Journal of Food and Nutrition Sciences
2022; 10(5): 165-170
http://www.sciencepublishinggroup.com/j/jfns
doi: 10.11648/j.jfns.20221005.16512
ISSN: 2330-7285 (Print); ISSN: 2330-7293 (Online)

Assessing the Efficacy of a Nutritional Intervention Program in a Tribal Area in Maharashtra

Anoushka Kapur

Biology Department, Dhirubhai Ambani International School, Mumbai, India

Email address:
Anna.kapur38@gmail.com

To cite this article:
Anoushka Kapur. Assessing the Efficacy of a Nutritional Intervention Program in a Tribal Area in Maharashtra. *Journal of Food and Nutrition Sciences*. Vol. 10, No. 5, 2022, pp. 165-170. doi: 10.11648/j.jfns.20221005.12

Received: September 15, 2022; **Accepted**: October 4, 2022; **Published**: October 24, 2022

Abstract: Nutritional deficiency is a key impediment to the development of India as it impacts the growth, health and productivity of its population. The government has sponsored a Midday Meal Scheme ("MMS"), a school meal program to improve the nutritional standing of children in the country. MMS currently serves approximately 120 million children in over 1.27 million schools and is the largest such program in the world. While MMS is far reaching and has the best of intentions its effectiveness in pre-primary and primary children is limited. The Bombay Mothers and Child Welfare Society ("BMCWS") a 100 year old social organization based out of Mumbai had introduced a nutrition support program in the form of a breakfast meal ("BMCWS Meal Plan") to address this deficiency in 2018. This study is designed to assess the efficacy of the BMCWS Meal Plan to serve as a supplement to the MMS in Rajgurunagar taluka, a tribal belt in Pune district, Maharashtra India.. The anthropometric indicators data collected is based on reporting guidelines of the Technical Expert Advisory Group on Nutrition Monitoring (TEAM) of UNICEF-WHO. Local school teachers collaborated to collect age, weight and height data for 159 children across 16 different schools in remote locations. Similarly hemoglobin readings of the children were taken with qualified nursing staff and the sample set was divided into three control groups. There was a clear improvement in the hemoglobin readings of the children in the program which implies the plan is effective in preventing anemia in children. Overall the results of the nutritional program show that it is not effective on anthropometric parameters however there is a positive impact on hemoglobin readings. Some changes to the existing nutrition plan will have a more pronounced impact on the children, specifically the introduction of pre-boiled eggs which will increase the protein intake in the diet and also be easy to transport to remote locations by the teachers.

Keywords: Malnutrition, Tribal Region, Anthropometric, Hemoglobin, Anemia, Nutritional Intervention

1. Introduction

Malnutrition is one of the more serious development challenges for India as it contributes significantly to the country's disease burden, specifically stunting and under-nutrition. About 68% of the deaths of children under the age of five in India can be attributed to child and maternal malnutrition [5]. Over half the children under five years were found to be either stunted (too short for their age) or wasted (too thin for their age) or both, in the Comprehensive National Nutrition Survey, released in 2019 [1]. The Food and Agriculture Organization (FAO) estimates that 195 million people in India (14.5% of the population) are undernourished [4].

The latest National Family Health Survey (NFHS) which is the most elaborate survey next only to the Population Census revealed interesting insights into India's malnutrition challenge. While there are some visible improvements related to increasing education levels, reduced infant mortality, and increased vaccinations there has been little progress in the health and nutritional status of the population. As per this survey, 36% of children below five years are stunted and 32 per cent are underweight. Among the stunted children, 37.3% are in the rural areas as compared to 30.1% in urban areas [11]. Anemia among children under-5 years has become significantly worse with the current prevalence at 67.1% compared to 58.6% according to the earlier survey [9] Malnutrition in India continues to be at a high level with 42.5% children below the age being underweight and almost 70% being anemic [6].

Malnutrition is defined as an inadequate supply of essential nutrients (such as vitamins and minerals) in one's diet which hampers overall growth and development and has adverse consequences on human capital, poverty, and equity where a child may also study less and have fewer professional opportunities [10].

