Double Burden of Malnutrition among Mother-Child Dyads in a Rural Area of West Bengal, India: A Comprehensive Analysis of Contributing Factors

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ABSTRACT

Background

The double burden of malnutrition (DBM), where undernutrition and overnutrition coexist, is a new paradigm in the global nutritional landscape. With an increasing rate of obesity and a gradual decline in undernutrition, India is currently experiencing this public health challenge. At the household level, among mother-child pairs, this disparity in nutritional status is becoming evident.

Objective

To assess the prevalence and patterns of the double burden of malnutrition among mother-child dyads and to determine the factors associated with this condition.

Method

In this observational, cross-sectional study, the nutritional status (double burden of malnutrition) of 360 mothers and their children (aged 0 - 23 months) from a rural community of West Bengal, India, was assessed. Data were collected via interviews using a pre-tested, semi-structured questionnaire and through standard anthropometric measurements. The collected data were subsequently analyzed using SPSS (Version 25).

Result

The findings showed that 16.1% of the mother-child pairs had double burden of malnutrition, the highest being the pair of overweight/obese mother-stunted children (10%). Mother's education (aOR 4.19, CI 1.65-10.62), food-insecure households (aOR 3.27, CI 1.51-9.16), and lower socio-economic class (aOR 2.70, CI 1.09-6.67) were found to be significantly associated with the presence of double burden of malnutrition among participants.

Conclusion

The double burden of malnutrition among mother-child dyads can be seen as a dual nutrition challenge that needs to be addressed with paramount importance. This contrasting form of malnutrition claims a renewed focus and program intervention through the equity-focused policies of Double Duty Action.

KEY WORDS

Double burden, India, Malnutrition, Mother-child Dyad, Rural

INTRODUCTION

The double burden of malnutrition (DBM) as a concept first emerged in 1992 at the International Conference on Nutrition (ICN) held by the Food and Agriculture Organization of the United Nations (FAO) and the World Health Organization (WHO). The DBM was presented as a new paradigm, recognizing that separating the treatment or prevention of nutritional deficiencies and excesses was no longer sensible, as most countries were dealing with both problems simultaneously.[1] As per WHO, in the year 2016, an estimated 41 million children under the age of 5 years were overweight or obese, while 155 million were chronically undernourished.[2] The nutritional scenario in India is no longer an exception because this country is still home to 35%, 33%, and 17% of under-five children who are stunted, underweight, and wasted, respectively.[3] On the contrary, the incidence of overweight/obesity has increased unexpectedly in India's poorer and more populous states.[4] India has more than 30 million obese people, and the number is increasing alarmingly.[5] Double burden of malnutrition can manifest at different levels when the household level DBM is the most significant one among all.[2] The double-burden household is more common in LMICs (Lower-middle income countries) undergoing rapid nutrition transition. Prevalence of total household-level DBM ranges between 3% and 35% across 126 LMICs, with stunted child overweight mother pairs being the most prevalent DBM type (1-24%).[6] Traditionally a mother's nutrition had always been related to a child's and vice versa. However, currently, the evidence suggests that the nutritional status of the mother and child is often positioned at opposite ends of the nutritional spectrum. Such discordant mother-child pairs are a crucial form of double burden at the household level. In accordance with that, the double burden mother-child pair (under-nutrition as well as overweight/obesity in the same setting) is two sides of the same nutritional crisis and more often occurs due to nutrition disparities. Even though such disparity of nutrition in mother-child dyads is an impending public health problem, the status of double burden among them remained underexplored, particularly in a lower-middle income setting. In this aforementioned context, the present study aimed to assess the prevalence and patterns of the double burden of malnutrition among the pairs comprising children aged 0-23 months and their mothers from a rural area of Hooghly district, West Bengal, and also to delineate the determinants for the same.

METHODS

This community-based, cross-sectional study was conducted from August 2023 to June 2024 in the villages situated in the service area of the Rural Health Unit and Training Centre at Singur, Hooghly district, West Bengal. A total of 64 villages, catered by 2 primary health centers and 12 subcentres, were included in this study. Children aged 0-23 months and their mothers were selected as study participants. Any debilitating disease of the child, as well as the mother, and those who were unable to respond were excluded.

