Research Article
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Difference in taste identification among obese and non-obese adult women

Abstract

Background

Previous studies have revealed that the sensitivity for taste differs between individuals with low versus high body mass index (BMI). However, this has predominantly been investigated for children and adolescents only. Observational studies on taste identification of adults are rare, conflicting and cannot be interpreted causally.

Objective

The aim of this study was to determine the difference between taste identification of obese and non-obese adult women. To determine difference in taste identification among obese and non-obese adult women.

To investigate both groups' ability to evaluate the intensity of all four tastes (sweet, sour, bitter, and salty).

Limitations

a. Time was a limiting factor.

b. It was a small scale study hence didn't involve a large sample.

Method

In an experimental design we explored taste identification in obese women (n=25) compared to non-obese women (n=25) of age ≥30years. Taste strips were used to measure taste identification overall. Each subject received four taste strips (sweet, bitter, sour, and salty) in a randomized sequence. These strips were placed on the tongue of the subjects and they were asked to identify the taste quality of each strip. Chi-square test was used to analyze the association of taste identification with BMI.

Result

The findings revealed that obese women were less accurate in identifying tastes overall (p=0.005). Both the groups showed a significant difference in detecting sweet taste (non-obese =92% & obese =76%) and salt taste (non-obese=84% & obese =64%) but these relationships were not statistically proven. There was a statistically proven difference in identification of bitter taste (non-obese 76=% & obese =48%). On the contrary, no difference was found in the identification of sour taste among both groups. (Obese =60% & non obese 60%)

Conclusion

Obese women were less accurate in identifying tastes than non-obese women. Thus, the hypothesis that obese and non-obese women differ in taste identification was confirmed in the present investigation. However, long-term studies are needed to better understand how these differences are brought about. Nonetheless, taste perception appears more susceptible than originally thought and further insight could potentially help develop strategies for obesity prevention.

Keywords: Obesity; Taste Identification; Body Mass Index

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Introduction

Obesity is one of the most common causes of mortality in the world while the population of the obese people is increasing. Obesity is fuelled by individual factors, nutrition transition and increasingly sedentary lifestyles that lead to excess caloric intake.[1] It has been observed that people with high BMI may have a higher motivation to eat and less motivation to cease eating when they are paying attention to taste.[2] Among individual factors, taste sensitivity plays an important role in food preferences, choices, and thus consumption.[3] This implies that a change in taste perception, which may alter attention to a particular taste, may affect eating behaviour in groups with different BMIs.

Previous studies describe differences between obese and non-obese subjects concerning their taste perception & frequency of taster and non-taster is found to vary in different populations. Data from previous researches revealed that obese children and adolescents

show a disturbance in some tastes. This showed that overweight and obese subjects may have a reduced or distorted sensory sensitivity that might increase the desire and ingestion of food, thus leading to excessive energy intake and weight gain.[4]

No studies, in any region of Pakistan, were found that addressed the difference in taste identification among obese and non-obese, whether for children or adults. But, international researches have revealed that the sensitivity for taste differs between individuals with low versus high body mass index (BMI). However, this has predominantly been investigated for children and adolescents only. Observational studies on taste identification of adults are rare, conflicting and cannot be interpreted causally. Therefore, in this study we hypothesized that there is a significant difference in taste identification between obese and non-obese adults.

Mechanism for linkage between taste and obesity

Taste perception is only one of the factors in the complex cause of obesity. It has been suggested that people with high BMI may have a higher motivation to eat and less motivation to cease eating when they are paying attention to taste. This implies that a change in taste perception, which may alter attention to a particular taste, may affect eating behaviour in groups with different BMIs.[5]

Previous researches also showed that people with a heightened sensitivity to the various taste sensations tend to eat less, possibly because they get more flavours in every bite, while people who overindulge simply may not taste food as keenly as others do. In 2010, for example, Australian researchers found those with higher sensitivity to the taste of fat tended to eat fewer fatty foods overall and had lower body mass indexes.[6]

Both taste and obesity may also be shaped by hormonal fluctuations. For example, the hormone leptin is associated with hunger, fat storage and the ability to taste sweet things. Obese people may be less sensitive to its daily cycles. Also, if the level of insulin circulating in the blood stream remains consistently elevated for long periods of time, as it does in many obese people, it could weaken the cells' receptors to the hormone, which in turn could mute taste sensitivity.[6]

Methodology

The research was a combined project of a group of two girls of BS 8th semester. Each student investigated their respective area. The objective of my study was to find the difference in taste identification between obese and non-obese adult women.

Subjects and sampling

Population and sample: The population consisted of adult women of age >30years. The sample was collected from people living in Karachi.

