Research Paper

Role of Community Infrastructure in Improving Nutrition in Under-five Children

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ABSTRACT

Background: In India, 26 million children are born every year. These children (0-6 years) comprise 13% of the country's population. Undernutrition is a fallout of malnutrition, malabsorption, and nutritional imbalance which causes a problem of being underweight in children. It can affect a child's brain development and other developmental milestones. This study is designed to understand the role of Anganwadi Centers (AWCs) (community day-care centres) and women's access to internet in reducing the undernutrition in children.

Methods: It was a retrospective cross-sectional study which was conducted during 2023-2024. The study population consisted of 724,115 Indian women in the age group of 15-49 years. We used anonymized, publicly available secondary data from the India National Family Health Survey (NFHS-5). The NFHS5 survey was carried out from the year 2019 to 2021. Information on various parameters was collected using a predesigned questionnaire. Statistical analysis including Pearson correlation coefficient analysis, simple linear regression and multiple linear regression analysis were carried out for independent variables including percent of operational AWCs and percent of women with internet access, and dependent variable (percent of underweight children per state). Statistical analysis of the data has been done by social science statistics tools. The significance level of 0.05 was considered for analysis.

Results: The states or union territories (UTs) with lower number of AWCs had a higher percentage of women with Internet access as compared to UTs with more AWCs. Multiple linear regression for independent variables (operational AWCs, and women with internet access), and dependent variable (underweight children per state) was developed. It was shown that $\beta 0=37.1607$; $\beta 1$ (AWCs)=0.5659; and $\beta 2$ (internet access)=-0.2907 and R squared value as 0.5709. This shows that independent variables have a significant influence on the number of underweight children in the state. Results of the Pearson correlation indicated that there is a significant large negative relationship between women's access to Internet and the percentage of underweight children in the state, $(r(34)=-0.733, P<0.001)$, meaning that with an increase in internet access for women the percentage of underweight children decreases.

Conclusion: The study clearly shows that when compared, community daycare centers (AWCs) have a limited role in the child's nutrition, but women's Internet access can be a determinant of the child's nutrition. Women's access to the Internet can help reduce the number of underweight children under five and improve overall maternal and child health as well as public health.

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Highlights

● Underweight in children is not a rural phenomenon but is also observed in urban children. There are few states like Punjab where 17.9% are urban underweight children whereas 16.4% are rural ones.

● The urban-rural gap in access to the internet for women is seen. Among urban women, 51.8% have access to the Internet but this percentage falls to 24.6 % in rural areas.

● When the data of India national family health survey (NFHS-5) (2019-21) is compared with NFHS4 (2015-16), the number of underweight children in some geographical areas have increased in number; so regular monitoring is necessary.

● Compared to operational Anganwadi centers (AWCs) (community day-care centres), women's access to internet is more beneficial in improving child nutrition. The eastern region of the country has shown the highest number of AWCs (87504.75) and at the same time, the highest number of underweight children (35.58%). In the northern region where the highest number of women (51.92%) have internet access, the percentage of underweight children is comparatively low (22.31%).

Plain Language Summary

Under-five children from mildly underweight to severely underweight are at risk of mortality. Weight-for-age is a recommended indicator for the nutrition of the child. Tackling malnutrition in children is important from their developmental point of view. This study investigated the infrastructures like community day-care centers and internet access for mothers in India. Day-care centers have a direct role in children's nutrition as they provide mid-day meals to the child. Access to internet technology for mother helps her gain knowledge about the right nutrition for the child's particular age. While developing the policies for ending malnutrition, community facilities that directly affect mothers or their children need to be studied in detail and regularly. Mothers access to Internet have more benefits as compared to the community day-care centres in tackling malnutrition in under-five children.

Introduction

Community day-care centres (Anganwadi centers-AWCs) in India are started as part of the integrated child development service (ICDS) program to combat child hunger and malnutrition. A total of 1.396 million AWCs are registered in the country (PIB, 2023) out of which 0.136 million are in urban areas whereas the rest are in rural areas of the country. Under-weight based on weight-for-age, is recommended as the indicator to assess changes in the magnitude of malnutrition over time (WHO, 2023). Evidence has shown that the mortality risk of children who are even mildly underweight is increased, and severely underweight children are at even higher risk (Measure Evaluation, 2023). Therefore, weight-for-age monitoring can help assess the contribution of public health policies or interventions to reducing mortality. In India, 26 million children are born every year. Children (0-6 years) comprise 13% of the country's total population (NHM-Goa, 2023). Studying malnutrition in under-five children is important from a public health perspective. Intending to improve the nutritional and health status of children in the age group of 0-6 years, the government of India in 1975 launched 'the ICDS'; AWCs is part of it (Sachdev & Dasgupta, 2001). AWCs provide nutrition and nutrition education, non-formal preschool education, and health education. Referral services, health check-ups, and immunization are also provided at AWCs which is part of the public health system.

