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# The effect of hyperemesis gravidarum on voice and dysphagia: a comparative study

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**Abstract. – OBJECTIVE: This study aims to determine the voice and gastrointestinal system changes of patients with hyperemesis gravidarum in the first trimester and to compare them with healthy pregnant women.**

**PATIENTS AND METHODS: This study was conducted prospectively. Two groups were defined as hyperemesis and healthy pregnant women. All the participants in the groups are between 20-42 years old and 6-12 weeks pregnant. Voice evaluation of all participants was made with the voice handicap index-10 (VHI-10). The Eating Assessment Tool-10 (EAT-10) was used for Dysphagia evaluation. The groups were compared, and the significance level was determined as $p<.05$.**

**RESULTS: In terms of mean age and week of gestation, both groups were matched. There was a statistically significant difference in total VHI-10 between the control and HG group. In terms of the EAT-10 on the other hand subjective swallowing problem, higher scores (more problematic) were observed in the HG group. There was no statistically significant correlation between age and VHI-10, VHI-10 sub-scores, or EAT-10.**

**CONCLUSIONS: Compared to healthy pregnant women, hyperemesis gravidarum affects the voice quality negatively and increases gastrointestinal complaints. Although these are shown with subjective parameters in this study, there is a need for studies that will make an objective evaluation.**

*Key Words:*
VHI-10, EAT-10, Pregnancy, Hyperemesis, Voice, Dysphagia.

## Introduction

Approximately 50-90 percent of pregnant women experience nausea and vomiting (NVP), with at least one-third requiring medical attention[1]. Excessive vomiting accompanied with weight loss and hypovolemia during pregnancy, culminating in ketonuria and/or ketoacidosis, is known as hyperemesis gravidarum (HG). It affects about 2% of pregnant women and is the most common reason of hospitalization in the first trimester[2-4]. There is no consensus on how to diagnose HG, which is the most severe form of nausea and vomiting in pregnancy. It has a major impact on the pregnant woman's quality of life and is resistant to treatment[5].

Sexual hormones constantly alter voice, which is one of the secondary sexual characteristics[6-9]. The larynx is a secondary sexual organ with sex hormone receptors, and it is a key center for voice[10,11]. The voice may vary during pregnancy due to hormonal changes, but it is unknown if HG has an additional affect.

Preventing this problem in pregnant women who use their voices professionally is even more critical. Reduced lung capacity and physiological reflux may degrade voice quality as a result of hormonal changes during pregnancy, while hyperemesis would exacerbate the problem. Pregnancy and hyperemesis can create vocal difficulties, which can be alleviated with voice exercises. The voice handicap index-10 (VHI-10), a widely used self-reported questionnaire that has been used in numerous studies for patients with varied voice disorders, is one of the assessment tools for voice. Progesterone inhibits smooth muscles, which produces a decrease in contractility in the entire gastrointestinal system, including the pylorus, according to some studies[12].

Due to hormones, stomach emptying slows down and peristalsis diminishes during pregnancy. These gastrointestinal issues are more common in people with HG. However, it was discovered in motility tests that pregnant women with HG had a faster motility rate than the average[13]. Progesterone alone has been shown to inhibit stomach contraction and produce gastric rhythm abnormalities[14].

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Whether or not stomach motility rises or decreases, or whether or not gastric rhythm disorder plays a part, it is a well-known fact that gastrointestinal symptoms increase during pregnancy, emphasizing the significance of further research into this topic. Gastrointestinal disorders might exacerbate metabolic difficulties and decrease nutritional status or fluid-electrolyte balance in pregnant women. The Eating Assessment Tool-10 (EAT-10) is a self-report questionnaire used in therapeutic settings to identify patients with dysphagic symptoms. The purpose of this study is to compare the effects of VHI-10 and EAT-10 on the voice and gastrointestinal system of patients diagnosed with HG to healthy pregnant women in the first trimester. As far as we know, there is no study in the literature that uses VHI-10 or EAT-10 to investigate the effect of HG on the voice or gastrointestinal system. In this respect, our study can contribute to the literature.

## Patients and Methods

The study protocol was approved by the Institutional Ethics Board (10/03/2021-411) in accordance with the Helsinki Statement and subsequent amendments. Participation in the study was entirely voluntary, and all individuals gave their informed consent. This was prospective observational case-control research.

