Media Gizi Kesmas
p-ISSN 2301-7392, e-ISSN 2745-8598
10.20473/mgk.v14i1.2025.77-86

ORIGINAL ARTICLE Open Access

Analysis of the Relationship between Physical Activity, Sleep Quality, and Nutritional Status in Adolescents

Analisis Hubungan Aktivitas Fisik, Kualitas Tidur, dan Status Gizi pada Remaja

Asmulyati S. Saleh[1], Ahmad David Royyifi Arifin[2]*, Nuimkhayat[3]

[1]Department of Nutrition, Health Polytechnic of the Ministry of Health Kupang, Kupang, 85111, Indonesia
[2]Department of Agricultural Product Technology, Universitas Jember, Jember, 68121, Indonesia
[3]Health Office of Ende Regency, Ende, 86317, Indonesia

Article Info

***Correspondence:**
Ahmad David Royyifi Arifin
royyifi@unej.ac.id

Submitted: 21-04-2025
Accepted: 17-06-2025
Published: 30-06-2025

Citation:
Saleh, A. S., Arifin, A. D. R., & Nuimkhayat. (2025). Analysis of the Relationship between Physical Activity, Sleep Quality, and Nutritional Status in Adolescents. *Media Gizi Kesmas*, 14(1), 77-86. https://doi.org/10.20473/mgk.v14i1.2025.77-86

ABSTRACT

Background: The nutritional condition of adolescents is a crucial element of their general health and development, shaped by several factors, including physical activity and sleep quality. Nutritional challenges in East Nusa Tenggara (NTT) encompass both under-nutrition and over-nutrition among adolescents. According to Riskesdas data from 2018, the prevalence of malnutrition among adolescents in NTT was 25.7% for those aged 13-15 years and 26.9% for those aged 16-18 years, while the obesity rate was 16% for adolescents aged 13-15 years. This issue is further intensified by insufficient physical exercise and poor sleep. Despite the existence of several interventions targeting dietary behaviors, the correlation between these elements and nutritional health remains underexplored, particularly in NTT.
Objectives: This study aimed to examine the correlation between physical activity, sleep quality, and nutritional status in teenagers aged 15 to 18 years at SMK Negeri 3 Kupang, East Nusa Tenggara. This study sought to determine the primary determinants factors affecting the nutritional status of teenagers, particularly in regions experiencing intricate dietary challenges such as NTT.
Methods: This research used a cross-sectional study design, conducted in April 2024 at SMK Negeri 3 Kupang. A total of 221 students were selected using the probability sampling technique. Physical activity was categorized into mild, moderate, and vigorous activities, assessed by the Physical Activity Level (PAL) questionnaire. Sleep quality was assessed via the Pittsburgh Sleep Quality Index (PSQI), while nutritional status was determined by body mass index (BMI). The correlation test was carried out using Goodman and Kruskal gamma and strengthened by the Chi-square test to compare the distribution of nutritional status in various categories of physical activity and sleep quality.
Results: This study showed no significant correlation between physical activity, sleep quality, and nutritional status, with a p-value greater than 0.05. Despite variations in exercise levels and sleep quality among groups with differing nutritional statuses, the correlation between these characteristics and nutritional status was not statistically significant.
Conclusion: Physical activity and sleep quality alone are sufficient to determine adolescent nutritional health. A more holistic approach that incorporates additional aspects such as nutrition, socioeconomic status, and other characteristics, is required. Effective therapies should focus on enhancing dietary behaviors, augmenting physical activity, managing stress, and fostering improved sleep patterns to elevate adolescent nutritional status.

Keywords: Adolescents, Good health and well-being, Nutritional status, Physical activity, Sleep quality.

ABSTRAK

Latar Belakang: *Kondisi gizi remaja merupakan elemen penting dalam kesehatan dan perkembangan umum mereka, yang dipengaruhi oleh berbagai faktor, termasuk aktivitas fisik dan kualitas tidur. Tantangan gizi di Nusa Tenggara Timur (NTT) meliputi masalah kekurangan gizi dan kelebihan gizi pada remaja. Berdasarkan data Riskesdas 2018, prevalensi masalah gizi pada remaja di NTT adalah 25.7% untuk usia 13-15 tahun dan 26.9% untuk usia 16-18 tahun, sementara prevalensi obesitas mencapai 16% pada remaja usia 13-15 tahun. Masalah ini semakin diperburuk oleh kurangnya aktivitas fisik dan kualitas tidur yang buruk. Meskipun telah ada berbagai intervensi yang menargetkan perilaku makan, hubungan antara faktor-faktor ini dan kesehatan gizi masih kurang dieksplorasi, khususnya di NTT.*

Tujuan: *Penelitian ini bertujuan untuk mengetahui korelasi antara aktivitas fisik, kualitas tidur, dan status gizi pada remaja usia 15 hingga 18 tahun di SMK Negeri 3 Kupang, Nusa Tenggara Timur. Penelitian ini bertujuan untuk menentukan determinan utama yang memengaruhi kondisi gizi remaja, khususnya di wilayah yang mengalami tantangan gizi yang rumit seperti NTT.*