Earlier studies have found that there are various risk factors associated with malnutrition among under-five children. Gender differences, families with low per capita income, urban-rural lifestyle, lower food consumption in girls compared to boys, poor feeding practices, and lack of knowledge about growth monitoring in children are some of the determinants (Sahu et al., 2015).

Place of residence, household wealth, birth weight, age of a child, awareness regarding diarrheal diseases and acute respiratory tract infection control, maternal education, number of under five-year-old children, and source

of drinking water have been mentioned as strong predictors of child nutritional status in developing countries (Mittal et al., 2007). Maternal factors like age, weight, and anemia also affect a child's nutritional status (Ganesh Kumar et al., 2010). There is a positive link between the nutritional status of children and the stages of development in the states in which they live (Som et al., 2007).

Recent studies have revealed that internet access plays an important role in improving the energy intake of low-income groups and should be considered as one of the United Nation's sustainable development goals (SDGs) of ending malnutrition (Xue et al., 2021). A few more studies prove the internet's role in tackling malnutrition (Yang et al.,2023; Ma & Zin, 2022; Yi et al., 2023).

The COVID-19 pandemic has unearthed our reliance on broadband internet, not as a luxury requirement, but as an essential utility such as water and electricity (Early & Hernandez, 2021). Broadband internet access is a super determinant of health because many other social determinants like education, health care, food, and income hinge on it (Bauerly et al., 2019).

Infrastructure development has a positive role in public health. There is no study available to show whether there is any effect of community infrastructure like public daycare centers or women access to internet on reducing under-five malnutrition, especially in the Indian context. This study is designed to understand, if any positive relationship persists between community infrastructure (daycare centers and women access to internet) in the reduction of child malnutrition. The results will be used to fill the knowledge gap and to frame strategic policies to obtain better results.

Materials and Methods

Design

This was a retrospective cross-sectional study using anonymized, publicly available secondary data from the India national family health survey (NFHS-5) which had been carried out from 2019 to 2021. This research study was done in the year 2023-24.

Study population

Our research population consisted of 724,115 women in the age group of 15-49 years. The majority of India's population growth comes from rural and underprivileged areas, while the rise in income comes from the urban privileged population (Kapoor, 2023). Accordingly, studying both populations was considered to help better understand the issue. The population is divided into four sub-samples to study- urban women, rural women, urban children, and rural children. For a detailed understanding of the geographical prevalence of underweight children in the country, the study population was divided into regions:

1) The northern region- has six states- Himachal Pradesh, Punjab, Uttarakhand, Haryana, Delhi, and Uttar Pradesh; 2) The southern region contains five states- Andhra Pradesh, Karnataka, Kerala, Tamil Nadu, and Telangana; 3) Eastern region- is consisting of the states of Bihar, Jharkhand, Odisha and West Bengal, 4) Western region states are Rajasthan, Maharashtra Gujarat and Goa; 5) Central region-It consists of two states- Madhya Pradesh and Chhattisgarh 6) North-East region includes-eight States viz. Arunachal Pradesh, Assam, Manipur, Meghalaya, Mizoram, Nagaland, Sikkim and Tripura. Union territories (UTs) (Andaman and Nicobar Islands, Chandigarh, Dadra and Nagar Haveli, Daman and Diu, Lakshadweep, Puducherry, Jammu & Kashmir, Ladakh) are grouped as per their geographical locations.

Database used for study

The data related to the percentage of underweight children and the percentage of women getting internet access were collected from the Ministry of Health and Family Welfare (MoHFW), Government of India. Data related to the number of AWCs per state were collected from the Ministry of Women and Child Development. The NFHS-5 data provides information for 707 districts, 28 states, and 8 UTs. The survey work for the NFHS-5 was planned in two phases. The first phase was carried out for 17 states and 5 UTs from 17 June 2019 to 30 January 2020 and the second phase has been completed in 11 States and 3 UTs from January 2nd 2020 to 30 April 2021.

