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IMPACT OF BREAKFAST EATING PATTERN ON NUTRITIONAL STATUS AND COGNITIVE PERFORMANCE AMONG LATE ADOLESCENT GIRLS—AN OBSERVATIONAL STUDY

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Objective: To study the impact of breakfast eating on cognitive performance, nutritional status and to study the relation between breakfast eating BMI, WtHR, cognitive performance of adolescent girls. **Method:** The present study was an observational study conducted in the campus of Sri Ramachandra University, Chennai from December 2015-April 2016. 50 adolescent girls 25 breakfast skippers and 25 breakfast non-skippers of age group 17-18 years with no illness, acute infections were included in the study by convenience sampling. Cognitive performance was measured using Wechsler memory scale, three day breakfast recall was used to calculate energy intake. **Conclusion:** It can be concluded from the present study that breakfast skipping does not hinder the cognitive abilities and nutritional status of adolescent girls.

Keywords: BMI (Body Mass Index), WHtR (Waist Height Ratio), DS (Digit Span), VPA (Verbal Paired Associates), LT (Logical memory Thematic unit), LS (Logical memory Story unit), LR (Logical memory Recognition)

INTRODUCTION

“Eat breakfast like a king, lunch like a prince, dine like a pauper”. This ancient proverb has more than a grain of truth in it, but sadly, most people leading today’s busy lives skip breakfast altogether. Although, breakfast has been considered the most important meal of the day, it is frequently skipped [1]. Consuming breakfast on regular basis is associated with improved cognitive performance and nutrient intake in adolescents [2]. Breakfast skipping may result in inadequate nutrient intake, which is not compensated at any other time in a day [3]. Eating breakfast is important during adolescence as they have high nutritional needs, due to brain development process, physical growth yet they have highest rate of skipping

breakfast [4-5]. Researchers noted that breakfast when skipped affects problem solving, short-term memory, attention and episodic memory [6-7]. Breakfast is seen as an important source of energy for the day. By eating breakfast brain can cope with demands of the morning [8]. Habitual skipping of breakfast can affect cognitive performance adversely as the gap of about 10-12 hours between dinner and breakfast causes low blood glucose levels [9].

Childhood and adolescence are two crucial stages in lifecycle that requires nutrition in adequate [10]. Breakfast is among the principle food, which satisfies the nutritional needs and increases mental workload ability [11]. Breakfast makes a large contribution to micronutrient intake [12]. Iron,

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B vitamins and VIT-D are approximately 20-60% higher in children who regularly consume breakfast [13]. Favorable nutrients intake with dietary fibre, carbohydrate, lower fat and cholesterol is seen in children who habitually consume breakfast [14]. There is evidence that breakfast positively affects learning in children in terms of school performance, behavior and cognition [15].

Consuming breakfast also contributes to maintain normal BMI. Two systemic review reports showed that adolescents who habitually consume breakfast have reduced chances of being overweight [16]. Hence, consumption of breakfast is always recommended [17-21]. Lack of knowledge of healthy food choices may negatively affect nutritional status and eating habits [22].

This study was undertaken to study the impact of breakfast eating pattern on nutritional status and cognitive performance of adolescent girls.

MATERIAL AND METHODS

The present study was an observational study conducted in Sri Ramachandra University in Chennai- Tamil Nadu from December-April 2016. Convenience sampling was done amongst adolescent girls 17-18 years of age with no illness or acute infections were included. Study protocol was approved by the institutes Ethics Committee. General profiles with anthropometric data were collected using proforma.

Cognitive performance of the adolescents was measured by using Wechsler memory scale which is a neuropsychological test, designed to measure different memory functions in a person. Anyone aged between 16-90 years can be used for this test. Raw scoring was followed for all the cognitive tools as per the instructions given by Department of Psychology. The raw scores of breakfast skippers and breakfast non-skippers were then compared under each sub-set of the used tool. Three-day breakfast recall was taken to assess the energy intake of breakfast skippers and non-skippers. Prior, to data collection written permission was obtained from the concerned authorities. One- on –one Interview technique was used as a research technique.

