

From plate to achievement: A structural model of how eating patterns influence learning motivation through the mediation of psychological well-being

Piring ke prestasi: Model struktural bagaimana pola makan berdampak pada motivasi belajar melalui mediasi kesejahteraan psikologis

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ABSTRACT

Eating habits plays an important role not only in physical health but also in psychological well-being, which in turn can influence students' learning motivation. However, studies that examine the relationship among these three variables simultaneously are still limited. This study aims to analyze the relationship between diet, psychological well-being, and learning motivation, as well as to test the mediating role of psychological well-being. The research used a quantitative approach with a survey design. The respondents were 227 students of SMAN 13 in Samarinda, selected using purposive sampling. The instruments included a diet questionnaire, the Indonesian adolescent psychological well-being scale, and the Academic Motivation Scale (AMS). Data analysis was carried out using Structural Equation Modeling Partial Least Squares (SEM-PLS) and mediation testing through bootstrapping with the PROCESS Hayes model. The results show that diet does not have a direct effect on learning motivation ($p = 0.58$), but it has a significant effect on psychological well-being ($p < 0.001$). Psychological well-being has a significant effect on learning motivation ($p < 0.001$) and fully mediates the relationship between diet and learning motivation (indirect effect = 0,0945; CI [0.025–0.0976]). These findings indicate that a healthy diet contributes to learning motivation through the improvement of psychological well-being. In conclusion, psychological well-being is a key factor that bridges the relationship between diet and learning motivation. This study recommends integrating healthy diet programs with psychological well-being enhancement strategies in schools to support students' academic achievement.

ABSTRACT

Pola makan memiliki peran penting tidak hanya bagi kesehatan fisik, tetapi juga bagi kesejahteraan psikologis yang pada gilirannya dapat memengaruhi motivasi belajar siswa. Namun, penelitian yang mengkaji keterkaitan ketiga variabel tersebut secara simultan masih terbatas. Penelitian ini bertujuan menganalisis hubungan antara pola makan, kesejahteraan psikologis, dan motivasi belajar, serta menguji peran kesejahteraan psikologis sebagai mediator. Metode penelitian menggunakan pendekatan kuantitatif dengan desain survei. Responden penelitian berjumlah 227 siswa SMAN 13 di Kota Samarinda yang dipilih dengan teknik purposive sampling. Instrumen penelitian meliputi kuesioner pola makan, alat ukur kesejahteraan psikologis remaja Indonesia, dan Academic Motivation Scale (AMS). Analisis data dilakukan menggunakan Structural Equation Modeling-Partial Least Squares (SEM-PLS) serta uji mediasi bootstrapping dengan PROCESS Hayes. Hasil penelitian menunjukkan bahwa pola makan tidak berpengaruh langsung terhadap motivasi belajar ($p = 0,58$), tetapi berpengaruh signifikan terhadap kesejahteraan psikologis ($p < 0,001$). Kesejahteraan psikologis berpengaruh signifikan terhadap motivasi belajar ($p < 0,001$), serta memediasi secara penuh hubungan antara pola makan dan motivasi belajar (indirect effect = 0,0945; CI [0,025–0,0976]). Temuan ini menegaskan bahwa pola makan sehat berkontribusi terhadap motivasi belajar melalui peningkatan kesejahteraan psikologis. Kesimpulannya, kesejahteraan psikologis merupakan faktor kunci yang menjembatani hubungan antara pola makan dan motivasi belajar. Penelitian ini merekomendasikan pentingnya integrasi program pola makan sehat dengan strategi peningkatan kesejahteraan psikologis di lingkungan sekolah untuk mendukung prestasi akademik siswa.

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1. INTRODUCTION

Learning motivation is one of the psychological factors that most strongly determines students' academic success. However, national data shows that Indonesian students still have relatively low learning motivation. Results from the 2022 Programme for International Student Assessment (PISA) indicate a decline in Indonesia's literacy, mathematics, and science scores compared to 2018, and the scores remain below the OECD average (OECD, 2023). One indicator of low learning motivation can be seen in the high rate of student absenteeism, limited active participation in class, and weak initiative in independent learning (Ministry of Education, Culture, Research, and Technology, 2024). Psychologically, learning motivation can be defined as internal and external drives that move individuals to achieve learning goals, maintain persistence, and strive for certain levels of achievement (Schunk, Pintrich, and Meece, 2014).

