

Body mass index (BMI) of vegetarian and non-vegetarian children in Nepal

Usha Acharya^{1*}; Jun Nakanishi²

¹Nepal Open University, Lalitpur

²Chukyo University, Japan

*Correspondence: uacharya73@gmail.com, ORCID: 0000-0003-1060-9875

ABSTRACT

This article builds upon a study that aimed to evaluate the BMI differences among vegetarian and non-vegetarian children of Nepal and to recommend the diet practice of growing-age children. A descriptive cross-sectional study was conducted to determine physical growth and calculate the BMI values of 1251 Koiri and Yadav children aged 6-14 years who were selected for the study. Data were analyzed based on age, sex, vegetarian and non-vegetarian children. The average BMI value wt (kg)/ht (m²) of non-vegetarian children was significantly higher than the vegetarian in both sex groups. The finding of the study clearly shows that vegetarian diet practice in children is smaller than the non-vegetarian. The study recommends that vegetarian group children required more plant source protein food for favorable growth and balanced physical growth, good health status to maintain different physical and mental disabilities, and enhance school performances. Protein requirements on vegetarian children may be fulfilled if the diet includes different varieties of plant-based protein sources in their regular meals. Therefore, the study recommends that vegetarian families regularly include protein-rich foods for the growing-age children, such as legumes, beans, different seeds and nuts, and a variety of protein sources.

Keywords: BMI value, height, non-vegetarian, physical growth, vegetarian, weight

INTRODUCTION

Vegetarians are known as the people who do not consume any meat, meat products, poultry, fish, or seafood. On the other hand, non-vegetarians consume these foodstuffs according to their availability. Similarly, social, cultural, and religious practices determine consumers' interest in consuming vegetarian and non-vegetarian foods. According to socio-cultural beliefs and tradition, people practice their food habits and manage their balance. Nutrient requirements are different according to individual needs and circumstances. Likewise, for children's smooth and favorable growth and development, a balanced diet should be provided to fulfill the required nutrients. According to Fahmida (2012), complementary foods are generally introduced as rice and grain sources diets mainly including the plant-based protein and small portion of animal-sourced protein, this insufficient nutrient consumes consequence negative impact on the growth of children, especially on the height/length and may illuminate the high occurrence of stunting in the different Southeast Asian countries. Addressing this issue, animal-sourced protein is one

of the important nutrients which help to build body tissues. If it is not sufficiently consumed, it may impact on reasonable growth of children.

As meals and dietary practice demand differently for different ages and sex, with rapid progress in the environment, some recent studies have recognized the impact of a multi-nutrient diet approach on lipid profiles, blood pressure, heart diseases and suggested paying attention to certain models of diet, for example, vegetarian diet (Sofi et al., 2016). On the other hand, many collective studies show that a poorly managed vegetarian diet may have the risk of developing anemia (Lilare & Sahoo, 2017; Toheed, Ayub, Ali, Mumtaz & Haneef, 2015; Lee & Krawinkel, 2011). According to studies on vegetarian diet and health, most of the studies have been found conducted among females, the prevalence of anemia among vegetarian females observed 64.4% in Mumbai, India *Lilare & Sahoo, (ibid)*, 22.2% in Korea (*Lee & Krawinkel, (ibid)*), 20.9% in Indonesia (Hermanto & Rahayuningsih, 2012) and 20.8% in Lahore, Pakistan *Toheed, Ayub, Ali, Mumtaz and Haneef, (ibid)*. This signifies that women who are adopting a vegetarian diet have a possible threat of anemia. Similarly, the risk factors may associate with small children as they are mainly dependent on their mothers. Suppose a mother is adopting the vegetarian diet practice. In that case, its direct reflections may seem to their children to adopt a vegetarian diet that influences health, physical growth and development-related issues.

Nepal is a multi-caste, multi-ethnic, multi-religious practiced, landlocked country between big neighborhood nations India and China. The lifestyle and food practices of Nepalese have shown disparity. Behind observing these variations may have the socio-cultural reflection of both neighborhood nations. Michelutti (2010) highlights that Yadav people in the Indian community as being vegetarian have been worshipping vegetarian deities and adopting them as important aspects of their living. Similarly, "vegetarianism is also a traditional part of the Hindu code of conduct. People who obey the rules concerning vegetarianism may be more likely to obey other religious censures and sanctions which include such things as ritual cleanliness and hygiene" (Hebert, 1985). This mechanism of religious practices may influence the physical growth of children.

