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PROPINQUITY BETWEEN COGNITION WITH SNACKING PATTERN OF THE SELECTED SCHOOL CHILDREN

Anitha M. C.*[1] and Anusuya Devi[2]

Ph. D Research Scholar[1], Assistant Professor[2],
Department of Nutrition and Dietetics, PSG College of Arts and Science, Coimbatore – 641014, Tamil Nadu, India.

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Corresponding author: Anitha M. C.

Ph. D Research Scholar, Department of Nutrition and Dietetics, PSG College of Arts and Science, Coimbatore – 641014, Tamil Nadu, India.

ABSTRACT

Background: The aim of the study was to explore snack intake and cognitive function in school going children in Coimbatore (10-12 years). **Materials:** A cross sectional study design with children studying in grades 5th to 7th grade, in different schools of Coimbatore. We visited 25 schools among 5 each government school and government aided and 3 matriculation and 2 CBSE schools permitted for the conduct of the study. Totally 1409 school children from government (n=407), Government aided (n=411), Matriculation (n=388), CBSE (n=203) A structured and validated questionnaire was developed. A cognition test assessment was done to find out the relationship between snack consumption and better cognition level with the help of National Psychological Corporation, Pune. Pramila Ahuja's Group Test of Intelligence for children from 9 to 13 years was used. **Results:** Majority of the school children were in government aided (29.2%). Socio- Economic Background depicts that rural adolescents prefer nearby government aided (55%) and government school going adolescents (53%) whereas urbanities select matriculation (59%) schools. Overweight and obesity was more prevalent among matriculation and CBSE school children. **Conclusion:** Poor nutritional quality snacking at school and at home was not associated with cognition function but positively associated with meal skipping pattern.

KEYWORDS: Cognitive function; Snack consumption; Snacking pattern; Cognition; Group Test of Intelligence.

INTRODUCTION

Adequate brain function is a pre-requisite for efficient cognition and the performance of organized behavior. Indeed, the uninterrupted activity of the brain is vitally important to the survival of an organism because it ensures the continuous performance of many essential voluntary and involuntary functions.[1] Balanced nutrition is very important in school-age children, which is a period of vigorous growth, increased activity, and the development of physical and cognitive functions. Food quality and good nutrition are related to brain development and cognitive function, which are important in childhood for health and well-being.[2,3] From the perspective of neuropsychology, adequate nutrition is essential for healthy brain functioning, optimal learning, and academic performance.[4] Numerous studies have been conducted about the beneficial and detrimental effects of specific nutrients and ingredients on cognition and behavior.[5-8] A study by Wolraich et al. finds that diets high in sucrose have no significant effects on behavior and cognitive performance in children.[9]

Recent years have seen a move away from analyzing the associations between isolated nutrients and brain health to an overall consideration of the effects of dietary behavior or patterns, such as the consumption of junk food.[10-13] The aim of this study is to explore the relationship between snack intake and cognitive function in school going children.

MATERIALS AND METHODS

1. Selection of population

The author contacted 11 Government schools (Government and Government aided) and 8 non-government schools (Matriculation and CBSE). Government schools are run by government where the fee ranged from Rs.1000-2000/year, whereas the selected non-government school collected a fee of Rs. 30,000-50,000/year. Permission was granted and data collection

was done among 6 government and 5 non-government schools respectively. Consenting male and female students of class 5- 7 were included in the study.

2. Selection of sample

Our sample size was 1409 school children. Gender differences were not considered in our calculation. However, we collected data from all consenting students from within the selected grades and schools. Duration of Study was about 3 months starting from July –September 2016.

3. Data collection

Using validated questionnaire, data like Age and Gender, Socio-Economic Background, anthropometry, frequency and awareness about nutrition labels were collected. Data collection was carried out using interview schedule method as it allows the researcher to build a rapport with the child and gives validation to the data.

