

Relationship Between Breakfast Intake with Mood and Short-Term Memory Among Medical Students of Pelita Harapan University : A Cross Sectional Study

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Abstract

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Introduction: Epidemiological studies stated people rarely eat breakfast even though breakfast have an important role in human physicality, mood and short-term memory. Mood is the tone of feelings a person feels, while short-term memory is part of the cognitive system used to store memories for a short time.

Aims: This research was conducted to determine the relationship between breakfast with mood and short-term memory among Medical Students of Pelita Harapan University.

Methods: This study used a cross-sectional study carried out on 133 students who were obtained based on the method of calculating, unpaired categorical comparative analytic samples. The sample population was taken by judgmental sampling on active students of the Faculty of Medicine, University of Pelita Harapan in 2020 according to the inclusion and exclusion criteria. Data were collected using a self-administered questionnaire, Positive and Negative Affect Schedule, Digit Span Test Forward Span. The statistical test used was Chi square and Fisher Exact, with data processing using Microsoft Excel 2019 and SPSS 24.0.

Result: There were 133 samples based on inclusion and exclusion criteria. The majority of sample was female (54.1%), batch 2018 (37.6%), 20 years old (36.8%), used to breakfast (62.4%), had a positive mood (96.2%), optimal short-term memory (64.7%). The result showed no significant between breakfast intake with mood (OR 2.585; 95%CI (0.417- 16.034); p=0.364) and significant relationship between breakfast intake with short term memory (OR 2.773; 95%CI (1.325-5.801); p=0.011).

Conclusions: There was no significant relationship between breakfast intake with mood, and a significant relationship between breakfast intake and mood was found. Further studies with larger samples are need to minimize biases in future studies.

Introduction

Breakfast is defined as the first meal of the day before 10:00 am and does not include drinking water.¹ Breakfast is also required at least 8 hours between the meal and the last meal that was consumed at night.² In fact, the awareness of eating breakfast is still minimally realized by some groups. A systematic review study by Monzani in the year of 2019, found that 30% of 286.804 respondents aged 2-18

years did not eat breakfast.³ This research is also supported by other studies made by Sutanto in 2015 in Jakarta found that almost 59% of 945 respondents aged 6-12 years did not eat breakfast as well.⁴ Breakfast must be recognized as a mandatory thing for all groups, because there are so many benefits that can be obtained from breakfast.^{3,5} Breakfast can reduce the risk of obesity, metabolic syndrome, improve function cognitive,

make a positive mood, improve the quality of life, and so on.^{3,5}

Mood is a feeling that someone feels during a certain period of time or on the other hand it can be defined as a tone of pleasant or unpleasant feelings that accompany a thought and lasted for a long time.⁶ Short term memory is a cognitive system that is used to store various sensory events, movements, cognitive information such as numbers, words, names, or other things in a short period of time.⁷ There are so many factors that can cause changes in mood and short-term memory, such as: sleep patterns, physical activity, lifestyle, food, stress, and so on.⁸

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In the central nervous system, there are several pathways that regulate mood. The regulation is formed by several hypotheses, including: monoamine, neurotrophic, and neuroendocrine pathways.¹² Monoamine pathways says that serotonin, norepinephrine and dopamine present in the cortex and limbic system plays a role in maintaining mood.¹² Neurotrophic pathways says that Brain Derived Neurotrophic Factor plays a role in nerve growth.¹² Disturbance or mutation in BDNF interfere mood, intellectual, attention function, and many more.¹² Neuroendocrine pathways says that high level of cortisol and dysregulation of thyroid function also interfere daily mood.^{12,13} Other studies prove that breakfast plays an important role in the regulation of neurotransmitters and neuromodulators in the nervous system.¹⁴ When blood sugar decreases, there is an expenditure of cortisol hormone which can induce the release of inflammatory cytokines that inhibits the function of neurotransmitters in humans so that it can decrease the level of serotonin hormone which trigger depression.¹⁵ On the other hand, breakfast can inhibit the excretion of

cortisol, therefore serotonin levels can increase and are closely related to a better mood.¹⁵ In conclusion, breakfast plays an important role in maintaining a positive mood.^{14,15}

