

Does odor and taste identification change during hyperemesis gravidarum?

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ABSTRACT

Aim To investigate a difference in odor and taste identification among pregnant women with hyperemesis gravidarum, those with healthy pregnancy and non-pregnant women.

Methods This prospective, controlled study included 33 pregnant women with hyperemesis gravidarum, 33 healthy pregnant and 26 non-pregnant women. For all participants, rhinological examinations were performed. Odor and taste identification were performed by holding Sniffin Sticks test battery (Burghart, Wedel, Germany) in all participants.

Results There was a statistically significant difference in results of odor identification tests among the groups ($p=0.031$). Rose odor was selected as the most pleasant odor by the hyperemesis gravidarum group, 32 (96.9%). Orange odor was selected as the most pleasant odor by the healthy pregnant women, 33 (100%) whereas the banana odor was selected as the most pleasant odor by the healthy non-pregnant women, 10 (38.4%). In taste identification tests, there was a significant difference in total taste scores among the groups ($p=0.003$).

Conclusion It is obvious that there is a need to evaluate odor thresholds and other parameters by detailed studies on odor perception in the context of hyperemesis gravidarum.

Key words: pregnancy, smell, sense of smell

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Original submission:

21 September 2015;

Revised submission:

28 October 2015;

Accepted:

26 November 2015.

doi: 10.17392/833-16

Med Glas (Zenica) 2016; 13(1):50-55

INTRODUCTION

Nausea and vomiting during pregnancy can lead to marked labor loss and impairment in quality of life. It has been reported that nausea and vomiting affect 50-80% of pregnant women (1, 2). Hyperemesis gravidarum is characterized by excessive nausea and vomiting, affecting 0.62-2% of all pregnant women (3). It can severely affect health of a fetus and pregnant women in particular. Weight loss of 5%, ketonuria, liver injury, renal injury and post-traumatic stress disorder after pregnancy can be observed in hyperemesis gravidarum (4). Growth retardation and low birth weight, preterm delivery and related perinatal morbidity can be observed in the fetuses of pregnant women with hyperemesis gravidarum (5). Several factors, including *Helicobacter pylori*, conditions accompanied by high levels of serum β -hCG, such as abnormal liver functions, molar pregnancy and multiple pregnancy, and biological, genetic, social and psychological factors are implied in the etiology of hyperemesis gravidarum (6-9). In addition, the risk for hyperemesis gravidarum is markedly increased in patients with hyperthyroidism (10). Hyperemesis gravidarum and ketonuria are more frequently observed in pregnancies involving female fetuses (11). Olfactory mechanisms have a primary role in the recognition of toxins and can be linked to nausea and vomiting as it is related to the sense of taste (12-14). The sense of smell prevents ingestion of rotten food before and in relation to the sense of taste. Occasionally, hyperemesis can be related to sensitivity to odors and there may be worsening in hyperemesis in case of odors with sensitivity (5,15).

The purpose of the present study was to investigate a difference in odor and taste identification among pregnant women with hyperemesis gravidarum, those with healthy pregnancy and non-pregnant women.

PATIENTS AND METHODS

Patients and study design

The study included 33 pregnant women with hyperemesis gravidarum (group 1), 33 healthy pregnant women (group 2) and 26 healthy non-pregnant women (group 3) who presented to the Obstetrics and Gynecology Clinic of Gevher

Nesibe Hospital of Erciyes University, Medicine School. In group 1 and 2, only pregnant women in the first trimester were included. For the hyperemesis gravidarum group, inclusion criteria were the presence of excessive nausea and vomiting, weight loss of 5% compared to baseline and positive ketones in urine. Urinary ketone was graded as +, ++, +++ and the parity of the participants was recorded.

All participants underwent rhinological examination at the Ear, Nose and Throat (ENT) and Head & Neck Surgery Clinic of Kayseri Training and Research Hospital. Overall, six subjects were excluded due to the following reasons: allergic rhinitis (n=1), upper respiratory tract infection (n=2), severe septum deviation (n=2) and diabetes mellitus (n=1). The remaining 86 participants without nasal abnormality or diabetes mellitus were included in the study. This study was approved by the Ethics Committee of Erciyes University. All patients gave informed consents before participation.