Study variables

The primary outcome variable or dependent variable in this study is the percentage of underweight children. The independent variable or explanatory variable is the number of AWCs per state (%) and the percentage of women getting internet Access. As per the NFHS-5 data, the children whose weight-for-age Z-score is below minus two standard deviations (-2 SD) from the median of the reference population are classified as underweight. Children whose weight-for-age Z-score is below minus three standard deviations (-3 SD) from the median are considered severely underweight (based on World health Organization (WHO) standards). Information on various parameters was collected using a predesigned questionnaire.

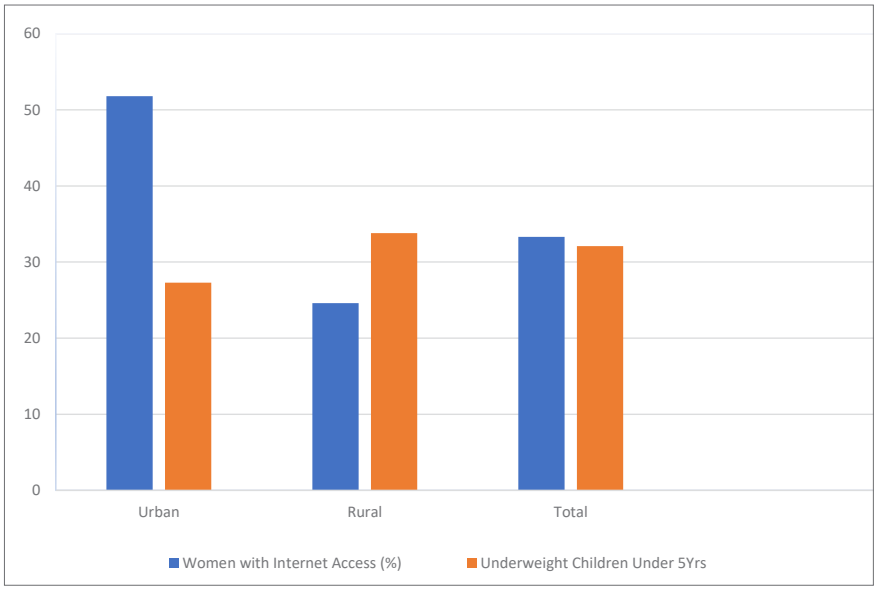

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Figure 1. National level data on women with internet access (%) and underweight children under five years of age (%)

Data analysis

Descriptive statistical analysis of the data was performed by calculating the Mean, median, and range. Pearson correlation coefficient analysis, simple linear regression, and multiple linear regression analysis were carried out to study the relationship between the independent variables (i.e. operational AWCs (%) and women with internet access [%]), with dependent variable -underweight children per state (%). Regression analysis was used to assess the specific forms of the relationships between variables whereas correlation analysis was used to measure the strength of the relationship between the variables. Social Science Statistics (2024) tools are used for the above analysis. The significance level of 0.05 was considered for analysis.

Results

National-level data in NFHS-5, on the percentage of women with internet access shows, urban women (51.8%), rural women (24.6%), and total (33.3%). Whereas the percentage of underweight children shows it is (27.3%) in urban India, (33.8%) in rural, and the total is 32.1% (Table 1) (Figure 1).

In every state of northern India, the percentage of urban women with internet access is higher than in rural areas (Table 2). The mean of women with internet access is 63.58 in urban areas as compared to 45.35 in rural areas. The average of total women with internet access is 51.92 for the country's northern region. In some of the northern states, a greater number of urban children were underweight compared with their rural counterparts. Some states have shown an increase in the percentage of underweight children when compared to NFHS4 data. In contrast, some other states of northern India have also shown a reduction in the percentage of underweight children.

In the northern region of India, the state of Uttar Pradesh has shown the highest number of AWCs (189024). Despite having the maximum number of AWCs here; the highest number (32.1%) of underweight children are observed. In spite of having more AWCs, the underweight children in some of the UTs in this region are more compared to UTs with lesser AWCs. The only variable of women's access to internet varies here. The states or UTs with lower number of AWCs have a higher percentage of women with internet access as compared to UTs with more AWCs.

Similar results are seen for the rest of the regions of the country. Regarding women's access to the internet in all states of south, east, west, central and north east India, the number of urban women with access to the internet is more than that of rural women. Some states of these regions have shown an increase in the percentage of the total number of underweight children compared to NFHS4 data. In spite of having a lesser number of AWCs, some of the states of these regions have a lesser number of underweight children. The better nutrition results in these states might be due to the better internet access for women.

