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REVIEW ARTICLE

Addressing barriers to maternal nutrition in low- and middle-income countries: A review of the evidence and programme implications

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Abstract

Adequate maternal nutrition during the "first 1,000 days" window is critical from conception through the first 6 months of life to improve nutritional status and reduce the risk of poor birth outcomes, such as low birthweight and preterm birth. Unfortunately, many programmes have targeted implementation and monitoring of nutrition interventions to infants and young children, rather than to women during pregnancy or post-partum. A literature review was conducted to identify barriers to food choice and consumption during pregnancy and lactation and to examine how low- and middle-income countries have addressed maternal nutrition in programmes. A literature review of peer-reviewed and grey literature was conducted, and titles and abstracts reviewed by authors. Twenty-three studies were included in this review. Barriers to adequate nutrition during pregnancy included cultural beliefs related to knowledge of quantity of food to eat during pregnancy, amount of weight to gain during pregnancy, and "eating down" during pregnancy for fear of delivering a large baby. Foods considered inappropriate for consumption during pregnancy or lactation contributed to food restriction. Drivers of food choice were influenced by food aversions, economic constraints, and household food availability. Counselling on maternal diet and weight gain during pregnancy was seldom carried out. Programming to support healthy maternal diet and gestational weight gain during pregnancy is scant. Tailored, culturally resonant nutrition education and counselling on diet during pregnancy and lactation and weight gain during pregnancy, as well as monitoring of progress in maternal nutrition, are areas of needed attention.

KEYWORDS

cultural barriers, food choice, lactation, maternal nutrition, pregnancy, weight gain during pregnancy

1 | INTRODUCTION

Adequate maternal nutrition during the "first 1,000 days" is especially critical from conception through the first 6 months of life to improve the nutritional status of the woman and infant and reduce the risk of adverse birth outcomes, such as low birthweight and preterm birth (Barker et al., 2010; Black et al., 2008, 2013; Haddad, Cameron, & Barnett, 2015; Özaltin, Hill, & Subramanian, 2010; Ramakrishnan, Grant, Goldenberg, Zongrone, & Martorell, 2012; Shrimpton, 2012; United States Agency for International Development [USAID], 2015). Data from 62 studies in low- and middle-income countries in Africa, Asia, and Latin America and the Caribbean found inadequate micronutrient intakes and little dietary diversity among pregnant and lactating women who consumed predominately plant-based diets (Lee, Talegawkar, Merialdi, & Caulfield, 2013).

Yet, unfortunately, most programmes have focused implementation and evaluation of nutrition interventions on infant and child health and nutrition outcomes and not on maternal nutrition-related outcomes (Lee et al., 2013; Victora et al., 2012). A lack of focus on pregnant and post-partum women reduces the number of programmes

monitoring and evaluating outcomes, such as maternal dietary intake, gestational weight gain, and birthweight (Victora et al., 2012).

Few studies have explored factors related to maternal nutrition and weight gain during pregnancy, including barriers and cultural beliefs as drivers of food consumption. Moreover, a gap exists in the translation of "evidence-to-programming" for maternal nutrition and weight gain during pregnancy. Therefore, this literature review was conducted to (a) identify drivers of food choice and consumption during pregnancy and lactation, including cultural beliefs, food preferences, and taboos and (b) examine issues and opportunities to improve maternal diet and weight gain during pregnancy through routine health contacts at the health facility and/or the community level and (c) discuss the type of information and counselling received on maternal nutrition and weight gain during pregnancy, in light of 2016 World Health Organization (WHO) Antenatal Care Guidelines in low- and middle-income countries.

Key messages

- There is limited available evidence on the type and quality of information and counseling received on maternal nutrition and weight gain during pregnancy.
- Findings suggest that counseling on gestational weight gain is weak.
- Nutrition education and counseling on diet during pregnancy and lactation and optimal weight gain during pregnancy can be strengthened through routine health contacts at health facilities and community-based platforms.
- Formative research is critical to the design and implementation of culturally resonate interventions, approaches, and messages.
- Strengthening communication and counseling skills is needed to address misperceptions and cultural beliefs around maternal nutrition.

2 | DESIGN AND METHODS

An extensive literature review of peer-reviewed and grey literature on maternal diet during pregnancy and lactation and weight gain during pregnancy was conducted, and programmatic implications of key elements of this review are presented.

The search strategy was developed and reviewed by the authors and included the following key words in various combinations: "maternal diet," "maternal dietary intake," "maternal diet and pregnancy," "cultural beliefs and pregnancy," "maternal diet cultural beliefs," "maternal diet and eating down," "maternal diet programs," "maternal diet and counseling," and "maternal nutrition counseling." PubMed, Cochrane Library, CINAHL Plus, and Scopus databases were searched using the above key words, and libguides, opengrey.eu, greylit.org, greynet.org, and WHO reports were perused for nonpublished, grey literature of programme reports or internally disseminated white papers published from January 2002–December 2015. Quantitative, qualitative, and mixed methods studies were included in the final review.

The initial search resulted in 165 peer-reviewed articles. One author reviewed and screened titles and abstracts to determine initial inclusion. Exclusion criteria included studies/trials with non-human subjects (i.e., animals); articles that reported dietary practices of women born in a low-income country who migrated to a high-income country; articles that reported behaviours associated with maternal diet in high-income countries; articles that focused on maternal anaemia, micronutrient supplementation, and related outcomes (i.e., birth outcomes); articles on consumption of nonfood items and geophagic material related to pica. After this initial exclusion of these articles, another author confirmed 23 articles for final inclusion in this review (see Table 1). The final 23 articles were chosen based on the following: (a) these articles identified specific barriers and facilitating factors associated with maternal diet during pregnancy and post-partum and (b) provided data on advice given on maternal diet during pregnancy and post-partum/lactation from key influencers, including facility-based health providers, community health workers, and family members, and (c) these data were collected in low- and middle-income countries, specifically the U.S. Agency for International Development's (USAID's) priority countries included in the 2016 Acting on the Call Report: Ending Preventable Maternal and Child Deaths,[1] including Bangladesh, Ethiopia, India, Indonesia, Kenya, Nepal, Nigeria, Pakistan, Senegal, and Tanzania, as well as findings from China, Laos, Vietnam, and Burkina Faso (USAID, 2016).

