Journal of Nutrition & Food Sciences
ISSN: 2155-9600

Debnath and Agrawal, J Nutr Food Sci 6, 6:6
DOI: 10.4172/2155-9600.1000559

Research Article Open Access

Effect of Nutrition Education and Dietary Modification on the Health Status of Kindergarten Children: A Case-control Study

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Received date: September 16, 2016; **Accepted date:** September 30, 2016; **Published date:** October 10, 2016

Abstract

Objective: To assess the effect of nutrition education and dietary modification on the health and nutritional status of kindergarten children.

Study design: A prospective case-control study was executed on 104 kindergarten children bifurcated 50 cases and 54 controls. Intervention: After anthropometrically segregating the KG children of both the groups, first primary data including socio-demographic, clinical and dietary assessments were noted using observation and interview method. Later, 45 minutes of nutrition education and dietary modification workshop 5 days a week were intervened among the cases of group A for a month whereas the controls were kept on casual daily routine. After one month of follow-up, the second primary data including the anthropometric and dietary changes among both the groups were noted and compared with the initial findings.

Analysis: Obtained results were statistically analyzed using paired T test.

Result: Number of cases taking optimal nutritional intake increased by 74% after the trial period of one month. There was a significant increase in the anthropometric status of the cases particularly height and chest circumference whereas no remarkable increase has been noted among the controls.

Conclusion: Nutrition education and optimal dietary changes showed improved health status of the kindergarten children in comparison to the controls which can further up-regulate their growth and development. Main outcome measure: Providing nutrition education to students at a young age would be beneficial for improving their nutritional status for lifelong.

Keywords: Health; Nutrition; Malnutrition; Nutrition education; Dietary modification

Introduction

Kindergarten years are considered as a pivotal phase for growth and development of the children that affects future learning as well as physical, mental and emotional health persisting throughout life [1-3]. A child being highly sensitive and least protected from the adverse living circumstances, is found more susceptible to diseased conditions and morbidity [4-6]. Hence, it is very important to build a strong health profile right from early years of life through adequate dietary intervention and addressing good food habits which will serve throughout protecting the body from broad spectrum of health hazards [7].

Health is affected by many predisposing factors, including-gender, family size, socio-economic status, residential condition, parental education, working status, nutritional knowledge of mothers, food availability, physical activity, social environment etc. [8]. Parental education is one of the important factors relating to childhood nutrition [9].

Fathers being the main earner and decision maker of the family, their higher education play an important role in ensuring better nutritional status of the children [10]. Physical activity (PA) is a reliable factor for the modulation of health status as the frequency or time incorporated in it is associated with number of positive mental and physical health outcomes and prevents weight gain among children as well [11-15].

Altered nutritional uptake or deviation from the standardized dietary allowances may lead to health disturbances, commonly termed as malnutrition which includes both obesity and under nutrition. There has been notable increase in the prevalence of overweight and obesity in the developing countries [16]. It is observed that approximately 10% of the schools going children are overweight as an outcome of unhealthy dietary habits that may further leave detrimental effects on their health status [17,18].

This further contributes to early onset of diseases of adulthood such as Type 2 Diabetes, arterial hypertension etc. [19]. Inadequate maternal and child caring practices, food insecurity and unhealthy environment are also the underlying causes aggravating the condition [20]. Malnutrition on the other hand has long-lasting effects on

children's health and therefore should be properly checked through nutritionally adequate diets and optimal eating pattern [21].

Anthropometric assessments commonly introduced for determining the nutritional status of a child include height, weight, body mass index (BMI), head circumference (HC), chest circumference (CC), mid-upper arm circumference (MUAC), skinfold thickness etc. [22]. Weight for height is considered as the most appropriate and reliable indicator of growth as it reflects wasting that may persist as a result of malnutrition or other predisposing factors like diarrhea, malaria etc. [23]. MUAC is often used as an efficient indicator of nutritional status as it is influenced by recurrent change in weight. The key dependent variable is BMI, increase of which denotes obesity whereas starving body denotes malnutrition [24].

Nutrition education is attracting ample of interest and concern for curbing health problems during childhood, but it is yet to be incorporated in the school curriculum nationwide [25]. Our study was executed with an objective to assess the effect of nutrition education on the nutritional intake and health status of kindergarten children.