Initial interviews with the Guidance and Counseling teacher, homeroom teachers, subject teachers, and several students at SMAN 13 Samarinda indicate that low learning motivation is a real and visible issue. One teacher stated, "Many students seem unenthusiastic about attending lessons, especially during the early hours. They often complain about feeling hungry or sleepy, and they struggle to focus during class discussions." When asked further, students admitted that they often skip breakfast because they are rushing to school or only buy light snacks on the way.

These interviews suggest that some students have low learning motivation, reflected in their lack of attention, low participation, and reluctance to complete academic tasks. The Guidance and Counseling teacher explained that many students show signs of losing interest in learning, such as frequently delaying assignments, showing little enthusiasm during class activities, and giving up easily when faced with challenges.

The homeroom teacher added that some students appear unfocused at the start of lessons, especially during the first few periods. A subject teacher shared, "When morning lessons begin, many students complain about being hungry, sleepy, and unable to concentrate. After further inquiry, they admitted they had not eaten breakfast or only consumed light snacks before leaving for school." Several interviewed students also mentioned that they often feel weak and unmotivated because they do not have time to eat in the morning.

One student even said, "If I haven't eaten, I don't feel like thinking, and the lessons feel extremely difficult." These findings show that low learning motivation does not stem solely from psychological factors, but is also linked to physiological issues such as irregular eating patterns and low nutritional intake. This condition then affects students' emotions and mental readiness to learn.

Low learning motivation impacts not only academic achievement but also students' psychological and social development. A UNESCO study (2023) found that students with low motivation are 2.5 times more likely to experience school disengagement and a decline in academic performance. In the long term, low motivation can contribute to higher dropout rates and inadequate readiness to compete in the job market (World Bank, 2023).

If this issue is not addressed promptly, it may lead to a decline in the quality of Indonesia's human resources, which serve as the foundation of national development. For this reason, understanding the factors that influence learning motivation has become an urgent need in both educational settings and adolescent health contexts.

Students' learning motivation is influenced by a range of internal and external factors. Internal factors include physical condition, health, emotions, and psychological well-being, while external factors involve family support, the school environment, and teachers' parenting styles (Santrock, 2020). Research by Utami and Wibowo (2022) shows that students with good physical health tend to have higher learning motivation compared to those with poor nutritional status. Psychological well-being, which includes life satisfaction, optimism, and positive emotional regulation, has also been shown to strengthen students' intrinsic motivation (Grahani, 2021; Rifdah et al., 2024). Environmental factors such as the availability of a healthy breakfast, social support, and an enjoyable learning atmosphere further enhance learning motivation (Ismiati et al., 2024).

In this context, eating patterns were selected as the independent variable because they play an important role in supporting cognitive functions and emotions related to learning activities (Adolphus, Lawton, and Dye, 2013). Balanced nutrition intake can improve concentration, memory, and positive mood. Meanwhile, psychological well-being is positioned as the mediating variable because it serves as the bridge between eating patterns and learning motivation. Based on the Self-Determination Theory (Deci and Ryan, 2000), psychological well-being is built through the fulfillment of basic psychological needs such as autonomy, competence, and relatedness. When these needs are met, individuals tend to develop strong intrinsic motivation. Conversely, poor eating patterns can reduce energy and emotional stability, which in turn lowers psychological well-being and learning motivation.

Several studies support the connection between these three variables. Ramadhan (2012) found that students with healthy eating patterns showed higher levels of concentration and enthusiasm for learning. González Olivares et al. (2020) demonstrated that psychological well-being plays a significant role in enhancing academic motivation through positive emotions and a sense of competence. Research by Setiadi et al. (2024) and Rifdah et al. (2024) also confirms that psychological well-being is positively associated with students' happiness and learning enthusiasm.

However, most of these studies examined only direct relationships between two variables, for example, between eating patterns and academic achievement, or between psychological well-being and learning motivation, without involving a comprehensive mediation model. Psychological well-being may function as a bridge in the relationship between eating patterns and learning motivation. Healthy eating habits can support cognitive abilities. This physiological condition then improves psychological well-being, which ultimately strengthens mental readiness for learning and increases motivation.

