Impact of community-based mitanin programme on undernutrition in rural Chhattisgarh State, India

Sheila C. Vir, Anuska Kalita, Shinjini Mondal, and Richa Malik

Abstract

Background. *Community health workers known as mitanins undertook family-level counseling and mobilized the community to improve coverage of maternal and child health services in the state of Chhattisgarh, India. The Nutrition Security Innovation (NSI) project was launched in selected blocks with additional inputs for promoting appropriate complementary feeding practices and disseminating information on Public Distribution System (PDS) entitlement. Within 3 years of project implementation, all NSI inputs in the project group (PG) were scaled up in the entire state.*

Objective. *To study the impact of interventions on nutritional status in PG and non-NSI comparison group (CG) blocks.*

Methods. *Quasi-experimental mixed methods were used. The sample consisted of 3,626 households with children under 3 years of age and 268 mitanins.*

Results. *A ratio of 1 mitanin per 250 to 500 population was effective. The coverage of exclusive breastfeeding, timely introduction of complementary feeding, DPT immunization, and antenatal care services was more than 70%. The PDS reached almost 90% of beneficiaries. In both the PG and the CG, one-third of children were undernourished, with one-quarter of children undernourished by 6 months of age. The prevalence of low birthweight was over 40%, and half of all women were undernourished. The estimated annual average reduction rate (AARR) for the entire state was estimated to be 4.22% for underweight and 5.64% for stunting.*

Conclusions. *The strategy of Mitanin Programme in the Indian state of Chhattisgarh was unique with the implementation of direct nutrition actions being spearheaded by the health sector and community health volunteers in coordination with the Integrated Child Development Services (ICDS) and the Public Distribution System (PDS). The highest priority was given to interventions in the first 92 weeks of life. This implied ensuring frequent counseling and delivery of services through the entire pregnancy period and continued follow up till the children were at least one year of age. An accelerated decrease in the annual rate of reduction of underweight and stunting was observed. The emerging findings point to the significant contributions that can be made by the National Rural Health Mission (NRHM) in India by involvement of community health volunteers known as Accredited Social Health Activists (ASHAs) towards reducing the persistent problem of undernutrition in the country.*

Key words: Annual average reduction rate of undernutrition, community volunteers, direct essential nutrition interventions, health sector

Introduction

A community-based approach, the Mitanin Programme, was launched by the health department in the state of Chhattisgarh, India, in November 2001. The state of Chhattisgarh was carved out from the large state of Madhya Pradesh in 2000. The state, located in the southeast part of central India, has 27 districts with a total population of more than 25 million [1]. The population is primarily rural, and 86% of households in the state belong to marginalized and socially excluded groups, one-third of whom are Scheduled Tribes. The Mitanin Programme is a part of the health sector reform initiated by the state government and is based on the principle of "empowerment concept of people's participation in the field of public health" [2]. Mitanin is a local term for a close female friend. Unlike traditional community health workers who provide

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healthcare or link the community to health services, mitanins are viewed as agents of social change. The launch of the Mitanin Programme was considered crucial to address the very high infant mortality rate of 95 per 1,000 live births in the state, as compared with the national average of 74 per 1,000 live births [3, 4]. Child feeding practices also revealed a grim scenario, with less than 15% of infants breastfed within 1 hour after birth. The prevalence of stunting among children in 1998/99 was 60.8% [4].

The Mitanin Programme is a unique initiative launched by the state to improve coverage of reproductive and child health services, such as routine immunization, antenatal care services, institutional deliveries, and promotion of breastfeeding practices. The programme involves over 60,000 women community volunteers who are elected by the communities and work as counselors for families having either pregnant women or children under 3 years of age. The role of mitanins concentrates on undertaking family-level outreach services, creating demand, and improving coverage of maternal and child health services, as well as supporting the health department in community organization-building and social mobilization on health and its determinants. Initially, the mitanins were not entitled to any honorarium, but since 2005, under the National Rural Health Mission, the mitanins have received incentives linked to various tasks [5]. Since the inception of the Mitanin Programme, a support structure for trainers, with each trainer working with 20 mitanins who are further supported by two or three block coordinators, has been established for training, monitoring, and motivation of the mitanins.

