

# **A study on Food and Nutrient Intake of selected school children under Noon meal programme in Madurai**

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## **Abstract**

India has the largest child population in the world. All efforts are being made by the Government for the development and welfare of children (Batool et al., 2012). In order to develop a scientifically sound and economically feasible health status of the children, the best and most effective long-term approach is good nutrition. Nutritional status is the condition of health of an individual as influenced by nutrient intake and utilization in the body. A total of 800 school going children between the age group of 6-13 years from primary schools, middle schools, high schools and higher secondary schools were selected for the study by random sampling method. Out of 800 school children, 400 children who participated in noon meal programme were considered as beneficiaries and other 400 children who did not participate in noon meal programme were considered as non- beneficiaries. To elicit information on socio-economic status, lifestyle, dietary pattern, Food Frequency and health status of the selected population, a specially designed interview schedule was developed. Mean food intake for the beneficiaries and non-beneficiaries of children in the age group of 6-10 years(n=428) and 11-13 years(n=372) were assessed, computed and compared from 24-hour Food recall schedule (ICMR, 2010). Mean nutrient intake for the beneficiaries and non-beneficiaries of children in the age group of 7-9 years(n=200) and 10-12 years (n=200; both boys & girls) were analyzed, computed and compared with Recommended Dietary Allowance (RDA) ICMR 2010.

From the data analysis, Comparison between beneficiary and non-beneficiary of selected children showed that, the mean food and nutrient intake of beneficiaries were better than non-beneficiaries. It might be due to regular intake of noon-meal in the school. But even for the beneficiaries some of the nutrient intake was lesser than ICMR, RDA. So, Children require a quantitatively, qualitatively and nutritionally balanced diet in order to meet the nutrient demands and also to improve the health & nutritional status.

*Key words: School children, noon meal, food intake, nutrient intake, nutritional status*

## 1. Introduction

Children constitute principle assets of any country. Children's development is very important for the overall development of society and the best way to develop national human resources is to take care of children. Nutrition is a fundamental pillar of human life, health and development across the entire lifespan. From the earliest stages of foetal development, at birth, through infancy, childhood, adolescence, and into adulthood and old age, proper food and good nutrition are essential for survival, physical growth, mental development, performance and productivity, health and well-being (WHO, 2000). Individuals can be broadly categorized into having optimal nutritional status, or being undernourished, over nourished, and malnourished. It is important to realize that many other life style and environmental factors, in addition to nutrition, influence health and wellbeing, but nutrition is a major, modifiable and powerful factor in promoting health, preventing and treating disease and improving quality of life. (Alim *et. al.*, 2012). An inadequate or imbalanced nutritional intake may not only affect growth and development in childhood but may also have its impact on health problems, such as heart disease later in life (Mansur *et al.*, 2015). The mid-day meal should contain adequate nutrients and should be palatable, hygiene, and operationally feasible. The food safety guidelines are for school level kitchens only, where the mid day meal is cooked for children. Quality assurance of mid day meal and food safety should be an integral part of food handling procedures at the school kitchen. The food provided through these kitchens should be nutritious, free from food adulterants, contamination pathogens, artificial non-food grade colours, and additives and adhere to food safety and quality norms.

Food safety encompasses selection, handling, preparation and storage of food in ways that prevent food borne illness and contamination. This includes a number of routines that should be followed to avoid potentially severe health hazards. ([www.mhrd.gov.in/guidelines-foodsafety-and-hygiene-under-mid-day-meal](http://www.mhrd.gov.in/guidelines-foodsafety-and-hygiene-under-mid-day-meal))

Growth is a significant indicator of nutrition status and health as poor diet and frequent infections can lead to growth retardation. So, the aim of the present study is to elicit information on socio- economic status and dietary pattern of the selected subjects as well as to assess the food and nutrient intake of the selected subjects. Nutritional status is the condition of health of an individual as influenced by nutrient intake and utilization in the body.

## 2. Literature review

In view of the importance of the review of related research, an attempt was made to analyze the related researches on nutritional status of children and Noon Meal Scheme. Nutrition is a significant factor in the growth, development and overall functioning of a child. Meeting nutritional requirements throughout childhood is essential for the development. An inadequate or imbalanced nutritional intake may not only affect growth and development in childhood but may also have its impact on health problems, such as heart disease later in life (Basavanthappa, 2008).

In low socio economic communities, the meal should be able to fill the nutrient gap that exists in the diets of children thus the school meal in principle should ensure bridge this food gap. Many nationwide surveys and studies undertaken at region levels by scientist have indicated except of nutrient deficiencies (Bakhetia, 2007). Protein Energy Malnutrition (PEM) signifies an imbalance between the supply of protein and energy and the body's demand for these to ensure optimal growth and function (Newel EI-Sayed, *et al.*, 2001).

