

# Non-Pharmacologic management practices for Anaemia in Pregnancy: A scoping review

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## KEYWORDS

effectiveness, management practices, Non-pharmacologic, Anaemia in pregnancy

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## ABSTRACT

**INTRODUCTION** Anaemia in pregnancy is a prevalent condition, impacting a significant portion of women globally and posing serious health risks to maternal and neonatal health. While pharmacological interventions aimed at reducing anaemia in pregnancy have received substantial attention, non-pharmacological approaches remain insufficiently studied. This review therefore sought to determine the available non-pharmacological management of anaemia in pregnancy and their effectiveness.

**METHODS** Four electronic databases were searched for relevant literature and a total of 2521 records were identified. The records were reduced to 34 articles and assessed for eligibility. Thematic analysis approach was used to analyse the extracted data and a narrative summary was used to report emerging themes to answer the review question.

**RESULTS** Eight records were included in the review. Effective management practices for AIP identified included nutritional interventions such as corn soya blend, red spinach, moringa, honey. Additionally, removal of fluoride from drinking water, food and other sources, and counselling-based intake of essential nutrients were found to be effective. However, one study found the consumption of only Vitamin C rich fruits to be an ineffective AIP management practice.

**CONCLUSIONS** Non-pharmacological managements of AIP are primarily dietary. Effective interventions included the consumption of corn soya blend, red spinach, moringa, fortified-milk groups, honey, fermented soybeans. The study emphasizes the need further investigation into non-pharmacological AIP interventions, representing a crucial step towards improved maternal and neonatal health.

## INTRODUCTION

Globally, nearly thirty percent of women of reproductive age, equivalent to over five hundred million women, and 36.5% in pregnant women are anaemic (World Health Organization, 2023). The World Health Organisation (WHO) defines anaemia as a condition in which the oxygen-carrying capacity of red blood cells in the body is insufficient to meet the physiological needs of an individual (World Health Organization, 2018). When a pregnant woman's haemoglobin level falls below 11g/dL, she is considered as having anaemia in pregnancy (AIP) (World Health Organization, 2011).

Anaemia in pregnancy can be either physiological or pathological (Morrison and Parrish, 2009). Physiological anaemia occurs when there is an increased production of red blood cells and a disproportionately greater increase in blood volume (Mukhopadhyaya, 2020). A state of haemodilution

occurs where plasma production is greater than red blood cell production and haemoglobin levels (normal 12-16g/dL blood), and haematocrit (normal 37- 47%) are reduced (Hark and Catalano, 2012). While physiological anaemia is normal in pregnancy, pathological anaemia can lead to maternal and neonatal morbidity and mortality. Pathological AIP results in reduced maternal blood oxygen-carrying capacity, which, if severe, may endanger the lives of both mother and foetus (Chandra et al., 2012; Stangret et al., 2017). The most common type of pathological AIP is iron deficiency anaemia, which has a global prevalence estimated to be between 20% to 80% (Breyman, 2015).

Numerous interventions aimed at reducing AIP have been introduced, however, evaluation of the programmes has been limited (Gangopadhyay, Karoshi and Keith, 2011). Multifaceted approaches including pharmacological and non-pharmacological interventions have been implemented to

manage AIP, namely micronutrient supplementation, dietary management, malaria prevention, and deworming (USAID, 2016). The primary strategy for preventing and managing AIP during pregnancy is iron and folic acid (IFA) supplementation until the 6-week postpartum (Ghana Health Service, 2017). There have been several issues with compliance, accuracy of dosing regimens and inadequate education of pregnant women by health personnel, negatively affecting the success of anaemia management strategies (Kamau, Mirie and Kimani, 2018).

The total iron requirement during pregnancy, including replacement of bodily losses, is approximately 1 gm/day. Iron requirements increase from 0.8 gm/day in early pregnancy to 7.5 mg/day by the end of 40 weeks (Monga, 2009; Troiano NH, Harvey CJ, Chez, 2012). Iron and folic acid supplementation non-adherence could lead to AIP and blood loss at childbirth (Alemayehu et al., 2016). Evidence shows that iron deficiency anaemia is a key cause of maternal morbidity and mortality because it leads to adverse effects of excessive blood loss (Sanghvi et al., 2010). Causal relationships have also been reported between severe anaemia and maternal complications, including wound infection following a caesarean section or episiotomy, placental abruption, puerperal pyrexia, perinatal infection, and bleeding (Gebremariam et al., 2017; Stephen et al., 2018).