In 2006, the Nutrition Security Innovation project, linked to the ongoing statewide Mitanin Programme, was launched in 23 blocks of 11 districts for accelerating reduction of rate of undernutrition. To date all reported community-based nutrition activities in India have been implemented in a project mode through the Integrated Child Development Services (ICDS) and have not been scaled up in the states [6–9]. In the NSI project, the ongoing Mitanin Programme continued to be implemented by the health sector with the addition of the specific project activities related to improving the nutrition situation. These included intensive behavioral change communication for promotion of appropriate complementary feeding practices along with continued promotion of exclusive breastfeeding for the first 6 months, establishment of kitchen gardens for promoting usage of locally available nutritious foods, and informing the community of their entitlements to subsidized food items through the state-modified Public Distribution System (PDS). The PDS is a food security program in India that, following the national guidelines, is expected to supply a minimum food basket of cereals, sugar, and kerosene cooking fuel at a cost subsidized by the Government of India primarily to prevent hunger. Modifications to the PDS food basket as well as the implementation design are the responsibility of the state government. The PDS was implemented in the entire state, but under the NSI project, actions were designed to inform families of their PDS entitlement and specific awareness activities were planned and implemented by mitanins.

In 2009, two of the three interventions of the NSI project, consisting of intensive promotion of child feeding and creating awareness of entitlement to the state-modified PDS system, were added to the ongoing Mitanin Programme and operationalized in the entire state through the health system comprising 4,741 sub-health centers, 721 primary health centers, 136 community health centers, 18 district hospitals, and 3 medical colleges. The interventions related to kitchen gardens were not scaled up.

Methods

A study was conducted in October and November 2011 to assess the impact of the NSI project interventions as compared with the impact of the overall Mitanin Programme in the rest of the state. Those receiving the NSI project interventions are referred as the project group (PG), and those receiving the overall Mitanin Programme in the rest of the state are referred to as the comparison group (CG). The NSI project was launched in 2006 in 23 selected blocks of 11 districts. Later, in 2009, the nutrition interventions of PG were also built into the ongoing Mitanin Programme in the remaining blocks of 11 PG districts and the rest of the 16 districts of the state.

A quasi-experimental, mixed-method design was used. Additionally, the combined data from the PG and the CG, representing the state nutrition situation, were compared with the last available state data from 2005/06 [10] for assessment of the annual average reduction rate (AARR) of undernutrition.

The sample size for each PG and CG was 1,800 households with children under 3 years of age. This sample size was calculated to detect at least a change of 5% with 95% confidence interval at 80% power for a design effect of 1.3. In addition, the study sample included about 150 mitanins from each of the two groups.

Two of the 11 NSI project districts prone to political disturbances were excluded. In the 9 districts, a total of 16 blocks and 360 villages were selected. Twelve respondents were randomly selected from each village who had children from each of the age groups 0 to 6 months, > 6 to 23 months, and > 23 to 35 months. Only mothers of infants 0 to 6 months of age were interviewed regarding antenatal care and breastfeeding practices. The respondents, including the mitanins, were interviewed with the use of field-tested

questionnaires in the local language.

Ethical clearance was granted to the study by the Ethical Review Committee of the Centre for Child Health and Nutrition—a non-governmental organization. Oral consent was obtained from the respondents before starting the interview. Every respondent had the right to refuse to be interviewed or to answer any specific survey questions. The investigators were trained to be sensitive to the respondents and to conduct interviews in a comfortable environment with the maintenance of confidentiality.

