A STUDY ON QUANTITATIVE EFFECT OF SUPPLEMENTARY NUTRITION PROVIDED IN ANGANWADIS IN PREDICTING PHYSICAL GROWTH OF PRE-SCHOOLERS

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ABSTRACT

Background: Malnutrition is serious problem in India. ICDS provides supplementary nutrition through anganwadis to its beneficiaries.

Aims & Objective: (1) To study quantitative effect of supplementary nutrition on physical growth of children beneficiaries of ICDS. (2) To understand determinants of physical growth among children registered with ICDS anganwadis.

Material and Methods: It was a prospective cohort study done during September 2010 to August 2011. All children of three to five years of 6 randomly selected anganwadis of Jhagadia block of Bharuch district were selected for study. The pretested and predesigned questionnaire was used for collection of data from the mother of the children at their home. Anthropometric measurements were done at anganwadi. Data for availing of supplementary nutrition by child and was obtained from anganwadis. Follow up anthropometric measurements were done another two times over the period of one year.

Results: Out of 104 children, 70 (67.3%) received adequate and 34 (32.7%) did not receive adequate supplementary nutrition. Both weight and height gain were more in the children who received adequate supplementary nutrition as compared to the children who did not receive adequate supplementary nutrition. Multivariate analysis indicated that, out of so many factors, supplementary nutrition and caste were the one which had significant effect on weight gain of children.

Conclusion: Supplementary nutrition provided at anganwadi has significant impact on physical growth of its beneficiaries

Key-Words: ICDS; Malnutrition; Prospective Cohort Study; Multivariate Analysis; Supplementary Nutrition

Introduction

Malnutrition is a major problem in India. The proportion of children under three years of age, who are underweight in India, decreased from 43 percent in NFHS-2 to 40 percent in NFHS-3, and the proportion of severely underweight decreased from 18 percent to 16 percent. Stunting decreased by a larger margin, from 51 percent to 45 percent. Severe stunting also decreased, from 28 percent to 22 percent.[1] But, despite decrease in proportion of malnutrition as compared to that of NFHS-2, still the problem is much higher in India when compared to other developed countries.

India's main early child development and nutrition intervention, the Integrated Child Development Services (ICDS) program, has expanded steadily across the country during the 35 years of its existence.[2] In ICDS program, Supplementary nutrition is provided through anganwadis. Yet more than thirty years later, its performance remains unsatisfactory. Examining its failings is the best approach to finding new strategies for dealing with the problem. In August 2005, at about the same time that the NFHS-3 was being compiled, the World Bank produced a weighty report on the subject of India's child malnutrition. It examined India's successes and failings through the prism of the Millennium Development Goals (MDGs) – halving the prevalence of underweight children by 2015 as a key indicator of eradicating extreme poverty and hunger. The World Bank reviewed the ICDS, finding that although it had been successful in many ways, it was yet to make a significant dent in child malnutrition. The report observes, too, that more attention has been given in the ICDS to increasing coverage than to improving the quality of service delivery, and to delivering food rather than changing family based feeding and caring behaviour.[3]

Supplementary nutrition provided through anganwadis is said to provide one third of calorie and one half of daily protein requirement of the child[2]. And no such study has been done which quantifies the effect of supplementary nutrition on growth of its beneficiaries. So, there is the need for analysis of the relative contribution of supplementary nutrition on physical growth of children attending anganwadi.

Aims and Objectives

1. To study quantitative effect of supplementary nutrition on physical growth of children beneficiaries of ICDS.
2. To understand determinants of physical growth among children registered with ICDS anganwadis.

