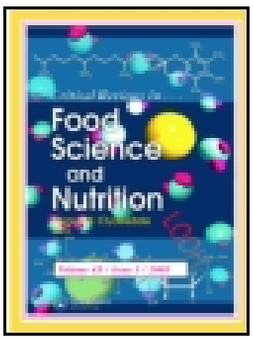

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REVIEW

Factors associated with the double burden of malnutrition at the household level: A scoping review

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ABSTRACT

The double burden of malnutrition (DBM) at the household level has been defined as the coexistence of underweight children and overweight mothers within the same household. The objective of the scoping review was to identify and understand factors associated with DBM. We conducted the scoping review of published, peer-reviewed journal articles in two major databases used in public health research (PubMed and Web of Science). A total of 70 articles met the eligibility criteria. The following factors were identified: mother's age, height, educational level, occupation, food intake, breastfeeding, family income, family size, and urbanization type. Overall, results were heterogeneous. Two scenarios have been identified. The first scenario is those obese women with a job, having a sufficient income, a high educational level, the ability to purchase food, and live either in rural or urban areas. The second scenario is obese women without a job, having an insufficient income, a low educational level, without the ability to purchase food, and live either in rural or urban areas. The DBM at the household level is a complex public health problem. There is a need for target-specific interventions to address child undernutrition and maternal overweight/obesity simultaneously.

KEYWORDS

Double burden of malnutrition; dual forms of malnutrition; dual burden of malnutrition; underweight child/overweight mother; stunted child/overweight mother; household

Introduction

Undernutrition (Black et al. 2013) and overweight (Williams et al. 2015) are public health issues that have been addressed in different ways. While undernutrition has been associated with poverty and food insecurity, obesity has always been associated with excessive food consumption and a sedentary lifestyle. However, there is strong evidence that these two forms can coexist within communities, families, households, and even within the same individual (Davis, Oaks, and Engle-Stone 2020; Popkin, Corvalan, and Grummer-Strawn 2020). The World Health Organization (WHO 2020) defines the double burden of malnutrition (DBM) as the coexistence of undernutrition along with overweight and obesity or diet-related noncommunicable diseases, within individuals, households, and populations, and across the life course. The DBM can take many forms depending on where and how it occurs, that is, in a country, community, household, and individual level (Davis, Oaks, and Engle-Stone 2020; Doak et al. 2005).

This scoping review will consider the DBM at the household level. At the household level (Davis, Oaks, and Engle-Stone 2020; Fongar, Gödecke, and Qaim 2019), there is a DBM when: 1) An adult is overweight/obese (BMI $\geq$25.0 kg/m2), and the child is underweight (Body Mass Index Z scores ((BAZ) <-2 SD); 2) An adult is overweight/obese (BMI $\geq$25.0 kg/m2), and the child is underweight (Weight-for-Age Z scores (WAZ) <-2 SD); 3) An adult is an overweight/obese (BMI $\geq$25.0 kg/m2), and the child is stunted (Height-for-Age Z scores (HAZ) < -2 SD); 4) An adult is overweight/obese (BMI $\geq$25.0 kg/m2), and the child is wasted (Weight-for-Age Z-scores (WHZ < -2 SD)); 5) An adult is overweight/obese (BMI $\geq$25.0 kg/m2), and the child has micronutrient deficiencies. According to the reviews by Kosaka and Umezaki (2017) and Popkin, Corvalan, and Grummer-Strawn (2020), the prevalence of this condition at the household level is still low. Worldwide the prevalence ranges from 0 to 26%, with an average of 10%. However, this complex phenomenon may increase in the coming years. The DBM is directly associated with the evolution of chronic noncommunicable diseases (Min et al. 2018; Wells et al. 2020), and constitutes an unprecedented challenge to global public health (Menon and Peñalvo 2019). Over the past few years, the DBM has been prioritized by international health organizations, prompting governments to swift action. Given the DBM at the household level has been little studied and is less well understood, this scoping review aims to answer the public health relevant research question: What factors are associated with the double burden of malnutrition at the household level?

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Table 1. PRISMA-ScR checklist.