The present study examines the BMI differences between vegetarian and non-vegetarian children of Koiri and Yadav castes. These caste groups are representative castes of the Terai region of Nepal. They are adopting the traditional occupation of vegetable farming and animal husbandry (Acharya, 2014). According to Bista (2004), the main livelihood of Yadav is rearing livestock like buffalos, cows and agriculture. Similarly, Pandeya (2065B.S.) argues that Yadav is a vegetarian caste group and practices it; they produce dairy and consume milk and yogurt. But, recently, if we observe the food habits of this caste, people are increasing who consume chicken, egg, fish, etc.

Along with Yadav, Koiri were also found inhabiting Terrain plains and known as vegetable growers (Bista, 2004). Their traditional livelihood is agriculture (vegetable cultivation), rearing cattle like a cow, buffalo, etc. and practicing a vegetarian diet. Despite the admiration of vegetarian meals worldwide, its outcomes on children's health are mostly unexplored, especially the physical growth. Based on the different sources on the authors' knowledge, this is the first study determining the BMI among vegetarian and non-vegetarian children in Nepal. More information is needed to comprehend the situation of the physical growth of children in order to minimize the risk of vegetarian diet practices. Hence, it is required to assess the BMI value differences among vegetarian and non-vegetarian children. It is, however, carried out to find out the meal practice and its impact on the physical growth of children in Nepal.

Research on factors associated with BMI value differences among vegetarian and non-vegetarian children is not known in Nepal by determining children's meal practices and physical growth. Therefore, the present study further argues the understanding of those factors with physical growth status among vegetarian and non-vegetarian children. In addition, the finding of the study could serve as a reference for future studies. The finding of this study would be a helpful source for researchers and help nutritionists and dietitians plan the appropriate guideline for providing the food requirements of growing-age children. Furthermore, this study assists in understanding the importance of meal practices and their influences on physical growth or BMI values differences of children.

MATERIALS AND METHODS

A descriptive cross-sectional study was conducted to determine physical growth and BMI values of children aged 6-14 years from the Koiri and Yadav caste. A structured interview schedule was administered to the mother of the child to collect data regarding the socio-demographic variables such as the age of a child, family income, education of parents, nature of family, family food practice, food frequencies, and generation of practicing vegetarian and changed into non-vegetarian, etc. And, the physical growth measurement recording form was administered to measure each child's height and weight value.

Study area, period, and sampling population

Mahottari and Rautahat districts of Nepal were selected purposively in this study. These districts represent the residing of Koiri and Yadav caste people. A descriptive cross-sectional study was conducted among school-going children together with their mothers. Mothers were advanced requested through school to visit the school to provide the child's information regarding socio-demographic information and feeding practices of the family and child. Except for a few cases, other guardians like fathers, grandparents came. Otherwise, all mothers have willingly accepted requests and cooperated in providing information by coming to school. As the research area is Terai belt, most of the children were found residing near and surrounding the school; most far ones were explained around half an hour walking. So, it was found not so difficult to come to the mother/guardian at school to provide information. Both the community and private boarding schools were selected for collecting data where the majority of Yadav and Koiri caste reside. Data collection was carried out twice a year (summer and winter) by deciding the suitable days concerning the school academic calendar from May 2014 to August 2018. All children aged 6 to 14 years of Yadav and Koiri castes who agreed to provide their height and weight measurements were measured from all selected schools by the census sampling procedure.

It was experienced that few children from the small age group were denied due to fear and grown-up girl children denied due to shyness to cooperate in measurement. So, the data were taken from only cooperative children than with their mothers. Altogether 1,270 children and mothers were consulted during data collection. While reviewing data with the date of birth and age of children, 19 children were found out of range and edited. These samples were from the final data set. So, the final sample is considered 1,251 school children. This is shown in detail in Table 1 below.