3 | RESULTS

3.1 | Knowledge and beliefs of optimal diet during pregnancy and lactation

This review identified that food intake during pregnancy and lactation was largely driven by personal preferences and cravings, food avoidance, food taboos, and cultural beliefs surrounding pregnancy physiology (see Tables 2 and 3).

Data from 16 studies indicate that some women have knowledge of which foods are "healthy" for consumption during pregnancy and lactation. In addition, four studies reported an understanding of the need for greater food consumption during certain life stages, relaying that women "should eat more" or "need extra food" during pregnancy or lactation (Girard, Dzingina, Akogun, Mason, & McFarland, 2012; Hartini, Padmawati, Lindholm, Surjono, & Winkvist, 2005; Levay, Mumtaz, Rashid, & Willows, 2013; Saldanha et al., 2012).

[1]The U.S. Agency for International Development's (USAID's) 2014 Acting on the Call Report formulated country-specific plans for working with partners in 24 priority countries to save the lives of mothers and children. The follow-up 2015 Acting on the Call Report provided country-by-country progress updates with new recommendations for reaching 38 million women with increased access to high-quality health services around the time of delivery.

TABLE 1 List of studies included in maternal diet review

Author (year)	Country	Methodology: Sample size and respondent group	Methodology: Study methods	Findings: Food taboos, beliefs, and norms	Findings: Food preference/ cravings	Findings: Economic constraints	Findings: Food appropriateness	Findings: Change in consumption during pregnancy or lactation	Findings: Pregnancy physiology	Findings: Source of information
Aubel et al. (2004)	Senegal	• 76 pregnant women or women of reproductive age (WRA) • 114 grandmothers	• Qualitative focus groups	X			X	X		• Grandmothers • Mothers • Mothers-in-law
Choudhury and Ahmed (2011)	Bangladesh	• 20 women: 12 lactating mothers and 8 pregnant women in Rangpur and Kurigram districts	• Qualitative in-depth interviews (IDIs)	X	X	X	X	X		• Elderly family members • Husbands
Choudhury et al. (2012)	Bangladesh	• 36 women: 18 pregnant women and 18 mothers who recently delivered in Dhaka	• In-depth semi-structured interviews (SSIs)				X			• Landladies (elderly women)
Christian et al. (2006)	Nepal	• 38 women: pregnant women, women with children, their mothers, mothers-in-law, and traditional birth attendants	• Focused IDIs	X	X	X	X	X	X	
de Sa et al. (2013)	Laos	• Khmu villagers (young mothers and older women) • Health care workers from two rural districts in Luang and Prabang provinces	• 8 focus groups • 33 SSIs	X			X	X	X	• Community members • Family members/ parents • Antenatal care (ANC) visits
Girard et al. (2012)	Taraba state, Northeast Nigeria	• 26 state and local government area key informants • 15 mothers • 15 health promoters • 31 community leaders	• Qualitative interviews • Focus group discussions (FGDs) • IDIs	X	X			X	X	• ANC visits (substantially under-utilized) • Husbands (often sole purchasers of food)
Hartini et al. (2005)	Indonesia	• Recruited from among 450 pregnant women enrolled in the dietary intake survey	• 4 focus groups • 16 IDIs • 4 non-participant observations with women • 2 IDIs with traditional birth attendants • 4 IDIs with midwives	X	X	X	X	X	X	• Midwives
Hishamshah et al. (2010)	Malaysia	• Mothers	• Qualitative interviews • Focus groups	X			X			• Post-partum care often led and supervised by older women (mothers or mothers-in-law)
Holmes et al. (2007)	Phongsali and Huaphan provinces, Laos	• N/A	• FGDs • Key informant interviews • Structured observation	X		X		X	X	• ANC services
Huybregts et al. (2009)	Burkina Faso	• 37 pregnant women	• IDIs	X		X	X	X	X	• Local health services

(Continues)

TABLE 1 (Continued)