The noon meal has many positive attributes such as a. Promoting school participation; b. Preventing classroom hunger; c. Facilitating the healthy growth of children; d. Intrinsic educational value; e. Fostering social equality; f. Enhancing gender equity; and g. Ensuring psychological benefits. (Ghatak 2010). Nutrition support to primary education is considered as a means to achieve the objective of providing free and compulsory universal primary education of satisfactory quality to all the children below the of 14 years (Srinivasan, 2008).

According to ICMR (2004), the calorie needs increase with the metabolic demands of growth and energy expenditure of the growing school children. Insufficient food not only results in under nutrition in terms of inadequate weight gain but also hinder their growth pattern. Up to 10 years of age, there is no difference in sex for ICMR- RDA. Nutritional status is the condition of health of an individual as influenced by nutrient intake and utilization in the body. The nutritional status is one of the best indicators of well being of population. (Mansur *et al.*, 2015)

## 3. Methodology

Madurai is the most important district in the state of Tamil Nadu. The research was carried out in government schools in Madurai, Madurai district, Tamil Nadu. The area which was selected for the study was based on the convenience of the investigator and the schools were chosen because of the availability of the required number of school going children, easy approachability, accessibility and good cooperation from the teachers, school meal organizers and also cooperation from the children and their parents.

A total of 800 school going children between the age group of 6-13 years from primary schools, middle schools, high schools and higher secondary schools were selected for the study by random sampling method. Out of 800 school children, 400 children who participated in noon meal programme were considered as beneficiaries and other 400 children who did not participate in noon meal programme were considered as non- beneficiaries. Dietary details regarding dietary habit, meals consumed, food preferences and frequency of food consumption were recorded. Data regarding the diet consumed by the different categories of the population, information on meal pattern, frequency of food consumption, eating behavior, food and nutrient intake and food preferences of the children were obtained through diet survey.

Mean food intake for the beneficiaries and non-beneficiaries of children in the age group of 6-10 years(n=428) and 11-13 years(n=372) were assessed, computed and compared from 24-hour Food recall schedule (ICMR, 2010).

Mean nutrient intake for the beneficiaries and non-beneficiaries of children in the age group of 7-9 years(n=200) and 10-12 years (n=200; both boys & girls) were analyzed, computed and compared with Recommended Dietary Allowance (RDA) ICMR 2010.

The average food intake of the children was calculated and compared with the suggested allowances of ICMR (2010). The raw equivalents for these food items were calculated and the nutrient available from this food intake was computed using the Tables of Food Composition and compared with RDA, ICMR, (2010).

## **4. Results and Discussion**

### **Food intake pattern of the sample children**

Food intake pattern of an individual children was influenced by socio-economic status, cultural practices and seasonal availability of the foods. This will also decide about the adequacy of the diets in terms of nutrient requirements. The mean food intake of the beneficiaries and non-beneficiaries children of age 6 to 10 years are shown in Table 4.1 & Figure 4.1.

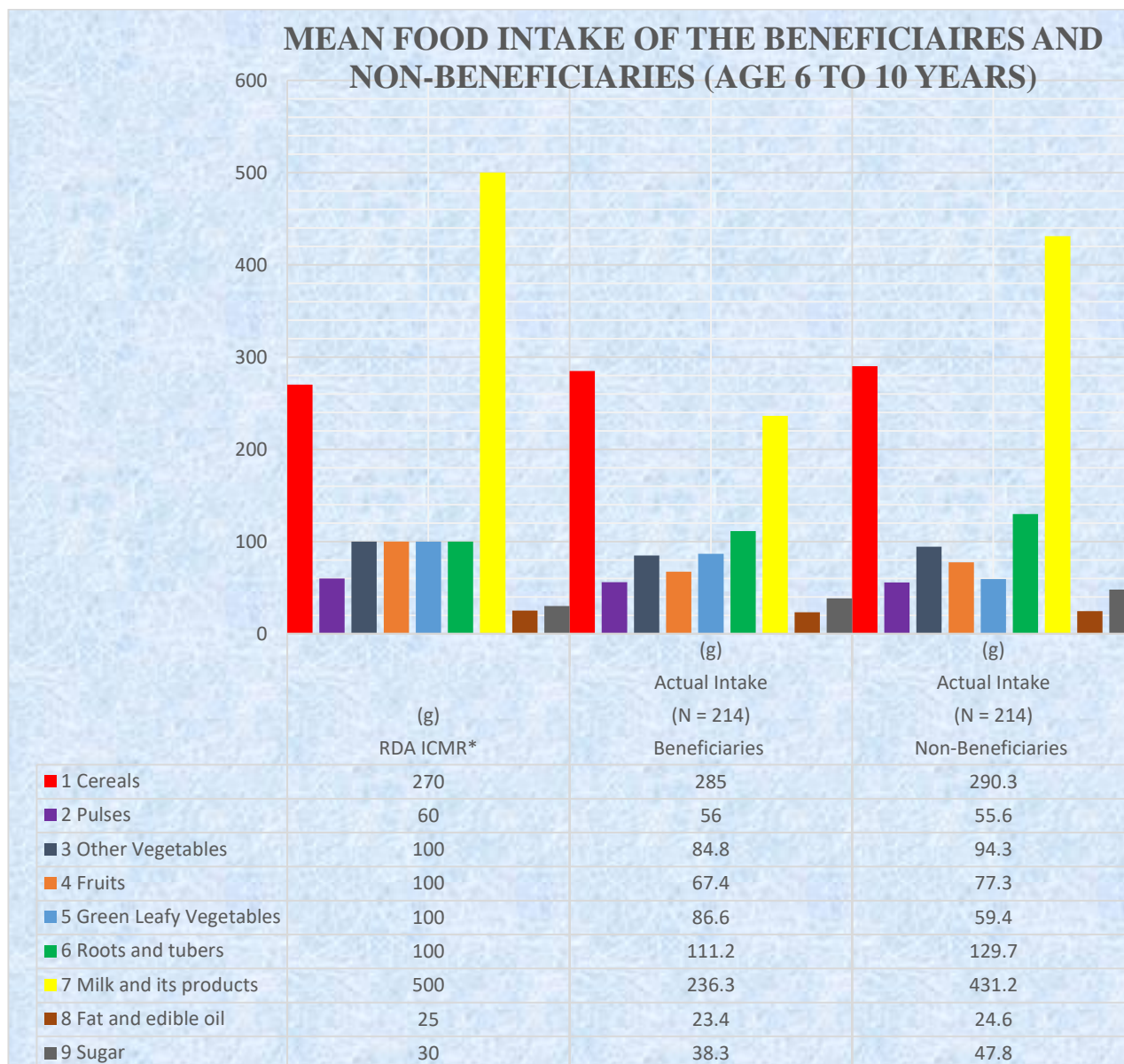
**TABLE –4.1**  
**MEAN FOOD INTAKE OF THE BENEFICIAIRES AND NON-  
 BENEFICIARIES (AGE 6 TO 10 YEARS)**