The children were weighed on a Salter's scale and their height was measured with an infantometer. World Health Organization (WHO) international child growth standards and WHO-ANTHRO software were used to assess nutritional status [11]. The mothers' height was measured with anthropometric rods and their weight with pedestal spring weighing machines.

The Mann-Whitney nonparametric test of association was used to assess the statistical significance of association between variables of interest, i.e., tests of differences between project and comparison groups. All analyses were performed with SPSS, version 17.0.

In the absence of baseline data, the impact on the nutritional status of children in the state was studied by combining PG and CG data and comparing them with the state data for 1998 and 2005 [4, 10]. The limitation of this method is that the current data covered a third of the districts of the state and also included geographic areas with a higher percentage of disadvantaged tribal populations. Data on the status of child feeding practices and antenatal care coverage for the entire state were compared with data from the last available (2009) statewide Coverage Evaluation Survey [12].

TABLE 1. Profile of mothers of children 0 to 36 months of age in the project group (PG) and the comparison group (CG) (% of mothers)

Characteristic	PG (n = 1,825)	CG (n = 1,801)
Age (yr)		
16–19	2.1	2.1
20–24	39.4	41.2
≥ 25	58.5	56.4
Caste		
General and other backward castes (OBCs)	51.0	39.7
Scheduled caste	18.0	21.0
Scheduled tribe	51.0	34.2
Age at 1st childbirth (yr)		
< 20	61.8	66.8
≥ 20	38.2	33.2
Education		
No formal schooling but can read and write	5.5	1.4
No formal schooling and illiterate	32.5	34.7
Completed primary, middle, or secondary school	59.7	61.8
Completed graduation or completed post graduation	2.3	2.2
PDS		
Aware of food entitlement from PDS	46.3	41.4*
Entitled households purchased food from PDS	99.8	99.9

PDS (Public Distribution System)
*$p < .05$.

Results

Education and socioeconomic status

The response rate of the study was 93.5%. A total of 3,626 households with children under 3 years of age were enrolled. Households from the PG and the CG were comparable in education and socioeconomic status. However, the proportion of households from disadvantaged Scheduled Tribes was higher in the PG than in the CG (51.0% vs. 34.2 %) (**table 1**).

Profiles of mitanins

Sixty percent of the 268 mitanins had been working for more than 4 years and 100 percent were literate. Most mitanins were in charge of populations of less than 500 consisting of about 75 to 100 households with about four or five pregnant women. The percentage of mitanins in charge of populations of less than 250 was greater in the PG than in the CG (48.9% vs. 38.0%) (**table 2**). A higher percentage of PG mitanins than CG mitanins visited their households in the preceding 30 days and spent more than 10 minutes with the families (**table 2**). The proportion of mitanins who organized cluster meetings of community members with health functionaries was higher in the PG than in the CG (93.1% vs. 19.7%).

Infant and young child feeding practices

In the total sample, only 1.3% of mothers of infants under 6 months of age reported not having ever breastfed their child; their reasons were insufficient milk secretion, weak child, or ill health. About 50% of mothers initiated breastfeeding within an hour after birth (**table 3**), while over 70% of mothers in both groups practiced exclusive breastfeeding until 4 or 5 months and introduced complementary food between 6 and 8 months (**table 3**). The rate of exclusive breastfeeding decreased substantially after 2 months (**fig. 1**). Half of the mothers fed their children three or more

TABLE 2. Profile of mitanins (community volunteers) in the project group (PG) and the comparison group (CG) (% of respondents)

Characteristic	PG	CG
Education	(*n* = 131)	(*n* = 137)
Primary school	69.5	56.9
High school or above	30.6	43.0
Years of working	(*n* = 131)	(*n* = 137)
< 1	7.6	14.6
1–4	26.7	25.5
> 4	65.8	59.4
Population covered	(*n* = 131)	(*n* = 137)
< 250	48.9	38.0
250–500	38.2	35.0
> 500	12.9	27.0
Time since last home visit by mitanin (days)[a]	(*n* = 131)	(*n* = 137)
≤ 15	32.8	23.6*
16–30	38.3	30.9*
Visited at home by frontline workers[b]	(*n* = 1,729)	(*n* = 1,624)
ANM	80.2	71.6
Mitanin	91.8	85.3
ICDS worker	79.4	79.4

ANM, Auxiliary Nurse Mid-wife; ICDS, Integrated Child Development Services
*$p < .05$.
a. Reported by mitanins.
b. Reported by mothers.