Metode: *Penelitian ini menggunakan desain penelitian cross-sectional, yang dilakukan pada bulan April 2024 di SMK Negeri 3 Kupang. Sebanyak 221 siswa dipilih melalui teknik pengambilan sampel probabilitas. Aktivitas fisik dikategorikan menjadi aktivitas ringan, sedang, dan berat, yang dinilai dengan kuesioner Tingkat Aktivitas Fisik (PAL). Kualitas tidur dinilai melalui Indeks Kualitas Tidur Pittsburgh (PSQI), sedangkan status gizi ditentukan oleh Indeks Massa Tubuh (IMT). Uji korelasi dilakukan menggunakan uji Gamma Goodman dam Kruskal, serta diperkuat dengan uji Chi-Square untuk membandingkan distribusi pada berbagai kategori aktivitas fisik dan kualitas tidur.*

Hasil: *Penelitian ini menunjukkan tidak terdapat korelasi signifikan antara aktivitas fisik, kualitas tidur, dan status gizi, dengan nilai p di atas 0.05. Meskipun terdapat variasi dalam tingkat latihan dan kualitas tidur di antara kelompok-kelompok dengan status gizi yang berbeda, korelasi antara karakteristik ini dan status gizi tidak signifikan secara statistik.*

Kesimpulan: *Aktivitas fisik dan kualitas tidur saja tidak cukup untuk menentukan status gizi remaja. Diperlukan pendekatan yang lebih holistik yang menggabungkan aspek-aspek tambahan seperti gizi, status sosial ekonomi, dan karakteristik lainnya. Terapi yang efektif harus difokuskan pada peningkatan perilaku diet, menambah aktivitas fisik, mengelola stres, dan membina pola tidur yang lebih baik untuk meningkatkan status gizi remaja.*

Kata kunci: *Aktivitas fisik, Kesehatan yang baik dan kesejahteraan, Kualitas tidur, Remaja, Status gizi*

INTRODUCTION

Nutritional status is a body condition that balances nutritional intake and body needs. Imbalanced intake can cause malnutrition, both undernutrition and overnutrition. The adolescent phase is one of the periods when a person experiences nutritional problems because their mental and physical growth experiences rapid changes. So that the fulfillment of good nutritional intake plays a very important role in supporting optimal growth and development (Noviyanti et al., 2023; Widiani et al., 2024).

Nutritional problems among adolescents are a serious concern every year, especially in East Nusa Tenggara (NTT). Riskesdas data in 2018 reported that the prevalence of malnutrition problems in adolescents showed a figure of 25.7% with an age range of 13-15 years and 26.9% in the age range of 16-18 years. Meanwhile, the prevalence of obesity in adolescents reached 16% among adolescents aged 13-15 years (Ratih, 2020). The high problem is based on unhealthy eating patterns, low consumption of vegetables and fruits, and the high trend of consuming fast food, which has a high calorie value (Irdiana and Nindya, 2017; Nuryani, 2019). This also has an impact on the decreased intake of micronutrients such as zinc, iron, vitamins and minerals so that there is a risk that adolescents tend to experience decreased immunity and mental development (Juniartha and Darmayanti, 2020).

In addition to the imbalance in nutritional intake in adolescents, other influential factors are physical activity patterns and sleep quality. Several

studies have shown that adolescents who are not physically active and experience poor sleep quality have a higher risk of experiencing nutritional problems such as obesity and metabolic disorders (Gifari et al., 2022; Zalda and Alamsyah, 2024). In NTT, the prevalence of nutritional problems among adolescents is quite concerning, where the NTT region is recorded as one of the regions with the highest prevalence of stunting in Indonesia (Herawahyuni et al., 2023). However, various training programs both in fulfilling local food and nutrition education continue to be carried out, but have not shown significant changes so that further evaluation is needed (Detha et al., 2022).

This study focuses on physical activity and sleep quality in adolescents because they tend to impact their health and mental health. This is a serious concern because it is based on several previous studies. Especially in NTT, there has been a significant decrease in physical activity and increase in sleep disorders, which have an impact on nutritional status in adolescents (Rahmawati et al., 2021; Kasmarini et al., 2023). In addition, poor sleep quality can disrupt hormonal balance, which is known to affect appetite and thus change adolescent eating patterns (Zalda and Alamsyah, 2024). Although many studies have examined all of the factors that influence adolescents' nutritional status, much research has not comprehensively explored the relationship between physical activity, sleep quality, and nutritional status particularly in East Nusa Tenggara (NTT). Nutritional problems exist in this region including over and under nutrition issues.

This study seeks to examine how physical activity, sleep quality, as well as nutritional status relate among adolescents aged 15–18 years in NTT. Also, the study seeks identification of key factors influencing nutritional status among adolescents in areas with nutritional issues. This research expects deeper perceptions into what causes poor nutritional outcomes among adolescents by understanding physical activity and sleep quality's roles.

For improving adolescent nutrition, effective health programs are expected to use findings of this study as a reference. These programs may include interventions for improved sleep quality, promotion of regular physical activity, also education on healthy eating habits. The study focuses upon how physical activity and sleep quality relate to the nutritional status of adolescents aged 15–18 years in East Nusa Tenggara (NTT). This method seeks a more holistic grasp of nutritional status. Ultimately, this research could powerfully ground future interventions. These interventions should seek to provide support for the physical health in addition to the overall well-being that adolescents need, especially in regions like NTT in which malnutrition is something that critically concerns.

