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RESEARCH ARTICLE

A comparative study of taste sensitivity to phenylthiocarbamide in pregnant and nonpregnant females

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ABSTRACT

Background: Pregnancy is a condition where various neuroendocrinal changes occur. During pregnancy there are drastic changes especially in steroid hormone levels e.g. Estrogen and progesterone. Recent studies have shown that auditory, visual and olfactory sensitivities of a female increase during pregnancy. This increase in sensitivity is due to increase in hormone levels during pregnancy. **Aims and Objectives:** The aim of the present study was to compare the taste sensitivity in pregnant and non-pregnant females. **Materials and Methods:** The present study was done in 100 non-pregnant females and 300 pregnant females (100 females of each trimester) of age group 20-40yrs.13 solutions of different concentrations of phenylthiocarbamide (PTC) were prepared and taste sensitivity was checked. **Result:** Numbers of tasters are more in pregnant females as compared to non-pregnant females. There is significant increase in taste sensitivity in first trimester of pregnancy as compared to other trimesters. **Conclusion:** We conclude that there is increased taste sensitivity in pregnant females as compared to non-pregnant females and significant rise is seen in first trimester of pregnancy.

KEY WORDS: Phenylthiocarbamide; Taste Sensitivity; Pregnant Females

INTRODUCTION

Taste is a specific type of chemo sensitivity. It is perceived by receptors present in oral cavity located on lingual surface, the palate, the epiglottis, larynx, pharynx and oesophagus.[1] This chemo sensitivity is normally stimulated by direct contact of ions or molecules present in food. Taste sensitivity actually refers to the ability of person to detect even minute concentration of a taste substance.

Biologically taste is determined by a genetic component. There are several substances which can be used to determine taste sensitivity e.g. Thiourea compounds. Among these, phenylthiocarbamide (PTC) is widely used to study the taste responses related to Mendelian factors.[2] PTC is a bitter compound. But the perception of bitter sensation of PTC is genetically determined. Bitter taste to PTC is felt only if a person carries the dominant gene. If this gene is recessive, then PTC will not give bitter taste. So we can classify individuals as tasters - they are able to taste PTC as bitter where as non-tasters are those that cannot perceive PTC as bitter.[3] These individuals who are not able to taste PTC are also called as taste blind to PTC. Taste blindness is highly selective for PTC since there is no taste blindness to other bitter substances or to substances which taste sweet, salty or sour.[4]

A number of factors either physiological or pathological influence the taste sensitivity. Taste sensation varies according to genetic, cultural, ageing and hormonal factors.[2] Pregnancy is a condition where various

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neuroendocrinological changes occur. Estrogen levels are 0.06 ng/ml during midluteal phase and rises progressively to 150 ng/ml during pregnancy. Similarly progesterone level rises from 0.1 to 2 µg/100 ml of plasma in nonpregnant state to 11-32 µg/100 ml in pregnant state.[5] Recent studies have shown that auditory, visual and olfactory sensitivities of a female increase during pregnancy.[2] This increase in sensitivity is due to increase in hormone levels during pregnancy. So the aim of the present study was to find out whether taste sensitivity changes during pregnancy.

MATERIALS AND METHODS

The present case-control study was done at antenatal clinic of Tertiary Care Hospital located at Mumbai Municipal Corporation, Maharashtra. The present study was done in 100 non-pregnant females and total 300 pregnant females (100 females of each trimester). The participants were divided into two groups i.e., Group A Control (non-pregnant Females) and Group B cases (pregnant females). The inclusion criteria for control group A was non-pregnant healthy females of age group 20-40 years, during luteal phase, not suffering from any major medical illness. The control with Females <20 and >40 years of age group, having any kind of menstrual abnormality or disease like ovarian tumor or polycystic ovarian disease or any endocrinal abnormality, on oral contraceptives or any medication affecting hormonal function or any history of diabetes, hypertension or any systemic illness were excluded.

Among the cases i.e., pregnant women includes all three trimesters without any complication between 20 and 40 years age group. Exclusion criteria for cases was pregnant females <20 and >40 years of age group associated with any complication e.g. Pregnancy induced hypertension, hydatidiform mole, twin pregnancy, ovarian tumor or any condition which can affect the hormonal functions. The cases and control were under gone for testing PTC taste sensitivity. The institutional ethical committee approval was taken prior to the study.

The cases were selected from the outdoor patients of antenatal clinic while controls were selected from the healthy women accompanying the pregnant women or in and around the hospital area. The participants were examined in the afternoon and were instructed not to drink or eat anything except water at least for 2 h before study. The subjects were first explained about the procedure of the test and the consent was taken.

Harris and Kalmus method[6] was used for testing PTC taste sensitivity. 13 different solutions of different concentrations of PTC were prepared as shown below:

Solution number	Concentration of PTC (mg/100 ml)
1	130
2	65
3	32.5
4	16.25
5	8.125
6	4.063
7	2.031
8	1.016
9	0.508
10	0.254
11	0.127
12	0.063
13	0.032

13 different solutions from No. 13 to No. 1 with different concentrations of PTC (Weakest 0.032 mg/100 ml to strongest 130 mg/100 ml) were prepared. 2-3 drops of solution were put over the tongue at a time and kept in mouth for 3 to 4 s, and then it was spit out. The subjects were asked to rinse their mouth with water in between testing each sample. The procedure was carried out till the subject identifies the bitter taste. The concentration at which the bitter taste was perceived is called threshold of PTC sensitivity for that subject.