Despite this, previous research has mostly explored the direct link between eating patterns and learning motivation, without examining the mediating role of psychological well-

being that underlies this relationship. Understanding how psychological processes mediate the effects of eating patterns on learning motivation is crucial for designing interventions and developing more effective, targeted policies.

According to literature review, there is a research gap in understanding the psychological mechanisms that mediate the relationship between eating patterns and learning motivation. Most previous studies focused on the physical aspects of eating patterns or examined learning motivation without considering psychological well-being as an intervening variable. Therefore, this study offers novelty by testing a structural model of the relationship between eating patterns, psychological well-being, and learning motivation simultaneously using a mediation approach. This approach is expected to provide a deeper understanding of how physiological and psychological factors interact in shaping students' learning motivation.

Based on this explanation, the purpose of this study is to analyze the effect of eating patterns on learning motivation through the mediation of psychological well-being among secondary school students in Samarinda City. This study also aims to offer theoretical contributions to the development of an integrative model that links physical and psychological health in the educational context, as well as practical contributions for schools and policymakers in designing nutritional and psychological interventions to sustainably improve students' learning motivation.

2. METHODS

Research design

This study uses a quantitative approach with a survey method to examine the relationship between eating patterns, psychological well-being, and students' learning motivation. The research design is explanatory correlational, because it aims to explain the causal relationships among the studied variables and to test the mediating role of psychological well-being in the relationship between eating patterns and learning motivation. The choice of a quantitative approach is based on the study's objective to empirically test the structural model through inferential statistical analysis (Creswell and Creswell, 2018).

Participants

The participants in this study consisted of 222 students drawn from a total population of 887 students at SMA Negeri 13 Samarinda, selected using proportional stratified sampling. This technique was used to ensure that each group within the population (based on strata such as gender, study program, and grade level) was proportionally represented. According to Sugiyono (2022), proportional stratified sampling provides more accurate representation compared to simple random sampling because it accounts for the proportion of each subgroup in the population. The inclusion criteria for this study were active students who agreed to participate, were between 15 and 18 years old, and completed the questionnaire in full.

Instruments

This study uses three main instruments that have been adapted and modified for the context of high school students in Indonesia:

- (1) **The Eating Pattern Questionnaire** by Ramadhani (2017) has been adapted and modified to measure eating patterns. The questionnaire consists of 30 items with a Likert scale of always, often, sometimes, rarely, and never. The reliability of the eating pattern measurement tool is 0.704, with an example item: "At breakfast I eat carbohydrate-rich foods such as rice, bread, noodles, cassava, and potatoes."
- (2) **The Psychological Well-Being of Indonesian Adolescents** by Abidin (2022) has 38 items with response options of very-very inappropriate, very inappropriate, inappropriate, appropriate, very-very appropriate. The reliability of the psychological well-being measurement tool is 0.770, with an example item: "In the past month, I have generally felt happy."
- (3) **Academic Motivation using the Indonesian version of the Academic Motivation Scale (AMS)** by Natalya (2018) which has been adapted and modified to measure learning motivation. The questionnaire consisted of 15 items with response options: strongly disagree, disagree, somewhat disagree, somewhat agree, agree, and strongly agree. The reliability of the Academic Motivation Scale was 0.970, with an example item: "I enjoy every step of the process when learning new things."

Prior to use, all instruments underwent content validity testing by five educational psychology experts and pilot testing on 55 high school students to ensure item clarity and appropriateness.

Data analysis

Data analysis was conducted in stages, starting with statistical assumption tests (normality, linearity, and multicollinearity), followed by descriptive analysis to describe the profile of students' eating patterns, psychological well-being, and learning motivation. Next, mediation analysis was conducted using SPSS PROCESS Macro (Model 4) to test the direct and indirect relationships between variables. Testing the significance of the mediation effect was conducted using the bootstrapping method with 5,000 samples at a 95% confidence interval.