Section	Item	PRISMA-ScR checklist item	Page #
Title			
Title	1	Identify the report as a scoping review	1
Structured summary	2	Provide a structured summary that includes (as applicable): background, objectives, eligibility criteria, sources of evidence, charting methods, results, and conclusions that relate to the review questions and objectives	2
Introduction			
Rationale	3	Describe the rationale for the review in the context of what is already known. Explain why the review questions/objectives lend themselves to a scoping review approach.	3
Objectives	4	Provide an explicit statement of the questions and objectives being addressed with reference to their key elements (e.g., population or participants, concepts, and context) or other relevant key elements used to conceptualize the review questions and/or objectives.	3
Methods			
Protocol and registration	5	Indicate whether a review protocol exists; state if and where it can be accessed (e.g., a Web address); and if available, provide registration information, including the registration number	NA
Eligibility criteria	6	Specify characteristics of the sources of evidence used as eligibility criteria (e.g., years considered, language, and publication status), and provide a rationale.	4
Information sources	7	Describe all information sources in the search (e.g., databases with dates of coverage and contact with authors to identify additional sources), as well as the date the most recent search was executed	4
Search	8	Present the full electronic search strategy for at least one database, including any limits used, such that it could be repeated.	4
Selection of sources of evidence	9	State the process for selecting sources of evidence (i.e., screening and eligibility) included in the scoping review.	5 – Figure 1
Data charting process	10	Describe the methods of charting data from the included sources of evidence (e.g., calibrated forms or forms that have been tested by the team before their use, and whether data charting was done independently or in duplicate) and any processes for obtaining and confirming data from investigators.	4
Data items	11	List and define all variables for which data were sought and any assumptions and simplifications made	4
Critical appraisal of individual sources of evidence	12	If done, provide a rationale for conducting a critical appraisal of included sources of evidence; describe the methods used and how this information was used in any data synthesis (if appropriate).	4
Synthesis of results	13	Describe the methods of handling and summarizing the data that were charted.	4
Results			
Selection of sources of evidence	14	Give numbers of sources of evidence screened, assessed for eligibility, and included in the review, with reasons for exclusions at each stage, ideally using a flow diagram	Figure 1
Characteristics of sources of evidence	15	For each source of evidence, present characteristics for which data were charted and provide the citations.	Tables 2 and 3
Critical appraisal within sources of evidence	16	If done, present data on critical appraisal of included sources of evidence (see item 12)	
Results of individual sources of evidence	17	For each included source of evidence, present the relevant data that were charted that relate to the review questions and objectives.	5–11 Tables 2 and 3
Synthesis of results	18	Summarize and/or present the charting results as they relate to the review questions and objectives.	Tables 2 and 3
Discussion			
Summary of evidence	19	Summarize the main results (including an overview of concepts, themes, and types of evidence available), link to the review questions and objectives, and consider the relevance to key groups.	11–14
Limitations	20	Discuss the limitations of the scoping review process.	14–15
Conclusions	21	Provide a general interpretation of the results with respect to the review questions and objectives, as well as potential implications and/or next steps.	15
Funding			
Funding	22	Describe sources of funding for the included sources of evidence, as well as sources of funding for the scoping review. Describe the role of the funders of the scoping review	NA

Methods

Data source and search strategies

We conducted a scoping review of published, peer-reviewed journal articles in two major databases frequently used in medical and public health research (PubMed and Web of Science). In this scoping review, we developed a protocol, followed the Preferred Reporting Items for Systematic Reviews and Meta-Analyses—Extension for Scoping Reviews (PRISMA-ScR) checklist and guidelines (Tricco et al. 2018) to ensure a robust and replicable process. The PRISMA-ScR reporting checklist was presented in Table 1. A comprehensive literature search strategy was developed. All the searches were limited to articles written in English and published between 2000 and March 2021. The search strategy was created using medical subject headings (MeSH) and keywords combined with database-specific advanced search techniques. The selected studies had to meet the following conditions: studies address the DBM at the household level, they had to be original analyses and not subject to review. The following search strategy (key words) was used: double burden of malnutrition OR dual forms of malnutrition OR dual burden of malnutrition OR underweight child/overweight mother OR stunted child/overweight mother AND household. Information was extracted from eligible studies using a data extraction form. The items included in the database were: author name, country, year, identified factors, and study type.

Study selection: Inclusion and exclusion criteria

All the results were screened by two independent reviewers (EGR and VFG) to determine eligibility for this review in a two-phase procedure. The first phase of screening was a title/abstract review to generate a pool of candidate articles for the second phase based on the full text of the

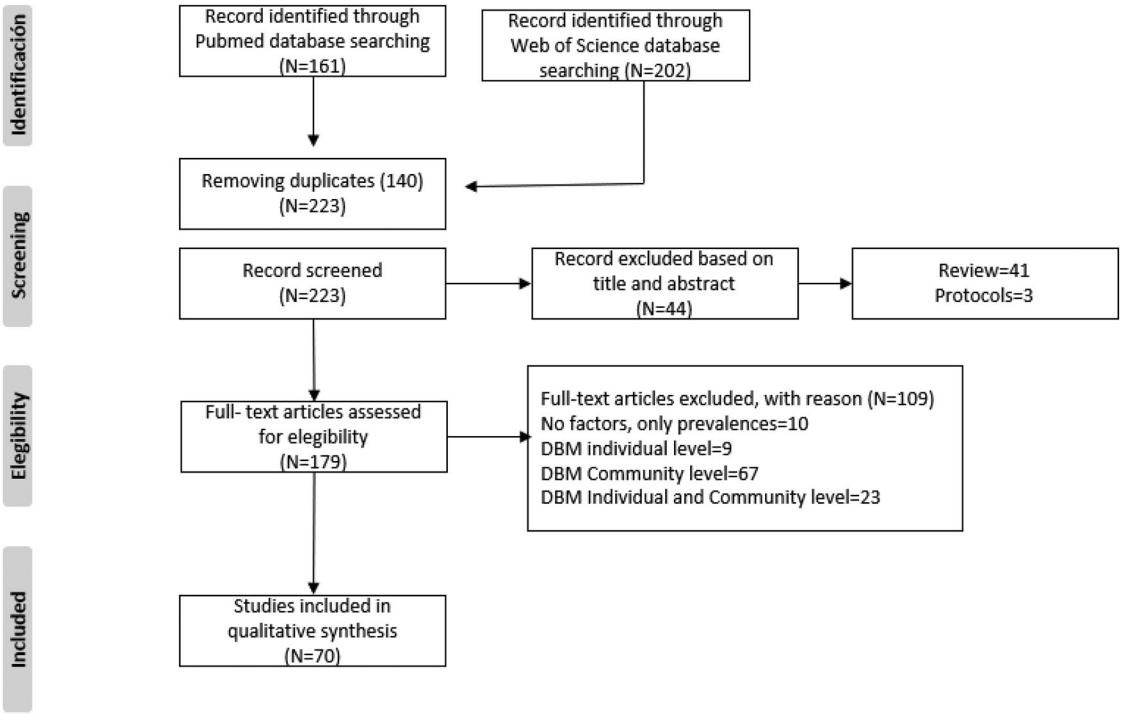

Figure 1. Preferred Reporting Items for Systematic Reviews and Meta Analyses (PRISMA) flow diagram.