India, a country with vast differences among people based on their economy so this is assessed using Revised Kuppuswamy Scale 2012[14] as tabulated below:

Socio-Economic Category	Monthly Income (Rs)
Upper	≥ 32,050
Upper Middle	12020-32,049
Middle/Lower Middle Income	12,019-8,010
Lower/Upper Lower	8,009-4,810
Lower	4,809- 1,600/ and less

**Revised Kuppuswamy scale 2012.*

Because of the convenience, we have merged upper middle and Middle/lower Middle income to a category of middle SES, in the same way lower SES comprises of lower/upper lower and lower income.

***B.* Anthropometry**

***i)* Height**

A stadiometer was used to measure the height of the children. The children were made to stand erect without shoes on a flat floor by the scale with heels together and toes apart. The head was comfortably held erect and the arms were relaxed and held in a natural manner. The head piece of the stadiometer was lowered slowly and was placed in the sagital plane over the head of the child applying a slight pressure to reduce the thickness of hair and make contact with the top of the head. Using this technique, the height of the children was measured to the nearest 0.1 cm accuracy.[15]

ii) Weight

Body weight is the most widely used and the simplest reproducible anthropometric measurement for the evaluation of nutritional status of young children. Body weight of all the children was measured using a digital weighing balance. The balance was validated using known weight for every 5 readings. The children were made to stand erect with minimum clothing and barefoot. The weight was noted to the nearest 0.1 kg.[15]

iii) BMI Percentiles

BMI, age and sex, specific percentile values for children both boys and girls were used to find out Underweight, Normal, Overweight, and Obese. In clinical practice, BMI for age growth charts can be used to determine an adolescent's BMI for age percentile and to track relative weight status through childhood to adolescence.

Percentile	BMI Category*
<5th Percentile	Underweight
≥5th to <85th Percentile	Normal
≥85th Percentile to <95th Percentile	Overweight/At risk
≥95th Percentile	Obesity

****CDC, 2000 [16]***

BMI percentiles were calculated using the online calculator for grouping the selected pre-adolescents according to the BMI category.

4. Cognitive Assessment

A cognition test assessment was done to find out the relationship between snack consumption and better cognition level with the help of (National psychometrics, Psychological Corporation Pune). Pramila Ahuja's Group Test of Intelligence (PGTI) (English) for the children from 9 to 13 years for both gender including seven sub tests, scrambled words, analogies, classification, disarranged, sentences, same opposite, series and best answers with the time limit of 35 minutes which is standardized on 10,373 students purchased from National psychometrics, Psychological Corporation Pune.[17] Classification of deviation IQ`s can be classified in each categories. The suggested classification of Revised Stanford-Binet[18] has been followed in the present investigation.

Deviation IQ`s	Classification
140 and above	Very superior
120-139	Superior
110-119	High average
90-109	Normal/Average
80-89	Low average
70-79	Borderline Defective
Below 70	Mentally Defective

5. Association of cognition and snack consumption

The association between cognition and snack consumption with various factors like school, age, gender type of diet, BMI percentile category, lifestyle pattern, snacking frequency, number of meals and snacks per day, meal skipping pattern to find out whether there is any association between lifestyle, snack consumption with cognition

Statistical analysis
All data analyses were performed using Statistical Package for the Social Sciences (SPSS) version 16.0.

Ethical statement
The study was granted approval by the Ethics Review Committee of the PSG Institute of Medical Research, Coimbatore. Consent forms, in both English and Tamil, for all students of grades 5 to 7th were signed by either of the parents of the children, and data were collected only from them.

RESULTS AND DISCUSSION

1. Age and Gender of the selected children

Age is the length of time during which a being or thing has existed. School children's age and gender are tabulated on the basis of school board and illustrated below.

Table-I: Age and Gender of the selected School children (N=1409).