Malnutrition manifests itself as kwashiorkor and marasmus in India. Kwashiorkor is a form of severe protein malnutrition characterized by edema and enlarged livers while Marasmus is caused by a deficiency in all macronutrients including carbohydrates, proteins and fats and causes visible wasting of fat and muscle under the skin, giving bodies an emaciated appearance [2]. Iron is another vital nutrient that many children lack and the resulting disease is called anemia. As per the World Health Organization, anemia is still one of the major health conditions occurring because of a shortage in the intake of minerals and vitamins. This condition is characterized by a low concentration of hemoglobin [13] and the effects of this widespread disease is severe amongst children.

There are several nutritional schemes of the government that are already in place, catering to specific target groups. The Special Nutrition Programs (SNP) provides supplementary nutrition and health care services to children including providing iron and folic acid tablets to preschool children in urban slums or tribal areas. The Applied Nutrition Programs (ANPs) works slightly differently and its main purpose is to make people aware of their own nutritional needs and those of their children. It targets children between the ages of 3 and 6 and pregnant or lactating mothers. The scheme explored in this paper is categorized as a Midday Meals program, intended to benefit children in primary school. Most recently, POSHAN (Prime Minister's Overarching Scheme for Holistic Nutrition) Abhiyaan was launched by Prime Minister Narendra Modi in March 2018. This is the flagship program to improve nutritional outcomes for children, pregnant, women, and lactating mothers. The POSHAN Abhiyaan aims to make India a malnutrition-free country by 202 and specifically to reduce stunting in children from 38.4 percent to 25 percent by 2022. The other themes included in POSHAN include eating healthy food to strengthen hygiene and sanitation, right age of marriage, antenatal care, optimal breastfeeding, anemia, and education of girls [8].

For children, anthropometric indicators are typically based on age, height and weight. There are three standard indicators "height-for-age", "weight-for-height", and "weight-for-age". Low height-for-age is referred to as "stunting", low weight-for-height as "wasting", and low weight-for-age as "underweight". Stunting is a cumulative indicator of nutritional deprivation from birth (or rather, conception) onwards. It is relatively independent of immediate circumstances, since height does not change much in the short term. Wasting, by contrast, is usually taken to be an indicator of short term nutritional status. "Weight-for-age" can be seen as a more comprehensive indicator, which captures stunting as well as wasting: both stunted and wasted children are likely to fall in the "underweight" category. Thus, if a single "summary" indicator is to be used, weight-for-age would claim special attention.

There is evidence that stunting or wasting in childhood is associated with serious deprivations, such as ill health, diminished learning abilities, or even higher mortality. More precisely, there is a great deal of variation in the genetic potential of individuals to be small or large, but nutritional deprivation in early life, resulting in a failure to attain one's genetic potential, is likely to cause lasting harm, see, for example, the review article by Victora et al which focuses on low and middle income countries [12]. While genetics is important at the individual level, they are much less so – and arguably completely unimportant – at the population level, so that populations with a high fraction of people who are stunted or underweight are populations where there is evidence of nutritional deprivation.

Furthermore, anthropometric status in children is evaluated on the basis of international standards, which reflect the anthropometric features of children in well-nourished reference populations. The distribution of heights and weights in the reference population is used to set "cut-offs" below which a child would be considered stunted, wasted or underweight. A standard cut-off is "median minus two standard deviations", based on the reference population so that, for example, a child of a given age who is shorter than this cut-off would be considered stunted [3]. This procedure is based on the assumption that the anthropometric achievements of children in the focus population (here, India) would be much the same as in the reference population, if the focus children were well-nourished. In other words, anthropometric standards are similar in both populations. Since this procedure tends to be applied all over the world, it amounts to saying that there are "universal" anthropometric standards for children.

This study attempts to test the efficacy of a breakfast meal plan sponsored by BWCWS, a sustainable for purpose organization that has been in existence for over a hundred years. They design and operate several programs in education, child welfare and nutrition to uplift the lesser privileged sections of society. The society works in concert with the government programs like MMS and existing infrastructure to walk the last mile and enhance the efficacy of the government programs. Rajgurunagar is the largest taluka in Pune district and a cluster of forty villages with a population of approximately three hundred and fifty thousand. It borders industrial belts around Chakan which is an automobile cluster but has not been able to keep up with the economic development in the area.

