many global health research and programs.[1], [2]

In this context, researchers are turning their attention to eating behaviors as modifiable factors that may contribute to weight regulation. Among these behaviors, eating speed (the rate of chewing and swallowing) stands out as a promising variable for study. Growing evidence suggests a potential link between rapid eating, increased energy expenditure, and a higher risk of overweight and obesity, through mechanisms that may include impaired early satiety signals and delayed onset of fullness .[3]

Against this background, this research paper explores the relationship between chewing and swallowing speed and body mass index (BMI) , expanding the analysis to include a set of subjective indicators associated with food intake regulation, namely appetite and the frequency of hunger during the day . The study primarily aims to examine differences in these eating patterns between obese and non- obese individuals, and to understand the extent to which eating speed contributes to the observed variability in BMI, hunger, and appetite.

To achieve these objectives, the study adopted a cross -sectional methodology that included a sample of 600 Iraqi male and female volunteers, who were clearly divided into two distinct groups: a group of individuals classified as obese (based on international body mass index standards) and a comparison group of individuals with normal weights. The research protocol was designed to ensure accurate measurement of the speed of eating a standardized meal, as well as to collect comprehensive data on anthropometric indicators (height, weight, age) and subjective indicators of appetite and hunger using validated and standardized questionnaires.

The importance of this study lies in the fact that it fills a gap in the evidence related to eating behavior in the Iraqi context and the Arab world more generally, and it also provides practical insights into the role of modifying eating speed as a potential strategy within weight management and obesity prevention programs.

The study found that faster chewing rate was positively associated with meal weight, while the number of times chewed per mouthful was inversely associated with meal intake. This suggests that individuals who chew quickly may consume more food, which could lead to weight gain. However, the relationship between chewing rate and body mass index (BMI) was not statistically significant, suggesting that other factors also contribute to weight gain beyond just chewing and swallowing speed.[4] [5].

The study indicates an association between fast eating and a high waist-to-height ratio among Japanese adolescents, reflecting a clear link to central obesity. The effect is further enhanced when fast eating is

coupled with eating habits that include eating until full, suggesting that chewing and swallowing speed may contribute to weight gain and abdominal fat accumulation in this age group.[6][7]

It is very well known that fast food increases weight and there is a close relationship between this because it is rich in calories and this may constitute a surplus of the body's energy needs, which makes the human body direct this surplus of food and calories to storage in the form of fat.[8][9]

Fast food consumption is consistently associated with overweight and obesity across diverse demographics and geographic locations. Evidence suggests that frequent consumption of fast food contributes to increased body mass index (BMI) and weight status, particularly among children and adolescents. This relationship is influenced by factors such as the high caloric density, large portion sizes, and convenience of fast food, which collectively promote excessive calorie intake.[10], [11]

Obesity represents the most dangerous disease of the modern era. Obesity is linked to many abnormal indicators as well as chronic diseases. Studies have proven the relationship between multiple cancers and obesity.[12]

While obesity is linked to respiratory diseases through many factors and the direct mechanical effect of adding excess weight to the lungs and putting pressure on them, on the one hand, and the effect on the levels of inflammatory cytokines on the other hand, there were high levels of cytokines in obese people. [13][14]

and laboratory scientific studies have proven that:

There are also proven relationships in scientific research that the significant relationships in statistics Biochemical association between type 2 diabetes and obesity: The rates of diabetes and insulin resistance were evident in the obese groups [15][16].

In 2019, COVID-19 struck, and research was ongoing. Obese patients had the highest proportion of COVID-19 cases, with the rates of complications and deaths being very high compared to non-obese people.[17][18]

Methodology

This study was designed using 600 volunteers, 323 of whom were males and 277 of whom were females, who provided their information.

Google Form was used to collect information about the volunteers and disseminate it to academic and health circles with good intellectual and scientific awareness. The information was based on questions and answers (age, height, weight, gender, chronic diseases, number of chews per bite of food, how much time you spend chewing to swallow a whole bite, etc.) and represented by a special Google Form form. Both Arabic and English languages were used to access high-accuracy information. Ethical approval was obtained from the local research committee prior to data collection. The SPSS statistical program was used Version 26

As well as Microsoft Excel 2020. The work can be described in three stages. The first stage is designing a questionnaire for volunteers, which contains a set of questions.

