



IJFANS

Volume 01, Issue 01, Oct-Dec 2012, www.ijfans.com

ISSN: 2319-1775

International Journal of Food And Nutritional Sciences



Official Journal of IIFANS

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RESEARCH PAPER

OPEN ACCESS

SUPPLEMENTATION OF BRAHMI AND ITS IMPACT ON COGNITIVE DEVELOPMENT AMONG SELECTED ADOLESCENT GIRLS

K.U. PAVITRA KRISHNA¹ AND R.GRACE ARTHI²

ABSTRACT

Hundred Adolescent girls in the age group of 17-19 years were randomly selected from Fatima College of Madurai. From them, 30 were selected as subgroup because of their acceptance, willingness and the cooperation rendered by them and screened for cognitive test by Wechsler's Adult Performance Intelligence Scale test. Based on the results, they were divided into experimental and control group. The general socio-economic profile, anthropometric measurements, food intake were collected. The impact of Brahmi supplementation was evaluated in terms of blood hemoglobin levels, Physical performance, and changes in the Cognitive development. The mean initial hemoglobin levels were 9.64, 9.44 and 10.32 g/dl respectively for experimental group. These values had increased to 10.94, 10.50 and 10.68 g/dl respectively after supplementation. After 60 days of the study period it could be noticed that girls from moderate anaemia categories had shifted to mild anaemic group. The reduction in the time gained by them ranged between 0.8 to 1.8sec for experimental group and 0.27 to 0.34 sec in the control group for walking and running (50 m). Adolescent girls who received the Brahmi supplementation registered the highest increment in the Picture Completion, Digit Symbol, Block Design, Picture Arrangement and Object Assembly (5.07,2.47, 3.27, 2.8,5.8) when compared to the scores of the control group (2,0.6,0.47,0.6,1.33) respectively. Statistical analysis proved that after supplementation there was a significant increase in the experimental group when compared with the control group. The findings of this study have thrown light on the extent to which the adolescent girls from low and middle income families are disadvantaged physically and intellectually because of their poor diets. A simple supplementation of an herb, Brahmi can stimulate their well-being and cognition to a very extent. The present findings call for creating awareness among the people, the benefit of including herbs in promoting the memory and intelligence.

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KEY WORDS:

ADD- Attention Deficit Disorder, WAPIST- Wechsler's Adult Performance Intelligence Scale test, PC-Picture Completion, DS-Digit Symbol, BD- Block Design, PA- Picture Arrangement, OA-Object Assembly

INTRODUCTION

Adolescents are a period of significant growth and body changes. The body's adjustment to puberty and continued development requires essential vitamins and minerals to cultivate a healthy individual (Croll et al 2001). During adolescence an individual's total nutrient needs reach their highest point in their life cycle. Due to this, adolescents are affected by severe malnutrition. Malnutrition can influence cognitive function directly through its effect on brain development as in early severe clinical under nutrition, or indirectly by interfering with learning experiences which are so important for intellectual development.

According to Gale Encyclopedia of Medicine (2008) Cognitive is the ability to think, learn, and memorize. Cognitive - pertaining to the mental processes of comprehension, judgment, memory, and reasoning, as contrasted with emotional and volitional processes (Mosby's Medical Dictionary, 2009).

Mental problems in adolescence that are most prevalent are depression, anxiety, psychosis, phobias, suicidal tendency etc. and this may lead to addictions, illegal activities, crime, eating disorders and may sometimes require counseling, therapies and strong medications (Heritage Amruth, 2007).

Ayurveda utilizes myriads of herbs for this purpose. Among these herbs, Brahmi (*Bacopa monierii*) is considered to be the premier one especially for treating brain problems and mental decline and is suitable for all persons irrespective of their body type. It is a powerful memory enhancer, improves learning power and concentration through the stimulation of neural activity. (Ray Sahetian, "Mind boosters", 1999). Being an effective nervine tonic, it is helpful in patients with stroke, epilepsy, nervous breakdown and ADD and is extremely helpful for students in initial acquisition as well as long-term retention of informations (Kissan world, 2008).

