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Indian Journal of Clinical Anatomy and Physiology

Journal homepage: <https://www.ijcap.org/>

## Original Research Article

## Taste dysfunction in obese type 2 diabetic individuals

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## ARTICLE INFO

## Article history:

Received 03-07-2022

Accepted 13-07-2022

Available online 10-10-2022

## Keywords:

Obesity

Central diabetic neuropathy

Gustatory function

Hypogeusia

Quality of life

## ABSTRACT

**Background:** Obesity is a well-known risk factor for many diseases. It is also known to enhance complications of many diseases eg. Type 2 Diabetes mellitus (T2DM). This study was done to assess the gustatory functions in obese T2DM individuals.

**Objective:** This study was done to assess the gustatory functions in obese T2DM subjects and compare the same with lean T2DM individuals.

**Materials and Methods:** A comparative study with a sample size of 40 was conducted. Patients aged 25 to 50 years with T2DM < 5 years duration and HBA1C  $\leq 7$  were divided into 2 groups, Group I- with normal weight (BMI of 18.5 to <25) and Group II with grade 1 obesity (BMI of 30 to < 35). Triple Drop Test was done to evaluate gustatory functions. Scoring from “5” to “1” was done on the identification of different concentrations of tastants.

**Result:** Taste scores for sweet, salty, sour, and bitter tastants were lesser in obese diabetics as compared to the lean T2DM subjects. This was statistically significant ( $p < 0.05$ ) Conclusion: Taste impairment is observed in obese diabetic subjects. This could be an indication of early central diabetic neuropathy. Hypogeusia may cause an increased preference for sweet-tasting or salty foods thus imposing greater health risks, increasing obesity, and negatively affecting the quality of life.

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## 1. Introduction

Diabetes mellitus and its symptoms were first described in ancient Egypt, around 2000 B.C.<sup>1</sup> Over the past few decades, patients with Type 2 Diabetes mellitus have more than doubled globally, making it one of the most important public health challenges worldwide. Type 2 diabetes is strongly associated with obesity. The prevalence of obesity-related diabetes is expected to double to 300 million by 2025.<sup>2</sup> The connotation ‘diabesity’, highlights the fact that the majority of diabetic individuals are overweight or obese.<sup>3,4</sup> An increased BMI increases the individuals’ mortality risk 7-fold.<sup>5</sup> According to the WHO, obesity is

the largest global chronic health problem.<sup>6</sup> It is estimated that by the year 2030, 60% of the world’s population will be overweight or obese.<sup>7,8</sup>

An impairment of gustatory function in T2DM patients has been reported in earlier studies. Duration of the disease and poor glycaemic control,<sup>9,10</sup> and obesity might play a causal factor for the same.

## 2. Materials and Methods

This was a cross-sectional study comprising a sample size of 40. Patients aged 25 to 50 years with T2DM < 5 years duration with HBA1C  $\leq 7$  were recruited from a tertiary care hospital for the research. They were divided into 2 groups, Group I- with normal weight (BMI of 18.5 to <25)

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**Table 1:** Concentrations of the taste stimuli used (g/ml) and the allotted scores

Dilution Steps	Score	Sucrose (Sweet)	Sodium chloride (Salty)	Citric acid (Sour)	Quinine hydrochloride (Bitter)
1	1	3	1	2.5	0.02
2	2	1.5	0.5	1.2	0.01
3	3	0.75	0.25	0.6	0.005
4	4	0.38	0.12	0.3	0.0025
5	5	0.19	0.06	0.15	0.0012

**Table 2:** A comparison of taste scores between Group I and Group II

Tastant	Taste Scores Mean $\pm$ SD		p value
	Group I	Group II	
Sweet	3.9 $\pm$ 0.96	2.34 $\pm$ 1.3	0.000
Salt	4.75 $\pm$ 0.55	3.32 $\pm$ 1.5	0.000
Sour	4.75 $\pm$ 0.55	4 $\pm$ 0.725	0.001
Bitter	3.24 $\pm$ 1.12	2 $\pm$ 1.17	0.002

and Group II with grade 1 obesity (BMI of 30 to < 35). The duration of the study was 2 months.