However, there is a paucity of research investigating non-pharmacological management practices associated with

AIP and their effectiveness (Sangeeta and Pushpalatha, 2014). This study seeks to determine the available non-pharmacological management of AIP and their effectiveness.

### Methods

The six-stage framework of Arksey and O'Malley (2005), was adopted for this scoping review. They include identification of research questions, search for relevant studies, selection of studies, data collection, data collating, summary and reporting and consultation.

### Search for relevant studies

A comprehensive search strategy was developed to identify relevant studies. The search was conducted across four main databases (PubMed, Embase, PubMed Central and Journal of Science Storage). Additional search and search for grey literature was done in Google and Google Scholar. The search terms included variation of non-pharmacological management, utilisation, AIP and prevalence. Boolean operators (AND, OR) were used to combine the search terms effectively. MeSH terms were developed for search in PubMed. The MeSH terms were then modified for search in other databases. The MeSH terms for the search conducted is presented in Table 1.

### Study selection

Records retrieved from a search conducted in databases were transferred to a referencing software, Mendeley, where duplicates were removed. Titles and abstracts were then screened for full-text papers. This screening was done by two of the authors and reviewed by a third author. Full-text records of eligible abstracts and titles were then retrieved for further screening. Full-text records were screened by authors for inclusion and exclusion. Inclusion and exclusion criteria established to guide the selection of studies for this review are presented in Table 2.

### Data extraction

Data was extracted independently by GOO and EAB, and reviewed by TDA. This was done to ensure that extracted papers were reliable and accurate. Inconsistencies between

**Table 1: MeSH terms for search in PubMed**

Search (#)	Search terms
#1 Search to identify utilisation	Utilisation* [MeSH Terms] OR Usage* OR Implementation* OR Use*
#2 Search to identify anaemia	Anaemia* [MeSH Terms] OR Anemia* [MeSh Terms] OR Low Hemoglobin* OR Iron Deficienc* OR Low Iron*
#3 Search to identify pregnancy	Pregnancy* [MeSh Terms] OR Pregnant women/woman* OR Gravid* OR Antenatal* OR Gestation* OR Mother* OR Matern*
#4 Search to identify non-pharmacological management	Non-pharmacolog* [MeSH Terms] OR Non-medic* OR Natural remedies* OR Non-drug* OR Medication-free* OR Non-chemical
#5 Search to identify effectiveness	Effectiveness* [MeSH Term] OR Efficacy* OR Impact* OR Effect*
Overall search strategy	1. #1 AND #4 AND #2 AND #3 AND #8 NOT ANIMAL 2. #1 AND #2 AND #3 AND #4 AND #5 AND #7 AND #8 NOT ANIMAL
Activate filter	English language

**Table 2: Eligibility criteria**

Inclusion criteria	Exclusion criteria
Studies involving pregnant women between the ages of 18 to 45 years	Studies involving pregnant women with severe medical comorbidities
Studies published in English language	Conference papers, preprints and studies not published in English language
Studies that have been peer reviewed	-
Grey literature	-