The pharmacological effects of *Bacopa monniera* are attributed to the presence of a number of biologically active compounds like alkaloids, saponins and sterols. The compounds responsible for the memory enhancing effects are triterpenoid saponins called "bacosides", the memory chemicals in Brahmi which helps to repair damaged neurons by adding muscle kinase, the protein involved in the synthesis of new neurons to replace the old ones. Depleted synaptic activity is thus restored, leading to augmented memory functions. Bacosides help in restoring the synaptic activity of neurons.

METHODOLOGY

Figure 1 represents the schematic flow chart of the methodology

COGNITIVE ASSESSMENT OF SELECTED ADOLESCENT GIRLS

The cognitive of the selected adolescent girls were determined using WAPIS. Wechsler scales have proved to be the best available individual test for evaluating intelligence among people between 15 to 45 years. The test used here (Wechsler Adult Intelligence Scale) is adapted to Indian conditions and set up norms for Indian population. This test consists of PC,DS,BD,PA,OA. When the items of each of the tests have been scored and the points summed, the result is the raw score for each test (Wechsler, 1974). The raw scores are then transferred into scaled scores using the table of scaled score equivalents. According to the subject's age, tables are used.

RESULTS AND DISCUSSION

A. SOCIOECONOMIC BACKGROUND OF THE SELECTED ADOLESCENT GIRLS

Socioeconomic Background of the selected Adolescent Girls is given in Figure 2

B. MEAN NUTRIENT INTAKE OF THE SELECTED ADOLESCENT GIRLS

Mean Nutrient Intake of the Selected Adolescent Girls is given in Figure 3

Dietary intake by 24-hour recall method initially revealed that the mean deficits in the intake of energy; protein and calcium were found to be more than 25 per cent in all the adolescent girls. Surveys carried out in India have shown that the diet consumed by the large majority of the vulnerable groups of population is inadequate in quantity and

quality leading to one or more deficiency diseases (Sommer and West, 1996).

C. ANTHROPOMETRIC STATUS OF THE SELECTED ADOLESCENT GIRLS

C1. Distribution of the Selected Adolescent Girls According to Height and weight

Height of populations are generally an index of their all round development (Gopalan et al., 2005). Distribution of the selected adolescent girls according to height and weight is presented in Table I.

C2. Body Mass Index of the Selected Adolescent Girls

The Table II presents the Body Mass Index of the selected adolescent girls.

From the above table II, it shows that 2 per cent, 14 per cent, 17 per cent, 34 per cent, 29 per cent of the selected adolescent girls were in severe under nutrition, moderate under nutrition, mild under nutrition, normal, Grade obese-I respectively and 4 per cent of them were Grade obese-II.

D. NUTRIENT CONTENT OF BRAHMI POWDER AND BRAHMI POWDER WITH HONEY

The nutrient content of the Brahmi powder and Brahmi powder with Honey are estimated and it is given in Table III.

E. IMPACT ASSESSMENT OF THE SUPPLEMENTATION STUDY USING BRAHMI WITH HONEY ON THE SELECTED ADOLESCENT GIRLS

E1. Biochemical Estimation of Selected Adolescent Girls

The change in Mean Blood Hemoglobin Levels of the Selected Adolescent Girls is presented in Table IV.

The mean initial blood hemoglobin levels of selected adolescent girls in age groups 17, 18 and 19 were found to be 9.64, 9.44 and 10.32 g/dl respectively. At the end of 60 days supplementation of Brahmi with honey, improvement in the hemoglobin levels was recorded to be 10.94, 10.50, 10.68g/dl for the same age group while a negligible improvement of 0.02 to 1.2 was recorded in the control group, bringing out clearly the beneficial effects of Brahmi in improving the biochemical status of the adolescent girls. The suggested desirable values for hemoglobin among 17-19 year old girls according to WHO is greater than 12g/dl.

The findings of the present study are supported by Battiprolu et al (2005) who found that daily supplement of a micronutrient enriched beverage registered significant increase in iron status of children in terms of blood hemoglobin levels when compared to the control group. The findings of the present study are in tune with the findings of Vijayalakshmi et al (2003) who found that supplementation with bioavailability enhanced Mung bean resulted in improved hemoglobin levels among school children. Iron supplementation remains as an important strategy for prevention and treatment of iron deficiency anaemia, producing substantial improvement in the functional performance of the major vulnerable groups (Allen, 2002). Risonar et al (2007) found that supplementation with iron folate tablets resulted in an increase in hemoglobin level and reduction in the prevalence of anaemia by 5.37 per cent.