Size of sample: The convenient sample was collected and the total sample size was 50 adult women i.e. 25 obese and 25 non-obese.

Variable: Taste sensitivity was the dependent variable whereas, BMI was independent variable.

Tools for data collection

The tools for data collection were observation sheet and taste strips.

Taste strips: For the assessment of gustatory function taste strips was used which were made of filter paper soaked in taste solutions for 1 min and then were dried. The length of taste strips was 3 inch and breadth ½ inches.

a. **Sweet**: table sugar: 1 teaspoon dissolved in 2 tablespoons of water.

b. **Salt:** table salt: 1 teaspoon dissolved in 2 tablespoons of water.

c. **Sour:** lemon: 1 teaspoon dissolved in 2 tablespoons of water.

d. **Bitter:** PROP (propylthiouracil): ½ tablet dissolved in 2 tablespoons of water.

The basic idea about these strips was developed from a previous class experiment.[7]

Observation sheet: Observation sheet included anthropometric measurements (height & weight) and a 5-point scoring scale was developed for comparing the intensities of all four tastes with 1, representing No Taste, 2 representing slight, 3 representing moderate, 4 representing Strong and 5 representing very strong taste. Basic idea about this rating scale was developed from a previous research.[8]

Study design

This type of research is experimental and qualitative in nature.

Method of data collection:

a. Body weight was measured with a weighing scale. Height was measured using inch tape. BMI was calculated (weight in kilograms divided by the square of the height in meters). Asian cut-offs were for obese (BMI > 25) and non-obese (BMI < 24.9).

b. For the assessment of gustatory function taste strips were used which were made of filter paper soaked in taste solutions and then were dried.[7]

c. Subjects were asked not to eat, to drink nothing but water before testing.

d. Before the testing began the taste qualities (i.e., sour like lemon, sweet like sugar) and intensity scale were explained to the subjects.

e. Taste strips were presented to the subjects in a randomized order.

f. Taste strips were placed on the tongue and subjects were asked to identify the taste quality by choosing one of four possible answers (sweet, sour, salty, bitter). Before assessment of each taste strip the mouth was rinsed with water.

g. Subjects were asked to rank the intensity of the taste quality on a 5-point rating scale.

Data entry

The data was entered in SPSS, Version 13 (Statistical Packages for the Social Sciences).

Statistical analysis

The level $P \leq 0.05$ was considered as the cut-off value for significance. Data were presented using descriptive statistics and Chi square test was used to analyze the association of taste identification

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with BMI. The same test was used for the comparison of intensities of all four tastes (sweet, bitter, sour and salty).

Results

Characteristics of the subjects

The population consisted of adult men of age >30years. The convenient sample was collected from people living in Karachi. The total sample size was 50 adult men i.e. 25 obese and 25 non-obese. Table 1 indicates the average age, weight, height and BMI of participants.

Table 1 Clinical characteristics of the subjects

	BMI ranges	
	Non obese	**Obese**
Age (years)	45.4	43.92
Weight (kg)	57.48	75.92
Height (m)	1.593	1.57
BMI (kg/m^2)	22.6	30.95

Table Abbreviations: BMI, body mass index; Kg, kilogram; M, meter

Table 1 revealed that Majority of the respondents were in their forties. The mean height was significantly lesser in obese group than non-obese; however, the mean weight and BMI were significantly greater in obese group.

Association of taste identification with BMI

The data was collected through observation sheet to evaluate the differences in taste identification among obese and non-obese adult women. Chi square test was used to analyze the association of taste identification with BMI. To illustrate the differences in identification of taste, data was presented graphically to show the percent of all four taste identified by the obese and non-obese groups.

Identification of sweet taste: When examining the Figure 1, it was found that obese women were less accurate in identifying sweet taste as compared to non-obese women but this relationship was not statistically proven as p value (p=0.123) is greater than 0.005.

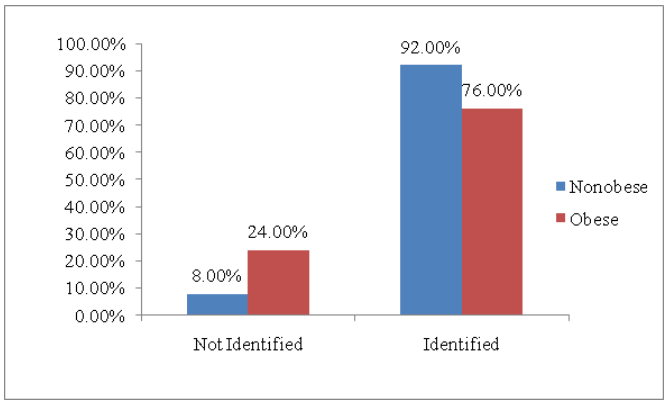

Figure 1 Difference in sweet taste identification.