Table(1): questionnaire for volunteers

Q	Question Type	Question Text
Q1	Single-choice	Gender:
Q2	Numerical input	Age (years):
Q3	Numerical input	Weight (kg):
Q4	Numerical input	Height (cm):
Q5	Numerical input	Chewing count per bite of food:
Q6	Likert scale	Rate your appetite level:(1 = Very low, 10 = Very high)
Q7	Multiple-choice	Do you have chronic diseases?
Q8	Conditional (Females)	If female: Are you pregnant?
Q9	Likert scale	Rate your hunger tolerance:(1 = Very low, 10 = Very high)

The second stage is collecting information in Excel format , filtering the information, and excluding information and data that contribute to a high standard deviation rate.

While information was excluded for older participants , pregnant women

The third stage is to use the SPSS program. And make mathematical statistics and output them graphically

Results:

showing the nutritional and behavioral characteristics of a sample of 600 individuals classified by sex and nutritional status (obese/non-obese), including data on body mass index, appetite, chewing behaviors, and the presence of chronic diseases:

Table(2): Behavioral and health differences between obese and non-obese individuals by gender

Q	Question Type	Question Text
Q1	Single-choice	Gender:
Q2	Numerical input	Age (years):
Q3	Numerical input	Weight (kg):
Q4	Numerical input	Height (cm):
Q5	Numerical input	Chewing count per bite of food:
Q6	Likert scale	Rate your appetite level:(1 = Very low, 10 = Very high)
Q7	Multiple-choice	Do you have chronic diseases?

Q8	Conditional (Females)	If female: Are you pregnant?
Q9	Likert scale	Rate your hunger tolerance:(1 = Very low, 10 = Very high)

The table clearly shows that eating patterns significantly influence obesity. Behaviors such as rapid swallowing, poor chewing, and eating quickly are all associated with weight gain, while eating slowly and chewing thoroughly are protective factors.

Table (3): Represents the statistical relationship of the student’s test between the Speed of Swallowing Bites, Number of Chews per Bite, Total Eating Time indicators

Q	Question Type	Question Text
Q1	Single-choice	Gender:
Q2	Numerical input	Age (years):
Q3	Numerical input	Weight (kg):
Q4	Numerical input	Height (cm):
Q5	Numerical input	Chewing count per bite of food:
Q6	Likert scale	Rate your appetite level:(1 = Very low, 10 = Very high)
Q7	Multiple-choice	Do you have chronic diseases?
Q8	Conditional (Females)	If female: Are you pregnant?
Q9	Likert scale	Rate your hunger tolerance:(1 = Very low, 10 = Very high)

Positive relationship between swallowing speed and body mass index (BMI):

Statistical analysis showed a statistically significant positive association. ($p < 0.01$) between the speed of swallowing the bite (the time taken to swallow after chewing) and the high values of the body mass index that represents the relationship between body mass and the number of chews per bite to obese and non-obese.

