# Comparision of Body Mass Index and Body Fat Percentage in Relation to Phenyl Thiocabamide Taste Sensitivity in 18-25 Years Aged Tasters and Non Tasters

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## ABSTRACT

**Introduction:** Obesity is one of the major cause for various health complications in Developing countries especially in Adults, and Dietary patterns will play major role in causing obesity. Study aimed to correlate Body Mass Index(BMI) and Body Fat Percentage (BFP) in relation to Phenyl Thiocarbamide (PTC) sensitivity in age group between 18-25 years tasters and non tasters.

**Material and Methods:** Cross-sectional design sample of 112 adults aged 18–25 years including both males and females. Adults were recruited from local medical college. Adult's height, weight and waist circumference were measured along with their PTC taster status. PTC was measured using two paper discs, one impregnated with NaCl (100 mol/l) and the other with PTC solution (0.50 mmol/l).

**Results:** A significant PTC sensitivity by socio-economic status (SES) interaction term (P =0.010) was detected where in tasters had the largest BMI, BFP percentile and Z-score, but only between the group with highest SES.

**Conclusion:** The Findings shows that other factors overcomes the influence of PTC sensitivity on adiposity in lower-SES groups. Thus, PTC tasters had the largest BMI and BFP, percentile and Z-score, but only among the highest-SES group.


**Keywords-** BMI, BFP, Phenyl Thiocarbamide, Taste sensitivity.

## INTRODUCTION

Obesity, the most common nutrition disorder in Western countries increasing dramatically in this decade especially in India. Currently a greater percentage of young population is overweight or obese. If these trends continue, this new generation will become heaviest adult population ever. Obesity during early life contributes to health problems such as heart disease, hypertension and diabetes. Studies in adults suggest that high-fat diet promote obesity. Old literature also shows that, the variations in dietary pattern that promote obesity in children are similar to those in adult, but this has yet to be demonstrated.[1] Obesity also show inheritance, it occurs in 7% of the children of normal weight parents, 40% of the children in families with one parent obese, but 80% of the children in families with two obese parents.[2]

The sense of taste plays major role in food selection.[3] Obesity is a disorder in which food intake is excessive. Obesity results from a long term positive energy balance-i. e. the energy intake is greater than the energy expenditure.[4] It has been hypothesized that food preferences are learned. A significant amount of young adults daily energy comes from highly palatable foods such as sweet-fat snacks, soft drinks, chocolate and discretionary fats. Intake of less palatable but more nutritive choices such as fruits, vegetables, and whole grains are lower than recommended.

The study done in 1986, found that the intake of a single food relative to the intake of other food is strongly affected by sensory- specific satiety.[5] Genetic inheritance plays major role in individual variations in respect to taste and food choices. Studies showed that the inherited ability to taste bitter thiourea compounds such as phenyl thiocarbamide (PTC) and 6-n propyl thiouracil (PTC) may be a marker for these differences. Thus, individual can be classified as taster or non-taster. Greater taste responsiveness to thiourea compounds has been associated with higher perceived intensity of sweet and bitter taste, and greater oral sensation from fat. It is clear from the previous studies, that subjects who are more sensitive to PTC avoid bitter and tasty foods.[6]

The incidence of non tasters to PTC varies around the world, approximately 3% in western Africa to > 40% in India. The term "non- taster" is misnomer, since so called non- taster can taste PTC at higher concentrations**.** A study in1989 concluded that variability in the threshold to PTC was controlled by a major locus with incomplete dominance as well as multi factorial component.[7] In 2001, few researchers, found locus of chromosomes gene of taste sensitivity for PTC locate, these found on chromosome 5q15 and evidence for an additional locus on chromosome 7q.[8-9] It has also been found that PTC tasters show greater sensitivity to wide range of oral stimuli, including bitter taste not associated with fruits, and vegetables, sweet tastes, oral irritants such as chili pepper, and textural sensation of fats, this is what determines their diet pattern.[10-11]

In present study we aimed to evaluate the taster status to PTC, and to compare their body mass index (BMI) and body fat percentage(BFP) with their taster status.

## MATERIAL AND METHODS

The cross-sectional study consisted Normal healthy young adults (male and female) in the age group of 18-25 years were selected for the study. A total of 112 normal healthy volunteer medical students from TN Medical college, Mumbai, Maharastra, India, participated in the present work. The protocol was approved

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by the Institutes Human Research and Ethics committee at the same time we have taken subjects informed consent from all the participants. All subjects body weight was measured without shoes using a weighing machine, and height measured in centimeters with tape.