Our memory system is divided into three different parts: sensory memory, short-term memory, and long-term memory.¹⁶ These three systems are mutually sustainable. According to Atkinson and Shrifin, sensory memory received stimuli from the external environment through sight, hearing, smell, touch, and taste.¹⁶ Human have the capacity to forget all the memory given by the sensory stimulus but human also have the capacity to store the memory given by the sensory stimulus as a short-term memory.¹⁶ Once in the short-term memory, the information can be forwarded to be stored in the long-term memory capacity or it can be replaced with a new information.¹⁶ The learning and memory functions in humans are arranged in a complex system in the human brain. Hippocampus and amygdala play an important role in maintaining human memory, on other hand amygdala maintain human emotional as well.¹⁷ Memory functions not only depends by an intact amygdala or hippocampus but it also depends on the lines connecting the hippocampus with the surrounding area as well as the amygdala with the surrounding area plays an important role.¹⁷ Lesion or diseases of the brain that involve these structures and circuits may cause memory disruption.¹⁷ Breakfast increases the level of sugar in the blood which is used by the brain neurotransmitter to produce a good neuronal activity that leads to a positive effect of short-term memory.¹⁷ On the other hand, gastrointestinal hormones that are present, triggered by an increase blood glucose level may lead an

improvement of the short-term memory function.¹⁸

Objectives

The present study aimed to know the overview of breakfast intake, mood, and short-term memory among Medical Students of Pelita Harapan University and also to determine the correlation of breakfast intake with mood and short-term memory among Medical Students of Pelita Harapan University.

Methods

Participants

The research sample was obtained from all Faculty Medicine, University of Pelita Harapan active students aged 17-22 years old, both men and women who meet the inclusion criteria. The total of 133 from 221 respondents were collected from December 2020 to February 2021. 88 respondents were excluded because they didn't meet the inclusion criteria.

Study Design

A cross-sectional study was conducted in Faculty Medicine, University of Pelita Harapan from December 2020 to February 2021. A judgmental sampling was used to collect 133 respondents based on method of calculating unpaired categorical comparative analytic samples. This research was approved by the ethic department in Faculty of Medicine, University of Pelita Harapan

Research Instrument

Data were taken using several questionnaires. Socio-demographic data such as name, gender, batch, age, breakfast habits, sleeping pattern, fasting, smoking, drug consumed, previous

diagnosed of mood, memory, and thyroid dysfunction were collected using self-administered questionnaire. Stress was collected using Perceived Stress Scale Questionnaire and physical activity was collected using International Physical Activity Questionnaire Short Form. On the other hand, Mood was collected using Positive and Negative Affect (PANAS) questionnaire and was categorized into positive affect and negative affect based on scoring system. Short-term memory was collected verbally using Digit Span Test Forward Span. Respondent will repeat length of number starting from 2 – 9 digits. If respondent can repeat numbers without making any mistake, then the numbers of digits will be added, but if respondent fails to repeat one long sequence, then respondents are given another opportunity to repeat one long sequence with different figures but same length. The test will be terminated if respondent fails to repeat 2 length sequences consecutively. Respondent who can repeat ≥ 6 numbers are said to be optimal, on the other hand respondent who can't repeat 6 numbers are said to be not optimal. Respondent whom age under 17 or above 22, sleeping pattern less than 7 hours a day, fasting, consuming drug such as antidepressants, anticonvulsants, anti-obesity, hormonal contraception, and other prohibited drugs, actively smoking, history of thyroid, mood, and memory dysfunction, history of moderate to severe stress in one week, and inadequate physical activity should be excluded from the study.

Statistical Analysis

Data analysis were performed using Microsoft Excel 2019 and Statistic Package for the Social Sciences 24th version. Fisher exact test was conducted

to assess the relationship between breakfast intake with mood among Medical Students of Pelita Harapan University and Chi Square test was conducted to assess the relationship between breakfast intake with short-term among Medical Students of Pelita Harapan University. The test is said to be significant when the p value is below 0.05.

Results

Table 1. Respondent Characteristic (N=133)

Respondent Characteristic	Number of Participants	Percentage
Gender		
Male	61	45.9%
Female	72	54.1%
Batch		
2018	50	37.6%
2019	42	31.6%
2020	41	30.8%
Age		
17	3	2.3%
18	34	25.6%
19	41	30.8%
20	49	36.8%
21	4	3.0%
22	2	1.5%
Breakfast Habits		
Used to ($\geq 3x/week$)	83	62.4%
Not Used to ($< 3x/week$)	50	37.6%
Mood		
Positive	128	96.2%
Negative	5	3.8%
Short-term Memory		
Optimal	86	64.7%
Non-Optimal	47	35.3%

Respondent Characteristic

Research and data collection was carried out in December 2020 - February 2021. The total sample that has been obtained is 133 respondents who have met the inclusion criteria. Respondent characteristics can be seen in table 1. Of the 133 respondents whose data had been processed, characteristics data was found as follows: majority respondents are female (54.1%), batch 2018 (37.6%), 20 years old (36.8%), used to breakfast

(62.4%), had a positive mood (96.2%), optimal short-term memory (64.7%).

Statistical Test Results

Relationship between breakfast intake with mood among Medical Students of Pelita Harapan University

Table 2 shows the Fisher exact test analysis regarding the relationship between breakfast with mood among Medical Students of Pelita Harapan university. Fisher Exact test was used because the results did not meet the Chi Square criteria which there was a column with an expected value of less than 5.