METHODS

This study employed a cross-sectional design conducted at SMK Negeri 3 Kupang during April 2024. Researchers selected the research sample from class X through a probability sampling technique so it consisted of 221 students. This study was approved by the Health Polytechnic of the Ministry of Health Kupang's research ethics committee using ethics approval number LB.02.03/4/0057/2024

In this study, the inclusion criteria were as follows: participants must be students from Class X at SMK Negeri 3 Kupang, aged between 15 and 17 years, and must have provided informed consent for participation in the study, along with parental consent for minors. Only students who met these criteria were included in the study. The exclusion criteria involved students who were unable to participate in the study due to chronic illnesses or other health conditions that might have interfered with accurate measurements of height and weight. Additionally, students who were unavailable for data collection during the study period, or those who did not provide consent to participate, were excluded from the study.

In this study, nutritional status served as the dependent variable, which was assessed using body mass index (BMI) calculated from height, measured with a microtoise, and weight, measured with a digital scale. The measurements were processed using WHO Antro Software, which calculates the BMI based on WHO standards. Nutritional status was categorized using the BMI for age Z-score, with categories of underweight for Z-score<-2 SD, normal for -2 SD≤Z-score≤+1 SD, overweight for +1 SD<Z-score≤+2 SD, and obesity for Z-score>+2 SD. These categories follow the WHO guidelines for assessing the nutritional status of school-age children (Khan et al., 2022).

The first independent variable in this study was physical activity, which was measured using the Physical Activity Level (PAL) questionnaire. This questionnaire estimates Total Energy Expenditure (TEE) relative to Basal Metabolic Rate (BMR). Based on the PAL score, physical activity levels were classified as low (PAL<1.4), moderate (1.4≤PAL<1.7), and intense (PAL≥1.7), based on internationally accepted thresholds for physical activity classification (Matias et al., 2023; Zulaily et al., 2024). The PAL questionnaire is adopted from Pool (2022), which has been widely validated in previous studies.

The second independent variable was sleep quality, measured using the Pittsburgh Sleep Quality Index (PSQI). The PSQI consists of 19 items across seven domains, including latency, duration, efficiency, disturbances, and daytime dysfunction. The total PSQI score ranges from 0 to 21, with good sleep quality classified as PSQI≤5 and poor sleep

quality as PSQI>5. The PSQI, an established tool developed and has been validated for assessing sleep quality across various populations, following the criteria established by (Liu et al., 2021).

The measurements were conducted by the researcher, assisted by enumerators and health workers who were trained in standard measurement procedures. Data collection for physical activity and sleep quality was done through self-administered questionnaires. Data were coded and checked for consistency before analysis. SPSS version 25 was used for data analysis. Goodman and Kruskal's gamma correlation was used to assess associations between variables, and Chi-square tests were applied to compare nutritional status across different categories of physical activity and sleep quality. Statistical significance was set at p-value<0.05.

RESULTS AND DISCUSSION

The analysis of nutritional status considers respondent characteristics such as gender, age, physical activity, sleep quality, and nutritional status. Table 1 shows information about the distribution of respondent characteristics such as gender, age, physical activity, sleep quality, and nutritional status. The distribution contained these characteristics. In this study, 221 respondents participated with most respondents female (151 or 68.3%) as opposed to male (70 or 31.7%). Most respondents in regard to age were 15 years old (116 or 52.5%), the rest (105 or 47.5%) were 16 years old. These characteristics clearly compose the respondents within this study, which researchers will use to analyze how these factors relate to nutritional status.

Table 1. Distribution of Respondent Characteristics

Variable	n	%
Gender		
Male	70	31.7%
Female	151	68.3%
Age		
15 years old	116	52.5%
16 years old	105	47.5%
Physical Activity		
Light	37	16.7%
Moderate	14	6.3%
Intense	170	76.9%
Sleep Quality		
Good	100	45.2%
Poor	121	54.8%
Nutritional Status		
Underweight	35	15.8%
Normal	169	76.5%
Overweight	14	6.3%
Obesity	3	1.4%

Regarding physical activity, the majority of respondents engaged in intense physical activity (170 or 76.9%), followed by those participating in light physical activity (37 or 16.7%) and moderate activity (14 or 6.3%). In terms of sleep quality, 45.2% (100) reported having good quality sleep, while 54.8% (121) had poor sleep quality. In terms of nutritional status, 15.8% (35) were categorized as undernourished, 76.5% (169) had normal nutritional status, 6.3% (14) were overweight, and 1.4% (3) were obese.

Table 2 presents the correlation analysis results between physical activity, sleep quality, and nutritional status using the Gamma correlation test. The analysis found no significant relationship between physical activity, sleep quality, and nutritional status. The p-value greater than 0.05 indicates that there is no significant association between these variables.

The correlation analysis results, as presented in Table 2, indicate that physical activity and sleep quality show very weak and non-significant associations with nutritional status (p-value>0.05). This suggests that there is no strong linear relationship between these variables. Therefore, physical activity and sleep quality may not directly influence nutritional status based on this analysis.

