THE EFFECT OF GIVING MORINGA HONEY TOWARDS HEMOGLOBIN LEVELS AND ERYTHROCYTE INDEX IN PREGNANT WOMEN WITH ANEMIA AT THE TURIKALE & LAU HEALTH CENTER, MAROS REGENCY

Rizka Mutmaina¹, Veni Hadju², Mardiana Ahmad³, Andi Nilawati⁴, Healthy Hidayanti⁵, Werna Nontji⁶

¹Department of Midwifery, Graduate School, Hasanuddin University, Indonesia
²Department of Microbiology, Faculty of Medicine, Hasanuddin University, Indonesia
³Department of Parasitology, Faculty of Medicine, Hasanuddin University, Indonesia
⁴Department of Surgery, Faculty of Medicine, Hasanuddin University, Indonesia
⁵Department of Pathology Clinic, Faculty of Medicine, Hasanuddin University, Indonesia
Email: mutmainar19p@student.unhas.ac.id; rizkamutmaina49@gmail.com

ABSTRACT

Background: This research aims to assess the effect of giving moringa honey to hemoglobin levels and erythrocyte index in pregnant women with anemia.

Method: The research employed a True Experiment type, with a Double Blind Randomized controlled trial design, in which the parties involved in the research such as the researcher and the subject did not know the difference between the MK/MB given. The research included 40 anemic pregnant women, 20 of whom were in the intervention group (MK) and 20 of whom were in the control group (MB). All of the participants got the same therapy, which consisted of taking 15 ml of MK/MB every morning before eating for eight weeks. All subjects continued to take Fe tablets at night. The Chi-Square, Mann-Whitney, and Wilcoxon tests were used to evaluate the data.

Results: On the whole, the research subjects were anemic pregnant women aged 20-30 years (80%) with gestational age of 20-23 weeks (55%). The results exhibited that the changes in Hemoglobin Levels and Erythrocyte Index were substantial between the two groups. The increase in hemoglobin levels was greater in the MC group (1.69 ± 0.42 vs 1.36 ± 1.38, p = 0.000) while the increase in erythrocyte index was also greater in the MCV group (4.35 ± 1.89 vs 3.11 ± 3.06, p = 0.020), MCH (2.31 ± 0.94 vs. 1.16 ± 1.84, p = 0.006), MCHC (2.35 ± 1.09 vs. 0.60 ± 1.53, p = 0.000).

Conclusion: Moringa honey is more effective in generating hemoglobin levels and the erythrocyte index (MCV, MCH, MCHC) in anemic pregnant women, making it a natural alternative treatment for treating and preventing anemia, as well as increasing and improving nutrition.

Keywords: Moringa Honey, Regular Honey, Hemoglobin, MCV, MCH, MCHC, Anemic Pregnant Women

I. INTRODUCTION

Because of the increased oxygen demand during pregnancy, which is driven by erythropoietin by the kidneys, pregnancy causes physiological changes in increasing blood volume and erythrocytes [1]. This situation will result in blood thinning because the amount of blood serum is greater than the growth of blood cells and makes pregnant women experience anemia [2]. Consistent with the World Health Organization 2018, more than 40% of pregnant women in the world are anemic [3]. In Indonesia, 89.6% of pregnant women experience anemia from 1.5 million pregnant women [4]. South Sulawesi Provincial Health Office, 23,839 pregnant women, 98.49% of them have Hemoglobin Levels of 8-11 mg/dl and 1.15% have Hemoglobin Levels < 8 mg/dl [5]. Maros District Health Office 2020, the prevalence of anemia pregnant women reached 4,686 cases out of 7,666 pregnant women [6]. Turikale Health Center 2020, Reporting from 987 pregnant women, there were 198 cases of anemia [7]. Lau Health Center in 2020, 75 cases of anemia have been recorded from 585 pregnant women [8].
The high cases of anemia that increase every year will have an impact on the risk of cesarean delivery, preeclampsia, postpartum hemorrhage, postpartum anemia, gestational hypertension, induction of labor, placental abruption, and blood transfusions during pregnancy [9]. Other risks can be experienced by infants with low birth weight, premature birth, neonatal complications, IUGR, to perinatal death [10].