Methods

Odor identification tests were performed in a well-ventilated room by holding Sniffin Sticks test battery (Burghart, Wedel, Germany). This test involves the presentation of odorants in felt-tip pens. The pens have similar shape and color. The pen's tip is placed in approximately 2 cm distance in front of both nostrils for 3 seconds, with an interval of 30 seconds between the different pens. The Sniffin Sticks test battery includes 12 odors: leather, peppermint, banana, coffee, cinnamon, licorice, rose, fish, cloves, lemon, orange and pineapple. After sniffing each odor, the patients were asked to find the right answer from a questionnaire including 4 options. All answers were recorded to obtain a score for both nostrils. All patients were asked which odor was most pleasant or unpleasant. The patients were classified as normosmia (10-12 scores), hyposmia (7-9 scores) and anosmia (0-6 scores) according to the right answers. In addition, patients rated their olfaction subjectively into one of three categories (good, fair or poor).

The identification of taste was tested for 4 main tastes, including quinine hydrochloride (bitter), citric acid (sour), sodium chloride (salty) and sucrose (sweet) by using taste sprays (Burghart,

Wedel, Germany). Taste Sprays were applied on the tongue to measure the identification of taste. The patient was asked to wash her mouth with water to prevent blending of tastes. We waited for 30 seconds before proceeding to the next taste. All answers were recorded and right answer scores were compared among the groups.

Statistical analysis

Comparison among the groups with odor and taste identification scores was evaluated using one-way analysis of variance (ANOVA) with the Bonferroni post-hoc test. The chi-square test was used to detect differences between nominal data. $p < 0.05$ was considered as statistically significant.

RESULTS

The mean age was 27.7 ± 5.4 years in the hyperemesis gravidarum group, 27.5 ± 6.1 years in the healthy pregnant group and 29.0 ± 5.2 years in the healthy non-pregnant women ($p = 0.581$).

In the odor identification test, a significantly different odor identification scores between hyperemesis gravidarum, healthy pregnant and non-pregnant women groups were found 9.1 ± 1.6 , 9.3 ± 1.4 , 10.12 ± 1.33 ($p = 0.031$) (Figure 1). Rose odor was selected as the most pleasant odor, 29 (87.8%), whereas fish odor was selected as the most unpleasant odor, 24 (72.7%) in the hyperemesis gravidarum group. Orange odor was selected as the most pleasant odor, 30 (90.9%), whereas fish odor was selected as the

most unpleasant odor, 29 (87.8%) in the healthy pregnant group. Banana odor was selected as the most pleasant odor, 26 (100%), whereas fish odor was selected as the most unpleasant odor, 24 (92.3%) in the healthy non-pregnant group. There were significant differences found among groups regarding perception of most pleasant odors ($p = 0.012$) and no difference was found among the groups regarding perception of most unpleasant odors ($p = 0.281$). All participants experienced difficulty in identification of pineapple and licorice odors.

Prevalence of hyposmia in hyperemesis and healthy pregnant group was 56.7% (33/19) and 30.0% (33/10), normosmia 3.3% (33/1) and 6.7% (33/3), and anosmia 40.0% (33/13) and 63.3% (33/20), respectively. Prevalence of hyposmia was 19.2% (26/5), normosmia 80.8% (26/21) in healthy non-pregnant women group. There were statistically significant differences among the groups regarding hyposmia, anosmia and normosmia ($p < 0.001$). A total of 10 (30%) patients considered their olfactory function as fair, 20 (60%) as good, and 3 (10%) as poor in hyperemesis gravidarum group. A total of 15 (46.7%) patients considered their olfactory function as fair, 16 (50%) as good, 1 (3.3%) as poor in the healthy pregnant group. A total of 15 (57.7%) patients considered their olfactory function as fair, 2 (7.7%) as good, and 9 (34.6%) as poor in the healthy non-pregnant women group. There was a significant difference detected subjectively rating their olfaction as good, fair and poor among groups ($p < 0.001$) (Table 1).