Materials and Methods

It was a community based prospective study, which was done during September 2010 to August 2011. Jhagadia block of Bharuch district, which is predominantly tribal, was selected for this study purposively. Six anganwadis out of total 228 anganwadis in Jhagadia block were randomly selected for this study. All the children of three to five years of these randomly selected anganwadis were enrolled in the study. Only this age group children were included in the study because they were the one who came to anganwadi for receiving supplementary nutrition. Total number of children aged between three to five years in all these six anganwadis came out to be 111. Initially all these children were enrolled in the study. All precautions were taken to reduce attrition problems. Standardization was done for anthropometric measurements (weight, length, head circumference, chest circumference) of children by using single instrument.

The pretested and predesigned questionnaire was used for data collection. Data on various social and cultural factors was taken from the mothers of the children beneficiaries of anganwadi at their homes. And anthropometric measurements of the children were done at anganwadis. Data for availing of supplementary nutrition by child and was obtained from anganwadis. On the basis of this data children were divided into two cohorts.

Exposed cohort included the children who received supplementary nutrition on an average for only up to 14 days per month over past six months. i.e. they were considered to have received inadequate supplementary nutrition. And unexposed cohort included the children who received supplementary nutrition on an average for more than 14 days per month over past six months, i.e. they were considered to have received adequate supplementary nutrition.

We assured that all children and their mother would be available at their home for next one year. Then, follow up visit was done two times over the period of one year, once in January-February, 2011 and the other in July-August 2011. At the end of the follow up period, 104 children remained in the study, because seven children moved from one group to another and hence, excluded from the analysis.

Data was entered and analyzed by using Epi Info software version 3.5.2 and SPSS version 16 was used for multivariate analysis.

Results

Out of 104 children, 34 were exposed (they did not receive adequate supplementary nutrition) and 70 were unexposed (they received adequate supplementary nutrition). The table 1 describes the changes in the physical growth of children under study over the period of one year. When baseline visit (visit 1) was taken into account, it was found that all the indicators of physical growth were lower in exposed group (mean weight = 10.9 kg, mean height = 86.9 cm) than the unexposed group (mean weight = 12.6 kg, mean height = 90.9 cm). As the year progressed, there was increase in the indicators of physical growth, irrespective whether the child received adequate (more than 14 days per month) supplementary nutrition or not.

Table-1: Anthropometric Indicators of Children under Study over 1 Year Period

Indicator	Exposed Cohort (n=34)			Unexposed Cohort (n=70)		
	Visit 1	Visit 2	Visit 3	Visit 1	Visit 2	Visit 3
Weight (kg) (mean ± SD)	10.9 ± 1.3	11.4 ± 1.2	11.8 ± 1.2	12.6 ± 1.4	13.3 ± 1.5	13.9 ± 1.5
Height (cm) (mean ± SD)	86.9 ± 4.9	88.3 ± 4.7	89.6 ± 4.7	90.9 ± 5.4	92.7 ± 5.5	94.1 ± 5.3

Table-2: Mean Increase in the Indicators of Physical Growth over Period of One Year

Indicator	Exposed Cohort (n=34)	Unexposed Cohort (n=70)	Total (n=104)	p value
Weight (kg) (mean ± SD)	841.2 ± 149.9	1338.6 ± 289.1	1175.9 ± 343.8	<0.000001
Height (cm) (mean ± SD)	26.3 ± 9.6	30.9 ± 18.8	29.4 ± 16.5	>0.05