The government has carried out the anemia control program through the provision of 90 tablets of blood added. But this has not been able to overcome the problem of anemia, because compliance in consuming Fe tablets, access to health services, family support, side effects and local belief in myths trigger pregnant women not to consume Fe tablets [11]. The high need for iron in pregnant women is not enough if only supplied through the administration of Fe tablets, but must be balanced by consuming foods containing macro and micro nutrients [12]. Moringa contains 14 macronutrients and 21 microelements which contain protein, fat, carbohydrates, fiber, potassium, magnesium, selenium, vitamins B, B2, B3, C, E and iron which play a role in helping increase hemoglobin levels [13]. Honey is a natural supplement that is good for consumption during pregnancy containing carbohydrates, protein, vitamins A, B1, B3, B12, B5, C, D, E, K, Beta carotene, as well as mineral content, salt and other substances such as iron, sulfur magnesium, calcium, potassium, sodium, phosphorus, along with antibiotics and antioxidants [14].

Yusna et al., through their research, giving MOLP supplements (500 mg Moringa leaf powder capsules) for 8 weeks to pregnant women with anemia in the third trimester significantly increased 1.46 g/dl hemoglobin levels, while the group that was given Fe (60 mg) only increased 0.76 g/dl Hemoglobin Level [16]. Another evaluation of research by Bachtiar indicated that the administration of Honey for 8 weeks resulted in an increase in hemoglobin levels (1.79-2.27 g/dl) [17]. Research related to the provision of Moringa extract / Moringa flour and honey, or a combination of the two has been carried out in various places, but the provision of Moringa Honey obtained from the results of giving Moringa juice to Apis Mellifera Bees has not been found until now. This research will investigate the administration of Moringa Honey (MK) towards the Increase in Hemoglobin Levels and Erythrocyte Index in pregnant women.

II. MATERIALS AND METHODS

Location and research design

This research was conducted out at Maros Regency, which has an area of 1619.11 km2 and has a population of 353.12, located around 33.40 kilometers from Makassar, South Sulawesi Province. Maros has 14 sub-districts, which in each sub-district has 1 public health center. Turikale Health Center and Lau Health Center are the places where this research was carried out. This research employs the True Experiment type, with a Double Blind Randomized controlled trial design, where the parties involved in the research such as researcher, and the subject do not know the difference between Moringa Honey (MK)/Regular Honey (MB) given.

Population and Subject

The population of this research were all pregnant women with anemia during the second to third trimester, who were in the area of the Turikale and Lau Public Health Centers. The sampling technique used was random sampling that met the inclusion criteria, namely pregnant women with gestational age 20-27 weeks, Hb <11 g/dl, single fetus, willing to be research subjects and consuming MK/MB by signing an informed consent form. The sample in this research was 40 subjects, which were obtained using the group sample size formula according to Sopiyudin Dahlan [17].

This research has received a recommendation for approval from the Research Ethics Commission of the Faculty of Public Health of Hasanuddin University Makassar and the Maros District Health Office.

Methods and data analysis

Sampling of the research was carried out by Screening Test and data collection in the form of age, parity, gestational age, education, occupation and income were measured by interview using a questionnaire. The data was processed using SPSS version 23 for windows. Thenceforth, the data were analyzed using the Chi-Square, Mann-Whitney and Wilcoxon tests.
**Procedure of Hematocrit Level Examination**

The research group was divided into two groups consisting of 20 intervention groups (MK) and 20 control groups (MB). Group determination was carried out after the Pre-Test blood sample was taken. Blood sampling was carried out twice, Pre and Post Test examinations were carried out by Health Analyst officers from the Turikale Maros Health Center who were directly accompanied by researchers, blood samples were taken through the median cubital vein as much as 3 cc. Hemoglobin and Erythrocyte Index (MCV, MCH and MCHC) were measured using the Hematology Analyzer URIT-3000 Plus which has been standardized by the Makassar Health Laboratory Center.

