

Assessment of Food Intake and Nutritional Status of Children Attending Montessori School of Pokhara Valley

Alina Lamsal¹, Dipendra Kumar Yadav^{1*}, Bijaya Parajuli²

¹School of Health and Allied Sciences, Pokhara University, Kaski, Nepal

²Madan Bhandari Academy of Health Science

Corresponding Author:

Dr. Dipendra Kumar Yadav, Email: dipendrayadavph@gmail.com, Phone: +977-9856033787

ABSTRACT

Introduction: Childhood is a time of critical growth in which proper nutrition is necessary. Children afflicted by sustained poor nutrition are at greater risk for obesity, mental and emotional health problems and a failure to thrive academically. The objective of this study was to assess the food intake and nutritional status of children attending the Montessori school.

Methods: A cross sectional study was carried out among 235 children of 3-5 years from twenty Montessori schools. Data were collected using simple random sampling. A weighed food was recorded from the consumption of children during a day of their stay in the Montessori school along with the observation of food consumption.

Results: More than every nine out of ten children (92.8%) didn't meet calorie requirement. The mean food intake during their stay in Montessori was 368.81 ± 111.89 grams. Mean calorie, fat, protein, retinol and beta carotene intake were 540 ± 150.5 Kcal, 10.04 ± 5.6 grams, 13.25 ± 5.49 grams, 49.76 ± 32.6 grams, 135.75 ± 274.67 grams respectively. Dietary fat (OR=3.7, 95% CI; 1.8- 7.5) and protein consumption (OR=2.2, 95% CI; 1.1- 4.4) were significantly associated with overweight status of children.


Conclusion: The number of nutritive foods should be increased so that the children meet adequate amount of nutrient required for the proper growth and development of their body. Since the association between dietary fat and protein intake with overweight condition was observed the excess use of fat providing foods should be limited and protein rich foods should be provided as per the Recommended Dietary Allowance (RDA) of Montessori children.

Keywords: Food intake, nutritional status, children, Nepal

ARTICLE INFORMATION

Source of Support:	No external support	Conflict of Interest:	None
Received	23 June 2022	Accepted:	14 April 2022
		Published Online:	20 April 2022

Copyright © 2022 by the author(s), wherein the author(s) are the only owners of the copyright of the published content.

Licensing: It is distributed under the terms of the [Creative Commons Attribution International License 4.0](https://creativecommons.org/licenses/by/4.0/) under the CC-BY 4.0  license, and is free to access on the Journal's website. The author(s) retain ownership of the copyrights and publishing rights without limitations for their content, and they grant others permission to copy, use, print, share, modify, and distribute the article's content even for commercial purposes.

Disclaimer: This publication's claims, opinions, and information are the sole creations of the specific author(s) and contributor (s). Errors in the contents and any repercussions resulting from the use of the information included within are not the responsibility of the publisher, editor, or reviewers. Regarding any jurisdictional assertions in any published articles, their contents, and the author's institutional affiliations, the Journal and its publisher maintain their objectivity.

INTRODUCTION

Childhood is a time of critical growth in which proper nutrition is necessary. Children afflicted by sustained poor nutrition are at greater risk for obesity, mental and emotional health problems and a failure to thrive academically.¹ Dietary intake is the long-run average daily intake of a nutrient or food. Recommended dietary

allowance (RDA) are the level of intake of essential nutrients need to be adequate in order to meet nutritional need of all healthy individual.² It is essential that children are encouraged to provide adequate nutrition as they spend a significant part of their time there and often consume food/beverages during school time. If a child attends the center for eight hours or more a day, they

should be provided with a least 50% of the recommended daily intake of nutrients as set out in the dietary Guidelines for Children and Adolescents in Australia.³ School staffs are able to reach both children and parents and schools can be an environment that stimulates healthy eating habits.⁴