Cochran's formula [$n=z^2pq/d^2$] for determining the sample size was applied.[7] The standard normal variate (z) was taken as 1.96 (5% type-I error); the prevalence (p) of double burden of malnutrition among mother-child dyads was 39% as per a study by Kumar et al. based on National Family Health Survey data of India (NFHS-4, 2015-16) and relative error in precision (d) as 20%.[8] Considering a design effect of 2 and a non-response allowance of 10%, the final sample size was estimated as 360. Thus, a total of 360 mother-child pairs had been studied.

A two-stage 30-cluster sampling technique was implemented using the probability proportional to the population size method. Each of the 64 villages was considered a cluster. In the first sampling stage, 30 clusters were selected after listing the villages according to their population. In the second stage, 12 participants were selected from each of the 30 selected clusters (Cluster size = sample size/number of clusters; i.e., 360/30=12) using simple random sampling. Eligible participants were approached to participate in the study with the help of the respective honorary health workers assigned in that area. Only one participant per household was selected to avoid overlapping of certain socio-demograohic and behavioral characteristics. In case two children of 0-23 months of age were present within the same household or of the same mother, the younger child was taken as the participant.

After building rapport with the participants, data collection was conducted via face-to-face interviews using a pre-designed, pre-tested schedule. Local-language versions of the schedule were face- and content-validated by public health experts. Malnutrition among the mothers and their children was assessed by anthropometric measurements. A calibrated digital weighing machine was used to measure the body weight of the mothers, and for children, a baby weighing scale pan was used. Bodyweight was measured at three separate observations at 10-minute intervals during data collection. Mother's height was measured with a non-stretchable tape, and in the case of children, recumbent length was taken with an infantometer. Anemia status was assessed using a hemoglobin testing kit containing a digital hemoglobinometer (Hemocue; Radiometer Medical ApS, Copenhagen, Denmark), test strips, a puncture lancet, a micropipette, cotton swabs, and spirit.

The outcome variable of this study is the double burden of malnutrition among mother-child dyads. The discordant pairs of mother and child, where the child is suffering from undernutrition and the mother is overweight/obese or vice versa, were considered as double-burden pairs. To ascertain the nutritional status of both mother and child, Body Mass Index (BMI) and status of anemia among mothers and stunting, underweight, and wasting in children were

used. Maternal BMI was categorized into three categories of underweight (BMI < 18.5), normal (18.5 to 24.9), and overweight (≥ 25.0), and stunting, underweight, and wasting by z-scores of < -2.00 of height-for-age, weight-for-age, and weight-for-height, respectively, as per the WHO guidelines.[9] Dietary diversity was measured for the mothers through MDD-W (minimum dietary diversity of women; it is a ten-item food group diversity indicator that reflects the presence of dietary diversity if 5 out of 10 food groups are consumed) questionnaire.[10] HFIAS (Household Food Insecurity Access Scale) questionnaire was used to measure household food security. This questionnaire containing a total of nine questions based on a recall period of 24 hours helps in distinguishing between food-secure and food-insecure households.[11] The structured questionnaire also contained socio-demographic details, such as age, sex, caste, education, marital status of the mother, socioeconomic status (according to B.G. Prasad's scale 2022), and family type.[12] Antenatal, intranatal, and postnatal history including parity of the mother, mode of delivery, birth weight, birth order, etc were also taken during data collection.

Data were analyzed using Microsoft Excel and Statistical Package for Social Sciences (SPSS Inc. Released 2007. SPSS for Windows, Version 16.0. SPSS Inc., Chicago, IL) Appropriate descriptive statistics were utilized for denoting the proportion of Double burden malnutrition pairs of mother-child as well as the independent variables. Tests of significance, like Chi-Square tests with risk estimations, were done to compare the proportions of study participants in terms of selected categorical variables. A p-value of < 0.05 was considered significant. After the exclusion of multicollinearity (variance inflation factor of > 5), the factors associated with double-burden pairs were determined using a test of significance (p < 0.05) via a univariate logistic regression analysis separately. The final multivariable models included all biologically plausible significant variables and the variables having a p-value of 0.25 or less in the respective univariate analysis to estimate the adjusted odds ratio (aOR).