School Board	Age (Years)													
	10 (n=380)				11 (n=829)				12 (n=200)				Total	
	Boys		Girls		Boys		Girls		Boys		Girls			
	No	%	No	%	No	%	No	%	No	%	No	%	No	%
Government	57	15	78	**20.5**	61	7	189	**23**	9	4.5	13	6.5	407	**28.9**
Government aided	75	20	54	14	91	**11**	102	12	42	**21**	47	**23**	411	**29.2**
Matriculation	32	8	56	15	61	7	161	19	34	17	44	22	388	27.5
CBSE	5	2	23	6	35	4	129	15.5	6	3	5	2.5	203	14.4

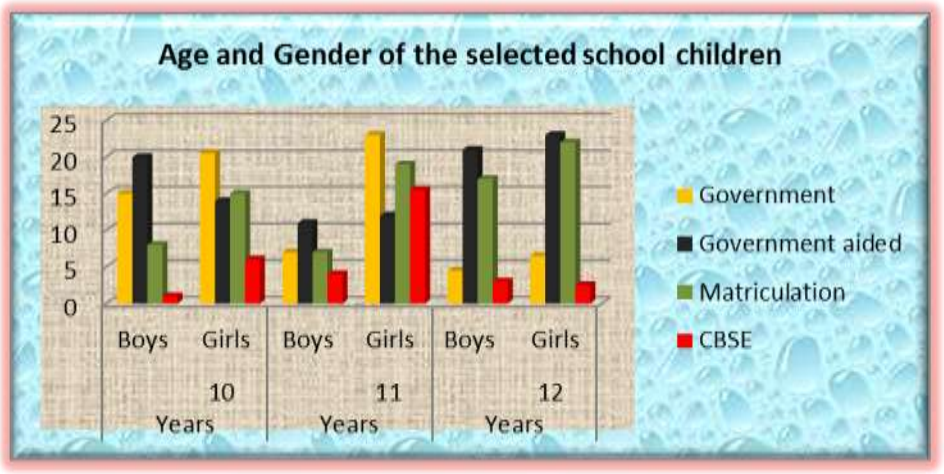


Figure-1.

Majority of the school children selected for the study were in government aided (29.2%), followed by government (28.9%) and matriculation (27.5%)schools, we could note a slight low numbers from CBSE schools as the permission was not granted.

2. Socio-economic background of selected school children

Individual's health and nutrition status is greatly influenced by family background, so it is tabulated below.

Table –II: Socio-economic background of selected school children (N=1409).

S. No	Socio-Economic Details	School Children							
		Government (n=407)		Government Aided(n=411)		Matriculation (n=388)		CBSE (n=203)	
		No	%	No	%	No	%	No	%
1.	**Living Area**								
	- Rural	259	**64**	277	**67**	132	34	56	28
	- Urban	148	36	134	33	256	**66**	147	**72**
	χ^2 = 159.492, df = 3, Sig. = S**								
2.	**Religion**								
	- Hindu	208	**51**	112	27	153	**39**	150	**74**
	- Christian	124	30.4	182	**44**	122	31	28	14
	- Muslim	75	18.4	116	28	110	28	21	10
	- Others	-	-	-	-	3	0.7	4	2

χ^2 = 149.152, df = 9, Sig. = S**									
3.	**No of persons at home**								
	- 1-2	16	4	7	2	-	-	-	-
	- 2-4	216	**53**	211	51	308	79	111	55
	- 3-6	153	37.5	182	44	67	17	87	43
	- > 6	22	5	11	3	13	3	5	2
χ^2 = 111.600, df = 9, Sig. = S**									
4.	**Type of Family**								
	- Nuclear	149	37	206	**50**	261	**67**	119	**59**
	- Joint	258	**63**	205	**50**	127	33	84	41
χ^2 = 123.450, df = 9, Sig. = S**									
5.	**Total Monthly Income**								
	- < 10,000	187	**46**	267	**65**	1	0	1	0
	- 10,001- 30,000	174	43	106	26	86	**22**	44	**22**
	- 30,001 - 50,000	46	11	37	9	120	31.5	82	**40**
	- 50,001 - 70,000	-	-	1	0.2	181	**47**	76	37
χ^2 = 878.560, df = 15, Sig. = S**									

S- Significance at 1% level, S*- Significance at 5% level, NS – Not Significant**