Globally, more than half of 3 to 6 years old children attend child-care centers. Dietary intakes of children attending child-care centers tend to fall short of Dietary Reference Intakes.⁵ Globally, ten per cent of preschoolers are overweight. The obese 6- and 10-years old child have a 50% and 70-80% risk of obesity at 35 years old respectively.⁶ Malnutrition is a major public health problem and accounts for about half of all child deaths worldwide. About 150 million children in developing countries are malnourished and more than half of underweight children live in South East Asia Region (SEAR).⁷ The latest statistics indicates that there are over 24,000 school based and community based Early Childhood Development centers in the country. When children are fed foods which contain inadequate amounts of nutrients, they may fail to grow and develop adequately.⁸ Lack of adequate nutrition will cause failure to gain weight in the short term and in the longer term will result in small stature. In Nepal no literatures have been found by researchers in this area so it is the novel one in Nepalese context. So, the objective of this study was to assess the food intake and nutritional status of children attending the Montessori school.

MATERIALS AND METHODS

A cross-sectional study was conducted among children of 3-5 years attending Montessori schools of Pokhara. A total of 235 children were randomly selected. Out of 70 Montessori schools, 20 Montessori schools were selected by using simple random sampling technique. The sample size of 235 was calculated using prevalence formula [$n = (z^2pq)/d^2$] taking prevalence of 18.8% children in preschool consume less than the recommended amount of energy.¹⁰ The calculated sample size was divided by total number of Montessori i.e., $n=20$ and equal numbers of children were taken from each Montessori using simple random sampling technique.

The children entering the Montessori school along with the parents at first were taken as the sample till the required sample size from the Montessori school was met. Likewise, parental consent was taken from the

parents of the selected children. The total duration of study was six months and conducted in the year 2015.

This study was carried out by weighing each and every empty utensil which was used to provide food and drink items to the children. Each food and drink items were properly weighed prior to consumption using Electronic Compact Scale. Leftovers of the food after the consumption was also weighed so as to know the actual portion size consumed. The method of cooking the food and ingredient used in the food items were observed and weighed using Electronic Compact Scale and recorded in the weighed food record. Nutritional status was assessed by measuring the height and weight of children. Height of the children was measured using stature meter and weight was measured through digital weighing machine. Nutritional status of children was calculated by taking the reference of WHO standards. All the instruments were standardized and checked before performing measurement of food items by using a known weight to ensure the validity and reliability. Calibration of Electronic Compact Scale was also carried out every morning. Data was entered on Epi-Data and analysis was done using Statistical package for Social Sciences (SPSS). Frequency, percentage, mean and standard deviation of each nutrient consumed were calculated. Bivariate technique was applied to analyze the association between dietary intake and nutritional status of Montessori children. Ethical approval was taken from Nepal Health Research Council (NHRC,846).

RESULTS

Two out of four children (40.9%) were of four years. Likewise, more than half of the children (57.9%) were male and about half of the children (40.9%) were studying in LKG class (Table 1).

Majority (99%) of the children of five years old did not met the adequate amount of calorie. The adequate amount of fat was not consumed by nearly two-third (67.7%) of the children. adequate amount of protein was not consumed by about two -third (60.9%) of children and adequate amount of Beta Carotene was not consumed by majority (94.9%) of children (Table 2).

Table 1: Socio demographic information of children

Characteristics	Frequency	Percentage
Age in years		
3 years	83	35.3
4 years	96	40.9
5 years	56	23.8
Sex		
Male	136	57.9
Female	99	42.1
Level of education		
Nursery	83	35.3
LKG	96	40.9
UKG	56	23.8

More than one third (37.4%) of children met 50-75 per cent of total calorie requirement. Likewise, one in every three children 76(32.3%) exceeded the fat requirement. In the same way, more than one fourth (28.9%) met 75-100 percent of the requirement of protein during the stay in Montessori. Similarly, more than four-fifth of the children