A statistician performed needed statistics. The collected data was analyzed with SPSS for windows, version 16.0, Chicago Inc. Bivariate analysis, One-way analysis of variance, Bonferroni test, Chi-square test, Pearson correlation, Scatter plot were used for comparing and

Table 1: Comparison of Mean, Standard Deviation and Level of Significance of Anthropometric Data, Cognitive Performance, 3-Day Recall of Breakfast Skippers and Non-Skippers

Data	Skippers (n = 25)	Non Skippers (n = 25)	t-value	p-value
	Mean (SD)	Mean (SD)		
Height (cm)	157.4 (2.3)	157.2 (3.6)	0.234	0.816 ^{NS}
Weight (kg)	55.7 (5.6)	57.8 (5.8)	-1.265	0.212 ^{NS}
BMI (kg/m ²)	22.4 (2.0)	23.4 (2.3)	-1.492	0.141 ^{NS}
WHtR	0.3 (0.04)	0.4 (0.04)	-5.96	0.554 ^{NS}
DS	17 (3)	18.2 (3.2)	-1.415	0.163 ^{NS}
VPA	23.8 (3.4)	24 (3.5)	-1.62	0.872 ^{NS}
LS	32.4 (6.2)	33.1 (7)	-4.09	0.684 ^{NS}
LT	9.7 (2.4)	10 (2)	-4.42	0.661 ^{NS}
LR	20.9 (3.2)	20.5 (3.5)	0.382	0.704 ^{NS}
DAY 1	65.4 (165.9)	361.8 (115.6)	-7.362	0.000***
DAY 2	84.8 (185.6)	376.5 (138.5)	-6.294	0.000***
DAY 3	58.7 (165.4)	395.8 (140.1)	-7.77	0.000***

Note: Ht - Height (cm), Wt - Weight (kg), BMI - Body Mass Index (kg/m²), WHtR - Waist to Height Ratio, Not significant - $P \geq 0.05$, Highly significant - $P \leq 0.01$, ***99.9%, $p < 0.001$ - 0.000-0.001.

correlating variables as applicable. P value of less than 0.05 was considered significant statistically.

RESULTS

A total of 50 adolescents of which 25 breakfast skippers and 25 breakfast non-skippers were enrolled. The comparison of anthropometric data, cognitive performance and 3-day breakfast recall are given in Table 1. Both the groups anthropometric data seemed to be similar and performed equally in cognitive performance. 3-day breakfast recall showed intake of calories to be higher in breakfast non-skippers.

Three-day dietary recall of breakfast skippers and non-skippers has been analyzed by using multivariate analysis within the group and the observed values are given in Table 2. Difference was observed between the mean values but statistically not significant.

Among breakfast skippers, Logical memory Story ($P < 0.05$) is significantly related to Digit Span. Logical

Table 2: Three-Day Dietary Recall of Skippers and Non-Skippers by Using Multivariate Analysis

Energy Intake	Day 1	Day 2	Day 3	F-value	P-value
	Mean (SD)	Mean (SD)	Mean (SD)		
Skippers (n=25)	65.5 (165.9)	84.8 (185.6)	58.7 (165.4)	0.153	0.859 ^{NS}
Non Skippers (n=25)	361.8 (115.6)	376.5 (138.5)	395.8 (140.1)	1.816	0.182 ^{NS}

Note: Not significant - $P \geq 0.05$.