Table 1. Women with internet access (%) and children under five years who are underweight (weight-for-age) (%)

National Level Data	%	
	Women With Internet Access	Under-weight Children Under 5 yrs (Weight-for-age)
Urban women- NFHS-5	51.8	27.3
Rural women- NFHS-5	24.6	33.8
Total- NFHS-5	33.3	32.1
NFHS 4 (2015-16)	No data is available in NFHS-4 survey	35.8

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Table 2. Geographical region-wise AWCs, women with internet access (%), and underweight children under five years (%)

Geographical Region	Descriptive Analysis	No. AWC Operational	%						
			Women With Internet Access			Under-weight Children Under 5 yrs (Weight-for-age) NFHS-5			Under-weight Children Under 5 yrs (Weight-for-age) NFHS-4
			Urban	Rural	Total	Urban	Rural	Total	Total
North	Mean	35769.56	63.58	45.35	51.92	21.22	21.475	22.311	25.01
	Median	20088	63.7	44	49.7	20.5	21.35	21	24.5
	Range	188574	28.7	44.7	44.6	11.2	21.8	15.2	22.9
South	Mean	30804.88	52.68	33.38	42.95	22.4	25.9875	25.1	25.325
	Median	34404	52.95	31.95	40.95	22.55	27.3	24.75	23.7
	Range	65819	33	42.1	40.9	14.3	21.3	17.6	19.1
East	Mean	87504.75	46	18.75	25.6	29	36.925	35.575	39.425
	Median	94573	43.9	19.15	25.2	29.35	37.45	35.8	39.15
	Range	84011	19.4	8.7	10.8	14.3	10.8	11.3	16.2
West	Mean	45399.2	57.36	32.82	43.22	29.62	35.94	33.22	34.32
	Median	53027	54.3	23.8	36.9	33.3	38	36.1	36
	Range	110024	29.2	50.8	42.9	11.1	16.9	15.7	15.5
Central	Mean	74510.5	45.5	20.45	26.8	27.2	33.45	32.15	33.45
	Median	74510.5	45.5	20.45	26.8	27.2	33.45	32.15	33.45
	Range	45249	2	0.7	0.2	2.8	1.5	1.7	1.5
North-east	Mean	12807.88	63.06	39.562	47.212	16.662	22.112	22.11	19.862
	Median	5769	62.15	40.35	47.35	14.75	21.55	21.55	18.05
	Range	60430	53.4	50.4	53.8	16.9	20.1	20.1	17.8

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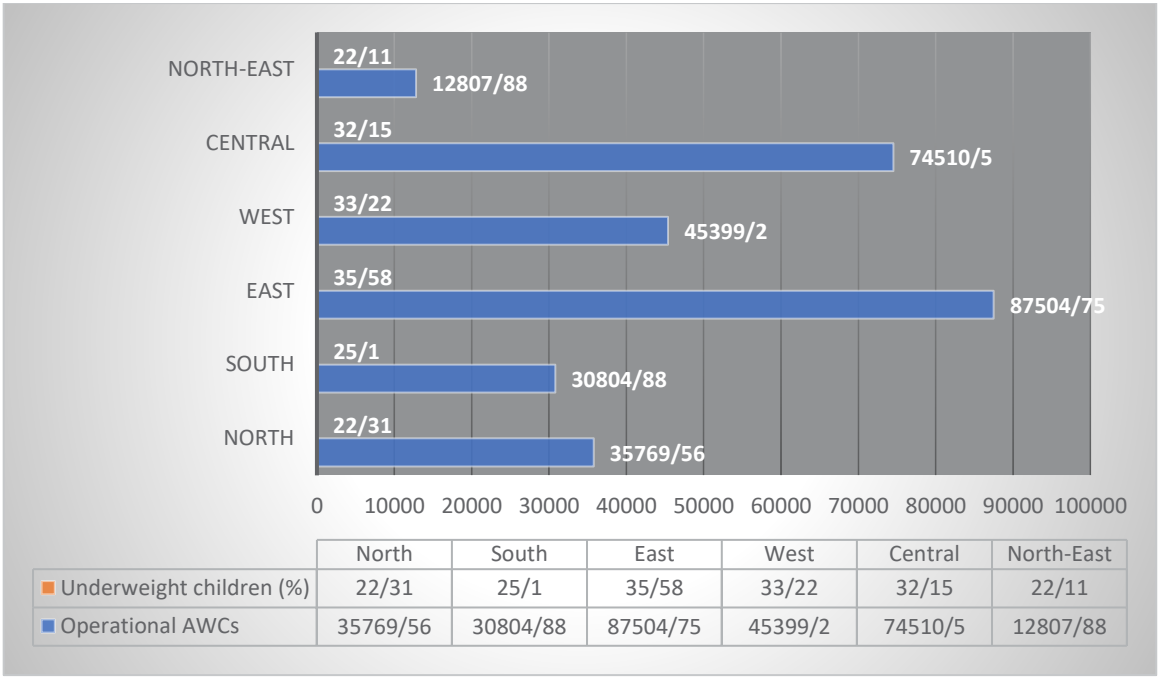