Sl.No	Food items	RDA ICMR* (g)	Beneficiaries (N = 214)		Non-Beneficiaries (N = 214)	
			Actual Intake (g)	Excess/ Deficit (%)	Actual Intake (g)	Excess/ Deficit (%)
1	Cereals	270	285	(+) 5.56	290.3	(+) 7.51
2	Pulses	60	56.0	(-) 6.67	55.6	(-) 7.33
3	Other Vegetables	100	84.8	(-) 15.2	94.3	(-) 5.7
4	Fruits	100	67.4	(-) 32.6	77.3	(-) 22.7
5	Green Leafy Vegetables	100	86.6	(-) 13.4	59.4	(-) 40.6
6	Roots and tubers	100	111.2	(+) 11.2	129.7	(+) 29.7
7	Milk and its products	500	236.3	(-) 263.7	431.2	(-) 68.8
8	Fat and edible oil	25	23.4	(-) 6.4	24.6	(-) 1.6
9	Sugar	30	38.3	(+) 27.6	47.8	(+)59.3

Note: Excess (+) or deficit (-) in percentage

\* Recommended Dietary Allowance (RDA) ICMR 2010 (g = gram)

**Figure-4.1 MEAN FOOD INTAKE OF THE BENEFICIAIRES AND NON-BENEFICIAIRES (AGE 6 TO 10 YEARS)**



The data gathered and presented in Table & Figure 4.1 revealed that the mean intake of cereal was 5.56 per cent and 7.51 per cent excess among 6 to 10 years of beneficiaries and non-beneficiaries respectively. With regard to pulses, there was a deficit of 6.67 per cent and 7.33 percent among beneficiaries and non-beneficiaries respectively. It is important to notice that among the food items, intake of sugar had a marked excess of 27.6 per cent and 59.3 per cent among beneficiaries and non-beneficiaries respectively. It is followed by roots and tubers which showed excess of 11.2 percent and 29.7 percent of beneficiaries and non-beneficiaries respectively.

Intake of fruits was marked deficit of 32.6 per cent and 22.7 per cent among beneficiaries and non-beneficiaries respectively. Intake of milk and milk products was also a showed a marked deficit of 263.7 per cent among beneficiaries and 68.8 per cent among non-beneficiaries. Intake of green leafy vegetables showed a deficit of 13.4 per cent and 40.6 percent among beneficiaries and non-beneficiaries respectively. It is followed by other vegetables which showed a deficit of 15.2 per cent and 5.7 per cent among beneficiaries and non-beneficiaries respectively. Intake of fat and edible oil was also showed a marked deficit of 6.4 per cent among beneficiaries and 1.6 per cent among non-beneficiaries.

Table 4.2 shows the mean food intake of the children of age 11 to 13 years.