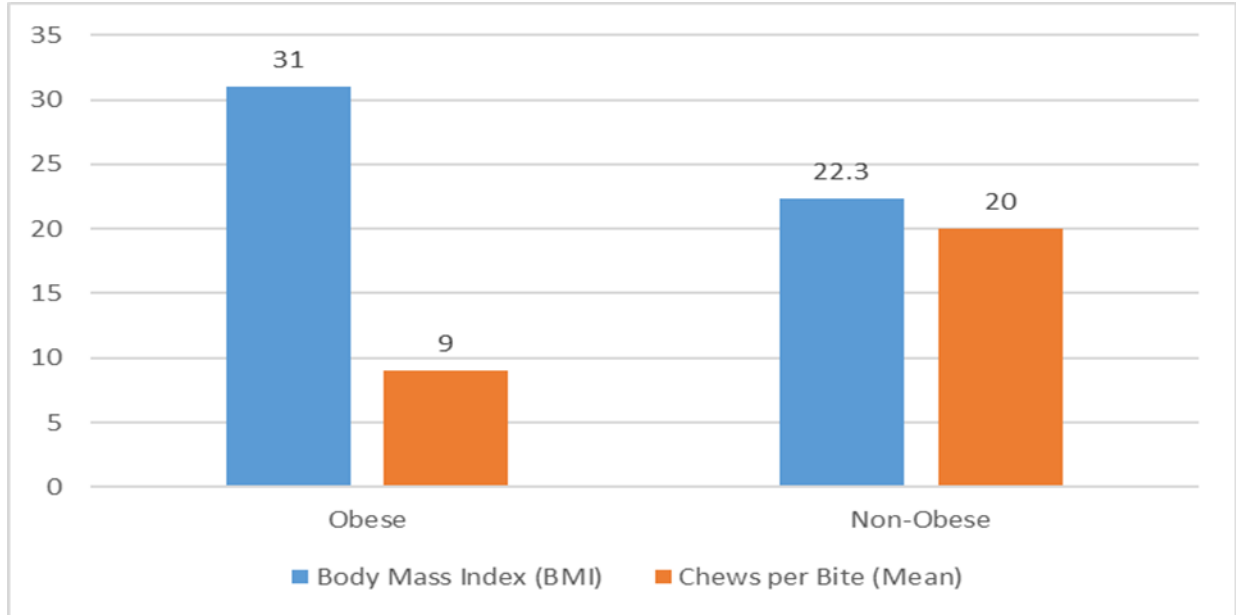


Figure:1

In other words, individuals with a higher BMI (obese) tend to swallow food significantly more quickly than individuals of normal weight. This finding suggests that accelerated swallowing is a behavioral trait associated with obesity .

The inverse relationship between the number of chews and weight gain :

A strong and statistically significant inverse association was observed . ($p < 0.001$) between the mean number of chews per mouthful and both BMI and overweight/obesity status .

That is, a higher number of chews before swallowing was associated with significantly lower BMI values. Participants who chewed their food more times per mouthful were less likely to be overweight or obese.

The inverse relationship between swallowing time and appetite :

Regarding appetite, the results revealed a statistically significant inverse relationship. ($p < 0.05$) between the total time spent swallowing food during the meal (associated with chewing and swallowing) and the intensity of hunger feelings before the meal and the self-reported appetite level .

In short, participants who took longer to chew and swallow reported lower levels of hunger and appetite before and during eating, compared to those who that represents the relationship between body mass and levels of hunger and appetite to obese and non-obese.