Identification of bitter taste: As shown in Figure 2, Women who were affected by obesity were less likely to detect bitter taste as compared to non-obese subjects but this relationship was not statistically proven (p=0.040).

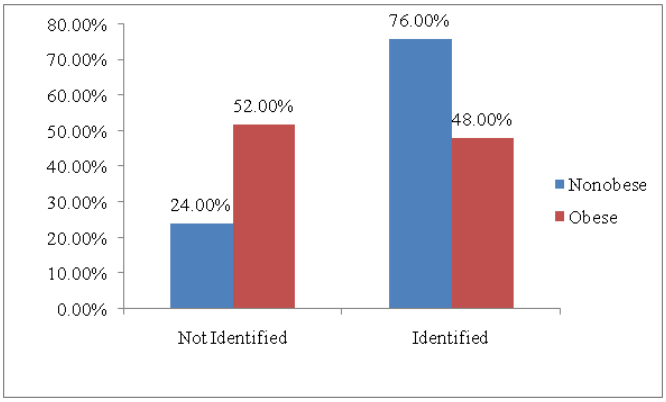

Figure 2 Difference in bitter taste identification.

Identification of Sour Taste: Figure 3 shows that obese and non-obese subjects identified sour taste easily and without much difficulty. We can say both the groups did not significantly differ in detection of sour tastes. (p=0.613) i.e. no difference was found in the identification of sour taste among both groups.

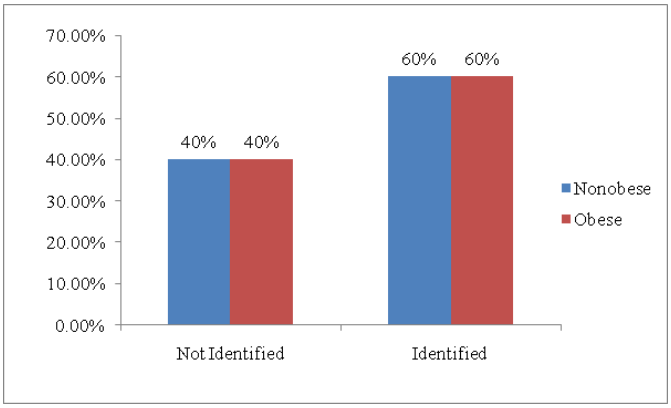

Figure 3 Difference in sour taste identification.

Identification of Salt Taste: Notably, there was a dramatic but not statistically significant difference in identification of salt taste quality among obese and non-obese participants, respectively (p=0.098) (Figure 4).

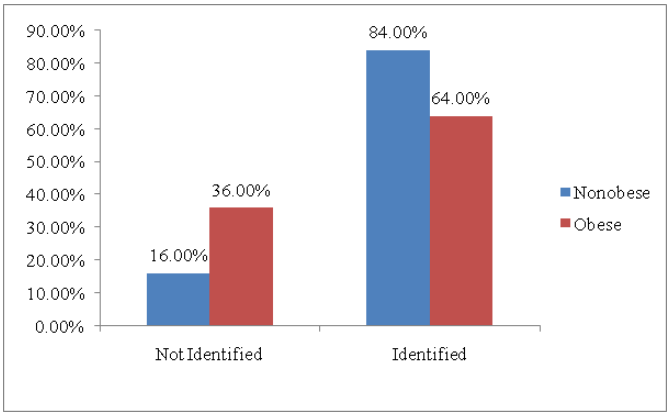

Figure 4 Difference in salt taste identification.

Taste intensity perception

The difference of taste intensity between obese and non-obese

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women was found by using chi square test. Results were presented graphically to show the percentages of all taste intensities rated by obese and non-obese groups.

Data of this study revealed significant differences among both groups in their ability to evaluate the intensities of all four tastes (sweet, bitter, sour and salty).

Intensity of sweet taste

Figure 5 showed that there was statistically significant difference between low sensitivity to sweet taste and high weight in women. (P=0.036).