Table 2: Age –wise calorie and nutrients consumption

Variables	Frequency	Percentage
Calorie requirement (n=235)		
Calorie not met	218	92.8
Calorie met	17	7.2
3 years (n=83)		
Calorie not met	68	81.9
Calorie met	15	18.1
4 years(n=96)		
Calorie not met	95	99.0
Calories met	1	1.0
5 years (n=56)		
Calories not met	55	98.2
Calories met	1	1.8
Nutrients consumption (n=235)		
Fat requirement not met	159	67.7
Fat requirement met	76	32.3
Protein requirement not met	143	60.9
Protein requirement met	92	39.1
Vitamin A (Beta carotene) requirement not met	223	94.9
Vitamin A (Beta carotene) requirement met	12	5.1

Nutrient supply as per RDA	Frequency	Percentage
Calorie Supply		
25-50% of RDA met	49	20.9
50-75% of RDA met	88	37.4
75-100% of RDA met	81	34.5
Exceeding RDA	17	7.2
Fat Supply		
Less than 25% of RDA met	14	6
25-50% of RDA met	63	26.8
50-75% of RDA met	56	23.8
75-100% of RDA met	26	11.1
Exceeding RDA	76	32.3
Protein supply		
Less than 25% of RDA met	1	0.4
25-50% of RDA met	27	11.5
50-75% of RDA met	47	20
75-100% of RDA met	68	28.9
Exceeding RDA	92	39.1
Beta carotene supply		
Less than 25% of RDA met	192	81.8
25- 50% of RDA met	19	8
50-75% of RDA met	12	5.1
Exceeding RDA	12	5.1

Table 5: Food items given by Montessori schools according to their functions

Food items	Functions	Frequency
Fruits	Protective food	9(45)
Jaulo and Khichadi	Energy giving/Body building	15(75)
Milk	Body building	10(50)
Rice Pulav and Roti	Energy giving	7(35)
Dal	Body building	5(25)
Tarkari	Protective food	6(30)
Breads, Cake, Corn flakes, Biscuits	Energy giving	10(50)
Egg and Chicken	Body building	4(20)
Noodles and Chowmein	Energy giving	2(10)
Haluwa,Sevai and Khir	Energy giving/Body building	3(15)

Table 3: Percentage of nutrient supply according to RDA

(81.8%) met less than 25 per cent of total Vitamin A (Beta Carotene) requirement. (Table 3) In an average the greater amount of meal was provided in the second meal and larger amount of energy, protein and Vitamin A Beta Carotene was gained in the same meal whereas, the third meal provided greater amount of fat in an average and the first meal provided greater amount of Vitamin A Retinol. Average intake during the day was lower than the RDA for all nutrients. (Table 4).

Three- fourth (75%) of the total Montessori schools provided 'Jaulo' and 'Khichadi' as their meal. In the same way, more than one fourth (35%) Montessori provided Rice, 'Pulav' and 'Roti' in their meal all of which constituted as major source of energy. Similarly, one half (50%) Montessori provided Milk in their meal which constituted as the major source of fat and protein. One half (50%) provided breads, cake, corn flakes and biscuits and nearly half (45%) of total Montessori schools included in the study, provided seasonal fruits in their meal. Likewise, more than one third (35%) Montessori provided 'Tarkari', nearly one fourth (20%) provided egg and chicken, less than one fourth (15%) provided other food items like 'Haluwa', 'Sevai' and 'Khir' whereas, one in every ten Montessori (10%) provided noodles and 'Chowmein'. (Table 5).

Nearly one third (32.8%) were found Stunted. Likewise, nearly one fourth (28.9%) were found to be underweight. Similarly, less than one fifth (11.5%) children were found to be wasted. In the same way, one in every ten children 24(10.2%) were overweight. (Table 6)

Table 6: Nutritional status of children

Nutritional status	Frequency	Percentage
Stunting status of children(n=235)		
Normal	158	67.2
Stunted	77	32.8
Level of stunting(n=77)		
Mildly stunted	69	88.3
Moderately stunted	8	11.7
Underweight status of children(n=235)		
Normal	167	71.1
Underweight	68	28.9
Level of underweight(n=68)		
1 st degree mild malnutrition	62	91.1
2 nd degree moderate malnutrition	6	8.9
Wasting status of children(n=235)		
Normal	208	88.5
Wasted	27	11.5
Obesity status of children(n=235)		
Normal	197	83.8
Overweight	24	10.2
Obese	14	6