Method and Materials

To obtain a homogenous group of children for the case-control study, two branches of the school-Sri Aurobindo institution, Barrackpore, West Bengal were selected. Following random sampling method, a gross total of 104 kindergarten children of age range of 3-6 years were enrolled as study subjects for the research work for a study period of 2 months. Following the inclusion and exclusion criteria as mentioned in the study protocol (Figure 1), 50 KG children from the main branch termed as group A and 54 KG children from the supporting branch termed as group B were treated as cases and controls respectively. Inclusion criteria constituted children of the respective age range, regular comers to the school while exclusion criteria included child with any serious health problem or suffering from chronic disease, not able to attend regular classes and physically/mentally handicapped.

The study protocol was checked and approved for standardization and authentication before further proceedings. The questionnaire to be filled was standardized by the authorities of the Department, BRSN College (WBSU). Parents of all the subjects were required to submit a written informed consent and a pre-formed questionnaire including socio-demographic information were needed to be filled by them prior to participation.

All 104 KG students of both the groups were assessed anthropometrically to segregate the samples into healthy and malnourished ones following WHO scaling. Observation and interview method were followed using a semi-structured questionnaire containing all the concerned parameters to be noted viz. socio-demographic status, anthropometric assessment, dietary assessment and visible clinical symptoms. Following the rating of socio-economic status in accordance to Kuppuswami's scale, children of both the groups were further categorized under low, high or middle classes. For anthropometric assessment, height, weight, mid-upper arm circumference (MUAC), head circumference and chest circumference of the kindergarten children were noted, belonging to both the case (group A) and control (group B) categories.

Body weight was measured using portable weighing machine, height using an anthropometer; and MUAC, head circumference and chest circumference using a measuring tape. Dietary assessment was done using interview scheduled questionnaire following dietary recall method. Visible clinical symptoms or health problems were noted among the children. After collection of the primary data, nutrition education and dietary modification were intervened among group A whereas; rest 54 KG students of group B were kept as control. The nutrition education program was continued for a month consisting of 45 min nutrition education class five days a week.

The nutritional education program was executed in accordance to provide children with information on diet and nutrition, with the aim of forming healthy dietary habits. The information was taught using learning-through play teaching methods, including posters, demo models, placards, games, group games and children's stories. Concerned care and priorities was given to the children's interaction, interest and participation during trial period, with an aim to establish a distinctive and dynamic educational process. Every child in the case group was provided with an individual dietary recommendation for daily food intake in accordance to RDA and even distribution of five food groups in their platter. Children were observed under strict supervision during the nutrition education session. After a month of follow-up, the kindergarten students were assessed to note the anthropometric and dietary differences in the cases (group A) and controls (group B). After data collection, the results expressed as mean ± SD were statistically analyzed using paired t test and the effect of nutrition program on health status of cases to that controls were drawn eventually.

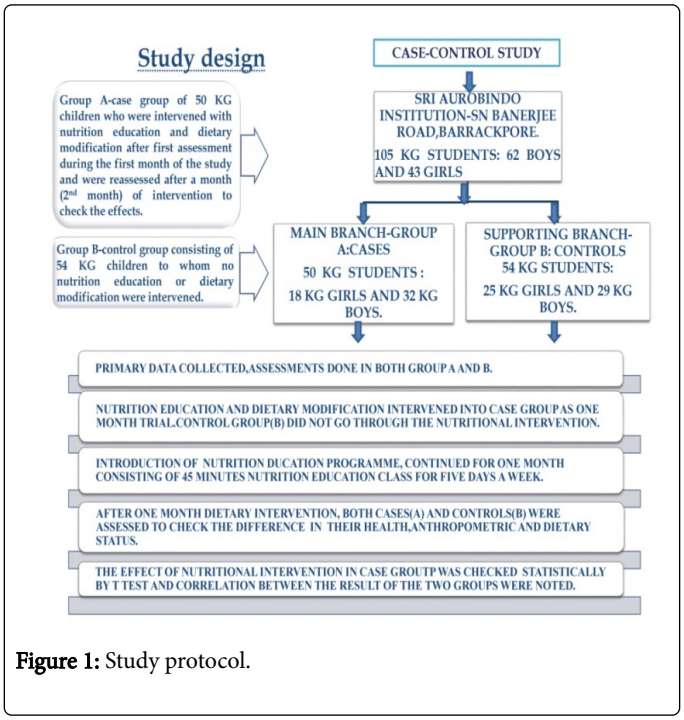

Figure 1: Study protocol.

Result

The segregation of the study population through random sampling method resulted in case groups with 50 kindergarten children-18 girls and 32 boys; and control groups with 54 kindergarten children-25 girls and 29 boys, all belonging to the age range of 3-6 years with no severe occurrence of diseases or deformity as followed by the inclusion and exclusion criteria's. As mentioned in Table 1, Kuppuswami's scaling was used for the categorization of children according to the socio-

economic class which depicted that maximum child of group A belonged to upper middle class whereas moreover equal proportion of children of group B belonged to upper and upper middle class groups.