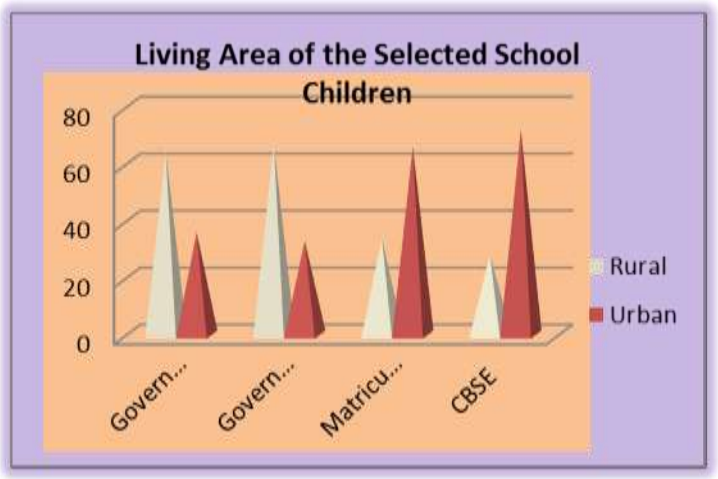


Figure – 2.

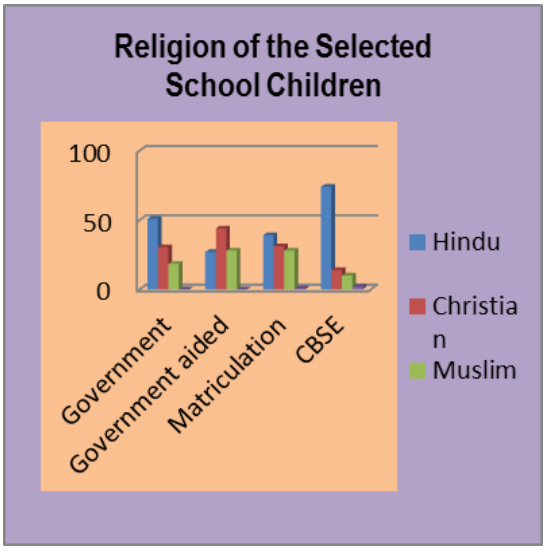
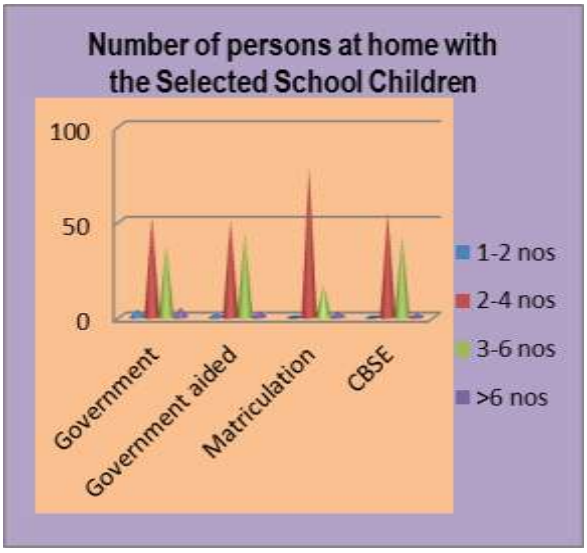


Figure – 3.



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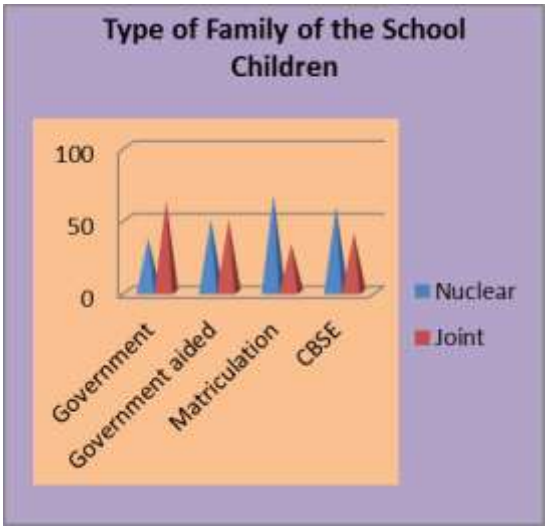