Afterwards, the researcher gave a box containing two Honey codes to the subject, and the subject was left to choose. The results of the choice of subjects will determine whether the subject is included in the intervention or control group. After each group has met 20 research samples, the subject will get honey based on the code that has been selected beforehand. Then the researcher will explain how to consume MK/MB. Subjects were required to consume MK/MB every day for 8 weeks with a dose of 15 ml every morning before meals. The MK/MB given is stored in a 100 ml container to be consumed for one week.

Every week a home visit is made to provide MK/MB and check the remaining honey consumption using a control sheet. Another evaluation was carried out by utilizing social media WhatsApp as a source of researcher and subjects communicating with each other. Created a WhatsApp group with a combination of subjects and researchers. Every morning, the researcher sends a reminder message on the consumption of MK/MB into the group. Subjects who do not respond/active in the group will be contacted via telephone by the researcher.

### III. RESULTS

**Subject Characteristics**

Table 1. Frequency Distribution of Subject Characteristics

<table>
<thead>
<tr>
<th>Group</th>
<th>Intervention N (20)</th>
<th>Control N (20)</th>
<th>Total N (40)</th>
<th>%</th>
<th>P Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>20 – 25 Years Old</td>
<td>9 (22.5)</td>
<td>7 (17.5)</td>
<td>16 (100)</td>
<td>0.779</td>
<td></td>
</tr>
<tr>
<td>26 – 30 Years Old</td>
<td>7 (17.5)</td>
<td>9 (22.5)</td>
<td>16 (100)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>31 – 35 Years Old</td>
<td>4 (10.0)</td>
<td>4 (10.0)</td>
<td>8 (100)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Parity</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Primigravida</td>
<td>2 (5.0)</td>
<td>5 (12.5)</td>
<td>7 (100)</td>
<td>0.212</td>
<td></td>
</tr>
<tr>
<td>Multigravida</td>
<td>18 (45.0)</td>
<td>15 (37.5)</td>
<td>33 (100)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Gestational Age</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>20 - 23 Weeks</td>
<td>9 (22.5)</td>
<td>12 (32.5)</td>
<td>21 (100)</td>
<td>0.342</td>
<td></td>
</tr>
<tr>
<td>24- 27 Weeks</td>
<td>11 (27.5)</td>
<td>8 (17.5)</td>
<td>19 (100)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Education</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Elementary School</td>
<td>5 (12.5)</td>
<td>3 (7.5)</td>
<td>8 (100)</td>
<td>0.670</td>
<td></td>
</tr>
<tr>
<td>Junior High School</td>
<td>6 (15.0)</td>
<td>6 (15.0)</td>
<td>12 (100)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Senior High School</td>
<td>9 (22.5)</td>
<td>10 (25.0)</td>
<td>19 (100)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Bachelor</td>
<td>0 (0.0)</td>
<td>1 (2.5)</td>
<td>1 (100)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Occupation</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Housewife</td>
<td>18 (45.0)</td>
<td>20 (50.0)</td>
<td>38 (100)</td>
<td>0.147</td>
<td></td>
</tr>
<tr>
<td>Entrepreneur</td>
<td>2 (5.0)</td>
<td>0 (0.0)</td>
<td>2 (100)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Income</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>&lt; 1 million</td>
<td>4 (10.0)</td>
<td>1 (2.5)</td>
<td>5 (100)</td>
<td>0.195</td>
<td></td>
</tr>
<tr>
<td>1-3 million</td>
<td>15 (37.5)</td>
<td>19 (47.5)</td>
<td>34 (100)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>&gt; 3 million</td>
<td>1 (2.5)</td>
<td>0 (0.0)</td>
<td>1 (100)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Chi-Square

Table 1 shows that the majority of the subjects in the intervention group were 20-25 years old, while the majority of the subjects in the control group were 26-30 years old. With an average multigravida pregnancy, most of the gestational ages in the intervention group were 24-27 weeks, while the majority of the gestational ages in the control group were 20-23 weeks. The average last education of the subject is high school, the occupation of the subject in the Intervention and Control group is dominantly the same, viz. entrepreneur, the average family income of the
Intervention and Control group is 1-3 million every month. The results of the statistical test of the differences between the two groups at the beginning of the research showed that the two groups were significantly different (p > 0.05) where the two groups had similarities for the variable characteristics of age, parity, gestational age, education, occupation, and income.