publications. Both phases were blinded and conducted in Excel, with conflicts being resolved through group consensus. Up until March 2021, 363 articles were retrieved, 161 in PubMed and 202 in Web of Science. Studies were included if they met the search criteria mentioned above. Studies were excluded if they only provided prevalence data or examined factors only at the individual, community levels or a combination of both. The 1st phase screening selected 179 (49,4%) for the following full-text screening. After applying these inclusion and exclusion criteria to the 2nd phase screening, a total of 70 articles were eligible for this scoping review. The results of article selection in each phase of search and screening processes were provided in the PRISMA flow diagram (Figure 1).

Results

Study design

Of the studies reviewed, 94.3% (n = 66) were cross-sectional. 2.9% (n = 2), were quasi-experimental studies, and 1.4% (n = 1) was a qualitative study (in-depth interviews), and 1.4% (n = 1) was a cohort study (Table 2).

Geographical location

In terms of geographic location, some articles contained information on more than two countries and more than two continents. 42.9% (30) of the articles included the information on the Asian continent, 27.1% (19) on the African continent, 20.0% (14) on Latin America, 2.9% (2) on the European continent, 1.4% (1) on North America, and 5.7% (4) analyzed information on Asia, Africa, and Latin America in the same article (Table 2).

Key findings

Significant protective or risk factors associated with the double burden of malnutrition at the household levels were identified. In most studies, the age range of women ranged from 15 to 49 years of age and that of children from 0 to 60 months. We classified those factors into several categories (1) biological variables (i.e., age, height); (2) socioeconomic variables such as mother's level of education, mother's occupation or work situation, and monetary income of the household; (3) health-related behaviors such as mother's feeding behaviors, food intake in the household, and lifestyle behaviors (i.e., being sedentary or engaged in physical activity); (4) other factor: area of residence (rural or urban) (Table 3).

Biological variables

Mother's age

The mother's age was one of the factors associated with the DBM in the households. Across the articles, 17.1% (12/70) of the ones included (Anik et al. 2019; Biswas et al. 2020; Blankenship et al. 2020; Das et al. 2019; Fooken and Vo 2021; Hong 2020; Jehn and Brewis 2009; Modjadji and Madiba 2019b; Oddo et al. 2012; Sassi et al. 2019; Sunuwar, Singh, and Pradhan 2020; Wong et al. 2015) showed that the risk of an overweight or obese woman having a child with malnutrition or nutritional deficiencies increases as age increases. Although there was no precise age, these articles indicated that after 35 years, the probability increases.

Mother's height

Of the articles 14.3% (10/70) included evidence that the mother's height was related to the child's low weight (Alaofè

Table 2. Study design and geographical location of articles of scoping review.