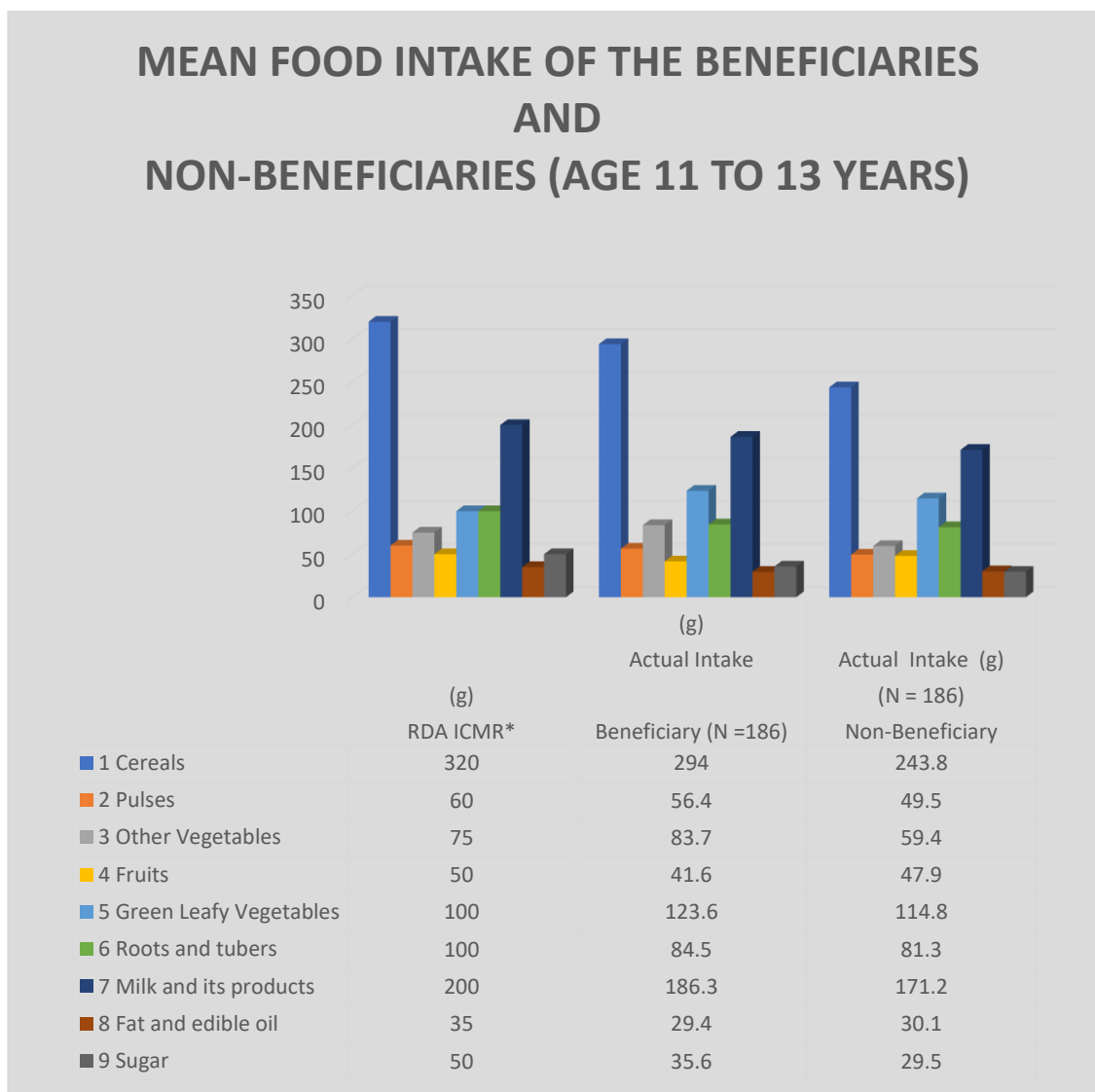
**TABLE 4.2**  
**MEAN FOOD INTAKE OF THE BENEFICIARIES AND**  
**NON-BENEFICIARIES (AGE 11 TO 13 YEARS)**

Sl.No	Food items	RDA ICMR* (g)	Beneficiary (N =186)		Non-Beneficiary (N = 186)	
			Actual Intake (g)	Excess/ Deficit (%)	Actual Intake (g)	Excess /Deficit (%)
1	Cereals	320	294	(-) 8.13	243.8	(-) 23.8
2	Pulses	60	56.4	(-) 5.67	49.5	(-) 19.7
3	Other Vegetables	75	83.7	(+) 11.6	59.4	(-) 20.8
4	Fruits	50	41.6	(-) 16.8	47.9	(-) 4.2
5	Green Leafy Vegetables	100	123.6	(+) 23.6	114.8	(+) 14.8
6	Roots and tubers	100	84.5	(-) 15.5	81.3	(-) 18.7
7	Milk and its products	200	186.3	(-) 6.85	171.2	(-) 14.4
8	Fat and edible oil	35	29.4	(-) 16.0	30.1	(-) 14.0
9	Sugar	50	35.6	(-) 28.8	29.5	(-) 41.0