Hemoglobin and Erythrocyte Index Analysis

Table 2. Analysis of Differences in Hemoglobin and Erythrocyte Index (MCV, MCH and MCHC) Levels Before and After Intervention

<table>
<thead>
<tr>
<th>Group</th>
<th>Pre Mean ± SD</th>
<th>Post Mean ± SD</th>
<th>P Value</th>
<th>Change</th>
<th>P Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hemoglobin</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Control</td>
<td>9.86 ± 0.75</td>
<td>11.23 ± 1.30</td>
<td>0.774</td>
<td>1.36 ± 1.38</td>
<td>0.000</td>
</tr>
<tr>
<td>Intervention</td>
<td>9.85 ± 0.55</td>
<td>11.55 ± 0.62</td>
<td>0.000</td>
<td>1.69 ± 0.42</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Erythrocyte Index</th>
<th>MCV</th>
<th>MCH</th>
<th>MCHC</th>
</tr>
</thead>
<tbody>
<tr>
<td>Control</td>
<td>88.38 ± 6.35</td>
<td>27.75 ± 2.75</td>
<td>29.65 ± 1.04</td>
</tr>
<tr>
<td>Intervention</td>
<td>91.50 ± 5.58</td>
<td>28.91 ± 1.80</td>
<td>30.26 ± 0.99</td>
</tr>
<tr>
<td>MCV</td>
<td>85.95 ± 4.50</td>
<td>27.43 ± 1.55</td>
<td>29.37 ± 1.05</td>
</tr>
<tr>
<td>Intervention</td>
<td>90.30 ± 3.34</td>
<td>29.74 ± 0.98</td>
<td>31.72 ± 1.25</td>
</tr>
<tr>
<td>MCH</td>
<td>27.45 ± 2.75</td>
<td>27.97 ± 0.98</td>
<td>29.74 ± 1.05</td>
</tr>
<tr>
<td>Intervention</td>
<td>31.72 ± 1.25</td>
<td>31.72 ± 1.25</td>
<td>31.72 ± 1.25</td>
</tr>
<tr>
<td>MCHC</td>
<td>29.65 ± 1.04</td>
<td>30.26 ± 0.99</td>
<td>31.72 ± 1.25</td>
</tr>
<tr>
<td>Intervention</td>
<td>30.26 ± 0.99</td>
<td>31.72 ± 1.25</td>
<td>31.72 ± 1.25</td>
</tr>
</tbody>
</table>

Mann-Whitney, Wilcoxon

Table 2 Based on the results of the Mann-Whitney test analysis, it can be seen that the average hemoglobin level before and after treatment was P = 0.000 where the p value was < 0.05, which means that there were differences in the values before and after treatment between the two groups. The largest increase in value was seen in the MK group with a mean difference of 1.69 ± 0.42 and an increase in the mean difference in the MB group of 1.36 ± 1.38. The results of the Wilcoxon test, P value = 0.000 < 0.05, there was a significant change in the increase in hemoglobin levels in both groups.

The results of the analysis of the Erythrocyte Index, the mean MCV value in both groups before and after treatment P = 0.456 > 0.05, which means there is no significant difference before and after treatment between the two groups. However, in the Wilcoxon test, it was seen that the P value = 0.020 < 0.05 where there was a significant change in the increase in MCV values in the MK and MB groups. The increase in MCV value in the MK group was greater than the MB with a mean difference of 4.35 ± 1.89 in the MK group and 3.11 ± 3.06 in the MB group.