Table 1: *Number of sample size by sex, age and vegetarian and non-vegetarian groups children*

Age (Year)	Boy		Girl		Total
	Vegetarian	Non-vegetarian	Vegetarian	Non-vegetarian	
6	30	36	34	24	
7	41	31	33	24	
8	33	36	34	36	
9	41	47	31	41	
10	28	66	31	44	
11	37	64	34	40	
12	45	60	43	34	
13	30	44	19	24	
14	12	25	8	11	
Total	297	409	267	278	1251

Measurement indices/tools

Measuring the height of children, an anthropometer (manufactured by GPM) was used. For the measuring method, Fujita (1954) was followed. For measuring the weight, a weighing scale ([UC-321-SV reciprocal sensitivity50g] made by A & D) was used, clothing was done as light as possible maximum a single piece top and down. The researchers carried out all physical measurements. Children's information regarding the date of birth was confirmed from the school registered record. Demographic and socio-demographic variables, including the history of vegetarianism and generation, came into non-vegetarian practices of the family (since these two caste groups were originally practiced vegetarian). For food item frequencies of the children's meals, mothers were invited to school. In contrast, only a few cases of fathers and other guardians came to provide data.

Data analysis

While measuring child, height was calculated in millimeter (mm) and weight in kilogram (kg); then to calculate the BMI value height (mm) value was converted into meter (mt) value (value/1000). Later, the weight (kg) value was divided by height (mt²) value as kg/mt² and further, this value was calculated into average and standard deviation (SD) value of BMI by sex and age of both vegetarian and non-vegetarian groups. For data analysis, IBM SPSS Statistics 21 was used.

Ethical approval

A letter of authority for the field survey was received from the district education office of each district. And, during the data collection, the researcher mentioned the research objectives and their rationale to Headmasters/Principals as well as other stakeholders and approved the permission for data collection from each selected school. Verbal consent was taken for anonymity and privacy of information regarding schools; students' family and students' data has been kept secure. An observation of the academic calendar of school teaching-learning activities and examinations time of data collection was decided. The purpose of the study, its rationale and privacy security were kept safe. Personal information such as personal name was clearly

mentioned to the mothers/guardians of students and kept confidential. Respondents and authorized persons were informed regarding the study's objectives, method, and benefits, and verbal consent was taken before the anthropometric measurement and interview of the mother/guardian.

RESULTS

Calculation of BMI value among vegetarian and non-vegetarian children

BMI is a widely used and comparatively simple index to determine the obesity of adults. (WHO, 2021, adults with a BMI of 30kg/m² or more are defined as obese. In the context of Japan, BMI 25kg/m² or more is defined as obesity. According to Dobashi (2015), in many countries, standard deviation (SD) values according to sex and age are preferred to monitor childhood obesity or underweighting, determining the BMI on growing-age children by the standard BMI value calculated by average height and weight for age of the child is difficult to set the criteria of obesity and underweight due to the differing ages of changes growth patterns of children during childhood.

The present study calculated the BMI values, differences among vegetarian and non-vegetarian children by weight (kg) by height (m²) as per age and sex groups (see Table 2).

Table 2: Age wise/sex wise average BMI values of vegetarian and non-vegetarian groups' children

Group	Age (Year)	Boy			Girl			Total
		BMI	SD	N	BMI	SD	N	
Vegetarian	6	13.6	1.1	30	13.3	1.4	34	
	7	13.8	1.1	41	13.6	1.4	33	
	8	13.9	1.1	33	13.7	1.6	34	
	9	14.2	1.7	41	13.8	2.2	31	
	10	14.5	1.4	28	14.1	1.4	31	
	11	14.6	2.5	37	14.2	2.8	34	
	12	15.1	1.9	45	14.5	2.0	43	
	13	15.8	1.7	30	15.8	1.3	19	
	14	16.6	2.5	12	16.1	1.5	8	
	Non-vegetarian	6	13.7	1.2	36	13.9	1.2	24
7		14.2	1.5	31	14.02	1.2	24	
8		14.2	1.1	36	13.9	1.4	36	
9		14.3	1.0	47	14.5	1.6	41	
10		14.8	1.4	66	14.4	1.9	44	
11		15.2	2.1	64	14.8	2.0	40	
12		15.3	1.6	60	15.7	1.8	34	
13		16.3	2.3	44	16.5	2.3	24	
14		16.8	2.6	25	17.0	1.6	11	
Total							1,251	

The detailed result of age and sex for the BMI values of children is presented in table 2. And in Figures 1 and 2, the sex-wise result is presented to indicate the trend of BMI value by sex.