BMCWS is doing great work in the area and this project was designed to help them assess the efficacy of the nutritional programs they had in place for the children in the area. The nutritional plan targets children between the ages 9 and 10 years and works in tandem with the teachers in the village schools to carry the supplementary meals to these remote locations.

2. Methodology

2.1. Aim of the Study

The study seeks to assess the efficacy of the supplementary nutritional plan sponsored by BMCWC in Rajgurunagar, district Pune, India for early stage school children (grades 3, 4 and 5). This supplementary nutrition plan works in concert with the Midday Meal Scheme sponsored by the government to help fight malnourishment. The midday meal plan is effective for older children but for younger children a breakfast supplement is critical to maintain their energy levels till the onset of the midday meal. Without the breakfast supplement, the children have a much higher drop out rate from the village school system [7].

This study will test the hypothesis: whether a breakfast supplement in addition to the midday meal scheme has had a meaningful impact on the nutrition profile of the children.

2.2. Research Design

In this study the independent variable was whether or not the child had been a part of the nutritional program and if so for how long. The dependent variables were their hemoglobin levels and BMI, indicators of their health conditions. The design was as follows:

The students who have been part of the program since its inception (Group A) will be subjected to anthropometric tests and blood tests to gauge their BMI and hemoglobin levels respectively.

Students who have newly joined the program or are about to join the program (Group B) will also be subjected to anthropometric tests and blood tests. The results from their tests will be compared to the results of Group A.

Students who have never been provided with the nutritional supplements will also be subjected to anthropometric tests and blood tests. This Group C serves as the control group and their results will be compared with Groups A and B.

The nutritional value of the breakfasts provided to the students will be evaluated. Special focus will be given to vitamin B, iron, protein and fiber levels.

Based on the results, nutritional supplements that can be easily supplied to the school's location will be identified and provided to the children.

2.3. Sample

The BMCWC Meal Plan covers approximately 1,000 children and our sample consisted of 159 students between the ages of 9 years and 11 years old studying in grade 4 across 16 schools in the area. All the children are from Rajgurunagar, district Pune, Maharashtra, India which is a cohort of 40 villages and is a declared tribal region. The sample was divided into three control groups (see table 1). Group A was 53 children who had been on the nutrition plan since 2018, Group B was 33 children who started on the plan in 2021 and lastly Group C had 94 children that did not have the benefit of the plan.

Table 1. *Gender Ratio in different sample groups of the study.*

Control Group/ Number of years in the programme	Girls	Boys
Group A	24	26
Group B	18	14
Group C	33	20
Total	75	60

BMCWC started the work in villages of Group A in 2018 i.e, Dhamnal, Kadachiwadi, Saindani, Shiroli, Vetale then moved to villages of Group B i.e, Nirmalwadi, Malegaon, Patharwadi, Ambedara, Pimpri, Bahirwadi. BMCWC will start working in Vikaswadi, Dawadi, Retwadi, Jambuldara, Rohkal which will be Group C or the control group of our research work.

BMCWC has collaborated with the village school teachers to transport the breakfast nutrition to each school, a few times a week as the remote location does not allow for easy passage of perishable products and also the packages cannot be bulky as they have to be hand carried.

2.4. Consent and Ethical Issues

Informed consent was taken from parents, teachers and the head of the charity for data collection. Confidentiality and privacy of the respondents was maintained; no data will be disclosed to a third party. No identifiers such as name or pictures are disclosed in the article or while conducting the study. Ethical guidelines of research were followed.

3. Results and Discussion

3.1. Hemoglobin Level

A change in hemoglobin level was observed when mean values of Hemoglobin for all the three groups were compared.

Table 2. *Mean and Standard Deviation (SD) of the Hemoglobin levels (g/dL) in Group A (N=4), B (N=1) and C (N=0).*

Number of years in the programme (N)	Sample Size (n)	Hemoglobin Levels (g/dL)	
		Mean	Standard Deviation
4	50	10.17	1.54
1	32	9.56	1.43
0	53	9.59	1.25

It can be observed in Table 2 that the mean hemoglobin level for Group A is 10.17 which is higher than that of Group C which is 9.59. However it is important to notice that the mean hemoglobin level for both is less than the normal levels for children aged 9-10 which is between 11.9 and 14. Another noteworthy thing that can be observed in Table 2 is

that the change in hemoglobin between Group B and Group C is not very significant which shows that the time period of one year hasn't affected the hemoglobin levels at all. To ascertain that the results are statistically significant or not, an ANOVA was done with all the three groups with a p value fixed at 0.05. The results obtained are shown in Table 3.