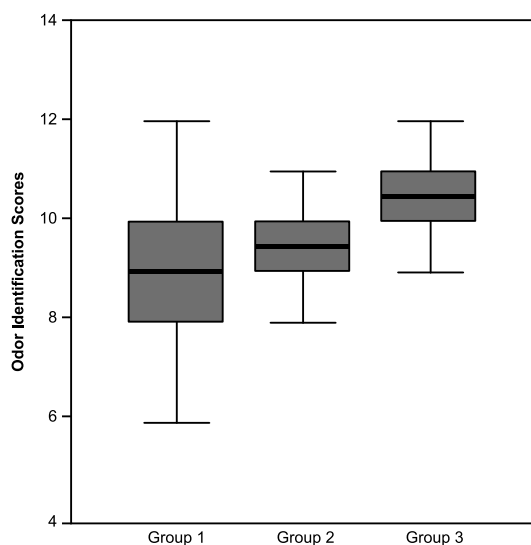


Figure 1. Comparisons of odor identification scores among the groups

Table 1. Right answers in the odor identification test according to the groups

Odors	No (%) of women			p
	Hyperemesis gravidarum	Healthy pregnant	Healthy non-pregnant	
Orange	28 (84.8%)	30 (90.9%)	25 (96.1%)	0.369
Leather	5 (15.1%)	7 (21.2%)	7 (26.9%)	0.640
Cinnamon	24 (72.7%)	27 (81.8%)	24 (92.3%)	0.331
Mint	28 (84.8%)	28 (84.8%)	25 (96.1%)	0.887
Banana	29 (87.8%)	27 (81.8%)	26 (100%)	0.190
Lemon	19 (57.5%)	22 (66.6%)	21 (80.7%)	0.343
Licorice	21 (63.6%)	13 (39.3%)	17 (65.3%)	0.084
Coffee	28 (84.8%)	28 (84.8%)	26 (100%)	0.403
Cloves	24 (72.7%)	27 (81.8%)	25 (96.1%)	0.161
Pineapple	17 (51.5%)	14 (42.4%)	21 (80.7%)	0.081
Rose	27 (81.8%)	29 (87.8%)	24 (92.3%)	0.590
Fish	24 (72.7%)	29 (87.8%)	24 (92.3%)	0.093
Odor identification scores	9.1 ± 1.6	9.3 ± 1.4	10.12 ± 1.33	0.031

No correlation was detected between the degree of ketone positivity and odor identification scores in the hyperemesis gravidarum group (p=0.906). When gravidity was assessed, no significant difference was detected between the groups.

In the taste identification test, there was a significant difference in total taste scores among the hyperemesis, healthy pregnant and non-pregnant group (3.4±0.9/3.9±0.1/3.92 ± 0.27, respectively) (p=0.003). There were also significant differences in the identification of salty (p=0.001), sour (p=0.017) and bitter (p=0.040) among the groups. However, there was no difference in the identification of sweet (p=0.745) among the groups (Table 2).

Table 2. Right answers in the taste identification test according to the groups

Taste	No (%) of women			P
	Hyperemesis gravidarum	Healthy pregnant	Healthy non-pregnant	
Salty	23 (69.6%)	30 (90.9%)	25 (96.1%)	0.001
Sour	26 (78.7%)	30 (90.9%)	25 (96.1%)	0.017
Sweet	28 (84.8%)	29 (87.8%)	23 (88.4%)	0.745
Bitter	27 (81.8%)	30 (90.9%)	25 (96.1%)	0.040
Taste identification scores	3.4±0.9	3.9±0.1	3.9±0.1	0.003

DISCUSSION

It has been established that a change of odor perception in pregnant women is a social issue and may involve a wide spectrum, extending up to normosmia, hyposmia or anosmia in several studies. In previous surveys, it has been observed that there is an alteration in odor perception in 68% of pregnant women (16,17).

Cameron et al. evaluated odor perception in pregnancy in 2 groups: pleasant and unpleasant odors. The authors roughly classified the unpleasant odor group into 3 major categories: social group, harmful material and food. In addition, pleasant odors in pregnancy were also classified into 3 categories: food-related, personal product and outdoor. The authors reported that fruit odors were the most pleasant odors, while meat and fish odors were the most unpleasant odors (18). In our study, fish odor was found to be the most unpleasant odor in all groups. The most pleasant odor was orange, banana and rose in the healthy pregnant group, healthy non-pregnant group and hyperemesis gravidarum group, respectively.

