https://doi.org/10.48047/AFJBS.6.15.2024.7627-7640

African Journal of Biological Sciences

Journal homepage: http://www.afjbs.com

Research Paper Open Access

Contribution of Institutional Mid-Day Meal towards RDA Accomplishment: A Study in Bengali Boys of Age Range 10-12 y in West Bengal, India

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Volume 6, Issue 15, Sep 2024

Received: 15 July 2024

Accepted: 25 Aug 2024

Published: 05 Sep 2024

doi: 10.48047/AFJBS.6.15.2024.7627-7640

ABSTRACT:
To eliminate hunger and undernutrition along with minimizing school drop-out rates and promoting better learning among children, the Government of India initiated Mid Day Meal Scheme (MDMS), now known as PM Poshan Scheme, the largest school lunch program in the world. Although policy wise the program is an important initiative, but often its nutritional aspects are not evaluated. In this backdrop, an attempt has been made to assess the nutritional contribution of MDM in children (age range: 10-12 y) in West Bengal. The results of the present study revealed that the average amount of energy (kcal) and protein (g) provided in MDM was 30.5% and 57.23% of RDA whereas the recommended norms are 33% and 50% respectively.

Keywords: food group, nutritional contribution, RDA, under nutrition

1. INTRODUCTION

School-going age, the transitional phase between childhood and adolescence, is considered the fourth developmental stage of life, after infancy, toddler, and preschooler. Moreover, it is the preparatory phase for rapid growth and development. Children in the age group of 0-14 year represent 29.5% of the large population of India (Census of India, 2011). The most important health

indicator is the growth of the child which is influenced by adequate intake of foods and nominal disease susceptibility. Cognitive health is also dependent on adequate food intake. Though in this period, growth is slower than in childhood, it is also the period when the body reserves adequate nutrition for rapid growth and development during middle and late adolescence (Foster *et al.*, 2004). Undernutrition is the most serious complication of this age group in South East Asia (WHO, 2013). Asia and Africa contribute 90% of the developing world's undernourished children of which 40% are from India (UNICEF, 2012). Undernourished children have both poor health and mental growth, so it is difficult for them to concentrate on education and schooling. To combat undernutrition, and its related issues and ensure nutrition security, especially in the present climatic condition (Banerjee et al., 2019), various strategies have been adopted by government and non-government organizations. In this regard, Mid Day Meal Scheme is an important school lunch program launched on August 15, 1995, by the then Ministry of Human Resource Development, now known as Ministry of Education, Government of India, to combat classroom hunger and promote better learning of school children belonging to low socio-economic group. In West Bengal, cooked MDM initially started in 1,100 schools of five districts such as Murshidabad, Birbhum, Bankura, Paschim Midnapore, and Jalpaiguri in January, 2003 (The Pratichi Report, 2010). The revised scheme, known as the 'Pradhan Mantri Poshan Shakti Nirman (PM Poshan)' Scheme with effect from September 29, 2021, is providing of hot cooked meals to children of pre-schools or Bal Vatika (before class I) along with about 11.80 crore children studying in classes I-VIII (6-14 years) in 11.20 lakh Govt. and Govt. aided schools, Education Guarantee Scheme (EGS), Alternative & Innovative Education (AIE) centres, Madrasas, and Maqtabs and made this scheme the largest of its kind worldwide (www.pmposhan.education.gov.in)

Most of the earlier studies have focused on the nutritional status of the children getting MDM and compared with those who did not get it. Still, there is a dearth of research regarding the adequacy of nutrients provided in the MDM. In this backdrop, the present attempt has been made to evaluate the nutritional contribution of MDM to meet recommended daily allowances of upper-primary school-going children.

2. METHODOLOGY

The present study was conducted among average 131 boys daily of age range 10-12 years, attending school from class five to eight for 12 months in a school located in West Bengal, India.

Initially, the study requirements were explained to the school authorities, parents/guardians, and the children. Names of the children whose parents/guardians showed interest and consented were enlisted. Individuals falling within the age range with no known chronic disease history (as reported by their parents/guardians) were considered for inclusion. The menu served in the school during the period and the amount of ingredients used for the preparation of meal was collected by the weighment of raw food method; for vegetables, weights were taken after peeling. The average amount of food consumed by each study participants on a single day was then calculated from the data obtained throughout the year. The nutritional composition of Mid-Day meal and the percent adequacy of MDM towards RDA was calculated (Longvah *et al.*, 2017; Revised RDA, 2024).