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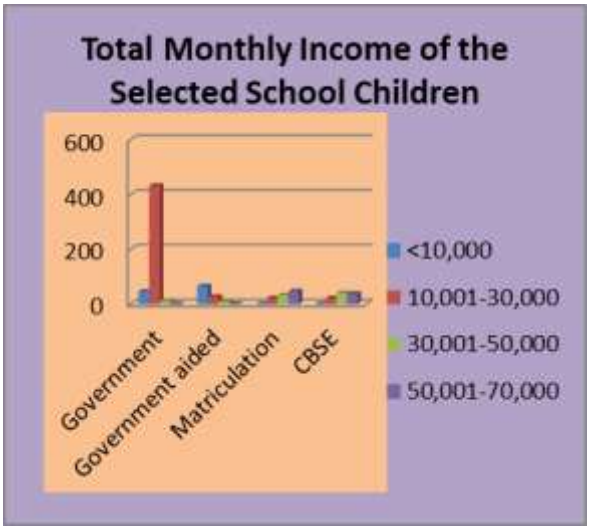

Figure – 6.

The above table clearly depicts that rural adolescents prefer nearby government aided (55%) and government school going adolescents (53%) whereas urbanities select matriculation (59%) schools. Hindu religion is highly prevalent among south India, which is again confirmed from our study. The selected school going adolescent's family dwell as nuclear family as we could note that majority of the family comprises only 2-4 members. Family income of Rs.≤10,000/- is noted among government and government aided school adolescents whereas matriculation adolescent's family income was between Rs. 30,000/-70,000 per month.

3. Distribution of BMI Percentiles of the Selected School Children

The best indicator of adolescents' well-being is growth which acts as a single measurement that best defines the nutritional and health status of children and helps to estimate the quality of life of population at large in the community. BMI percentiles of the adolescents and groups are given in table

Table III: Distribution of BMI Percentiles of Selected School Children (N=1409).

BMI Percentile	Age Years	School Children															
		Government (n=407)				Government aided (n=411)				Matriculation (n=388)				CBSE (n=203)			
		Boys		Girls		Boys		Girls		Boys		Girls		Boys		Girls	
		No	%	No	%	No	%	No	%	No	%	No	%	No	%	No	%
> 95th Percentile (Obesity)	10	2	0.4	1	0.2	3	0.7	2	0.4	14	3.6	29	7	-	-	11	5
	11	5	1	1	0.2	12	3	9	2	32	8	98	25	1	0.4	46	23
	12	-	-	1	0.2	1	0.2	4	1	8	2	18	5	1	0.4	2	1
85-95th percentile (Overweight)	10	5	1	1	0.2	14	3.4	8	2	7	2	13	3	2	1	4	2
	11	2	0.4	1	0.2	8	2	10	2.4	12	3	26	7	19	9	37	18
	12	-	-	-	-	5	1	6	1.4	11	3	14	4	1	0.4	1	0.4
5th - 85th Percentile (Normal)	10	39	9.5	62	15	39	9	36	9	9	2	12	3	2	1	8	4
	11	42	10	156	38	56	13	66	16	17	4	32	8	12	6	43	21
	12	7	2	10	2	26	6	27	6.5	12	3	11	3	4	2	2	1
<5th Percentile (Underweight)	10	11	3	15	4	19	5	8	2	2	0.5	2	0.5	1	0.4	-	-
	11	12	3	31	8	15	4	17	4	-	-	5	1	3	1	3	1.4
	12	2	0.4	2	0.4	10	2.4	10	2.4	3	0.7	1	0.2	-	-	-	-

*CDC (2000)

