Study of Taste Changes for Salt and Restriction of Salt in Preeclampsia

Yoshifumi Mizumoto¹* and Teruaki Okuyama²

¹Department of Obstetrics and Gynecology, Self Defense Forces Central Hospital, Tokyo 154-8532, Japan
²International University of Health and Welfare, Atami Hospital, Shizuoka 413-0012, Japan

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Summary We studied the salt taste change during pregnancy and investigated its meaning in normal pregnancy and preeclampsia female in salt restriction. 40 normal pregnant female, 35 pregnant female with preeclampsia and 64 healthy non-pregnant female were recruited to this study. Gustatory test was performed with the filter-paper disk method. Salt solutions, 0.1, 0.2, 0.4, 0.6, 0.8 and 1.0 weight % were made from reagent grade sodium chloride and distilled water. The threshold of salt taste in pregnant female was higher than that of non-pregnant female. The threshold of salt taste in preeclampsia female was higher than that of pregnant female. The threshold of salt taste in normal pregnant female was correlated with their weight gain during pregnancy however that in preeclampsia female was not correlated. The threshold of salt taste was decreased and the symptom of preeclampsia was improved when preeclampsia female took the salt restriction diet therapy. It is suggested that the change of salt taste was related to the increased need of sodium according to progress of normal pregnancy, and was also related to the improvement of the symptoms of preeclampsia in salt restriction. The salt taste may be an objective indicator of salt intake for preeclampsia.

Key Words: preeclampsia, taste change, salt restriction

Introduction

Preeclampsia is one of the important complications in pregnancy. This preeclampsia has some characteristic symptoms such as a hypertensive disorder associated with proteinuria, edema, and at times coagulation or liver-function abnormalities. Salt restriction was enforced as a treatment of preeclampsia formerly [1–3], most authorities no longer advocate salt restriction because salt restriction had led to sufficient depletion of extracellular volume to compromise renal perfusion and extreme salt restriction let a symptom become worsen [4–6].

On the other hand, many women experience that foods taste change with the pregnancy [7–9] and salt taste threshold was increased during pregnancy [8, 10], although the significance of change of taste in pregnancy isn’t clear. Salt is physiologically accumulated in a body and, a quantity of circulation plasma increases as a progress of pregnancy, and we have a great deal of interest in salt because of the increased requirement for sodium that accompanies pregnancy [11]. Appropriate salt intake is important in health management in pregnant woman. However, dietary salt intake is different with the individual eating habits greatly, and there is not the reliable guide which we examine a quantity of intake easily in outpatient clinic. Some reported changes in salt taste related to sodium deficits [12–14]. It is possible that salt taste is related with a quantity of intake during pregnancy. So, we studied to the change of salt taste in healthy and preeclampsia pregnant women and we
Y. Mizumoto and T. Okuyama

investigated that salt taste was related to the extent of preeclampsia in the salt restriction.

Material and Methods

40 healthy pregnant women, 35 pregnant women in preeclampsia, 64 non-pregnant healthy women were recruited to this study. All subjects did not smoke. Diagnostic criteria of pregnancy preeclampsia followed a definition of Japan obstetrics gynecology society [15]. All patients with preeclampsia of this study were classified in a slight illness example entirely. All pregnant female had no other medical complications including anemia and no nutritional problems. And all pregnant female in preeclampsia had no medications for preeclampsia and they did not receive hospital treatment. As for average age of healthy pregnant female, pregnant female in preeclampsia and the non-pregnancy female, as for 28.8 ± 3.9, 30.3 ± 4.8 and 30.1 ± 8.6, respectively, and as for average body weight (kg), as for 57 ± 5, 59 ± 10 and 53 ± 6, respectively, and as for average height (cm), as for 158 ± 5, 159 ± 6 and 159 ± 5, respectively. There was not the meaningful difference between three groups.

Gustatory test was performed with the filter-paper disk method [16]. Salt solutions, 0.1, 0.2, 0.4, 0.6, 0.8 and 1.0 weight % were made from reagent grade sodium chloride and distilled water. Each subject was presented with a tray holding cups with a set of salt solutions. Subjects were given some each set of solutions from weakest to strongest, and to indicate the salt solution they most preferred and we adopt this concentration of solution to taste threshold.

Salt restriction was performed as follows that we advised salt restriction diet and checked the change of symptoms in preeclampsia after 4 weeks later. We determined the improvement of preeclampsia if any symptoms disappeared such as proteinuria or edema or hypertension.

Statistical analysis was performed by ANOVA and non-parametrics tests including Spearman Rank correlation coefficient, Kruskal Wallis test and Mann-Whitney U test. Differences in the proportionate occurrence of events between two groups were assessed using Chi square analysis.

The study was approved by the local ethics committee. Informed consent was obtained from every object person.