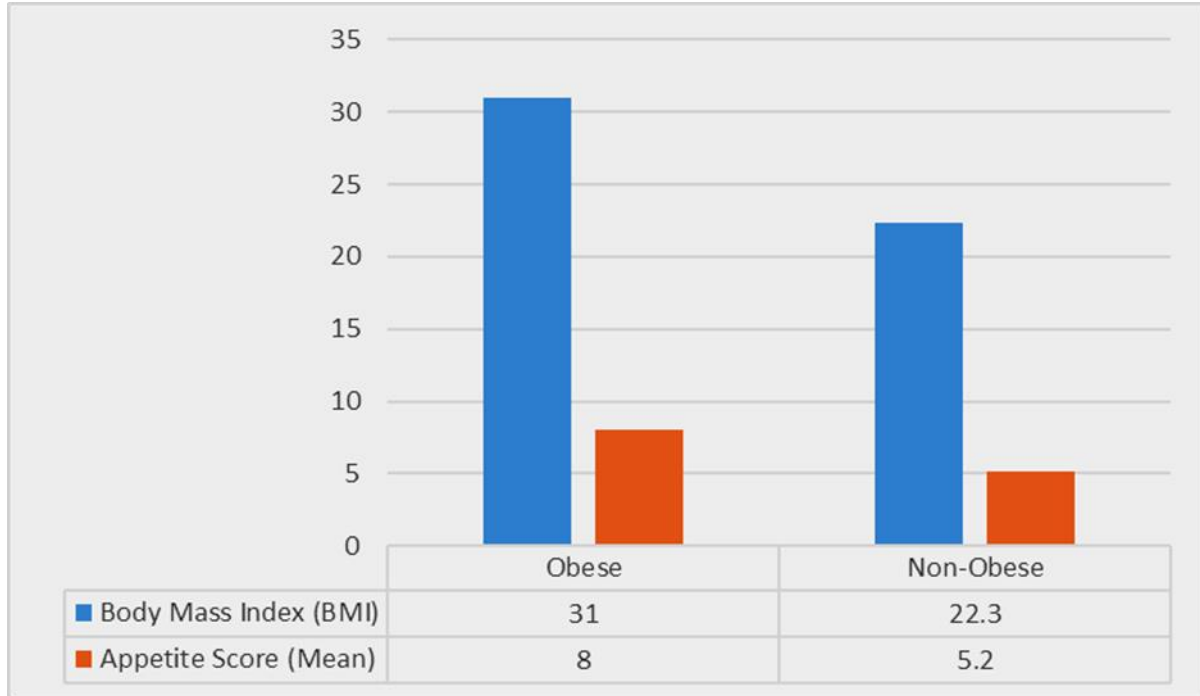


Figure: 2

Summary and preliminary explanation: Taken together, these findings suggest a distinct eating behavior pattern among obese individuals in the Iraqi sample : eating more rapidly by reducing the number of chews per mouthful and accelerating the swallowing process . This behavior, in turn, appears to be associated with increased BMI and amplified hunger and appetite . These findings reinforce the hypotheses that slowing down eating (increased chewing and prolonged swallowing time) may contribute to appetite regulation and improved satiety signals, which could have a positive impact on weight management .

Discussion and Conclusion:

The results showed a clear association between swallowing speed, poor chewing , and high BMI, which supports the hypothesis.

Delaying the secretion of satiety hormones (such as leptin and PYY): Eating quickly reduces the interaction time of food with the receptors in the stomach and intestines, which weakens the neurohormonal signals required to feel full that represents the relationship between body mass and chronic diseases.

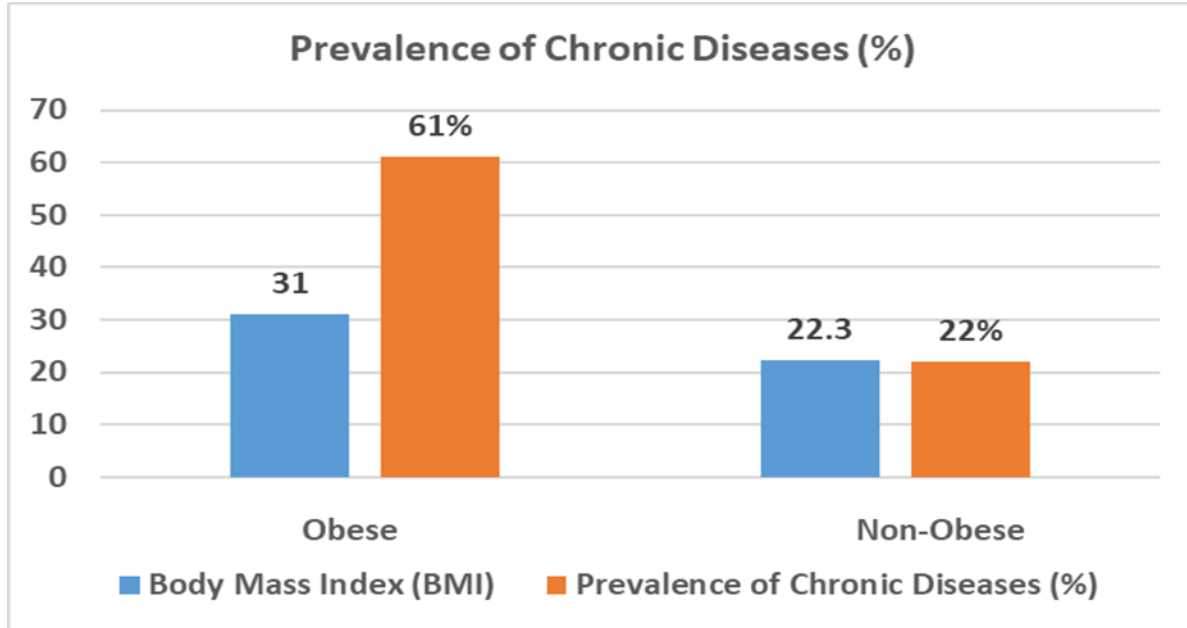


Figure3:

Inhibiting the role of "stretch receptors" in the stomach : Swallowing food without adequate chewing reduces the stimulation of these receptors, which are a major source of satiety signals.

Evidence from our results: The inverse relationship between swallowing time and appetite supports that prolonged chewing improves hunger regulation, which is consistent with global studies (such as the work of [19][20]

The role of the gut microbiome

The association of obesity with changes in the composition of intestinal bacteria (dysbiosis) appears as a possible factor that explains the results of the study :

Insufficient chewing limits the breakdown of fiber in the mouth (by the salivary enzyme amylase), shifting the burden of its digestion to the intestine, and altering the balance of bacterial fermentation[21] . decreased production of short-chain fatty acids (SCFAs) Produced from the fermentation of fiber (such as butyrate), which regulates satiety, inflammation, and glucose metabolism .

