

Effect of Nutrition Education on Pregnancy Specific Nutrition Knowledge and Healthy Dietary Practice among Pregnant Women: A Summary of Available Evidence

Lidia Ghirmai* and Ghidey Gebreyohannes

Department of Midwifery, School of Nursing, Asmara College of Health Sciences, Asmara, Eritrea

Abstract

Healthy pregnancy and birth outcomes are greatly influenced by the intake of adequate and balanced nutrition. Pregnant women's nutritional knowledge and practice have been identified as important prerequisites for their proper nutritional intake. The antenatal period with the opportunities for regular contact with health professionals appears to be the ideal time and setting to institute the intervention which could maximize pregnant women's outcome and that of their baby by motivating them to make nutritional changes. This review has shown that the nutrition messages given to pregnant women by trained health professionals using a holistic approach in a sustained manner can play a huge role in increasing their knowledge and in introducing positive dietary practices among them. Thus ANC clinics must play a leading role in coordinating the effort of awareness creation regarding nutrition during pregnancy.

Keywords: Balanced nutrition; Pregnancy diet; Hematologic disease

*Corresponding author:

Lidia Ghirmai, Department of Midwifery, School of Nursing, Asmara College of Health Sciences, Asmara, Eritrea, Tel: +291-7447480; E-mail: LidiaGhirmai94@gmail.com

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Introduction

Nutrition is a central and fundamental pillar of human life that is required for health and development throughout the entire life span in general and during pregnancy in particular [1-5]. The most nutritionally demanding time of a woman's life is pregnancy. She needs more calories and essential nutrients than other women to support the growth and development of her baby. Hence, perfectly fitting in to that time is a key component of women and her child's life [6]. The pre- and early postnatal phases are the periods during which changes to nutritional status may have the most detrimental impact [7-10].

A pregnancy diet which is sufficient in energy, with a variety of nutrients, minerals, and vitamins, and the mother's avoidance of toxins and contaminants, is important to ensure health for the mother and the growing fetus while poor quality diet during pregnancy has been found to be associated with unhealthy maternal weight gain, increased risk of infections, preeclampsia, anaemia, low birth weight babies which grow and develop less well and have poorer chance of survival than normal birth weight babies, preterm birth or miscarriage. In addition to that, one factor that determines the BMI of women 15 years after every childbirth is weight gain during pregnancy [11,12]. Moreover, pregnancy complications such as, preeclampsia, gestational diabetes, macrosomia, dystocia and higher prevalence of CS can

arise with excessive intake of nutrients during pregnancy [13-15].

Adequate and balanced nutrition during gestation has been recognized as a prerequisite for a healthy pregnancy and birth outcomes and this is significantly determined by their nutritional knowledge and practice [8,9,16-20].

In Sub-Saharan Africa an estimated 42% of women aged 15 to 45 years are anemic with a prevalence of more than 50% during pregnancy. This hematologic disease in women of childbearing age is associated with an increased risk of complications during pregnancy and causes infants to enter life with sub-optimal iron stores [21-25]. In addition to this, some studies indicate that the level of nutritional knowledge and practice among pregnant women was low and were subjected to low adherence to iron folate supplementation especially in low income countries like Ethiopia. From this findings it is vivid that pregnant women are unable to take steps to make decisions regarding their diet during pregnancy [1,5].

In Ethiopia, there are studies done on the knowledge and practice of pregnant women with regard to nutrition during pregnancy which shows that pregnant mothers were restricting their food intake, considered some food as taboo, not adhering to micronutrient supplementations and were not taking additional meals during pregnancy mainly due to low level of knowledge.

Some studies also showed that they were not aware of the benefits of supplementary nutrients provided during ANC visits [5,16].

Poor nutrition is one of the potentially modifiable risk factors known to be associated with poor pregnancy outcomes [1]. This statement gives green light for ANC providers to give proper nutrition education with the purpose of reinforcing good dietary behavior, practice and eliminating undesirable practices to pregnant women [2,5].