3. RESULTS

Respondent descriptions

The research respondents numbered 227 students of SMAN 13 Samarinda City with demographic descriptions as in table 1 below:

Table 1. Demographic Data

Characteristics	Categories	Frequencies	Percentages
Gender	Male	88	38.8%
	Female	139	61.2%
Father's Education	Elementary	26	11.5%
	Junior High School	18	7.9%
	Senior High School	123	54.2%
	Diploma III	15	6.6%
	Diploma IV/Bachelor	35	15.4%
	Master/Doctor	10	4.4%
Mother's Education	Elementary	119	8.4%
	Junior High School	23	10.1%
	Senior High School	117	51.5%
	Diploma III	21	9.3%
	Diploma IV/Bachelor	40	17.6%
	Master/Doctor	7	3.1%
Parent's Total income	<Rp. 3,700,000 (Minimum Wage)	97	42.7%
	Rp 3,700,000 - Rp 5,000,000	52	22.9%
	Rp 5,000,000- 10,000,000	36	15.9%
	>Rp 10,000,000	42	18.5%

Table 1 shows that the study involved 227 high school students in Samarinda, consisting of 88 male students (38.8 percent) and 139 female students (61.2 percent). The majority of respondents' fathers had completed senior high school (54.2 percent), followed by bachelor or diploma-four qualifications (15.4 percent) and elementary school (11.5 percent). Similarly, most respondents' mothers had completed senior high school (51.5 percent), followed by bachelor or diploma-four qualifications (17.6 percent) and junior high school (10.1 percent). In terms of parental income, most respondents were in the category of less than Rp3,700,000 (42.7 percent), followed by Rp3,700,000 to Rp5,000,000 (22.9 percent), and Rp5,000,000 to Rp10,000,000 (15.9 percent).

Descriptive analysis

The descriptive analysis indicates that the data meet the requirements for further statistical testing. The normality test shows a significance value of 0.200 (> 0.05), which means the data are normally distributed. The linearity test also shows a linear relationship between eating patterns and learning motivation, as well as between psychological well-being and learning motivation, indicated by significance values greater than 0.05. These results confirm that the assumptions of normality and linearity are fulfilled, allowing the use of appropriate parametric statistical analyses.

Hypothesis test results

The path analysis results show that the direct effect of eating patterns on learning motivation is not significant, with a coefficient of $\beta = 0.02$ and $p = 0.58$. The R^2 value of 0.017 indicates that eating patterns explain only 1.7% of the variance in learning motivation, which reflects a very small contribution. However, the analysis also shows that eating patterns have a significant effect on psychological well-being, with $\beta = 1.36$, $p < 0.001$, and $R^2 = 0.066$. This means that better eating patterns contribute positively to higher psychological well-being. In other words, the better an individual's eating habits, the higher their level of psychological well-being, making this variable an important factor in mental and emotional health.

Furthermore, psychological well-being is found to have a significant effect on learning motivation, with $\beta = 0.16$, $p < 0.001$, and $R^2 = 0.142$. These results indicate that psychological well-being plays a strong role in enhancing learning motivation. Individuals with good psychological well-being tend to be more focused, enthusiastic, and intrinsically driven to learn consistently.

Path analysis results

When eating patterns and psychological well-being are analyzed together as predictors of learning motivation, the results are significant with $R^2 = 0.143$. However, the significant contribution comes mainly from psychological well-being, while eating patterns do not show a meaningful direct effect. This indicates that the relationship between eating patterns and learning motivation is not direct, but operates through psychological factors as a mediator.

The mediation test using bootstrapping (Hayes, 2013) supports this conclusion. The indirect effect of eating patterns on learning motivation through psychological well-being is significant (Indirect Effect = 0.0945; CI [0.025; 0.0976]), while the total effect is not significant ($\beta = 0.08$; $p = 0.05$). Based on these findings, the results indicate full mediation, where eating patterns influence learning motivation only through psychological well-being. This shows that psychological well-being acts as the main psychological mechanism linking eating habits to an individual's motivation to learn.

