Determinants of Micronutrient Fortified Blended Food (Balbhog) Consumption among Children 6–35 Months of Age Provided through the Integrated Child Development Services Program in Gujarat, India

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Abstract

Context: The state of Gujarat had introduced Extruded Fortified Blended Food, Balbhog, as take-home ration for children 6–35 months of age. The study aimed to understand awareness, availability, and consumption pattern of Balbhog and gain insights on factors influencing its regular use. Aims: This study aims to understand coverage and feeding practices of micronutrient fortified blended food (Balbhog) and determine factors for its regular use. Subjects and Methods: A cross-sectional survey of 1623 households with children of 6–35 months of age registered in Anganwadi centers was conducted in the four districts of Gujarat. Household and dietary survey were conducted to understand child care and feeding practices at household level. Results: The results showed high awareness about Balbhog (88.6%) among caregivers, with majority reporting using it (81.7%) before. Regular Balbhog consumption (42.2%), however, declined considerably across all population characteristics. Monthly distribution of adequate Balbhog packets, taste of Balbhog preparations, meal frequency of children, and caregivers’ participation in the monthly Integrated Child Development Services (ICDS) event emerged as strong predictors of regular Balbhog consumption. No disparity in consumption was observed across socioeconomic characteristics of the population. Conclusion: Household feeding practices and ICDS program factors mediated regular use of Balbhog among children. Improving availability of entitled Balbhog packets, raising awareness about Balbhog preparations, and improving child feeding practices could help in increasing Balbhog consumption in the community.

Keywords: Anganwadi worker, determinants, fortified food, Integrated Child Development Services, take-home ration

INTRODUCTION

India accounts for almost 40% of the undernourished children in the world[1] and responds to this challenge through Integrated Child Development Services (ICDS) program. ICDS program is delivered from Anganwadi centers (AWCs) by Anganwadi Worker – appointed on every 1000 population. The ICDS program in Gujarat which was launched in 1975, currently covers 5.2 million beneficiaries (children under 6 years, pregnant women, lactating mothers, and adolescent girls) through 52,649 operational AWCs.[2] Although the program coverage has increased over the years, implementation challenges regarding targeting of services to eligible households and promotion of appropriate complementary feeding practices still exists.[3] While broad program guidelines are provided by the central government, the Government of Gujarat has introduced many initiatives to improve nutritional status of its population.[3] Under supplementary nutrition programme (SNP), government had introduced micronutrients fortified take-home ration (THR) premixes – Balbhog for children and Sheera, Upma, and Sukhadi for pregnant women, lactating mothers, and adolescent girls.[4]

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Fortification of staple foods has limited impact on young children due to its inadequate consumption. Extruded Fortified Blended Food products (EFBF) are now being viewed as an important intervention to address child malnutrition and their impact on children's growth and development exists in many countries.

Balbhog is a micronutrient-rich EBF product and is made out of wheat (40%), bengal gram (12%), defatted soyabean (12.5%), edible oil (12%), and sugar (28%) with addition of selected micronutrients. Daily intake of Balbhog provides 33% of the Recommended Dietary Allowances (RDA) of calories and proteins and 50% RDA of micronutrients. All 6–35-month age children registered in AWC are entitled for seven Balbhog packets (500 g each) every month, and about 1.8 million children receive Balbhog as part of SNP in the state. The objective of our study was to determine awareness, accessibility, and usage of Balbhog in ICDS program areas of Gujarat and gain insights on factors influencing its regular use.

**Subjects and Methods**

**Study design and setting**

A multistage cluster sampling was conducted to select 1623 children aged 6–35 months registered in the ICDS program. In the first stage, one district each (Surat, Jamnagar, Patan, and Dahod) was randomly selected from the four geographical regions of the state; in the second-stage ICDS, project sectors from each district were selected based on probability proportional to size; in the next stage, one AWC was randomly selected from each ICDS sector; and finally, children were randomly selected from the enlisted 6–35-month age children in the AWCs. A total of 1760 children were selected, and after nonresponse from 137 caregivers, we interviewed primary caregivers (mother) of 1623 children after obtaining their consent. The study protocol was approved by Institutional Ethics Committee of Public Health Foundation of India (TRC-IEC-78/10).