TABLE 3. Breastfeeding and complementary feeding practices reported by mothers in the project group (PG) and the comparison group (CG) (% of respondents)

Practice	PG	CG
Breastfeeding 0–6 mo	(*n* = 605)	(*n* = 599)
Breastfed the youngest child	98.8	98.5
Breastfed ≤ 1 h after birth	52.0	44.6*
Exclusively breastfed at 4–5 mo	80.3	73.8
Complementary feeding (> 6–36 mo)	(*n* = 1,194)	(*n* = 1,182)
Introduced semisolid food at 6–8 mo	73.0	67.8
Introduced semisolid food at 6–9 mo	81.1	77.3
No. of feedings/day	(*n* = 1,194)	(*n* = 1,182)
0–2	32.7	31.5
3 or 4	56.1	49.9*
5 or 6	4.8	7.1
Don't know	6.2	11.0
Added oil or fat to food	33.0	27.3*
Feed mashed food	52.2	39.4*
Child encouraged while being fed	60.9	62.5*
Person who feeds child	(*n* = 1,194)	(*n* = 1,182)
Mother	86.4	76.5*
Grandmother	10.1	10.4
Older sibling, father, or other	16.8	28.7
Handwashing	(*n* = 1,194)	(*n* = 1,182)
Before feeding	82.9	75
With soap and water	59.8	66.9*

*$p < .05$.

times per day, and one-third added fat or oil to the complementary food to increase its energy density. More mothers in the PG than in the CG mashed the child's food, encouraged the child to eat frequently, and spent 30 to 45 minutes in feeding the child. The percentage of mothers who washed their hands before feeding was high in both groups and was higher in the CG (**table 3**). In both groups, only 6% to 7% of children were reported to have suffered from diarrhea in the preceding 2 weeks. Only 4% to 5% of mothers increased the amount of food they gave their children during and after diarrhea. Overall DPT coverage was 75%, and measles vaccine coverage was 56.0% in the PG and 55.4% in the CG.

Maternal care and health services

Over 60% of mothers had their first child when they were under 20 years of age. Over 70% of mothers received three antenatal care services, and over 60% of mothers registered for antenatal care in the first trimester. A significant increase in coverage of antenatal care services and institutional delivery was noted since 2005 (**fig. 2**). Over 80% of mothers in both groups received a supply of iron–folic acid tablets and were advised on the benefits of the tablets (**table 4**). However, only one-third consumed the prescribed minimum of 100 tablets. Only 8.5% of mothers in the PG complained of side effects, as compared with 14.4% in the CG.

PDS and kitchen gardens

Almost 90% of beneficiaries in both groups reported regular receipt of supplies of cereals and sugar from the subsidized PDS (**table 1**). Significantly more households in the PG than in the CG had kitchen gardens (46.6% vs. 32.5%).

Nutritional status of children

The prevalence rates of underweight, stunting, and wasting among children were not significantly different between the two groups. Almost one-third of children in both groups were underweight, one-third were stunted (**table 5**), and 11.1% of children in the PG and 15.3% of those in the CG had severe wasting. By

