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REVIEW

Green Midwifery Care in Climate Change and Newborn Nutrition

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ABSTRACT

Climate change refers to long-term changes in the Earth's climate system, such as temperature increases, changes in precipitation patterns and more frequent extreme weather events, as a result of human activities following the industrial revolution. The main causes of climate change include the burning of fossil fuels, deforestation and industrial processes. These activities cause greenhouse gases to accumulate in the atmosphere and cause global warming. Especially after the Industrial Revolution, the world temperature continues to rise and climate change continues to occur. Since the mid-19th century, both breastfeeding and the Earth's climate have suffered greatly from the rise of industrial capitalism. First called global warming, then climate change due to its many negative consequences, it is seen as the most important global health threat of the 21st century. Factors such as increasing temperatures, thirst, food insecurity and environmental toxins as a result of climate change also affect breast milk production and the breastfeeding process indirectly, if not directly. This situation threatens both the health of the mother and the healthy nutrition opportunities of infants. Therefore, considering the long-term effects of climate change, maternal and child nutrition should be at the top of the climate change agenda. Midwives have important roles in minimizing the negative effects of climate change on health. This review is a review of the literature on the interaction of climate change with breastfeeding and breastfeeding.

Introduction

According to the United Nations Framework Convention on Climate Change, "Climate change" is defined as a change in climate resulting from human activities that directly or indirectly disrupt the composition of the global atmosphere, in addition to the natural climate change observed in comparable time periods (UNFCC, 1994).

Climate change significantly affects human life and health and has reached a level that poses a vital risk if the necessary measures are not taken. The World Health Organization (WHO) describes climate change as the greatest problem of the 21st century (WHO, 2015).

Climate change negatively affects health by disrupting the water, food chain and living environment necessary for life, with direct (such as hot weather, air pollution) or indirect effects (such as water scarcity, migration) on humans. Climate change has a detrimental effect on access to clean water, clean air, the maintenance of social structure, safe shelter and food security. With the change in the distribution of disease-carrying vectors, increases in infectious diseases (e.g. malaria), diarrheal diseases, adverse weather events, and morbidity and mortality rates due to air pollution can be observed (General Directorate of Public Health, 2023).

Changes in weather events and natural balance affect human health physiologically and psychologically in different dimensions. In particular, some groups, those experiencing social exclusion such as age, gender, poverty or being a refugee, are more sensitive and vulnerable to the effects of climate change on health (Xie et al, 2021). Climate change is a long-term process that causes many health problems (WHO, 2014).

The relationship between climate change and breast milk includes the effects of environmental factors on maternal health and infant nutrition on a wider scale. A number of studies investigating the impact of breastfeeding on sustainability and climate change are presented in the UNICEF report (UNICEF, 2021). Climate change may have indirect effects on infant health. Studies conducted on the subject; It is suggested that the high exposure of pregnant women and their fetuses to climate change causes adverse health outcomes (Helle et al., 2009; Dadvand et al., 2011; Robledo et al., 2015; Schifano et al., 2016; Verburg et al.,2016; Booth et al., 2017; Elongi et al., 2017; Janani and Changaee, 2017; Wang et al., 2018; Bekkar et al., 2020; Mandakh et al., 2020; Xie et al., 2021).

The climate crisis is a global challenge that poses potential risks to breastfeeding practices and outcomes. Climate change has multifaceted effects that affect the breastfeeding dyad in environmental, social and human health dimensions.

Health professionals have a key role to play in many of the UN's Sustainable Development Goals, including developing "a food system that provides food security and nutrition for all, so that the economic, social and environmental foundations for food security and nutrition for future generations are not compromised" (WFP, 2018). The International Confederation of Midwives (ICM) has chosen the theme for World Midwives Day 2024 as "Midwives are activists for climate solutions" (ICM, 2024). The purpose of this review is to draw attention to the interaction of climate change with breastfeeding and nutrition, and to discuss the remedial effects that midwifery care can provide on this interaction.