Table 3: Correlation of Anthropometric Measures and Cognitive Performance of Breakfast Skippers

Variables	BMI (Kg/m ²)	WHtR	DS	VPA	LS	LT	LR
BMI (Kg/m ²)	1						
WHtR	0.106 (0.613)	1					
DS	0.184 (0.379)	-0.379 (0.061)	1				
VPA	0.366 (0.072)	-0.122 (0.561)	0.306 (0.137)	1			
LS	0.061 (0.773)	-0.352 (0.084)	.447* (0.025)	0.37 (0.069)	1		
LT	0.245 (0.237)	0.073 (0.729)	0.29 (0.159)	.405* (0.044)	0.273 (0.187)	1	
LR	0.22 (0.290)	0.11 (0.958)	.419* (0.037)	.618** (0.001)	.624** (0.001)	.747** (0.001)	1

Note: BMI- Body Mass Index (kg/m²), WHtR – Waist to Height ratio, DS-Digit Span, VPA- Verbal Paired Associates, LS- Logical memory story, LT- Logical memory Thematic, LR- Logical memory Recall. ** Correlation is highly significant at the 0.01 level (2-tailed); * Correlation is significant at the 0.05 level (2-tailed).

memory Thematic ($P < 0.05$) is significantly related to Verbal Paired Associates. Logical memory Recognition ($P < 0.05$) is significantly related to Digit Span and Logical memory Recognition ($P < 0.001$) showed high significant relation with Verbal Paired Associates, Logical memory Story, and Logical memory Thematic in Table 3.

Table 4: Correlation of Anthropometric Measures and Cognitive Performance of Breakfast Non-Skippers

Variables	BMI (Kg/m ²)	WHtR	DS	VPA	LS	LT	LR
BMI (Kg/m ²)	1						
WHtR	.684** (0.000)	1					
DS	0.093 (0.660)	-0.137 (0.514)	1				
VPA	0.237 (0.253)	0.252 (0.224)	0.258 (0.212)	1			
LS	0.046 (0.829)	-0.113 (0.589)	.659** (0.000)	0.158 (0.452)	1		
LT	0.21 (0.289)	0.282 (0.171)	.575** (0.003)	0.245 (0.238)	.534** (0.006)	1	
LR	.398* (0.490)	.419* (0.370)	.559** (0.004)	0.207 (0.321)	.649** (0.000)	.800* (0.000)	1

Note: BMI- Body Mass Index (kg/m²), WHtR – Waist to Height ratio, DS-Digit Span, VPA- Verbal Paired Associates, LS- Logical memory story, LT- Logical memory Thematic, LR- Logical memory Recall. ** Correlation is highly significant at the 0.01 level (2-tailed); * Correlation is significant at the 0.05 level (2-tailed).

When BMI, WHtR, Cognitive Performance were correlated, WHtR ($P < 0.001$) is shown to have highly significant relation with BMI. Logical memory Story ($P < 0.001$) is shown to have highly significant relation with Digit Span. Logical memory Thematic ($P < 0.001$) is shown to have highly significant relation with Digit Span and Logical memory Story. Logical memory Recognition ($P < 0.001$) is shown to have highly significant relation with Digit Span, Logical memory Story and Logical memory Thematic. Logical memory Recognition ($p < 0.05$) is shown to have significant relation with BMI and WHtR in Table 4.

Amongst the skippers and non-skippers, WHtR detected 48% ($n = 12$) and 56% ($n = 14$) as healthy, 8% ($n = 2$) of skippers and 32% ($n = 8$) of non-skippers were considered over weight by BMI. Amongst the skippers and non-skippers WHtR detected 48% ($n = 12$) and 40% ($n = 10$) as extremely slim, and 8% ($n = 2$) of skippers and 4% ($n = 1$) of non-skippers were considered as underweight by BMI in Table 5.