Adolescent girls in the study were grouped into four categories according to the degree of anaemia. Table V presents the data regarding the shift of girls from one category to another at the end of the study period.

Initially there were 6 adolescent girls in the mild anaemia (Hb: 10-12 g/dl) category followed by 8 girls in the moderate anemia (Hb: 7-10 g/dl) in experimental group.

After 60 days of the study period it could be noticed that girls from moderate anaemia categories had shifted to mild anaemia group. These changes show encouraging trend because shifting from moderate degree of anaemia to milder degree of anaemia is more challenging than registering mild increments in blood hemoglobin levels alone.

E2. Physical performance of the Selected Adolescent Girls

Physical performance of the selected Adolescent Girls is given in Figure 4.

Performance in the physical test by the adolescent girls in experimental group was found to be better after supplementation indicating the beneficial effects of supplementation. Though there was a slight improvement in the performance of the control group, the performance by the girls in the supplemented groups was higher when compared to their initial performance. Siva kumar et al (2006) using a double-blind, placebo controlled, matched pair, cluster-randomized study, proved the hypothesis that supplementation with a micronutrient-fortified beverage improves micronutrient status and physical development in the school children. Similar results were registered in the present study.

E3. Cognitive Development of the Selected Adolescent Girls

The mean scores for cognitive development of the selected adolescent girls is given in Figure 5.

Adolescent girls who received Brahmi supplementation registered highest increment in all the tests when compared to the scores of the Control group.

F. CATEGORIZING ADOLESCENT GIRLS ACCORDING TO THEIR COGNITIVE DEVELOPMENT

Supplementation of Brahmi has improved the cognitive performance of all the supplemented adolescent girls. However, it was of interest to find out how many adolescent girls have improved from one stage to the other. For this purpose the girls were classified into various categories as follows based on their intelligence obtained.

The Table VI clearly reflects that initially among 15 adolescent girls, 14 adolescent girls were in Below Normal (BN) or Average (A) category and at the end of supplementation the number of adolescent girls in Very Superior (VS), Superior (S) and Bright Normal (BN) categories increased greatly and there were no girls in Average (A) and Dull Normal (DN) category after supplementation for experimental group. The control group also showed a mild increase in the scores for all the five tests though not as high as experimental groups. The increase in score of the control group is attributed to their being in the developmental phase of life. Similar findings of Colgan and Colgan (2007) endorse the present findings that when 5-15 years of girls were supplemented, an improvement in cognition was observed. The group also made great gains in reading skills and scored higher

on standardized tests. Another study done by Vaizir et al (2006) showed that attention and concentration increment scores were higher ($p < 0.05$) than those of the placebo group after supplementation with a beverage fortified with a range of micronutrients which significantly improved attention concentration over four months.

CONCLUSION

Majority of the families had adopted nuclear family system and belonged to the low income group and about 92 per cent of the selected adolescent girls were non-vegetarians. Nearly 80 per cent skipped the breakfast due to lack of time. The food intakes of the adolescent girls were inadequate in quantity especially green leafy vegetables, fruits, milk and milk products, fats and oils, sugar and jaggery and pulses. The mean nutrient intake of the adolescent girls was deficient by more than 25 per cent in energy, protein and calcium. A glaring deficit in the intake of vitamins and minerals was noted among all the selected adolescent girls reflecting the poor intake of foods such as leafy vegetables and fruits.

All the anthropometric parameters like height, weight and BMI were found to be less than the corresponding standards (NCHS, 2004) indicating the presence of malnutrition. The mean initial haemoglobin levels were 9.64, 9.44 and 10.32 g/dl and increased to 10.94, 10.50 and 10.68 g/dl respectively indicating the beneficial effects of Brahmi supplementation for the experimental groups. Grouping the adolescent girls into mild, moderate and severe anaemic groups revealed that initially 54 and 40

per cent of adolescent girls were in the moderate and mild anemic groups. After 2 months of the study period it could be noticed that girls from moderate anaemia categories had shifted to mild anaemia group.