Table 2. Summary of Analysis Results

Relationship between Variables	Coefficients (β)	p-value	R ²	Descriptions
Eating habits → Learning Motivation	0.02	0.58	0.017	Insignificant
Eating habits → Psychological Well-Being	1.36	< 0.001	0.066	Significant
Psychological Well-Being → Learning Motivation	0.16	< 0.001	0.142	Significant
Eating habits → Psychological Well-Being → Learning Motivation	0.0945	CI [0.025; 0.0976]	—	Full mediation

4. DISCUSSION

This study aimed to analyze the relationships between eating patterns, psychological well-being, and learning motivation among students, and to examine the mediating role of psychological well-being. The findings support three out of the four proposed hypotheses. The first hypothesis, which states that eating patterns have a positive effect on psychological well-being, is supported. The second hypothesis, which states that psychological well-being positively affects learning motivation, is also supported. However, the third hypothesis, which predicts a direct effect of eating patterns on learning motivation, must be rejected because the effect is not significant. Interestingly, the fourth hypothesis regarding the mediating role of psychological well-being is supported, showing a pattern of full mediation. This means that eating patterns influence learning motivation only through an increase in psychological well-being, not through a direct path.

These findings are consistent with an indirect-only mediation model and provide empirical evidence for the psychological mechanisms that link physiological factors such as nutrition to academic behavioral outcomes such as learning motivation. Conceptually and statistically, the results align with a full mediation pattern, where eating patterns affect learning motivation exclusively through psychological well-being. The non-significant direct effect of eating patterns on learning motivation should be interpreted carefully. The coefficient (β) approaches zero, and the R^2 value is very small (1.7%), indicating that variations in learning motivation are not strongly influenced by eating patterns directly within this sample.

There are several possible explanations. First, the effect of eating patterns may be indirect or mediated by psychological or biological processes, so it does not appear as a direct effect. Second, the size or measurement method of the eating-pattern and learning-motivation variables may reduce the sensitivity needed to detect a direct effect. Third, there may be other confounding or mediating variables that were not included in the model, which makes the direct effect appear weak. Therefore, it is important to emphasize that the absence of a direct effect does not mean that eating patterns are irrelevant. It shows that the influence works through mediator variables, which is supported by the mediation results.

The significant finding between eating patterns and psychological well-being ($\beta = 1.36$; $p < 0.001$) indicates a strong positive relationship. Individuals with better eating patterns tend to report higher psychological well-being. Theoretically, this can be explained through several biological and psychosocial mechanisms. Nutritional intake affects brain function, mood, energy levels, and stress regulation, which shape the perception of well-being. In addition, healthy eating habits are often linked to other lifestyle factors that support well-being, such as regular sleep, physical activity, and social stability.

The finding that psychological well-being has a significant effect on learning motivation ($\beta = 0.16$; $p < 0.001$; $R^2 = 0.142$) supports the idea that internal psychological conditions play an important role in sustaining academic motivation. Individuals who feel more psychologically well are more likely to have focused attention, cognitive energy, good emotion regulation,

and intrinsic motivation to pursue learning goals, all of which are relevant to academic performance. An R^2 of about 14 percent shows that psychological well-being explains a non-trivial portion of the variation in learning motivation, although much of the variance remains unexplained. This indicates the need to include additional predictors in the theoretical model.

The mediation result (Indirect Effect = 0.0945 with a confidence interval that does not cross zero) reinforces the conclusion that the effect of eating patterns on learning motivation occurs through increased psychological well-being. In practical terms, this means that interventions focused only on changing eating habits may not directly increase learning motivation unless they also improve participants' psychological well-being, for example by reducing anxiety or improving mood and sense of competence. In other words, health-promotion programs that integrate nutrition education with mental-health support or well-being enhancement strategies have the potential to be more effective in improving learning motivation than nutrition-only programs.

The findings show that eating patterns do not have a direct effect on learning motivation, but they do have a significant effect on psychological well-being. Psychological well-being is then proven to be an important factor that increases students' learning motivation. Therefore, psychological well-being functions as a full mediator between eating patterns and learning motivation.

These findings are in line with previous studies showing that healthy eating patterns are linked to better mental health, including positive emotions, psychological resilience, and feelings of happiness (Jacka et al., 2017). Good nutritional intake can improve brain function and emotional stability, which in turn strengthens psychological well-being. Furthermore, research by Deci and Ryan (2000) in Self-Determination Theory (SDT) also emphasizes that psychological well-being is an important foundation for the development of more intrinsic and sustainable learning motivation.