Citation	Year	Country	Type of study
Angeles-Agdeppa	2003	Filipinas	Cross sectional
Khor, GL	2003	Malaysia	Cross sectional
Doak CM	2005	Brazil, China, Indonesia, Kyrgyz Rep., Russia, Vietnam, USA.	Cross sectional
Garrett JL	2005	Latin america(8) Asia (7), Africa (27)	Cross sectional
Asfaw A.	2007	Egypt	Cross sectional
Isanaka S	2007	Colombia	Cross sectional
Jehn M	2009	South Asia, Sub Sahara Africa, North Africa, Latinamerica (6)	Cross sectional
Saibul N	2009	Malaysia	Cross sectional
Lee J	2012	Guatemala	Cross sectional
Oddo VM	2012	Bangladesh and Indonesia	Cross sectional
Dop MC	2012	Capa verde (Africa)	Cross sectional
Galiano LP	2012	Colombia	Cross sectional
Grijalva-Eternod CS	2012	Western Sahara	Cross sectional
Masibo PK	2012	Kenia	Cross sectional
Ihab AN	2013	Malaysia	Cross sectional
Kimani-Murage EW.	2013	South Africa	Cross sectional
Roemling C	2013	Indonesia	Cross sectional
Bassett MN	2014	Argentina	Cross sectional
Leroy JL	2014	Mexico	Cross sectional
Ramirez-Zea M	2014	Guatemala	Cross sectional
Severi C	2014	Uruguay	Cross sectional
Vaezghasemi M	2014	Indonesia	Cross sectional
Zeba AN	2014	West Africa	Cross sectional
Sekiyama M	2015	Indonesia	Cross sectional
Fildes A	2015	England	Cohorte
Kimani-Murage EW	2015	Kenia	Cross sectional
Parra DC	2015	Colombia	Cross sectional
Wibowo Y	2015	Indonesia	Cross sectional
Wong CY	2015	Malaysia	Cross sectional
El Kishawi RR	2016	Palestina	Cross sectional
Géa-Horta T	2016	Brazil	Cross sectional
Jones AD	2016	30 countries (Sub Saharan African)	Cross sectional
Sarki M	2016	Nepal	Cross sectional
Choy CC	2017	Samoa	Cross sectional
Gubert MB	2017	Brazil	Cross sectional
Shamah-Levy	2017	Mexico	Cross sectional
Choy CC	2018	Samoa	Cross sectional
Mahmudiono	2018	Indonesia	Cross sectional
Mahmudiono	2018	Bangladesh	Cross sectional
Oddo VM	2018	Guatemala	Qualitative
Tydeman-Edwards	2018	South Africa	Cross sectional
Nykänen EA	2018	Ghana	Cross sectional
Parra DC	2018	Colombia	Cross sectional
Parra DC	2018	Colombia	Cross sectional
Shifler Bowers K	2018	USA	Cross sectional
Alaofè H	2019	Benin	Cross sectional
Anik AI	2019	Myanmar	Cross sectional
Das S	2019	Bangladesh	Cross sectional
Hauqe SE	2019	Bangladesh	Cross sectional
Jayalakshmi R	2019	India	Cross sectional
Mamun S	2019	Bangladesh	Cross sectional
Modjadji P	2019	South Africa	Cross sectional
Modjadji P	2019	South Africa	Cross sectional
Sassi S	2019	Tunisia	Cross sectional
Shinsugi C	2019	Sri Lanka	Cross sectional
Sunguya BF	2019	Tanzania	Cross sectional
Williams PA	2019	Rwanda	Quasiexperimental
Jamaluddine Z	2020	Líbano	Quasiexperimental
Khan Saadia	2020	Pakistan	Cross sectional
Patel Ratna	2020	India	Cross sectional
Amoussou L	2020	Grand-Popo, Benin	Cross sectional
Berhane HY	2020	Ethipia	Cross sectional
Blankenship JL	2020	Islands	Cross sectional
Ghattas H	2020	Middle East, North Africa (11) Latin America Caribbean (13)	Cross sectional
Hong SA.	2020	Myanmar	Cross sectional
Sunuwar DR	2020	Nepal	Cross sectional
Fooken J	2021	Asian countries (11)	Cross sectional
Nakphong MK	2021	Cambodia	Cross sectional
Biswas T	2021	South and Southeast Asia	Cross sectional
Félix-Beltrán L	2021	Mexico	Cross sectional

Table 3. Characteristics of included studies (in chronological order of publication).

First autor	Covariates
Angeles-Agdeppa	Mother's education, mother's occupation, size of household, adequate nutrient intake, physical activity
Khor, GL	Adequate nutrient intake, physical activity, household income, mother's education
Doak CM	Household income, type of urbanization
Garrett JL	Household income, adequate nutrient intake
Asfaw A.	Adequate nutrient intake
Isanaka S	Adequate nutrient intake
Jehn M	Type of urbanization, mother's occupation, mother's education, size of Household, household income, mother's age
Saibul N	Mother's occupation, adequate nutrient intake
Lee J	Household income, type of urbanization, mother's Height, physical activity
Oddo VM	Mother's age, mother's education, mother's height, size of household, breast-feed
Dop MC	Type of urbanization, adequate nutrient instake
Galiano LP	Type of urbanization
Grijalva-Eternod	Adequate nutrient intake, type of urbanization
Masibo PK	Type of urbanization, mother's education, size of household, household income
Ihab AN	Size of Household, mother's education, household income
Kimani-Murage	Household income, mother's education, type of urbanization
Roemling C	Household income
Bassett MN	Mother's education, size of Household
Leroy JL	Household income, mother's education
Ramirez-Zea M	Household income
Severi C	Mother's Height, mother's education
Vaezghasemi M	Household income, type of urbanization
Zeba AN	Type of urbanization, adequate nutrient instake, physical activity
Sekiyama M	Adequate nutrients intake
Fildes A	Breast-feed
Kimani-Murage	Type of urbanization, household income
Parra DC	Household income, type of urbanization
Wibowo Y	Adequate nutrient intake
Wong CY	Mother's age, mother's education, household income
El Kishawi RR	Household income, size of household, mother's education
Géa-Horta T	Mother's height, adequate nutrient intake, mother's education, household income, breast-feed
Jones AD	Type urbanization, household income
Sarki M	Mother's education, household income
Choy CC	Adequate nutrient intake
Gubert MB	Household income, mother's education
Shamah-Levy T	Adequate nutrient intake, type of Urbanization, household income
Choy CC	Adequate nutrient intake
Mahmudiono T	Mother's education, physical activity
Mahmudiono T	Mother's education, size of household, adequate nutrient intake, household income
Oddo VM	Mother's occupation
Tydeman-Edwards	Adequate nutrient intake, type of Urbanization
Nykänen EA	Adequate nutrient intake, type of urbanization,
Parra DC	Household size, mother's education, household income
Parra DC	Household size, mother's education, household income
Shifler Bowers K	Adequate nutrient intake
Alaofè H	Household income, mother's education, mother height, physical activity, size of household, type of urbanization
Anik AI	Breast-feed, mother's age, mother's education, household income, physical activity
Das S	Mother's education, mother's age, type of urbanization, household income, size of household
Hauqe SE	Adequate nutrient intake, household income, type of urbanization
Jayalakshmi R	Type urbanization, mother's education, household income
Mamun S	Household income, type urbanization, mother's education
Modjadji P	Household income, mother's heigh, type urbanization, mother's age
Modjadji P	Household income, type urbanization
Sassi S	Mother's education, mother's age, physical activity
Shinsugi C	Mother's education
Sunguya BF	breast-feed, type of Urbanization, Adequate nutrient intake, mother's education, household income
Williams PA	breast-feed, physical activity, adequate nutrient intake
Jamaluddine Z	Adequate nutrient intake, mother's education
Khan, Saadia	Breast-feed, adequate nutrient intake
Patel, Ratna	Mother's education, household income
Amoussou Lokossou YU	Size of household, mother's education, household income, type urbanization
Berhane HY	Mother's education
Blankenship JL	Household income, mother's height, mother's age, mother's education, size of household
Ghattas H	Mother's education, Household income
Hong SA.	Type urbanization, household income, mother's education, mother's height, mother's age, breast- feed
Sunuwar DR	Mother's heigh, mother's age, mother's education
Fooken J	Type of Urbanization, household income, mother's education, mother's age, size of Household
Nakphong MK	Household income, mother's height
Biswas T	Mother's education, mother's age, household income
Félix-Beltrán L	Mother's height