RESULTS

Background characteristics of the study participants:

The median age of the mothers was 25 years, with an interquartile range of 21-29 years, and in the case of the children, it was 13 months (interquartile range 5-17 months). Among all the 360 children, 51.2% were male and 48.8% were female. Among them, 93.6% were Hindu by religion, and 75.3% were living in a joint family. Approximately 31.1% of the participants belonged to socioeconomic class IV (according to the B.G.Prasad Scale 2022), and 40% of the mothers had an educational level of middle school, as seen in the table table 1

Table 1. Background characteristics of the respondents (n=360)

Parameters	Categories	Number (%)
Age of the mothers (years)	18-25	200 (55.6)
	26-30	110 (30.5)
	31-35	43 (12)
	≥36	7 (1.9)
Age of the children (months)	0-6	101 (28.1)
	7-12	73 (20.2)
	13-18	122 (33.9)
	19-23	64 (17.8)
Sex of the children	Male	184 (51.2)
	Female	176 (48.8)
Religion	Hindu	337 (93.6)
	Muslim	23 (6.4)
Type of family	Nuclear	271 (75.3)
	Joint	89 (24.7)
Mothers' education[¥]	Below primary	22 (6.2)
	Primary	21 (5.8)
	Middle	115 (31.9)
	Secondary	89 (24.7)
	Higher Secondary	60 (16.7)
	Graduate and above	53 (14.7)
Fathers' education	Below primary	54 (15)
	Primary	84 (23.3)
	Middle	96 (26.7)
	Secondary	75 (20.8)
	Higher Secondary	31 (8.6)
	Graduate and above	20 (5.6)
Socio-economic class[£]	Class I (Upper class)	12 (3.3)
	Class II (Upper middle class)	68 (18.9)
	Class III (Middle Class)	104 (28.9)
	Class IV (Lower Middle Class)	112 (31.1)
	Class V (Lower class)	64 (17.8)

[¥]Below primary=illiterate and below the 5th standard, p rimary=passed the 5th standard, middle= passed the 8th standard, secondary=passed the 10th standard, higher secondary=passed the 12th standard
[£]According to the B.G. Prasad Scale 2022

The pattern of the double burden of malnutrition among mother-child dyads:

The mother-child pairs with discordant nutritional status within the same household were observed in the current study. Pertaining to the pattern of DBM, four types of pairs were found, viz., stunted child-overweight/obese mother (SC_OWM), underweight child-overweight/obese mother (UWC_OWM), wasted child-overweight/obese mother (WC_OWM), overweight/obese child-anemic mother (OWC_AM), and the highest form of double burden pair being the stunted child with overweight/obese mother (10%) table 2. Thus, among a total of 360 study participants, any form of double-burden malnutrition was found to be present among 16.01% of the mother-child dyads.

Table 2. Different pairs of Double Burden among mother-child dyads (n=360)

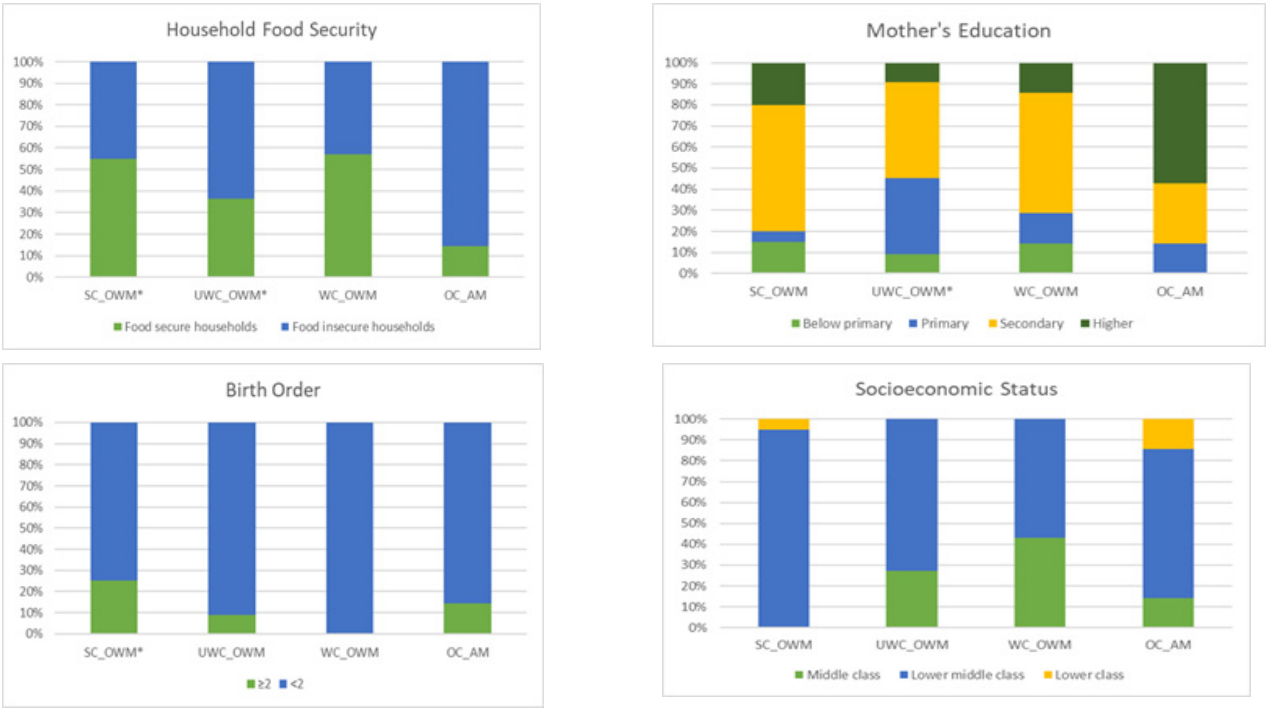
Double Burden pairs	Number* (n)	Percentage (%)
Stunted child-overweight/obese mother (SC_OWM)	36	10
Underweight child- overweight/obese mother (UWC_OWM)	20	5.6
Wasted child- overweight/obese mother (WC_OWM)	12	3.3
Overweight/obese child-anemic child (OC_AM)	8	2.2