**Survey instruments**

A bilingual questionnaire (Gujarati and English) was designed and translated into the local language and backtranslated for validation. Female investigators – graduates from home science and food and nutrition department – collected data on: (a) socioeconomic and demographic characteristics; (b) infant young child feeding practices; (c) access and consumption of Balbhog; (d) access and utilization of ICDS and health services; (e) dietary intake in the past 24 h; and (f) food frequency pattern.

**Statistical analysis**

Before data entry, supervisors checked questionnaires for its completeness and correctness. Double data entry was made using Microsoft Access. For analysis, all Balbhog preparations were clubbed under Balbhog, and its consumption of at least five times a week was considered as regular use for the study. Multivariate analysis using logistic regression was conducted to identify determinants of regular Balbhog use. $P < 0.05$ was considered as statistically significant. SPSS (IBM SPSS, Version 19.0. Armonk, NY: IBM Corp) was used for data analysis.

**Results**

**Awareness and consumption of Balbhog**

Out of the total 1623 children, 43% of children were in 12–23 months’ age group, 78% children were from rural areas, 39% belonged to other backward class, and 90.4% were Hindus. Majority of the caregivers were in the 15–24-year age group and had received no formal schooling. Table 1 shows conditional analysis for Balbhog use by children among those caregivers who (a) had heard of Balbhog and (b) have both heard and reported to have previously given it to children. High awareness about Balbhog existed across all population groups. However, when having heard of Balbhog was controlled for in the analysis, the percentage of caregivers who have previously used Balbhog before (81.7%) declined marginally for each of the population characteristics. The decline was much more substantial across all population characteristics among regular Balbhog users (42.2%) when awareness and prior use were controlled for in the analysis. For example, 81.6% scheduled caste caregivers had previously used Balbhog, but 49% were its regular users. Likewise, among lowest wealth quintile caregivers who had used Balbhog before (85%), about 46% used it regularly.

**Age of introduction to Balbhog**

Mean age for introducing Balbhog to children was 8.9 months; 62% children were introduced to Balbhog between 6 and 9 months’ age. Proportionally, more children from scheduled caste (65%), residing in rural areas (64%), and from district Patan (66%) were introduced to Balbhog between 6 and 9 months’ age than children from other caste groups, districts, and urban areas.

**Distribution of Balbhog packets**

All registered children in 6–35 months’ age group are entitled for monthly seven Balbhog packets of 500 g each from AWC. Our result showed that households received average $5.0 \pm 3.0$ packets (range: 0–10 packets) in the last month preceding the survey. Among the regular Balbhog users $(n = 1175)$, 43% received recommended 7 or more Balbhog packets; 28% received between 4 and 6 packets; 29% received 1–3 packets; and 8.7% received no packets in the month preceding the survey (detailed results not shown). The analysis indicated that distribution of entitled 7 packets was more likely to be in rural (44.6%) versus urban (35%) areas, in lowest wealth quintile (51%) versus highest wealth quintile group (37.2%) and in Patan district (59%) compared to other districts ($P < 0.05$).

**Additional ingredients during Balbhog preparation**

Balbhog is positioned as a precooked food requiring no additional ingredients during preparation. Our 24-h dietary...
survey results showed that caregivers put additional ingredients during Balbhog preparation to improve its palatability – 58% caregivers added sugar or Jaggery and 77% added additional oil or ghee (clarified butter) while cooking Balbhog.