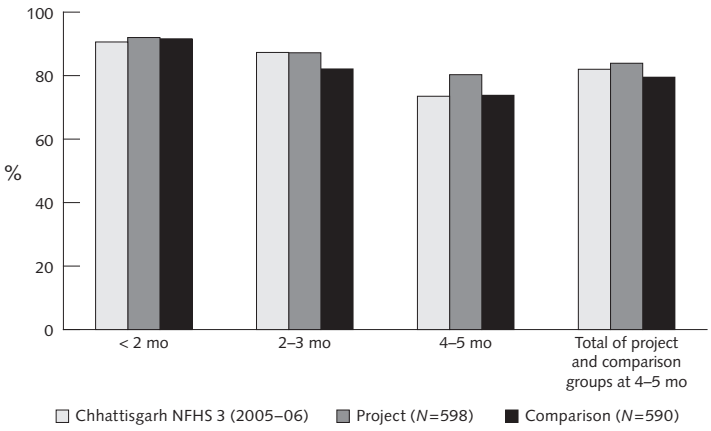

FIG. 1. Trends in exclusive breastfeeding practices in project and comparison groups in 2011 as compared with 2005/06. NFHS 3, National Family Health Survey 3.

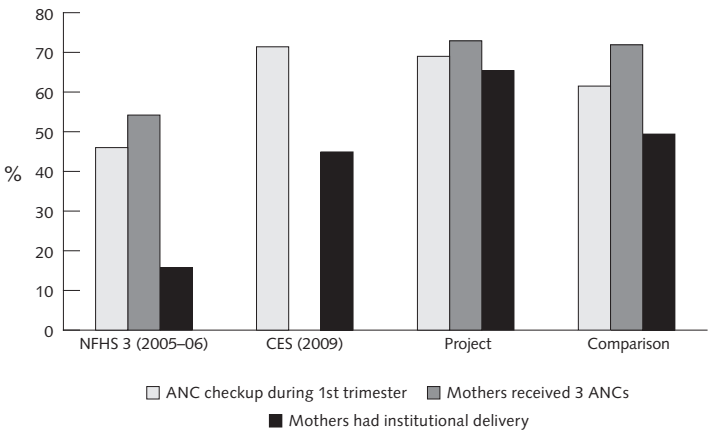

FIG. 2. Maternal care practices reported by mothers of infants 0 to 6 months of age in project and comparison groups as compared with earlier surveys in Chhattisgarh. ANC, antenatal care visit; Coverage Evaluation Survey (CES) [12], and National Family Health Survey (NFHS-3)[10].

6 months of age, one-quarter of infants in both groups were underweight (**fig. 3**). The sharpest increase in underweight prevalence occurred between 6 and 11 months. Almost one-quarter of children were stunted by 6 months of age (**fig. 3**). The highest rates of stunting occurred from 11 to 23 months. Half of the women in both groups were undernourished, with body mass index (BMI) < 18.5 (**table 5**). The rate of underweight, but not the rate of stunting, among children was significantly higher among those whose mothers were undernourished.

Nutritional status of children and women

The rates of underweight and stunting were significantly higher in children of mothers with a history of low-birthweight babies (**table 6**). The association between birthweight and maternal BMI was studied for 893 of the 1,204 infants under 6 months of age. In both the PG and the CG, the percentage of mothers with a history of low-birthweight babies was higher among those with BMI < 18.5 than among those with BMI ≥ 18.5 (**table 7**).

Rate of reduction of undernutrition

The data from the PG and the CG were combined to give an overall picture of nutrition in the state. The combined data were compared with the earlier data available from state nutrition surveys of 1998/99 and 2005/06 [5], and the annual average reduction rates (AARRs) for underweight, stunting, and wasting were calculated. The AARR was 4.22% for underweight and 5.64% for stunting for the period from 2005 to 2011. The corresponding AARRs for the period from 1998 to 2005 were 1.45% and 1.93%. The AARR for wasting

for the period from 2005 to 2011 was 3.53%, compared with 0.4% for the period from 1998 to 2005 (**table 8**).