Environmentally friendly nutrition with breast milk

Every person wants to live their life in a healthy way. Governments should also support public health programs to achieve this goal. Breast milk nutrition contributes to health programs as a natural and environmentally friendly resource. Nutrition has a very important place in the development of individual and community health. Good nutrition is necessary for a person's growth, development, physical and mental health, and resistance to diseases, especially infectious diseases (Bilgel, 1997).

Various socioeconomic, cultural and environmental factors play a role in the mother's decision on which path to follow in feeding her baby. In order to protect newborns from infection, reduce malnutrition, ensure their psychosocial development and normal growth, mothers should be encouraged to breastfeed their babies and the necessary conditions should be created on a global scale to facilitate breastfeeding (UNICEF, 2024).

Breast milk basically contains carbohydrates, proteins, fats, vitamins, water and minerals necessary for the growth and development of the baby. It also contains various bioactive components necessary for the health of the baby (Bode et al., 2014). Beyond their nutritional aspects, microorganisms, oligosaccharides, and various bioactive compounds that play an important role in host-microorganism interactions and infant health are critical nutrients that support infant immune development (Bülez, 2022). Microbiota is defined as a community of microorganisms found in a distinct ecological niche or environment (Güney et al., 2017). Breast milk is thought to have positive effects on the infant's intestinal microbiota and therefore the immune system, resulting in protection from infectious diseases and non-infectious diseases (Dinleyici, 2020).

The climate crisis is a global challenge that poses potential risks to breastfeeding practices and outcomes. Climate change has multifaceted effects that affect the breastfeeding dyad in environmental, social, and human health dimensions (Cappelli, 2021; Zadkovic et al., 2021).

Women, infants, and children are extremely vulnerable to climate change. This vulnerability varies depending on various reasons. Climate change events create challenging conditions. This situation makes it difficult for infants to breastfeed at both low and high levels (Zadkovic et al., 2021; Grubesic et al., 2022).

Maternal and child nutrition should be at the top of climate change agendas. Considering how important breastfeeding is for child health in climate-related events, it is imperative to protect and support breastfeeding during development (Cappelli, 2021; Zadkovic et al., 2021).

Maternal, fetal, newborn and child health are disproportionately affected by increasingly frequent epidemics. These epidemics are caused by infectious diseases related to climate change (Blakstad and Smith, 2020). Changes in climate-related environmental conditions cause various water, air, food and vector-borne pathogens. This situation further increases the burden of malnutrition, especially among women, infants and children (Fanzo et al., 2021). Breastfeeding contributes to climate resilience but is also under threat from climate change. Understanding the complex interactions between climate change and breastfeeding is important to ensure that both mothers and infants are protected against the climate crisis (Dall'Oglio et al., 2020; Grubesic et al., 2022).

The effects of climate change on maternal nutrition

Climate change negatively affects food production with its consequences such as drought, flood and adverse weather events. This situation creates food shortages and food insecurity in some regions. Climate change significantly affects migration rates worldwide. According to the IDMC Internal Migration Monitoring Center 2018 Global Migration Report, 17.2 million people were forced to migrate due to natural disasters (IDMC, 2018).

The world continues to warm due to climate change. Heat waves are occurring more frequently and intensely. When comparing temperatures before the 1960s to today, an average increase of 2°C in global temperatures has been accepted as the critical value. However, according to the International Meteorological Organization (WMO) report, a temperature increase of

0.1 to 0.3°C every decade shows that the situation has reached serious dimensions (WMO, 2018).

Breast milk production is directly related to maternal nutrition. Breast milk is 87% water (Samur, 2012). Breast milk is the best source of fluid for newborns. Especially in hot and dry regions, when the mother becomes dehydrated due to lack of access to sufficient water, the risk of decreased milk production may increase due to the disruption of the mother's fluid balance. This is a situation that directly affects the baby's breastfeeding (Zadkovic et al., 2021).

Water insecurity due to frequent and severe droughts is strongly linked to food insecurity affecting women and children. Especially in low-income or rural areas, the climate crisis has negative effects on breastfeeding as mothers cannot meet their nutritional needs. Mothers who are malnourished may not be able to produce enough breast milk, which can make breastfeeding difficult (Blakstad et al., 2020).

Extreme temperatures affect not only mothers but also newborns. High temperatures cause faster dehydration in babies (Xu, 2017).