### Participants

Pregnant women aged 20 to 42, with a gestational age of 6 to 12 weeks and 108 participants were grouped as Controls (n:54) and HG (n:54).

The hyperemesis group included pregnant women who lost 5% of their pre-pregnancy weight, had ketonuria, had dehydration symptoms, and had a positive fetal heartbeat. On the day of the evaluation, all the participants had no prior history of voice abnormalities and were clear of upper respiratory tract infection symptoms. Participants with a history of benign or malignant laryngeal lesions, head and neck cancers, head and neck surgery, thyroid surgery, cardiothoracic surgery, neurological disorders, rheumatologic disease, or topical steroid use for respiratory diseases were asked and were eventually ruled out of the study if they were not suitable. Patients who previously underwent esophageal or gastrointestinal system surgery, as well as those with a neurological disorder that may impact swallowing ability, were excluded from the trial. Participants who did not complete the questions correctly or who did not return the surveys were also removed from the study.

### Voice and Eating Assessment

The Voice Handicap Index-10 (VHI-10) was completed by all participants, which is a validated self-assessment scale for determining the degree of voice handicap. Physical (pVHI-10), emotional (eVHI-10), and functional (fVHI-10) are the three sub-factors (fVHI-10). On a five-point scale, participants score the items from 0 (never) to 4 (always). The overall score ranges from 0 to 40, with higher numbers indicating a more severe voice impairment[15]. The normal range of the VHI-10 was established as 11 in previous reports, and any score below 11 was classified as "patient-reported dysphonia"[16]. The EAT-10 is a frequently used functional health status measure that analyzes the severity of dysphagia as perceived by the patient. The ten items are rated on an ordinal scale by the patients (0 representing no difficulty and 4 representing a severe problem). Overall scores range from 0 to 40, with a score of 3 or more being considered abnormal[17].

### Statistical Analysis

The data were analyzed and visualized by R Studio[18]. Normal distribution was tested with Kolmogorov-Smirnov and Andersen Darling tests. Qualitative variables were provided as frequency and percentage, while quantitative variables were expressed as mean and standard deviation (SD). When the variables were normally distributed according to the Kolmogorov-Smirnoff test, parametric tests were employed to analyze the data. When the sample size was 30 and the variables were not normally distributed, nonparametric tests were employed. The independent samples *t*-test and Mann Whitney U test were employed to examine the connection between continuous variables. Spearman's correlation test was performed to investigate the relationship between the VHI-10, age, and gestational weeks A coefficient (r between 0.7 and 0.9 was strong, a coefficient between 0.5 to 0.7 was moderate, and a coefficient between 0.3 to 0.5 was considered as weak). The level of significance was set at $p<.05$.

## Results

Both groups were matched in terms of mean age and week of pregnancy. In terms of age and

**Table I.** Age and gestational week distribution between groups.

| | Controls (n: 54) | HG (n: 54) | *t* | *p** |
|---|---|---|---|---|
| Age (Mean ± SD) | 29.4 | 30.8 | -1.093 | .277 |
| Gestational Week (Mean ± SD) | 9.0 | 8.67 | 0.797 | .427 |

*Paired-samples *t*-test. *Abbreviations:* SD: standard deviation; *t*: test statistics.

gestational week ($p$ =.277 and $p$=.427, respectively), there was no statistically significant difference between groups (Table I). Between the control and HG groups, there was a statistically significant difference in total VHI-10 ($p$ =.023 and $p$ =.026, respectively). The HG group had considerably higher (more handicap) eVHI-10 and fVHI-10 subscales than the controls ($p$ =.013 and $p$=.008, respectively), but pVHI-10 did not differ between groups ($p$=.395).

The descriptive data and intergroup comparisons are presented in Table II. Age did not have a statistically significant relationship with VHI-10, VHI-10 sub-scores, or EAT-10 ($p$ >.05). A significant relationship between a gestational week and VHI-10, VHI-10 sub-scores, or EAT-10 scores was not found ($p$ >.05). Table III summarizes the correlation between the survey scores, age, and gestational week.