Discussion

The Mitanin Programme in the state of Chhattisgarh during the period from 2001 to 2009 concentrated not only on improved access to health services but also on nutrition education, prevention of infection, and primary curative services for common ailments. Mitanins were also involved in action on social determinants and health inequity issues, such as domestic violence and dialoguing informally with frontline workers of the ICDS to improve coverage of direct essential nutrition interventions with actions for promoting exclusive breastfeeding, hygiene feeding practices, full immunization, care of pregnant women, and providing support in improving access to subsidized food of the PDS. Actions for promotion of complementary feeding and reaching populations with PDS entitlement were launched in the entire state in 2009. The current survey revealed that over 70% coverage of most of the interventions was achieved in the state, which

TABLE 4. Supply and consumption of iron–folic acid (IFA) tablets by mothers of infants under 6 months of age in the project group (PG) and the comparison group (CG) (% of respondents)

IFA tablets	PG (n = 605)	CG (n = 599)
Supplied with tablets	91.9	82.8*
Received and consumed tablets	(n = 556) % received (% consumed)	(n = 496) % received (% consumed)
< 100 tablets	46.9 (38.5)	50.0 (34.1)
100–120 tablets	51.4 (45.3)	49.0 (39.1)
> 120 tablets	1.6 (1.1)	1.0 (0.8)
Mother advised on importance of IFA	98.9	98.4
Reason for taking IFA		
Own health	26.4	26.6
Quality of blood	67.3	63.5
Health of fetus	30.2	34.9
Safe delivery	9.5	9.1
Others	1.8	2.0
Side effects (nausea, stomach upset) reported	8.5	14.4

*p < .05.

TABLE 5. Nutritional status of children 0 to 35 months of age and body mass index (BMI) of mothers in the project group (PG) and the comparison group (CG) (% of respondents)

Indicator	PG (n = 1,775)	CG (n = 1,749)
Nutritional status of children 0–35 mo		
Underweight	35.0	36.4
Severely underweight	13.8	15.6
Stunted	34.2	35.5
Severely stunted	19.1	19.1
Wasted	28.7	29.8
Severely wasted	11.1	15.3
Undernutrition in mothers		
BMI < 18.5	46.1	47.0
BMI ≥ 25.0	2.5	2.6
BMI of mothers and % of underweight in children 0–35 mo		
BMI ≥ 18.5	32.5*	33.3*
BMI < 18.5	38.0*	39.8*
BMI of mothers and % of stunting in children 0–35 mo		
BMI ≥ 18.5	32.4	33.9
BMI < 18.5	35.7	37.2

*p < .05.

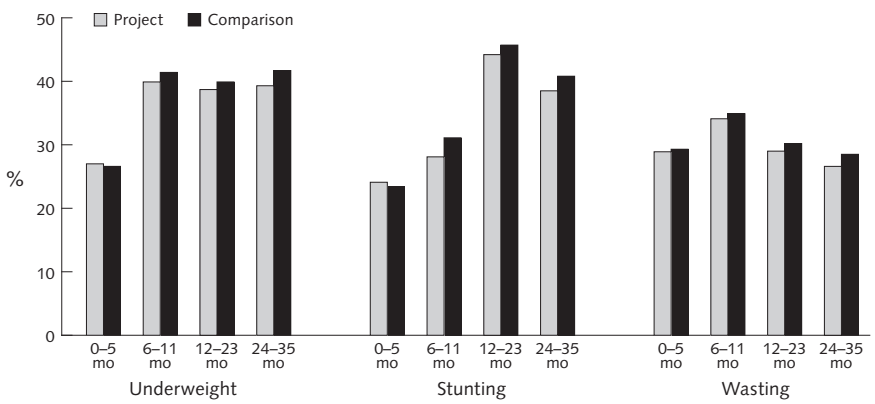

FIG. 3. Agewise trends in nutritional status (– 2 SD) of children 0 to 35 months of age in the project and comparison groups

evidently contributed to the rapid improvement in the nutritional status of children in both the PG and the CG. Improving delivery of these direct interventions, with at least 90% coverage, has been recommended for addressing immediate causes of undernutrition and reducing undernutrition rates by about 30% [13–16]. An analysis of data on coverage of selected essential direct nutrition interventions and stunting rates across the various states of India has also demonstrated a statistically significant association [16]. The Scaling Up Nutrition (SUN) Framework for Action also promotes such nutrition-specific direct interventions, along with actions for influencing the underlying causes of undernutrition [17].