It is observed that the intensity of heat waves is increasing, especially in Africa (Harrington, 2020). A study examining baby feeding practices with climate change revealed that even under hot conditions, feeding only with breast milk does not dehydrate babies and their urine output is normal (Edney et al., 2022).

The impact of climate change on infections

Climate change also increases the risk of infection due to reasons such as temperature increases and pollution of water resources. 780 million people worldwide lack access to clean drinking water and 2.5 billion people lack improved sanitation. Waterborne diseases and foodborne infections in particular threaten the health of breastfeeding mothers. Infections such as diarrhea cause dehydration. In order for a mother to have plenty of milk, she needs to drink plenty of water in addition to her daily food and breastfeed frequently (Aşılar et al., 2018). For this reason, infections that cause dehydration can reduce the mother's milk production and limit the baby's breastfeeding capacity (CDC, 2021; Ebi et al. 2018).

The World Health Organization has stated that diarrhea, a preventable and treatable disease, is the third leading cause of death in children under the age of five. Diarrhea is responsible for the deaths of approximately 443 thousand children under the age of five each year (WHO, 2024).

The 2016 ''Global Burden of Disease Study'' revealed that babies who are not breastfed are 14 times more likely to die from diarrhea than babies who are exclusively breastfed (IHME, 2018).

Inadequate water and hygiene conditions due to natural disasters or environmental degradation put the health of both the mother and the baby at risk. This prevents the mother from breastfeeding comfortably and makes it difficult for the baby to receive adequate nutrition. UNICEF reports show that climate change increases the spread of deadly diseases such as cholera, malaria and dengue fever, and this situation has serious consequences especially for pregnant women and children (UNICEF, 2023).

Climate change affects the distribution of species carrying zoonotic diseases and their proximity to humans, increasing the risk of exposure to diseases (HCWH, 2019). In recent years, an increase in zoonotic diseases has been observed in Turkey. The spread of diseases such as Crimean-Congo Hemorrhagic Fever, Zika virus, West Nile virus and malaria reveals current and potential health risks in our country (Polat, 2017).

The stress effect of climate change

Environmental stress due to climate crisis creates various negative effects on breastfeeding. Disasters, migrations and natural disasters related to climate change cause psychological stress on individuals (Obradovich et al., 2018).

Stress can be physical or psycho-emotional and negatively affects the initiation, maintenance of breastfeeding and the secretion of breast milk in breastfeeding mothers (Zanardo, 2016). Stress factor can make the breastfeeding process difficult by negatively affecting the regulation of breastfeeding hormones and reducing milk production, as well as weakening the mother-baby bond. It is stated that mothers who are stressed and anxious about the care and nutrition of their babies are also anxious about breastfeeding and breastfeeding rates decrease significantly (Duran et al., 2020).

Increased expenses during pregnancy, birth and postpartum periods affect low-income families more deeply and increase stress levels (Yağmur et al., 2010; Şahin et al., 2021). It is reported that having a low income level causes women's stress levels to increase in the postpartum period (Mollard et al., 2021).

Migration and climate refugees

Adverse weather events and natural disasters caused by climate change are causing climate refugees. According to World Bank estimates, more than 216 million people could be forced to migrate by 2050 due to climate change (Worldbank, 2021).

In many societies, climate change is forcing spouses or partners to seek income-generating activities away from their families, leaving women with more care and provision responsibilities than before the climate change-related crisis (Blakstad, 2020). In developing regions, women and children are among the most vulnerable among those forced from their homes by climate change. Displaced women face risks such as gender-based violence, domestic violence, forced marriage, and human trafficking. Gender inequalities prevalent in low- and middle-income countries often lead to restrictions on women's and girls' decision-making power, their access to resources and basic services, and their ability to manage and recover from climate-related disasters (CARE International, 2020).

Climate change events create conditions that make it difficult for mothers to breastfeed safely and comfortably in both low- and high-income settings. Climate migrants often face challenges such as lack of infrastructure, hygiene problems, and access to clean water. This makes it difficult to provide the necessary hygiene conditions for breastfeeding, and mothers who lack adequate nutrition and rest opportunities during migration experience difficulties in breastfeeding (Zadkovic et al., 2021; Grubesic and Durbin, 2022).