## Discussion

According to our findings, the HG had higher eVHI-10 and f-VHI-10 ratings than the controls. In other words, emotional and functional voices were much higher in hyperemesis-affected pregnant women than in the control group. There was no significant difference between the two groups in terms of p-VHI-10 scores. The association between voice and hormones has been proven in studies. In the premenstrual period, loss of tone, vocal tiredness, and a harsh voice is noted due to low estrogen[19,20]. Human placental lactogen, estrogen, progesterone, and human chorionic gonadotropin are all enhanced throughout pregnancy[21]. Estrogen promotes hypertrophy in the laryngeal mucosa and increases secretion in glandular cells, while progesterone decreases glandular cell secretion, increases acidity, and increases viscosity[22]. Edema can cause voice alterations during pregnancy. Many patients have been studied to see how sex hormones affect their voices. Estrogen and progesterone secretion are lowered in menopausal women. As a result, one-third of menopausal singers experience vocal alterations during the menopause period[23]. The extracellular fluid increases in the third trimester as the plasma volume increases in the first and second trimesters. Diaphragmatic elevation and changes in chest diameter may also produce voice alterations in the third trimester. We believe these factors were not the cause of the difference between the groups because the gestational ages were identical and was similar in our study[24]. Ülkümen et al[25] evaluated objective acoustic characteristics with the GRBAS scale and VHI-10 in third-trimester pregnant women and found that subjective assessments are at least as sensitive as objective assessments[25]. Although there are numerous studies that show changes in voice as a result of high-

**Table II.** Comparison of VHI-10 and EAT-10 scores according to groups.

| | Controls (n: 54) | | HG (n: 54) | | | |
|---|---|---|---|---|---|---|
| | Mean (SDI) | Median (min-max) | Mean ± SD | Median (min-max) | *U* | *p* |
| **VHI-10** | | | | | 1073 | .013 |
| TotalVHI-10 | 4.40 (3.78) | 0 (0-18) | 5.67 (3.30) | 0 (0-15) | 1090 | .023 |
| pVHI-10 | 2.57 (2.02) | 2 (0-7) | 2.87 (1.93) | 2 (0-7) | 1321 | .395 |
| fVHI-10 | 0.91 (1.27) | 0 (0-6) | 1.42 (1.32) | 1 (0-7) | 1044 | .008 |
| eVHI-10 | 0.94 (1.32) | 0 (0-6) | 1.4 (1.33) | 1 (0-7) | 1073 | .013 |
| **EAT-10** | 1.85 (2.56) | 1 (0-13) | 2.45 (2.65) | 2 (0-14) | 1107 | .026 |

*Mann Whitney U test. *Abbreviations:* n, number; SD: standart deviation; VHI-10: Voice Handicap Index-10; fVHI-10: functional scale of VHI-10; pVHI-10: physical scale of VHI-10; eVHI-10: emotional scale of VHI-10; EAT-10: Eat Assessment Tool 10.

**Table III.** Correlation matrix between age, gestational week and survey scores.

| | | e-VHI10 | p-VHI10 | f-VHI10 | totalVHI-10 | EAT-10 |
|---|---|---|---|---|---|---|
| Age | Spearman's rho | 0.038 | 0.078 | 0.076 | 0.078 | 0.047 |
| | *p*-value | 0.698 | 0.421 | 0.434 | 0.425 | 0.628 |
| Gest.Week | Spearman's rho | -0.046 | -0.064 | 0.058 | -0.002 | -0.017 |
| | *p*-value | .637 | .508 | .548 | .823 | .859 |

*Abbreviations:* VHI-10: Voice Handicap Index-10; fVHI-10: functional scale of VHI-10; pVHI-10: physical scale of VHI-10; eVHI-10: emotional scale of VHI-10; EAT-10: Eat Assessment Tool 10.

er sex steroids during pregnancy, we were unable to identify any of them that linked it to HG[26-28].

Pregnant women with hyperemesis gravidarum had higher EAT-10 scores for swallowing function than typical pregnant women. Subjective swallowing function is harmed by hyperemesis gravidarum.

The EAT-10 is a commonly used health status questionnaire that evaluates dysphagia severity from the patient's perspective[17,29]. Swallow tests, videofluoroscopy, nasendoscopy, manometry, 24-hour pH study, and diagnostic gastroscopy are among the invasive approaches used to diagnose dysphagia. The EAT-10 is a screening test that is used to assess swallowing problems.