In the current study, the difference in nutritional status of children in the project and comparison groups was not significant. This could possibly be due to a poorer undernutrition scenario in the PG at the time of the NSI project launch, since the PG had a higher proportion of tribal population than the CG (51.0% vs. 34.2%), and the available data show that the tribal population is invariably nutritionally worse off [10]. Moreover, the specific activities of the NSI project interventions, such as active promotion of complementary feeding and ensuring access to subsidized food through the PDS, were scaled up in the entire state within 3 years of launch of the project, and this possibly resulted in improvement of the coverage of direct interventions through the support of mitanins

TABLE 6. Birthweight and its association with undernutrition rate in children 0 to 35 months of age in the combined project and comparison groups (% of children) (n = 2,529)[a]

Birthweight (kg)	Underweight (–2 SD) (n = 870)	Not underweight (n = 1,629)
< 2.5	46.2	42.2*
2.5–3.0	41.9	42.2
> 3.0	11.9	15.6
Birthweight (kg)	**Stunted (–2 SD) (n = 870)**	**Not stunted (n = 1,659)**
< 2.5	47.6	41.5*
2.5–3.0	40.3	43.0
> 3.0	15.4	12.1*

*p < .05

a. The rate of low birthweight in the total population studied was 43.6%.

TABLE 7. Association of low birthweight (< 2.5 kg) and body mass index (BMI) of mothers of infants under 6 months of age in the project group (PG) and the comparison group (CG) (% of newborns)

	PG (n = 480)		CG (n = 414)	
Birthweight	BMI > 18.5 (n = 258)	BMI < 18.5 (n = 222)	BMI > 18.5 (n = 205)	BMI < 18.5 (n = 209)
< 2.5 kg	45.7	55	46.3	49.3
> 2.5 kg	54.3	45	53.7	50.7
Significance (within group, i.e., < 2.5 kg and > 2.5 kg within BMI < 18.5 and BMI ≥ 18.5)	.05275	.03678*	.13845	.76916

*p < .05.

TABLE 8. Comparison of reduction rate of undernutrition in the two periods 1998–2005 and 2005–2011

Period of study	Stunting (%)	Underweight (%)	Wasting (%)
Period 1998–2005 (6-year period)			
NFHS State Survey (1998/99)	60.8	53.2	24.8
NFHS State Survey (2005/06)	52.6	47.8	24.1
Absolute point percentage difference	8.2	5.4	0.7
Annual rate of percentage prevalence decrease	1.17	0.77	0.1
Relative % decrease	13.49	10.15	2.82
AARR	1.93	1.45	0.40
Period 2005–2011 (7-year period)			
NFHS 2005	52.6	47.8	24.1
Current survey 2011	34.8	35.7	29.2
Absolute point percentage difference	17.8	12.1	5.1
Annual rate of percentage prevalence decrease	2.96	2.00	0.85
Relative % decrease	33.84	25.3	21.16
AARR	5.64	4.22	3.53

AARR, Annual Average Reduction Rate; NFHS, National Family Health Survey

in the entire state, including the comparison blocks, as well as in reducing the difference between the project and comparison groups.