Table 4: Average food and nutrient intake by children

Characteristics		First meal (n=235)	Second meal (n=211)	Third Meal (n=115)	Total (n=235)
Meal (g)	Mean	144.8	227.7	77	386.8
	SD	112.6	105.4	39.1	111.9
Energy(kcal/day)	Mean	184.7	318.2	142.2	540
	SD	172.9	123.5	37.8	150.5
Fat(g/day)	Mean	4.3	3.59	5.20	10.1
	SD	5.39	3.54	3.49	5.6
Protein(g/day)	Mean	4.3	7.8	3.9	13.3
	SD	4.07	3.91	2.3	5.49
Vitamin A Retinol(g/day)	Mean	23.7	16.9	22.3	49.8
	SD	32.9	23.7	20.1	32.6
Vitamin A Beta Carotene(g/day)	Mean	22.8	122.6	5.8	135.8
	SD	62.2	269.6	8.8	274.7

Table 7: Factors associated with Dietary intake and nutritional status

Variables	Nutritional status		χ^2	p value	UOR (C.I.)
	Stunted	Normal			
Calorie not met	74(33.9%)	144(66.1%)	1.901	0.193#	2.4(0.7-8.6)
Calorie met	3(17.6%)	14(82.4%)			
Fat not met	46(28.9%)	113(71.1%)	3.282	0.070	0.6(0.3-1.0)
Fat met	31(40.8%)	45(59.2%)			
Protein not met	53(37.1%)	90(62.9%)	3.061	0.080	1.7(0.9-2.9)
Protein met	24(26.1%)	68(73.9%)			
Beta Carotene not met	74(33.1%)	149(66.9%)	0.346	0.755#	1.5(0.4-5.7)
Beta Carotene met	3(25%)	9(75%)			
	Underweight	Normal			
Calorie not met	65(29.8%)	153(70.2%)	1.136	0.408#	1.9(0.5-7.1)
Calorie met	3(17.6%)	14(82.4%)			
Fat not met	51(32.1%)	108(67.9%)	2.356	0.125	1.6(0.8-3.1)
Fat met	17(22.4%)	59(77.6%)			
Protein not met	48(33.6%)	95(66.4%)	3.808	0.051	1.8(0.9-3.3)
Protein met	20(21.7%)	72(78.3%)			
Beta Carotene not met	67(30%)	156(70%)	2.610	0.188#	4.7(0.6-37.3)
Beta Carotene met	1(8.3%)	11(91.7%)			
	Wasted	Normal			
Calorie not met	26(11.9%)	192(88.1%)	0.567	0.701#	2.2(0.3-17.0)
Calorie met	1(5.9%)	16(94.1%)			
Fat not met	21(13.2%)	138(86.8%)	1.427	0.232	1.8(0.7-4.6)
Fat met	6(7.9%)	70(92.1%)			
Protein not met	21(14.7%)	122(85.3%)	3.669	0.055	2.5(0.9-6.4)
Protein met	6(6.5%)	86(93.5%)			
	Overweight	Normal			
Exceeding RDA of fat	22(29%)	54(71%)	13.5	0.000*	3.7(1.8-7.5)
Not exceeding RDA of fat	16(10.1%)	143(89.9%)			
Exceeding RDA of protein	21(22.8%)	71(77.2%)	4.9	0.026*	2.2 (1.1-4.4)
Not exceeding RDA of protein	17(11.9%)	126(88.1%)			

*Statistically significant at $p < 0.05$, #p-value from fisher exact test Fig in parenthesis shows percentage

In this study, dietary fat (OR=3.7, 95% CI; 1.8, 7.5) and protein consumption (OR=2.2, 95% CI; 1.1, 4.4) were significantly associated with overweight status of children.