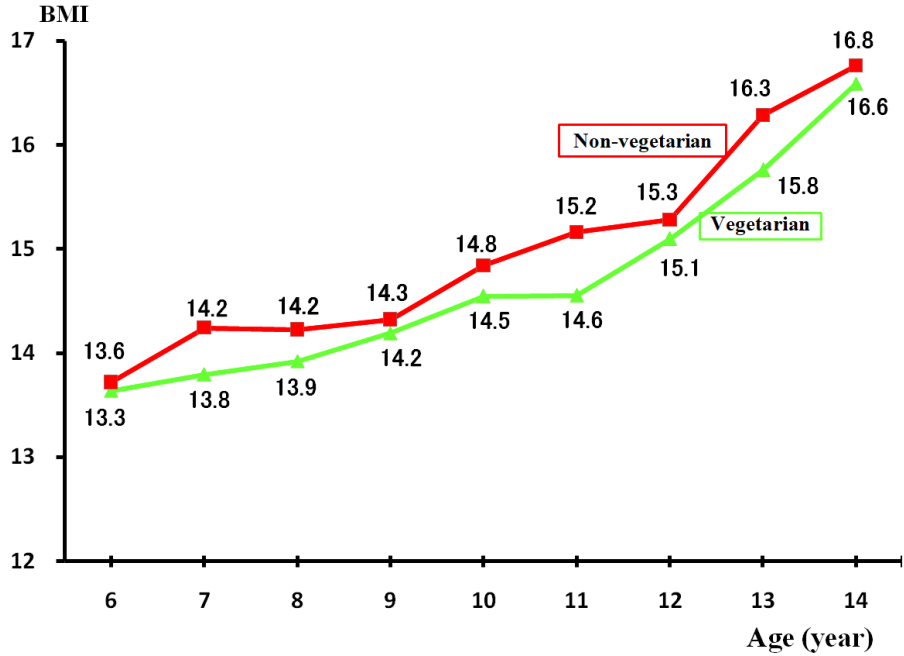


Figure 1. Age wise BMI values of vegetarian and non-vegetarian boys

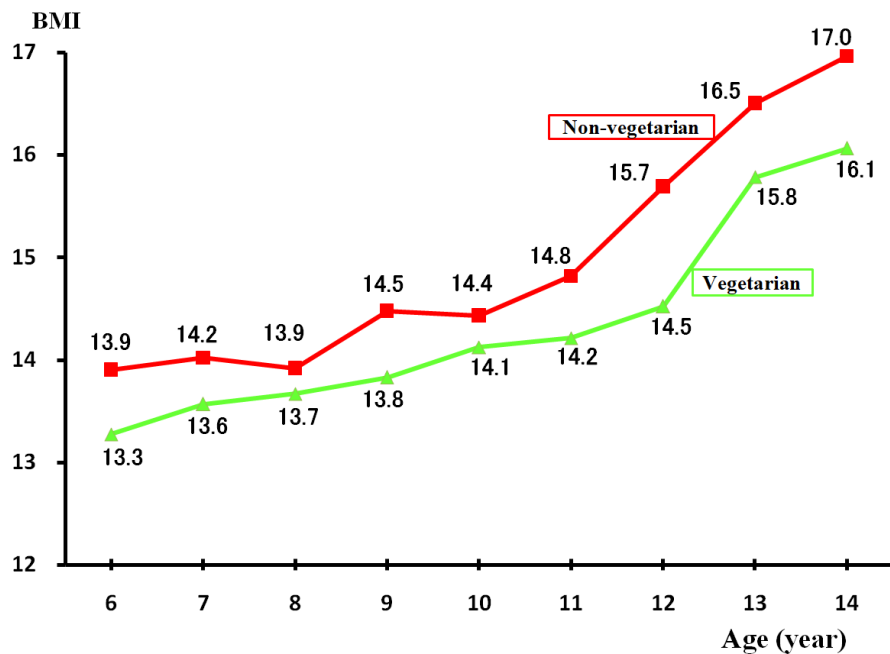


Figure 2. Age wise BMI values of vegetarian and non-vegetarian girls

While observing the result sex-wise of BMI value (Figure 1 and 2), non-vegetarian group children were found with bigger BMI values than vegetarian children for both sexes and all age groups. These differences were observed higher in girls after the age of 11 years comparing to the boys.

Also, there were observed significant differences calculating the independent samples bivariate t-test value of 95% confidence interval of the difference on boys. A significant difference was noted (see detailed Table 3).