The AARR for underweight in the state of Chhattisgarh was 4.22%, almost double the AARR of 2.9% reported for the 100 focused districts of India in the HUNGaMA nutrition survey and the lower rate noted in the neighboring state of Madhya Pradesh for the same period of 2005 to 2011 [10, 18]*. The AARR for stunting in the state was 5.64%, which is much higher than the rate of 3.9% per year recommended by WHO for achieving the global target of a 40% reduction in the global number of children under 5 years of age who are stunted by 2025.**

The accelerated rate of decrease in undernutrition observed in this state could be due to the leading role played by the health sector in the implementation of the selected direct nutrition interventions through organizing frequent counseling at the family level of households with children under 3 years of age, social mobilization activities, and responding to demands created for maternal and child health services with the support of community mobilizers or mitanins. In the Indian context, this program design is important, because normally the health sector plays only a secondary role to ICDS for nutrition intervention actions.

Involvement of community volunteers in family-level counseling for behavioral change and for appropriate delivery of health and nutrition services proved effective. Such an impact of community volunteers in contributing to behavioral change at the family level and in the rapid decrease in undernutrition prevalence was reported from Thailand when a ratio of 1:15–20 households was built into the program strategy [19]. Unique streamlining of the PDS as a high political priority in Chhattisgarh State also appears to have contributed to the positive impact on nutritional status. The impact of the effective PDS strategy on food diversity in complementary feeding of children could have contributed significantly to improving the nutrition scenario.

A higher impact on nutritional status could have been achieved if nutrition of adolescent girls and mothers had been addressed to reduce the observed high incidence of low birthweight and to prevent undernutrition in the first 6 months of life. In the current survey, one-quarter of infants were underweight or stunted in the first 6 months of life, and undernutrition rates were significantly associated with low BMI in mothers and a history of having low-birthweight children. It is well documented that the chances of low-birthweight children growing into normally nourished young children are lower than for normal birth children [20]. A longitudinal study showed that low birthweight increases the risk of underweight by 3 to 5 times, stunting by 2.1 to 4.3 times, and wasting by 2.2 to 2.9 times in the first five years of life [21]. Special care in feeding low-birthweight children is critical, along with measures for addressing the problem of malnutrition in adolescence and ensuring mothers enter pregnancy at the right age with adequate weight as well as adequate iron storage [21, 22].

The current data and earlier reports reveal that growth failure begins in the first year of life itself [10, 20, 21], and the prevalence of underweight and stunting continues to increase between 6 and 23 months and almost plateaus thereafter [10, 23, 24]. A recent longitudinal study showed that growth failure prior to 12 months is strongly associated with short adult stature as compared to linear growth failure occurring between 12 and 24 months or 24 months and mid-childhood [24].The importance of giving the highest priority to actions reaching pregnant women and infants and children in the first 92 weeks of life is evident.

The current findings are of immense significance because efforts are being directed in India to scale up the selected direct interventions along with intensifying actions to influence nutrition through ICDS and the health sector [25]. The current findings reveal that with the active role of mitanins, the health sector reached mothers and infants with direct essential nutrition intervention actions, improved coverage, and made a significant difference in the rate of reducing undernutrition in Chhattisgarh. Moreover, the country today has a suitable infrastructure of community health volunteers, built on the concept of mitanins and other community-based projects [8], who are referred to as Accredited Social Health Activists (ASHAs), under the National Rural Health Mission (NRHM) program [5]. The existing network of ASHAs offers an opportunity for adopting the lessons learned from the Mitanin Programme in the NRHM. This implies building on the current tasks of ASHAs, which primarily focus on the incentivized reproductive and child health tasks, such as routine immunization, antenatal care services, and institutional deliveries. It is imperative that ASHAs be trained to be involved simultaneously in focusing on the implementation of all the essential direct nutrition interventions in order to make a rapid difference in the persistent problem of undernutrition in the country.

Authors' contributions

Sheila C. Vir provided technical support in analysis and interpretation of the survey data and was the lead author. Anuska Kalita supported the development of research tools and coordinated with the survey agency for technical and administrative support. Shinjini Mondal coordinated with the survey agency regarding

*National Institute of Nutrition (NIN). Nutrition Profile of Madhya Pradesh, Directorate of ICDS presented to State Government of Madhya Pradesh. Personal communication, 2010.

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