	North	South	East	West	Central	North-East
Underweight children (%)	22/31	25/1	35/58	33/22	32/15	22/11
Operational AWCs	35769/56	30804/88	87504/75	45399/2	74510/5	12807/88

Figure 2. Mean of number of operational AWCs and percentage of underweight children below 5 years old

When the mean was compared for the geographical regions of the country, the eastern region showed the highest number of AWCs (87504.75) whereas the north-east had shown the lowest number of AWCs (12807.88). But when the mean percentage of underweight children for various geographical regions is analysed, the highest number of underweight children (35.58%) is seen in the eastern region whereas the lowest number of underweight children is seen in the North-east region (22.11%) of the country (Figure 2).

When the mean was calculated for internet access and the percentage of malnourished children for each geographical region of India, North India has the highest number of women with internet access (51.92%). North is followed by the northeast (47.21%) region, west (43.22%), south (42.95%), central (26.8%), and east (25.6%) (Figure 3).

The eastern region has shown (35.58%) the highest number of underweight children. This region is followed by west (33.22%), central (32.15%), south (25.1%), north (22.31%), and northeast (22.11%). Compared to NFHS4, the mean of all these geographical regions for underweight children shows a reduction except for the northeast region.

When the range was calculated for various geographical regions, the highest value of range was observed for internet access for Northeast India (53.8), which means that the difference in internet access for different states is grater here. Some states have women with more internet access and some states have less. Northeast is followed by north (44.6), west (42.9), south (40.9), east (10.8), and central (0.2) regions.

When the range was compared for the percentage of underweight children in various geographical regions, the Northeast showed the maximum value (20.1). It is followed by south (17.6), west (15.7), north (15.2), east (11.3) and central (1.7) region. When the range was compared for operational AWCs for all geographical regions, the north showed the highest (188574) range followed by west (110024), east (84011), south (65819), north-east (60430), and central (45249).

The regression analysis results in this study show a linear correlation between the variables of women's access to the internet and children under five years who are underweight (weight-for-age) in India. Here β coefficient is -0.36 ($P< 0.001$) meaning that when you increase women's access to internet by 1, the value of Y which is the percentage of underweight children decreases by 0.3552 (Table 3).

The simple linear regression analysis of the independent variable AWCs (%) in the state- and the dependent variable- the percentage of underweight children per state shows $\beta=1.46$, $P<0.001$. R-squared (R^2) equals 0.3366. This means that 33.7% of the variability of Y-