Table 2 shows the frequency of physical activity (PA) performed by the children of case and control groups. The time incorporated into PA was observed to be elevated among the case groups after nutrition education session. After the trial period about 80% of the children were found to do regular physical activity in the form of outdoor games or co-curricular activities as performed in schools whereas, the time spent by the control groups before and after the study period was same as no knowledge about physical education was delivered to them.

Group			Upper Class		Upper Middle Class		Lower Middle Class	
			No. of Students	Percentage (%)	No. of Students	Percentage (%)	No. of Students	Percentage (%)
A (n=50)	Male	Female	16	32	24	48	10	20
	32	18						
B (n=54)	29	25	23	43	21	39	10	18

Table 1: Categorization of students according to the scoring of Kuppuswami's scale.

Group A (n=50)									
Gender	Month	Daily		Alternate Days		Weekends		Seldom	
		No. of Students	Percentage (%)	No. of Students	Percentage (%)	No. of Students	Percentage (%)	No. of Students	Percentage (%)
Male (n=32)	1st	3	9.37	5	15.63	11	34.38	13	40.63
	2nd	16	50	7	21.88	6	18.75	3	9.38
Female (n=18)	1st	2	11.12	2	11.12	8	44.45	6	33.34
	2nd	8	44.45	5	27.78	3	16.67	2	11.12
Group B (n=54)									
Gender	Month	Daily		Alternate Days		Weekends		Seldom	
		No. of Students	Percentage (%)	No. of Students	Percentage (%)	No. of Students	Percentage (%)	No. of Students	Percentage (%)
Male (n=29)	1st	6	20.69	5	17.24	8	27.58	10	34.48
	2nd	6	20.69	5	17.24	8	27.58	10	34.48
Female (n=25)	1st	4	16	2	8	11	44	8	32
	2nd	4	16	2	8	11	44	8	32

Table 2: Categorization of students according to the frequency of physical activity performed.

Group A (n=50)							
Gender		Near about RDA		Less than RDA		More than RDA	
		No. of Students	Percentage (%)	No. of Students	Percentage (%)	No. of Students	Percentage (%)
Male (n=32)	Before	15	46.87	11	34.37	6	18.75
	After	23	71.87	5	15.63	4	12.5
Female (n=18)	Before	9	50	5	27.78	4	22.23
	After	13	72.23	2	11.12	3	16.67
Group B (n=54)							

Gender	Month	Near about RDA		Less than RDA		More than RDA	
		No. of Students	Percentage (%)	No. of Students	Percentage (%)	No. of Students	Percentage (%)
Male (n=29)	Before	14	48.27	10	34.48	5	17.24
	After	12	41.38	13	44.83	4	13.79
Female (n=25)	Before	11	44	7	28	7	28
	After	9	36	7	28	9	36

Table 3: Categorization of students according to their daily calorie consumption.

Table 3 shows the daily calorie consumption by the cases and controls. It was found that merely 47% of the cases were taking optimal calorie intake daily, which hiked up to 72% after nutrition education session. Children taking less and more than the RDA nearly reduced to half whereas, among the controls there was no such significant increase in the number of children taking optimal dietary intake after the study period.

Tables 4 and 5 reveal the assessments of anthropometric status of the cases. The mean height before intervention was 100.74 ± 5.64 cm which increased to 102.26 ± 5.62 cm (P value <0.05***) after the follow up. The BMI as observed before and after the nutrition education session falls on normal range as provided by WHO. The head circumference before (49.20 ± 1.23) and after (49.80 ± 1.16) nutrition intervention have revealed significant improvement (P value <0.05***). There was remarkable net increase in 0.22 cm in the chest circumference after the session (P value <0.05***).

Tables 6 and 7 shows the anthropometric assessments of the controls evaluated prior and later to the trial period. It was found that no such significant improvement was noticed in the anthropometric parameters. Previously done research studies have evaluated better improvement in Weight-for-age to that of height-for-age through nutrition education [26]. On contrary Sneha et al. documented significant difference in the height after nutrition education program along with marginal difference in weight and BMI [27].