It is reported that the impacts of the climate crisis will vary according to geographical location and the development level of the countries. It is thought that low- and middle-income countries, which are the least involved in the process, may be much more affected by this crisis (Althor et al., 2016).

Protection of infants from climate change depends on their caregivers and community resources. Therefore, the risk of exposure varies around the world. However, government agendas, such as the United Nations, do not pay enough attention to the disproportionate impact of climate change on the health and food security of women, infants and children living in low-income areas (Blakstad and Smith, 2020; CARE International, 2020; Pope et al., 2021).

Environmental toxins and breast milk

With climate change, environmental toxins such as air pollution, agricultural chemicals, and industrial pollution are increasing. These toxins have negative effects on the content of mothers' milk. In particular, pollution of air and water resources can increase the risk of these toxins passing into breast milk and pose potential risks to infant health.

A study published by Ragusa et al., examining the milk of 34 mothers, found that microplastics were found in breast milk and posed a serious threat to newborn and child health (Ragusa et al., 2022).

Breast milk is the most important source of nutrition for the healthy growth and development of babies. Nutrients, antibodies, and other substances can pass to the baby through breast milk. One of these substances is organochlorine pesticides (OCP), which are harmful to human health. Aytaç et al. (2010), the presence of OCP in the milk of 62.7% of the mothers participating in the study was detected, regardless of age, occupation and place of residence (Aytaç et al., 2010). Environmental chemical pollutants, factors that we are exposed to due to reasons such as food, consumer products and environmental air pollution pose a great threat to both human health and nature and climate all over the world. Particulate matter pollution, also known as PM, is a term that describes extremely small solid particles and liquid droplets suspended in the air. Particulate matter (PM) in the air is not a single pollutant; it is a mixture of many chemical types. Arık (2023) reported in his study that particulate matter (PM10) exposure levels, daily life habits such as tap water use, use of disposable containers, especially with hot drinks, and an increase in body mass index have an effect on DNA damage. In addition, it was concluded that breast milk is a useful biological tool for measuring the level of exposure to environmental pollutants and their effects on health (Arık, 2023).

Climate change and alternative infant feeding

Breastfeeding, childbirth, and other forms of reproductive labor are considered natural processes and are therefore ignored and not included in traditional economic indicators. The classification of reproductive labor as 'non-work' creates an artificial scarcity that allows formula companies to find a place in the market without recognizing the value of women's labor (Federici, 2009; Walters, 2019). Despite this, the total global economic loss due to non-breastfeeding is estimated at $341 billion (Smith, 2019).

In some cases, mothers are forced to resort to formula when they cannot breastfeed due to environmental challenges. However, logistical problems caused by climate change can also make formula distribution difficult. In addition, in regions where there is no access to clean water, formula use becomes a riskier feeding option for infants. Hipgrave et al. (2011) found that infants who were formula-fed after an earthquake had a higher incidence of diarrhea during the week than those who were not (Hipgrave et al., 2011).

In difficult conditions, the problems experienced by families in accessing clean water, bottles, heaters and cleaning materials to prepare powdered formula milk pose a risk to infant nutrition. These difficulties also endanger the healthy nutrition and growth of infants (Ratnayake et al., 2022). Malnutrition resulting from inadequate nutrition affects vulnerable groups, especially infants and children (Tsuboyama et al., 2014). Therefore, encouraging and supporting breastfeeding is very important for healthy nutrition of infants. Breastfeeding provides necessary nutrients and protects against infections. It also reduces families' dependence on clean water and equipment such as bottles, ensuring healthy nutrition of infants even in difficult conditions.

During disasters, relief efforts often focus on large amounts of formula donations, creating a dependency and need for continuous formula supply. Because breastfeeding cannot be easily resumed once interrupted. After the Great West China Earthquake in 2008, donated formula remained in the region for five years. This has led to an increase in the use of formula (prelacteal formula) before breastfeeding begins, which has become a major barrier to exclusive breastfeeding (Binns et al., 2019).