*Multiple responses

Figure 1 shows the distribution of different outcomes across socioeconomic status, mother's education, birth order of the child, and household food security. The distribution of SC_OWM and UWC_OWM was significantly different between food-secured households and households where food insecurity was present. The DBM (SC_OWM) also significantly differed across the birth order of the child, where the majority of the SC_OWM pairs had a birth order of two or more. The majority of the DBM pairs belonged to the lower middle socioeconomic class (according to the B G Prasad's Scale 2022), although no significant difference was found.

Factors associated with the Double Burden of Malnutrition among Mother-Child Dyads

In the final multivariable regression analysis model, three variables emerged as significantly associated with the double burden of malnutrition. The socio-economic class of below III in modified B G Prasad Scale 2021 (AOR= 2.70, 95% CI= 1.09 – 6.67), mother's education of below middle school (AOR= 4.19, 95% CI= 1.65 – 10.62), food insecure households (AOR= 3.72, 95% CI= 1.51– 9.16) had a significant positive association with the double burden of malnutrition among mother-child dyads. The model was fit to use as per the insignificant p (> 0.05) in the Hosmer-Lemeshow test, while 36% (Cox and Snell's R2) and 47% (Nagelkerke 's R2) of the variance of dependent variables could be explained by this multivariable model (Table 3).



*Indicates significant association (Chi-square, p-value < 0.05)

Figure 1. Distribution of different double burden mother-child dyads across Household food insecurity, Birth order, Socioeconomic status, and Mother's Education:

DISCUSSIONS

The primary objective of the present study was to assess the double burden of malnutrition among mother-child pairs in a rural area of India. In a developing nation like India, the nutritional profile is changing with progress on several indicators of undernutrition but rapidly rising rates of overweight/obesity, especially among adults. This transition leads to the development of the double burden of malnutrition, even at the household level, with no exception for mother-child pairs.

This study was carried out among 360 mother-child pairs over one year. The findings showed that 16.1% of the pairs had a double burden of malnutrition. Among 58 double-burden mother-child pairs, 26 were male children and 32 were female. The highest percentage of double burden

Table 3. Factors associated with the double burden of malnutrition among mother-child dyads: Multivariable Logistic Regression (n=360)

Parameters	Total No. (n=360)	Presence of Double Burden of malnutrition (n=58)	Adjusted Odds Ratio (aOR); 95% CI	p-value$
Socioeconomic status				
Class III and above	184	23 (12.5%)	Ref (1)	0.031
Below class III	176	35 (19.8%)	2.70(1.09-6.67)	
Mothers' education				
Middle school and above	317	42 (13.2%)	Ref (1)	0.003
Below middle school	43	16 (37.2%)	4.19(1.6-10.6)	
Fathers' education				
Middle school and above	222	23(10.4%)	Ref (1)	0.378
Below middle school	138	35 (25.4%)	1.61 (0.5-4.6)	
Birth order				
≤ 2	323	43 (13.3%)	Ref (1)	0.737
> 2	37	15 (40.5%)	1.23(0.3-4.1)	
Minimum dietary diversity among mothers				
Present	140	20 (14.3%)	Ref (1)	0.127
Absent	220	38 (17.2%)	1.21 (0.2-4.3)	
Household food security				
Food secured household	207	26 (12.6%)	Ref (1)	0.004
Food insecure household	153	32 (20.9%)	3.72(1.5-9.1)	

