

ORIGINAL ARTICLE

The impact of regular breakfast intake on cognitive performance and emotional status of adolescent undergraduate medical students

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ABSTRACT

Background: Breakfast consumption, being the first meal of the day can be useful for better health outcomes and educational performance. Enhancement of academic capabilities of students is an essential factor that has a significant effect on their future life.

Aim: A cross-sectional survey was designed to find out the effects of regular or irregular breakfast eating habits on cognitive performance and emotional status of adolescent Saudi Arabian medical students.

Methods: In this cross-sectional study, ninety female medical students of Princess Nourah bint Abdulrahman Women University, Riyadh were recruited with an average age of 18-19 years. The students were divided into two groups A and B. Group A included 60 students who took breakfast on the day of study; whereas group B comprised of 30 students who did not take breakfast on study day. Students were tested using Test Performance Assessment Quiz to test their cognitive ability. A proforma based on positive or negative emotions of student was filled by each student. The response rate of students was 98%.

Results: The mean BMI of group A was lower as compared to group B, but was statistically insignificant. Academic performance and positive emotions of students taking breakfast were significantly higher ($P < 0.001$) compared to students skipping breakfast. Moreover, negative emotions in subjects taking breakfast were significantly less ($P < 0.001$) than student taking breakfast infrequently or skipping it.

Conclusion: The academic performance as well as subjective wellbeing of adolescents may be enhanced and improved by early recognition and correction of their meal habits. There is a need to encourage adolescents to take breakfast on regular basis during the period of rapid development of brain and body to avoid health issues in future.

Key Words: *Breakfast, adolescent, academic performance, cognition*

Introduction: Breakfast is considered to be the most significant meal of the day, as it gives nourishment and energy especially in young age. It may be related with a number of advantages like good performance in class, decent behaviour and positive attitude (Liu, Hwang & Dickerman 2013). Consumption of quality breakfast is also associated with constructive outcomes, the healthy status of body weight and lifestyle-related factors. Moreover it also affects the learning ability of adolescents regarding performance in their academics, and cognitive activities (Adolphus, Lawton, & Dye, 2013).

Childhood and young age is a critical time in which best nutritional support and healthy lifestyle patterns are needed. The habit of taking breakfast in routine may have longterm beneficial effects on health as well as mood and

emotions (Huang, Wahlqvist, Lee, & Chiang, 2018). Irregular consumption of breakfast is related with misbehaviours, like poor attitude with teachers and colleagues and bad habits like smoking. An inverse relationship was observed between frequency of taking breakfast and mental health condition by a study. It was found that students taking breakfast infrequently are depressed and may be slow in mental activities compared to students taking regular breakfast (Cartwright, Wardle & Steggle 2003).

Adolescence is associated with increased level of hormones, rapid body growth and psychological changes (Christie & Journal 2005). Studies have demonstrated that consumption of breakfast is related to better brain function and cognitive presentation (Pivik, Tennal & Chapman 2012, Hoyland & Dye 2009). Additionally, it was reported that breakfast may be associated with school or college activities like regular attendance, respectable behaviour in class, attainment of more success and affection with institute (Grantham-McGregor, 2005).

Researchers demonstrated that breakfast intake affects particular components of cognitive function, like the level of memory and attention in class room (Nabb, 2006). It is reported that quality of breakfast may be related to volumes of white and grey matter of brain as well as with intelligence quotient (IQ) (Taki et al., 2010). Breakfast also helps to maintain the level of blood glucose which may affect efficient cognitive processing pertaining to neuro-hormonal perturbations (Widenhorn-Müller, Hille & Klenk 2008).

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In view of important associations between breakfast intake and academic performance, a cross-sectional survey was designed to find out the significance of regular or irregular breakfast eating habit and cognition performance in adolescent Saudi Arabian medical students.

Research question: Are there any effects of regular or irregular breakfast eating habits on cognitive performance and emotional status of adolescent medical students?