3. RESULTS

The weekly menu prescribed for the MDM by the Government of West Bengal (AWP&B on MDM, 2020-21) and the menu, served in the school under study is presented in table 1.

Table 1: Cyclic menu prescribed by the Government of West Bengal and menu provided in the school under study

Day	**Recommended Menu**	**Provided Menu**
Monday	Rice, Dal, Soyabean curry	Rice, Dal, Mixed vegetables
Tuesday	Khichdi with leafy vegetables	Rice, Egg-Potato curry
Wednesday	Rice, Egg curry	Rice, Dal, Mixed vegetables
Thursday	Rice, Soyabean curry, Dal	Rice, Dal, Egg bhujia
Friday	Rice, Dal, Mixed vegetables	Rice, Fried potato, Soyabean-Potato curry
Saturday	Rice, Egg curry, Mixed vegetables	Mixed vegetable khichdi

It can be observed from table 1 that the menu served in the school was not as same as recommended by the Government of West Bengal on daily basis though it was somewhat similar if considered on weekly basis.

The average amount of foodstuffs served in MDM as indicative of first week of the study period made available per day per child is presented in table 2.

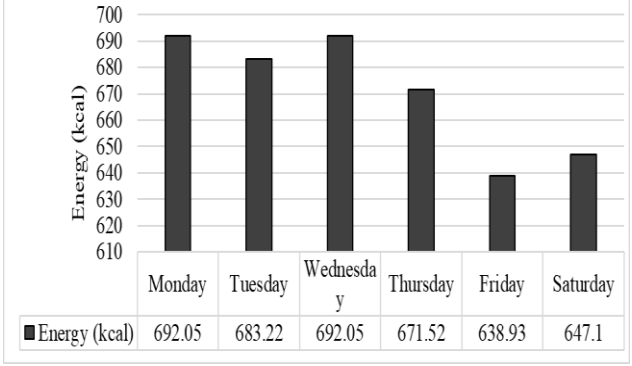
Table 2: Average amount of foodstuffs per child per day as per cyclic menu provided in the school under study

Day	**Menu**	**Foodstuffs**	**Amount per child (g)**
Monday	Rice, Dal, Mixed vegetables	Rice	131.3
		Lentil	15.27
		Vegetables	348.99
		Spices	4.23
		Fats and oils	5.34
		Sugar	0.61
Tuesday	Rice, Egg-Potato curry	Rice	131.3
		Egg	50
		Potato	99.23
		Spices	17.23
		Fats and oils	6.87
		Sugar	0.61
Wednesday	Rice, Dal, Mixed vegetables	Rice	131.3
		Lentil	15.27
		Vegetables	348.99
		Spices	4.23
		Fats and oils	5.34
		Sugar	0.61
Thursday	Rice, Dal, Egg bhujia	Rice	131.3
		Lentil	15.27
		Egg	24.05
		Vegetables	99.23
		Spices	11.72
		Fats and oils	5.34
		Sugar	0.61
Friday	Rice, Fried Potato, Soya bean-Potato curry	Rice	131.3
		Soya bean	11.45
		Vegetables	99.23
		Spices	12.82
		Fats and oils	5.72
		Sugar	0.61
Saturday	Hotchpotch	Rice	131.3
		Green gram dal	22.9
		Vegetables	110.7
		Spices	4.62
		Fats and oils	6.1