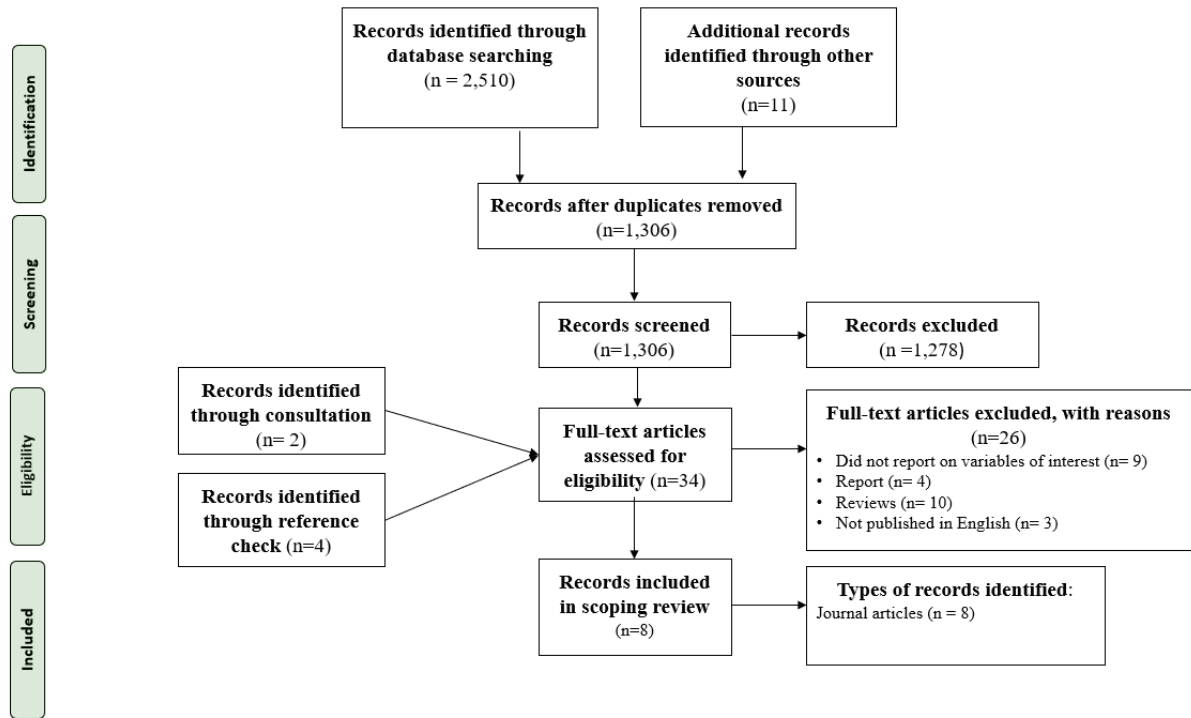
**Table 3: Data extraction form**

Author(s), year of publication and country	Purpose of the study	Study design	Population	Sample	Effectiveness of non-pharmacologic management
<sup>26</sup> Tanzania	To test the effect of a micronutrient-fortified beverage containing 11 micronutrients (iron, iodine, zinc, vitamin A, vitamin C, niacin, riboflavin, folate, vitamin B-12, vitamin B-6 and vitamin E) on the haemoglobin, iron and vitamin A status of pregnant women in Tanzania	Experimental study	Pregnant women	259	The supplement resulted in an increase in haemoglobin concentration ferritin levels, and reduced the risk of anaemia and iron deficiency anaemia.
<sup>23</sup> India	To evaluate the effectiveness of interventions for control of anaemia in pregnant women and to identify the major detrimental and confounding factors statistically.	Experimental study	Pregnant women	249	Women who either withdrew or reduced fluoride intake benefited in terms of raising their Hb levels.
<sup>22</sup> Indonesia	Increasing the consumption of Fe-rich foods and thus improving Fe bioavailability without significantly increasing diet cost is the most sustainable intervention for improving Fe intake.	Experimental study	Pregnant women	252	Optimized diet with fermented soyabean (tempeh) and vitamin C-rich fruit in the present study had a positive outcome in women with iron deficiency anaemia, their baseline haemoglobin and ferritin levels were raised.
<sup>24</sup> Vietnam	To measure haemoglobin status and reduction of underweight in a group of pregnant women who received iron-fortified or non-fortified milk, and another group who received iron supplements (tablets) or placebo.	Experimental study	Pregnant women	176	The probability of anaemia was slightly lower in the supplement than in the fortified-milk group.
<sup>25</sup> Cambodia	To assessed the effect of prenatal CSB (Corn Soya Blend) Plus supplementation on birth weight and secondary outcomes of low birth weight (<2500 g), small for gestational age, birth length and head circumference, preterm birth (37 weeks), maternal weight gain, and anaemia at 24–28 weeks, 30–32 weeks, and 36–38 weeks of gestation among rural Cambodian women	Experimental study	Pregnant women	547	There was no significant difference in birth weight between the CSB Plus and control group. Significant reductions were observed in preterm birth. There were no significant differences in low birth weight, small for gestational age, birth length, head circumference, or maternal weight gain. A higher rate of foetal loss was observed.
<sup>29</sup> Indonesia	To study differences in Hb levels before and after giving red spinach in the second trimester of pregnancy to women with anaemia at the Puskesmas Segala Mider Bandar Lampung, in 2019	Quasi-experimental study	Pregnant women	36	There were significant differences between before and after the administration of red amaranth/spinach in pregnant women with anaemia in increases of Hb levels.
<sup>28</sup> Indonesia	To determine the effect of giving honey on pregnant women who have anaemia	Quasi experiment	Pregnant women	16	There was an effect of giving honey to increase the haemoglobin levels of pregnant women.
<sup>27</sup> Indonesia	To determine the effect of giving honey with extra Moringa on haemoglobin levels and erythrocyte index in pregnant women with anaemia	Experimental study	Anaemic pregnant women	40	Moringa honey is more effective in producing haemoglobin levels and erythrocyte index