All the participants of this study were asked to explain the taste of PTC-impregnated test papers. Participants has been asked first to rinse their mouth with water, and the paper was placed on the middle of their tongue. After tasting the PTC paper, there was a questionnaire session, "Did they feel any taste?" based on this taste perception we have classified all the participants in to two categories. the subjects who said no placed under Non -Tasters group and the participants who said yes(bitter taste) placed under Tasters group. The subjects who are responded ambiguously were rested later

**Body Mass Index (BMI)** of all participants calculated by dividing their body weight (kilograms) with their height(centimeters), and divided into four categories[12] based on their BMI:

Group A –underweight individuals - BMI < 18.5 kg/m2
Group B-normal individuals – BMI 18.5 to 24.9 kg/m2
Group C-overweight individuals – BMI 25 to 29.9 kg/m2
Group D-obese individuals – BMI >= 30 kg/m2

**Body Fat Percentage** of each subject was measured by OMRON'S Body Fat Monitor. This body fat monitor measures body fat percentage by Bioelectrical Impedance (BI) Method.[13]

## STATISTICAL ANALYSIS

The results were compared between tasters and non-tasters. For each parameter, the mean value and standard deviation were calculated. Unpaired 't' test was applied using GraphPad InStat version 3.00 for Windows 95, Graph Pad Software,[z] San Diego California USA.

## RESULTS

All the 112 subjects selected for the study were between 18 to 25 years of age. Among 112 subjects selected for the study, 70 were males and 42 were females (Table-1). Among 70 males 49 were tasters and 21 were non-tasters. Among 42 females 28 were tasters and 14 were non-tasters.

The mean values for body mass index and body fat percentage in all the tasters were 19.550 ± 2.50 kg/m$^2$ and 19.594 ± 7.06 % respectively. The mean values for body mass index and body fat percentage in all the non-tasters were 23.414 ± 4.35 kg/m$^2$ and 27.428 ± 6.01 % respectively. There was meaningful variation in respect to body mass index and body fat percentage of tasters and non-tasters males. The 'p' value was <0.0001 (Table-2).The mean values for body mass index and body fat percentage in male tasters were 19.222 ± 2.42 kg/m$^2$ and 16.446 ± 5.63 % respectively.

The mean values for body mass index and body fat percentage in male non-tasters were 24.138 ± 4.23 kg/m$^2$ and 25.414 ± 6.03 % respectively. There was significant difference in body mass index and body fat percentage between tasters and non-tasters males. The 'p' value was <0.0001 (Table-3).

The mean values for body mass index and body fat percentage in female tasters were 20.125 ± 2.58 kg/m$^2$ and 25.103 ± 5.89 % respectively. The mean values for body mass index and body fat percentage in female non-tasters were 22.328 ± 4.45 kg/m$^2$ and 30.450 ± 4.73 % respectively. There was also meaningful variation in respect to body mass index and body fat percentage of tasters and non-tasters females. The 'p' value was <0.05 (Table-4).

## DISCUSSION

In the present study, observations of Body Mass Index and Body Fat Percentage of tasters and non-tasters were determined.

The mean age of the subjects was 18.57 ± 0.7193 years while that of tasters was 18.55 ± 18.5584 years and that of non-tasters was 18.60 ± 0.7745 years. The similar studies had been done but in different age groups. In 2003, Kalmus had done a study on age group of 4-5 years, as in this age social factor will not affect the body mass index and body fat percentage.[14] In 1961**,** Fischer et al had carried a work on age of 41.8 ± 1.8 years women and In this study the life style and social factors plays a role in developing obesity.[15] In our study we had chosen the age group of 18-25 years because they are intelligent enough to go through test and identify the taste of solutions, while social factors will not play much in developing the obesity thus confounding factors can be minimize.

In human being we can divide population into two groups considering their taste sensitivity to a specific bitter compound e.g. Phenylthiocarbamide (PTC), 6-n-Propylthiouracil (PTC). Those who can identify taste of PTC/PTC at very low concentration are tasters while those who could not are non-tasters. In the present study, we had used PTC solution of different concentration ranging from 0.000127 gm/dl to 0.130000 gm/dl (no. 13- 01). Solution No. 5(0.008125 gm/dl) was taken as cutoff point for those who can identify the taste

| | Taster | Non-taster | Total |
|---|---|---|---|
| Male | 49(44%) | 21(19%) | 70(63%) |
| Female | 28(25%) | 14(13%) | 42(38%) |
| Total | 77(69%) | 35(31%) | 112(100%) |