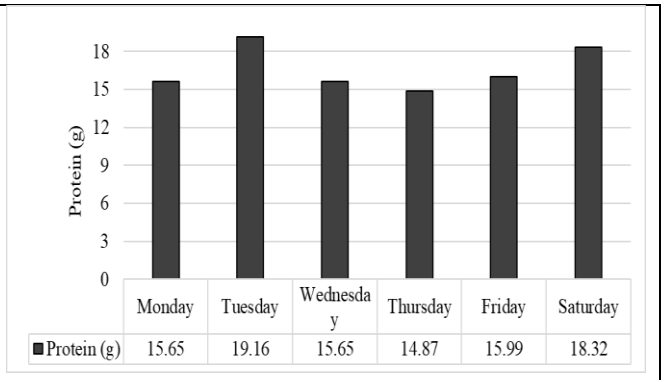
		Sugar	0.61

From table 2, it can be noted that in the present study, except on Saturday, lentil was cooked on most of the days. Green gram dal was used on every Saturday in the preparation of khichdi, whereas in contrary, a study carried out in Haryana (Rana, 2010), channa dal was used in khichdi in place of green gram dal for cost effectiveness. From table 2, it was also found that Dal and Mixed vegetables (Monday and Wednesday) provided the maximum amount of energy whereas the minimum came from Fried potato and Soya bean-Potato curry given on Friday. On the other hand, highest proportion of protein, nearly close to the daily recommended norm was provided by Egg-Potato curry. It can be noted that as provided menu was varied every day, nutritional composition of the meal was also changed accordingly.

Energy (kcal) and protein (g) made available from cyclic menu per study participants per day were calculated (Longvah *et al.*, 2017) and presented in figure 1.



1. (a)Energy (kcal)



1. (b)Protein (g)

Figure 1: *Day wise distribution of energy (kcal) and protein (g) content of the cyclic menu per study participants per day provided under study*

From figure 1, it can be observed that energy and protein content of six days cyclic menu during the first week of the study period that were made available for every student varied from about 639-692kcal and 15-19g respectively, were below the recommended norms of 700kcal of energy and 20g of protein.

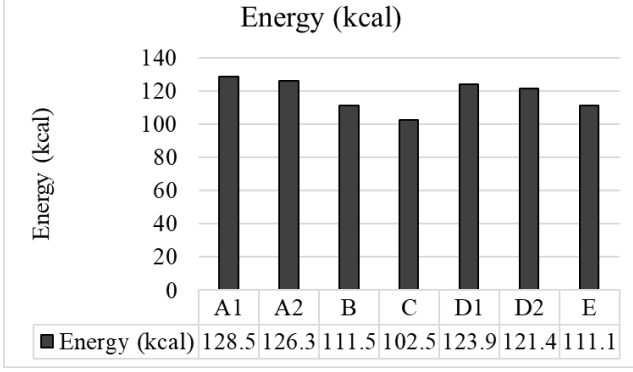
Different vegetables which were cooked during the whole year under study, was categorized and presented in table 3.

Table 3: Categorization of different cooked vegetables during the whole year under study

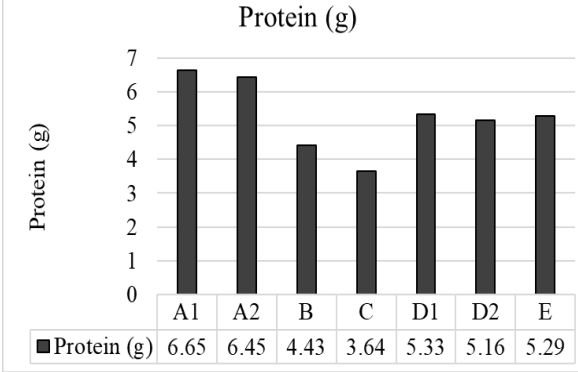
Category	Different cooked vegetables
A1	Potato, Brinjal, Broad beans, Pumpkin, Papaya, Ridge gourd, Banana rhizome, Drumstick, Parwar, Cauliflower, Cabbage, and Tomato
A2	
B	Potato, Brinjal, Broad beans, Pumpkin, Papaya, Ridge gourd, Banana rhizome, Drumstick, and Tomato
C	Potato, Brinjal, Broad beans, Pumpkin, Papaya, Ridge gourd, Banana rhizome, and Tomato
D1	Potato, Brinjal, Broad beans, Pumpkin, Papaya, Ridge gourd, Banana rhizome, Drumstick, Cauliflower, Cabbage, and Tomato
D2	
E	Potato, Brinjal, Broad beans, Pumpkin, Papaya, Ridge gourd, Banana rhizome, Drumstick, Parwar, and Tomato

In table 3, cooked vegetables were categorized as A1, A2, B, C, D1, D2 and E. In category A1, A2 and D1, D2 the vegetables were same but the amounts used to cook, were different. The school in which this study has been carried out, instead of costly vegetables, seasonal and easily available vegetables like potato, pumpkin, brinjal, banana rhizome etc. were used in mixed vegetable curry. Similar result was also reported from another study (Mehta *et al.,* 2012).