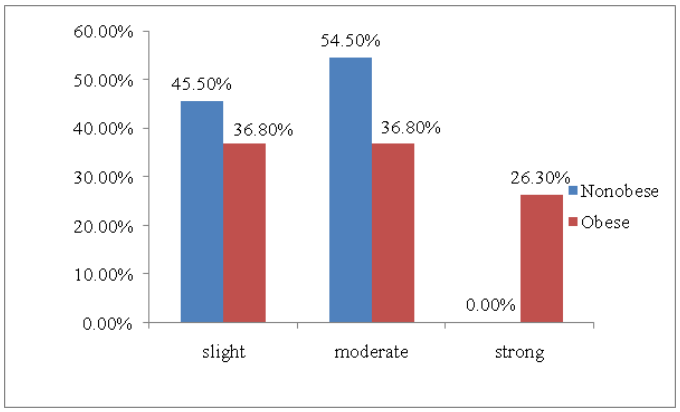

Figure 5 Difference in intensity of sweet taste.

Surprisingly, obese-subjects' strong sweet taste intensity rating was higher when compared to non-obese subjects strong intensity rating that was as low as 0 percent.

Intensity of bitter taste

Subjects of both the groups rated strong intensity of bitter taste higher on the rating scale. Women affected by obesity didn't show a significant difference as compared to non-obese women. (p=0.984) (Figure 6).

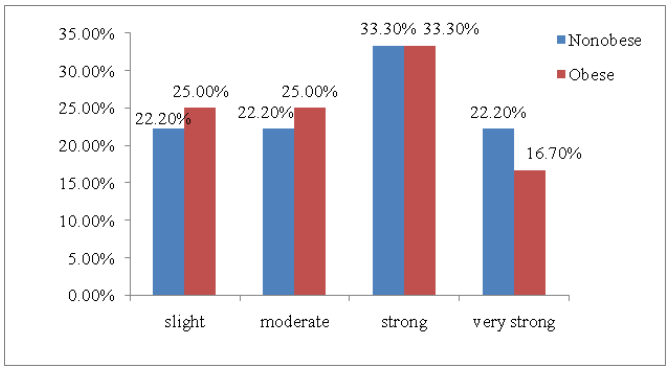

Figure 6 Difference in intensity of bitter taste.

Intensity of sour taste

The non- obese respondents rated sourness lower in intensity than obese women. Although not statistically proven (p=0.266), the results in Figure 7 showed that in comparison with other sour taste intensities, strong intensity for sour taste was related to higher BMI (Figure 7).

Intensity of salt taste

Concerning the salt taste intensity rating, obese subjects rated slight intensity higher as compared to non-obese. One the other hand, obese participants rated the strong intensity lower on the intensity scale when compared to the non-obese subjects but these findings were not statistically proven. (p=0.701) (Figure 8).

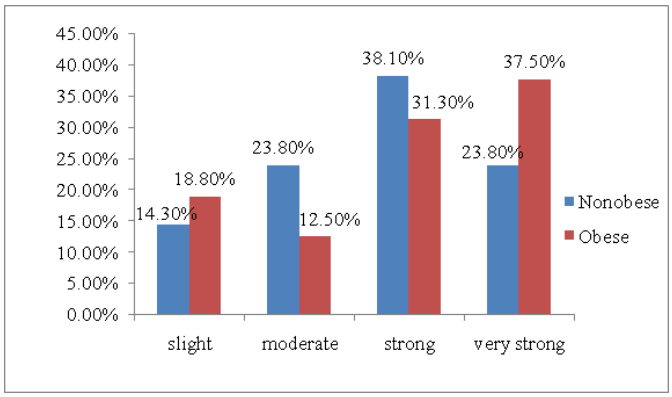

Figure 7 Difference in intensity of sour taste.

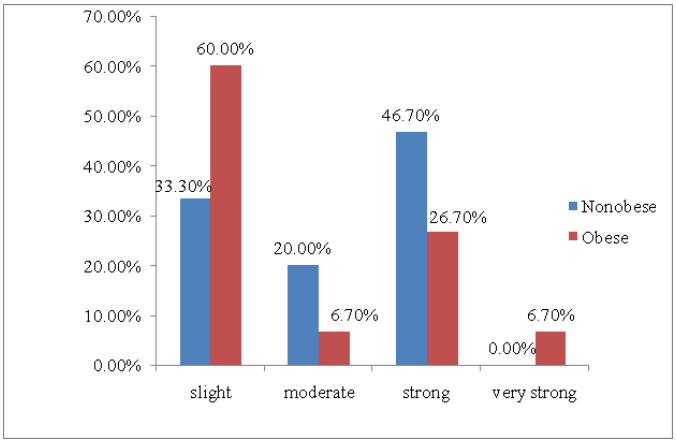

Figure 8 Difference in intensity of salt taste.

Classification of respondents on the basis of taste identification

Analyzing the results of taste identification more in depth, we scored the results from one to four (1=1 taste identified onwards to 4=4 tastes identified) and classified the respondents in to 3 categories; poor taster (score 1-2), average taster (score 3) and super tasters (score 4).