Table 2. Gamma Correlation between Variables and Nutritional Status

Variable	Nutritional Status				Correlation Coefficient (r)	p-value
	Underweight (n)	Normal (n)	Overweight (n)	Obesity (n)		
Physical Activity						
Light	7	27	3	0	0.05	0.548
Moderate	3	10	1	14		
Intense	25	132	10	17		
Sleep Quality						
Good	15	78	5	2	0.01	0.937
Poor	20	91	9	1		

However, the Chi-square test results presented in Table 3 reveal a different perspective. A statistically significant difference was found in the distribution of nutritional status across varying levels of physical activity (p-value=0.000). This suggests that the prevalence of underweight, normal, overweight, and obesity differs meaningfully among participants classified as having light, moderate, or intense physical activity. In contrast, no significant difference was observed in nutritional status distribution between groups based on sleep quality (p-value=0.937), indicating that sleep quality does not appear to affect nutritional status in a statistically detectable way.

Taken together, these findings imply that while direct correlation analyses may fail to capture complex group differences, comparative analyses such as the Chi-square test can reveal important variations in nutritional status related to physical activity levels. Therefore, it is crucial to use multiple complementary statistical approaches to fully understand the relationships and differences in such categorical health data. These insights highlight the nuanced and multifaceted nature of the factors influencing nutritional status.

Table 3. Distribution of Nutritional Status by Physical Activity and Sleep Quality with Chi-square Test

Variable	Nutritional Status				p-value
	Underweight (n)	Normal (n)	Overweight (n)	Obesity (n)	
Physical Activity					
Light	7	27	3	0	0.548
Moderate	3	10	1	14	
Intense	25	132	10	17	
Sleep Quality					
Good	15	78	5	2	0.937
Poor	20	91	9	1	

Relationship between Physical Activity and Nutritional Status

Teenagers' physical activity and nutritional status link is a complicated one as it is affected by elements other than the level of physical activity. With a p-value=0.548 the findings of this study show that there is no appreciable correlation between the degree of physical activity and nutritional state in teenagers. Though most of the respondents participate in high-intensity physical exercise, these results imply that their nutritional situation cannot be explained by physical activity alone. This suggests that the nutritional situation of teenagers is much influenced by various elements like food, socioeconomic level, and hereditary aspects as well (Narciso et al., 2019; Guazzelli Williamson et al., 2020).

Prior studies have demonstrated that sufficient physical exercise correlates with enhanced nutritional status. For instance, Supit et al. (2021) observed that physical exercise affects BMI in university students. Furthermore, studies have shown the need of integrating physical exercise with a balanced diet to attain optimal nutritional health (Tresnanda and Rimbawan, 2022). The results of this study demonstrate that although physical exercise significantly influences nutritional status, a healthy diet is an essential determinant. Previous research by Praditasari and Sumarmik (2018) indicates that, despite the advantages of physical exercise, an imbalanced diet might negatively impact nutritional status, especially in teenagers who frequently display irregular eating habits.

Often a major obstacle to reaching high nutritional status is a bad diet. Adolescents who ate well and regularly exercised were more likely to have a normal nutritional condition, according a study by Ismiati and Suri (2018). On the other hand, a study by Retnaningrum and Dieny revealed that teenagers with poor diets and restricted physical

activity had a greater risk of obesity, which is directly connected to their nutritional situation (Retnaningrum and Dieny, 2015). Khairunnisa et al (2023), who discovered that poor diet and insufficient physical exercise greatly affect nutrition-related issues, particularly among teenage females, further supports this result.

Furthermore, very important in the link between physical activity and nutritional condition are socioeconomic elements. Children from low-income backgrounds may find it challenging to get sports facilities and healthy meals (Hasanah, 2022). Low socioeconomic level raises the risk of inadequate nutritional status by means of restricted access to exercise facilities and wholesome meals. Thus, socioeconomic elements might affect the link between physical activity and nutritional state; better economic situations usually provide access to more nutritious food and exercise facilities.

Besides socioeconomic issues, genetic effects significantly impact the correlation between physical activity and nutritional status. Studies suggest that persons with a familial predisposition to obesity may exhibit increased vulnerability to weight-related problems, even participating in regular physical exercise (Muchtar et al., 2022). This suggests that although physical activity and food are crucial for nutritional status, specific genetic predispositions may render individuals susceptible to nutritional diseases, particularly when other factors like diet and socioeconomic status are not addressed. Thus, it can be inferred that the interaction of several variables substantially affects the correlation between physical activity and nutritional status in teenagers. Consequently, initiatives aimed at enhancing adolescent nutritional status must use a comprehensive approach that incorporates physical activity, dietary habits, socioeconomic factors, and genetic influences. Interventions that concentrate just on physical activity or food are improbable to provide enduring enhancements in adolescent nutritional outcomes.

Moreover, study by Hartini et al. (2022) underscores the significance of nutritional education in affecting adolescents' nutritional status, hence enhancing the correlation between physical activity and nutritional status. Research indicates that teenagers possessing strong nutritional awareness are more inclined to integrate a balanced diet with consistent physical exercise, hence enhancing their nutritional status. This indicates that enhancing awareness of nutrition and the significance of physical exercise might successfully elevate the nutritional status of teenagers.