Energy (kcal) and protein (g) obtained from different categories of seasonal vegetables are presented in figure 2.



2. (a) Energy (kcal)

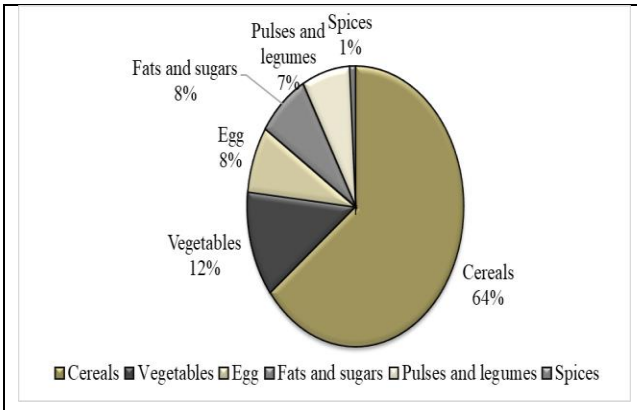


2. (b) Protein (g)

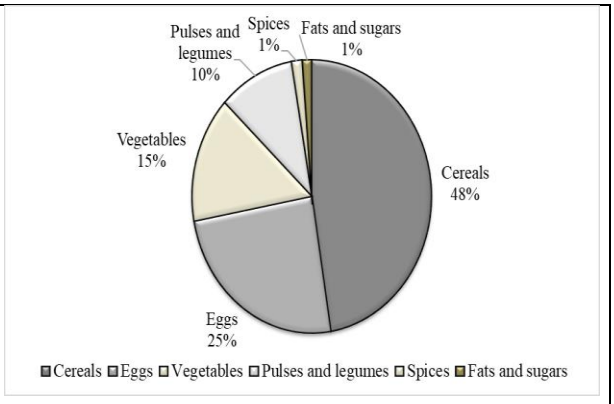
Figure 2: *Energy (kcal) and protein (g) obtained from different categories of seasonal vegetables*

Vegetables were cooked on the basis of their seasonal availability and nutritional composition of meal was changed accordingly which can be clearly seen in figure 2. Menu A1 provided highest amount of calorie and protein and Menu C provided lowest in both cases, mainly due to the exclusion of drumstick, parwar, cauliflower and cabbage.

The average distribution of calorie and protein from different food groups are presented in figure 3.



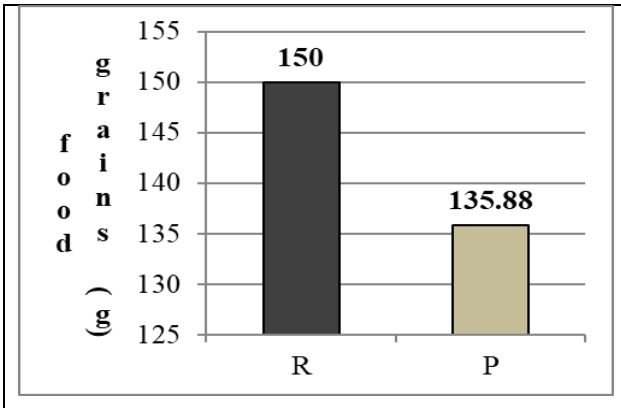
3. (a) Energy Distribution (%)



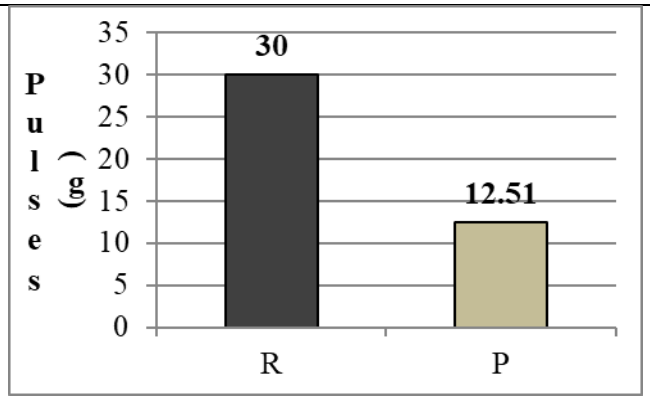
3. (b) Protein Distribution (%)

