EFFECTS OF IRON FOLIC ACID AND MULTI-MICRONUTRIENT SUPPLEMENTATION SINCE PRECONCEPTION ON HEMOGLOBIN CONCENTRATION, BIRTH WEIGHT, LENGTH, AND NUTRITIONAL STATUS OF CHILDREN

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ABSTRACT

Objective: This study aims to compare effects of MMS and IFAS on hemoglobin concentration and pregnancy outcome.

Method: This research is a double-blind randomized control trial design. MMS and IFAS were given since preconception to newlyweds. 113 brides are eligible, divided randomly into 56 IFA and 57 MMS group. Hb was measured after 6 months intervention, anthropometry of child was assessed at birth and 24 months.

Results: Compared IFAS with MMS showed no significant difference on Hb concentration of women, with p=0.555. Birth length (p=0.007) and birth weight (p=0.008) was significantly different. Children nutrition status based on WHZ and WAZ on both groups showed no significant different, p=0.259 and p=0.148 respectively whereas HAZ differ significantly p=0.02.

Conclusion: IFAS and MMS had the same effect in maintaining hemoglobin concentration. However, MMS had a better impact on birth length, birth weight, and HAZ score of children under two.

KEYWORDS: Birth weight; IFA; MMS; Preconception; Nutritional status

I. INTRODUCTION

The high burden of undernourished children and maternal health continuous to be a public health priority in developing countries although limited intervention exists. There were about 47 million children under 5 years of age are wasted, 14.3 million are severely wasted and 144 million are stunted whereas about 40% of pregnant women worldwide are anaemic.1,2 Maternal micronutrient deficiency during pregnancy can permanently affect the growth and development of fetus which can alter the growth and development later in life.3 Undernourished girls who get pregnant are tend to deliver small babies, and therefore more likely to have faltered growth and impaired cognitive development which in turn will be passed throughout future generation.

As the optimum growth, health and neurodevelopment across the life span are established in early life, specifically during the 1000 days of life, having adequate nutrition on this critical period is therefore fundamental prerequisites. The implementation of maternal nutrient supplementation before conception can correct micronutrient deficiency as well as maternal underweight before conception.4,6

Multi-micronutrient supplementation (MMS), especially in the region where maternal undernourished is highly prevalence, has been suggested as a cost-effective way to meet the requirement in this period.7 Therefore, introducing the MMS before conception and during pregnancy could be considered as an effective way to achieve the optimum health both for women and offspring.
Many studies on MMS have been conducted, but mostly focus on maternal health. The MMS used in those studies contained at least three micronutrients and mostly were done in low- and middle-income countries. Besides, the duration of intervention was varied in which some started before pregnancy, during pregnancy and continued after giving birth. Furthermore, the results of these studies showed inconsistency. Therefore, the idea of replacing MMS with IFAS is still being debated. This study aims to compare the effects of MMS and IFAS on hemoglobin concentration, pregnancy outcome, and the nutrition status of children under two.

II. METHODS

This study is a prospective longitudinal study with a double-blind randomized control trial design. The trial was started on July 2018 and it was conducted in Luwuk Banggai district, Central Sulawesi province, Indonesia which had a high prevalence of stunted children. A total of 216 newlywed registered but only 113 met the inclusion criteria. The inclusion criteria were (1) women who were 18-35 years old (2) nulliparous (3) consumed MMS or IFA supplementation during preconception and pregnancy period. The exclusion criteria included (1) severe anemia, (2) obese (BMI>30) 3) multiple pregnancy (4) consume other supplement (5) have hypertension, kidney failure, tuberculosis, hyperglycemia. Of 113 women then assigned randomly into 56 IFA and 57 MMS group. The hemoglobin concentration of mothers was measured by using the HemoCue. Data on weight and length of children were collected by performing anthropometric measurement at the age of 1 day and 24 months. Weight and length were then converted to weight for age Z Score (WAZ), length for age Z Score (LAZ) and Weight for length Z Score (WLZ). The obtained data then were analyzed using SPSS, with paired T-test, independent t test and Mann Whitney test for data that not normally distributed.

III. RESULT

The IFA group received 60mg of iron and 0.4mg ug while MMS contains 14 minerals and vitamins. Both supplements were intended for daily consumption. During the intervention, some women were drop out, IFA (n=13), MMS (n=37). Those in groups successfully delivered the babies, IFA (n=16), MMN (23). After 2 years, 2 infants lost contact in IFA group and 3 infants in MMS group (Figure 1).
Table 1 Effect of MMS and IFAS before and during pregnancy on hemoglobin concentration of preconception women before and after 6 months of intervention

<table>
<thead>
<tr>
<th>Group</th>
<th>Baseline mean±SD</th>
<th>Endline mean±SD</th>
<th>p-value</th>
<th>Mean Difference ±SD</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>IFA (n=43)</td>
<td>12.87±1.00</td>
<td>13.07±1.06</td>
<td>0.184</td>
<td>0.20±0.96</td>
<td>0.555</td>
</tr>
<tr>
<td>MMS (n=37)</td>
<td>12.63±1.51</td>
<td>12.96±1.23</td>
<td>0.116</td>
<td>0.35±1.32</td>
<td>0.555</td>
</tr>
</tbody>
</table>

*Paired T-Test, b Mann Whitney

Table 1 shows hemoglobin concentration on IFAS and MMS groups, baseline and endline data, did not differ significantly in which mean±SD 12.87±1.00, 13.07±1.06 (p=0.18) and 12.63±1.51, 12.96±1.23 (p=0.12), respectively. Similarly, there was also no significant different between these group with mean difference ± SD of IFA 0.20±0.96 and 0.35±1.32 (p=0.55).

