Life Style Factor Analysis and Body Mass Index (BMI) of Semarang Runners

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ABSTRACT

***Background**: Running has become one of the most popular sports for people of all ages. The presence of exciting running events and races has further boosted the sport's popularity. However, enthusiasm for participating in running races is not always accompanied by a healthy lifestyle, including regular physical activity, adequate sleep, effective stress management, and balanced nutritional intake. **Aims**: This study aims to determine the factors influencing the BMI of the running community in Semarang City. **Methods**: The research employed a quantitative, cross-sectional design. The population consisted of members of the Semarang Runners community aged 18–24 years. A total of 71 respondents were selected using a total sampling method. Data were collected using the International Physical Activity Questionnaire (IPAQ), Pittsburgh Sleep Quality Index (PSQI), 24-hour food recall, Perceived Stress Scale (PSS), and BMI measurements. Data analysis was conducted using the chi-square test to assess correlations. **Results**: The results indicated that, based on the chi-square test, physical activity, sleep quality, stress, and achievement were not significantly associated with BMI, as their p-values were greater than 0.05. However, among dietary pattern variables—including energy, protein, fat, and fiber intake—only energy intake showed a significant association with BMI, with a p-value of 0.005. **Conclusion**: The study suggests that members of the Semarang Runners community should focus on managing their energy intake to support and improve their health. While other factors such as physical activity and sleep quality also contribute to overall fitness, energy intake appears to be a key determinant of BMI in this population.*

***Keywords**: Body Mass Index, Dietary Intake, 24 Hour Food Recall, Physical Activity, Sleep Quality, Stress.*

INTRODUCTION

According to the World Health Organization (WHO), adolescents are the largest contributors to the high prevalence of physical inactivity among population groups (Adi, 2022). The 2022 Global Report on Physical Activity states that 81% of adolescents and 27.5% of adults fail to meet the minimum physical activity recommendations necessary for optimal health (WHO, 2022). WHO estimates that inactivity could result in an additional 500 million cases of non-communicable diseases worldwide. To address this, WHO urges countries to implement policies promoting active lifestyles and regular exercise (WHO, 2022).

Grid Nation, a community advocating sports as a way of life, aims to improve public health and overall quality of life through various sports and wellness programs (Millennial, 2024) (Yohanes Kiling and Novianti Kiling-Bunga, 2019).. However, data from 2022 shows that the sports participation rate among Indonesians declined to 30.93%, down from 32.80% in 2021. Additionally, the average daily steps taken by Indonesians is only 3,513 (Deputi 3 Pembudayaan Olahraga Kemenpora RI, 2022). These figures highlight ongoing challenges in increasing physical activity levels within the population.

Health is a valuable asset for every individual that should be preserved and enhanced. Running communities, composed of individuals sharing a passion for the sport, have the potential to achieve optimal health and serve as role models for a healthy lifestyle within society. Key aspects of a healthy lifestyle include regular physical activity, quality sleep, a balanced diet, and effective stress management—all of which significantly influence health status, especially body

Received: 25-02-2025, Accepted: 17-04-2025, Published Online: 05-03-2026

mass index (BMI). Adopting a healthy lifestyle reflects self-actualization, a sense of health responsibility, and interpersonal support in coping with stress (Santika, 2022). To date, no research has specifically examined the relationship between physical activity, sleep quality, diet, stress levels, and BMI among members of running communities.

Semarang Runners (SR) is the largest running community in Central Java and has been a pioneer in promoting running activism in Semarang since its establishment in 2013. SR exemplifies how a healthy lifestyle can be implemented within a community. However, many members face health issues during training and at events. Preliminary studies suggest that one contributing factor is a mismatch between members' BMI and their body proportions.

Given these supporting factors, researchers are eager to further investigate the relationships between physical activity, sleep quality, diet, stress levels, and BMI among members of the Semarang City Running Community.

METHODS

This study employs a quantitative research design with a cross-sectional approach to examine the relationships between variables. Ethical approval was granted by the Health Research Ethics Committee of the Faculty of Public Health, Diponegoro University, under the reference number 377/EA/KEPK-FKM/2024. The population consists of all members of the Semarang Runners community aged 18–24 years. The study involved participants within this age group who were members of the community. Primary data were collected directly by the researchers through questionnaires designed to address each research variable. Data collection instruments included the International Physical Activity Questionnaire (IPAQ) for physical activity, the Pittsburgh Sleep Quality Index (PSQI) for sleep quality, a 24-hour food recall for dietary patterns, and the Perceived Stress Scale (PSS) for stress levels. Secondary data were obtained from literature reviews, agencies, and other relevant sources supporting the research.

RESULTS AND DISCUSSION

The univariate analysis revealed that the gender distribution of respondents was 29.6% female and 70.4% male. The highest proportion of respondents was aged 24 years (22%), and the majority had completed high school education (63.4%). Regarding occupation, most respondents were either still students (39.4%) or identified as students (36.6%).