Figure 3: *Average distribution of energy (%) and protein (%) per study participants per day from different food groups and spices in the school under study*

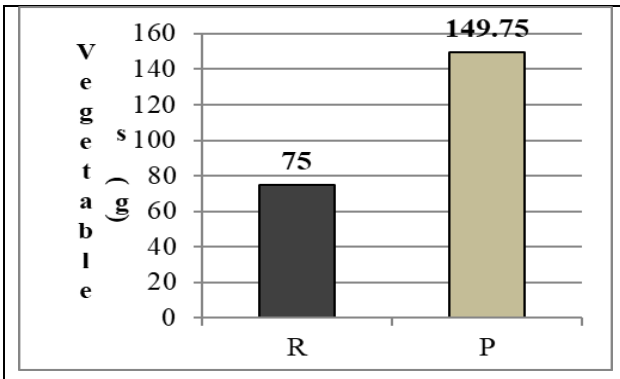
The information about the recommended food norm to be served in MDM (Annual Report, GOI, 2021-22) and average actual intake per study participants per day in the school under study were compared and presented in Figure 4.



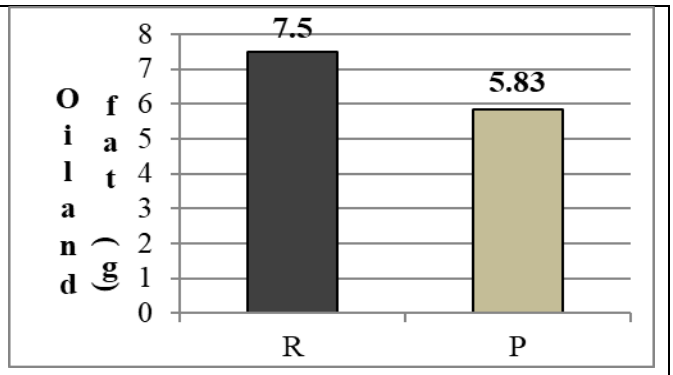
4. (a) Foodgrains (g)



4. (b) Pulses (g)



4. (c) Vegetables (g)



4. (d) Oil and fat (g)

Figure 4: *Comparison between recommended norms to be served and average actual intake per study participants per day (g.d^{-1}) in MDM*

R: Recommended norm to be provided in MDM for upper primary children, P: Provided food norms on an average per student per day in the present study

It can be noted from figure 4 that requirements as prescribed to be served in MDMs were being fulfilled only in case of vegetables which is mainly due to the easy availability and cost effectiveness.

From year-wise data, daily nutritional contribution of MDM made available on an average by each study participants under study is calculated and presented in table 4 (Longvah *et al.*, 2017).

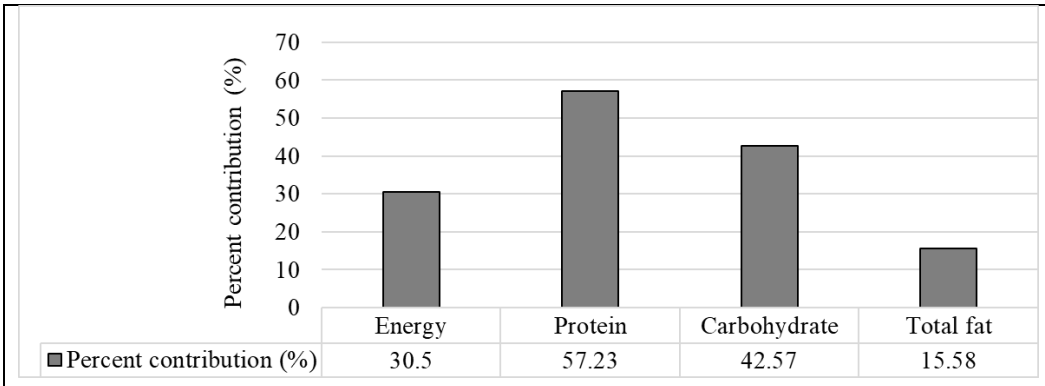
Table 4: Average nutritional contribution of MDM made available per study participants per day under study