Table 2 Effect of MMS and IFA supplementation before and during pregnancy on infant birth weight and newborn length.

<table>
<thead>
<tr>
<th>Group</th>
<th>Birth Weight (g) mean±SD</th>
<th>P-value</th>
<th>Group</th>
<th>Birth Length (cm) mean±SD</th>
<th>P-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>IFA (n=16)</td>
<td>2764.37 ± 517.13</td>
<td>0.008*</td>
<td>IFA (n=13)</td>
<td>47.85 ± 0.52</td>
<td>0.007*</td>
</tr>
</tbody>
</table>

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Table 2 compare the effect of maternal preconception between MMS and IFAS group on birth weight and birth length. There was a significant different both on birth weight and newborn length, with mean±SD birth 2764.37 ± 517.13, 3174.34 ± 392.73 (p=0.008) and 47.85 ± 0.52, 50.00 ± 0.49 (p=0.007),respectively. The birth weight and newborn length of infants of women receiving MMS was higher than those of IFA group. In addition, the different sample size on birth weight and length group is due to unavailability of newborn length data of 5 newborn babies.

Table 3 Effect of MMS and IFA supplementation before and during pregnancy on nutritional status of children, 2 years old.

<table>
<thead>
<tr>
<th>Group</th>
<th>WLZ Median ± SD</th>
<th>LAZ Median ± SD</th>
<th>WAZ Median ± SD</th>
</tr>
</thead>
<tbody>
<tr>
<td>IFA (n=14)</td>
<td>-0.25 ± 0.61</td>
<td>-1.69 ± 1.36</td>
<td>-1.12 ± 0.94</td>
</tr>
<tr>
<td>MMS (n=20)</td>
<td>-0.34 ± 1.28</td>
<td>-0.47 ± 1.03</td>
<td>-0.43 ± 1.30</td>
</tr>
<tr>
<td>P-value</td>
<td>0.259</td>
<td>0.002*</td>
<td>0.148</td>
</tr>
</tbody>
</table>

* Level of significant *p < .05. Mann whitney. WLZ, weight-for-length z score; LAZ, length-for-age z score; WAZ, weight-for-age z score.

Table 3 presents the comparison of effect MMS and IFA on nutritional status of infants, 2 year old which was represent in WLZ, LAZ and WAZ. By age of 2y, there was no significant different on WLZ and WAZ of infants between groups which median (SD) -0.25 ± 0.61, -0.34 ± 1.28 (p=0.259) and -1.12 ± 0.94, -0.43 ± 1.30 (p=0.148), respectively. However, LAZ of infants differed significantly which median (SD) -1.69± 1.36, -0.47 ± 1.03 (p=0.002).

IV. DISCUSSION

Our findings showed there was an increase Hb concentration of women after 6 months of implementation either IFAS or MMS. However, the increase was not significant within and between groups. As the evaluation of effectiveness of iron supplementation mostly based on an increase of Hb level, therefore our finding was consistent with the study conducted in Vietnam found that women who consumed either IFA or MMS over 6 months before conception increased iron store of mother and infant.8 Moreover, a systematic review comparing daily iron supplementation with folic acid or with other vitamins and mineral found that women receiving IFAS are more likely to have higher Hb concentration than those of MMS group.9

The second finding of our study was the birth weight and newborn length differed significantly between IFAS and MMS groups. MMS groups delivered heavier and taller babies than those in IFAS groups. This was consistent with the systematic reviews conducted by Ramakrishnan et all, Haider, et all, Keats et all found that MMS resulted in significant reduction on low birth weight compare to IFAS and also an increase mean birth weight.10,11 Previous study conducted in the same region demonstrated also similar results.12 This could be as a consequence of significant improvement in gestational age due to MMS and IFAS implementation which lead to improve birth weight and length.13 Unlike a trial conducted in China was inconsistent with our finding in which there was no significant different on birth weight, length on both groups.14 This could underline the important of other determinant factors such as economic status, environment and nutritional status.

Based on nutritional status of children 2y old, there was a significant different on LAZ whereas WAZ and WLZ did not differ. MMS group has higher LAZ than IFA. These findings were in line with study done by Christian found that ponderal and linear growth velocities for children who exposed prenatal MMS were faster from 12 to 24 month of age compared with children in the IFA group.15 Similarly, a trial in Burkina Faso showed that LAZ of MMS group was higher than IFAS, and MMS can decrease stunting.16 This can be explained by the biological mechanisms of interaction among iron, insulin growth factor-1, ghrelin and insulin concentration that determine linear growth.17,18 However, there was a meta-analysis study found that there was no significant effect on LAZ, WAZ, WLZ on children under 5y.19
V. CONCLUSION

The prenatal multi micronutrient supplementation provided benefit for women and pregnancy outcome. Both IFAS and MMS had the same effect on maintaining hemoglobin concentration on preconception and pregnant women. In term of effect on birth weight, newborn length, and LAZ, MMS had a better effect than IFAS.

REFERENCES