Specifically health and nutrition education to improve and ensure regular consumption of foods rich in iron, foliate and vitamin C and to reduce consumption of interfering substances has appeared to be a core strategy for the prevention and control of anaemia [10-21]. Food-based strategies, which include fortification of foods with micronutrients and dietary diversification to increase production and consumption of foods rich in iron, vitamin C and foliate as well as supplementation with specific micronutrient to the vulnerable groups and other public health measures, have been in operation for over two decades. However the outcome has not been really apparent. One of the most important barriers reported was the absence of health and nutrition education.

It is well studied that education holds a key factor in health promotion. Determining training needs is a vital step to achieve this goal [18,26]. Though knowledge is not behaviour, it determines the dietary behaviour. Hence the antenatal period with the opportunities for regular contact with health professionals appears to be the ideal time and setting to institute the intervention which could motivate mothers to make changes that could maximize their outcome and that of the baby [2,5].

The WHO recognized the impact of nutrition in pregnancy and recommends that ANC providers should provide adequate, specific and acceptable nutrition related advice to their ANC clients during every visit of antepartum [11]. Majority of the studies who focused on improving dietary knowledge and practice among pregnant women used Pender's health promotion model which is described in detail below. This model is based on an attempt to describe the multidimensional nature of individuals interacting with their interpersonal and physical environments as they pursue health. The studies were conducted with the purpose of attaining satisfactory knowledge and practice among pregnant women ultimately resulting in optimal maternal weight gain, adequate maternal diet and positive infant outcomes such as satisfactory birth weight. This review will focus on the collective overview of the effect of nutrition education and counselling during pregnancy in improving pregnancy specific nutritional knowledge and practice of pregnant women.

Rationale of the Review

The single most important cause of infant morbidity and mortality in the world is poor maternal nutrition and the resulting LBW. The elimination or at least reduction in the rate of LBW has been named by WHO as one of the main global indicators of progress [11]. Every two minutes around the world there is a maternal

death and one woman dies every seven minutes from PPH, the single most common cause of maternal mortality [8]. Despite that fact, it is not uncommon to observe women to eat less during pregnancy to avoid fatal abnormality and so to prevent difficult delivery. A study done in some area also revealed that food taboos and misconceptions governing pregnancy exist. This was due to the belief that certain food items will be plastered on the fetal head, fear of abortion, fatal abnormality and still birth [13]. These findings call for a nutritional communication in ANC that is more tailored towards women dietary habits, cultural background, nutritional knowledge as well as level of nutrition literacy.

Although, grossly maternal health has been given attention through researches and projects, those focusing specifically on maternal nutrition are limited [1]. At the same time limited research focuses on midwife's nutrition education and little is also known about their perception of this role, the influence of the model of care, and the barriers and facilitators that may influence them in providing quality nutrition advice to pregnant women. There is also a report from the studies that the information received by pregnant women was passive and more medically directed [27].

This proves right the need to synthesize evidence about the effects of interventions to prevent maternal deaths and reduce maternal morbidities. Health education and counselling instituted correctly is the core of all preventive and control measures. There are strong evidences that show nutrition counselling during pregnancy has significant impact on dietary habit of pregnant women, maternal and birth outcome of pregnancy.

Pregnant women are one of the vulnerable populations to develop iron deficiency anaemia. Severe Anaemia (Hb<7.0 g/dl) which worsens with pregnancy in a study sample was found to be 6.4% after which when an intervention was implemented, no subject was found to be severely anaemic [27]. This gives a picture that the role of nutrition counselling at ANC visit is indisputably crucial to stop the intergenerational cycle of malnutrition.

Theoretical and conceptual model of the studies

The conceptual frame work best for appropriate conducting of this sort of researches is centred around the Health Belief Model which is based on the premise that people are most likely to take health related action (e.g., eat a healthy diet), if they feel that by doing so they can avoid a negative health condition. The HBM assumes that health is a main concern for most people, and that a given health action will result in the desired goal of eliminating or reducing the perceived serious consequences of a health condition. The majority of researches basically employed the HBM as a core strategy to enhance the effect of the intervention in increasing knowledge of pregnant women and promoting positive dietary behaviours among them. The primary constructs of the model are Perceived Susceptibility, means pregnant women's belief that they are susceptible to poor fetal growth, LBW and other diseases when they have an inadequate nutrition; Perceived Severity, knowledge and belief that having