and Asaolu 2019; Blankenship et al. 2020; Félix-Beltrán, Macinko, and Kuhn 2021; Géa-Horta et al. 2016; Hong 2020; Lee et al. 2012; Modjadji and Madiba 2019b; Nakphong and Beltrán-Sánchez 2021; Oddo et al. 2012; Severi and Moratorio 2014). As the mother is shorter, the child's growth probability retardation increases, predisposing

this condition genetically. The sharp increase in stunting between 6 and 18 months of age likely reflects the cumulative effect of stunting in utero and early childhood. The risk increases when the mother is less than 150 centimeters tall (Félix-Beltrán, Macinko, and Kuhn 2021). Mothers with short stature are very likely to provide a nutritionally restricted uterine environment; therefore, the fetus will have an inadequate supply of nutrients and restricted growth, resulting in low birth weight and will be short. Finally, adult height is likely influenced by genetic, environmental, and social conditions experienced in childhood and poor maternal health, not only in developing countries but also in modern Western societies (Félix-Beltrán, Macinko, and Kuhn 2021).

Socioeconomic variables

Mother's education

A total of 52.9% (37/70) of the included articles mentioned the mother's educational level as a factor associated with DBM. The educational level of the mother is a controversial aspect. In some studies, the mother's high education level is a risk factor (Angeles-Agdeppa, Lana, and Barba 2003; Anik et al. 2019; Biswas et al. 2020; Blankenship et al. 2020; Das et al. 2019; El Kishawi et al. 2016; Hong 2020; Khor and Sharif 2003; Leroy et al. 2014; Oddo et al. 2012; Patel et al. 2020; Wong et al. 2015) for having an underweight child, while this is a protective factor in others (Alaofè and Asaolu 2019; Amoussou Lokossou et al. 2020; Anik et al. 2019; Bassett et al. 2014; Berhane et al. 2020; Fooken and Vo 2021; Géa-Horta et al. 2016; Ghattas et al. 2020; Gubert et al. 2017; Jamaluddine et al. 2020; Jayalakshmi and Kannan 2019; Jehn and Brewis 2009; Kimani-Murage 2013; Mahmudiono, Mamun, et al. 2018; Mahmudiono, Nindya, et al. 2018; Mamun and Mascie-Taylor 2019; Masibo and Makoka 2012; Oddo et al. 2012; Parra et al. 2018a, 2018b; Sarki, Robertson, and Parlesak 2016; Sassi et al. 2019; Severi and Moratorio 2014; Shinsugi et al. 2019; Sunguya et al. 2019; Sunuwar, Singh, and Pradhan 2020). In their article, Vanessa Oddo et al. (Oddo et al. 2012) reported the DBM in Indonesia and Bangladesh. While education level is a protective factor against DBM in Indonesia and in Bangladesh, a high level of education is a risk factor for DBM. Likewise, in the article by Anik et al. (Anik et al. 2019)., the high level of education is associated with DBM in Pakistani households, while in Nepal, the opposite occurs. For those who consider the mother's education as a protective factor, the mother's educational level plays a fundamental role in the child's nutritional status. For instance, when mothers have some education, they are more aware of their children's health and dietary precautions than those without education. Mothers with a low level of education do not have sufficient knowledge about good, healthy eating practices. Maternal schooling could effectively mitigate the adverse effects of household wealth on the prevalence of double burdened households. Women with less education participate less in the labor market and have lower and unstable incomes. Furthermore, lower educational levels are associated with a lack of knowledge about buying healthy foods (Géa-Horta et al. 2016). In this scenario, families often adopt compensatory feeding practices, such as increased consumption of fast food, soft drinks, canned goods, and candies, instead of consuming foods with better nutritional quality due to the latter's higher cost (Géa-Horta et al. 2016). On the other hand, some studies did not find direct associations between the mother's educational level and DBM (Ihab et al. 2013; Jayalakshmi and Kannan 2019; Khor and Sharif 2003). They claim that even if mothers are educated enough to have adequate knowledge about good dietary choices, their decision depends on household income and other expenses (Jamaluddine et al. 2020; Jayalakshmi and Kannan 2019).