In a study, EAT-10 was compared to videofluoroscopy, the gold standard approach, in patients with a preliminary diagnosis of oropharyngeal dysphagia, and it was shown that when the cut-off value was set at 230, EAT-10 had 0.89 sensitivity and 0.82 specificity. The EAT-10 questionnaire, which consists of ten items and contains symptoms of swallowing problem and dysphagia, is said to have strong internal consistency, repeatability, and validity. A score of 3 or higher on the EAT-10 scale should be considered abnormal[17].

People with dysphagia have higher rates of depression and anxiety[31]. Even dysphagia alone can cause panic and anxiety and eating problems[32]. The clinician has often overlooked this situation. After detecting nausea and vomiting in pregnancy, it is important to follow up the patients for many reasons, such as determining the need for drug therapy, adjusting the drug dose, monitoring clinical improvement, and determining the duration of treatment. Scales have been developed for this purpose. For example, in The Pregnancy Unique Quantification of Emesis scale (PUQE), Rhodes is a scoring system used to evaluate nausea and vomiting and symptoms in treated patients[33,34].

One of the key goals of this research was to see if there was a link between EAT-10 and HG, and if there was, whether it was clinically meaningful.

We discovered that the EAT-10 score in the HG group was statistically considerably higher. The EAT-10 was created with the intention of determining the severity of dysphagia[17]. The majority of EAT-10 research has been done on geriatric patients, neurological patients, or patients with head and neck cancer. Applying these findings to young patients, such as pregnant women, may not always be appropriate. According to a comprehensive review, the cost of health care increased by 40% in the presence of dysphagia, and the length of hospital stay increased by three days[35]. According to a study conducted in England[36], HG patients spent an average of 3.5 days in the hospital. Dysphagia is known to cause hospitalizations, thus, it is probable that hospitalizations in HG patients are due to dysphagia. As a result, if dysphagia in HG patients can be recognized and treated early on, health costs can be decreased.

As the pregnancy advances, reflux and digestive issues are likely to worsen. These can make swallowing and speaking difficult. In our study, there was no correlation between gestational age and questionnaire scores. This could be due to the fact that we included pregnant women between the ages of 6 and 12. There was no link between age and swallowing difficulty or patient-reported voice impairment.

The problem of older ages is swallowing disorder caused by presbyopia or sarcopenia. This condition could be explained by the fact that our study included young and healthy pregnant women. Pregnancy is a complex process that has an impact on emotional, functional, and physical well-being. Similarly, a variety of factors influence vocal quality. According to our research pregnant women with hyperemesis complaints generally mentioned emotional and functional voice impairments. The lack of a structural abnormality or lesion affecting the vocal cords can be explained to the fact that the F-vhi-10 scores

were not statistically different between the two groups. If the contents of the stomach frequently upset the esophagus, supraglottic, and oropharyngeal mucosa, hyperemesis can create swallowing issues. Esophagitis has a detrimental impact on swallowing ability.

### Limitations

The lack of an objective evaluation of voice, such as acoustic analysis, is the most significant restriction of our research. Swallowing could also be examined using flexible fiberoptic swallowing. During the COVID-19 epidemic, this research was carried out. These investigations could not be carried out due to ethical concerns as well as contamination concerns. Transporting pregnant women to the otolaryngology department for acoustic analysis, transporting them to a controlled environment like a silent cabin, and undergoing an interventional procedure with a high risk of aerosol spread may not be acceptable. The study, on the other hand, looked at the quality of life associated with both voice and swallowing, using healthy pregnant women as a control group. To the best of our knowledge, there is no other study in the literature that combines both voice and swallowing functions.

## Conclusions

It was determined that the voice and swallowing function were negatively affected in the HG group compared to the control. Although this study was made according to subjective evaluation criteria, there is still a need for studies in which more objective parameters will be used.

### Conflict of Interest

The Authors declare that they have no conflict of interests.

### Financial Disclosure

This research received no specific grant from any profit or non-profit institution.

### Ethics Committee Approval

The Ethics Committee approval was received from Hitit University Faculty of Medicine Ethics Committee (10/03/2021-411). All procedures performed in this study involving human participants were in accordance with the 1964 Declaration of Helsinki and its later amendments.

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