Physical performance by the adolescent girls in experimental groups was found to be far better than the initial performance indicating the beneficial effects of Brahmi supplementation. The reduction in the time gained by them ranged between 0.8 to 1.8 for experimental group and 0.27 to 0.34 sec in the control group for walking and running (50 m). The mean scores obtained by the adolescent girls in experimental group after 60 days feeding was significantly greater than those of control girls for all the five cognitive tests. Initially more selected adolescent girls were in Average (A) and Dull Normal (DN) category and at the end of supplementation the number of adolescent girls in Very Superior (VS) and Superior (S) categories increased greatly. At the end of the study there were no girls in the Average (A) and Below Normal (BN) category. Hence it could be concluded that supplementation had helped to improve in all the four areas of Cognitive development namely memory, concentration, intelligence and attention. Supplementation of adolescent girls with Brahmi resulted in the maximum benefits in all the parameters tested. The control group registered the least improvements.

ACKNOWLEDGEMENT

I bow my soul to the God Almighty for showering me with his blessings and giving

me the strength in both my body and soul to finish this project.

I am privileged to express my deep sense of gratitude and respect to Sr.Fatima, the Principal, Fatima College (Autonomous), Madurai for providing me this opportunity to do this dissertation work. I immensely thank Mrs.Vasantha Esther Rani, Head, Department of Home Science with Food biotechnology, Fatima College (Autonomous), Madurai her best wishes, valuable suggestions and encouragement gave me strength to complete the work successfully. My sincere thanks to my research guide Ms.R.Grace Arthi, Lecturer, PG Department of Home Science with Food biotechnology for her supportive wisdom, dynamic and constant guidance, which helped me a lot in the successful completion of the study. I thank my Ph.D research guide Dr.M.Sylvia Subapriya, Associate Professor, Avinashilingam Institute for Home science and Higher Education for Women, Coimbatore for her valuable suggestions and comments for the publication of this manuscript.

I would like to acknowledge Tamilnadu State Council for Science and Technology (TNSCST) for awarding 'Student Projects Scheme 2008-09' and providing funds to carry out this project work successfully.

Words seem inadequate to express my glowing gratitude to my beloved parents Mr.N.Krishnan and Mrs.V.Usha Krishnan, who were the pillars of encouragement and supported physically and morally with showers of love, blessings and affection, which enabled me to succeed in all my works. I profoundly thank my grand parents for their sustained prayers which

gave me strength throughout the study. My heartfelt thanks to the participants of the study for their willingness and kind co-operation throughout the period of study.

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Figure 1 represents the schematic flow chart of the methodology