Breastfeeding promotion and support are not sufficiently integrated into disaster preparedness and climate mitigation policies. However, infant and young child mortality is highest after disasters, which are aggravated by climate change. In these settings, it is particularly important to provide appropriate support for continued breastfeeding and avoid unnecessary formula distribution (Hirani, 2019; Grubesic).

Long (2021) studied the use of renewable gas in Ireland to replace breast milk presented an analysis

comparing the emission savings achieved in the production of breast milk substitutes using renewable gas in Ireland with the emission savings achieved by increasing exclusive breastfeeding to 50%. The results show that meeting global breastfeeding targets results in greater emission savings than using renewable gas. This suggests that increasing breastfeeding rates could significantly reduce the energy demand associated with breast milk substitutes (Long, 2021). Food security for infants and young children is not possible without encouraging and achieving high breastfeeding rates (Binns, 2021).

The effects of breastfeeding on climate change

Breast milk is a renewable natural resource that is often neglected in discussions about sustainable food production, environmental degradation, and climate change. Breast milk is a natural, renewable food that is environmentally safe, produced without pollution, unnecessary packaging, and waste, and delivered to the consumer (Bülez, 2022). Breastfeeding offers a sustainable and safe solution for infants in terms of nutrition in the face of increasing food and water shortages due to climate change. Breast milk meets the most basic nutritional needs of infants, leading to less food, energy, and water consumption. It also reduces the environmental footprint by reducing dependence on formula. In order to increase breastfeeding and encourage breastfeeding all over the world, the World Health Organization recommends that all infants be exclusively breastfed for the first six months, and breastfed with complementary foods from the 6th month until the age of 2 and beyond (Scott et al., 2015; Grant, 2016; Chan et al., 2022). As of 2021, the breastfeeding rate for the first six months has reached 48%. This shows that the 50% target set for 2025 is approaching. However, we are still far from reaching the 70% rate, which is the sustainable development goal for 2030 (WHO, 2018).

Breast milk is the most suitable source of infant nutrition to ensure normal growth and development (Ballard et al., 2013). It is an ideal physiological food for infancy because its content changes according to the needs of the baby, it protects against infections, and it meets the physiological and psychosocial needs of the baby alone in the first six months. It has been proven that breastfeeding reduces morbidity and mortality rates in the newborn, ensures appropriate nutrition, growth and development of the newborn, and is superior to other forms of nutrition (WHO, 2018).

Even in disaster situations, including famine, breastfeeding continues to be the best option to meet the nutritional needs of infants (Binns et al., 2012). In addition, it is accepted that breastfeeding benefits the family and country economy for many reasons such as its economic advantages. Breastfeeding is an environmentally friendly form of nutrition due to its low cost and the fact that it does not cause waste problems (Gökçay et al., 2021).

Breastfed babies are also less likely to have sudden infant death syndrome, respiratory and gastrointestinal system infections (Ip et al., 2009). At the same time, breastfeeding is also linked to a reduced risk of developing non-communicable diseases such as diabetes, obesity and cardiovascular system diseases in later life (Geddes et al., 2013).

Healthcare services account for approximately 4-5% of total carbon emissions worldwide. This rate is due to many factors such as energy use of healthcare systems, production of medical supplies, pharmaceuticals, transportation and waste management. According to the report ''The Health Sector's Contribution to the Global Climate Crisis and Opportunities for Action'', if the global healthcare sector were a country, it would be the fifth largest greenhouse gas emitter on the planet (HCWH, 2019). Improving breastfeeding helps reduce climate change because it is a "green" infant feeding practice compared to infant formula (Smith, 2019; Pope et al., 2021). Increasing breastfeeding rates will improve infant and adult health while also helping to reduce greenhouse gases. Breastfeeding has been shown to reduce the energy demands associated with breast milk substitutes and to help reduce the negative environmental impact of food alternatives, including reducing greenhouse gas emissions (Long, 2021).

Breastfeeding provides health benefits both in infancy and throughout life, and protects against the effects of climate change by preserving the body microbiome (Binns 2016; Wilson 2020).