**Determinants of regular Balbhog consumption**

Multivariate analysis using logistic regression was used to identify potential factors influencing regular Balbhog consumption [Table 2]. Among ICDS and community health events, participation of caregivers in Annaprashan Diwas was significantly associated with regular use of Balbhog (adjOR = 1.65; 95% confidence interval [CI]: 1.24–2.19). Among feeding practice variables, frequency of meals had a significant effect on regular Balbhog consumption, likelihood of regular use increased with increase in the number of meals in a day (4+ meals adjOR = 2.92 95% CI: 1.53–5.59; 3 meals

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**Table 1: Balbhog awareness and use, conditional analysis by population characteristics**

| Background characteristics | Number of children (n) | Heard of Balbhog (%) | Previously used Balbhog (among those who have heard of Balbhog (%) | Regular Balbhog use (among those who have heard and previously used Balbhog) (%) |
|----------------------------|------------------------|----------------------|------------------------------------------------------------------|---------------------------------------------------------------------------------|
| Residence                  |                        |                      |                                                                  |                                                                                |
| Rural                      | 1263                   | 89.5 (1130)          | 82.0 (927)                                                        | 42.6 (395)                                                                      |
| Urban                      | 360                    | 85.6 (308)           | 80.5 (248)                                                        | 40.7 (101)                                                                      |
| District                   |                        |                      |                                                                  |                                                                                |
| Dahod                      | 410                    | 94.9 (389)           | 84.1 (327)                                                        | 50.5 (165)                                                                      |
| Jamnagar                   | 403                    | 82.9 (334)           | 79.6 (266)                                                        | 23.3 (62)                                                                       |
| Patan                      | 401                    | 94.0 (377)           | 78.5 (296)                                                        | 42.2 (125)                                                                      |
| Surat                      | 409                    | 82.6 (338)           | 84.6 (286)                                                        | 50.3 (144)                                                                      |
| Religion                   |                        |                      |                                                                  |                                                                                |
| Hindu                      | 1468                   | 89.6 (1316)          | 81.9 (1078)                                                       | 41.6 (448)                                                                      |
| Non-Hindu                  | 155                    | 78.7 (122)           | 79.5 (97)                                                         | 49.5 (48)                                                                       |
| Caste                      |                        |                      |                                                                  |                                                                                |
| SC                         | 158                    | 86.1 (136)           | 81.6 (111)                                                        | 45.0 (50)                                                                       |
| ST                         | 493                    | 89.0 (439)           | 81.3 (357)                                                        | 49.0 (175)                                                                      |
| OBC                        | 629                    | 90.8 (571)           | 81.8 (467)                                                        | 36.8 (172)                                                                      |
| Others                     | 286                    | 84.6 (242)           | 80.2 (194)                                                        | 40.7 (79)                                                                       |
| Mothers’ education         |                        |                      |                                                                  |                                                                                |
| No schooling               | 730                    | 91.0 (664)           | 82.8 (550)                                                        | 44.9 (247)                                                                      |
| 1-5                        | 247                    | 85.8 (212)           | 83.5 (177)                                                        | 39.5 (70)                                                                       |
| 6-8                        | 329                    | 84.5 (278)           | 81.3 (226)                                                        | 38.1 (86)                                                                       |
| 9-10                       | 209                    | 90.9 (190)           | 80.5 (153)                                                        | 41.8 (64)                                                                       |
| 10+                        | 108                    | 87.0 (94)            | 73.4 (69)                                                         | 42.0 (29)                                                                       |
| Wealth index               |                        |                      |                                                                  |                                                                                |
| Lowest                     | 323                    | 92.9 (300)           | 85.0 (255)                                                        | 45.9 (117)                                                                      |
| Second                     | 326                    | 90.8 (296)           | 79.7 (236)                                                        | 43.2 (102)                                                                      |
| Middle                     | 325                    | 87.4 (284)           | 84.5 (240)                                                        | 40.8 (98)                                                                       |
| Fourth                     | 326                    | 86.5 (282)           | 78.4 (221)                                                        | 40.7 (90)                                                                       |
| Highest                    | 323                    | 85.4 (276)           | 80.8 (223)                                                        | 39.9 (89)                                                                       |
| Mothers’ age (year)        |                        |                      |                                                                  |                                                                                |
| 15-24                      | 674                    | 86.4 (582)           | 80.1 (466)                                                        | 42.3 (197)                                                                      |
| 25-29                      | 621                    | 88.6 (550)           | 85.1 (468)                                                        | 40.8 (191)                                                                      |
| 30-34                      | 236                    | 93.2 (220)           | 78.6 (173)                                                        | 43.4 (75)                                                                       |
| 35+                        | 92                     | 93.5 (86)            | 79.1 (68)                                                         | 48.5 (33)                                                                       |
| Sex                        |                        |                      |                                                                  |                                                                                |
| Male                       | 866                    | 89.1 (772)           | 80.3 (620)                                                        | 41.5 (257)                                                                      |
| Female                     | 757                    | 88.0 (666)           | 83.3 (555)                                                        | 43.1 (239)                                                                      |
| Age of child (months)      |                        |                      |                                                                  |                                                                                |
| 6-11                       | 376                    | 81.9 (308)           | 64.0 (197)                                                        | 43.1 (85)                                                                       |
| 12-23                      | 696                    | 90.7 (631)           | 84.8 (535)                                                        | 39.6 (212)                                                                      |
| 24-6                       | 551                    | 90.6 (499)           | 88.8 (443)                                                        | 44.9 (199)                                                                      |
| Total children             | 1623                   | 88.6 (1438)          | 81.7 (1175)                                                       | 42.2 (496)                                                                      |