Author (year)	Country	Methodology: Sample size and respondent group	Methodology: Study methods	Findings: Food taboos, beliefs, and norms	Findings: Food preference/ cravings	Findings: Economic constraints	Findings: Food appropriateness	Findings: Change in consumption during pregnancy or lactation	Findings: Pregnancy physiology	Findings: Source of information
Kavle et al. (2015)	Egypt	• 120 women: pregnant women, lactating mothers, and non-lactating mothers	• IDIs	X	X	X	X	X	X	• Health care providers • Husbands • Mothers-in-law • Friends • Neighbours
Khadduri et al. (2008)	Pakistan	• Men • WRA • Health service providers	• 43 SSIs • 34 FGDs • 21 SSIs: new mothers, new fathers, and dais	X		X	X	X	X	• Traditional birth attendants • Elderly women
Lakshmi (2013)	Andra Pradesh, India	• 600 pregnant tribal women of Srikakulam district of north coastal Andhra Pradesh aged 15–45	• Pre-tested IDIs • Direct observation	X	X		X	X	X	• Prenatal care appointments (to appease authorities, with little understanding of purpose)
Levay et al. (2013)	Bangladesh	• 12 pregnant women and new mothers • 2 husbands • 9 non-pregnant women • 5 health care workers	• Participant observation • FGDs • SSIs				X	X		• Older women
Lundberg and Trieu (2011)	Vietnam	• 20 women visiting postpartum clinic	• In-depth SSI for exploration of a smaller group of women, based on 4 open-ended questions	X	X		X	X		• Mothers • Mothers-in-law
Mukhopadhyay and Sarkar (2009)	Sikkim, India	• 199 women of Nepali caste groups who gave birth 1 year before	• Pre-tested questionnaire answered by mothers	X		X	X			
Oni and Tukur (2012)	Nigeria	• 421 pregnant women in the community who visited 4 primary health care centres	• Visited 4 primary health care centres	X	X		X		X	• Traditions passed on from generation to generation • Husbands • Mothers-in-law • Fathers
Perumal et al. (2013)	Western Kenya	• 979 pregnant women who attended ANC clinics	• Cross-sectional survey					X	X	• ANC clinics
Raven et al. (2007)	China	• 12 mothers • 12 husbands • 12 grandmothers • 4 health workers • 4 traditional medicine practitioners	• SSIs • Key informant interviews	X			X	X		• Knowledge within families • Books • Internet • Health professionals • Older family members
	Ethiopia	• Mothers aged 18–45 years	• 53 FGDs		X	X	X	X		

(Continues)

TABLE 1 (Continued)

Author (year)	Country	Methodology		Findings						Source of information
		Sample size and respondent group	Study methods	Food taboos, beliefs, and norms	Food preference/ cravings	Economic constraints	Food appropriateness	Change in consumption during pregnancy or lactation	Pregnancy physiology	
Saldanha et al. (2012)		• Community leaders • Members of community associations	• 23 IDIs							• Health extension workers • Voluntary community health workers • ANC visits
Sein (2013)	Myanmar	• 31 women who had at least one live birth	• FGDs	X			X		X	
Takimoto et al. (2011)	Japan	• 500 pregnant women attending a prenatal clinic in downtown Tokyo	• Questionnaire from clinic					X		
Young and Pike (2012)	Tanzania and Kenya	• 149 Kenyan pregnant women • 40 Tanzanian WRA	• SSIs	X		X	X			• Co-wives • Elderly women in the community

3.1.1 | Foods considered healthy and/or appropriate for pregnancy

Sixteen of 24 studies described certain foods considered appropriate for consumption during pregnancy or lactation. In Burkina Faso, Egypt, Ethiopia, India, Kenya, and Tanzania, pregnant women recognized the importance of higher recommended intake of "vitamins" and quality of diet (e.g., consuming vegetables, fruits, meat, fish, eggs, and milk) as important during pregnancy, yet this knowledge did not always translate into practice, often due to the financial capacity of the household (de Sa et al., 2013; Kavle et al., 2015; Lakshmi, 2013; Levay et al., 2013; Saldanha et al., 2012; Young & Pike, 2012). A higher quality of the diet during pregnancy was also connected to greater birth size in Burkina Faso and Nigeria (Girard et al., 2012; Huybregts, Roberfroid, Kolsteren, & Van Camp, 2009). In Laos and Nepal, women stated they desired to increase amounts of food considered as "good," such as fish, meat, and fruit (Christian et al., 2006; de Sa et al., 2013). Women mentioned that increased consumption of the quantity of food during pregnancy was thought to "strengthen the child's body" in Egypt (see Table 2).

3.1.2 | Foods considered healthy and/or appropriate during lactation/post-partum

Three studies described foods considered "appropriate" for consumption during lactation. In Egypt, breastfeeding mothers discussed the receipt of conflicting information from health workers versus family members (i.e., grandmothers and fathers) regarding consumption of vegetables and sugary foods (Kavle et al., 2015). Mothers tended to follow the advice of health providers (see Table 2). In Bangladesh, women are advised to eat dry food after delivery, cooked without water, and rice with mashed potato and black cumin seed to keep the stomach "cool" and for increased breast milk production (Choudhury et al., 2012). In Tanzania and Kenya, broth was frequently mentioned as "appropriate" during lactation, as it provided "strength" to mothers (Young & Pike, 2012). Kavle et al. (2015) relayed that Egyptian women discussed inappropriate or nonnutritious "junk" foods during lactation that were avoided, with the mother preferring nutritious foods seen to facilitate breast milk production (see Table 2).

3.1.3 | Food appropriateness according to a humoral belief system

Food appropriateness is determined by a humoral belief system, where hot and cold states dictated suitability of food for consumption during pregnancy and lactation was reported in nine studies. These studies described pregnancy as a "hot" state that can harm a foetus, and women were advised to avoid certain hot and spicy foods (e.g., beef and anchovies), whereas "cool" foods (e.g., coconut milk), thought to alter the "hot" state of pregnancy, were recommended for consumption (Choudhury & Ahmed, 2011; Christian et al., 2006; Hishamshah et al., 2010; Holmes et al., 2007; Lakshmi, 2013; Lundberg & Ngoc Thu, 2012; Mukhopadhyay & Sarkar, 2009; Raven, Chen, Tolhurst, & Garner, 2007; Sein, 2013). In Indonesia, cold foods, such as cucumber, watermelon, water of young coconut, squash, and papaya, are encouraged for consumption during pregnancy to decrease thirst, increase body water content, and make the babies "comfortable in the womb,"

TABLE 2 Selected quotes illustrating barriers to maternal nutrition during pregnancy, lactation, and post-partum