Mother's occupation

In 5.7% (4/70) of the articles included, the researchers affirmed that the mother's occupation could influence the DBM at home. The mechanisms by which a mother's employment may relate to the DBM at the household level are not well understood (Oddo et al. 2018). On the one hand, it can be said that a working mother would have the possibility of buying more and varied food; therefore, Oddo et al. (2018) have found that the risk decreases when the mother works. However, on the other hand, some authors (Angeles-Agdeppa, Lana, and Barba 2003; Jehn and Brewis 2009; Saibul et al. 2009) state that if mothers are employed, they have less time to prepare quality food and prefer to resort to fast food. Therefore, associating the mother's occupation and workload with the DBM in some households could be attributed to the lack of time for them and their home. Lack of time could hamper proper menu planning, food selection, preparation, and effective child-rearing practices (e.g., feeding practices).

Household income

The income in the family is a debatable factor concerning the DBM among households. While some authors (20/70) state that the higher the income, the greater the risk of suffering from DBM (Alaofè and Asaolu 2019; Anik et al. 2019; Biswas et al. 2020; Blankenship et al. 2020; Das et al. 2019; Doak et al. 2005; El Kishawi et al. 2016; Fooken and Vo 2021; Garrett and Ruel 2005; Ghattas et al. 2020; Hauqe, Sakisaka, and Rahman 2019; Hong 2020; Ihab et al. 2013; Jayalakshmi and Kannan 2019; Khor and Sharif 2003; Lee et al. 2012; Leroy et al. 2014; Mamun and Mascie-Taylor 2019; Oddo et al. 2012; Patel et al. 2020), other authors (22/70) argue the opposite (Amoussou Lokossou et al. 2020; Géa-Horta et al. 2016; Gubert et al. 2017; Jehn and Brewis 2009; Jones, Acharya, and Galway 2016; Kimani-Murage 2013; Kimani-Murage et al. 2015; Mahmudiono, Nindya, et al. 2018; Masibo and Makoka 2012; Modjadji and Madiba 2019a; Modjadji and Madiba 2019b; Nakphong and Beltrán-Sánchez 2021; Parra et al. 2018a, 2018b; Parra et al. 2015; Ramirez-Zea et al. 2014; Roemling and Qaim 2013; Sarki, Robertson, and Parlesak 2016; Shamah-Levy et al. 2017; Sunguya et al. 2019; Vaezghasemi et al. 2014; Wong et al. 2015). Regarding the studies that indicated that high-income

households are at risk of suffering a double burden of malnutrition, all emphasize those households with sufficient income to buy food. However, the quality of the food may not be sufficient to provide the enough nutrients for growing children and may lead to obesity in adults (mothers).

According to the authors, low income was a risk factor for DBM in the households, and economic barriers prevent children from getting adequate nutrition and a better living environment. Also having a low-income force some families to live in houses with poor infrastructure, sometimes made of unsuitable materials such as cardboard, which poses a threat to the health of the people living there, especially children. These conditions increase the risk of infectious diseases. In contrast, there are studies in which it was evidenced that having a high income increases the risk of DBM at home. In this case, the money is used for needs other than good nutrition, or people tend to buy unhealthy foods.

Size of household

Of the 70 articles, 15 (21.4%) show that as the number of household members increases, the risk of finding DBM is higher (Alaofè and Asaolu 2019; Amoussou Lokossou et al. 2020; Angeles-Agdeppa, Lana, and Barba 2003; Bassett et al. 2014; Blankenship et al. 2020; Das et al. 2019; El Kishawi et al. 2016; Fooken and Vo 2021; Ihab et al. 2013; Jehn and Brewis 2009; Mahmudiono et al. 2018; Masibo and Makoka 2012; Oddo et al. 2012; Parra et al. 2018b; Parra et al. 2015). For example, Das et al. (2019) state a high number of young children in the same household could affect the availability of food for children, mainly when the children are under five years (Fooken and Vo 2021). Furthermore, Blankenship et al. (2020) state that a large family increases economic barriers to achieving adequate child nutrition and better living environments at home. Also, In low-income families, the more people live in the household, the less food each household member consumes (Ihab et al. 2013; Jehn and Brewis 2009).

Health-related behaviors

Breast-feed

In 12.9% (9/70) of the included articles, the researchers mentioned non-breastfeeding as one of the factors associated with DBM at the household level (Anik et al. 2019; Fildes et al. 2015; Géa-Horta et al. 2016; Hong 2020; Khan et al. 2020; Mahmudiono et al. 2018; Oddo et al. 2012; Sunguya et al. 2019; Williams et al. 2019). All the researchers who mentioned breastfeeding agree that it is a protective factor against DBM at home. For example, Oddo et al. (2012) state that breastfeeding increases the probability that the children will meet their daily nutritional needs. Additionally, the risk of maternal overweight decreases as the child is breastfed. Breastfeeding time will decrease the risk of DBM at home. For example, Hong (2020) mention that exclusive breastfeeding for six months is a protective factor against DBM. Furthermore, Anik et al. (2019) suggest that the benefits of breastfeeding occur between 24 and 59 months.