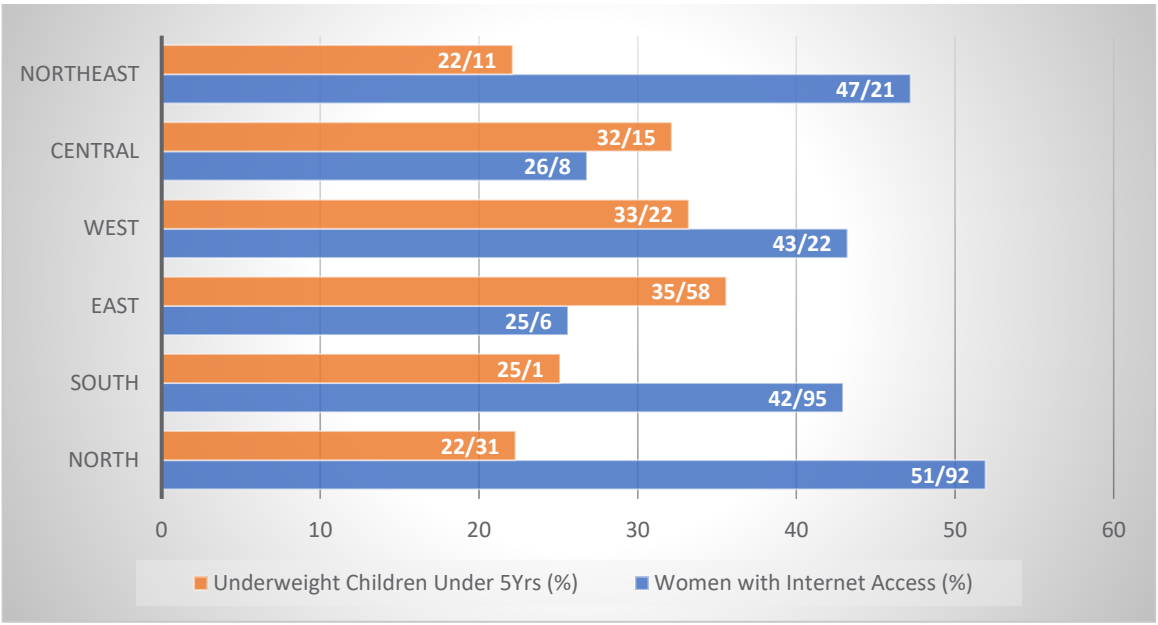

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Figure 3. Geographical distribution of the average of women with internet access (%) and underweight children under five years (%)

the dependent variable (i.e. underweight children) is explained by X variable (i.e. AWCs).

To examine the relationship between the dependent variable and one of the independent variables, a linear regression analysis was done. Multiple regression is used to understand how the two independent variables influence the outcome. Both regression analyses will be helpful in predicting effective and accurate results for targeted policy interventions.

Multiple linear regression was done to investigate the relationship between independent variables- operational AWCs (%) and women with internet access (%), and dependent variable- underweight children per state (%). The developed model shows β0=37.1607, β1=0.5659, and β2=-0.2907 as well as R^2 value as 0.5709. This shows independent variables significantly influence the number of underweight children in the state. It shows that with an increase in the number of women with internet access, the number of underweight children decreases (Table 4).

Results of the Pearson correlation indicated that there is a significant positive relationship between operational AWCs (%) and the percentage of underweight children in the state, (r (34)=0.58, P<.001). Results of the Pearson correlation indicated that there is a significant large negative relationship between women's access to internet (%) and the percentage of underweight children in the state, (r (34)=0.733, P<.001) (Table 5).

The results of inferential statistical analysis show a positive correlation between AWCs and population of underweight children. However, the descriptive analysis show discrepancy with relation to the number of AWCs and number of underweight children. This is indicative of the role of other factors related to the efficiency of AWCs which is influencing the population of underweight children.

Here the comparative results indicate that women's access to internet can give better results in reducing the number of underweight children than the AWCs. The above statistical analysis shows that women's access to the internet has a significant role in reducing the percentage of underweight children when compared to AWCs.

Table 3. Simple linear regression analysis of independent and dependent variables

Dependent Variables	Independent Variables	T-statistic	P	β-coefficient	r	R^2
Underweight children	Women with Internet Access	-6.2918	0	-0.3552	-0.7335	0.538
Underweight children	AWCs	4.1536	0.0002	1.458	0.5802	0.3366

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Table 4. Multiple regression analysis for the study variables

Predictor	Co-efficient	Estimate	Standard Error	T-statistic	P	Summary of Overall Fit
Constant	β 0	37.1607	3.7481	9.9145	0	
AWCs	β 1	0.5659	0.3553	1.5927	0.1208	R^2=0.5709 Overall P=0
Women with internet access	β 2	-0.2907	0.0685	-4.2453	0.0002	

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Table 5. Pearson correlation analysis for study variables at significance level of 0.05

Independent Variables	Dependent Variables	Pearson Correlation Coefficient (r)	R^2	P	Inference
AWCs	Underweight children	0.5802	0.3366	0.0002	Moderate positive relation
Women with internet access	Underweight children	-0.7335	0.538	0.00001	Moderate negative relation

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Discussion

Earlier studies have proved the role of community-based childcare centers in improving child nutrition and development (Gelli et al., 2017). Our study clearly shows when compared with women's access to internet, AWCs have a limited role in the nutrition and proper weight of the child, thus internet access for mothers can be one of the possible determinants of improving a child's nutrition. Our results are in agreement with the studies which concluded that they have failed to deliver the program efficiently in spite of several positive changes in the ICDS. They have contended that the program will not be able to deliver effectively until the several loopholes are not channelized effectively (Aziz, & Abdul Azeez, 2023., Chakraborty et al, 2024).