**Table 4: Thematic analysis: Effectiveness of interventions for AIP**

Themes	Specific interventions	Authors
Effective	Micronutrient-fortified beverage containing 11 micronutrients (iron, iodine, zinc, vitamin A, vitamin C, niacin, riboflavin, folate, vitamin B-12, vitamin B-6 and vitamin E)	26
	Removal of fluoride from drinking water, food and other sources	23
	Counselling based intake of essential nutrients calcium, iron, folic acid, vitamins C, E and other antioxidants through dairy products, vegetables and fruit	23
	Consumption of Corn Soya Blend	25
	Consumption of Red amaranth/spinach	29
	Consumption of Moringa honey	27
	Consumption of fortified-milk group	24
	Giving honey	28
Ineffective	Optimized diet with fermented soyabean and vitamin C-rich fruit	22

**Figure 1: PRISMA Flow chart showing search results and screening process**



extractors were resolved during regular meetings. We extracted the data based on authors, year of publication, the purpose of study, study design, population, sample, rate of utilisation and effectiveness of utilisation. Table 3 presents the data extraction form and characteristics of included studies.

**Collating, summarising, and reporting the results**

Thematic analysis approach was used to analyse the extracted data and a narrative summary was used to report emerging themes to answer the review questions. The

implication of the study results for future research, education and healthcare policies were also examined and reported.

**RESULTS**

**Search results**

A total of 2,510 records were identified from the initial database search and 11 additional records were identified from other sources. After the removal of 1,215 duplicates, 1,306 records were screened for full text articles. Thirty-four (34) full-text records were assessed for eligibility. Twenty-eight full-text records were removed and 8 records were

**Figure 2: Map of the countries the included studies were conducted**


included in this review. The search results and screening process are presented in Figure 1. In all, 1,575 participants were sampled by the 8 studies.

#### Characteristics of the studies

Most of the studies were conducted in Indonesia [n=4] (Wijaya-Erhardt, Muslimatun and Erhardt, 2011) followed by India [n=1] (Bhasin et al., 2023), Vietnam [n=1] (Hoa et al., 2005), Cambodia [n=1] (Janmohamed et al., 2016) and Tanzania [n=1] (Makola et al., 2003). Randomised controlled trial was the most used study design in the studies included [n=6] (Makola et al., 2003; Hoa et al., 2005; Wijaya-Erhardt, Muslimatun and Erhardt, 2011; Rahmawati et al., 2022; Bhasin et al., 2023) followed by quasi experimental design (n=2). Again, most of the reviewed studies were published in 2020 (Imron and Samuel, 2020; Laili, Purnani and Aminah, 2020).