Anthropometric Parameters Assessed among Cases (group A, n=50)			Mean ± SD	Std. Error Mean (SEM)	Correlation
Pair 1	Height (cm)	Before	100.74 ± 5.64	0.79	0.991
		After	102.26 ± 5.62	0.79	
Pair 2	Weight (Kg)	Before	15.70 ± 3.00	0.42	0.978
		After	16.61 ± 3.11	0.44	
Pair 3	Body Mass Index (BMI, Kg/m)	Before	15.43 ± 2.38	0.33	0.967
		After	15.82 ± 2.41	0.34	
Pair 4	Head Circumference (HC, cm)	Before	49.20 ± 1.23	0.17	0.874
		After	49.80 ± 1.16	0.16	
Pair 5	Chest Circumference (CC, cm)	Before	52.26 ± 3.26	0.46	0.964
		After	53.48 ± 3.54	0.50	
Pair 6	Mid-Upper Arm Circumference (MUAC, cm)	Before	15.72 ± 1.77	0.25	0.887
		After	17.18 ± 1.63	0.23	

Table 4: Comparison of anthropometric status of case group before and after nutrition education and dietary modification.

Anthropometric Parameters Assessed among Cases (Group A, n=50)		Mean ± SD	Std. Error Mean	Paired Differences				
				95% Confidence Interval of the Difference		t test (two-tailed)	Df	Significance Level (P value)
				Lower	Upper			
Pair 1	Height: Before-After	-1.52 ± 0.74	0.10	-1.7328	-1.3072	-14.35	49	P value <0.05***
Pair 2	Weight: Before-After	-0.912 ± 0.65	0.09	-1.0989	-0.7251	-9.8	49	P value <0.05***

Pair 3	BMI: Before-After	-0.38 ± 0.61	0.08	-0.5624	-0.21	-4.4	49	P value <0.05***
Pair 4	Head Circumference: Before-After	-0.60 ± 0.60	0.08	-0.7723	-0.4278	-7	49	P value <0.05***
Pair 5	Chest Circumference: Before-After	-1.22 ± 0.95	0.13	-1.4926	-0.9474	-8.99	49	P value <0.05***
Pair 6	MUAC: Before-After	-1.46 ± 0.81	0.11	-1.6929	-1.2271	-12.59	49	P value <0.05***
Values are expressed as mean ± SD, *=P value <0.0, **=P value <0.001, ***P value <0.0001 (at 95% confidence interval), t=Paired t test, two tailed, p<0.05=Significant								

Table 5: Comparative analysis of the anthropometric status of the case group before and after nutrition education and dietary modification using paired t test.

Anthropometric Parameters Assessed among Controls (Group B, n=54)			Mean ± SD	Std. Error Mean (SEM)	Correlation
Pair 1	Height (cm)	Before	108.49 ± 7.76	1.05	0.995
		After	109.49 ± 7.73	1.05	
Pair 2	Weight (Kg)	Before	17.96 ± 3.99	0.54	0.986
		After	18.67 ± 4.13	0.56	
Pair 3	Body Mass Index (BMI, Kg/m^2)	Before	15.17 ± 1.91	0.26	0.920
		After	15.49 ± 1.95	0.26	
Pair 4	Head Circumference (HC, cm)	Before	49.50 ± 1.71	0.23	0.948
		After	49.78 ± 1.58	0.21	
Pair 5	Chest Circumference (CC, cm)	Before	49.50 ± 1.71	0.23	0.948
		After	49.781.58	0.21	
Pair 6	Mid-Upper Arm Circumference (MUAC, cm)	Before	16.09 ± 1.87	0.25	0.953
		After	17.59 ± 1.81	0.24	
Values are expressed as mean ± SD, *=P value <0.0, **=P value <0.001, ***P value <0.0001 (at 95% confidence interval), t=Paired t test, two tailed, p<0.05=Significant					

Table 6: Comparison of anthropometric status of control group before and after nutrition education and dietary modification.

Anthropometric Parameters Assessed among Controls (Group B, n=54)		Mean ± SD	Std. Error Mean	Paired Differences				
				95% Confidence Interval of the Difference		t test (Two-tailed)	Df	Significance level (P value)
				Lower	Upper			
Pair 1	Height: Before-After	-1.00 ± 0.75	0.10	-1.2071	-0.7929	-9.687	53	P value <0.05***
Pair 2	Weight: Before-After	-0.70 ± 0.68	0.09	-0.8921	-0.519	-7.587	53	P value <0.05***
Pair 3	BMI: Before-After	-0.32 ± 0.77	0.10	-0.537	-0.1148	-3.097	53	P value <0.05**
Pair 4	Head Circumference: Before-After	-0.28 ± 0.54	0.07	-0.4361	-0.138	-3.863	53	P value <0.05***
Pair 5	Chest Circumference: Before-After	-0.28 ± 0.54	0.07	-0.4361	-0.138	-3.863	53	P value <0.05***

Pair 6	MUAC: Before-After	-1.50 ± 0.56	0.07	-1.6546	-1.3454	-19.463	53	P value <0.05***
Values are expressed as mean ± SD, *=P value <0.0, **=P value <0.001, ***P value <0.0001 (at 95% confidence interval), t=Paired t test, two tailed, p<0.05=Significant								

Table 7: Comparative analysis of the anthropometric status of the control group before and after nutrition education and dietary modification using paired t test.