inadequate nutrition might affect well-being of the child later in life; Perceived Benefit, belief concerning the efficacy of receiving health education and following up instructions regarding healthy dietary practices to reduce the chance of poor fetal growth, low birth weight and other diseases related to inadequate nutrition; Perceived Barriers, belief about the cost of adhering to the recommended guidelines such as lack of money; Perceived Threat, women who have inadequate nutrition i.e. woman consumed all nutrients lower than the minimum acceptable levels based on the guideline of daily food serving. Having said that, the role of education mattering to health then appears. Education first exerts direct effect on the people that engage in it and it impacts on the choices of contexts that people come to inhabit or on their opportunities to choose such contexts [27]. The effect of education is not a one-off impact that leads individuals into given contexts. The benefits of education are more dynamic.

Nutrition education, counselling and its effect: “Proper nutrition can prevent birth defects and allow neonates to start life at a healthy weight, reducing later risks of disease” A pregnant women should prepare her meals and snacks in a way that can fulfil her daily energy requirement of 2200 kcal. This is believed to achieve the recommended weight gain in pregnancy which is 11.5 to 16 kg; on average is 12.5 kg for women with normal pre pregnancy BMI [5].

Knowledge and practice of pregnant women pre and post intervention: Average knowledge scores at three time periods (pre-intervention, immediate after intervention, and 6 weeks) were significantly increased in the majority of the studies. A recent Eritrean and Ethiopian studies revealed these facts as the knowledge level increased in the following manner respectively: 29.01/47 (SE=0.35), 42.73/47 (SE=0.24), and 40.94/47 (SE=0.26) and 53.9% to 97% [5,27]. Similar quasi experimental Iranian study also revealed that the awareness level of pregnant women about healthy nutrition significantly increased from 3% before intervention to 31% after the nutritional education intervention [2]. It also agrees with a study done in India which found an overall nutritional knowledge improvement from a mean of 22 in the pre-test to 32.7 at post-test [17]. In another study, there was statistically significant difference in total knowledge from (66.5 ± 28.9) to (117.6 ± 25.3) and total attitude from (3.3 ± 2.1) to (9.5 ± 2.8) scores in the pregnant women after the nutritional education sessions with improvement from 45.5% to 80.5% and from 27.3% to 79.2% in knowledge and attitude respectively (p-value <0.001) [28-30]. In another study, the intervention group recorded significantly higher dietary knowledge score (mean=19.30, SD=0.88) compared to the control group score (mean=14.36, SD=2.11), p < 0.001 after intervention. In the same study and in particular, the intervention group recorded a significant increase in dietary knowledge score from the pretest (mean=14.60, SD=2.53) to post-test (mean=19.30, SD=0.88), as well as practices score from the pretest (mean=6.69, SD=1.97) to post-test (mean=8.70, SD=1.16), p < 0.001, [29,30]. This similarities show the effectiveness of nutrition education in improving knowledge of pregnant women. In addition to that, the GATHER counselling skills incorporated in the training given to health

professionals might have helped improve the communication between the professionals and their pregnant patients thereby significantly increasing the percentage of women who had an ample opportunity to discuss healthy eating at their antenatal care visits. Another scenario is that the pregnant women could have had some previous exposure to certain dietary-related topics either at home or elsewhere. The Eritrean and Iranian studies didn't show any significant interaction with the socio demographic characteristics except with gravidity [2]. This result is a sign that there was gap in knowledge across most categories of background characteristics. This fact makes preparing a one and only teaching module easier as the prepared module can be equally effective for pregnant women of various background characteristics.

Assessing the preferred source of information among pregnant women was necessary as it helps in devising recommendations. Health care professionals (A doctor/Nurse/Midwife) were the preferred source of information in an Eritrean (70.2%) and Australian (67.4%) studies. In another Knowledge, Attitude and Practice survey, the main sources of information were doctors [19]. These results were unlike other studies such as a recent Ethiopian study where the result was not in favour of health professionals as the best source of information [5]. The same was also evidenced in Polish's study where half of the pregnant women mentioned own experience as source of information [20].