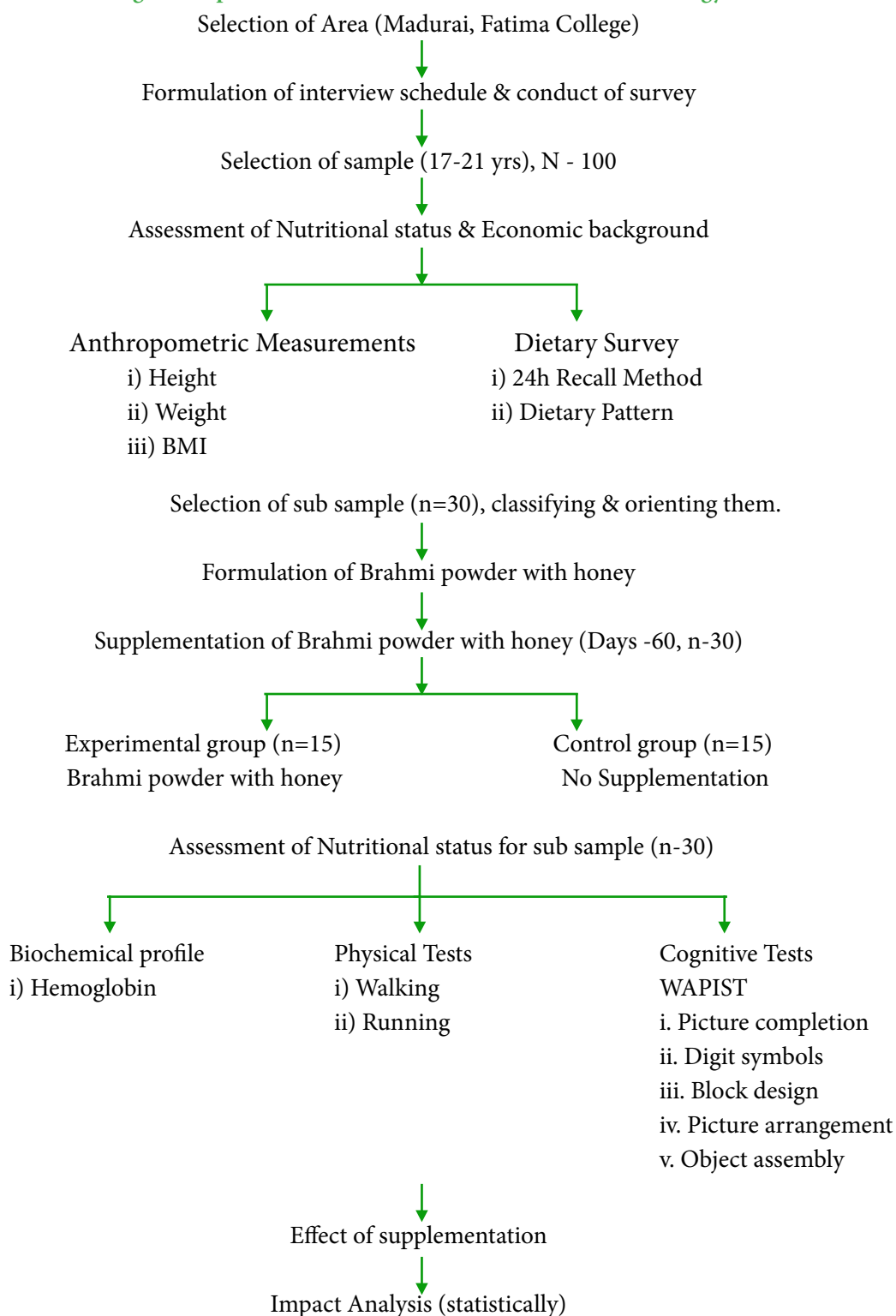


Figure 2: Socioeconomic Background of the selected Adolescent Girls

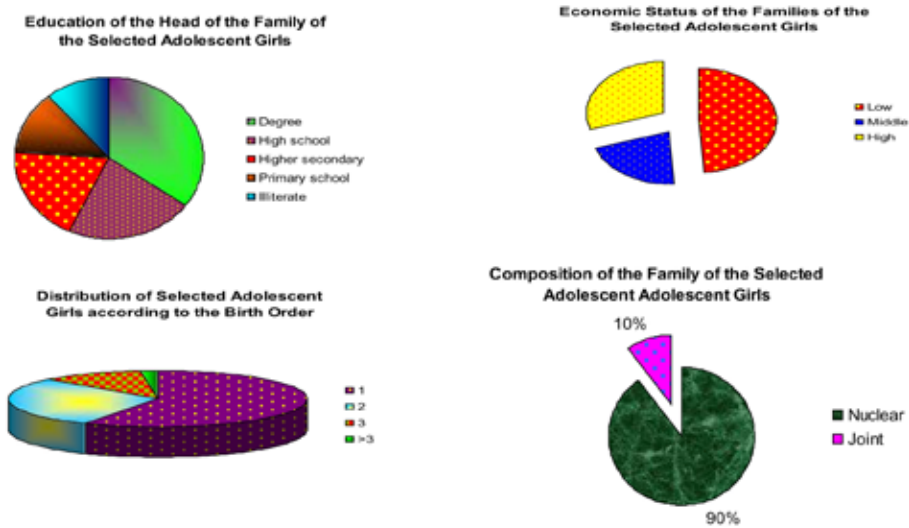


Figure 3: Mean Nutrient Intake of the Selected Adolescent Girls