Results

The threshold of salt taste in pregnant women was significantly high level than that in non-pregnant women, and the threshold of salt taste in preeclampsia women was also significantly high level than that in pregnant women (Fig. 1). The salt taste threshold in the healthy pregnant women was increased gradually with the progress of pregnancy (Fig. 2), and there were significant correlation between the threshold salt taste in pregnant women and the weight gain from prior to the pregnancy (r = 0.45, p<0.01, Fig. 3).

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Fig. 1. Comparison of salt taste threshold among non pregnant women, normal pregnant women and pregnant women in preeclampsia

Threshold of non pregnant women < Threshold of pregnant women in preeclampsia, p<0.01
Threshold of normal pregnant women < Threshold of pregnant women in preeclampsia, p<0.01
Threshold of non pregnant women < Threshold of normal pregnant women, p<0.01
Statistical analysis was performed by Kruskal Wallis and Mann-Whitney U test
Discussion

On the other hand, the threshold of salt taste in preeclampsia women was high since early stage of pregnancy and there was no correlation with the weight gain from the non-pregnant time (Fig. 2 and 3). The threshold of salt taste in pregnant women was significantly decreased after the salt restriction (Fig. 4) and the symptom of preeclampsia was improved significantly after the salt restriction in preeclampsia women (Table 1).

Changes in taste sensitivity have been reported to occur in humans related to age, ethnic background, drug and pregnancy [17–19]. For most of women, pregnancy is accompanied by changes in some certain foods taste and smell [7]. Some found that salt taste threshold was increased during pregnancy [8–10] and also the salt taste threshold of preg-
nant women was higher than that of non-pregnant women in this study. Some reported changes in salt taste related to sodium deficits [12–14]. Salt is physiologically accumulated in body and, a quantity of circulation plasma increases as a pregnancy progresses, and the change of salt taste is related with water and electrolyte of quantities of plasma which is physiologically circulated by the pregnancy [11]. In this study, the salt taste threshold was correlated with the weight gain from the non-pregnancy time. Usually, it is believed that the weight gain in pregnant women is in proportion to increased quantity of circulation plasma. It is suggested that the change of salt taste threshold is related to the increased need of sodium according to progress of pregnancy. Preeclampsia is one of the complications in pregnancy. This preeclampsia has some characteristic symptoms such as a hypertensive disorder associated with proteinuria, edema, and at times coagulation or liver-function abnormalities. Salt restriction was enforced as a treatment of hypertension in preeclampsia formerly; most authorities no longer advocate salt restriction because extreme salt restriction let a symptom become worsen [20–23]. Appropriate salt intake is important in health management in pregnant woman. It is recommended that pregnant women take salt of 7 or 8 gram per day. Many Japanese pregnant women take salt of more than 10 gram per day and usually dietary salt restriction is being advocated for preeclampsia in the obstetric outpatient service [24].

Dietary salt intake is different with the individual eating habits greatly, and there is not the reliable guide which we examine a quantity of intake easily in outpatient clinic. In this study, we found that the threshold of salt taste in preeclampsia female was higher than that of pregnant female and the threshold of salt taste was decreased and the symptom of preeclampsia was improved when preeclampsia female took the salt restriction diet therapy. Generally, we know that drugs induce the taste disorder and Zinc deficiency is one of the causes of taste disorder [25]. Preeclampsia female was dosed with antihypertensive drugs such as hydralazine hydrochloride if they did not improve by bed rest or nutritional supports. The relation between drug and change of the threshold of salt taste are poorly understood because all pregnant female in preeclampsia had no medications for preeclampsia in this study. It might be considered the medication for pregnant female as a cause of taste disorder if they are given drugs for long

![Fig. 4. Comparison of the salt taste threshold between those before the salt restriction and those after the salt restriction in pregnant women](image-url)

Threshold of pregnant women after salt restriction < Threshold of pregnant women before salt restriction, p<0.01

<table>
<thead>
<tr>
<th>Threshold of the salt taste</th>
<th>Symptom of preeclampsia</th>
<th></th>
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<tbody>
<tr>
<td></td>
<td>improved</td>
<td>Not improved</td>
</tr>
<tr>
<td>decrease</td>
<td>9</td>
<td>1</td>
</tr>
<tr>
<td>Not decrease</td>
<td>1</td>
<td>5</td>
</tr>
<tr>
<td>Total</td>
<td>10</td>
<td>6</td>
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The improved symptom of preeclampsia is significantly correlated with the change of the threshold of salt taste (p<0.01, by Chi square analysis).
period. It is suggested that the change of salt taste was related to the increased need of sodium according to progress of normal pregnancy, and was also related to the improvement of the symptoms of preeclampsia in salt restriction. The salt taste may be an objective indicator of salt intake for preeclampsia.

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References