An Eritrean study documented a 64.8% of pregnant women who knew maternal under nutrition would bring fetal complications [27]. This result was higher than East College's result where 34.8% respondents had the same idea [1]. A cross sectional study in India found an even lower proportion of mothers (27.4%) with this knowledge. The discrepancy in the results is hugely due to difference in study setting. The pregnant women who were part of the study in Eritrea resided in an urban city which consequently enabled them to have access to information and lesser wrong cultural influences. There was also a difference in the percentage of pregnant women who knew about fatal complication of under nutrition [5]. This difference could be an impact of the differences in the cultural and spiritual influences of the areas. Similar proportion of respondents was fully aware of the effect of maternal under nutrition on fatal weight, 90.7%, 82.8%, 66.8% [5,9,27].

A comparable proportion of respondents were familiar with the fact that a pregnant women needs to eat more than their non-pregnant state, 60.9%, 66.5% [5-27]. Both these results were lower than Pakistani mothers who did believe so (84%). Moreover, in another study as many as 70% of the respondents had the knowledge that they should eat differently from non-pregnant women [19]. In addition to that, in a study of Shashemene District, Ethiopia, more than three forth (82.4%) believed in the importance of eating balanced diet during pregnancy [13]. This was discordant with that of University of Yaoundé's result where the majority (52%) of the study respondents thought that a mother should eat according to her appetite [3].

More pregnant women were knowledgeable about many food sources of iron in a study by Teweldemedhin et al., 2021 when compared to a study done by Zealand (31.8%) [26] but it was in consonance with an Indian study where 61.3% of the pregnant women had a satisfactory knowledge on food source of iron [17]. In a 2012 study by Mohammad et al., the overall knowledge regarding iron rich foods was also low [10]. Contrary to these comparative study's finding was reported in a Tanzanian study where 94.8% of the study population had moderate knowledge regarding sources of iron rich foods [21-25]. Teweldemedhin et al., study in 2021 has also shown that necessity of supplementation because of inadequacy of nutrients in foods was correctly addressed by 85.6% of pregnant women. A similar study demonstrated a lower proportion of mothers (67.7%) with the same understanding regarding supplementation during pregnancy [26]. Teweldemedhin et al., study also showed that only 40% of the study participants correctly answered the duration of iron supplementation though their proportion due to intervention increased to 97.7%. The same effect was seen in a study conducted on the same topic which was 35.5% prior to intervention and later increased to 92.1% [26].

Practice of pregnant women pre and post intervention: Average practice scores at the two time periods increased in the refereed studies. The study by Teweldemedhin et al., can be mentioned as one where the mean overall score of practice of pregnant women was found to be 12.55/16 (78.44/100) and 13.13/16 (82.06/100) in the pre and 6 weeks' later assessment respectively. This score was higher than is obtained in an Ethiopian study where the score was 6.2/11 (56.36/100) [26]. The high practice score in the study mentioned earlier is an expected response to their higher level of knowledge as previously described. Another possible reason could be that the 6 weeks assessment in the study by Teweldemedhin et al., was done post a major Christian holiday (Geez New Year) where a variety of food items are served. Regardless of the quantity of change, an interventional study also showed a significant increase in quality and quantity of the diets consumed. A significant increase in the amount of almost all the food groups consumed in the post-nutrition education as compared to non-nutrition education and pre-nutrition education group was also evidenced in a Dutch study. An Egyptian study in 2006 also pointed that the target women increased their consumption of foods and avoided second-hand smoke [26]. A high proportion of pregnant women with good practice were also seen in Pakistan (65.5%). A study in Swaziland found a closer proportion with 51% good practice among pregnant women. In contrary to these findings in a study of University of Yaoundé, more than half (58%) of pregnant women ate according to their appetites which was according to their belief [3]. The low practice in some studies indicates that adequate knowledge does not necessarily translate into a healthy practice [28,29].