Table 1. characteristics of respondents

Characteristics	N	%
Gender		
Women	21	29.6
Man	50	70.4
Age		
18	12	16.9
19	8	11.3
20	5	7.0
21	7	9.9
2 2	8	11.3
23	9	12.7
24	22	31.0
Education		
Senior high school	45	63.4
D3	4	5.6
S1	22	31.0
Work		
Un employed	7	9.9
College Student	28	39.4
University student	26	36.6
ASN	5	7.0
Enterpriser	5	7.0

Table 2. Research variables

Category	N	%
IMT		
Abnormal	8	11.3
Normal	63	88.7
Physical activity		
Low	13	18.3
Moderate	29	40.8
High	29	40.8
Sleep quality		
Good	30	42.3
Bad	41	57.7
Stress level		
Light	6	8.5
Moderate	58	81.7
High	7	9.9
Performance		
Once	8	11.3
Never	63	88.7
Dietary habit		
Energy intake		

Received: 25-02-2025, Accepted: 17-04-2025, Published Online: 05-03-2026

Category	N	%
Not enough	48	67.6
Moderate	14	19.7
Sufficient	4	5.6
Excessive	5	7.0
Protein intake		
Not enough	19	26.8
Moderate	9	12.7
Sufficient	13	18.3
Excessive	30	42.3
Fat intake		
Not enough	34	47.9
Moderate	17	23.9
Sufficient	6	8.5
Excessive	14	19.7
Fiber intake		
Not enough	69	97.2
Moderate	-	-
Sufficient	-	-
Excessive	2	2.8

The majority of members in the running community have a normal BMI, accounting for 88.7%. BMI is a method used to assess an individual's nutritional status by comparing their weight to their height. An unusually low or abnormal BMI can affect physical fitness (Shafitri, 2020). It can also lead to various health risks, including a weakened immune system, increased susceptibility to diseases, and symptoms such as fatigue and lethargy, which can negatively impact performance (Astuti, Bayu and Destriana, 2022). Low physical activity levels are observed in 18.3% of respondents, while moderate and high physical activity levels both account for 40.8%. Moderate-intensity physical activity is recommended for individuals aged 17–64 years. For adolescents or adults with low physical activity, there is a potential risk of developing obesity (Astuti, Bayu and Destriana, 2022). The prevalence of physical inactivity has increased in many countries, with insufficient or low levels of physical activity identified as a major contributor to non-communicable diseases. Approximately 21–25% of the burden of cancer and colon diseases, 27% of diabetes, and 30% of heart disease are attributed to a lack of physical activity (Liando, Amisi and Sanggelorang, 2021). The community's strong enthusiasm for running is expected to lead to an increase in the percentage of individuals engaging in higher levels of physical activity.

Among members of the running community, the proportion with poor sleep quality is higher, at 57.7%, compared to 42.3% with good sleep quality. Insufficient sleep duration can contribute to obesity, as increased BMI is directly related to shorter sleep duration. Respondents with poorer sleep quality have a 45% higher likelihood of experiencing obesity if their sleep duration is reduced and sleep quality is compromised (Amri, 2024). It can be concluded that members of the Semarang Runners community may be at risk of obesity if they experience poor sleep quality.

Stress is classified into three categories: mild, moderate, and severe. Moderate stress has the highest percentage, accounting for 81.7%. Stress is the body's reaction to stressors that are difficult to manage. It can influence a person's eating habits, a phenomenon known as stress-coping behavior (Herlin Simanoah, Muniroh and Aditya Rifqi, 2022). Coping with stress can be divided into two types. One approach is emotion-focused coping, where individuals regulate their emotional reactions to stress by engaging in activities such as watching TV, playing games, or consuming food and alcoholic beverages (Juzailah and Ilmi, 2022). The relationship between stress and sleep quality is well-documented, with higher stress levels generally leading to poorer sleep quality. Stress activates the body's hypothalamic-pituitary-adrenal (HPA) axis, increasing cortisol levels, which can make it difficult to fall asleep and stay asleep. While stress itself may not directly cause weight gain, these behaviors can contribute to an increase in BMI, especially when combined with insufficient physical activity and excessive food and beverage intake.

Dietary patterns, including the intake of energy, protein, fat, and fiber, reveal that the majority of respondents have inadequate energy intake (67.6%), excessive protein intake (42.3%), insufficient fat intake (47.9%), and very low fat intake (97.2%), indicating that nearly all respondents have inadequate fat intake. A person’s energy requirements vary based on body weight and physical activity level. Energy intake must align with these needs; exceeding this limit can lead to obesity (Astuti, Bayu and Destriana, 2022). Over time, food consumption patterns have evolved. The increasing intake of fast food and junk food is facilitated by technological advances,

Received: 25-02-2025, Accepted: 17-04-2025, Published Online: 05-03-2026

making these foods more accessible. Such foods are not advisable, as excessive consumption without adequate physical activity can lead to weight gain, which is directly linked to an increase in BMI (Suyasmi, Citrawathi and Sutajaya, 2018).