The MCH value increased in the mean before and after treatment in both groups with a P value = 0.036 < 0.05. In the increase in the mean difference, the MK group was seen to be larger with a difference of 2.31 ± 0.94 and the MB group a difference of 1.16 ± 1.84. Wilcoxon test P value = 0.006 < 0.05 where there is a significant change in the MCH value in the MK and MB groups. The mean MCH value before and after the treatment of the two groups was significant with a P value = 0.001 < 0.05. However, the clinical improvement was higher in the MK group with a mean difference of 2.35 ± 1.09 and the MB group with a difference of 0.60 ± 1.53. The results of the Wilcoxon test statistically P value = 0.000 < 0.05 in both the MK and MS groups where there was a significant change in the increase in the MCHC value in the MK and MB groups.

IV. DISCUSSION

According to the findings, taking 15 ml of Moringa Honey (MK)/Regular Honey (MB) before meals every morning for 8 weeks can raise hemoglobin levels and the erythrocyte index (MCV, MCH, MCHC) in the MK and MB groups. This could be demonstrated statistically with a P value of less than 0.05, indicating that Ho is rejected while Ha is accepted.
On the Table. 2 The average increase in Hemoglobin Levels and Erythrocyte Index (MCV, MCH, MCHC) was greater in the MK group. In line with the research of Hadju et al, giving Moringa Extra to pre-conception pregnant women can increase maternal hemoglobin levels from 0.1 to 2.0 gr/dl with an average increase of 1.54 compared to the control group given MMN tablets, an increase of 0.1 -1.0 with a mean increase of 0.22 [18]. Research by ishak et al, administration of Moringa leaf extract can increase hemoglobin levels by up to 58% [19].

Another research by Rismawati, where there was an increase of 1.42 mg/dl of hemoglobin levels in anemic pregnant women to the administration of Moringa leaf capsules, and an increase of 0.9 mg/dl in pregnant women who only consumed Fe [20]. This situation proves that in increasing Hemoglobin Levels, it is not enough if only treated with Fe supplementation, but it is necessary to give other additional food supplements to meet 80% of the RDA of iron in the mother during pregnancy.

MK gives an average increase in Hemoglobin Levels greater than MB because MK contains iron, protein, vitamin c and folic acid which is greater than MB, which helps in the process of increasing Hemoglobin Levels. Protein in MK is the main component of globin which plays a role in transport and storage of iron. The absorption of iron in the small intestine is assisted by proteins that act as transport vehicles, namely transferrin and ferritin. If protein intake is lacking, iron absorption is inhibited and causes iron deficiency [21].

Vitamin C in MK plays a very important role in iron absorption, because it can increase iron absorption by reducing ferric iron to ferrous, so that it is more easily absorbed in the small intestine and its transfer into the blood. With Vitamin C the absorption of non-heme iron that is consumed can increase up to 4 times [22]. Antioxidants (flavonoids and polyvenols) contained in MK also help in increasing hemoglobin and red blood cells [23].

Another research by Isnainy, giving Moringa Leaf Extract 500 mg and honey to pregnant women for 15 days can increase hemoglobin levels from 10.0 gr/dl to 11.1 gr/dl [24]. Another research was also conducted by Wardiyah & Ervina, Seeing the results of giving honey to pregnant women in the third trimester can increase the hemoglobin level of pregnant women with an average value of hemoglobin levels before being given honey 9.973 gr/dl after being given honey increased to 10.66 gr/dl [25]. Research by Erma, giving Moringa Leaf Extract to adolescent girls can increase 1.19 g/dl Hemoglobin Levels [26]. In line with Erma's research by Lusi et al, administration of Moringa Leaf Powder Capsules also increased 1.76 gr/dl Hemoglobin Levels in adolescent girls [27, 28].

The increase in the erythrocyte index (MCV, MCH, MCHC) in the MK group was in line with the research of Suzzana et al, where there was a significant increase in hemoglobin levels and MCHC values for the administration of 700 mg/capsules of Moringa Leaf Extract [29]. A research by Dewi Hastuti giving Moringa Leaf Extract supplementation plus royal jelly at a dose (500 mg MLE + 10 mg RJ)/day, can increase the value of MCV (6.32), MCH (0.87), MCHC (0.43) which statistically has a significant effect on increasing the index. Erythrocytes of pregnant women were anemic with P = 0.000 < 0.05 [30].