About half of all fatalities in children under five are attributable to undernutrition (UNICEF, 2023). Asia is home to over 70% of malnourished children, with India, Pakistan, and Bangladesh having the highest prevalence in this region (Akhtar, 2016). In the digital age, the penetration of the internet and social media have become determinants of lifestyle changes and the resulting health consequences (Deetjen, 2018).

Our study results are similar to the earlier studies where the urban or rural area was the determinant of child malnutrition (Rahman & Rahman, 2019; Akram et al., 2018). A study in northern Ethiopia showed that children born to rural mothers were more likely to be severely underweight than children born to urban mothers. The reason for the rural-urban gap may be that in urban areas, women have more access to information about child nutrition, health services, and feeding practices (Abebe et al., 2022).

A similar urban-rural divide was noticed in the Bangladesh population where access to primary education, household socioeconomic status, adequate maternal healthcare utilization, improvement of transportation, and awareness about nutrition in urban areas compared to rural ones are the determinants behind this divide (Anik et al., 2021). That urban children from families with higher average monthly incomes do not exhibit undernutrition problems may be because higher income levels increase their ability to provide more than enough nutrition for their growing children (Gudu et al., 2020).

Regarding the number of underweight children, our findings indicated geographical variations across the country indicating that more number of underweight children were in rural areas. Similar to our study, geographical variations and urban-rural variation were noticed in earlier studies (Khan et al., 2019). Here children of higher birth orders (4 or more) living in rural areas of central, eastern, and north-eastern regions of the country are benefitting from AWCs. AWCs provide mid-day meals to children throughout the country especially in rural areas via the government-run integrated child development scheme (ICDS). Ministry of Women and Child Development under the ICDS has set up community day-care centers or AWCs. Other than mid-day meal it provides five more services-immunization, nutrition & health services, referral services, supplementary nutrition, and non-formal pre-school education. Urban children generally do not have access to these AWCs (Chandra, 2020). Locally available food variety and social customs related to dietary habits are also reasons behind the geographic variations in the diet adequacy of children (Longvah et al., 2017).

The contributing factors for undernutrition may differ from one region to another (Gangurde et al., 2023). In our study, the variation was noticed at the state level as well as regional levels. Our results are similar to the results of the study carried out in Ethiopia to understand the cluster variation of underweight and detecting spatial heterogeneity at the sub-national level over time (Atalell et al., 2022). This will be useful for identifying gaps in child nutrition programs at the state level and coming up with targeted nutritional interventions for the population at risk.

A prevalence study carried out in a population of Nepal shows the similar effect of the socioeconomic divide on the outcomes of child nutrition. This study suggests context-specific health information education and communication (IEC), behaviour change communication (BCC) materials such as radio jingles, posters, pamphlets, and other pictorials can be designed in the local languages and delivered through multiple channels so that messages can be reached out to disadvantaged communities (Adhikari et al., 2017). This also applies to the Indian population, where by disseminating health information in regional languages via the internet, the government can cover maximum population cost-effectively. Studies have proved that internet access significantly facilitates healthcare access and mitigates the negative impact of income inequality on healthcare access (Yu & Meng, 2022; Duplaga, 2021).

In our study, some states had a higher number of underweight children in their urban areas compared to rural ones. Our results match the earlier studies where the prevalence of underweight was more seen in an urban slum than in a rural area (Murarkar et al., 2020; Bhadoria et al., 2013). It was observed in these studies that the low income of the family had resulted in underweight children from an urban slum. A study carried out in Bangladesh has also shown more underweight children in urban slums than in rural ones. The study states that for people living in slums, poverty is related to low income and consequent consumption patterns. In the majority of cases, the poor are not involved in stumpy-earning jobs and often have inadequate income which subsequently results in spending the majority of their earnings on food, mainly staples like rice, cereals, lentils, potatoes, and vegetables, and usually evade costly items like meat and poultry, milk, and fruits. There are schools of thought indicating that chronic malnutrition and undernutrition among children are often the result of deprivation of such necessary food items over a long period (Ahsan et al., 2017).

In recent years the internet has become a popular source of health information (Javanmardi et al., 2018; Sun et al., 2022). Research studies show a relationship between internet technology and dietary health. These effects are mixed. A significant positive association has been seen between internet use and fast-food consumption in rural Chinese children (Hansstein, et al., 2017). In contrast, a study in Iran shows that knowledge of nutrition from the internet can improve dietary quality (Joulaei et al., 2018).