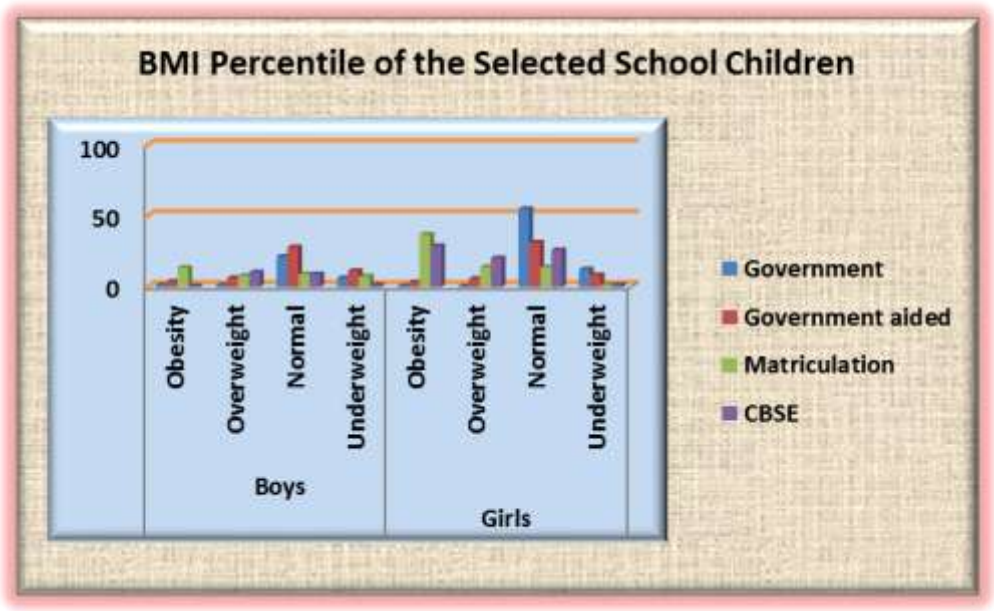

Figure – 7.

The results show that the overweight and obesity was more prevalent among matriculation and CBSE school children. We could see majority of the government and government aided children fall under the normal category.

4. Interconnection between cognition and various factors relating to food consumption and life style pattern

Cognitive assessment of the selected school children is given in the table below:

Table IV: Cognitive assessment of the selected school children (N=1409).

	Variables	Deviation IQ`s											
		Superior (120-140)		High Average (110-119)		Normal (90-109)		Low Average (80-89)		Borderline Defective (70-79)		Mentally Defective (<70)	
		No	%	No	%	No	%	No	%	No	%	No	%
1	**School**												
	Government (n=407)	29	7	73	18	158	39	64	**16**	53	**13**	30	**7**
	Government aided(n=411)	44	11	92	**22**	167	41	62	15	41	10	5	1
	Matriculation(n=388)	50	**13**	87	**22**	163	42	63	**16**	22	6	3	0.8
	CBSE(n=203)	21	10	39	19	88	**43**	31	15	16	8	8	4
	X^2=56, Df = 15, S**												
2	**Age (Years)**												
	10 (n=380)	41	**11**	77	20	158	**42**	60	16	32	8	12	3
	11 (n=829)	85	10	168	20	346	**42**	117	14	82	**10**	31	**4**
	12 (n=200)	18	9	46	**23**	72	36	43	**21.5**	18	9	3	1.5
	X^2=11, Df = 10, NS												
3	**Gender**												
	Boys (n=508)	50	**10**	105	**21**	200	39	89	17.5	48	9	16	**3**
	Girls (n=901)	94	**10**	186	**21**	376	**42**	131	**84**	9	**30**	30	**3**
	X^2=2.4, Df = 5, NS												
4	**Type of Diet**												
	Vegetarian (n=311)	38	**12**	53	17	128	41	51	**16**	34	**11**	7	2
	Non-Vegetarian (n=771)	83	11	160	21	310	40	119	15	68	9	31	**4**
	Ova-Vegetarian(n=327)	23	7	78	**24**	138	**42**	50	15	30	9	8	2
	X^2=13 Df = 10, NS												
5	**BMI category**												
	Underweight (n=174)	10	6	41	**24**	67	38.5	25	14	25	**14**	6	3
	Normal (n=676)	70	10	139	21	269	40	109	16	64	9.5	25	**4**
	Overweight ((n=167)	22	**13**	27	16	69	41	28	**17**	18	11	3	2