Table 2. Fisher Exact Analysis Relationship between Breakfast and Mood (N=133)

Breakfast Habits	Mood		P-value	Odds Ratio (OR)	CI (95%)
	Positive n (%)	Negative n (%)			
Used to	81 (97.6%)	2 (2.4%)	0.364	2.585	0.417-16.034
Not Used to	47 (94.0%)	3 (6.0%)			

Table 3. Chi Square Analysis Relationship between Breakfast and Short-term Memory (N=133)

Breakfast Habits	Short-term Memory		P-value	Odds Ratio (OR)	CI (95%)
	Optimal n (%)	Non-Optimal n (%)			
Used to	61 (73.5%)	22 (26.5%)	0.011	2.773	1.325-5.801
Not Used to	25 (50%)	25 (50%)			

From the results of data analysis using Fisher Exact test, the P-value was 0.364. The P-value is above 0.05, means there is no significant relationship between breakfast intake with mood among Medical Students of Pelita Harapan University.

Relationship between breakfast intake with short-term memory among Medical Students of Pelita Harapan University

Table 3 shows the Chi Square analysis regarding the relationship between breakfast and short-term memory among Medical Students of Pelita Harapan University.

From the results of data analysis using Chi Square test, the P-value is 0.011. P-value is below 0.05, there is a significant relationship between breakfast and short-term memory among Medical Students of Pelita Harapan University. Data analysis showed an odds ratio of 2.773, which means that people who are not used to eat breakfast have a 2.773 times risk of having non-optimal short-term memory.

Discussion

In this study, there was no significant relationship between breakfast and mood, shown from the p value of 0.364 ($p > 0.05$). This research in line with the cross-sectional study conducted by Daung, et al. on 2014 in Malaysia involving 127 respondents where the results of the study found that breakfast was not significantly associated with mood.^[19] These insignificant results can happen because study implemented by Daung, et al. carried out on work days as well as not seeing the work stress load that each employee has, where the moderate or heavy stress can interfere overall mood.^[19] Similar cross-sectional studies implemented by Alrayes, et al. in 2018 involving 170 respondents also found that there was no significant relationship between breakfast and mood.^[20] Alrayes stated that study was conducted at schools that have International Quality Certification and Certificate of Excellence in Educational Performance in Saudi Arabia for 5 consecutive years.^[20] On the other hand, study did not look at the stress history of each respondent. So that Alrayes said it can be the main factor of these

insignificant results.^[20] The same thing happened in this current study. This study was majority carried out on end of semester holidays and student days off, on the other hand this study also pay attention to respondent stress levels using Perceived Stress Scale Questionnaire so that there were very few respondents that have a negative mood and it may be the main cause of this insignificant results.

Results of this study are not in line with the cross-sectional studies carried out by Ren et al. in China in 2020, found that people who are not used to have breakfast tend to be at risk for negative mood.^[21] Therefore, there is a relationship between breakfast and mood.^[21] Similar study conducted by Zhu, et al. in 2015 in China also found a relationship between breakfast and mood.^[22] The differences in the results of this study can occur due to differences in the number of respondents. Research conducted by Ren, et al. followed by 1,060 respondents, research conducted by Zhu, et al. followed by 10,174 respondents, while in this current study followed by 133 respondents. On the other hand, differences of mood assessment questionnaires also gave different results.

Results of this study found a significant relationship between breakfast with short-term memory shown from the p value of 0.011 ($p < 0,05$). This study is in line with the cross-sectional study carried out by Awaliyah in 2019 which involved 74 respondents, found that breakfast plays an important role in short-term memory.^[23] On the other hand, this study is also supported by a cross-sectional study implemented by Bakhtiyari, et al. in 2020 which was attended by 60 respondents also stated that breakfast plays an important role in short-term memory.^[24] These same results can occur due to the same method that was used to take each sample. Breakfast habits pattern was seen for the past week also short-term memory sampling used a recall test. This

significant result shows that breakfast plays an important role in gastrointestinal hormones, neurotransmitter, and good neuronal activity that keep an optimal short-term memory.

Conclusion

In conclusion, majority of respondents used to have breakfast, have a positive mood and an optimal short-term memory. On the other hand, there is no significant relationship between breakfast and mood among Medical Students of Pelita Harapan University and there is a significant relationship between breakfast and short-term memory among Medical Students of Pelita Harapan University.

Limitation

Study of relationship between breakfast and mood implemented by using self-report questionnaire, where the method has a high risk of bias. Among other things, respondents over-reported or under-reported. The use of English based questionnaire is expected to represent mood of respondent in better way, but it creates confusion for some respondent. On the other hand, study of relationship between breakfast and short-term memory implemented by using video call method due to the COVID-19 pandemic and it depends on each internet network. This caused some respondents to ask repetition of digit span test due to unstable internet connection. Also in this study, there were some difficulties to find respondents due to the COVID-19 pandemic.

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