Sanitation and Multiple Micronutrient Supplementation in Pregnancy Outcomes: Literature Review

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Abstract

BACKGROUND: Around 2.6 billion people lack proper sanitation. In addition, nutritional problems such as multiple micronutrient (MMN) deficiency can increase morbidity, mortality, and impaired neurocognitive growth at later stages of life. In addition to the need for a sanitary approach, a globally applicable strategy to prevent micronutrient deficiencies in pregnant women, UNICEF recommends the use of MMN for prenatal supplementation as an initial program in developing countries, to reduce the risk of poor birth outcomes.

AIM: The aim of this literature study was to analyze the relationship between sanitation and the multimicronutrient (MMN) approach in pregnancy and birth outcomes.

METHODS: This research was conducted using literature review method. Various references were collected from online database including reports, journals, and books. The journals were mostly from the scholarly journals. The articles were screened according to the research objectives. The keywords used are sanitation, pregnancy, and multiple micronutrient approach.

RESULTS: Several studies have shown that sanitation and the multi micronutrient (MMN) approach play a role in determining pregnancy outcomes. We conclude that the importance of sanitation on pregnancy outcome is to reduce the chance of infection. The importance of MMN in pregnancy outcomes is that mothers who consume MMN during pregnancy can reduce the risk of poor birth output. The role of stakeholders is needed in the future.

CONCLUSIONS: Several studies have shown that sanitation and multi micronutrient (MMN) play a role in determining pregnancy outcome.

Introduction

The growth and development of a child are very much determined by the conditions of the womb and when the life of first 2 years. Chronic nutritional deficiencies when in this period can lead for less outcomes later, about disorders in cognitive development, immune function, growth, and an increase developing chronic disease later, which has consequences to human health [1]. Develop of the immune system is very important [2]. The WHO notes around 830 women worldwide died every day because the complications about pregnancy and 99% are in developing countries. In developing countries, in 2015, MMR reached 239 per 100,000, compared to developed country which only reached 12 per 100,000 [3]. Sanitation is one of the crucial facets for women who are either planning to have a baby [4].

There is a consensus that pregnant women need more supplements than just folic acid. Required supplements containing vitamins and minerals are considered to be a more efficient approach to the problem of micronutrient deficiency. Based on this, multivitamin and mineral supplements were designed for pregnant women in developing countries. Then, this MMN is tested in various countries to see its benefits [5]. A meta-analysis study also found that MMN supplementation significantly reduced the incidence of low birth weight (LBW) and small infants for gestational age [6].

Sanitation is one of the crucial facets for women who are either planning to have a baby. Exposure to unsafe water, poor sanitation, and poor waste management during pregnancy have a significant relationship with an increased risk of infection in the mother, which can lead to LBW and premature birth [7].
The aim of this literature study was to analyze the relationship between sanitation and the multimicronutrient (MMN) approach in pregnancy and birth outcomes.

Methods

This research was conducted using literature review method. Various references were collected from online database including reports, journals, and books. The journals were mostly from the scholarly journals. The articles were screened according to the research objectives. The keywords used are sanitation, pregnancy, and multiple micronutrient approach. The data are selected from Google Scholar journals and the literature of the past 10 years. Screened data and selected based on adequate criteria and keywords based on research objectives. Inclusion criteria are journal about sanitation, pregnancy, and multiple micronutrient approach. The number of papers in the initial search is 100 articles. The number of papers that selected for the specific scope of this review is 23 articles. We follow Prisma for reporting in systematic reviews (Figure 1).

Discussion

Sanitation in pregnancy

The WHO was reported that 4.0% of all deaths and 5.7% of total lives could associated with water, sanitation, and hygiene. Water quality are related to environmental chemicals add a quite a heavy load of disease. Water quality associated with environmental chemicals adds to the considerable burden of disease and is exacerbated by inadequate water supply, sanitation and hygiene, and no quantification of improvements in water supply and sanitation [8]. Adverse conditions can originate not only from contaminated water sources but also from poor hand hygiene, which can made worse by limited access to water [9]. Poor water or environmental sanitation factors (health facilities and housing conditions) contribute to maternal mortality [8].