DISCUSSION

This study indicated that 20.9 percent of children met less than 50 per cent of RDA of energy whereas 37.4 per cent children met less than two third of RDA and 34 per cent children met two third and above of RDA of energy. A similar study conducted to assess the nutritional status and dietary pattern of preschool children in Rohtak city of India indicated that 16

percent children met less than 50 per cent of RDA of energy while, nearly 64 percent children met less than two third of RDA of energy and about 20 percent children met two third and above of RDA of energy.⁹ Both the study showed different type of results it may be because of variability in the sample size and food consumption pattern of children.

The energy requirement of children between the age of 3 to 5 ranges from 1240 to 1690 kcal/day likewise the requirement of protein, fat, calcium, iron and vitamin A range from 22-30 g/day, 25g/day, 400mg/day, 12-18mg/day and 400g/day respectively.¹⁰ During their stay in the Montessori school, they should be provided with a least 50% of the recommended daily intake of nutrients.¹¹ This study found that the Montessori schools of Pokhara Valley provided energy giving foods like; rice, 'Jaulo', 'Khichadi', Corn flakes, 'Roti', Body building foods like; 'Daal', 'Egg', Milk and Protective foods like- fruits and 'Tarkari'. In an average children intake 386.8 gram during their duration of stay in the school with minimum intake of 154.5 gram and maximum intake of 749 gram.

The average energy intake in their first, second and the third meal was 184.7 kcal, 318.2 kcal and 142.2 kcal respectively. Similar study conducted among Dutch child-care children showed that children consumed a mean of 116 kcal during the morning snack 488 kcal during lunch and 169 kcal during the afternoon snack.¹² The amount of energy provided from the first, second and third meal in the later study is quite high. It may be because of the food consumption behavior of children and food providing practices of child care settings in the Dutch provinces. In this study the average energy intake of children during their stay in the Montessori was 540 kcal. Likewise, average fat and protein intake were, 10.4 and 13.25 gram respectively. Similar result was seen in the study conducted in Kerala among the tribal preschool children.¹³ It might be because of similarity in geographical and food consumption practices of children of Nepal and India.

This study revealed that 32.8 percent of children were stunted, 11.5 percent were wasted, 10.2 percent were overweight and 6 percent were obese. NDHS 2016 indicates that 36 percent of under five children were stunted, 11.5 percent were wasted and 27 percent of children were underweight.¹⁴ Similarly, a study conducted among 986 private school children in

Nepal indicated that 14.6% children were overweight and 11.3% children were obese.¹⁵ The results seem to be slightly different which may be due to the variability of the sample size.

Dietary fat and protein intake were found to be significantly associated with the overweight and obesity status of children but other nutritional status of children significantly differed with the dietary intake. No association was observed in the energy intake and BMI of children. A study conducted in Adelaide, South Australia to determine the nutrient intakes and status of preschool children also showed no association between BMI and energy intake.¹⁶

This study has some limitations that should be explored. As the nutrient consumed by children at home was not captured by the study so the study findings cannot be generalized to nutrient consumed as per RDA by children of Pokhara.

CONCLUSION

In conclusion the majority of the Montessori children of Pokhara were lacking to meet the nutrient requirement according to the age standard. The schools were lacking to provide the adequate amount of calorie and vitamin A (retinol) required to the children. Nearly one third of the children were found to be stunted, more than one tenth of children were wasted whereas more than one fourth of children were underweight. So it has been recommended that nutrition education must be provided in the Montessori schools. Also, measurement of weight and height of children must be done periodically. Since the association between dietary fat and protein intake with overweight condition was observed the excess use of fat providing foods should be limited and protein rich foods should be provided as per the RDA of children.

Acknowledgment: We are grateful to all the care givers, teachers and head of the Montessori schools who welcomed with warm heart and voluntarily provided their helping hands.