**Table-1:** Taste sensitivity to ptc among subjects

| | BMI (Kg/cm$^2$) | BF% |
|---|---|---|
| Taster | 19.55 | 19.59 |
| Nontaster | 23.41 | 27.42 |
| p- Value | <0.0001 | <0.0001 |
| t- Value | 5.94 | 5.68 |

**Table-2:** Comparison of mean values of BMI and BF% in all the subjects.

| | BMI (Kg/cm$^2$) | BF% |
|---|---|---|
| Taster | 19.22 | 16.44 |
| Nontaster | 24.13 | 25.41 |
| p-Value | <0.0001 | <0.0001 |
| t- Value | 6.146 | 5.976 |

**Table-3:** Comparison of mean values of BMI and BF% in male subjects.

| | BMI (kg/cm$^2$) | BF% |
|---|---|---|
| Taster | 20.12 | 25.1 |
| Nontaster | 22.32 | 30.45 |
| p-Value | <0.05 | <0.05 |
| t-Value | 2.033 | 2.947 |

**Table-4:** Comparison of mean values of BMI and BF % in female subjects.

of solution No. 5-13 were classified as "tasters" and those who can identified taste of solution No.1-4 were classified as "non-tasters".[16]

In the present study we had evaluated taster status of 112 subjects. Out of these subjects 77 were tasters and 35 were non-tasters i.e. 31% are non-tasters. The incident of taster status varies country / race wise. The non tasters in India are approximately 40%**.** Taster status is genetically determined and genes are located on chromosome 5q15 and evidence for an additional locus on chromosomes 7. In the present study, among the 112 subjects, out of 70 were males and 42 were females. Among males 49 were tasters and 21 were-non tasters i.e. 30%. And in females 28 were tasters and 14 were non-tasters 33.33%. The percentage of tasters in females was more than males though it was not statistically significant. Another significant finding is that, tasters perceive sugar much sweeter than non-tasters and also recognize fat at very lower concentration than non-tasters.

In this study the mean BFP of subjects was 22.04 $\pm$ 7.6548 % and BFP of tasters was 19.59 $\pm$ 7.0668 %, while the BFP for non-tasters were 27.42$\pm$ 6.0198%. This shows that tasters have BFP at lower end of normal range while non-tasters have BFP at higher end, which makes then more prone for obesity.

From the above finding it is clear that tasters have less Body Mass Index and Body Fat Percentage than non-tasters ($p<0.0001$). This is supported by (Metron BB et al, 1958, CDC growth charts, 2000 and Shivaprasad et al, 2012).[17-19] In contrast Saraswathy et al, in 2011 found that there was no relation between BMI and PTC intensity ratings.[20]

As it was found that the non-tasters have higher body mass index and body fat percentage than tasters the reason for that was hypothesized that the tasters have low acceptance to sweet and fatty foods. Kathleen L, Keller et al, 2004, had done a study in on 4-5 years old children and had found that non-tasters boys had higher BMI than tasters.[21] In another study on middle aged women by Tepper et al in 1999, showed the results supporting to the present study.[22] The study performed by Goldstein and Gretchen L. et al in 2007, also supports present study.[23] All these studies suggest that the non-tasters have higher body mass index and body fat percentage than tasters. In 1998, Tepper B.J et al. carried out study on children and result of this study shows that both medium tasters and super tasters could discriminate differences in fat content between 40% fat and 10% fat salad dressings, but non-tasters could not. Although medium and super tasters showed no preference for either dressing, while the non-tasters preferred the 40% fat dressings.[24] A separate study by Keller K. L. et al in 2002 had proved that tasters have low acceptance for full fat milk than non tasters and also high daily intake of fat in non tasters than taster. It also showed that non-tasters have high daily intake of fat than tasters.[25] Duffy V. B et al in 2000 carried out a study suggesting that liking of sweet and high-fat food and beverages groups decreased with increasing perceived bitterness of PTC. Though in this study males showed highly significant relation with BMI and BFP but in female it not highly significant that may be because of the voluntary attempt of female to restraint their diet which mask the effect of their taster status.[26]

However taster status of an individual cannot be controlled as it is genetically determined and obesity also shows a pattern of inheritance. One can prevent or delay the occurrence of these diseases and obesity by altering their diet and life style. By knowing their taster status, we can explain them the cause of their dietary habit and advise them to modify dietary habits and lifestyle to prevent non-tasters from becoming obese and prevent them from other diseases too. So it is important to know once taster status.

## CONCLUSION

In present study using PTC, results show that non-tasters have significantly higher BMI and Body Fat Percentage than tasters. From this we can conclude that non-tasters are more prone for obesity than tasters. As the sample size was less the study needs to be supported by long-term experimentations with more number of samples.

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