Nutrient	**Mean values**
Energy (kcal)	681.48
Protein (g)	18.52
Carbohydrate (g)	127.71
Fats (g)	9.19
Vitamin A (µg)	56.46
Thiamine (mg)	0.34
Riboflavin (mg)	0.15
Niacin (mg)	8.86
Folic acid (µg)	68.54
Vitamin C (mg)	31.07

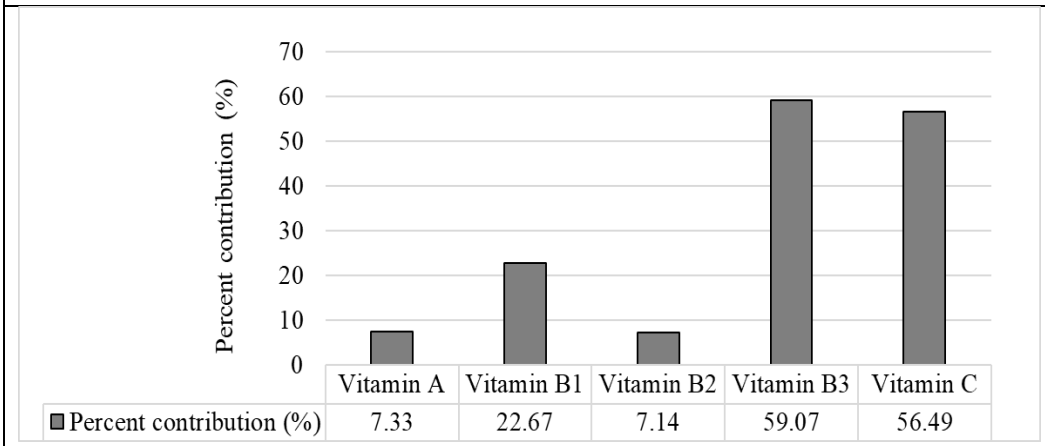
Calcium (mg)	127.61
Iron (mg)	4.7

The data presented in table 4 revealed that the amount of energy and protein obtained from MDM are 681.48kcal.d^{-1} and 18.52g.d^{-1} which are found to be 2.7% and 7.5% lower than the recommended norms of 700kcal and 20g respectively. The amount of carbohydrate and fat provided to the children are 127.71g.d^{-1} and 9.19g.d^{-1} respectively. There are no recommended norms for carbohydrate and total fat to be provided in MDM till date. It can also be noted that availability of other nutrients was also less.

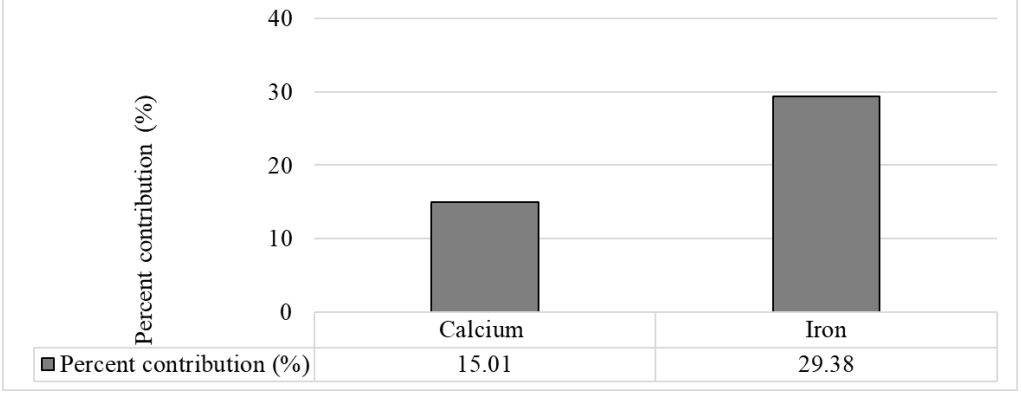
The findings of percent contribution of MDM towards RDA of the study participants was calculated and given in Figure 5.