Barriers	Country	Key illustrative quotes	Authors
Knowledge and beliefs of optimal diet during pregnancy and lactation			
Foods considered healthy and/or appropriate for pregnancy	Burkina Faso	"Some say that it is because of a lack of good nutrition during gestation, when a person does not consume 'rich' foods, the child cannot grow well in the belly."	Huybregts et al., 2009
	Egypt	"Useful food for the pregnant women are chicken, eggs, meat, milk, lentil, and also home food. Pregnant women should eat fruits (guava). These foods are important because they strengthen the child's body."	Kavle et al., 2015
	Nepal	"I feel like eating good things like fish, meat, or sweets, but we don't have these in our house."	Christian et al., 2006
Foods considered healthy and/or appropriate during lactation/post-partum	Egypt	"I eat everything, people advised me to eat – Halawa and sugary food, but my doctor told me it is better to eat green vegetables."	Kavle et al., 2015
	Egypt	"What is bad for lactating women are chips, soda, and fast food. Sodas affect the bones, potato chips is not nutritive and fast food is greasy. All this is transmitted through the milk to the child and harms the child in the same way."	Kavle et al., 2015
Food appropriateness according to a humoral belief system	Vietnam	"My mother told me that I must eat hot food so that my blood will flow properly. My body feels cold after I lost blood from birth. If I eat cold food after birth, my blood would clog. I would be unhealthy and sick all the time."	Lundberg & Ngoc Thu, 2012
Food avoidance	Burkina Faso	"Mango gives you diarrhea, if you eat some [mango] you will have diarrhea and your thing [fetus] will be in a bad position. You yourself will wither and your thing [fetus] will stop developing. It's the water of the mango that will make him [fetus] become so. And on the day of the delivery, you can only deliver after emptying the water of the mangos."	Huybregts et al., 2009
	Indonesia	"Rice crust causes the placenta to be become sticky," "leaves of the candlenut tree and breadnut cause difficulty in pushing during birth," "jackfruit causes a sticky layer around the newborn," "foods from a river or sea, such as eel, fish, and shrimp, would cause the fetus to be upside down," and "chicken eggs would make the women perform like a chicken during delivery and need more time for delivery."	Hartini et al., 2005
Other perceptions in relation to maternal diet	Ethiopia	"They think that the health of the baby is determined by God."	Saldanha et al., 2012
Advice provided by key influencers on diet during pregnancy and lactation	Bangladesh	"It is good to follow [the advice of] the elderly women in taking food especially after the delivery, this restriction at least will not be harmful for me."	Choudhury et al., 2012
Food consumption patterns during pregnancy and lactation			
Food consumption during lactation varied	Bangladesh	"My mother brings me food in my room and gives me lesser than my usual intake of food so that I don't fall ill. Poaati ma (lactating mother) should eat as less as possible till her umbilical cord dries up. It does not matter if I'm still hungry and feel weak and as long as I don't have to spend money for doctor's visit. It does not harm if you follow the elder women. I have the whole life to myself to eat more. So it's fine if I eat a little less the first 1–2 months. I prefer weakness to illness."	Choudhury & Ahmed, 2011
	China	"Women at this time [postpartum] are weak, and food will help rebuild her strength, promote recovery, and improve breastfeeding."	Raven et al., 2007
	Egypt	"The more I eat, the more milk I have. I eat more now that I breastfeed than I used to eat when I was pregnant."	Kavle et al., 2015
Constraints to achieving optimal maternal diet			
Economic constraints	Bangladesh	"I know that eating more food is necessary when there is a baby in womb. But I am poor, how can I afford it?"	Choudhury & Ahmed, 2011
	Tanzania	"I didn't want it [maize meal], I had to force myself to swallow, like a child. But what are the options?"	Young & Pike, 2012
	Ethiopia	"...due to resource limitations, most of us do not change our feeding habits in pregnancy. Our food is always the same. We sometimes try to find additional foods like vegetables and wot (sauce), but we will share all available food with the rest of the family members."	Saldanha et al., 2012

(Continues)

TABLE 2 (Continued)

Barriers	Country	Key illustrative quotes	Authors
Maternal diet counselling during antenatal/postnatal care: A missed opportunity			
Counseling on weight gain during pregnancy	Egypt	"A pregnant woman gains extra weight because extra weight is being formed around him, the baby. She will gain weight because the baby will increase her weight, he is gaining weight so it will add on to her weight, and it has nothing to do with her health or her nutrition, so there is no reason to keep the pregnant woman from gaining weight."	Kavle et al., 2015
	Egypt	"A pregnant woman should gain weight to be 70–80 kilos since they are two persons. Originally she was 50–60 kilos."	Kavle et al., 2015

which can avoid miscarriage (Hartini et al., 2005). In contrast, hot foods, such as beef, mutton, rice with black pepper, anchovies, salted fish, and certain drinks (coffee and milk), were perceived to cause harmful problems such as stomach aches, cramping, and diarrhoea. Excessive consumption of hot food was believed to lead to vomiting and, in some cases, abortion (Hartini et al., 2005; Hishamshah et al., 2010; Lakshmi, 2013).

In contrast to pregnancy, a confinement period for up to 53 days after delivery, where hot foods are preferable to cold foods, is thought to balance hot and cold states (Hishamshah et al., 2010). In Malaysia, cold foods are avoided because during the "cold" state of childbirth, the body must "be balanced" afterwards (Hishamshah et al., 2010). It is commonly believed that "cold" protein sources such as seafood, mackerels, and eggs caused itchiness; and "cold" carbohydrates, such as rice, yams, and sweet potatoes, lead to abdominal discomfort during breastfeeding, which are avoided (Hartini et al., 2005; Hishamshah et al., 2010). In Vietnam, women consume "hot" foods during the post-partum period, such as pig's feet with papaya, red bean, potato, and rice, which are believed to stimulate blood flow (see Table 2).