The prevalence rate of super tasters is slightly increased among obese women as compared to non–obese. Also, poor taster subjects were found to have significantly lower BMI as compared to average tasters, this is statistically proven (p=0.005) and graphically illustrated in Figure 9.

Discussion

The aim of this research was to study the taste identifications of all four taste qualities in adult women to see whether it relates to bodyweight.

This study explored that the taste identification among non-obese individuals was higher compared to obese subjects. Obese subjects had more difficulties in identifying different tastes including sweet, bitter and salty. In addition, the two groups correctly prioritized the identification of sour taste.

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Our findings of impaired and intact taste identification are in line with previous research conducted in Washington[8] that has also supported the hypothesis that a strong correlation exists between taste identification and obesity but for children and adolescent.

Also, our outcome data are similar to the findings of Wiegand et al.,[9] and colleagues reported online in Archives of Disease in Childhood,[9] who reported that obese adolescents showed no differences for sour tastes, but only for bitter and salty. On the other hand Wiegand et al.,[9] reported that obese and non-obese groups were extremely good in identifying sweet tastes, unlike the current study. The question, however, arises why two studies so far found that sour tastes remain unaffected in obese group (current study and Overberg et al.[8] Sour taste appears to be due to protons, and unlike salt taste in humans, anions do not appear to significantly alter the sour taste quality.[10]

It is argued that the obese experience less sweetness than do the non-obese. One possible reason is that those additional pounds in obese influence hormone levels throughout the body, which changes the way taste receptors, relay information to the brain. For example, the hormone lepton is associated with hunger, fat storage and the ability to taste sweet things. Obese people may be less sensitive to its daily cycles. Also, if the level of insulin circulating in the blood stream remains consistently elevated for long periods of time, as it does in many obese people, it could weaken the cells' receptors to the hormone, which in turn could mute taste sensitivity.[6] In addition, different structures (papillae) are responsible for responding to different tastes: bitter and sour receptors are linked to circumvallated papillae, and sweet and salty to fungi form papillae.

We further tested the effects of BMI on taste intensity of sweet, bitter sour and salty assuming that obese people will experience lower intensities of tastes. Again support for this hypothesis was obtained. We observed that intensity ratings for sweet, bitter and salty were higher in non-obese compared with obese. On the contrary, sour Intensity rating was unaffected by BMI.

In fact, when separating the subjects into three groups according to taste identification as poor, average and super tasters (Figure 9), we observed that most of the non-obese participants fall in the category of average tasters than do the obese participants. Surprisingly it was found that obese respondents, being at extreme, fall in the categories of super tasters as well as poor tasters. Researchers have debated for many years findings that non-tasters may be more prone to obesity because they have fewer taste buds than tasters and because of this; they have reduced sensitivity to many tastes.[11] But reason behind obese people being super tasters is not yet known.

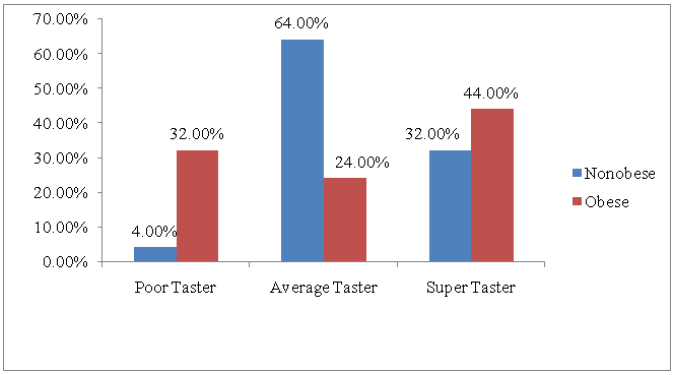

Figure 9 Classification of respondents on the basis of taste identification.

Conclusion

It is concluded that the results of this study support the hypothesis that obese and non-obese women differ in their taste perception. Obese subjects could identify taste qualities less precisely than non-obese respondents, agreeing with the prior study found on this subject. However, long-term studies are needed to better understand how these differences are brought about.

With the facts and figures stated above it is evident that the relationship between obesity and taste sensitivity needs further investigation also with regards to the fact that the data used in this study is limited with respect to the sample size and method used.

However, no implication seems to exist in the compliance to a weight loss program. Further research still needs to be done to establish the cause-effect association between taste perception and BMI. Thus, it could be suggested an implication for taste sensitivity also in diet-induced weight loss program. However, evidence in regard to this issue is still in lack.

Acknowledgements

None.

Conflict of interest

The author declares no conflict of interest.

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