Note: Excess (+) or deficit (-) in percentage

\* Recommended Dietary Allowance (RDA) ICMR 2010

**Figure-4.2 MEAN FOOD INTAKE OF THE BENEFICIARIES AND NON-BENEFICIARIES (AGE 11 TO 13 YEARS)**



It was inferred from Table & Figure 4.2 that intake of cereals showed a percentage deficit of 8.13 per cent and 23.8 per cent among beneficiaries and non-beneficiaries and the intake of green leafy vegetables were found to be excess of 23.6 per cent among beneficiaries and 14.8 per cent among non-beneficiaries. With regard to pulses, there was a deficit of 5.67 percent and 7.5 percent among beneficiaries and non-beneficiaries respectively. Intake of other vegetables of the 11 to 13 years children of beneficiaries were found to be excess of 11.6 per cent and deficit of 20.8 per cent among non-beneficiaries. Intake of root and tubers showed a percentage deficit of 15.5 per cent and non-beneficiaries. Intake of milk and milk products, & fats and oil (6.85,14.4 & 16,14) showed a deficit among both beneficiaries and non-beneficiaries respectively. Intake of fruit, & sugar (16.8,4.2 & 28.8,41) were also showed a deficit among both beneficiaries and non-beneficiaries respectively.



## Nutrient Consumption of Selected Children

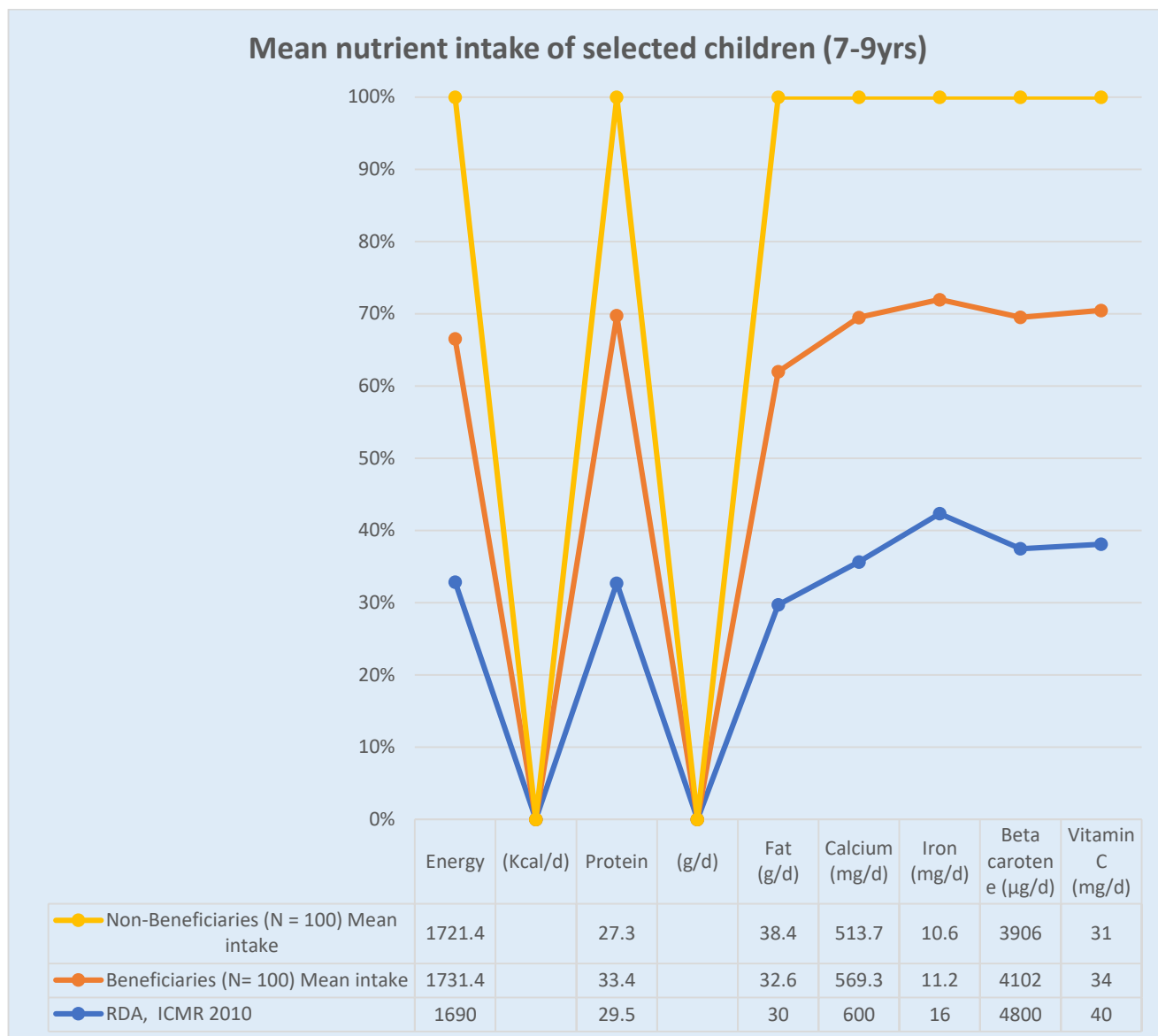
Intake of nutrients of selected beneficiary and non-beneficiary children were ascertained using 24-hour recall technique. Energy, Protein, Fat, Calcium, Iron Beta-carotene and Vitamin A intake per day were computed. Comparison of these nutrients with RDA (Recommended Dietary Allowance) values (ICMR, 2004) prevailing during the study period. The data collected about the nutrient intake for the children in the age group of 7-9 years was presented in Table 4.3