Exclusion criteria comprised of subjects with a past or present history of psychiatric disorders, recent respiratory tract infection, hypothyroidism, chronic kidney or liver disease stage, on sedatives, antibiotics, antiepileptic medications, alcoholics, smokers, pan, tobacco and other substance abusers, pregnant or breastfeeding women and subjects who have contacted COVID-19 in the past six months. Consent was obtained from the Institute's Review Board. HBA1C levels, anthropometric measurements and BMI were calculated. The triple drop test was used to evaluate gustatory function. Five different concentrations of sweet, salty, sour and bitter tastants were used in dilutions of 50% steps using sucrose, sodium chloride, citric acid, and quinine hydrochloride respectively (Table 1). Samples were presented as drops on the anterior part of tongue, swished in the mouth for ~5 seconds and spit out. Subject was asked to rinse the mouth thoroughly with water in between. Scoring was done depending on the identification of concentrations, "1" being highest, "5" being the lowest concentration.

### 2.1. Statistical analysis

Quantitative variables were analysed using descriptive statistics such as mean and standard deviation, qualitative variables were analysed using frequency and percentage. Student's t test was used to test the difference in the mean values.

### 3. Result

The mean taste scores for the tastants: sweet, salty, sour and bitter in Group I were 3.9 $\pm$  0.96, 4.75 $\pm$  0.55, 4.75 $\pm$  0.55 and 3.24 $\pm$  1.12 respectively, while the mean taste scores in Group II were 2.34 $\pm$  1.3, 3.32 $\pm$  1.5, 4 $\pm$  0.725 and 2 $\pm$  1.17 respectively. A significant difference ( $p < 0.05$ ) was noticed in the taste scores amongst the two groups. This

signifies that obese patients with T2DM respond to a higher concentration for the tastants as compared to non-obese T2DM patients. (Table 2)

### 4. Discussion

This study provides an assessment of taste sensations perceived by T2DM patients in the Indian population and it supports the findings of previous studies. In a study by Shreya Khera et al it was observed that T2DM patients showed a higher threshold to sweet, salt, sour and bitter tastes.<sup>11</sup> Manley KJ et al concluded in their study that a significant impairment in sweet taste sensation occurs in diabetic patients.<sup>12</sup>

Taste impairment observed in obese T2DM patients can have a negative impact on health and can further deteriorate diabetes. Hypogeusia may cause the already obese diabetics to consume more food and indulge more in hedonic eating. Obesity itself is a risk factor for many diseases esp. in diabetic individuals and it should not progress further. Utilized to advise them to use ingredients that enhance flavours but have low: herbs, spices, potassium chloride, non-nutritive sweeteners and sweet enhancers, in order to limit sodium and sugar intake.

### 5. Conclusion

Our study concludes that gustatory impairment for the tastants – sweet, salty, sour, and bitter was observed in obese Type 2 Diabetes mellitus patients having the disease for less than 5 years, though maintaining a fair glycaemic control. This may affect their choices of food items like preference for sweet-tasting food which can exacerbate hyperglycaemia and aggravate obesity. Hypoguesia may also lead to greater intake of salty diet which can escalate the risk of hypertension, renal and heart diseases. Obesity itself is a risk factor for many diseases esp. in diabetic individuals and it should not progress further. It would further decline

the quality of life (QOL). Knowledge about Hypogeusia in obese diabetics may be used in dietary counseling. Further, studies with larger sample size should be undertaken to understand how exactly obesity impairs taste sensation.

## 6. Source of Funding

This research did not receive any specific grant from funding agencies in the public, commercial, or not-for-profit sectors


## 7. Conflicts of Interest


The authors declare no conflicts of interest

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**Cite this article:** Hasan AZ, Preethi B L, Kalra P, Kumar M A. Taste dysfunction in obese type 2 diabetic individuals. *Indian J Clin Anat Physiol* 2022;9(3):189-191.