MMN in pregnancy

Micronutrient deficiency is more common, especially in low pregnant women to countries has middle income. Risk of pregnant women by multiple micronutrient deficiencies caused by an increased need for fetal and placental development. The inability to meet the increased needs can be bad for the mother and fetus [6]. Deficiency of vitamin and mineral extends widely iron deficiency in reproductive age women can negatively impact pregnancy. The outcome of such deficiency includes LBW. This can be done by an efficient approach of combining different kinds of vitamin and mineral into a supplement. Based on this approach, multivitamin and mineral supplementation designed to be consumed by pregnant women was developed and made available through UNICEF. These multivitamins and mineral supplements were tested in efficacy and effectiveness series tests that included some countries and continents. The aim of this trial is found that multivitamin and mineral using pregnancy supplements can increase important results such as birth weight and improve supplement consumption adherence to pregnancy and micronutrient status in addition to reduce infant and neonatal mortality rate [10].
Multiple micronutrient supplementation during pregnancy in low-income countries: A meta-analysis of effects on stillbirths and on early and late neonatal mortality (Carneiro Ronansans et al., 2009)

Supplementation provides about RDA from various micronutrients. Nineteen trials (involving 138,538 women) were identified as eligible. Some micronutrient supplements that contain iron-folic acid provide a significant effect on maternal anemia in third trimester, and potentially reduce the risk of preterm birth and LBW infants.

Multiple-micronutrient supplementation during pregnancy for prevention of maternal anemia and adverse birth outcomes in a high-altitude area: a prospective cohort study in rural Tibet of China (Yi Jun Kang et al., 2017)

Supplementation in rural Tibet is associated with a reduction in maternal anemia in third trimester, and potentially reduce the risk of preterm birth and LBW infants.

Systematic review and meta-analysis: Association between water and sanitation environment and maternal mortality (Lenka Benova et al., 2014)

Water, sanitation, hygiene and enteric infections in children, Joe Brown et al., 2015

Using evidence from the past 150 years of the WSH-related illness burden followed by a general review of water, sanitation and hygiene transmission route and control steps


Cochrane Database of Systematic Reviews

Micronutrient Deficiency in Women Living in Industrialized Countries During the Reproductive Years: Is there a Basis for Supplementation with Multiple Micronutrients? Ella Schaefer (2016)

Multiple micronutrient supplementation during pregnancy in low-income countries: A meta-analysis of effects on birth size and length of gestation (Santher B.K. et al., 2014)

Multiple micronutrient supplementation in pregnancy outcomes (Padhi, B. K. et al., 2015)

Risk of Adverse Pregnancy Outcomes among Women Practising Poor Sanitation in Rural India (Padhi, B. K. et al., 2015)

Modifiers of the effect of maternal multiple micronutrient supplementation on stillbirth, birth outcomes, and infant mortality: a meta-analysis of individual patient data from 17 randomised trials in low-income and middle-income countries (Emily R Smith, Anuraj H Shanka et al., 2017)

Table 1: Collection of Journal Literature that explains the relationship in the topic of sanitation and multiple micronutrient supplementation in pregnancy outcomes