The majority 69.3% of the pregnant women have added at least one additional meal from no pregnant diet [27], this was in accordance with an Ethiopian's study result of 69.7% [5]. Moreover it was similar to an Indian study where there was a significant increase in the amount of almost all the food groups consumed

in the post-NE as compared to non-NE and preNE group [17]. In addition, the intervention group reported significantly higher dietary practices score (mean=8.70, SD=1.16) compared to the control group score (mean=7.02, SD=1.66), $p < 0.001$. The average daily number of food servings also significantly improved in the experimental group in a study by Abu-Baker et al., conducted in 2021 [28]. This was the opposite of a study done in Wando Genet where 75.2% of the pregnant women did not take any additional meal during pregnancy. A possible explanation for this result was involvement of women with a larger household size who had to share the food among them in the study [23]. Similarly in a study of Shashemene District, Ethiopia, only 33.2% made changes to their normal eating habit [13]. In the same study, more than one third (38.3%) of pregnant women practice fasting during pregnancy, in this study only 1 respondent reported fasting. The difference in the knowledge regarding the concepts as well as disparities in the economic level of the communities studied could have hugely influenced the outcome of the studies.

In a southern Ethiopia study, the habit of skipping meals was observed to a higher extent than was evidenced in the study by Teweldemedhin et al. 2021. About 43.8% commonly skipped lunch and 24.2% reported that they skipped breakfast [26]. In one study the most commonly skipped meal was dinner [27]. A probable reason for this is that in the comparable study the proportion of respondents with a large family size and in their earlier gestation with associated nausea and vomiting which could have made consuming food early in the morning difficult was high.

In general, 58.1% were in line with consuming 2 to 3 servings of dairy per day, 56.7% were in line with consuming 2 servings of green vegetables; 1 serving of a yellow vegetable per day [27]. This was a bit higher than an Ethiopian study's result where 42.4% were in line with dairy products and 46.1% in line with green vegetable servings [5] but similar to a study in USA where 42.7% and 58.9% of respondents had a habit of daily drinking of milk and eating fresh vegetables respectively. In an Indian study, most (90%) reported consuming green leafy vegetables and fruits only once or twice a week due to economic constraints [17]. In addition to that more than three fourth (76.5%) of study participants reported to consume cereal based crops and about three fourth (74.5%) reported consuming legumes in the preceding 24 hrs. in a study at Wando Genet district [23]. It is obvious that diet of different communities is not the same and so one can't expect pregnant women to consume similar items in similar proportion. The proportion of women who correctly started to practice serving meals, which is serving alone slightly increased in the studies. This lack of big difference may be due to the fact that nutrition knowledge alone may not be sufficient to initiate behavioural application of healthy diets. More importantly the highly socialized culture of the countries where you get to be served with all your family members cannot be just undone.

The adherence to iron supplements before the intervention in this study by Teweldemedhin et al. [26] was 86.5%. This in comparison was higher than Zelalem et al. [5] result which was 69%, a study in North Western Zone of Tigre (37.2%), America

(63.7%), Italy (45.3%), India (62%) and Pakistan (56%). It is true that the adherence of pregnant women towards iron supplements decreased after intervention. A probable reason for this is that the pregnant women coming for their first ANC visit though had not started taking the iron supplement were considered as having the correct practice. When they were started on the supplements the probability of them to not adhere to the supplements started to appear for various reasons. The most commonly reported reason for not utilizing iron supplements in the above studies was their side effects and perception that supplements have no benefits. In the quasi experimental study by Teweldemedhin LG et al., the commonly reported reasons were gastrointestinal side effects, forgetfulness, and poor access to the supplement. Other reasons from the other referred studies include unappealing taste, fear of difficult delivery and surprisingly in an Indian study respondents believed that supplements cause miscarriage and may cause their children to have a dark complexion and because dark complexions are considered undesirable, some women discontinue use of the supplement. The intervention strategy, free supplementation and health providers with adequate knowledge regarding the supplements being the primary source of information could be the cause for higher percentage of pregnant women with correct practice in some studies [26].