Table 3: *Independent samples bivariate t-test (p = <0.05) value (boys)*

Independent Samples Test												
Goups	N	Mean	Std. Deviation	Std. Error Mean	Levene's Test for Equality of Variances	t	df	t-test for Equality of Means			95% Confidence Interval of the Difference	
								Sig. (2-tailed)	Mean Difference	Std. Error Difference	Lower	Upper
Non- veg	442	14.948	1.9227	.0915	Equal variances assumed	2.841	753	.005	.3980	.1401	.1229	.6730
Veg	313	14.550	1.8590	.1051	Equal variances not assumed	2.857	685.452	.004	.3980	.1393	.1245	.6715

Similarly, while observing the result of independent samples bivariate t-test result of girls, the significant differences noted higher than the boys (see detailed Table 4)

Table 4: *Independent samples bivariate t-test value (p = <0.05) (girls)*

Independent Samples Test												
Goups	N	Mean	Std. Deviation	Std. Error Mean	Levene's Test for Equality of Variances	t	df	t-test for Equality of Means			95% Confidence Interval of the Difference	
								Sig. (2-tailed)	Mean Difference	Std. Error Difference	Lower	Upper
Non- veg	290	15.093	2.0377	.1197	Equal variances assumed	3.220	570	.001	.5484	.1703	.2139	.8830
Veg	282	14.544	2.0358	.1212	Equal variances not assumed	3.220	569.582	.001	.5484	.1703	.2139	.8830

According to the result drawn from these results, vegetarian children were found with low BMI values than non-vegetarian children.

DISCUSSION

This study explored the differences in physical growth and food practice among vegetarian and non-vegetarian groups in order to recommend the appropriate diet provision for growing-age children. When observing the BMI value as well as physical growth status of vegetarian and non-vegetarian children, while observing the result of the study, it was found that the vegetarian children have smaller and low BMI values than non-vegetarian group children. BMI is the relatively associated height or length of the body with its diameter, so bones, muscles and adipose tissues should be relatively developed for the favorable growth and well-balanced body structure, so it was needed.

Jacobs and Dwyer (1988) highlight that it is challenging for restrictive vegetarian diets to accelerate bone volume and density in the growth spurt stage. It is inevitable of nutritional needs of proper energy, protein, calcium, vitamins and other nutrients for the significant increases of growth and growth spurt in the puberty stage of children.

The physical growth pattern of a child born in a vegetarian practicing family and reared by vegetarian mothers was found insufficient energy, calcium, and vitamin D intake. They are recommended supplementary in-taking of riboflavin and vitamin B-12, even though parents were unaware of providing nutritional requirements of such supplement diets for their children (Sanders, 1988). While observing the food practice of the children in the field, most of the mothers/guardians responded that children were fed what the adult was eating. If the family practiced strict rituals of vegetarianism and excluded meat, fish, and eggs but only vegetarian meals, children would follow the same. These socio-cultural phenomena of meal practicing might be affecting the physical growth, building bone, muscle and adipose tissue of the growing-age children.

Amit (2010) states that proper caloric intake should be secured and regular monitoring of the growth of children is required. Particular consideration should be taken for sufficient protein consumption, for the requirement of essential fatty acids, iron, zinc, calcium, and vitamins B12 and D proper supplementation may be provided for the fully vegetarian practicing family children. Mothers who are in the bearing child and lactating stage should also be aware of taking proper nutrition for the nutritional needs of the fetus and infant. Young adolescents need to be strictly monitored on constrained vegetarian practices. So, this study recommends that appropriate animal products diets are inevitable for growing-age children.

CONCLUSION

This study was carried out in order to find out the BMI values differences among vegetarian and non-vegetarian children of Nepal to determine the meal practices of family and its outcomes on physical growth and body structure of growing-age children. The result of the study on non-vegetarian children was found bigger BMI values in all age groups of both sexes than vegetarian groups. According to the result of the study, it is inevitable to pay concern on favorable meal practices of growing-age children despite the fact that the older adults adopt vegetarian meals either as a ritual or their choices in being vegetarian. And it is advisable that protein requirements on vegetarian children may be met if the diet includes different varieties of meal items from plant-based sources.

Therefore, it is recommended that the vegetarian family's parents/guardians regularly include protein-rich foods items such as pulses, beans, nuts, and different seeds to feed the growing-age children by combining the different varieties of plant protein sources.

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