3.1.4 | Food avoidance

Foods considered inappropriate for consumption during pregnancy or lactation, such as spicy, bad-smelling, and nausea-inducing foods, often led to elimination of these foods from the diet in several countries, including Burkina Faso, India, Indonesia, Nepal, Laos, and Senegal (Christian et al., 2006; de Sa et al., 2013; Lakshmi, 2013). Foods of high nutrient value were avoided during pregnancy, based on a wide range of cultural taboos and misinformation (Hartini et al., 2005; Holmes et al., 2007; Huybregts et al., 2009; Lakshmi, 2013). In Indonesia, for example, 14 kinds of vegetables, 10 kinds of fish, 5 meat/animal source foods, and 14 fruits were avoided, despite self-reports of the known benefits of these nutrient-rich foods for prevention of illness (e.g., anaemia; Hartini et al., 2005). Most women believed these foods led to negative health effects for the mother and foetus (Hartini et al., 2005; see Table 2). In Burkina Faso, pregnant women reported that some nutritious foods were perceived to cause illness, including "burns" from red pepper, constipation from couscous, and vomiting from dried okra (Huybregts et al., 2009).

The phenomenon of food avoidance also stemmed from beliefs of ill effects during labour and delivery caused by consumption of certain foods. These cultural beliefs ranged from "eating coconut or pork made the baby fat and caused a more difficult birth" in rural Laos (de Sa et al., 2013) to consuming pork would "make the baby spotted like the pig" and yams, or "foofoo," would result in a big baby and difficult labour in Senegal (Aubel, Touré, & Diagne, 2004). Similarly, in India, certain protein and iron-rich foods, such as ducks, pigeons, beef, and fish, are believed to cause a big baby and, subsequently, a difficult labour because of a larger head (Choudhury & Ahmed, 2011). In another study from rural Laos, women believed eating a female pig caused headaches, dizziness, and fever, resulted in fatigue in the post-partum period for up to 5 months post-delivery (Holmes et al., 2007).

3.1.5 | Food preference and cravings

In six studies, personal preference and cravings were reported as key drivers of food choice during pregnancy and post-partum. In Bangladesh, women described cravings for sweet and spicy foods during pregnancy, such as drink made from molasses, rice with green chilies, and milk, and restricted their diet to these specific foods (Choudhury & Ahmed, 2011). In Nepal, women craved very spicy and sour foods, such as pickles, yet also believed these foods "caused pain to the baby and hurt its stomach," so they did not consume these foods often (Christian et al., 2006).

Conversely, in Indonesia, women held a common perception that cravings are caused by food the infant craved. Midwives relayed that if pregnant women did not consume a craved food, such as unripe fruit or warm soup, then the infant may be born with "too much saliva," which was perceived to negatively affect the infant health (Hartini et al., 2005). Food patterns among Kenyan and Tanzanian women revealed that greater than half of women reported specific cravings, mostly for meat and milk, and aversions to maize, buttermilk, and animal blood (Young & Pike, 2012). Although women perceived that craved foods "go well together with the child inside" (Young & Pike, 2012), several factors limited consumption of these foods, including avoidance due to cultural food taboos during pregnancy or post-partum life stages, economic constraints, advice from mothers-in-law, or husbands on consumption of foods, as well as food allocation among household members (Hartini et al., 2015; Saldanha et al., 2012; Christian et al., 2006; Young & Pike, 2012; Choudhury & Ahmed, 2011).

3.1.6 | Other perceptions in relation to maternal diet

Studies also noted a lack of understanding of the physiological state of pregnancy and the foetal development process in relation to maternal

TABLE 3 Illustrative cultural beliefs of food preferences, aversions, and cravings during pregnancy and post-partum

Food item/category	Country	Selected cultural beliefs
During pregnancy		
Junk food	Egypt	• Causes cancer in the blood • Makes the bones fragile • Causes miscarriages • Potato chips cause worms
	Indonesia	• Could cause bleeding
Caffeinated beverages	Egypt	• Destroy iron and cause anaemia • Act as a "stimulant"
Seafood	Indonesia Myanmar	• Causes foetus to be upside down in the womb • Causes drowsiness
Salty food	Egypt	• Increases albumin in the blood • Contributes to the "malformation" of the child • Creates "swelling" and "oedema" • Causes burning of the chest • Causes poisoning • Causes allergies • Forms salty stones in the body • Has no nutrition
	Laos	• Pork would make the baby fat and cause a more difficult birth
	Nigeria	• Snails predispose the baby to excessive salivation and vomiting
Acidic/spicy food	Egypt	• Is not nutritious • Causes heartburn
	Myanmar	• Causes hypertension, dizziness, and drowsiness
	Nepal	• Causes pain to the baby and hurts its stomach
Fruits/vegetables	Burkina Faso	• Mangoes give diarrhoea
	Indonesia	• Prevent vomiting and disease • Jackfruit could lead to the formation of a sticky layer of thick fat around the newborn
	Laos	• Make the mother thin and pale • Coconut would make the baby fat and cause a more difficult birth
	Myanmar	• Cause abdominal pain and loose motion in mother and newborn
	Nepal	• Too many mangoes cause abortion
During lactation/post-partum		
Salty food	Vietnam	• Helps to have more breast milk
Acidic/spicy food	Laos	• Causes diarrhoea or bleeding from the uterus
Fruits/vegetables	Laos	• Unripe fruits, such as green mangoes, cause post-partum sickness, including fever, body aches, numbness, tingling, weakness, and bleeding
	Vietnam	• Fresh vegetables and fruits are considered 'cold' and would not help with lactation

diet. Girard et al. (2012) revealed a few mothers, community leaders, or health promoters related poor nutrition during pregnancy to low birthweight or intrauterine growth restriction because they attributed the child's health to "divine will," indicating that awareness of the consequences of poor maternal nutrition is lacking. A few studies cited the belief that the foetus and food were both "located in the stomach," and therefore, if a woman ate too much food, the "fetus would not have room to grow" (Christian et al., 2006; Huybregts et al., 2009). For example, in Nepal, women reported the stomach was "filled with the baby," so if a woman ate more "it would press down on the baby." (Christian et al., 2006).