In terms of quantifying physical activity, some research advise applying more objective measuring instruments including accelerometers, which can offer more reliable data than the Physical Activity Level (PAL) questionnaire depending on self-reportingSuryoadji and Nugraha (2021) found that although the PAL questionnaire offers a decent picture of teenagers' physical activity, objective measurements via wearable devices can be more accurate, particularly in circumstances whereby physical activity is impacted by outside events including a pandemic or lockdown policies. This implies that in research aiming at teenagers' physical activity and nutritional situation, more exact and methodical measuring techniques should be used.

In essence, the combination of several elements, including food, socioeconomic level, and genetics, defines the link between physical activity and nutritional state in teenagers. Thus, a strategy including all these elements is required to holistically raise teenagers' nutritional situation. Interventions combining better eating, increased physical activity, and teaching on the value of both elements will be more successful in promoting teenagers' long-term nutritional health.

Relationship between Sleep Quality and Nutritional Status

The relationship between sleep quality and nutritional status in adolescents is crucial, particularly in relation to obesity and metabolic disorders. The results of this study indicate that there is no significant relationship between sleep quality and nutritional status in adolescents (p-value=0.937). Although poor sleep quality can disrupt hunger hormones, such as ghrelin and leptin, which may lead to obesity, these findings suggest that other factors, such as diet, stress, social media use, and socioeconomic factors, also play a significant role. Sleep quality alone is not sufficiently significant in affecting adolescent nutritional status without considering these factors (Bodur et al., 2025).

Poor sleep quality can increase levels of ghrelin, a hormone that stimulates appetite, while levels of leptin, a hormone that signals satiety, will decrease. As a result, adolescents with poor sleep quality tend to consume more food and are at risk of obesity (Fitri and Setiarini, 2022; Pitoy et al., 2022). Data from the 2018 Riskesdas survey revealed that poor sleep patterns might be connected to the approximately 16% of teenagers aged 13–15 years who were overweight or obese (Fitri and Setiarini, 2022). Other research has also indicated that someone who sleeps fewer than six hours every night typically consumes morure calories from fats and quick meals (Susmiati, 2018). This indicates that inadequate sleep quality might affect not only weight rise but also influence of bad eating practices.

According to to previous research, poor quality of sleep is connected to weight increase and bad changes in eating habits. Other factors, such as stress levels, social media usage, and physical activity, have also been found to influence poor sleep quality in teenagers, as reported in various studies. Stressful individuals have been observed in several

studies to have sleep problems and even to readily ingest unhealthy meals, therefore raising their obesity risk (Pangestika et al., 2018; Pradnyaparamita et al., 2023). Furthermore, additional research reveal that teenagers who spend more time on social media often have disrupted sleeping patterns. This influences their general eating habits and activity, hence they often suffer with nutrition (Woran et al., 2021). It is shown that teenagers who spend a lot of time on social media often have disturbed sleeping habits, which influences their eating behavior and general condition as well. Teenagers' sleep quality is greatly impacted by psychological elements and everyday behaviors that might aggravate their nutritional issues. In this study, sleep quality did not have a direct impact on changes in nutritional status in adolescents. However, in terms of metabolic changes, poor sleep quality can affect hormones that regulate appetite, including increased ghrelin levels and decreased leptin, which contribute to increased hunger which affects the increased risk of obesity in adolescents (Susmiati, 2018). In addition, poor sleep quality not only affects hormones, but also overall metabolism (Sitoayu et al., 2021; Bustami and Ikhssani, 2022).

Given the negative impacts of poor sleep quality on physical health and nutritional status, improving adolescent sleep quality is very important to consider. Several studies have shown that by increasing awareness of the importance of adequate sleep, adolescents can overcome various health problems, including eating disorders and obesity (Batiari et al., 2022). Therefore, greater attention should be given to improving good sleep habits among adolescents. Interventions that focus on education about sleep hygiene and ways to reduce stress and responsibly use social media can help adolescents sleep better and, ultimately, support obesity control and improve their metabolic health. Repeated poor sleep quality will create a negative cycle that affects the physical health as well as the mental and emotional well-being of adolescents. This will have an impact on adolescent stress which in turn affects healthy eating patterns and nutritional balance in adolescents. This emphasizes the importance of paying attention to psychological factors such as stress when managing sleep quality and nutritional status in adolescents (Fitri and Setiarini, 2022; Pradnyaparamita et al., 2023).

In this study, sleep quality was measured using the Pittsburgh Sleep Quality Index (PSQI) which is commonly used to assess sleep quality subjectively. However, the PSQI also has shortcomings triggered by the subjectivity of adolescents' perceptions who hope that the results will show that their sleep quality will look better (Zhuang et al., 2022). Although other studies that have validated this questionnaire show that the PSQI shows good reliability and validity, different factor structures appear in various samples, indicating that PSQI scores do not always reflect actual sleep status, especially when related to diverse social and cultural contexts (Fabbri et al., 2021). Other studies on this questionnaire also show that the purpose of using this questionnaire can produce different sleep quality results. Adolescents may report better or worse sleep quality than their actual conditions to meet research expectations or standards (Kim and Lee, 2019). Therefore, it is important for research on sleep quality to consider more rigorous research methods and designs and also incorporate objective measurements to obtain more accurate information on adolescent sleep quality.