Hosmer-Lemeshow model fitting information
$\chi^2 = 5.643$, p = 0.582
Cox and Snell's $R^2 = 0.36$
Nagelkerke's $R^2 = 0.47$
$p-value < 0.05 is considered as significant

pairs was of overweight/obese mother-stunted children (36 out of 360). A study done by Jayalakhsmi et al. in Kerala, India, reported that the prevalence of stunted children and overweight/obese mothers was 10.7%.[13] Another study by Masibo et al., done in Africa, reported that out of the overweight/obese mothers, 20% had stunted children, 5.4% had underweight children, and 3.1% wasted children.[14] Shakiyama et al. showed that the prevalence of double-burden mother-child pairs was 30.6% of the total households in rural Indonesia.[15]

In the present study, a few factors were found to be associated with the double burden of malnutrition among mother-child pairs, such as poor socio-economic condition, low level of mother's education, and household food security. Though not rendered statistically significant in the final model of multivariate logistic regression analysis, low levels of father's education, higher birth order of the child, and absence of minimum dietary diversity among mothers were found to be significantly associated with double burden malnutrition in univariate regression. A study done in Ethiopia by Tarekgn et al. also showed that those with poor socio-economic status were more likely to experience DBM than households with middle economic status.[16] Another study by Kumar and Mohanty done in India also demonstrated that a poor wealth index was significantly associated with the double burden of malnutrition.[8] A study by Rachman et al. in Indonesia showed that the lower educational status of mothers is positively associated with DBM.[17] In contrast to such findings, another study done by Sutopa et al. in Bangladesh showed that households with highly educated mothers and fathers are at an increased risk of having DBM.[18] A similar finding to the current study is demonstrated by another study of urban Indonesia, which stated that household food insecurity is significantly associated with DBM pairs like stunted children and overweight or obese mothers.[19] Gubert et al. had done a study in Brazil that also showed a positive association between household food insecurity and the double burden of malnutrition among mother child pairs.[20]

This study carries certain limitations. Owing to the cross-sectional design, no causal relationship could be established between the double burden of malnutrition and its risk factors. Some of the factors could only be elicited from self-reports, which were recall-based; hence, there might be recall bias or social desirability bias.

CONCLUSION

From this current study, a significant proportion of mother-child pairs were found to be suffering from the double burden of malnutrition, which is no less than 16.1%. On the other hand, it can be said that nutrition is a cross-cutting determinant for both health and development challenges, with the ability to catalyze the achievement of key global goals and targets. And when this nutritional challenge is related to the most important category of population which is the dyad of a mother and child, the nation cannot afford to neglect that. So, addressing the double burden of malnutrition should be regarded as a catalyst for addressing policy challenges beyond health – including reducing health and social inequities within populations, and raising educational attainment. The double burden of malnutrition can be seen as a dual nutrition challenge that needs to be addressed with double-duty action which includes interventions, programs, and policies that have the potential to simultaneously reduce the risk or burden of both undernutrition (including wasting, stunting, and micronutrient deficiency or insufficiency) and overweight, obesity. Malnutrition in all its forms, even the intersection of seemingly contrasting and confounding forms of malnutrition provides a critical point for renewed focus, as

well as policy and program interventions and these need to be tackled by equity-focused policies and systems through changes in community capacity building, advocacy, and political will.