Adequate nutrient intake

All the articles explain food consumption as one of the associated factors; however, only 34.3% (24/70) associate it with DBM at the household level (Angeles-Agdeppa, Lana, and Barba 2003; Asfaw 2007; Choy et al. 2017, 2018; Dop et al. 2012; Garrett and Ruel 2005; Géa-Horta et al. 2016; Grijalva-Eternod et al. 2012; Hauqe, Sakisaka, and Rahman 2019; Isanaka et al. 2007; Jamaluddine et al. 2020; Khan et al. 2020; Khor and Sharif 2003; Mahmudiono et al. 2018; Nykänen et al. 2018; Saibul et al. 2009; Sekiyama et al. 2015; Shamah-Levy et al. 2017; Shifler Bowers, Francis, and Kraschnewski 2018; Sunguya et al. 2019; Tydeman-Edwards, Van Rooyen, and Walsh 2018; Wibowo et al. 2015; Williams et al. 2019; Zeba, Delisle, and Renier 2014). The possible mechanism for the coexistence of maternal over-nutrition and child under-nutrition may relate to changes in the household's dietary pattern (Hauqe, Sakisaka, and Rahman 2019). Many households choose to switch from their traditional foods to diets rich in saturated fat, sugar, and lack of fruits and vegetables. A household favoring energy-rich foods that do not contain a wide range of micronutrients in the diet could result in poor nutrition among children and obesity in adults. Additionally, there is the extremity of food insecurity. At this point, they found homes in which they had nothing to eat. Despite this situation, the mothers were overweight (Mahmudiono et al. 2018).

Physical activity

Even though this factor is outstanding in metabolism, few studies (10/70) (Alaofè and Asaolu 2019; Angeles-Agdeppa, Lana, and Barba 2003; Anik et al. 2019; Khor and Sharif 2003; Lee et al. 2012; Mahmudiono et al. 2018; Sassi et al. 2019; Tydeman-Edwards, Van Rooyen, and Walsh 2018; Williams et al. 2019; Zeba, Delisle, and Renier 2014) have investigated it. Although some studies (Khor and Sharif 2003; Williams et al. 2019; Zeba, Delisle, and Renier 2014) found that little physical activity or a sedentary lifestyle increases the likelihood of women gaining weight, while in another study such as Sassi et al. (2019) found that it has no association with the development of the DBM in the household.

Other factor

Type of urbanization

Of the 70 articles included in this review, 27 (38.6%) spoke about this topic. Some authors claim that living in rural areas is a risk factor for developing DBM at home (Alaofè and Asaolu 2019; Doak et al. 2005; Galiano et al. 2012; Kimani-Murage 2013; Lee et al. 2012; Masibo and Makoka 2012; Modjadji and Madiba 2019a; Modjadji and Madiba 2019b; Nykänen et al. 2018; Parra et al. 2018a; Shamah-Levy et al. 2017; Sunguya et al. 2019; Tydeman-Edwards, Van Rooyen, and Walsh 2018), while others claim that the risk

increases if they live in urban areas (Das et al. 2019; Doak et al. 2005; Fooken and Vo 2021; Hauqe, Sakisaka, and Rahman 2019; Jehn and Brewis 2009; Kimani-Murage et al. 2015; Mahmudiono et al. 2018; Vaezghasemi et al. 2014; Zeba, Delisle, and Renier 2014). However, some authors argue that the risk may be similar in both rural and urban areas (Dop et al. 2012; Hong 2020; Jayalakshmi and Kannan 2019; Oddo et al. 2012). Periurban sites, areas of neither urban nor rural, are considered a risk for developing the DBM because these places do not have the necessary infrastructure to house people. Many of these sites are illegally occupied. For this reason, they do not have the required conditions such as electricity, drinking water, and others (Amoussou Lokossou et al. 2020; Grijalva-Eternod et al. 2012; Jones, Acharya, and Galway 2016; Mamun and Mascie-Taylor 2019).

Discussion

The double burden of malnutrition at the household level is a complex problem because it involves two conditions that have historically been addressed separately (Davis, Oaks, and Engle-Stone 2020; Popkin et al., 2012). Studies from the Asian, African, and Latin American continents were selected for this scoping review (Table 2). DBM is a problem that mainly affects low- and middle-income countries currently undergoing a nutrition transition. This transition is attributed to global changes in dietary systems expressed by greater availability of commercialized foods such as refined sugars and flours and processed foods (Batal et al., 2018).

In the articles included, individual aspects of the mothers and those related to the household were identified. Within the individual aspects are age, height, physical activity, educational level, and occupation. Household-related factors include monetary income, food intake, size of the household, and type of urbanization (rural or urban).

Age is one factor associated with the double burden of malnutrition. Although its effect is not yet clear (Wells et al. 2020), it can be said that an obese woman increases the risk of having a child with low weight as age increases. Regarding height, this factor can be explained by the physiological inability of some short women (De Onis and Branca, 2016; Özaltin, 2010) for their uterus to support and give the baby the necessary nutrients (Wells et al. 2020). These characteristics of the mother have a biological and genetic component, which is why it is considered a vicious circle. The likelihood that these women are currently nutritionally deficient could be associated with nutritional deficiencies in childhood (Wells et al. 2020). In this scoping review, the studies showed two scenarios. The first is that of an obese or overweight mother with a job, sufficient income, high educational level, who might live in a rural or urban area. The second scenario is of an obese or overweight mother, who does not work, without sufficient income, with a low educational level and therefore unable to purchase food, who might live in either a rural or urban area. In both scenarios, the mother is obese or overweight and has an underweight child. In the first scenario, it is logical to find a mother who can buy food, and who buys large quantities of non-nutritious food because they are busy and therefore does not have time to cook for various reasons. It is possible that they are just overwhelmed or overworked or do not have time. In this scenario, it is common to find women who do not breastfeed their children and being sedentary. Although these types of women could live in rural and urban areas, it is common for them to live in urban areas. Therefore, the coexistence of under- and overnutrition may be the resultant factor of a marked shift in people's dietary and lifestyle practices, especially in urban areas (Anik et al. 2019; Hauqe, Sakisaka, and Rahman 2019; Mahmudiono et al. 2018). Eating high-fat, high-calorie diets, the presence of passive entertainment devices, and mechanized labor influence patterns of food demand and physical activity (Angeles-Agdeppa, Lana, and Barba 2003).