**Table 4.3 Mean Nutrient Intake of selected children (7-9yrs)**  
N=200

Nutrients	RDA, ICMR 2010	Beneficiaries (N= 100)		Non-Beneficiaries (N = 100)	
		Mean intake	Excess (+)/ Deficit (-)	Mean intake	Excess (+) /Deficit (-)
Energy (Kcal/d)	1690	1731.4	(+41.4)	1721.4	(+31.4)
Protein (g/d)	29.5	33.4	(+3.9)	27.3	(-2.2)
Fat (g/d)	30	32.6	(+2.6)	38.4	(+8.4)
Calcium (mg/d)	600	569.3	(-30.7)	513.7	(-86.3)
Iron (mg/d)	16	11.2	(-4.8)	10.6	(-5.4)
Beta carotene (µg/d)	4800	4102	(-698)	3906	(-894)
Vitamin C (mg/d)	40	34	(-6)	31	(-9)

\* Recommended Dietary Allowance (RDA) ICMR 2010

**Figure-4.3 Mean Nutrient Intake of selected children (7-9yrs)**



The results in Table & Figure 4.3 indicated that, the mean intake of energy and fat for both beneficiaries and non-beneficiaries were comparatively higher than the RDA-ICMR 2010. Mean intake of protein was higher than the RDA for beneficiaries but for non-beneficiaries it was lower. All the other nutrients like calcium, iron, beta-carotene and vitamin C mean nutrient intake for both beneficiaries and non-beneficiaries were comparatively lower than the RDA-ICMR 2010. Comparison between beneficiaries and non-beneficiaries mean nutrient intake showed that, the mean nutrient intake of beneficiaries was better than non-beneficiaries. It might be due to the regular intake of noon-meal in the school. Thus, it may be inferred from the analysis that noon meal programme contributes positively to increase daily nutrient requirement of selected children under this study.

**Table 4.4 Mean Nutrient Intake of selected children (10-12yrs) N=200**

Nutrients	Gender	RDA ICMR 2010	Beneficiaries (N= 100)		Non-Beneficiaries (N = 100)	
			Mean Intake	Excess (+) / Deficit (-)	Mean Intake	Excess (+) / Deficit (-)
Energy (Kcal/d)	Boys	2190	2226.8	+36.8	1819.13	-370
	Girls	2010	2168.5	+158.5	1865.2	-144.8
Protein (g/d)	Boys	39.9	42.3	+2.4	36.8	-3.1
	Girls	40.4	40.2	+0.2	38.3	-2.1
Fat (g/d)	Boys	35	32.38	+2.62	38.2	+3.2
	Girls	35	34.8	+0.2	42.1	+7.1
Calcium (mg/d)	Boys	800	759.5	-40.5	652.6	-147.4
	Girls	800	829.8	+29.8	632.5	-167.5
Iron (mg/d)	Boys	21	16.4	- 4.6	15.5	-5.5
	Girls	27	28.5	+1.5	23.2	-3.8
β -carotene (µg/d)	Boys	4800	3966	-834	3574	-1226
	Girls	4800	3798	-1002	3658	-1142
Vitamin C (mg/d)	Boys	40	32	-8	31	-9
	Girls	40	35	-5	30	-10

