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# Impact of Gender and Age on Taste Perception for Sucrose in Patients with Type II Diabetes Mellitus

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## 1 INTRODUCTION

The prevalence of diabetes mellitus has dramatically increased over the world in the recent past. A cross-sectional study conducted between 2005 and 2006 has confirmed that one in five adults in Sri Lanka has either diabetes or pre-diabetes (Katulanda, *et al.*, 2008).

The sense of taste is an important chemical sense that play a critical role in human life. Sweet taste is the most pleasurable taste amongst the other tastes namely, sour, salt, bitter and umami. Consumption of sugar exceeding the healthy limits may disrupt the glycaemic control in patients with diabetes, causing an impairment of sweet taste perception (Green, 2010).A recent study has confirmed that ability to detect sweet taste is impaired in diabetes and it is proven that there is an alteration in the preference for sucrose amongst the diabetics (Yu, *et al.*, 2014).However, the impact of gender and age on taste perception for sucrose in diabetics has not been reported before.

Perception of taste (i.e. Supra-threshold sensitivity and preference) refers to a sensitivity that results from stimulation of gustatory nerves with different intensities, through a chemical sensing system.

Identifying the taste perception for sucrose in diabetics of different age and gender categories might provide useful information when recommending dietary adjustments. In a recent study we have confirmed that diabetics irrespective of the age and gender have significantly lower ratings for supra-threshold concentrations of sucrose when compared to normoglycemic controls (Wasalathanthri *et al.*, 2014). However, factors which contribute for this have not been uncovered fully. Thus, the aim of the current study is to assess the supra-threshold intensity ratings and preference for sucrose in patients with type II diabetes mellitus and to assess how the gender and age affects the taste perception for sucrose in them.

## 2 METHODOLOGY

This study is a part of a prospective cohort study conducted at the Department of Physiology, University of Sri Jayewardenepura. Baseline data of a total of 86 patients, aged between 35-60 years, with a history of type II diabetes mellitus for more than 5 years were considered. Patients who have oral ulcers which affect the taste perception and those who are on medications that change the taste perception were excluded from the study.

Data on socio-demographic and clinical characteristics such as age, gender, marital status, educational level, level of income, duration and family history of diabetes, adherence to diet control and complications of diabetes were obtained by an interviewer administered questionnaire after obtaining the written informed consent. The study was approved by the Ethics Review Committee of University of Sri Jayewardenepura.

Supra-threshold intensity ratings and the preference for sucrose were tested on participants who were asked to abstain from food, smoking, alcohol and betel chewing from 10pm, the previous day. A standard breakfast comprising of a plantain and 2 slices of brown bread with margarine added was given 1 hour before sensitivity testing to standardize their satiety. Supra-threshold intensity ratings were assessed by a series of sucrose solutions (2.02M, 0.64M, 0.2M, 0.064M, 0.02M, 0.0064M) and the patients were asked to rate on a general labeled magnitude Scale (gLMS). The mean supra-threshold intensity rating was calculated for each concentration after 3 consecutive tests (Green *et al*, .2010). Preference for sucrose was tested according to the "Monell 2-series, forced choice tracking method" for sucrose taste (Narukawa *et al.,* 2010).HbA1c was tested on all participants to assess glycemic control.

## 3 RESULTS AND DISCUSSION

**Table 1:** Demographic and clinical characteristics of study participants

| Variable | Category | N | % |
|---|---|---|---|
| Gender | Male | 36 | 42 |
| | Female | 50 | 58 |
| Age | ≤ 50 years | 19 | 22 |
| | >50 years | 67 | 78 |
| Duration of DM | 5-10 years | 64 | 74 |
| | >10 years | 22 | 26 |
| Family history | Yes | 52 | 40 |
| | No | 34 | 60 |
| HbA1c value | ≤7% Male | 08 | 09 |
| | Female | 09 | 10 |
| | >7% Male | 28 | 33 |
| | Female | 41 | 48 |
| Complications | Male | 26 | 38 |
| | Female | 43 | 62 |
| Adherence to diet control | Male | 24 | 41 |
| | Female | 35 | 59 |