A study carried out on an Indian population shows that eHealth movement is underway within healthcare systems in developing countries, but the adoption of eHealth resources remains low (Shaohai et al., 2021). This study on Indian population further says demographics, health beliefs, and technology enablers are the significant factors for the use of eHealth. It also adds ahead, these factors influence the prevalence of internet health information seeking (IHIS), the diversity of IHIS, and discussing internet health information with doctors. Understanding the factors affecting the health digitization process can help better promote eHealth adoption in developing countries like India. A study carried out in Africa for the implementation of universal health coverage suggests innovative strategies such as digital health (Olu et al., 2019). Certainly, the successful deployment of it on a wider scale faces several challenges for geographically diverse countries like India. Digital health has several benefits namely improving access to healthcare services, especially for those living in remote areas, improvements in safety and quality of healthcare services and products, improved knowledge and access of health workers and communities to health information; cost savings and efficiencies in health services delivery and improvements in access to the social, economic and environmental determinants of health, all of which could contribute to the attainment of universal health coverage. Similar to Africa, India also faces the challenges in deployment of digital health like weak health systems, lack of awareness and knowledge about digital health, and poor infrastructure such as unstable power supply, and poor internet connectivity.

India has 40 cities with over a million population, 396 cities with between 1,00,000 and 1 million, and 2500 cities with between 10,000 and 1,00,000 (Sarkar, 2022). The internet and electricity should be provided in these areas on a priority basis. Studies have shown that the diffusion of internet services has dramatically reduced informational frictions and has given people unprecedented sources of health information (Tan & Goonawardene, 2017; Benda et al., 2020; Rubin, 2021).

Nutrition education has a significant impact on increasing maternal knowledge and children's nutritional status and age-appropriate weight. Nutritional education can be achieved through booklets, guidebooks, leaflets, and internet technology applications (Prasetyo et al., 2023).

This study has made considerable contributions to literature but some limitations will be addressed in the future. Our study is based on the data of the Ministry of Health and Family Welfare, Government of India collected for NFHS-5. The limitations which are related to any secondary data are also associated with this data. There are many factors that are responsible for the weight of children. Only two factors are discussed in this paper, and there is no way to comprehensively consider the impact of other factors on the results in this paper, such as social and cultural barriers. These are the focus of our next research. Also, there is no data available for the internet access to women in NFHS-4 for comparison with data of NFHS-5.

Conclusion

This study shows women's access to internet is far more beneficial in improving child nutrition if compared to the community day-care centers (AWCs). Problem of underweight in children is not only seen in rural areas but is also observed in urban areas. At the same time, urban-rural gap in access to the internet for women is observed in this study. Underweight of children is a key indicator of their malnutrition. Such a child can be stunted, wasted, or both. Low-cost, easy-to-implement, and innovative strategies are needed to tackle the problem. Interventions using technology might help to improve the situation faster. Contrary to expectations, though the penetration of the internet is increasing in India, women still have less access to the internet. The disparities in access to the internet should be treated as a public health issue as internet access has become a social determinant of health information. The outbreak of COVID-19 has highlighted that lack of internet access is a lack of access to health information, so it becomes an important determinant of public health. Women should be treated as a focused group and provided with broadband internet as they are responsible not only for their health but for their children's health. Indeed, women living in rural areas, remote areas, and less educated women can remain deprived of health information due to lack of access to the internet which can affect their and their children's health. Internet access and health information in regional languages should be provided to women/mothers which can help to achieve SDGs related to maternal and child health. Workers at AWCs should be empowered with internet technology so they can have access to information related to nutrition in children.

Ethical Considerations

Compliance with ethical guidelines

Our study is based on the publicly available anonymised secondary dataset of the NFHS-5 surveys with no identifiable information on the participants and can be freely accessed from the Ministry of Health and Family Welfare website in India. As per the data, the ethical approval for the NFHS-5 surveys is obtained from the Ethics Review Board of the International Institute for Population Sciences, Mumbai, India. These surveys are reviewed and approved by the ICF Institutional Review Board, USA. As per the NFHS-5 data, informed written consent for participation in this survey is obtained from the respondents during the survey. Each individual's approval is sought before the participant interview, as per the consistent methodology followed in these national surveys.

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Authors' contributions

Conceptualization, methodology, analysis, and investigation: Jaimini Sarkar; Supervision, statistical analysis, original draft preparation: Chiradeep Sarkar; Review, editing and final approval: All authors.

Conflict of interest

The authors declared no conflict of interest.

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