3.1.7 | Advice provided by key influencers on diet during pregnancy and lactation

Twelve articles reported receipt of advice from family members, primarily mothers/mothers-in-law, or friends to women on recommended foods for consumption during pregnancy, as well as foods to avoid (Aubel et al., 2004; Choudhury & Ahmed, 2011; Choudhury et al., 2012; de Sa et al., 2013; Hishamshah et al., 2010; Kavle et al., 2015; Khadduri et al., 2008; Levay et al., 2013; Lundberg & Ngoc Thu, 2012; Oni & Tukur, 2012; Raven et al., 2007; Young & Pike, 2012). Most mothers followed advice from these trusted sources of information. Advice given to women as a consequence of traditions passed from generation to generation varied from "eat less food than usual so they do not become ill" to "sit over or near a fire to dry their bodies" (Choudhury & Ahmed, 2011; Hartini et al., 2005; Khadduri et al., 2008; Oni & Tukur, 2012). Yet mothers often reported adhering to the advice given out of respect for these trusted sources (Choudhury & Ahmed, 2011; Hartini et al., 2005; Khadduri et al., 2008; Oni & Tukur, 2012).

3.2 | Food consumption patterns during pregnancy and lactation

3.2.1 | Food consumption during pregnancy is often reduced

Reductions in quantity of food consumed during pregnancy due to personal beliefs and traditional practices were commonly reported by women. In nine studies, women relayed deliberately eating less food during pregnancy due to fear of having a large baby and enduring a difficult labour (Aubel et al., 2004; Choudhury & Ahmed, 2011; Christian et al., 2006; de Sa et al., 2013; Hartini et al., 2005; Huybregts et al.,

2009; Khadduri et al., 2008; Perumal et al., 2013; Takimoto, Mitsuishi, & Kato, 2011). The practice of intentionally eating less or "eating down" during pregnancy for fear of delivering a large baby and enduring long, painful labour was cited in many countries, including Burkina Faso, Senegal, Nepal, Laos, India, Japan, Pakistan, and Indonesia (Christian et al., 2006; Hartini et al., 2005; Holmes et al., 2007; Huybregts et al., 2009; Khadduri et al., 2008; Oni & Tukur, 2012; Saldanha et al., 2012; Takimoto et al., 2011).

Increasing the quantity of food during pregnancy is challenging for most mothers. In Nepal, few women reported increasing their food consumption during pregnancy, because they felt like eating a greater amount of food, more food was available in the household, or due to specific food cravings (Christian et al., 2006). Change in dietary habits can be difficult when women become pregnant (Saldanha et al., 2012). Dietary recall data confirmed little change in food consumption patterns and inadequate dietary intakes during pregnancy (Huybregts et al., 2009). In Burkina Faso, diets mainly consisted of a high consumption of cereals and, to a lesser extent, vitamin A-rich fruits, vegetables, nuts/pulses, and fats/oils. The median intake of roots/tubers, dairy products, eggs, and meat/poultry/fish was found to be less than 1 g per day (Huybregts et al., 2009).

3.2.2 | Food consumption during lactation varied

Food consumption patterns for lactating mothers varied considerably, from reducing food intake to eating larger amounts of food (Choudhury et al., 2012; Christian et al., 2006; Hartini et al., 2005; Kavle et al., 2015; Khadduri et al., 2008; Lundberg & Ngoc Thu, 2012; Raven et al., 2007). In Bangladesh, Nepal, Laos, and Pakistan, women observed a confinement period following childbirth "to restore strength and balance" (Choudhury et al., 2012; Christian et al., 2006; Khadduri et al., 2008). During this time period, small amounts of selected foods with little to no nutritional value, such as rice, salt, and broth are typically consumed for up to 40 days (Choudhury & Ahmed, 2011; Choudhury et al., 2012; Christian et al., 2006; de Sa et al., 2013; Hartini et al., 2005; Khadduri et al., 2008).

On the other hand, increased consumption of food during lactation was often related to restoring energy and breast milk production in other contexts. For example, post-partum women in urban slums of Dhaka discussed the need to eat large amounts of food, with the number of meals ranging from five to eight in a day (Levay et al., 2013; Lundberg & Ngoc Thu, 2012; Raven et al., 2007). In Egypt, women relayed that a greater quantity of food consumed was linked to higher breast milk production. In Vietnam, the majority of women believed that they should eat large quantities of high protein "hot" foods, to restore their "vital energy" and promote breast milk production (Lundberg & Ngoc Thu, 2012). Similarly, in Myanmar, postnatal women consumed meat, vegetables, and soup as women held perceptions that soup promotes breast milk production and chicken has "wound healing power," which are necessary to promote recovery after delivery (Sein, 2013). On the other hand, in Pakistan and Egypt, women were given "special food" (containing milk, almonds, chicken soup, or *halwa*) during the postnatal period, which was believed to restore their strength and improve lactation (Kavle et al., 2015; Khadduri et al., 2008).

3.3 | Constraints to achieving optimal maternal diet

Economic constraints and intra-household allocation are key barriers to achieving adequate maternal dietary intake during pregnancy and post-partum.