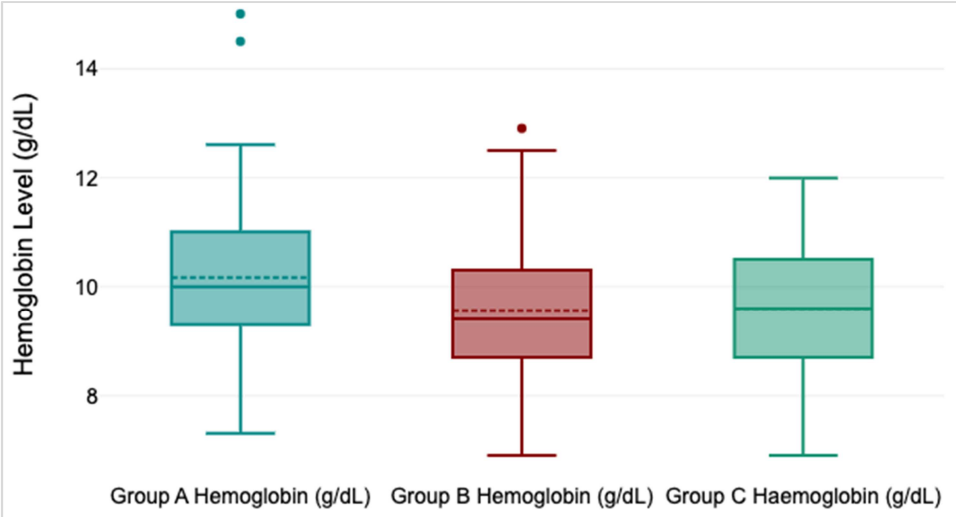

Figure 1. *Change in Hemoglobin level (g/dL) for Group A, Group B and Group C.*

The difference in mean values can also be seen in Figure 1, Hemoglobin level for Group A is higher than Group B and Group C.

Table 3. *One-way Analysis of Variance of Hemoglobin levels in Group A, B and C (n=135).*

Hemoglobin

	Sum of Squares	df	Mean Squares	F	p	Critical F-Value
Between Groups	11.19	2	5.6	2.83	.062	3.06
Within Groups	266.89	135	1.98			
Total	278.08	137				

Note.*p < .05.

The effect on Hemoglobin level was not found F(2,135)= 2.83, p > .05. The change in Hemoglobin level was not significant when compared for all the three groups.

A t-test was also conducted between Group A and Group C to see if the change in Hemoglobin was significant or not. As established during the discussion of mean values the effect of diet was not present for a one year time period hence t-test for Group B and Group C was not performed.

Table 4. *Summary of Independent t-test between Group A and Group C on Hemoglobin level (mg/dL) (n=105).*

	n	Mean	Std. Deviation	t	p
Group A Hemoglobin (g/dL)	51	10.17	1.54	2.11	.037
Group C Hemoglobin (g/dL)	54	9.59	1.25		

Group A (M= 10.17, SD= 1.54) reported significantly higher levels of hemoglobin than Group C (M=9.59, SD= 1.25), p < .05 for both equal and unequal variances.

As reported in table 4, it can be seen that there is statistical difference between the mean values of Group A and Group C which confirms the hypothesis that the nutritional plan implemented by BMCWC affects the hemoglobin level over a tenure of at least four years.

3.2. Anthropometric Measurement

3.2.1. Body Mass Index (BMI)

Change in BMI was not observed when the mean value of all the three groups were compared.