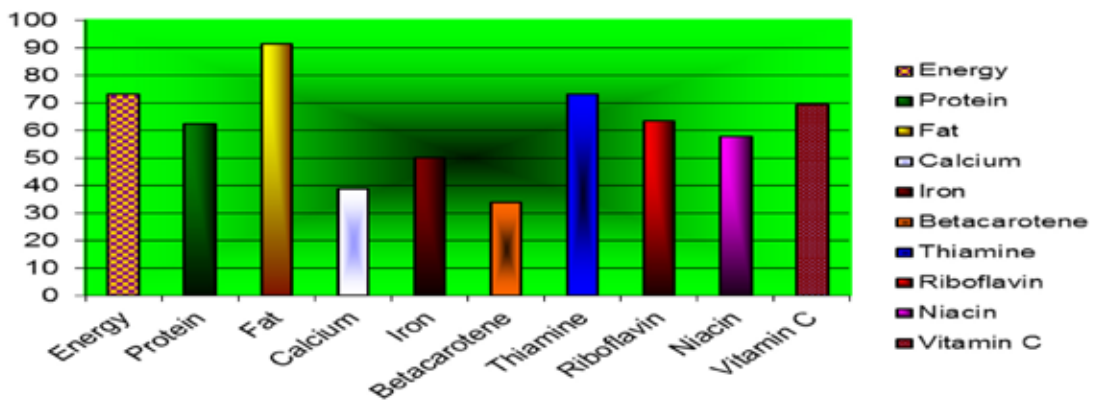


Figure 4: Physical performance of the selected Adolescent Girls

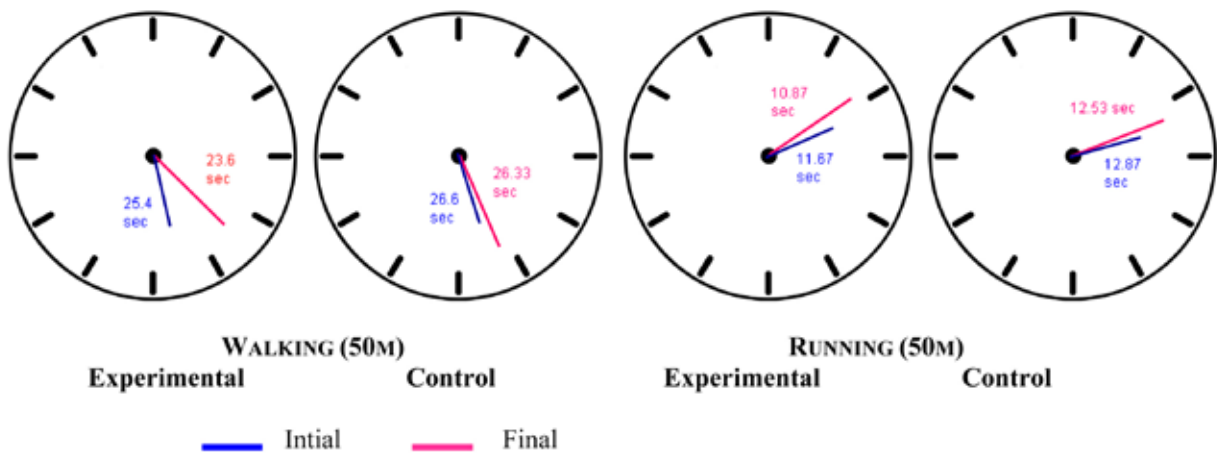


Figure 5: The mean scores for cognitive development of the selected adolescent girls