Aim: To find out the effects of regular or irregular breakfast eating habits on cognitive performance and emotional status of adolescent Saudi Arabian medical students.

Methods: This cross-sectional study was conducted on 90 female medical students of Princess Nourah bint Abdul Rahman Women University, Riyadh. The students were divided into two groups A and B. Group A included 60 students who took breakfast on the day of study and group B included 30 students who did not take breakfast on study day. Students were tested using Test Performance Assessment Quiz to test their level of cognition. A proforma based on positive or negative emotions of student was filled by each student. Informed consent of students was taken. The response rate of students was 98%.

The study was approved by Institutional Review Board and Ethical Committee.

Measures: The height, weight and hip measurements of all students were measured and BMI was calculated.

Breakfast routines: Reports on student's breakfast consumption routine, time, quantity and regularity were assessed by using performa (Annexure 1)

Cognition: Test Performance Assessment Quiz to test the cognition level of student was based on ten questions related to their subject in a calm and quiet classroom during college timings (Annexure 2 and 3).

Statistical methods: Data was entered and analyzed by SPSS 20. Variables were expressed as mean, standard deviation (SD), and percentages. Correlation between variables was calculated using Spearman's Coefficient Correlation. $P < 0.05$ was taken as significant.

Results: Mean age of group A and group B was 18.9 and 18.8 year respectively. BMI of group A was lower as compared to group B but this shows no significant difference. The percentage of students taking breakfast sometimes was 22.2%, mostly 27.7% and always 15.5% while 1.11% never took breakfast in group A. The percentage of students never skipping breakfast was zero%, sometimes 13.3%, mostly 13.3% and always 6.6%. Overall 65.4% students took breakfast regularly while among group B, 33.2% did so. Academic performance of group A was significantly higher ($P < 0.001$) compared to academic performance of group B. Positive emotion of group A was

significantly more ($P < 0.001$) compared to group B; On the other hand, negative emotions in group A were significantly less ($P < 0.001$) than group B (Table & Figure).

Discussion: Our study reports that breakfast consumption is associated with increased intellectual ability, attention and academic presentation. Children and adolescents who take breakfast infrequently are undernourished. They exhibit

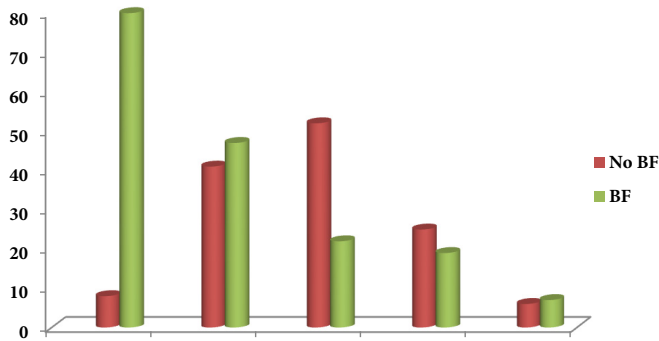
Table 1: Demographic characteristics of adolescents with habits of usage of breakfast

Variables	Consumption of breakfast study day (group A (n=60))	Noconsumption of breakfast study day (group B) (n=30)
Mean age (Year)	18.90±0.09	18.85±1.1
BMI (Kg/m ²)	18.84±1.86	22.11±2.7
Consumption of breakfast in routine (% age)	Never 1.11 Sometimes 22.2 Often 27.7 Almost always 15.5	Never 00 Sometimes 13.3 Often 13.3 Almost always 6.6
Academic performance (Score)	91.76±11.61	51.0±17.14**
Emotional status (+ve)	30.90±5.12	08.30±5.21**
Emotional status (-ve)	07.04±5.06	25.0±3.84**

decreased attendance, and less attention in the class, as well as they face more health related problems in comparison with children and adolescents who take breakfast frequently (Taha, 2017).