Increased activity of Firmicutes/Bacteroidetes bacteria Associated with extracting higher calories from food .[22]

Support from our results : Changes in appetite and frequency of hunger may reflect an imbalance in the production of gut hormones (such as GLP-1) associated with the microbiome[23] .

The obesity epidemic among women: the complex interaction between biology and psychology

The study recorded a significant increase in obesity rates among female participants, which calls for discussion of interrelated factors :

Social and hormonal pressures : In the Iraqi context, women may face multiple stressors (such as family responsibilities, mobility restrictions, hormonal fluctuations), which leads to the use of food as an emotional coping mechanism[24] .

Supporting results : The association of fast eating with increased appetite in the women in the sample may reflect an attempt to speed up the attainment of pleasure from food during periods of stress [25]. number of volunteer participants in the study.

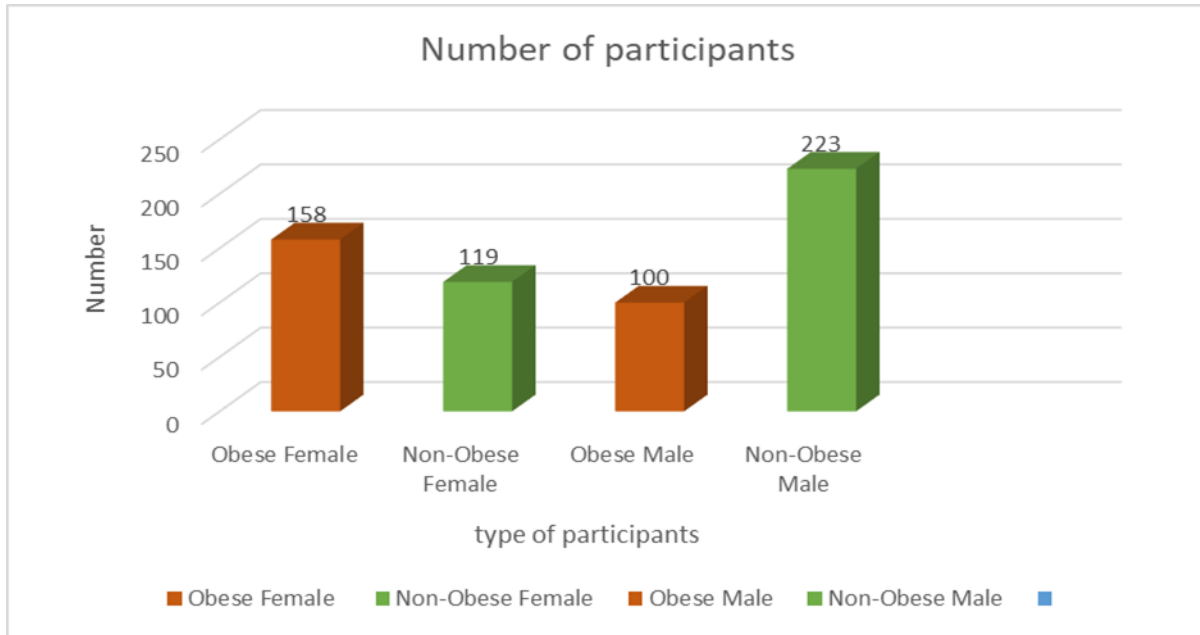


Figure 4:

It is clear that the number of volunteer participants in the study was more male than female, and this may be attributed to women’s shyness to provide their information.

This study not only confirms the role of chewing and swallowing behavior as a major determinant of obesity, but also opens doors to understanding the underlying biochemical (microbiome) and psychological (emotional eating) mechanisms. The success of anti-obesity programs in Iraq requires integrating these factors into

Based on previous findings, it necessary to (chewing each mouthful 20 times) into plans. Design programs specifically for women that focus on stress management as an alternative to emotional eating. Study the effect of modifying eating speed on satiety hormone levels and the gut microbiome in an Arab population. "This study confirms that slowing down eating is not just a nutritional recommendation, but an evidence-based preventive strategy to combat the obesity epidemic in Iraq, especially in light of its interaction with biological, psychological, and social factors."

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