Table-3: Percentiles of Weight Gain and Height Gain over One Year Period

	Exposed Group		Unexposed Group	
	Weight Gain (gm)	Height Gain (mm)	Weight Gain (gm)	Height Gain (mm)
Minimum	300	15	300	15
1st Quartile	800	20	1200	25
Median	900	22.5	1400	30
3rd Quartile	900	30	1500	40
Maximum	1000	50	2500	55
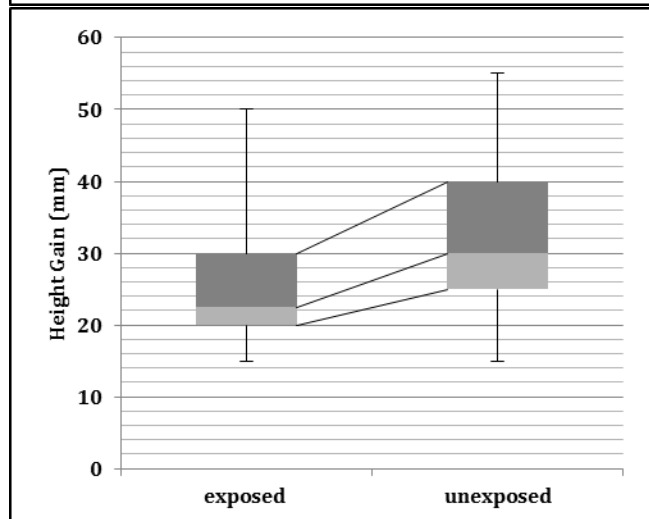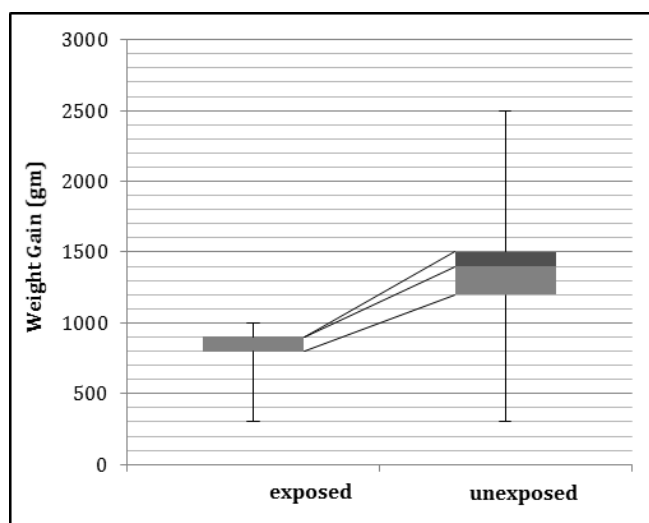
Figure-1: Box whisker Plot of Weight Gain and Height Gain in Exposed and Unexposed Group over the Period of One Year

Table-4: Pearson's Correlation Coefficient (r) of Weight Gain and Height Gain over One Year Period and Average Number of Days per Month in a Year for which Supplementary Nutrition is availed by the Child

Variables	r	p value
Supplementary nutrition and weight gain	0.604	p<0.01
Supplementary nutrition and height gain	0.154	p>0.05

Table-5: Multiple Linear Regression Analysis Table Denoting the Regression Coefficients of Significant Explanatory Variables Affecting Weight Gain in Children over One Year Period

Variable	Regression Coefficient	Wald's Statistic (t)	p value	95 % CI
Constant	388.3	4.1	<0.0001	200.3-576.3
Supplementary Nutrition	45.1	8.1	<0.00001	34.4-55.8
Caste	257.5	3.5	0.001	112.4-412.7

The table 2 describes the mean change in the indicators of physical growth in both exposed and unexposed group of children over the period of one year. When weight gain was considered, mean increase in weight in exposed group was 841 grams compared to near 1300 gram for unexposed group and the difference was found to be significant. But, when height gain was taken into account, the difference in exposed and unexposed cohort of children was not significant.

Table 3 shows the minimum, 1st quartile, median, 3rd quartile and maximum value of weight gain and height gain in exposed group i.e. children receiving supplementary nutrition up to 14 days per month and unexposed group i.e. children receiving supplementary nutrition more than 14 days per month over the period of one year. It is clearly seen that all the percentiles as well as range of weight gain as well as height gain is more in unexposed group than exposed group.

The figure 1 shown above supports the finding of table 3, which compares the weight gain and height gain over the period of one year in exposed and unexposed group by box whisker plot. Range of weight gain in children of exposed group (not received adequate supplementary nutrition) was from 300 gram to 1000 gram, while it was from 300 gram to 2500 gram in unexposed group (received adequate supplementary nutrition). Quartiles and median weight gain was also higher in the children who received adequate supplementary nutrition. Similar was the case with height gain, but it was not as remarkable as the difference which weight gain had among exposed and unexposed group.