	Obesity (n=392)	42	11	84	21	171	**44**	58	15	25	6	12	3
	X^2 =19 Df = 15, NS												
6	**Physical activities**												
	i. Bicycle												
	< 30min (n=925)	23	2	166	18	296	32	401	**43**	27	3	12	1
	30-60minutes (n=204)	11	5	19	9	101	**49.5**	40	20	22	11	11	5
	X^2 =21, Df = 5, NS												
	ii. Yoga												
	< 30min (n=869)	32	4	152	17	264	30	392	**45**	19	2	10	1
	30-60minutes(n=450)	20	4	91	20	114	25	129	**29**	67	15	29	6
	X^2 =11, Df = 15, NS												
	iii. Sports												
	30-60minute(n=796)	69	9	44	5.5	159	20	346	**43**	142	18	36	4.5
	<30 minutes (n=440)	21	5	35	8	110	25	201	**46**	54	12	19	4
	X^2 =8.3, Df = 10, NS												
7	**Snacking Frequency**												
	Daily (n=1217)	124	10	258	**21**	490	40	191	16	112	9	42	3
	4-5 times/day(n=161)	19	**12**	29	18	70	**43.5**	22	14	17	11	4	1
	2-3 times/day (n=27)	1	1	4	15	12	4	7	**26**	2	7	1	**4**
	Once/week (n=5)	-	-	-	-	4	8	-	-	1	**20**	-	-
	X^2 =11, Df = 15, NS												
8	**Number of meals& snacks/day**												
	3 meals+2 snacks(n=507)	160	**31.5**	108	21	91	**18**	78	15	51	**10**	19	4.5
	3 meals+1 snacks(n=175)	39	**22**	37	21	26	15	25	14.5	23	13	25	14.5
	2meals+2,3snacks(n=727)	115	16.5	138	19	171	23.5	127	17	116	16	60	8
	X^2 =19, Df = 20, NS												
9	**Meal skipping**												
	Breakfast (n=206)	56	27	43	21	36	17.5	30	14.5	21	10	20	10
	X^2 =42, Df = 20, S**												
	Lunch (n=116)	31	27	22	19	18	15	16	14	17	15	12	10
	X^2 =41, Df = 10, S**												
	Dinner (n=67)	18	27	13	19	12	18	10	15	8	12	6	9
	X^2 =14, Df = 15, NS												
10	**Screen Time/day**												
	Don` t watch + < 1hour (n=751)	136	18	155	21	142	19	154	20	111	15	53	7
	1-2 hours (n=587)	132	22	115	19.5	127	22	89	15	27	4.5	97	17
	3-4 hours +more(n=71)	15	21	18	25	14	20	12	17	7	10	5	7
	X^2 =15, Df = 20, NS												
11	**Playing videos games/day**												
	Don`t play (n=439)	132	30	101	23	78	18.5	59	13	50	11	19	4.5
	<1 hour (n=890)	114	13	173	19	264	30	121	13.5	120	13.5	98	11
	1- 2 hours/more (n=80)	21	26	10	12.5	18	22.5	14	17.5	12	15	5	6.5
	X^2 =34, Df = 15, S**												

NS- Not significant, S-Significant at 1% level, S*- Significant at 5% level**

From the above table we could note 1% level significant difference in cognition among the schools, meal skipping pattern especially breakfast, lunch and number of hours of playing videos.

Skipping breakfast during pre adolescence (10-12 years) leads to transient decrease in late morning cognitive performance.[19]

CONCLUSION

Poor nutritional quality snacking at school and at home was not associated with cognition function but postively associated with meal skipping pattern. These results may have important implications for the promotion of healthy lifestyles by educational agencies and schools also associating healthy snacking with educational outcomes can perhaps enhance the value of having responsible health behaviors and boost motivation for a healthy way of life.

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Author Disclosure
The author declares no conflict of interest.

Ethical Clearance
The study was granted approval by the Ethics Review Committee of the PSG Institute of Medical Research, Coimbatore. Consent forms, in both English and Tamil, for all students and the data were collected only from them.

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