This study also supports the findings of Glabska et al. (2020), who reported that eating patterns are closely related to psychological well-being, and that psychological well-being has a positive effect on learning motivation. Their study shows that consuming a balanced nutritious diet is correlated with improved mood and mental health among adolescents, which then influences their readiness and enthusiasm for learning. Similarly, Stewart-Brown et al. (2019) state that psychological well-being is a significant predictor of intrinsic motivation and academic achievement.

These findings also align with the results of Ryan and Deci (2017), who explain that high psychological well-being reflects the fulfillment of basic psychological needs (autonomy, competence, and social relatedness), which form the foundation for intrinsic learning motivation. Thus, this study strengthens the empirical evidence that psychological well-being plays an important role in linking physiological factors (such as eating patterns) with learning behavior.

However, the results of this study differ from previous findings reported by Adolphus et al. (2019), who found that healthy eating patterns, particularly breakfast habits, have a direct and significant effect on learning motivation and academic performance without involving psychological variables as mediators. This discrepancy is likely due to differences in sample characteristics, measurement methods, and the cultural and social contexts of the respondents. In this study, the effect of eating patterns on learning motivation was not directly significant, but it became significant when mediated by psychological well-being. This shows that in the context of the respondents in this study, the influence of eating patterns on academic behavior operates more through improvements in psychological conditions rather than directly through physiological processes or cognitive energy. Therefore, the findings of this study offer a new perspective that the relationship between nutrition and learning motivation is not linear but depends on the psychological factors that bridge the two.

The fact that the influence of eating patterns on learning motivation only appears through the mediation of psychological well-being reinforces that adopting a healthy lifestyle does not automatically increase students' enthusiasm for learning. Instead, it must first be internalized through a positive psychological state. This means that students who follow a balanced and nutritious eating pattern tend to have a more stable mood, lower stress levels, and better mental energy, which in turn increases their motivation to learn.

The findings of this study provide theoretical implications for the development of research in health and educational psychology, particularly within the subfield of learning motivation in the framework of Self-Determination Theory by Deci and Ryan. This can be interpreted as evidence that Self-Determination Theory is not only relevant in the context of psychological needs for autonomy, competence, and relatedness, but can also be integrated with nutritional and health perspectives that consider physiological conditions as a foundation for psychological well-being. In addition, the study also shows that psychological well-being serves as a full mediator.

This enriches the literature on pathways within the dynamics of learning motivation. The practical implication of this study is the importance of school interventions and educational policies that do not only focus on providing healthy food but also integrate it with efforts to enhance students' psychological well-being. For example, providing a healthy school cafeteria should be accompanied by psychoeducational activities about the importance of eating patterns for mental health and learning motivation.

In addition, counseling support and self-development activities can strengthen the positive effect of eating patterns on students' learning motivation. In the field of public health services, interventions aimed at improving psychological well-being (such as light cognitive-behavioral interventions or emotional regulation skills training) can be complemented with healthy lifestyle guidelines, creating a synergy between psychological improvement and

healthy eating habits. For practitioners, evaluating changes in well-being as an intermediate outcome when designing nutrition programs can help measure their indirect impact on motivation and academic performance.

This study has several limitations that need to be considered. The cross-sectional design used only captures the relationships between variables at a single point in time, making it impossible to infer causality. The research model is also limited to three main variables: eating patterns, psychological well-being, and learning motivation, whereas other factors such as family support, parenting style, and academic pressure may also influence learning motivation. Additionally, the use of adapted and modified instruments may affect construct validity, even though their reliability is good. The study context, limited to a single school in Samarinda, also restricts the generalization of findings to other regions with different characteristics. External factors such as physical conditions and the environment during questionnaire administration were not fully controlled. Nevertheless, this study still provides an important contribution to understanding the role of psychological well-being as a mechanism that mediates the influence of eating patterns on students' learning motivation.

5. CONCLUSION

This study shows that eating patterns influence learning motivation indirectly through the full mediation of psychological well-being. In other words, healthy eating habits can enhance psychological well-being, which in turn strengthens students' motivation to learn. The implications of these findings highlight the importance of integrating balanced nutrition programs with efforts to improve psychological well-being in order to enhance students' learning quality. Therefore, schools, parents, and policymakers need to collaborate in creating an environment that supports healthy eating habits and adolescent mental health as part of a strategy to improve the quality of human resources.

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