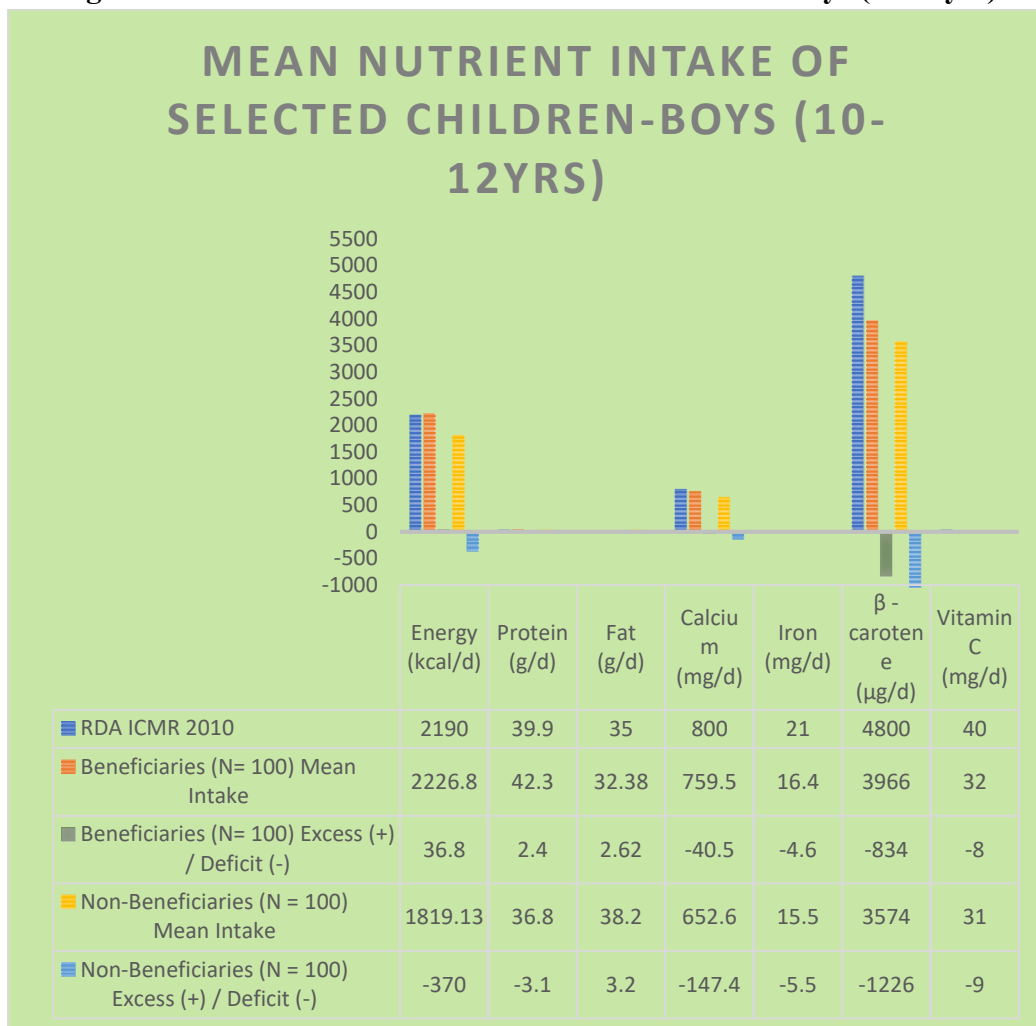
\* Recommended Dietary Allowance (RDA) ICMR 2010

From the Table 4.4 it was inferred that, the mean intake of consumption of nutrients like energy, protein, fat, calcium, iron, beta-carotene and vitamin C of beneficiaries and non-beneficiaries of both boys and girls were discussed and compared with RDA to know the excess or deficit intake.

**Table 4.5 Mean Nutrient Intake of selected children-Boys (10-12yrs)**

Nutrients	RDA ICMR 2010	Beneficiaries (N= 100)		Non-Beneficiaries (N = 100)	
		Mean Intake	Excess (+) / Deficit (-)	Mean Intake	Excess (+) / Deficit (-)
Energy (kcal/d)	2190	2226.8	+36.8	1819.13	-370
Protein (g/d)	39.9	42.3	+2.4	36.8	-3.1
Fat (g/d)	35	32.38	+2.62	38.2	+3.2
Calcium (mg/d)	800	759.5	-40.5	652.6	-147.4
Iron (mg/d)	21	16.4	- 4.6	15.5	-5.5
β -carotene (µg/d)	4800	3966	-834	3574	-1226
Vitamin C (mg/d)	40	32	-8	31	-9