#### Findings

Two major themes which included effective and ineffective interventions emerged from the analysis. Below are the details of the thematic analysis are present below:

Themes: Effective

1. Micronutrient-fortified beverage containing 11 micronutrients (iron, iodine, zinc, vitamin A, vitamin C, niacin, riboflavin, folate, vitamin B-12, vitamin B-6, and vitamin E) (Makola et al., 2003)
2. Removal of fluoride from drinking water, food, and other sources (Bhasin et al., 2023)
3. Counselling-based intake of essential nutrients calcium, iron, folic acid, vitamins C, E, and other antioxidants through dairy products, vegetables, and fruit (Bhasin et al., 2023)

4. Consumption of Corn Soya Blend (Janmohamed et al., 2016)
5. Consumption of Red amaranth/spinach (Imron and Samuel, 2020)
6. Consumption of Moringa honey (Rahmawati et al., 2022)
7. Consumption of fortified-milk group (Laili, Purnani and Aminah, 2020)

Themes: Ineffective

1. Optimized diet with fermented soybean and vitamin C-rich fruit (Wijaya-Erhardt, Muslimatun and Erhardt, 2011)

#### Effective and Ineffective Interventions

A significant number of the included studies reported interventions as effective in dealing with AIP. The effective interventions included: corn soya blend (Janmohamed et al., 2016), red spinach (Imron and Samuel, 2020), moringa, honey (Rahmawati et al., 2022), consumption of optimized diet with fermented soybean (Wijaya-Erhardt, Muslimatun and Erhardt, 2011), fortified-milk group (Hoa et al., 2005) and honey (Laili, Purnani and Aminah, 2020). Additionally, micronutrient-fortified beverage containing 11 micronutrients (Makola et al., 2003), removal of fluoride from drinking water, food and other sources and counselling-based intake of essential nutrients calcium, iron, folic acid, vitamins C, E and other antioxidants through dairy products, vegetables and fruit were found to be effective (Bhasin et al., 2023). However, only one study found the consumption of only vitamin C rich fruits ineffective (Wijaya-Erhardt, Muslimatun and Erhardt, 2011).

#### DISCUSSION

This scoping review revealed that non-pharmacologic

management practices for AIP included the consumption of corn soya blend, red spinach, moringa, fortified-milk groups, honey, fermented soybeans, and micronutrient-fortified beverage containing 11 micronutrients. Additionally, other management practices included the removal of fluoride from drinking water, food and other sources, and counselling-based intake of essential nutrients calcium, iron, folic acid, vitamins C, E and other antioxidants through dairy products, vegetables and fruit were effective. However, only one study found that vitamin C rich fruits were ineffective in the management of AIP.

Anaemia in pregnancy is known to be caused by insufficient intake of dietary iron or poor absorption of iron. Effective management practices for AIP are basically dietary in nature (Dwumfour-Asare and Kwapong, 2014). Dietary interventions that target improving upon quality, and increasing food diversity, are possibly the most desirable and effective interventions for AIP (da Silva Lopes et al., 2021).

Nutritional counselling to pregnant women during ANC visits is associated with a lower likelihood of anaemia, independent of possible confounding variables (Taddese et al., 2023). There is also a lack of specific guidelines for how to operationalize nutrition interventions at country or global level, particularly those involving behaviour change counselling (King et al., 2022). While counselling programs may differ by context, there is an urgent need for global guidance translating this research to program implementation guidance that can be adapted at country level in order to achieve effective nutrition behaviour change counselling in lower and middle income countries and delivery of high-quality nutrition interventions (Sanghvi et al., 2010).

Several studies have highlighted the effectiveness of soya bean supplementation as a source of dietary intervention for the management of AIP (Barai and Gurwara, 2016; Suryani, 2023). Soybean and its derivatives are an excellent source of high-quality protein, with low concentrations of saturated fat, high dietary fibre and bioactive components like the isoflavones. The absorption of dietary iron from soybeans has been reported to be better than other foods of plant origin (Darmawan, Karima and Maulida, 2017).

Our review found that red spinach was effective in managing AIP. Several studies have shown that spinach consumption has an effect on the incidence of anaemia in pregnant women (Fajrin, Nikmah and Ningsih, 2022). Spinach plants are relatively cheap and a good source of iron. It is highly nutritious and contains several minerals including vitamins A, B and C, calcium, phosphorus. For every 100 grams of spinach there is 3.9 grams of iron (Fajrin, Nikmah and Ningsih, 2022). In a pre-experimental study conducted in Indonesia among 153 pregnant women to determine the effect of consumption of red spinach juice on haemoglobin on pregnant women found that consumption of red spinach juice could change the haemoglobin content in pregnant mother of third trimester (Mardiah, Andreyana and Rismawan, 2021). Implying that the consumption of red spinach in the

right quantities will enhance iron absorption for optimal haemoglobin production.