When correlation between average number of days for which supplementary nutrition was provided in anganwadi and weight gain was checked, Pearson's correlation coefficient was

found to be significant at 1 % level, which was r = 0.604, which means there is an association between supplementary nutrition provided in anganwadi and weight gain over the period of one year. This was not the case with supplementary nutrition and height gain.

Multivariate analysis was done by including various predictor variables including variable of our interest (supplementary nutrition provided at anganwadis). Various variable include exposure factor (average number of days per month for which supplementary nutrition was provided), age, sex, caste, family type, family size, education of parents, average expenditure of child's family per month, status of borrowing money or selling assets of child's family, illness in past six months and birth weight.

Then backward elimination approach was used to find the best model. This means eliminating variables or groups of variables one at a time, keeping only those that are meaningful in the model depending the more p value suggesting variable remove first and then next higher and so on. So at every level, the factor which did not have significant effect on weight gain was removed. And at the end, only two factor remained, which included caste of the child and variable of our interest (average number of days per month for which supplementary nutrition was provided).

The result shows that, even without contribution of any factor, a child would gain about 388 gram of weight in 1 year with 95 % confidence interval ranging from 200 gram to 577 gram. When supplementary nutrition is provided to the child for one day per month per year, a child gained 45 gram more weight as compared to child who did not avail supplementary nutrition even for a single day with the 95 % confidence interval ranging from 34 gram to 56 gram. When caste was taken into account, a child belonging to SEBC caste gained 257 gram more weight per year as compared to the child belonging to ST caste with the 95 % confidence interval ranging from 112 gram to 412 gram.

So the final model is, **Weight gain (gram) = 388.3 + 45.1 × supplementary nutrition (days) + 257.5 × caste (SEBC)**

Model summary showed that R2 value for the present study was 0.423, which means that 42.3 % proportion of variance of the original data explained by the model.

Discussion

Gujarat has crossed the population of 6 crores as per the provisional data released under census2011.[4] 14.79% of the population in Gujarat is tribal.[5] Out of total 26 districts of Gujarat, more than half are tribal districts. In southern Gujarat, all districts have population of scheduled caste and scheduled tribe in a substantial amount. Southern Gujarat includes districts of Dangs, Valsad, Navsari, Surat and Bharuch. Bharuch district is situated between the central Gujarat and the south Gujarat and has many blocks which are predominantly tribal including Jhagadia.[6] The proportion of tribal population of villages of Jhagadia ranges from 67.5 % to 86.5 %.[7]

A sizable number of tribal in this district are socioeconomically underprivileged and have BPL status. Although the literacy level in this district is 70%[4], but the proportion of illiterates in this block is 52 % to 58.4% and a number of tribal groups are either agricultural laborer (39.5 % to 43.4 %)[7] or own meagre quantity of land. Landless labourers are usually daily wagers and earn about forty to fifty rupees per day.[8] It has been observed that both the husband and wife go to field from morning to evening during the farming seasons. Because of their work, they take their children along with them in the farm, preventing them to receive supplementary nutrition provided in anganwadi, which is said to provide one third of calorie and one half of daily protein requirement of the child. So there was need of the study, which quantifies the effect of supplementary nutrition on growth of the children, so that its importance could be well explained to the parents.

With this background, it was tried to observe the pattern of malnutrition taking into consideration 111 children from sampled six anganwadis from Jhagadia block. All 111 children were divided into two groups depending upon their exposure to supplementary nutrition. Those receiving

supplementary nutrition only up to 14 days were labeled as exposed cohort and those receiving supplementary nutrition for more than 14 days were considered in unexposed cohort. Total 34 children received on an average supplementary nutrition up to 14 days, whereas almost double number of children reported receiving SN for more than 14 days a month. While calculating the mean attendance during study period, seven children moved from one group to another and hence, excluded from final analysis, giving a total of 104 children under observation for this study.