SC: Scheduled Caste, ST: Scheduled Tribes, OBC: Other backward class
Similar findings were also reported from our
1.45-2.89
1.65*
2.04*
[14]
Although Balbhog is
The results show high awareness and coverage
1.53-5.59
2.92*
1.00
0.04
The result shows that liking for Balbhog’s
taste also emerged as important factors influencing its
water did not come out well, and caregivers used additional
ingredients (sugar or Jaggery, oil, ghee, and milk) to improve
preparation consistency and sweetness.[14] Although Balbhog is
positioned as ready to eat product, additional ingredients were
perceived as extra cost by many families and were not used by
many families. Caregiver’s knowledge of additionalities and
their affordability seemed critical for improving Balbhog’s
taste and increasing its acceptability among children.

Adequate distribution of Balbhog packets emerged as a strong
predictor for its regular consumption. Usage of Balbhog
depended on its availability at home, and households that
received entitled packets were more likely to be its regular
user than households which received less number of packets.
The audit of AWCs done during the same survey found almost
all AWCs had received stipulated supply of Balbhog packets
in the last 3 months preceding the survey, but its distribution
to eligible households was average 4.8 packets per month.
Inadequate distribution of packets to households, despite
their availability in AWCs, was due to diversion of packets to
noneligible households, as well as low demand for the product
by children due to its inferior taste. Further analysis of Balbhog
distribution system at AWCs can help ICDS staff identify and
resolve bottlenecks in the distribution chain.

The likelihood of regular Balbhog use increased with number
of meals given to children in a day. In our study, caregivers
who fed meals to their children at regular intervals also
consciously included Balbhog in their children’s diet leading
to its increased consumption. Intrahousehold sharing of food
provided through supplementary feeding program remains
a major concern for the program. Various targeted feeding
programs have highlighted that 50%–75% of the ration does
not reach the intended recipient due to sharing with family
members.[15] Similar findings were also reported from our
study with Balbhog being shared with other children and
household members.

Among the monthly health and ICDS events in
community – Mamta Diwas, Annaprashan Diwas, and growth
monitoring visits to AWC – participation in Annaprashan
Diwas was significantly associated with regular Balbhog
consumption. The Annaprashan Diwas strategy to demonstrate
Balbhog preparations in mother’s groups on a fixed day of
the month influenced its regular use than promoting it in
open village event like Mamta Diwas where focus remains
on immunization services and distribution of THR premixes
to beneficiaries.