Table 5. *Mean and Standard Deviation (SD) of the BMI (kg/cm) in Group A (N=4), B (N=1) and C (N=0).*

Number of years in the programme (N)	Sample Size (n)	BMI (kg/cm)	
		Mean	Standard Deviation
4	50	14.17	1.66
1	32	14.14	1.67
0	53	14.38	2.77

In table 5, it can be seen that the mean value of BMI for Group C is at 14.38 kg/cm than for Group A which was at 14.17 kg/cm, the value for Group B was also not that different at 14.14 kg/cm. It is interesting to see that these values were within the normal BMI range for that age group which is 13-18 kg/cm. It shows that the difference created in BMI is also marginal but is of less concern as they are still within normal levels.

An ANOVA was done with all the three groups for BMI to see if there was any statistically significant difference in the mean values.

Table 6. *One-way Analysis of Variance of Body Mass Index (BMI) in Group A, B and C (n=135).*

Body Mass Index (BMI)

	Sum of Squares	df	Mean Squares	F	p	Critical F-Value
Between Groups	1.71	2	0.85	0.18	.834	3.06
Within Groups	633.95	135	4.7			
Total	635.66	137				

Note.*p < .05.

The effect on BMI was not found $F(2,135)= 0.18$, $p > .05$. The change in BMI was not significant when compared for all the three groups.

3.2.2. Classification on the Basis of Underweight and Healthy Individuals

The BMI data was also classified on the basis of Underweight and Healthy individuals for Group A, B and C.

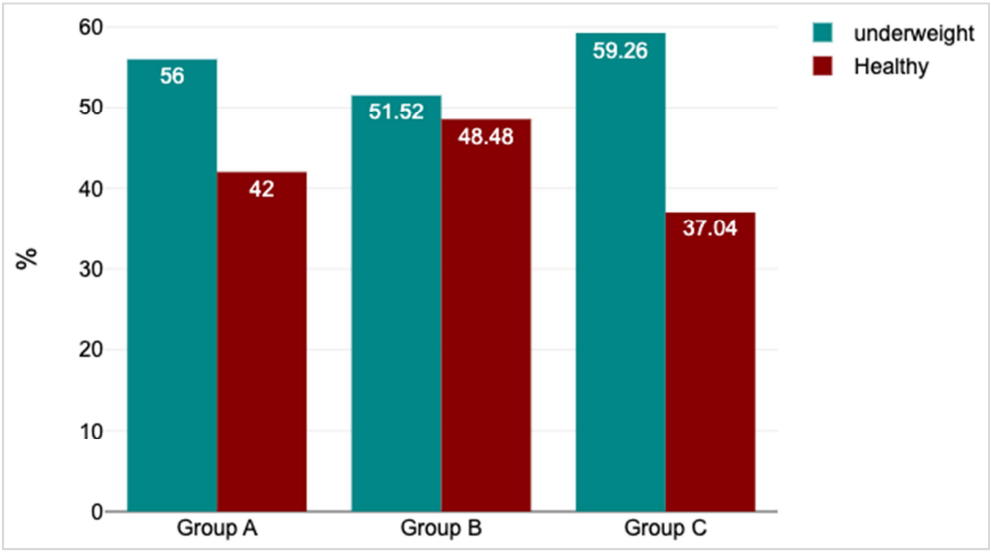

Figure 2. *The percentage distribution of the number of healthy and underweight students in Group A (n= 50, N=4), B (n=32, N=1) and C (n=53, N=0).*

Figure 2 depicts the difference in percentage of children who are healthy and underweight is lesser in Group A and B, in comparison to Group C. The difference for Group C is almost 22% which needs a clear need for intervention like the BMCWC breakfast intervention. However it is important to relook at the impact of the intervention and modify the breakfast plan.

4. Conclusion

The present study shows the effectiveness of the nutritional intervention program given to the children residing in Rajgurunagar, Pune Maharashtra, India. There has been a positive change in the BMI and Hemoglobin levels of children over the years. This further indicated the importance of breakfast in day to day life. Hence, this study has repercussions for providing valuable feedback to BMCWC on the efficacy of their nutritional intervention program and will possibly be used to engage with CSR programs of corporations in this heavily industrialized area to be more benevolent. Also this study will be used to lobby the government policy makers to consider a change in the Midday Meal Scheme for younger children.