Overall, sleep quality in adolescents does not have a direct impact on their nutritional status, but it can increase the risk of obesity and metabolic disorders. This study highlight that psychological factors, such as stress, as well as daily habits, such as social media use, have a significant impact on sleep quality. Therefore, it is important for health intervention programs to improve sleep quality by educating about the importance of adequate sleep and stress management, and paying more attention to the impact of social media habits on adolescent sleep health. Additionally, more objective measurements of sleep quality need to be considered to obtain more accurate data in future studies.

While this study provides valuable insights into the relationship between sleep quality and various factors, its limitations include the reliance on self-reported data for assessing sleep quality. Adolescents may report their sleep quality differently based on social expectations or the desire to meet perceived research standards, potentially introducing bias. Furthermore, the Pittsburgh Sleep Quality Index (PSQI), though widely used, has some subjectivity in its results, as it relies on personal perception of sleep quality. However, the strength of this study lies in its focus on the psychological and behavioral factors influencing sleep quality, providing a comprehensive understanding of adolescent sleep health. Future research should aim to use more objective measures, such as actigraphy or accelerometers, to assess sleep quality, and consider longitudinal approaches to capture long-term effects of poor sleep on adolescent health.

CONCLUSION

The results of this study show that physical activity and sleep quality have no significant correlation in nutritional status among adolescents aged 15 to 18 years at SMK Negeri 3 Kupang, East Nusa Tenggara. Although variations in physical activity and sleep quality were observed across different nutritional status categories, the study did not find a direct, statistically significant relationship between these factors. Other factors, such as diet, stress, from using social media, and socioeconomic

conditions, may play a more significant role in influencing nutritional status. These findings suggest that a comprehensive approach, considering not only physical activity and sleep quality but also dietary habits, stress management, and socioeconomic factors, is necessary to improve adolescent nutritional status, especially in regions like NTT facing a double nutritional burden. Further research can use more accurate measuring instruments, such as accelerometers to measure physical activity and more comprehensive and objective sleep quality questionnaires to obtain accurate data. In addition, longitudinal studies are very important to see the long-term impact of these factors on adolescent health as a whole.

Acknowledgment

The authors would like to express their deepest gratitude to the research colleagues and students who assisted in the data collection process for this study. Special thanks are also extended to the Health Office of Ende Regency and the Department of Nutrition, Health Polytechnic of the Ministry of Health Kupang, for providing permission and facilities for the conduct of this research. We also appreciate all the respondents who participated in this study, as well as all individuals who supported the research, both directly and indirectly.

Conflict of Interest and Funding Disclosure

The authors declare no conflict of interest.

Author Contributions

ASS: conceptualization, data curation, formal analysis, funding acquisition, investigation, methodology, project administration; ADRA: validation, visualization, writing-review and editing; N: supervision, validation.

REFERENCES

Batiari, N.M.P., Budiharto, B., Suratmi, T., 2022. Kecemasan Remaja: Faktor-Faktor Risiko berdasarkan Model Ekologi Sosial. Insan Jurnal Psikologi Dan Kesehatan Mental. https://doi.org/10.20473/jpkm.v7i12022.36-53.

Bodur, M., Aydin, A., Yildirim, R., 2025. The overlooked factor: Sleep quality in assessing malnutrition risk and nutritional status in adolescents with cystic fibrosis. Sleep Medicine. 127, 120–126.

Bustami, A., Ikhssani, A., 2022. Obesitas dan Gangguan Tidur pada Remaja: Tinjauan Pustaka. https://doi.org/10.36911/nutrient.v2i1.1310.

Detha, A.I.R., Maranatha, G., Riwu, M., Datta, S.C.U., 2022. Pelatihan Pengolahan Pangan Sumber Protein pada Kelompok Pemberdayaan Perempuan dalam Upaya Mencegah Stunting Di Desa Fatumonas, Kecamatan Amfoang Tengah, Kabupaten Kupang. International Journal of Community Service Learning. https://doi.org/10.23887/ijcsl.v6i2.47195.

Fabbri, M., Beracci, A., Martoni, M., Meneo, D., Tonetti, L., Natale, V., 2021. Measuring Subjective Sleep Quality: A Review. Int J Environ Res Public Health. https://doi.org/10.3390/ijerph18031082.

Fitri, A., Setiarini, T., 2022. Dampak Gangguan Tidur terhadap Status Gizi pada Remaja. Jkep. https://doi.org/10.32668/jkep.v7i2.1030.

Gifari, N., Sitoayu, L., Nuzrina, R., Ronitawati, P., Kuswari, M., Prasetyo, T.J., 2022. The Association of Body Image, Percent Body Fat, Nutrient Intake, Physical Activity Among Adolescent. Nutrition & Food Science. https://doi.org/10.1108/nfs-10-2021-0305.

Guazzelli Williamson, V., Dilip, A., Dillard, J.R., Morgan-Daniel, J., Lee, A.M., Cardel, M.I., 2020. The influence of socioeconomic status on snacking and weight among adolescents: A scoping review. Nutrients 12, 167.