Further, our review found that micronutrient-fortified beverages were effective in managing AIP. Evidence shows that micronutrient-fortified beverages reduce micronutrient deficiencies including AIP and improve the nutritional status of pregnant and lactating women (Yang and Huffman, 2011). In a randomised double-blind placebo-controlled study conducted in Tanzania among 439 pregnant women to determine the efficacy of a multiple micronutrient fortified beverage containing eleven nutrients at physiological levels in prevention of anaemia and improving iron and vitamin A status. It was determined that the multiple micronutrient-fortified beverage given to the pregnant women for eight weeks improved their haemoglobin, serum ferritin and retinol status. The women's anaemia risks were significantly reduced (Tatala et al., 2002).

Fluorosis can cause destruction of the gastrointestinal mucosa, leading to destruction of red blood cells leading to anaemia other health complications in pregnancy (Yousefi et al., 2017; Bhardwaj et al., 2023). Similarly, in a study conducted by Susheela and Kumari, among 3262 pregnant women visiting antenatal clinics (ANC) in New Delhi, India to address AIP among pregnant women and school children through a field-tested novel strategy found that pregnant women consumed fluoride are unable to absorb iron and other supplements that are provided at ANC resulting into becoming anaemic and deliver small infants or risking their lives (Susheela and Kumari, 2020).

Consumption of an optimized diet with fermented soyabean and vitamin C rich fruits was found to be ineffective in the management of AIP. This finding is inconsistent with the fact that soyabean contains iron and vitamin C promotes iron absorption. Perhaps, the right quantity of soyabean and vitamin C in grammes were not measured accurately in the study. However, evidence shows that combining soya bean and vitamin C reduces iron absorption (Milman, 2020; Piskin et al., 2022). This is because soya bean contains phytic acid and a functional group that inhibits iron absorption (Zhang, Huang and Jiang, 2014).

It has been shown that honey has significant effects in increasing haemoglobin levels in pregnant women with anaemia. In fact, it contains iron and vitamin C among other nutrients that are useful in managing anaemia. However, an included study reported honey as not very efficacious in the management of AIP. This discrepancy could be as a result of the severity of the condition and the duration of the study. The more severe the anaemia, the more time is required in its management (Jimenez, Kulnigg-Dabsch and Gasche, 2015).

#### Limitation

The studies included in this review were very few (n=8) with only one in Africa. This may affect the ability of the result of this review to be generalised. Despite this limitation,

this review used robust method in extracting, screening and reviewing of the data. Furthermore, the authors sought advice from expert deemed relevant for this review to provide comprehensive evidence on non-pharmacological management of AIP.

## CONCLUSION

In conclusion, the non-pharmacological management of Acute Iron Poisoning (AIP) primarily involves dietary interventions. The reviewed studies highlighted effective strategies, including the consumption of corn soya blend, red spinach, moringa, fortified-milk groups, honey, and fermented soybeans. However, caution is advised regarding the combination of soybean and vitamin C, as it may hinder iron absorption, suggesting the need for careful consideration in recommending such combinations.

Furthermore, to broaden our understanding of AIP management, it is recommended that future studies explore alternative non-pharmacological interventions beyond the dietary scope. The current research focus on dietary measures leaves room for investigating additional strategies. Additionally, addressing the geographical gap in research is crucial, with a high prevalence of AIP in Africa. Conducting more studies in this region will contribute to developing region-specific recommendations and a more comprehensive understanding of effective AIP management. In summary, while dietary interventions are proven effective, expanding research initiatives and including diverse geographical perspectives will enhance our knowledge of non-pharmacological approaches to AIP management.

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**CONFLICTS OF INTEREST**

The authors have completed and submitted the ICMJE Form for Disclosure of Potential Conflicts of Interest and none was reported.