The second scenario is complex because an obese mother was found with a malnourished child but without the economic capacity to have the necessary nutrients in the household. The question that appears is, why is that mother still obese? Women from poor households may be consuming cheaper and less nutritious (more calorie-dense) foods that lead to being overweight (Khor and Sharif 2003), or the explanation must have a biological background in that the mother can conserve fatty tissue despite not having enough calories (Wells et al. 2020; Doak et al. 2005). The second scenario can occur in both rural and urban areas; the explanation for the above is that many of the mothers who lived in rural areas migrated to urban areas in search of better opportunities (Félix-Beltrán, Macinko, and Kuhn 2021).

Regarding the place of residence, in the review, periurban areas are related factors for developing the double burden of malnutrition. Jones, Acharya, and Galway (2016) stated the situation of refugees in an African country, who must live in periurban places far from the communities that cities provide. These sites are suburban; therefore, they do not have limited access to food. Furthermore, some of these areas do not have drinking water or sewage services. For this reason, the risk of becoming sick from any disease is higher.

Many researchers highlight that education is a determining factor for these women, along with their children, to balance their body weight; however, many women with a high or adequate level of education do not have sufficient knowledge about nutrition (Mahmudiono et al. 2018).

There is a need for target-specific interventions to address child undernutrition and maternal overweight/obesity simultaneously. Behavioral education interventions (Menon and Peñalvo 2019) were developed to improve modifiable behaviors that contribute to malnutrition and to equip mothers with the skills necessary to overcome these problems. For example, a randomized controlled trial on households in urban Indonesia was designed by Mahmudiono et al. (2018) to target the coexistence of stunted children and overweight/obese mother. In this study, mother-child pairs were randomly assigned to receive either a 12-week nutrition education and home visits or printed educational materials, in addition to a government-funded

food supplementation program. Findings were mixed. There were no intervention effects on either children's weight and heights or maternal primary outcome measures such as weight, waist circumference, and BMI. However, the intervention resulted in a substantial improvement in maternal self-efficacy to engage in physical activity, eat fruits and vegetables, and provide children with growth-promoting animal protein. While the DBM may be a preventable phenomenon, it is a multifactorial phenomenon that education alone cannot adequately address.

In 2017, the World Health Organization (WHO) published the first set of recommendations called five double-duty actions (DDAs) to tackle the double burden of malnutrition (WHO 2017). They include: 1) promotion and protection of exclusive breastfeeding in the first 6 months, 2) promotion of approximate early and complementary feeding in infants, 3) maternal nutrition and antenatal care programs, 4) regulation on marketing, and 5) school food policies and programs.

To tackle DBM, future studies need to consider multilevel factors at the individual, community, and societal levels when developing intervention strategies. Differences in cultural knowledge and practices should also be considered. To better understand how interventions can be finetuned for enhanced effectiveness, we call future studies to test strategies related to all five WHO proposed DDAs.

Limitations

Although researchers have discussed the DBM for a long time (Doak et al. 2005), many limitations still explain those factors that could be associated with that condition (Davis, Oaks, and Engle-Stone 2020). With just the definition, we can find many forms of the double burden of malnutrition. For this scoping review, only the definition that implies the obese mother and underweight child was considered.

The results were not consistent in the selected articles. The inconsistent findings could be explained by the unclear definition of malnutrition (Davis, Oaks, and Engle-Stone 2020). The criteria used to enter the items was an obese or overweight mother in a household, and one of her children was underweight. Although studies had the same elements, the internal definition of each study may be different.

Among the articles included, 94.3% had a cross-sectional design. This type of study can have many biases, mainly informational (Levin 2006). For examining causal relationships of public health problems such as DBM, longitudinal observational or case-control studies could be a good alternative (Mann, 2003). Another study type that allows researchers to explore more in-depth and identify risk factors is the qualitative study (Grossoehme, 2014). Although qualitative studies are criticized for presenting subjective ideas, they allow us to explore certain factors we want to clarify. For example, Oddo et al. (2018) used in-depth interviews to assess why, if a mother works, the probability of a DBM in her household increases. This method made it possible to clarify this situation in Guatemalan homes. Additionally, Williams et al. (2019) and Jamaluddine et al. (2020) used quasi-experimental designs to address some risk factors associated with the DBM at home. Williams et al. (2019) implemented strategies to address practices related to eating and physical activity. Jamaluddine et al. (2020) used a teaching program to improve the eating habits of children and mothers.

Conclusions

The DBM at the household level is a complex public health problem. In this scoping review, factors associated with this condition were identified; however, the results were not homogeneous. It is recommended that longitudinal observational studies or in-depth qualitative studies be carried out to elucidate the causal effects and better understand the context of the phenomenon. There is a need for target-specific interventions to address child undernutrition and maternal overweight/obesity simultaneously.

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