According to our study, the BMI of students taking breakfast regularly or frequently was less compared to students who usually skip breakfast. A number of studies have documented that skipping breakfast on a regular basis may be related to increased body mass index (BMI) (Song, Chun & Obayashi, 2005). It has been demonstrated that this is most probably due to muddled eating among adolescent girls associated with modern life style (Becker, 2004). Result of a study suggests that the association among skipping of breakfast, eating pathology, and increased BMI may be relatively complex. However, it may be possible that eating pathology mediates the link between skipping breakfast and obesity (Becker, 2004). We also observed in this study that most of the Saudi students used to take breakfast frequently. It has been reported that the habit

Figure 1: Comparison of negative emotional status in students who skip breakfast with the students who take breakfast frequently.



of eating breakfast either occasionally or infrequently was related with decreased functioning of brain and poor quality of life (Chen, Sekine, Hamanishi, Yamagami, & Kagamimori, 2005). An irregular meal pattern with skipping of breakfast is indirectly linked with serious health issues (Niemeier, 2006). During the period of adolescence, the developmental changes related with psychological, physical and social patterns are different from other phases of life (Onyiriuka, Umore, 2013). Healthy eating behaviour including regular breakfast in the period of adolescence is a basic requirement for psychosocial development, physical growth and cognitive activities, and it may also prevent diet-related diseases in later ages (French, Lin, Nutrition, & 2003).

Our data observed high scores on academic performance tests in students, who frequently consume breakfast as compared to students who take breakfast infrequently. Our study is in consensus with other studies which demonstrated a dose-response effect between the frequent use of breakfast and good academic performance among adolescents (Nutrition 2007). Better cognitive activities and intellectual performances also depend on good quality of diet, intake of vitamins and minerals, along with regular exercise (Adolphus et al., 2013). On the other hand children who take breakfast infrequently are usually less active and have a poor level of cardio-respiratory fitness (Hallström, Labayen and Ruiz, 2013). According to a study, one of the significance of breakfast is to restore the low level of blood glucose (the energy source of brain) after long period of over night fasting, in addition to its beneficial effect on cognitive activities and academic performance (Mahoney, Taylor & Kanarek, 2005).

There is a direct relationship between behaviour, cognitive activities and academic performance. An increase in mental concentration after taking breakfast, in comparison to non-consumption of breakfast, may be a mirror of increased attention during academic lessons. In the same way, changes in cognitive activity may also affect the academic performance in a cumulative style. The usefulness of taking breakfast on

cognitive performance is usually short term. With regular consumption of breakfast, these temporary changes in cognitive function during class lessons may consequently translate into enhancement of the ability to remember class lessons.

Our study observed that adolescents who take breakfast frequently have less negative emotions than those who take breakfast infrequently. A study demonstrated that skipping of breakfast and risk of depression are related with decreased calorie intake (Hall, Tejada-Tayabas, & Monárrez-Espino, 2017). Another study stated that there are two physiological changes observed in case of skipping breakfast. One is 50-400% increase level of brain-derived neurotrophic factor engaged with emotional and cognitive functions with fasting, which may lead to negative emotions especially depression (Plasticity, 2017). Another factor is rise in level of hormone Ghrelin, in fasting condition which is related with mood swings (Spencer & Xu, 2012). Studies based on taking breakfast and mental health reported an inverse relationship between the frequency of taking breakfast and status of mental health. It has been demonstrated that students taking infrequent breakfast have poor mental health and develop negative emotions including anxiety and psychosocial poor function.

Limitations of study: The scores of the students can be affected by student's own academic performance across the year, also in comparison with their scores in other subjects regardless of their taking breakfast on that day. Study did not take the information on the quantity and type of food taken in breakfast and did not include male students.

Conclusion: Our study confirmed positive association between frequency of breakfast intake, academic performance and emotional status of a group of Saudi Medical students. However, there is a need for increased awareness among students and parents regarding the effects of taking breakfast on academic performance and emotional status in both female and male adolescent

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