In a study by Laska et al., smell threshold was evaluated by using n-butanol and it was shown

that smell thresholds were significantly higher in pregnant women in the first trimester compared to the control group and no significant difference was shown in the discrimination of odor intensity (19). Köble et al. reached two conclusions in their study. Firstly, the authors found that, contrary to the expectation, there was no change in the perception of odor during the first trimester. Secondly, they found that there were alterations in hedonic smell rates (20). This finding is a phenomenon related to potential toxins of cigarette, alcohol and coffee rather than being related to odors. In their study, Köble et al. found that pregnant women avoided smells of gum, cigarettes and coffee (20). There are studies reporting that odor perception in pregnancy is a mechanism aiming to avoid toxins rather than pleasure, as with cigarettes, alcohol and coffee. This can be a mechanism related to protection of the fetus (20). In our study, we found that pregnant women suffered from fish and leather odors, and that these odors triggered nausea in seven pregnant women with hyperemesis gravidarum.

In the study of Köble et al., it was reported that odor perception did not differ in pregnancy (20). In our study, we concluded that there was no significant difference in odor perception between pregnant women with hyperemesis gravidarum and healthy pregnant women.

Swallov et al. concluded that odor perception did not differ in pregnant women when compared to non-pregnant healthy women (15). The authors found that there was minimal difference in odor perception in pregnant women when compared to men. In that study, the only significant difference between pregnant women and healthy controls was found in the perception of melon odor. In the same study, it was shown that there was a trigger for nausea in 68% of women and that there was no correlation between the severity of nausea and vomiting and the intensity of odors. The authors reported that odors of oil and fried meat were undesired stimuli (15). In contrast, Humel et al. reported that nausea and vomiting were not related to odor in pregnant women (21). In the present study, it was concluded that pregnant women with hyperemesis gravidarum did not differ from those with a healthy pregnancy regarding olfactory sensitivity. We also found that fish odor was unpleasant odor triggering nausea and that

there was no difference in the perception of fish odor among the groups.

Laska et al. found that leather, lemon and natural gas odors were more intense in the first trimester when compared to the control group. In addition, orange and grape odors were found to be less pleasant (19). It was found that there was a decrease in identification of soot, pine and leather odors in pregnant women at first trimester in a recent study, in which pregnant women were classified into 3 groups based on gestational week. No difference was found in pregnant women at second and third trimester and those with healthy pregnancy (22). In our study, smell identification was additionally assessed in pregnant women with hyperemesis gravidarum and the most pleasant odor was orange in the healthy pregnant group, while it was rose in the hyperemesis gravidarum group.

Köble et al. measured taste in pregnant women and found that taste sensitivity was decreased in the first trimester when compared to non-pregnant women. The authors reported that bitter taste was decreased in particular. It was also reported that pregnant women experienced difficulty in identifying sweet, even at very low concentrations, whereas they were more sensitive to salty (20). Similarly, our results demonstrated that there was a significant difference for salty ($p=0.001$), sour ($p=0.017$) and bitter ($p=0.040$), while there was no significant difference for sweet ($p=0.745$).

It might be more appropriate to add odors of toxins or substances with harmful effects while conducting smell studies in such special groups. In our study, the only substance that could be harmful for pregnancy was coffee. In addition, threshold differences between groups might also

be measured by adding a smell threshold test, as in the study by Laska et al (20).

Some limitations of this study should be mentioned. First the small size of our patient sample represents an important limitation. Secondly, this is a cross-sectional study. Thirdly, we did not conduct an objective evaluation of odor and taste perception tests. Nevertheless, the result of this study was a subjective evaluation of odor and taste perception in patients with hyperemesis gravidarum by Sniffin Sticks test and taste sprays.

Hyperemesis gravidarum is a condition that seriously affects the health of a pregnant woman and a fetus. Previous studies suggest that odor perception does not make difference between pregnancy and healthy women. In our study, we have demonstrated that odor and taste identification scores were different between pregnant women and non-pregnant women; however there was no difference between women with hyperemesis gravidarum and those with healthy pregnancy. It is obvious that there is a need to evaluate odor thresholds and other parameters by detailed studies on odor perception in the context of hyperemesis gravidarum.

ACKNOWLEDGEMENT

This study was presented at the 11th International Ear Nose Throat and Head & Neck Surgery Congress, Ankara, 17-19 April 2014.

FUNDING

No specific funding was received for this study

TRANSPARENCY DECLARATION

Competing interests: None to declare.

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