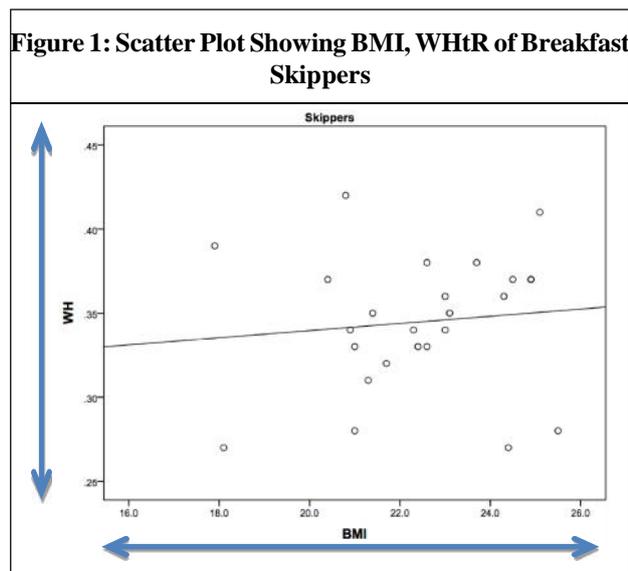
Table 5: Interpretation of BMI and WHtR of Breakfast Skippers and Non-Skippers

Parameter	Interpretation	Breakfast Skippers (n=25)	Breakfast Non-Skippers (n=25)	Chi-square	P-value
BMI (Kg/m ²)	Underweight ($<18.5 \text{ kg/m}^2$)	2 (8%)	1 (4%)	4.609	.100 ^{NS}
	Normal ($18.5 - 24.9 \text{ kg/m}^2$)	21 (84%)	16 (64%)		
	Overweight ($25-29.9 \text{ kg/m}^2$)	2 (8%)	8 (32%)		
WHtR	Extremely slim (<0.34)	12 (48%)	10 (40%)	0.336	.845 ^{NS}
	Healthy slim ($0.35-0.41$)	1 (4%)	1 (4%)		
	Healthy ($0.42-0.48$)	12 (48%)	14 (56%)		

Note: BMI- Body Mass Index (kg/m^2), WHtR – Waist to Height ratio, $p>0.05$ – Not Significant.

Chi-square test revealed no significant difference between WHtR and BMI of breakfast skippers and non-skippers.

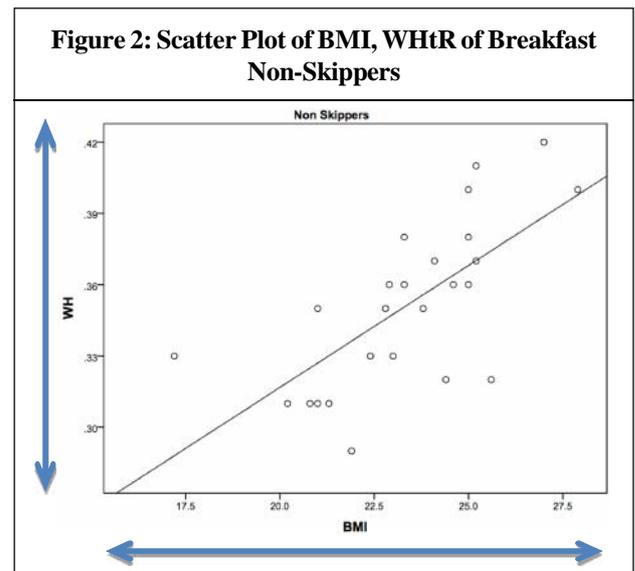
With BMI as the fit value and WHtR as the estimated value, the scatter plot of breakfast skippers is shown to have a very weak positive correlation with R-value 0.106 (Reference R value: up to 0.1). The P-value ($P>0.05$) is not significant in Figure 1.



With BMI as the fit value and WHtR as the estimated value, the scatter plot of breakfast non-skippers is shown to have a strong positive correlation with R-value 0.684 (Reference R value: 0.6-0.79). The P-value ($P<0.000$) is highly significant with 99.9% Confidence Interval index in Figure 2.

DISCUSSION

Breakfast is considered to be an essential prerequisite for



the potential to learn in children [24]. In the present study, anthropometric data, cognitive performance was found to be similar or equal between breakfast skippers and non-skippers. Results of a study conducted by Mahnaz et.al., published in European International Journal of Science and Technology (2014) indicated that only verbal classification has significant results and other sections did not show significant effect on cognitive performance [25]. A healthy weight according to WHtR was seen in breakfast non-skippers although BMI showed more number of non-skippers to be overweight. BMI does not take into account the body fat distribution. Hence, WHtR is a better indicator of healthy or unhealthy weight gain. Some studies have found that children who frequently skip breakfast have higher risk of being obese compared to those who regularly consumed breakfast [26-28].