Hartini, D.A., Dewi, N.U., Aiman, U., Nurulfuadi, N., Ariani, A., Fitrasyah, S.I., 2022. Hubungan Aktivitas Fisik dan Pengetahuan Gizi dengan Status Gizi Remaja Pasca Bencana Di Kota Palu. Ghidza Jurnal Gizi dan Kesehatan. https://doi.org/10.22487/ghidza.v6i1.444.

Hasanah, S.U., 2022. Hubungan Persepsi Body Image dan Tingkat Ekonomi dengan Status Gizi Remaja Putri Di Kabupaten Nabire Provinsi Papua. Jurnal Kesmas (Kesehatan Masyarakat) Khatulistiwa. https://doi.org/10.29406/jkmk.v9i3.3745.

Herawahyuni, H., Zainuddin, A., Yasnani, Y., 2023. Faktor yang Mempengaruhi Kejadian Stunting pada Balita Usia 6-59 Bulan Di Wilayah Kerja Puskesmas Benu-Benua, Kecamatan Kendari Barat, Kota Kendari Tahun 2022. https://doi.org/10.37887/jgki.v4i1.43103.

Irdiana, W., Nindya, T.S., 2017. Hubungan Kebiasaan Sarapan dan Asupan Zat Gizi dengan Status Gizi Siswi SMAN 3 Surabaya. Amerta Nutrition. https://doi.org/10.20473/amnt.v1i3.6249.

Ismiati, I., Suri, D., 2018. Hubungan Pola Makan dan Aktivitas Fisik dengan Status Gizi pada Remaja Di Sma Negeri 2 Sigli Kabupaten Pidie. Journal of Healthcare Technology and Medicine. https://doi.org/10.33143/jhtm.v3i1.1012.

Juniartha, I.G.N., Darmayanti, N.P.E., 2020. Gambaran Status Gizi Siswa Sekolah Menengah Pertama (Smp) Di Kuta, Bali. Coping Community of Publishing in Nursing.

https://doi.org/10.24843/coping.2020.v08.i02.p04.

Kasmarini, F., Andriani, E., Sabrina, S., 2023. The Relationship between Fast Food Consumption, Pocket Money, and Quality of Sleep with Over Nutrition in Adolescents. Jurnal Gizi Prima (Prime Nutrition Journal). https://doi.org/10.32807/jgp.v8i2.400.

Khairunnisa, A., Said, I., Wikanti, C.Z.A., 2023. Hubungan Pola Makan, Aktivitas Fisik, dan Gangguan Menstruasi dengan Status Gizi Remaja Putri Di SMAN 1 Tangerang Selatan. https://doi.org/10.62358/mgii.v1i2.13.

Khan, D.S.A., Das, J.K., Zareen, S., Lassi, Z.S., Salman, A., Raashid, M., Dero, A.A., Khanzada, A., Bhutta, Z.A., 2022. Nutritional status and dietary intake of school-age children and early adolescents: systematic review in a developing country and lessons for the global perspective. Frontiers in Nutrition. 8, 739447.

Kim, G., Lee, J., 2019. Systematic Review of the Pittsburgh Sleep Quality Index Used for Measuring Sleep Quality Among Adults with Trauma Experiences. Korean Journal of Adult Nursing. https://doi.org/10.7475/kjan.2019.31.4.337

Liu, D., Kahathuduwa, C., Vazsonyi, A.T., 2021. The Pittsburgh Sleep Quality Index (PSQI): Psychometric and clinical risk score applications among college students. Psychological Assessment 33, 816.

Matias, C.N., Cardoso, J., Cavaca, M.L., Cardoso, S., Giro, R., Vaz, J., Couto, P.A., Dores, A.R., Ferreira, T.B., Tinsley, G.M., others, 2023. Game on: A cross-sectional study on gamers' mental health, Game patterns, physical activity, eating and sleeping habits. Computers in Human Behavior. 148, 107901.

Muchtar, F., Sabrin, S., Effendy, D.S., Lestari, H., Bahar, H., 2022. Pengukuran Status Gizi Remaja Putri sebagai Upaya Pencegahan Masalah Gizi Di Desa Mekar Kecamatan Soropia Kabupaten Konawe. Abdi Masyarakat. https://doi.org/10.58258/abdi.v4i1.3782.

Narciso, J., Silva, A.J., Rodrigues, V., Monteiro, M.J., Almeida, A., Saavedra, R., Costa, A.M., 2019. Behavioral, contextual and biological factors associated with obesity during adolescence: A systematic review. PLoS One 14, e0214941.

Noviyanti, N.P.A.W., Widayati, K., Daryaswanti, P.I., Febianingsih, N.P.E., Dewi, N.L.M.A., Astutik, W., Sulistyadewi, N.P.E., 2023. Status Gizi Remaja Putri Di Kecamatan Jembrana Kabupaten Negara. Bali Health Published Journal. https://doi.org/10.47859/bhpj.v5i2.429.

Nuryani, N., 2019. Gambaran Pengetahuan, Sikap, Perilaku dan Status Gizi pada Remaja Di Kabupaten Gorontalo. Jurnal Dunia Gizi. https://doi.org/10.33085/jdg.v2i2.4473.