DM- diabetes mellitus


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**Table 2:** Taste perception in relation to gender

| Sucrose concentration | Gender | Mean/±SD Supra-threshold intensity ratings for sucrose | P value (*p<0.05) t-test |
|---|---|---|---|
| **2.02M** | Male | 69.226 /±24.44 | 0.063 |
| | Female | 78.158 /±19.54 | |
| **0.64M** | Male | 56.639 /±24.63 | 0.410 |
| | Female | 60.898 /±22.74 | |
| **0.2M** | Male | 25.702 /±13.57 | 0.074 |
| | Female | 32.140 /±17.92 | |
| **0.064M** | Male | 12.016 /±9.0 | 0.493 |
| | Female | 13.899/ ±14.5 | |
| **0.0202M** | Male | 4.985 /±4.47 | 0.313 |
| | Female | 6.648 /±9.0 | |
| **0.0064M** | Male | 3.066 /±2.46 | 0.364 |
| | Female | 4.171 /±6.95 | |
| **Mean preference** | | | |
| | Male | 0.183 /±0.03 | *0.023 |
| | Female | 0.097 /±0.01 | |

The supra-threshold intensity ratings and preference for sucrose in men and women are given in Table 2. In the present study, supra-threshold intensity ratings for all concentrations of sucrose solutions were lower in men than women. Further, the findings indicate that men had a significantly higher preference for sucrose compared to women (p=0.023). In addition, only 41%of men in this study cohort controlled their diet. However interestingly, only 33% of men reported a poor glycaemic control (HbA1c of **≤7)** and only 38% had self-reported complications. In contrast, greater percentage of women had HbA1c values of > 7 (48%) and had self-reported complications (62%) despite having a higher sensitivity and a lower preference for sucrose. In agreement to this finding, another study also reported a higher preference for sucrose by diabetic men compared to diabetic women (Yu, *et al.*, 2014). Although it appears that men have a higher tendency to consume more sugar because they have a higher preference for sweet taste, they may be consuming less due to lower ratings for supra threshold concentrations of sucrose as how the alterations in supra-threshold intensity ratings affect sweet consumption in diabetics is still an unresolved question. The relationship between the taste perception and age is shown in table 3.The mean supra-threshold intensity rating for the sucrose solution with the highest concentration (2.02M) was significantly lower (*p=0.04) in patients above 50 years compared to those who were below 50 years. However, the mean supra-threshold intensity ratings for all lower concentrations of sucrose solutions (0.064M, 0.0202M, 0.0064M) were significantly lower (p=0.04, p=0.002, p=0.01 respectively) in younger patients (≤ 50 years).Furthermore, the results indicated that patients who were below 50 years of age had a significantly higher mean+/-SD preference (0.27 ±0.24vs 0.16±0.08) for sucrose compared to their older counterparts (p=0.005). Due to higher preference, the young patients are likely to consume more sugar. Liking for sweet-taste foods was reported to be higher even in non-diabetic individuals who are young suggesting that the young people may have unhealthy eating patterns as a result of greater preference for sweet taste (Sergi, *et al.*, 2017). However, when

HbA1c values are compared between the two groups, only 15% of younger patients appeared to have a poor glycaemic control (HbA1c>7%) whereas 68% of older patients reported a HbA1c>7%.This finding might be contributing to explain the current trend of onset of diabetes at a younger age (Sakurai *et al.,* 2014).

**Table 3:** Taste perception in relation to age

| Sucrose concentration | Age | Mean/±SD Supra-threshold Intensity ratings | P value (*p<0.05) t- test |
|---|---|---|---|
| ***2.02M** | ≤ 50 years | 83.067/±19.20 | *0.040 |
| | >50 years | 71.964/±22.31 | |
| **0.64M** | ≤ 50 years | 65.551/±23.22 | 0.182 |
| | >50 years | 57.290/±23.43 | |
| **0.064M** | ≤ 50 years | 9.904/±5.20 | *0.049 |
| | >50 years | 14.020/±13.76 | |
| **0.0202M** | ≤ 50 years | 3.000/±2.54 | *0.002 |
| | >50 years | 6.789/±8.20 | |
| **0.0064M** | ≤ 50 years | 1.978/±1.78 | *0.011 |
| | >50 years | 4.199/±6.12 | |
| **Mean preference** | | | |
| | ≤ 50 years | 0.267/±0.24 | *0.005 |
| | >50 years | 0.163/±0.08 | |

## 4 CONCLUSIONS AND RECOMMENDATIONS

Diabetic men tend to have a higher preference for sweet taste and lower intensity ratings for supra-threshold concentrations of sucrose compared to women. Despite, men in this study cohort had a better glycemic control with less complications compared to women. Although the tendency of consuming sugar is expected to be increased with higher preference, it is not clear how changes in intensity ratings for sucrose solutions affect sugar consumption in diabetics. Patients who are below 50 years showing a significantly higher preference for sucrose may be contributing to the tendency of consuming sweet-taste energy dense foods which is a popular dietary component in this age group. These findings should be considered when dietary recommendations are given to patients with type 2 diabetes mellitus.


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