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REFERENCES

1. World Health Organisation. Health-topics Nutrition. Geneva;WHO:2022.[Cited on 7.7.2022] Accessed from https://www.who.int/health-topics/nutrition.
2. World Health Organization. The double burden of malnutrition. Policy brief. Geneva: WHO; 2017. [cited on 8.7.2022]. Available from https://www.who.int/publications/i/item/WHO-NMH-NHD-17.3.
3. MoHFW Govt. of India. Nutrition INDIA. 2019 [cited on 8.7.2022]. Available from https://nutritionindia.info/dashboard/nutritionINDIA#/?section=1&areaId=IND
4. Siddiqui Z, Donato R. The dramatic rise in the prevalence of overweight and obesity in India: Obesity transition and the looming health care crisis. *World Dev.* 2020;134: 105050
5. Gouda J, Prusty RK. Overweight and obesity among women by economic stratum in urban India. *J Health Popul Nutr.* 2014 Mar;32(1):79-88.
6. Seferidi P, Hone T, Duran AC, Bernabe-Ortiz A, Millett C. Global inequalities in the double burden of malnutrition and associations with globalisation: a multilevel analysis of Demographic and Health Surveys from 55 low-income and middle-income countries, 1992-2018. *The Lancet Glob Health*. 2022 Apr 1;10(4):e482-90.
7. Charan J, Biswas T. How to calculate sample size for different study designs in medical research? *Indian J Psychol Med*. 2013 Apr;35(2):121-6.
8. Kumar M, Mohanty P. Does maternal overnutrition carry child undernutrition in India? *PLoS One*. 2022 Jun 17;17(6):e0265788
9. World Health Organization. Child Growth Standards.[Internet]. WHO;Geneva.[cited 2022 Aug 30].Available from https://www.who.int/tools/child-growth-standards/standards
10. Minimum dietary diversity for women [Internet]. FAO; 2021 [cited 2022 Aug 30]. Available from: http://www.fao.org/documents/card/en/c/cb3434en
11. Coates J, Swindale A, Bilinsky P. Household Food Insecurity Access Scale (HFIAS) for measurement of food access: indicator guide: version 3. [Internet] 2007. [cited on 2011 Aug 30]. Available from https://www.fantaproject.org/sites/default/files/resources/HFIAS_ENG_v3_Aug07.pdf
12. Majhi MM, Bhatnagar N. Updated B.G Prasad's classification for the year 2021: consideration for new base year 2016. *J Family Med Prim Care*. 2021 Nov;10(11):4318-9. doi: 10.4103/jfmpc.jfmpc_987_21. Epub 2021 Nov 29. PMID: 35136812; PMCID: PMC8797132.
13. Jayalakshmi R, Kannan S. The double burden of malnutrition: an assessment of 'stunted child and overweight/obese mother (SCOWT) pairs' in Kerala households. *J Public Health Policy.* 2019 Sep;40(3):342-50.
14. Masibo PK, Humwa F, Macharia TN. The double burden of overnutrition and undernutrition in mother-child dyads in Kenya: demographic and health survey data, 2014. *J Nutr Sci.* 2020 Jan 24;9:e5.
15. Sekiyama M, Jiang HW, Gunawan B, Dewanti L, Honda R, Shimizu-Furusawa H, et al. Double Burden of Malnutrition in Rural West Java: Household-Level Analysis for Father-Child and Mother-Child Pairs and the Association with Dietary Intake. *Nutrients*. 2015 Oct 2;7(10):8376-91
16. Tarekegn BT, Assimamaw NT, Atalell KA, Kassa SF, Muhye AB, Techane MA, et al. Prevalence and associated factors of double and triple burden of malnutrition among child-mother pairs in Ethiopia: Spatial and survey regression analysis. *BMC Nutr*. 2022 Apr 21;8(1):34.
17. Rachmah Q, Mahmudiono T, Loh SP. Predictor of Obese Mothers and Stunted Children in the Same Roof: A Population-Based Study in the Urban Poor Setting Indonesia. *Front Nutr.* 2021 Dec 6;8:710588.
18. Sutopa TS, Bari W. How does mode of delivery associate with double burden of malnutrition among mother-child dyads?: a trend analysis using Bangladesh demographic health surveys. *BMC Public Health*. 2022 Jun 23;22(1):1243. doi: 10.1186/s12889-022-13660-5. PMID: 35733171; PMCID: PMC9219174.
19. Mahmudiono T, Nindya TS, Andrias DR, Megatsari H, Rosenkranz RR. Household Food Insecurity as a Predictor of Stunted Children and Overweight/Obese Mothers (SCOWT) in Urban Indonesia. *Nutrients*. 2018 Apr 26;10(5):535
20. Gubert MB, Spaniol AM, Segall-Corrêa AM, Pérez-Escamilla R. Understanding the double burden of malnutrition in food insecure households in Brazil. *Matern Child Nutr.* 2017 Jul;13(3):e12347