<table>
<thead>
<tr>
<th>Title</th>
<th>Characteristics</th>
<th>Finding</th>
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<tbody>
<tr>
<td>Multiple micronutrient supplementation during pregnancy in low-income countries: A meta-analysis of effects on stillbirths and on early and late neonatal mortality (Carneiro Ronansans et al., 2009)</td>
<td>22,396 children whose mothers received several micronutrient supplements 22,003 children in the control group</td>
<td>Case control</td>
</tr>
<tr>
<td>Multi-micronutrient supplementation during pregnancy for prevention of maternal anemia and adverse birth outcomes in a high-altitude area: a prospective cohort study in rural Tibet of China (Yi Jun Kang et al., 2017)</td>
<td>A total of 1,149 pregnant women are eligible allocating daily supplementation with FA in one area and MMN containing recommended allowances for twenty-three vitamins and minerals in other countries from ≤ 24 weeks of gestation and continuing until delivery</td>
<td>Cohort</td>
</tr>
<tr>
<td>The Effect of Intermittent Antenatal Iron Supplementation on Maternal and Infant Outcomes in Rural Viet Nam: A Cluster Randomised Trial (Hanieh, et al.)</td>
<td>The treatment group was divided into three groups (Group 1 was given regular iron and folic acid supplements, Group 2 was given iron and folic acid 2 times a week, Group 3 was given multiple micronutrients</td>
<td>Cohort, randomized trial</td>
</tr>
<tr>
<td>Systematic review and meta-analysis: Association between water and sanitation environment and maternal mortality (Lenka Benova et al., 2014)</td>
<td>Literature in Medline, Embase, Popline and Africa Wide EBSCO since 1980</td>
<td>Cohort</td>
</tr>
<tr>
<td>Water, sanitation, hygiene and enteric infections in children, Joe Brown et al., 2015</td>
<td>Using evidence from the past 150 years of the WSH-related illness burden followed by a general review of water, sanitation and hygiene transmission route and control steps</td>
<td>Case control</td>
</tr>
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Some micronutrient supplements that contain iron-folic acid provide a significantly greater reduction neonatal mortality for female neonates compared with male neonates rather than iron folic acid supplementation alone (RR 0.85, 95% CI 0.75–0.96 vs. 0.95–1.17; p value for interactions 0.007). Some micronutrient supplements resulting in a greater reduction in LBW (RR 0.81, 95% CI 0.74–0.89; p value for interactions 0.049), small births for gestational age (0.92, 0.87–0.97; p = 0.03), and 6 months mortality (0.71, 0.60–0.86; p = 0.04) in anemia pregnant women (HB < 110 g/L) compared to pregnant women who are not anemic. Multiple micronutrients supplements also have a greater effect on preterm birth among underweight pregnant women (BMI < 18.5 kg/m²). RR 0.84, 95% CI 0.78–0.91; p = 0.01. Initiation of several micronutrient supplements before 20 weeks gestation gave a greater reduction in preterm birth (RR 0.89, 95% CI 0.85–0.93; p = 0.03). Generally, survival and birth the effect of the results from multiple micronutrient supplementation is greater with high adherence (≥ 95%) supplementation. Some micronutrient supplements do not significantly increase the risk of stillbirth or neonatal, 6 months, or infant mortality, not in whole or in any of the 26 subgroups examined |
decades, the level of compliance in the consumption of supplements is still low. To overcome the problem of other deficiency of micronutrient, in 1999, the UNICEF, UNU, and WHO approved multi-micronutrient composition tablets or MMN tablets. The composition of this tablet is in accordance with the RDA for all vitamin for pregnant women [6]. MMN supplementation during pregnancy can reduce abortion risk and intrauterine growth restriction. In double blind randomly control trial in the group that received MMN and who only received folic acid and iron showed that there was a 10% [11]. MMN in pregnant women to controls who only received folic acid and iron, it was a decrease incidence stillbirth and premature and mortality [12].

Sanitation, MMN, and pregnancy output

There are several factors that affect the baby size, one of which is the nutrition of the mother during pregnancy. There is a clear relationship between maternal protein consumption in the last month of pregnancy and the baby size. Worse the mother’s nutrition, the less her birth weight and length of the baby. In addition, mineral deficiency in the mother during pregnancy is also said to have an effect on postnatal development including damage to neurological and immunological functions in infants [13]. In addition, for children under five to not experience poor nutritional status, improvement in environmental hygiene is needed. This can be done by maintaining the water
MMN administration was found to decrease a small and large incidence for gestational age [20]. A meta-analysis study also found that MMN supplementation significantly reduces incidence of LBW. Different results from several studies did not show changes in infant mortality at birth or after birth with MMN administration, even MMN administration data during pregnancy increased initial risk and perinatal neonatal mortality compared to mothers given folic acid and iron supplements after MMN study exclusion. This finding is surprising but must be carefully criticized [6], [21]. A meta-analysis study by Devakumar et al. in general found no anthropometric differences and body composition in children aged 0–9 years [22]. Research data from 12 studies found no significant effect of MMN administration on infant length. The effect on head circumference was generally not significant in 10 studies. The results of arm circumference measurements in three studies also did not show any significant effect [20]. Nguyen’s research in Vietnam showed that the administration of preconception MMN in women before pregnancy was related to the increase of height of children at 2 years of age which that only received folic acid, but there was no difference groups that received MMN supplements and groups who received iron-folic acid supplements [22]. The results of meta-analysis by Kawai et al. showed no difference in perinatal mortality after MMN administration in developing countries. The study showed that maternal education levels and gestational age when first receiving MMN contributed to the heterogeneous effect of perinatal mortality rates [23].

Conclusion

Several studies have shown that sanitation and the multimicronutrient (MMN) approach play a role in determining pregnancy outcomes. We conclude that the importance of sanitation on pregnancy outcome is to reduce the chance of infection. The importance of MMN in pregnancy outcomes is that mothers who consume MMN during pregnancy can reduce the risk of poor birth output. The role of stakeholders is needed in the future.

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