5. (a) Energy and Macronutrient



5. (b) Vitamins



5. (c) Minerals

Figure 5: *Percent contribution of nutrients per study participants obtained from MDM towards RDA*

For 10-12 years old boys the Estimated Energy Requirement (EER) is 2233kcal d^{-1} and RDA for protein is 31.8g d^{-1}. Minimum 130g carbohydrate is recommended for brain glucose utilization for 10-12 years old boys and it is recommended that acceptable carbohydrate distribution range by age and physiological group as percentage of energy should be 45%-65% for 3-18 years. According to this distribution range, the calculated recommended value of carbohydrate is 300g d^{-1}. The visible fat recommendation for 10-12 years boys are 35g d^{-1}. It has also been recommended that fat from foods other than visible fat should be 10% of energy. According to this, the calculated total fat intake for this age group is 59g.d^{-1}. The recommended dietary allowances of vitamins such as A, B_1, B_2, B_3, C and minerals such as calcium and iron for 10-12 years old boys are 770mcg, 1.5mg, 2.1mg, 15mg, 55mg, 850mg and 16mg respectively (Revised RDA, 2024).

4. DISCUSSION

The results of the present study revealed that though MDM was almost meeting recommended protein value, it is unable to fulfill the prescribed energy requirement which contrasted with a previous study (Mehta *et al.,* 2012) which found that MDM was insufficient in terms of both protein and energy. An appreciable amount of protein obtained from MDM in the present study came from animal source i.e. egg which is of high biological value.

MDM is set to provide one-third (33%) RDA of energy and one-half (50%) RDA of protein. Figure 5 showed that the contribution of energy, protein, carbohydrate, and fat towards RDA of the study

participants was 30.5%, 57.23%, 42.57%, and 15.58% respectively. One study revealed that MDM was fulfilling 31.8% and 39.2% RDA of energy and protein respectively; the contribution of protein was much lower than the present study (Mehta *et al.,* 2012).

The contribution of micronutrients such as vitamin A, vitamin B_2, vitamin B_3, vitamin B_9, vitamin C, calcium, and iron towards the RDA was 7.33%, 22.67%, 7.14%, 59.07%, 56.49%, 15.01%, and 29.38% respectively. It has been found that most of the micronutrients except vitamin B3 and vitamin C allotted in MDM in the present study were not adequate in terms of percent contribution towards RDA. Though the amount of vitamin C provided in the present study met half the amount of RDA, most of it came from potatoes which encountered high levels of destruction during cooking. Similarly, the majority of iron found in the present study was the non-haem type which does not absorb readily within the human body. The percentage availability of vitamin A and vitamin B2 were very low which is less than 10% and the level of vitamin B9 provided in the present study was negligible in terms of percent contribution towards RDA. Still, from this study it may be stated that MDM did have a contribution to the daily intake of the children. At the same time, there are rooms for improvement in obtaining optimum nutritional benefits, ensuring nutrition security (Banerjee *et al.,* 2019), and preventing all forms of malnutrition, which is a burning issue (Banerjee *et al.,* 2015), and various strategies are being adopted to address these (Banerjee *et al.,* 2014a; Chatterjee *et al.,* 2015; Banerjee *et al.,* 2014b; Saha *et al.,* 2021).

Studies carried out in different states of the country also found that nutritional contribution of MDM in the schools was inadequate in terms of most of the nutrients; although in the present study, the amounts of the nutrients available were higher than the previous studies (Yadav *et al.,* 2014; Gupta *et el.,* 2010; Saha *et al.,* 2021). A similar trend of results has also been reported in an earlier study from our group (Saha *et al.,* 2021). Studies (Kushwaha, 2008; Yadav *et al.,* 2014) have also reported that MDM in schools did not provide one-third RDA of any nutrients.

5. CONCLUSION

From the present study it may be concluded that though the average amount of protein provided in MDM throughout the year was 57.23% of RDA i.e., more than the recommended norm, but when considered daily, MDM was found to serve less than 50% protein of RDA for 3 days in a week. In the case of energy, MDM served to the study participants did not meet the recommended

norm on any of the working days and served 30.5% of RDA throughout the year. Further, the amount of provided vegetables was much higher than the norm throughout the year, but still, most of the micronutrients available for the study participants did not provide one-third of the RDA.

Acknowledgments: The authors are thankful to all the volunteers taking part in the study, concerned institutional authorities for their liberal cooperation and the University Grants Commission, India.

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