Final Anthropometric Reading Taken at 2nd Month of Study (Equal Variances Not Assumed)	t test for Equality of Means						
	t test (Two-tailed)	Df	Sig. Level (P value)	Mean Difference	Std. Error Difference	95% Confidence Interval of the Difference	
						Lower	Upper
Final height	-5.481	96.687	0.000	-7.23074	1.31929	-9.84927	-4.61221
Final weight	-2.883	98.017	0.005	-2.06022	0.71463	-3.47839	-0.64206
Final BMI	0.751	94.486	0.454	0.32547	0.43328	-0.53476	1.18569
Final HC	0.048	96.883	0.962	0.01296	0.27146	-0.52581	0.55174
Final CC	6.770	66.823	0.000	3.69296	0.54549	2.60411	4.78182
Final MUAC	-1.219	101.918	0.226	-0.41259	0.33850	-1.08400	0.25882

Table 8: Statistical analysis to compare the anthropometric results of case and control groups using t test.

Discussion

It was found that one month trial of dietary modification and nutrition intervention among the case group had a positive effect on the health condition and nutrition profile in comparison to that of the control group. These improvements in the quality of nutrition despite of short duration interventional process have been highlighted by other researchers too [28]. It was observed that prescribing RDA to the children shifted the underweight ones to the normal groups within a month. Alike our results, previously done research have also observed significant increase in the number of meals taken per day [29]. The consumption of junk food was curbed to the threshold levels by giving nutrition education and personalized daily dietary intake format to every children of the case group. Children were observed to have more hygiene concerns with neat and clean attire during the second assessments done after the one month trial period. Similar results to that of our study have been obtained by several researchers mentioning significant reduction in the number of subjects who were underweight and wasted after intervention program. An evidential increase in the Levels of serum proteins, calcium and Vitamin D after intervention has also been notified by many [30]. An experimental study done by Ayesha et al. came up with a primary outcome of decreased severity of wasting and changes in the feeding habits as well [29].

There was no change found in the control group concerning the anthropometric and dietary status as assessed after the interventional period of month signifying the reason being no dietary modification or nutrition education was implemented on them. The numbers of subjects under the normal, overweight and underweight category were the same during the second assessment as before. There was no increase in the frequencies PA among them. It has been found that very few kindergarten children engage in physical activities daily whereas the current PA guidelines recommends 180 min of PA per day [30,31]. The meal frequency, dietary pattern, calorie consumption, frequency of milk consumption, distribution of other food groups in their diet remained unaltered during the second month of evaluation.

Understanding the feeding attitudes and behavior of children is important in terms of child health. Environmental factors play an important role in children's dietary profiles and parents should receive guidance on what foods should be given at home [32]. For nutrition programs to be successful, it is essential to have adequate time, adequate knowledge transfer, appropriate resources, and suitable educational materials and teacher training [33]. School Environment, social and physical environments including schools' can directly and indirectly affect health beliefs and behaviors [34]. Many studies introduced previously reveals that dietary habits opted by the children after nutrition education along with subjecting them to psycho-educational games and conducting summer camps have seem to enhance their nutritional profile [35-44]. On contrary, many nutrition research works have found no significant differences in the dietary habits of the children before and after the nutritional intervention program [45-52].

Conclusion

There comes a broad inference with the result of the study in accordance to the dietary modification being made and nutrition education being delivered to the case group keeping the controls as a constant. As found in the literature, use of information that is developmentally appropriate impacts the subjects' ability to gain knowledge and skills needed for implementation of behavior change. Helping subjects to increase their nutrition knowledge better enables them to adopt and follow the Dietary Guidelines, improving overall health and promoting academic achievement. Reinforcement of the lessons presented is important to help the children make informed

choices about foods and nutrition. Incorporating nutrition lessons into the school curricula would provide increased knowledge about healthful choices for the students. Providing nutrition education to students at a young age would be beneficial in helping the students make lifelong changes.

Implications for Research and Practice

The results as obtained can be utilized further for extensive research to analysis how varied nutritional intervention can affect the overall growth and development of the kindergarten children and the study can be extended to a discrete level so as to observe the effect of individual nutrient modification on specific body function.

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