3.3.1 | Economic constraints

Eleven articles cited economic constraints as a major barrier to obtaining those foods in Bangladesh, Indonesia, Burkina Faso, Egypt, Ethiopia, India, Kenya, Nepal, Nigeria, Pakistan, and Tanzania. Poor economic conditions were primarily defined as the inability to purchase nutritious foods for the household, such as dairy products (e.g., milk), fish, chicken, eggs, and red meat (Christian et al., 2006; Girard et al., 2012; Hartini et al., 2005; Huybregts et al., 2009; Kavle et al., 2015). Women stated that they desired or craved certain foods to support pregnancy, yet often could not afford these foods and needed guidance on how to increase consumption of nutritious foods, based on economic constraints (Choudhury & Ahmed, 2011; Saldanha et al., 2012). Women from Tanzania reported strong aversions to maize, yet consumed maize as a less expensive alternative to meat (Young & Pike, 2012). In Ethiopia, men are often primary decision makers who "decide what should be purchased in the market, and they [the men] buy the cheapest things in the market" (Girard et al., 2012). Men may not have money to shop and can be "constrained by other commitments, [and] seldom give wives the money to go to the market for shopping" (Girard et al., 2012).

3.3.2 | Intra-household food allocation

In four articles, husbands and children eat prior to women in the household due to cultural norms, and women often do not eat additional meals during pregnancy and lactation (Girard et al., 2012; Hartini et al., 2005; Levay et al., 2013; Saldanha et al., 2012). In Indonesia, Ethiopia, and Nigeria, if a woman desired to increase her food consumption, she was unlikely to acknowledge her needs before the needs of her children and husband, which take precedence (Girard et al., 2012; Hartini et al., 2005; Saldanha et al., 2012).

3.4 | Maternal diet counselling during antenatal/postnatal care: A missed opportunity

Despite the opportunity to counsel mothers on diet during pregnancy at routine health facility visits (i.e., antenatal care [ANC]) and/or visits by community health workers, only seven studies cited that nutrition information was given during these visits (de Sa et al., 2013; Girard et al., 2012; Holmes et al., 2007; Kavle et al., 2015; Oni & Tukur, 2012; Perumal et al., 2013; Saldanha et al., 2012). Moreover, only five articles reported that guidance on maternal diet was given during ANC (Girard et al., 2012; Kavle et al., 2015; Perumal et al., 2013; Saldanha et al., 2012). Yet specific information on which foods, why, and how often they should be consumed were not provided during ANC. A cross-sectional study in Kenya reported a positive impact of ANC counselling on knowledge of foods to eat during pregnancy and revealed that, in comparison to women who did not attend ANC, women with <4 ANC visits and ≥4 ANC visits had significantly greater health knowledge, which included general information on nutrition, as

women were advised to "eat well" (e.g., good quality foods) and take iron tablets or syrup (Perumal et al., 2013). Similarly, in Ethiopia, communities had an awareness of the importance of maternal diet, yet received "vague and inconsistent education and counseling" (Saldanha et al., 2012). Health extension workers showed women pictures of foods (i.e., carrots, kale, pumpkin, meat, and eggs) and simply advised women to "eat more during pregnancy" (Saldanha et al., 2012). In Nigeria, health promoters indicated that they tell women to "eat well," "eat balanced diets," "not eat the same thing every day," and to eat things such as banana, fish, and a lot of fruit and three meals a day but also indicated women did not always have the decision on household food purchases (Girard et al., 2012). Cost, distrust, distance, and lack of adequate services as reasons for not accessing ANC services and which can be a hindrance to receipt of information on maternal nutrition (Girard et al., 2012).

3.4.1 | Counselling on weight gain during pregnancy

There was little information on knowledge of and counselling on gestational weight gain during ANC, as this review identified only four studies addressing this topic. In Egypt, although some women associated healthy weight gain and foetal growth with good nutrition and the quantity of food consumed, many did not understand the connection between dietary intake and weight gain during pregnancy. Weight gain was perceived as a consequence of carrying an "additional person." When asked about the appropriate amount of weight to gain during pregnancy, women in Egypt relayed that they do not receive counselling on weight gain during pregnancy at ANC visits (Kavle et al., 2015).

In findings from a qualitative study carried out in Nigeria, health promoters and local government area key informants discussed that counselling on adequate weight gain during pregnancy, advice on food preparation and consumption, and a balanced diet are part of routine ANC (Girard et al., 2012). However, during focus group discussions, the majority of women reported they had never been weighed during ANC. The few women who reported being weighed relayed not receiving information or guidance about their weight gain or loss (Girard et al., 2012). Few health providers specified the amount of weight women should gain or how to monitor weight gain.

4 | DISCUSSION

This review described the appropriateness of foods, food taboos, preferences and cravings, and associated cultural beliefs as drivers of food consumption during pregnancy and lactation. Advice from influential family members, economic constraints, and intra-household food allocation is a barrier to achieving optimal maternal diet.

This review revealed that limited evidence is available on the type and quality of information and counselling received on maternal nutrition and weight gain during pregnancy at health facility and/or community levels. Although the importance of counselling on maternal diet during pregnancy has been recommended in the literature on maternal diet (Lee et al., 2013; Mason et al., 2014; Victora et al., 2012), our review reveals a lack of information regarding the content and/or quality of counselling on diet that was provided during ANC visits, indicative that targeted, quality counselling is needed during ANC visits, addressing the local context, cultural beliefs, and misperceptions regarding food consumption (McGowan & McAuliffe, 2012; Victora et al., 2012). Findings from this review also suggest that counselling on weight gain during pregnancy during ANC is weak. Recent data on weight gain during pregnancy from 29 Asian and African countries reveal that the average weight gain was approximately 7 kg, which is about half of the minimum weight gain recommended during pregnancy for U.S. women (Coffey, 2015).