LIMITATIONS

Small sample size, variables such as genetic and environmental variations were not measured, academic performance was not considered, 3-day breakfast recall of protein, fat, carbohydrate not calculated, life style questionnaire should have been used.

FINDINGS

Adolescents are aware of the importance of nutrition and balanced diet, but ignore their health. Peers and advertisements seem to influence the dietary choices.

CONCLUSION

Adolescents are future and backbone of any Nation. Therefore their health issues need special attention. It can be concluded from the present study that breakfast skipping does not hinder the cognitive abilities and nutritional status of adolescent girls.

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REFERENCES

1. Matthys C, De Henauw S, Bellemans M, De Maeyer M and De Backer G (2007), "Breakfast Habits Affect Overall Nutrient Profiles in Adolescents", *Public Health Nutrition*, Vol. 4, No. 10, pp. 413-421.
2. Linen L (2007), "Is Breakfast Consumption Related to Mental Distress and Academic Performance in Adolescents?", *Public Health Nutrition*, Vol. 10, pp. 422-428.
3. Nicklas T and Reger C (2000), "Breakfast Consumption with and Without Vitamin-Mineral Supplement Use Favorably Impacts Daily Nutrient Intake of Ninth-Grade Students", *Journal of Adolescent Health*, Vol. 27, pp. 314-321.
4. Hoyland A and Dye L (2009), "A Systemic Review of the Effect of Breakfast on Cognitive Performance of Children and Adolescents", *Nutrition Research Reviews*, Vol. 22, pp. 220-243.
5. Rampersaud G C (2009), "Benefits of Breakfast for Children and Adolescents: Update and Recommendations for Practitioners", *American Journal of Lifestyle Medicine*, Vol. 3, pp. 86-103.
6. Vaisman N, Voet H and Vakil E (1996), "The Effects of Breakfast Timing on Cognitive Function of Elementary School Students", *Arch.Pediatric Adolescent Med.*, Vol. 150, pp. 1089-1092.
7. Werner D (1987), "Disabled Village Children: A Guide for Community Health Workers, Rehabilitation Workers, and Families", *Palo Alto*, Hesperian Foundation, California, USA.
8. Bellisle F (2004), "Effects of Diet on Behavior and Cognition in Children", *British Journal of Nutrition*, Suppl. No. 2, pp. 227-232.
9. Mathews R (1996), "Importance of Breakfast to Cognitive Statement on the Link Between Nutrition and Cognitive Development in Children", Tufts University, School of Nutrition, Unpublished, Medford, MA.
10. Diana Benitez (2005), "The Importance of Breakfast in Children and Adolescents", Unpublished M S Dissertation Submitted to Family and Consumer Sciences, available from: URL <http://www.csun.edu/amarenco/Fcs%20380/diana%20benitez.pdf>
11. Gholamreza Veghari and Azad Reza Mansourian (2012), "Breakfast Consumption Amongst School Children in Northern Iran", *J Nepal Paediatr. Soc.*, Vol. 32, No. 3, pp. 193-199, available from: URL <http://www.nepjol.info/index.php/JNPS/article/view/6095>
12. Balvin Frantzen L, Trevino R P, Echon R M, Garica-Dominic O and Dimarco N (2013), "Association Between Frequency of Ready-to-Eat Cereal Consumption,