The participants were divided into two groups i.e., tasters- those who were able to detect the bitter taste of PTC in solution No. 13 to solution No. 5 and Non-tasters: Those who were able to detect the bitter taste only in solution No. 4 to solution No. 1 or who could not detect the bitter taste in any solution. Further among the pregnant women who tested positive, divided into two groups i.e., tasters with solution No (9-13) and tasters with solution No (5-8).

All the collected data was analysed. The percentage and Chi-square test analysis was done. $P < 0.05$ considered as statistically significant (S).

RESULTS

Table 1: Comparison of taste sensitivity to PTC in pregnant and non-pregnant females: The numbers of tasters are 70% in pregnant females as compared to 59% in non-pregnant females. This shows significant rise in taste sensitivity in pregnant females as compared to non-pregnant females.

Table 2: Comparison of taste sensitivity to PTC in each trimester of pregnancy and non-pregnant females: Among the three trimesters of pregnancy, the numbers of tasters are 77% in first trimester and only 64% and 69% during second and third trimesters, respectively. The difference is highly significant stastically. So there is significant rise in taste sensitivity in first trimester of pregnancy as compared to second and third trimesters of pregnancy.

Table 1: Comparison of taste sensitivity to PTC in pregnant females and non-pregnant females

Group	Group B	Group A	Total
	Pregnant females	Non-pregnant females	
Tasters	210 (70)	59 (59)	269
Nontasters	90 (30)	41 (41)	131
Total	300	100	400

PTC: Phenylthiocarbamide

Table 2: Comparison of taste sensitivity to PTC in each trimester of pregnancy and non-pregnant females

Group	Taster and non-taster percentage (%)			
	Taster		Non-taster	
First trimester	77.0		23.0	
Second trimester	64.0		36.0	
Third trimester	69.0		31.0	
Non-pregnant	59.0		41.0	
Chi-square tests	**Value**	**Df**	***P***	**Association is**
Pearson Chi-square	8.025	3	0.045	Significant

PTC: Phenylthiocarbamide

Table 3: Comparison of tasters among three trimesters of pregnancy

Group	Percentage of tasters			
	Solution No (5 to 8)		Solution No (9 to13)	
First trimester	24.40		75.60	
Second trimester	40.60		59.40	
Third trimester	54.90		45.10	
Total	39.40		60.60	
Chi-square tests	**Value**	**df**	***P***	**Association is**
Pearson Chi-square	14.597	2	0.001	Significant

Table 3: Comparison of tasters among three trimesters of pregnancy: The numbers of tasters who were able to detect PTC in solution No. 9 to 13 (0.508 mg/100 ml to 0.032 mg/100 ml) were 75.60% in first trimester of pregnancy, 59.40% in second trimester and 45.10% in third trimester of pregnancy. This shows that the numbers of tasters responding to lesser concentrations of PTC are more in first trimester as compared to second and third trimesters of pregnancy.

DISCUSSION

In this study, there was a statistically significant increase in taste sensitivity in pregnant females as compared to non-pregnant females. Similar increase in taste sensitivity during pregnancy was also observed by Duffy et al.[7]

Yucel et al. had done scanning electron microscopic studies on dorsal surface of rat tongue during pregnancy. They also found correlation between the alterations of steroid hormone levels in pregnancy and morphological changes in the lingual papillae.[8]

This change in taste response during pregnancy is due to the effect of changed steroidal hormone levels e.g. Estrogen and progesterone. These hormones act on two sites (a) Taste buds or taste receptors, (b) Brainstem.[9]

The receptors for taste is taste buds or taste cells which are present in different papillae on lingual surface. These are also present on the palate, epiglottis, larynx, pharynx and oesophagus. The life span of taste cells is 10 days. The new taste cells are derived from surrounding epithelial cells which are constantly being renewed.[1] This process of renewal is constantly affected by nutritional and hormonal status in females.[10] During pregnancy there is drastic increase in steroidal hormones which may have effect on taste buds and might have increased their sensitivity. In some experimental studies, it is also found that there are some differences in topographic configuration of these papillae in pregnant rats as compared to controls.[8]

There is also increase in progesterone level in saliva during pregnancy. So the level of hormones in the saliva has direct effect on taste sensation. This increase in progesterone level in saliva is more in first trimester as compared to second and third trimesters of pregnancy. This might be one of the reasons for significant increase in taste sensitivity in first trimester as compared to second and third trimesters of pregnancy.[11]

Increased steroid hormones also cause changes in electrolyte levels and water retention. All these together reduce the taste threshold as well as have effect on functioning of sensory nervous system.[2]

Experimental studies also showed that the response of parabrachial pons to bitter taste threshold was increased in overectomised rats as compared to normal control female rats.[9]

Results of the present study support the "EMBRYO PROTECTION HYPOTHESIS" given by Hook which states that increased olfactory sensitivity specifically to pungent odour and increased taste sensitivity specifically to bitter taste in first trimester of pregnancy is to avoid certain foods having teratogenic and abortifacient chemicals.[12]

The limitation of this study is that along with PTC taste sensitivity actual measurement of hormone levels in each trimester of pregnancy and non- pregnant women were not done.

CONCLUSION

There is increase in taste sensitivity to PTC in pregnant females as compared to non-pregnant females. Among all

the three trimesters of pregnancy the percentage of tasters responding to very low concentration of PTC i.e., solution No. 9 to 13 (0.508-0.032 mg/100 ml) are 77%. This indicates taste sensitivity is significantly more in first trimester as compared to other trimesters of pregnancy. All these changes might have occurred because of change in sensitivity at receptors as well as brainstem nuclei for taste due to raised steroidal hormones.

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