Breastfeeding can reduce all these health costs by reducing morbidity rates and thus reducing carbon emissions. Going forward, supporting breastfeeding under normal conditions as well as in humanitarian emergencies due to climate change is key (Grubesic et al., 2022).

Breast milk adapts to changing environmental conditions. When a mother is exposed to an infection, her body produces antibodies against that infection, and these antibodies are passed on to her baby through breast milk, potentially protecting the baby against diseases. Peng (2020) reported in her study that mothers had COVID-19 antibodies in their breast milk after infection or vaccination (Peng, 2020).

Global average temperatures are increasing and communities all over the world will be exposed to these temperatures. Necessary interventions should be made to protect the health of babies. Breastfeeding rates should be increased, which is the most beneficial, economical and environmentally friendly form of nutrition, and babies should be fed exclusively with breast milk for the first six months (Dall'Oglio et al., 2020).

The duties of midwives in breastfeeding under the shadow of climate change

The International Confederation of Midwives (ICM) emphasizes the importance of midwives in combating

climate change and states that midwives play a key role in reducing carbon emissions. The ICM has determined the theme of World Midwives Day 2024 as "Midwives are climate solution activists", indicating that the health of women and babies is significantly affected by disasters experienced as a result of the effects of global warming on nature and humans. The role of midwives in advocating life includes protecting the lives of not only humans but also all living things in nature. In health systems where preventive health services are important, the role and status of midwives are both important and respected (Çalışıcı, 2024).

Conclusion

In conclusion, it is clear that climate change and its negative effects are inevitable. These negative effects pose an increasing threat to individual and community health. In particular, the effects of climate change on the breastfeeding process pose serious health risks for mothers and babies.

Increasing the knowledge and awareness levels of midwives on climate change and breastfeeding will strengthen the capacity of societies to cope with this global problem and raise healthy generations. According to the recommendations of the ICM, it is of critical importance for midwives to take a leadership role in combating climate change and to support mothers in breastfeeding. In this context, it is recommended that modules on climate change be added to midwives' training programs and that their participation in research on this subject be encouraged.

In addition, awareness of resource use at individual and institutional levels is one of the important steps to be taken in combating climate change. Such training and awareness programs for midwives will not only increase the quality of health services, but will also create a solid foundation for a sustainable future.

Recommendations

ICM's midwifery care recommendations for climate solutions are as follows:

Recommendation 1: Midwives provide environmentally sustainable health services and play a key role in making health systems more climate resilient. During climate crises, midwives can adapt to provide safe, respectful and quality care for women and gender diverse people. Simply put, midwives are a vital climate solution.

Recommendation 2: Midwives provide services where people live, reducing the need to travel to health facilities. Access to a midwife's care provides more time and expertise for obstetricians for women with complex care needs. This reduces the vehicle footprint of health services, making them more sustainable and accessible for all.

Recommendation 3: Continuity of midwifery care improves maternal health outcomes and ensures more babies are born alive, on time and healthy. Better health outcomes mean that mothers and babies will need less medical care in the short and long term. This reduces the use of medical resources and limits medical waste.

Recommendation 4: Midwives help mothers achieve their breastfeeding goals, and mothers often breastfeed for longer. Breastfeeding does not require packaging or shipping, saves water, and improves the health of women and babies. Midwives supporting women to breastfeed successfully is good for babies, women, and the planet.

Recommendation 5: Midwives are champions of sexual and reproductive health. They empower women to manage their own reproductive health by providing education, contraception, comprehensive abortion care, and support. This supports women's rights and economic resilience, while reducing their vulnerability to the impacts of climate change.

Recommendation 6: Community-based midwives can more easily reach areas affected by climate disasters and provide essential reproductive and maternal health services quickly. Midwives are a valuable community in the face of climate disasters, and their evidence-based knowledge and supply distribution ensure that women and babies have access to care, even in the worst conditions.

In our warming world, funders and health systems are funding midwifery services to support providers who can coordinate effective crisis response plans.

Declarations

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Not applicable.

Conflict of Interest

Authors disclose no potential conflicts of interest.

Ethics

Not applicable.

Informed Consent

Not applicable.

Author Contributions

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Data Availability

The data used to support the findings of this study can be made available upon request to the corresponding author.

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