- Nutrient Intakes, and Body Mass Index in Fourth-Sixth-Grade Low-Income Minority Children”, *J. Acad. Nutr. Diet.*, Vol. 113, pp. 511-519.
13. Gibson S (2003), {Micronutrient Intakes, Micronutrient Status, and Lipid Profiles Among Young People Consuming Different Amounts of Breakfast Cereals: Further Analysis of Data from the National Diet and Nutrition Survey of Young People Aged 4 to 18 Years”, *Public Health Nutr.*, Vol. 6, pp. 815-820, 10.1079/PHN2003493 [PUBMED].
 14. Deshmukh-Taskar PP, Nicklas T A, O’Neil CE, Keast D R, Radcliffe J D and Cho S (2010), “The Relationship of Breakfast Skipping and Type of Breakfast Consumption with Nutrient Intake and Weight Status in Children and Adolescents: The National Health and Nutrition Examination Survey 1999-2006”, *J. AM. Diet. Assoc.*, Vol. 110, pp. 869-878, 10.1016/j.jada.2010.03.023.
 15. Hoyland A, Dye L and Lawton C L (2009), “A Systematic Review of the Effect of Breakfast on the Cognitive Performance of Children and Adolescents”, *Nutr. Res. Rev.*, Vol. 22, pp. 220-243.
 16. Szajewska H and Ruszczynski M (2010), “Systematic Review Demonstrating the Breakfast Consumption Influences Body Weight Outcomes in Children and Adolescents in Europe”, *Crit. Rev. Food Sci. Nutr.*, Vol. 50, pp. 113-119.
 17. US Department of Health and Human Services (2010), *Healthy People, 2nd Edition, With Understanding and Improving Health and Objectives for Improving Health*, Vol. 2, US Government Printing Office, November 2000, Washington DC.
 18. Nicklas T A (2003), “Calcium Intake Trends and Health Consequences from Childhood Through Adulthood”, *J Am Coll Nutr.*, Vol. 22, pp. 340-356.
 19. Miller G, Forgac T and McBean I (1998), “Breakfast Benefits Children in the US and Abroad”, *J Am Coll Nutr.*, Vol. 17, pp. 4-6.
 20. Healthy Kids-Child Health (2004), “Centres for Disease Control and Prevention”, available at: <http://www.cdc.gov/od/oc/childhealth/>, Accessed August 10.
 21. Briggs M, Safaii S and Beall D (2003), “Position of the American Dietetic Association, Society for Nutrition Education, and American School Food Service Association- Nutrition Services: An Essential Component of Comprehensive School Health Programs”, *J Am Diet Assoc.*, Vol. 103, pp. 505-514.
 22. Gan W Y, Mohd N M, Zalilah M S and Hazizi A S (2011), “Differences in Eating Behaviors, Dietary Intake and Body Weight Status Between Male and Female Malaysian University Students”, *Mal J Nutr.*, Vol. 17, No. 2, pp. 213-228.
 23. Taras H (2005), “Nutrition and Student Performance”, *Journal of School Health*, Vol. 6, No. 75, pp. 199-213.
 24. Dye L and Iuch A (2000), “Macronutrients and Mental Performance”, *Nutrition*, Vol. 10, No. 16, pp. 1021-1034.
 25. Mahnaz Nasir Khan, Memoona Khalid, Nasreen Kausar and Samia Khalid (2014), “Effect of Breakfast Skipping on Cognitive Performance of Girls of Age 14-16 Years”, *European International Journal of Science and Technology*, Vol. 3, No. 7, pp. 135-140.
 26. Harding S, Teyhan A, Maynard M J and Crikshank J K (2008), “Ethnic Differences in Overweight and Obesity in Early Adolescence in the MRC DASH Study: The Role of Adolescent and Parenteral Lifestyle”, *Int J Epidemiol.*, Vol. 37, pp. 162-172.
 27. Tin S P, Ho S Y, Mak K H, Wan K L and Lam T H (2011), “Breakfast Skipping and Change in Bidy Mass Index in Young Children”, *Int J Obesity*, Vol. 35, pp. 899-906.
 28. Dubois L, Girard M, Potvin Kent M, Farmer A and Tatone-Tokuda F (2009), “Breakfast Skipping is Associated with Differences in Meal Patterns, Macronutrient Intakes and Overweight Among Pre-School Children”, *Public Health Nutr*, Vol. 12, pp. 19-28.