5. Limitations

The research work was mainly cross-sectional however a longitudinal could have provided more insights into the continuous change happening over a long period of time. Modification in the diet could have also unraveled a lot of interesting facts. The study was unable to look at the changes in BMI and anthropometric measures on the basis of gender. The qualitative experiences of teachers and parents could provide valuable insights to the overall implementation and

need of any nutritional program for the children.

Acknowledgements

I would like to acknowledge and thank Dr. Madhav Narayan Sathe (BMCWS - Mumbai), Mrs. Sharmila Shivaji Sandbhor (BMCWS - Rajgurunagar), Mrs. Manisha Vikas Surve (BMCWS - Rajgurunagar) and Mrs. Shilpa Yuvraj Sandbhor for helping with the data collection and providing technical assistance and guidance throughout the project. I would also like to thank all the nurses and teachers who helped in organizing the health camps for data collection.

References

[1] Aguayo, V. (n.d.). *Comprehensive National Nutrition Survey*. National Health Mission. Retrieved September 12, 2022, from https://nhm.gov.in/WriteReadData/l892s/1405796031571201348.pdf

[2] Butler, N., & Streit, L. (n.d.). *Kwashiorkor and Marasmus: What's the Difference?* Healthline. Retrieved September 12, 2022, from https://www.healthline.com/health/kwashiorkor-and-marasmus

[3] FANTA Project. (n.d.). *MODULE 3 excerpt of "Guide to Anthropometry: A Practical Tool for Program Planners, Managers, and Implementers."* FANTA Project. Retrieved September 12, 2022, from https://www.fantaproject.org/sites/default/files/resources/MODULE-3-FANTA-Anthropometry-Guide-May2018.pdf

[4] FAO. (n.d.). *Hunger in India*. India FoodBanking Network. Retrieved September 12, 2022, from https://www.indiafoodbanking.org/hunger

[5] India State-Level Disease Burden Initiative Malnutrition Collaborators*. (2019). The burden of child and maternal malnutrition and trends in its indicators in the states of India: the Global Burden of Disease Study 1990–2017. *Lancet*, *3*, 855-70. https://www.thelancet.com/journals/lanchi/article/PIIS2352-4642(19)30273-1/fulltext

[6] Mother Child Nutrition. (2019). *Food and Nutrition Board - India - Mother, Infant and Young Child Nutrition & Malnutrition - Feeding practices including micronutrient deficiencies prevention, control of wasting, stunting and underweight*. Mother and Child Nutrition. Retrieved September 12, 2022, from https://motherchildnutrition.org/india/food-nutrition-board.htm

[7] Ntumva, M. (2013). School Dropout in Community Secondary Schools: A Case of Nyamilama Secondary SchoolMwanza Tanzania. *International Journal of Science and Technology*, *2* (10).

[8] POSHAN Abhiyan. (2018, October 22). *POSHAN Abhiyaan - PM's Overarching Scheme for Holistic Nourishment*. National Portal of India. Retrieved September 12, 2022, from https://www.india.gov.in/spotlight/poshan-abhiyaan-pms-overarching-scheme-holistic-nourishment

[9] Sheriff, K. (2021, November 25). *Health survey shows anaemia a concern across age groups in children, women*. The Indian Express. Retrieved September 12, 2022, from https://indianexpress.com/article/india/health-survey-anaemia-in-children-women-7640057/

[10] Siddiqui, F. (n.d.). The Intertwined Relationship Between Malnutrition and Poverty. *Frontiers in Public Health*, *8*. https://www.frontiersin.org/articles/10.3389/fpubh.2020.00453/full

[11] Smile Foundation. (2021, December 18). *What has NFHS-5 revealed about malnutrition in India?* Smile Foundation. Retrieved September 12, 2022, from https://www.smilefoundationindia.org/blog/what-has-nfhs-5-revealed-about-malnutrition-in-india/

[12] Victora, C. G. (2008). Maternal and child undernutrition: consequences for adult health and human capital. *The Lancet*, *371* (9609), 340-357. https://www.sciencedirect.com/science/article/pii/S0140673607616924

[13] World Health Organisation. (n.d.). *Anaemia*. WHO | World Health Organization. Retrieved September 12, 2022, from https://www.who.int/health-topics/anaemia