In the study done by Bhasin, Sanjiv K. et al, it was observed that total attendance at the anganwadi showed statistically significant relation with the degree of malnutrition. Overall, children who attended anganwadis were nutritionally better than their counterparts who did not attend anganwadi during their childhood. He pointed by univariate analysis that attendance in anganwadi is significantly associated with degree of malnutrition $p < 0.05$.[9]

Sumati vaid et al in their study found that children who attended anganwadi centers had good health or appearance as compared to their counterparts. Chi-square revealed that there is significant difference in the height and weight of the children who attended ICDS centers and those who did not attend ICDS centers at 0.10 and 0.025 level of significance. They observed that weight and height of the children who attended anganwadi was significantly higher than the child who did not attend anganwadi. They attributed this difference to the supplementary nutrition component of the anganwadi.[10]

Mean values of both the parameters i.e. weight and height were higher among those who were in unexposed cohort as compared to children in exposed group. It means that children categorized as receiving adequate supplementary nutrition were better off in terms of their weight, height and mid arm circumference to start with. The above statement was checked by examining differences in mean weight gain between these two groups over the period of one year. The statistically significant gain in weight over a period of one year in unexposed group may be due to the exposure factor of supplementary nutrition.

This study had restricted period of observation with only three readings over one year. Thus, weight being more sensitive to get affected, got significantly increased due to supplementary nutrition in this study. Higher variation in unexposed cohort (e.g. range of height gain from 15 mm to 55 mm, range of weight gain from 300 gram to 2500 gram) suggest the existence of major potential for increase in height and weight gain in the children receiving adequate supplementary nutrition. It is clearly seen from Box-Whisker plot and summary statistics that potential of achievement for anthropometric parameters could not be utilized by children from the exposed group who received supplementary nutrition for few days.

Multiple linear regression analysis gave a model which predicted two variables namely supplementary nutrition and caste as determinants for weight gain over the period of one year. With increase in supplementary nutrition for one day per month per year, 45 gram of weight gain is expected. The expected weight gain ranges from 35 to 55 gram. In practice, the use of variable caste in this model, would be difficult due to two reasons. The major chunk of the beneficiaries for supplementary nutrition for under-five children belonged to scheduled tribe. Another caste like SEBC which took benefits of supplementary nutrition, was distinctly different in terms of a number of characteristics. The model derived in this study is able to explain the variability in weight gain by 42% when days of supplementary nutrition and caste are considered. This figure shows usefulness of the model in predicting the outcome. Hence, days of supplementary nutrition as defined in this study and considered as an exposure variable has come out as effective predictor for an outcome variable of weight gain. The significance of caste in this model may not have much practical application because most of the beneficiary group would come from a single caste having similar profile.

In a study done by Monica Jain, the findings were not akin to that of our study. She pointed that for the children aged 3-5, the supplementary nutrition component of ICDS program does not seem to be making any significant positive difference for height or weight. However she

pointed that though there was no effect of supplementary nutrition on nutritional status for children 3-5 years, it does not necessarily mean that supplementary nutrition should be stopped for this age-group. In addition, it is possible that supplementary nutrition might be helping to keep morbidity down. Also, supplementary nutrition might help to maintain energy levels for children, so that they can engage in physical activity which is important for the maintenance of good health, social and psychological well-being, and perhaps even cognitive development. Moreover, since ICDS is providing only 20-30% of the energy requirements of these children, she did not expect to see rapid weight gain.[11]

Conclusion

Both weight gain and height gain was more in the children who received adequate supplementary nutrition than the children who did not receive adequate supplementary nutrition. Among various factors, which were included for predicting weight gain, supplementary nutrition and caste of the child were found to be the most important factors I predicting weight gain the children beneficiaries of the anganwadi.

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