Fifty eight participants have avoided one or more food types in their current pregnancy in the study by Teweldemedhin et al., but after intervention only 15 had the same practice. In an Ethiopian study 27.3% were avoiding certain food types and this decreased to 16.5% after intervention [26]. A study in Shashamane found that half (49.8%) of the pregnant women in the area were avoiding one or more foods [30]. About 20.9% of the pregnant mothers in Wando Genet also restricted their food intake. This was also noted among 16% of Nigerian pregnant women. The disagreement in the results clearly indicates that feeding practices differ from culture to culture and society to society. Not only that, but food habits are also mainly determined by the availability of indigenous food supply, socio-cultural and educational orientation of food processing and preparation methods and the difference of these characteristics in the study participants could have had a hand in bringing difference in the results.

In one of the reviewed articles [27]. States that personal dislike associated with nausea and vomiting during pregnancy was the most common reason that forbade women from consuming certain food items. A person telling them that the food may cause fatal abnormality with consequent difficulty during delivery was reported by similar number of respondents (1.9%). Higher proportion (9.9%) restricted their food intake in Akaka city in Ethiopia for the latter mentioned reason [5]. Cultural values and food taboos due to health, cultural or spiritual reasons exempted mothers from eating meat in University of Yaoundé's study [3]. The same reason was also reported in Shashamane's study [13]. A lower proportion in some areas as compared to the other studies could be due to difference in beliefs and educational level of women.

Conclusion

From the review, it would appear that pregnancy is an influential "teachable moment" to promote healthy nutrition. It is true that there was variation in the results of the studies and the authors to their best tried to explain these discrepancies by highlighting the differences in the culture, beliefs, and background characteristics of the study respondents in the various studies. It is also evident that all nutritional advice is not followed. This may be due to lack of interest in making a change in one's diet, or certain perceived or encountered barriers that may prevent people from eating healthier diets such as the lack of money (cost), lack of time (too busy with work) or taste. Further review that addresses these issues may then be necessary to address these issues.

Differences in gravity of food cravings and aversions were possibly in response to beliefs about what should be consumed alongside physiologic changes in pregnancy; thus requiring dietary counselling and support to be started early in pregnancy.

Repeated reports of inconsistent messages indicates an urgent need for training of ANC providers about maternal nutritional not only during pregnancy but across the life span. It is only through training that midwives will be able to appreciate strategies and techniques in providing NE to women or the community at large. This has been made true in a study by Hiram et al., [30] where it was possible to improve the knowledge and practices of health professionals through the available proposed interventions aimed at primary health care teams providing antenatal care. In a study by Nankumbi et al. only women attending the clinic for the first time were educated. This indicated a missed opportunity for follow-up and reinforcement of the nutritional knowledge. A recommendation from this finding is that the messages could be structured in a way that a single topic is discussed at every ANC visit. The authors also recommended that for effective implementation of NE, the messages have to be crystal clear, consistent and delivered with appropriate teaching methods. Appropriate documentation and evaluation of the messages transmitted is also a necessary step in achieving the desired goals [13]. Incorporating social media applications to increase dietary knowledge and improve dietary practices in the perinatal period could also be another important step.

All the studies appear to be characterized by design or analysis limitation rendering the evidences weak. Increased number of well-designed researches is needed to quantify the capacity for and cost-effectiveness of nutrition education provided during pregnancy that target improved nutrition of the pregnant mother to improve maternal, neonatal and child health outcomes and inform the development of best practices.

Conclusion

The following limitations were mentioned in the studies and need to be considered while interpreting the findings. The results of some studies could not be generalized because of the study designs used. The topic of study had limited available literature. The possible effect of other sources like TV, books, magazines and

radio broadcasting on the change in the knowledge and practice of pregnant women towards nutrition could not be controlled in some studies. Face to face interview may lead to social desirability bias which may in turn bring higher proportion of correct practice among pregnant women on the follow-up questioning (as the practice is self-reported) in the majority of the studies. Having said that, there could have been better ways of confirming whether pregnant women were using iodized salt or not such as doing a dye test. The self-reporting mechanism of responding also led to recall bias which could have led to information bias.

Consent for Publication

All authors read and approved the final manuscript

Competing Interest

The authors declare that there is no conflict of interest regarding the publication of this paper.

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