REFERENCES

1. Lillard A, Else-Quest N. The early years: Evaluating Montessori education. Science. 2006 Sep 29;313(5795):1893-4. <https://doi.org/10.1126/science.113236> [PubMed] [Google Scholar]
2. Park ES, Yee YH, Lee JS. Recommended dietary allowances for young children and food guideline for preschool children in Sweden. Korean Journal of Community Nutrition. 2004;9(6):742-52. <http://www.nso.go.kr> [Google Scholar]

3. Baghurst KI. Dietary guidelines: the development process in Australia and New Zealand. *Journal of the American Dietetic Association*. 2003 Dec 1;103(12):17-21. DOI 10.1016/j.jada.2003.09.032. <https://doi.org/10.1016/j.jada.2003.09.032> [PubMed]
4. NRCCoD A, Food NR, Board N. Recommended dietary allowances. Washington, DC: National Academies. 1980 Sep 1;21(5):68-72. [Google Scholar]
5. Cowbrough K. Feeding the toddler: 12 months to 3 years—challenges and opportunities. *J Fam Health Care*. 2010 Jan 1;20(2):49-52. <https://doi.org/10.1016/j.jada.2003.09.032> [PubMed] [Google Scholar]
6. Hunter N. 6% of 3-year-olds obese [Accessed 2nd October 2015] Available from: www.irishealth.com
7. De Onis M, Blössner M, Borghi E. Prevalence and trends of stunting among pre-school children, 1990–2020. *Public Health Nutrition*. 2012 Jan 1;15(01):142-8. DOI:10.1017/S1368980011001315. <https://doi.org/10.1017/S1368980011001315> [PubMed]
8. Richard H. pediatric obesity. [Accessed 2nd October 2004] Available from: <http://www.nationwidechildrens.org/>
9. Verma R, Prinja S. Assessment of nutritional status and dietary intake of preschool children in an urban pocket. *Int J Epidemiol*. 2008;6(1):1-5. [Google Scholar]
10. South East Asian Food Composition Table Hulshof P, Doets E, Seyha S, Bunthang T, Vonglokham M, Kounnavong S, Famida U, Muslimatun S, Santika O, Prihatini S, Nazarudin N. Food composition tables in Southeast Asia: The contribution of the SMILING project. *Maternal and child health journal*. 2019 Jan 15;23(1):46-54. <https://doi.org/10.1007/s10995-018-2528-8> [Google Scholar]
11. Gubbels JS, Kremers S, Stafleu A, Dagnelie P, De Vries N, Thijs C. Child-care environment and dietary intake of 2- and 3-year-old children. *Journal of Human Nutrition and dietetics*. 2010;23(1):97-101. DOI: 10.1111/j.1365-277X.2009.01022.x. <https://doi.org/10.1111/j.1365-277X.2009.01022.x> [PubMed]
12. Van Ansem WJ, Schrijvers CT, Rodenburg G, Schuit AJ, Van de Mheen D. School food policy at Dutch primary schools: room for improvement? Cross-sectional findings from the INPACT study. *BMC Public Health*. 2013 Dec 1;13(1):331-9. <https://doi.org/10.1186/1471-2458-13-339> [PubMed]
13. Meshram II, Arlappa N, Balakrishna N, Rao KM, Laxmaiah A, Brahman GN. Trends in the prevalence of undernutrition, nutrient and food intake and predictors of undernutrition among under five year tribal children in India. *Asia Pacific journal of clinical nutrition*. 2012;21(4):562-8. <https://doi.org/10.1016/j.orcp.2014.10.219> [PubMed] [Google Scholar]
14. MOHP, Nepal. Nepal Demographic and Health Survey 2016 Kathmandu, Nepal: New ERA and ICF; 2017. Available from: <https://www.dhsprogram.com/pubs/pdf/fr336/fr336.pdf>.
15. Koirala M, Khatri RB, Khanal V, Amatya A. Prevalence and factors associated with childhood overweight/obesity of private school children in Nepal. *Obesity research & clinical practice*. 2015 May 1;9(3):220-7. <https://doi.org/10.1016/j.orcp.2014.10.219> [PubMed] [Google Scholar]
16. Zhou SJ, Gibson RA, Gibson RS, Makrides M. Nutrient intakes and status of preschool children in Adelaide, South Australia. *Medical Journal of Australia*. 2012 Jun 18;196(11):696. DOI: 10.5694/mja11.11080. <https://doi.org/10.5694/mja11.11080> [PubMed]