The increase in erythrocyte index occurs because MK contains flavonoids, iron, vitamin c and folic acid which is greater than MB. Folic acid in MK helps in the formation of red blood cells in the bone marrow [31]. The flavonoids in MK act as antioxidants, which in blood cells can act as a reservoir for hydroxyl radicals and superoxide so as to protect membrane lipids and prevent damage to red blood cells and erythrocyte membrane structures in the body [32]. MK contains 53.16% antioxidant inhibition which can prevent excessive free radicals that increase lipid peroxidase (LPO) activity and reduce the antioxidant status of erythrocytes, causing damage to the erythrocyte membrane, decreasing the number of erythrocytes and hemoglobin, which has an effect on the incidence of anemia [33].

Another research by syahruni definite that the administration of Moringa Extract could increase the number of erythrocytes 0.28 million/µ and an increase of 0.06 million/µ in the group that did not consume Moringa Extract, this research also analyzed the increase in hemoglobin levels with an average increase of 1.24 gr/dl in the group. Moringa extract and 0.18 gr/dl in the group that did not consume Moringa Extract [34]. Research conducted by Iriansy tina, administration of Moringa Leaf Flour can increase 0.18 x 10⁶/mm³ the number of erythrocytes in pregnant women and the group with Fe consumption only gives an increase of 0.05 x 10⁶/mm³ [35].

Moringa honey is one of the innovations in developing honey products produced by Apis Mallifera bees, which are fed with processed Moringa leaf juice, which is then stored in bee hive cells to produce Moringa honey. Moringa honey is an herbal supplementation that aims to improve the nutritional status and health of pregnant women [36].
Moringa Honey contains (8700ppm) Protein, (100ppm) Fat, (610ppm) Polyphenols, (802,600ppm) Carbohydrates, (289,822 ppm) Flavonoids, (670 ppm) Vitamin C, (307.22 ppm) Fe, (302.86 ppm) Calcium, (705.8 ppm) Sodium, (84.51 ppm) Magnesium, (1400 ppm) Potassium, (300 ppm) Phosphorus, (2.4428ppm) Zinc, and (53.16%) Antioxidant Inhibitory [37].

Moringa honey has been tested for its toxicity content by the Faculty of Pharmacy, Hasanuddin University Makassar, the LC50 value is 614.58 μg/mL. Based on the toxicity category, if the value (LC50 > 500 μg/mL) is lower/no toxicity level, in the toxicity test Moringa honey is classified as having low toxicity so it is safe for consumption by pregnant women [38].

In addition to being able to increase Hemoglobin Levels and Erythrocyte Index, Moringa Honey also provides an increase in the nutritional adequacy rate for pregnant women to exceed 80% of the daily RDA before being given treatment. The results of the RDA of subjects that are less than 80% of the RDA should be pregnant women. After the treatment, the Food Recall was calculated again and found an increase in nutrients in Carbohydrates, Energy, Protein, Fat, Vitamin C, Iron, Calcium, Folic Acid and Phosphorus which increased from before being given treatment. So that the adequacy of the maternal RDA during pregnancy can be met and even exceeds the RDA of 80%.

V. CONCLUSIONS

There was an increase in hemoglobin and erythrocyte index levels in the MCV, MCH and MCHC values before and after treatment in the Moringa Honey and Healthy Honey groups. However, the average increase in Hemoglobin Levels and Erythrocyte Index (MCV, MCH and MCHC) was higher in the Moringa Honey group. In addition to increasing Hemoglobin Levels and Erythrocyte Index, Moringa Honey also provides an advantage in increasing appetite, the body feels fresher, the feeling becomes calmer, Moringa honey is also able to overcome problems commonly felt by pregnant women such as insomnia, fever and coughs, and nausea experienced during pregnancy.

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