Few studies have documented the implementation of interventions to improve maternal dietary practices and weight gain during pregnancy through health programmes. Conditional cash transfer programmes included maternal nutrition interventions in Malawi and Mexico, yet did not assess impact of the interventions on maternal nutritional status and food consumption patterns and focused solely on child health outcomes (e.g., birthweight, stunting, and underweight; Hypher, 2010; Miller, Tsoka, & Reichert, 2008; Sepúlveda et al., 2006; Rivera, Sotres-Alvarez, Habicht, Shamah, & Villalpando, 2004; Victora et al., 2012). In India, the Integrated Child Development Services carried out monitoring of weight gain in pregnancy, dietary education/counselling in Anganwadi Centers at the community level, (Ramakrishnan, Imhoff-Kunsch, & Martorell, 2014), yet no maternal-related outcomes were reported (Pandav, 2006).

Recent revised WHO ANC guidelines call for a minimum of eight contacts, which include ANC and community level contacts (WHO, 2016). Health programmes should maximize these opportunities to strengthen the quality of counselling on maternal nutrition and counselling on weight gain during pregnancy. Antenatal and postnatal routine health contacts are opportunities to provide information to women on maternal diet and/or weight gain during pregnancy. In particular, ANC is an opportune time to identify women with an "unhealthy" dietary pattern in early pregnancy (McGowan & McAuliffe, 2012). Our review indicates counselling on appropriate weight gain during pregnancy has been largely overlooked in national policy and protocols guiding service delivery, despite global guidance on weight gain (Rasmussen & Yaktine, 2009; WHO, 2016; Jaacks, Kavle, Perry, & Nyaku, 2017). Counselling and social behaviour change communications are critical and should include context-specific and culturally resonate discussions on the "what and why" of foods to consume that provide the necessary energy, protein, micronutrients, and fatty acids, including fortified staple foods and condiments. These materials should address cultural taboos and perceptions, which can limit food intake and provide feasible solutions to increase dietary intake (USAID, 2015).

4.1 | Community-level interventions

Maternal diet counselling and messaging can also be integrated into community level activities, such as home visits carried out by community-level health workers or engaging elder women and fathers through mother to mother or community support groups. Grandmothers and elder women may not have up-to-date on information to provide to younger pregnant women who view them as a trusted source of information (Aubel et al., 2004). Engaging grandmothers, elder women, and other key influencers of nutrition practices, such as fathers, presents an opportunity for behaviour change at the community and household level and can encourage early and frequent

ANC visits (Gryboski, 1996; Kayongo-Male & Onyango, 1984; Wiley, 2002).

Beyond the inclusion of trusted family and community members in community interventions, another potential platform for integrating maternal nutrition interventions and facilitating behaviour change is through Care Groups, which consist of volunteer community-based health educators who visit 10–15 neighbours to share information on various health topics. The implementation of the Care Group model has been documented in 28 countries (Perry et al., 2015) and has demonstrated improved breastfeeding rates and receipt of maternal multiple micronutrient supplementation (George et al., 2015). This community-based model may provide an opportunity to discuss information on maternal diet with mothers and their families.

4.2 | Limitations

The review has some limitations. Information on ANC visits consists only of information provided in the current reviewed studies. Little data are available on the content and quality of counselling and beliefs and challenges faced by health providers providing services, focused specifically on maternal diet and weight gain during pregnancy. Lack of measurement of maternal dietary consumption and effectiveness of interventions to impact on maternal dietary intake was a key limitation of this review. Finally, there are unpublished programme findings utilized for internal use and not available on public domains, which may have not been included in this review.

5 | CONCLUSIONS

5.1 | Implications for programmes

Evidence of interventions to address a healthy maternal diet during pregnancy and the post-partum period and optimal weight gain during pregnancy is scant. Pregnancy is an ideal time to encourage dietary and lifestyle changes that women might otherwise resist because pregnancy often increases motivation and desire to learn (Bronner & Auerbach, 2005). Nutrition education and counselling on diet during pregnancy and lactation and optimal weight gain during pregnancy can be strengthened through routine health contacts, taking into account the local context and beliefs. This review also highlights the importance of formative research in designing roll out of interventions, approaches, and messages, which are culturally resonate. Strengthening communication and counselling skills can aid to address cultural beliefs, misperceptions, and constraints identified in this review.

Identification and use of platforms to improve nutrition preconception is also critically important to improve nutritional status prior to pregnancy and lactation. Incorporation of maternal nutrition into preservice and in-service curriculums and trainings of health providers and community level workers is critical (FANTA, 2014). Community-based channels should be explored as a platform to strengthen maternal diet alongside infant and young child feeding practices and to reach key influencers of dietary practices.

Another gap is a lack of standardized monitoring and clear targets and goals to measure progress toward improving maternal nutrition indicators and outcomes (Lee et al., 2013; Victora et al., 2012). Monitoring of maternal dietary intake (i.e., diversity and frequency) is needed to track improvements in maternal nutrition in health programmes (Victora et al., 2012), such as through the Minimum Dietary Diversity indicator, which measures consumption of least 5 out of 10 food groups among women 15–49 years of age (FAO & FANTA, 2014).

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CONFLICTS OF INTEREST

Megan Landry was hired as a consultant by PATH to carry out the literature review presented in this paper.

CONTRIBUTIONS

JK formulated research question and directed the literature review. ML carried out the literature review, and ML and JK compiled the data. JK and ML jointly wrote the manuscript. All authors reviewed and approved the final manuscript.

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