**Figure 4.4 Mean Nutrient Intake of selected children-Boys (10-12yrs)**

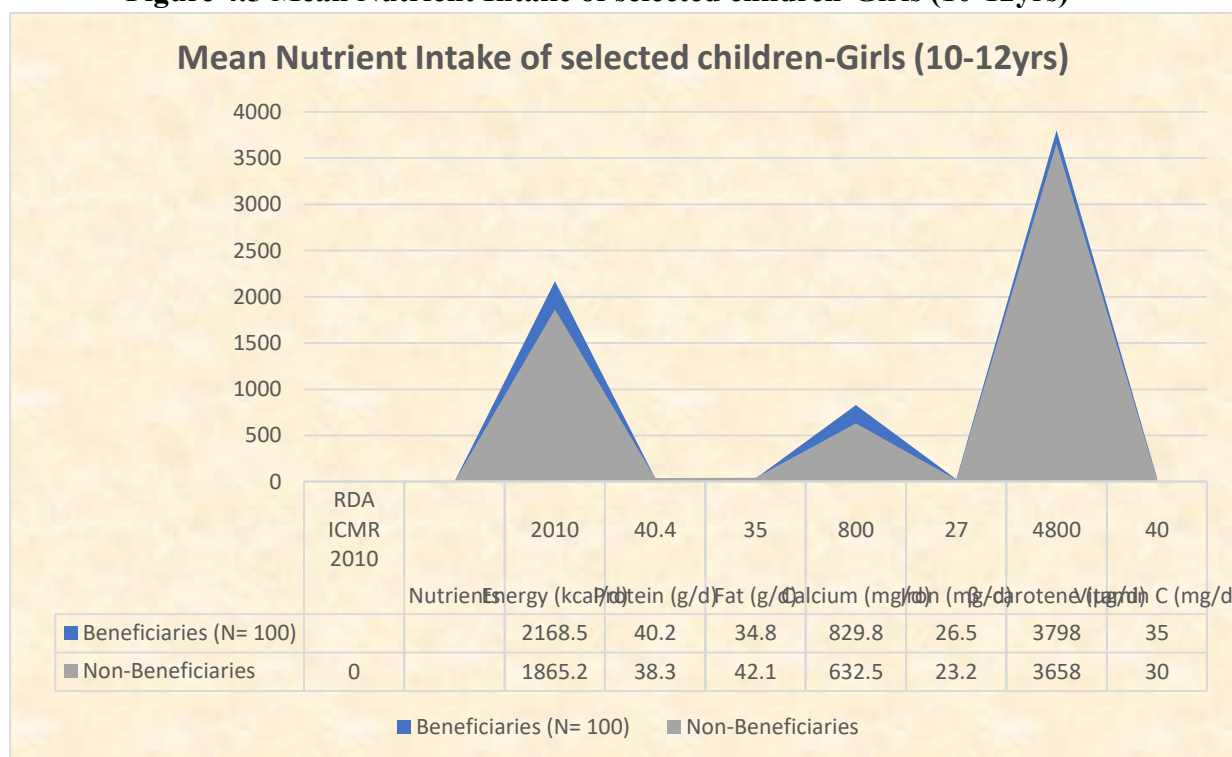


The results in Table 4.5 & Figure 3.4 indicated that in the case of beneficiary boy children the mean energy, protein and fat were comparatively excess and for non-beneficiary boy children the mean intake of energy and protein were lower than the RDA-ICMR 2010, but the fat intake of non-beneficiary boy children was higher. All the other nutrients like calcium, iron, beta-carotene and vitamin C mean nutrient intake for both beneficiary and non-beneficiary boy children were comparatively lower than the RDA-ICMR 2010.

**Table 4.6 Mean Nutrient Intake of selected children-Girls (10-12yrs)**

Nutrients	RDA ICMR 2010	Beneficiaries (N= 100)		Non-Beneficiaries (N = 100)	
		Mean Intake	Excess (+) / Deficit (-)	Mean Intake	Excess (+) / Deficit (-)
Energy (kcal/d)	2010	2168.5	+158.5	1865.2	-144.8
Protein (g/d)	40.4	40.2	-0.2	38.3	-2.1
Fat (g/d)	35	34.8	+0.2	42.1	+7.1
Calcium (mg/d)	800	829.8	+29.8	632.5	-167.5
Iron (mg/d)	27	26.5	-0.5	23.2	-3.8
β -carotene (µg/d)	4800	3798	-1002	3658	-1142
Vitamin C (mg/d)	40	35	-5	30	-10

**Figure 4.5 Mean Nutrient Intake of selected children-Girls (10-12yrs)**



It is clearly understood from Table 4.6 & Figure 4.5 that in the case of beneficiary girl children the mean nutrient intake of energy, protein, fat, and calcium were found to be excess than the RDA – ICMR (2010) and it was deficit for beta-carotene, iron and vitamin C. In the case of non-beneficiary girl children, except fat, all other nutrients energy, protein, calcium, iron, beta-carotene and vitamin C were found to be deficit than the RDA. Thus, it was concluded that, the noon meal programme contribute nearly one third of the daily nutrient allowance for both beneficiary boy and girl children.

## **5. Conclusion**

From the present study it was concluded that, the mean food intake and the mean intake of consumption of nutrients like energy, protein, fat, calcium, iron, beta-carotene and vitamin C of beneficiaries and non-beneficiaries of both boys and girls were discussed and compared with RDA to know the excess or deficit intake. It was suggested that nutritional quality of noon meal can be further improved by inclusion of more fruits and vegetables or alternatively a fortified food which will take care of the micronutrient deficits.

From the data analysis, Comparison between beneficiary and non-beneficiary of selected children showed that, the mean food and nutrient intake of beneficiaries were better than non-beneficiaries. It might be due to regular intake of noon-meal in the school. But even for the beneficiaries some of the nutrient intake was lesser than ICMR, RDA. The global education initiative called “Feeding Minds, Fighting Hunger” (FMFH) for improving nutrition related knowledge among children which is found to be interactive and sustainable. So, Children require a quantitatively, qualitatively and nutritionally balanced diet in order to meet the nutrient demands and also to improve the health & nutritional status.

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