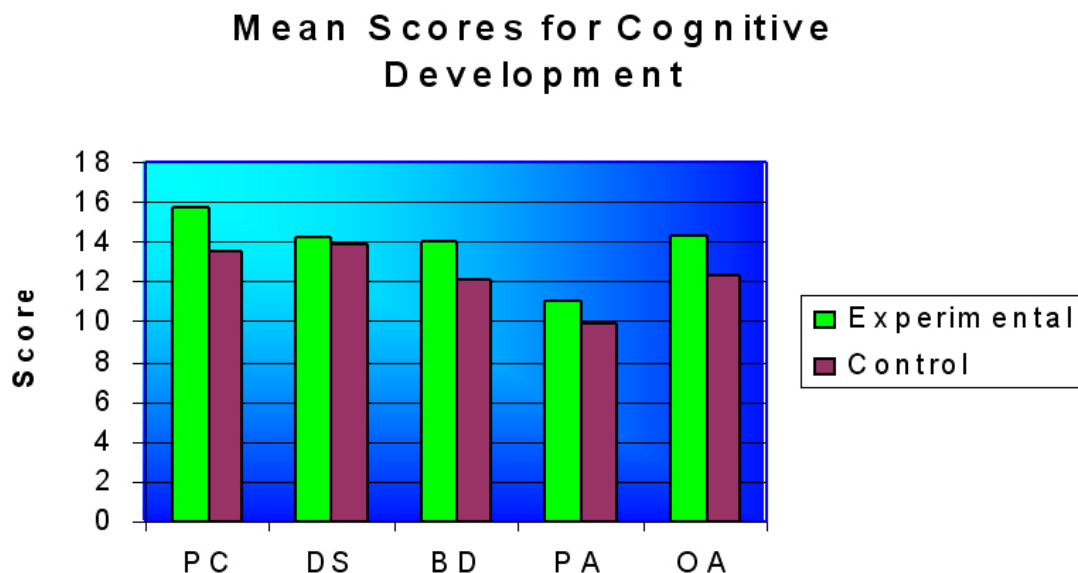


Table 1: Distribution of the Selected Adolescent Girls According to Height and weight (N=100)

Sl. No	Age (in years)	Height (cm) Mean± SD	Standard Height	Weight (kg) Mean± SD	Standard Weight NCHS (2004)
1.	17	156.8 ± 5.26	NCHS (2004)	47.12± 6.17	54-54.4
2.	18	156.7 ± 3.10		52.2 ±6.50	
3.	19	154.05± 2.91		47.5 ±8.95	

Table 2: Body Mass Index of the Selected Adolescent Girls (N=100)

S.NO	Criteria*	BMI	Number	Percent
1.	Severe under nutrition	<16	2	2
2.	Moderate under nutrition	16-17	14	14
3.	Mild under nutrition	17-18.5	17	17
4.	Normal	18.5-20	34	34
5.	Grade obese-I	20-25	29	29
6.	Grade obese-II	>25	4	4
	Total		100	100

*WHO (2003)

Table 3: The nutrient content of the Brahmi powder and Brahmi powder with Honey are estimated

S.NO	Nutrients	Brahmi powder (100g)	Brahmi powder with Honey (100g)
1.	Energy	290	309
2.	Protein	6.25	2.38
3.	Iron	52.8	18.9
4.	Zinc	13	4.55
5.	Vitamin C	2.8	0.98
6.	Calcium	220	80.25

Table 4: Mean Blood Hemoglobin Levels of the Selected Adolescent Girls (g/dl) (N=10/age group)

Age (in yrs)	Experimental Group (Supplementation of Brahmi with Honey)			Control Group (No supplementation)			t' value
	Initial	Final	Increments	Initial	Final	Increments	
17	9.64	10.94	1.3	8.22	8.34	0.12	3.039
18	9.44	10.50	1.06	9.94	10.32	0.38	0.135
19	10.32	10.68	0.36	9.68	9.70	0.02	1.831

Table 5: Grouping of Adolescent Girls according to Degree of Anemia

Degree of Anemia*	Experimental Group (Supplementation of Brahmi with honey) (n=15)		Control Group (No supplementation) (n=15)	
	Initial	Final	Initial	Final
Normal (Hb>12 g/dl)	1	1	0	0
Mild Anemia (Hb: 10-11.99g/dl)	6	10	5	6
Moderate Anemia (Hb: 7.1-9.99 g/dl)	8	4	10	9
Severe Anemia (Hb: < 7 g/dl)	0	0	0	0

Table 6: Distribution of Adolescent Girls for Cognitive Development

I.Q range	Classification	Initial Age Group			Final Age Group		
		17	18	19	17	18	19
130 above	VS	-	-	-	2	3	1
120-129	S	-	1	-	2	2	1
110-119	BN	1	-	-	1	-	3
90-109	A	4	3	2	-	-	-
80-89	DN	-	1	3	-	-	-