### DISCUSSION

Awareness of fortified food supplements is an important factor
for its use.[11,12] The results show high awareness and coverage
of Balbhog in the AWC areas. The awareness and prior use
of Balbhog were proportionally more in disadvantaged
groups – rural areas, tribal district, and the lowest wealth
quintile – than in advantaged groups, indicating proper
targeting of the product to the vulnerable population. We
found regular consumption of Balbhog was not influenced by
socioeconomic and demographic factors but was mediated by
the child feeding practices, preparation methods, participation
in Annaprashan Diwas, and adequate distribution of packets
in households.

### Table 2: Determinants of regular Balbhog use among 6-35-month age children

|                        | Adjusted OR | CI          | P     |
|------------------------|-------------|-------------|-------|
| Balbhog packets received last month |             |             |       |
| ≤3 (RC)                | 1.00        | 0.02        |       |
| 4-6                    | 1.81*       | 1.26-2.61   | 0.02  |
| 7+                     | 2.04*       | 1.45-2.89   | 0.02  |
| Participated in Annaprashan Diwas |             |             |       |
| No (RC)                | 1.00        | 0.04        |       |
| Yes                    | 1.65*       | 1.24-2.19   | 0.02  |
| Meal frequency of children in a day |         |             |       |
| ≤1 (RC)                | 1.00        | 0.01        |       |
| 2                      | 2.30*       | 1.13-4.67   | 0.01  |
| 3                      | 2.72*       | 1.38-5.34   | 0.01  |
| 4+                     | 2.92*       | 1.53-5.59   | 0.01  |
| Taste of Balbhog       |             |             |       |
| Dislike (RC)           | 1.99*       | 1.36-2.91   | 0.02  |

*Significant at P < 0.05 Adjusted for age, sex, caste, mother’s education,
residence, wealth status, household size, media exposure, participation
in Mamta Diwas and growth monitoring events and perceived Balbhog
quality. RC: Reference category, CI: Confidence interval, OR: Odds ratio

adjOR = 2.72, 95% CI: 1.38–5.34; 2 meals adjOR = 2.3, 95%
CI: 1.13–4.67). The result showed that children consuming 4
or more meals in a day were about 3 times more likely to be
regular user of Balbhog than children consuming one meal.

Adequate distribution of Balbhog packets and Balbhog’s
taste also emerged as important factors influencing its
regular use. Caregivers who received the entitled seven or
more Balbhog packets were two times more likely to be
regularly feeding Balbhog to their children than caregivers
receiving <3 packets (adjOR = 2.04; 95% CI: 1.45–2.89).
Likewise, the odds of regular Balbhog consumption was two
times more among children who liked the taste of Balbhog
preparation than those who disliked its taste (adjOR = 1.99;
95% CI: 1.36–2.91). No social, economic, and demographic
factors emerged as a predictor for regular Balbhog use.
**Conclusion**
The results highlight that regular Balbhog consumption is mediated by individual, household, and programmatic level factors and is not influenced by socioeconomic and demographic factors. Adequate counseling of caregivers on Balbhog is therefore important for its promotion, use, and compliance. To improve consumption, caregivers need to be made aware about Balbhog preparations that are tastier and acceptable to children. Balbhog’s contribution of providing essential micronutrients to attain adequate physical and mental growth in children needs to be stressed to improve its targeting and demand. Estimation of actual beneficiaries in AWC catchment areas and reaching out to them will be crucial for improving Balbhog availability in households. Future inquiry in the state should focus on examining frontline worker’s capacity to counsel caregivers on IYCF practices and Balbhog. Once implementation issues have been adequately addressed, further research will be useful to assess impact of Balbhog on nutritional status of children.

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**Conflicts of interest**
There are no conflicts of interest.

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