Pangestika, G., Lestari, D.R., Setyowati, A., 2018. Stres dengan Kualitas Tidur pada Remaja. Dunia Keperawatan Jurnal Keperawatan Dan Kesehatan. https://doi.org/10.20527/dk.v6i2.4412.

Pitoy, F.F., Tendean, A.F., Rindengan, V.C.C., 2022. Kualitas Tidur dan Indeks Massa Tubuh pada Remaja. Nutrix Journal. https://doi.org/10.37771/nj.vol6.iss2.836.

Pool, J., 2022. The QCS Pool Activity Level (PAL) Instrument for Occupational Profiling: A Practical Resource for Carers of People with Cognitive Impairment 5th edn. Jessica Kingsley Publishers.

Praditasari, J.A., Sumarmik, S., 2018. Asupan Lemak, Aktivitas Fisik dan Kegemukan pada Remaja Putri Di SMP Bina Insani Surabaya. Media Gizi Indonesia. https://doi.org/10.20473/mgi.v13i2.117-122.

Pradnyaparamita, A., Muniroh, L., Atmaka, D.R., 2023. Hubungan Kualitas Tidur dan Stres dengan Pola Makan Remaja Di Kota Kediri saat Pandemi COVID-19. Media Gizi Kesmas. https://doi.org/10.20473/mgk.v12i2.2023.1007-1013.

Rahmawati, D.P., Indarto, D., Hanim, D., 2021. Correlation of Snacking Frequency, Hemoglobin Levels, Physical Activity and Pocket Money with Nutritional Status in Female Adolescents. Media Gizi Indonesia. https://doi.org/10.20473/mgi.v16i3.207-214.

Ratih, R.H., 2020. Hubungan Perilaku Makan dengan Status Gizi pada Remaja Putri Di SMAN 2 Tambang. Jurnal Smart Kebidanan. https://doi.org/10.34310/sjkb.v7i2.397.

Retnaningrum, G., Dieny, F.F., 2015. Kualitas Diet dan Aktivitas Fisik pada Remaja Obesitas dan Non Obesitas. Journal of Nutrition College. https://doi.org/10.14710/jnc.v4i4.10150.

Sitoayu, L., Aminatyas, I., Angkasa, D., Gifari, N., Wahyuni, Y., 2021. Hubungan konsumsi makanan cepat saji, tingkat stres dan kualitas tidur terhadap status gizi pada remaja putra SMA DKI jakarta. Indonesian Journal of Human Nutrition 8, 55–64.

Supit, E.D., Mayulu, N., Bolang, A.S.L., Kawengian, S.E.S., 2021. Aktivitas Fisik dan Status Gizi Mahasiswa saat Pandemi COVID-19. Jurnal Biomedik JBM. https://doi.org/10.35790/jbm.13.2.2021.31763.

Suryoadji, K.A., Nugraha, D.A., 2021. Aktivitas Fisik pada Anak dan Remaja selama Pandemi COVID-19: Sebuah Tinjauan Sistematis. Khazanah. https://doi.org/10.20885/khazanah.vol13.iss1.art3.

Susmiati, S., 2018. Lama Waktu Tidur dengan Kejadian Obesitas pada Remaja (Case Control

Study). Ners Jurnal Keperawatan. https://doi.org/10.25077/njk.13.1.42-49.2017.

Tresnanda, N., Rimbawan, R., 2022. Hubungan Perilaku Makan dan Aktivitas Fisik dengan Status Gizi Mahasiswa IPB Masa Pembelajaran Jarak Jauh. Jurnal Ilmu Gizi dan Dietetik. https://doi.org/10.25182/jigd.2022.1.1.1-7.

Widiani, N.K.A.S., Mayangsari, A.S.M., Witarini, K.A., Pratiwi, I.G.A.P.E., 2024. Hubungan antara Status Gizi, Asupan Zat Besi dan Seng dengan Prestasi Belajar pada Remaja Putri Di SMP Santo Yoseph. E-Jurnal Medika Udayana. https://doi.org/10.24843/mu.2024.v13.i02.p17.

Woran, K., Kundre, R.M., Pondaag, F.A., 2021. Analisis Hubungan Penggunaan Media Sosial dengan Kualitas Tidur pada Remaja. Jurnal Keperawatan. https://doi.org/10.35790/jkp.v8i2.32092.

Zalda, F., Alamsyah, P.R., 2024. Relationship of Sweet Caffeinated Beverages Consumption and Sleep Quality with Nutritional Status in Adolescent. Media Gizi Indonesia. https://doi.org/10.20473/mgi.v19i2.164-171.

Zhuang, J., Wu, J., Fan, L., Liang, C., 2022. Observation on the Clinical Efficacy of Traditional Chinese Medicine Non-Drug Therapy in the Treatment of Insomnia: A Systematic Review and Meta-Analysis Based on Computer Artificial Intelligence System. Computational Intelligence and Neuroscience. https://doi.org/10.1155/2022/1081713.

Zulaily, N., Ahmad, A., Shahril, M.R., 2024. Associated Factors of Physical Activity Among 12 Years Old School Adolescents in Terengganu, Malaysia. Malaysian Journal of Medicine & Health Sciences.20.