Eight out of 71 respondents have won a running race. Achievements in sports are closely linked to physical fitness. An individual's ability to exercise without feeling fatigued largely depends on their aerobic endurance (Putri and Wiriawan, 2024). A runner needs to sustain endurance to cover a specific distance within a short period. A sedentary lifestyle can lead to an increase in body fat percentage and BMI, as well as a decrease in muscle mass (Putri and Wiriawan, 2024). Indirectly, this can hinder one's ability to run and reduce their chances of success in running.

Table 3 illustrates the association between respondent characteristics and BMI. No significant relationship was found between these characteristics and BMI, as gender, age, occupation, and education all yielded p-values greater than 0.05. The proportion of respondents with a normal BMI is highest among those with certain occupational characteristics, with a p-value of 0.182.

Table 3. Relationship between respondent characteristics and body mass index (BMI)

Variable	Abnormal		Normal		P value
	n	%	N	%	
Gender					
Women	1	4.8	20	95.2	0.261
Man	7	14.0	43	86.0	
Age					
18	1	8.3	11	91.7	0.706
19	0	0.0	8	100.0	
20	1	20.0	4	80.0	
21	1	14.3	6	85.7	
2 2	0	0.0	8	100.0	
23	2	22.2	7	77.8	
24	3	13.6	19	86.4	
Education					
Senior high school	6	13.3	39	86.7	0.669
D3	0	0.0	4	100.0	
S1	2	9.1	20	90.9	
Work					
Unemployment	1	14.3	6	85.7	0.182
Student	1	3.6	27	96.4	
College Student	3	11.5	23	88.5	
ASN	1	20.0	4	80.0	
Self-employed	2	40.0	3	60.0	

Table 4. Relationship between independent variables and body mass index

Variable	Abnormal		Normal		P value
	n	%	N	%	
Physical activity					
Low	1	7.7	12	92.3	0.829
Medium	4	13.8	25	86.2	
High	3	10.3	26	89.7	
Sleep quality					
Good	1	3.3	29	96.7	0.071
Bad	7	17.1	34	82.9	
Stress level					
Light	1	16.7	5	83.2	0.262
Moderate	5	8.6	53	91.4	
Heavy	2	28.6	5	71.4	

Received: 25-02-2025, Accepted: 17-04-2025, Published Online: 05-03-2026

Variable	Abnormal		Normal		P value
	n	%	N	%	
Performance					
Once	1	12.5	7	87.5	0.907
Never	7	11.1	56	88.9	
Dietary habit					
Energy sufficiency level					
Not enough	4	8.3	44	91.7	0.005
Moderate	1	7.1	13	92.9	
Sufficient	0	0.0	4	100.0	
Excessive	3	60.0	2	40.0	
Protein adequacy level					
Not enough	3	15.8	16	84.2	0.609
Moderate	0	0.0	9	100.0	
Sufficient	1	7.7	12	92.3	
Excessive	4	13.3	26	86.7	
Adequate fat levels					
Not enough	2	5.9	32	94.1	0.119
Moderate	1	5.9	16	94.1	
Sufficient	2	33.3	4	66.7	
Excessive	3	21.4	11	78.6	
Adequate fiber levels					
Not enough	7	10.1	62	89.9	0.079
Moderate	-	-	-	-	
Sufficient	-	-	-	-	
Excessive	1	50.0	1	50.0	

Table 4 presents the results of the chi-square crosstab analysis examining the relationship between physical activity, sleep quality, diet, stress levels, achievements, and BMI among members of the Semarang Runners running community. The results show a p-value of 0.828 ($p > 0.05$), indicating no significant relationship between physical activity and BMI within this community. This may be influenced by the duration and intensity of physical activity, which are relatively good among most respondents. Most participants, regardless of their physical activity level (low, medium, or high), have a normal BMI. Physical activity can help reduce waist circumference and is closely linked to a decrease in body fat percentage (Sulistyorini, 2014). The choice of physical activity assessment tools also impacts study outcomes; research using the International Physical Activity Questionnaire (IPAQ) tends to yield more accurate results, as it provides a detailed analysis of various types of physical activity (Kusuma, Darmono and Anggraini, 2013). Similar findings were observed in studies involving high school students, who engage in numerous activities each week. Generally, the higher the level of physical activity, the more favorable the BMI (Kusuma, Darmono and Anggraini, 2013). Another study on medical students also found no significant relationship, indicated by a p-value greater than 0.05, as most participants had moderate levels of physical activity and BMI within the normal range. The researchers suggested that other factors not included in the study might have influenced BMI (Riskawati et al., 2020).

Regarding sleep quality, no significant relationship with BMI was found, as indicated by a p-value greater than 0.05. Several studies suggest that sleep duration may play a more crucial role than sleep quality. Individuals with longer sleep durations, even if sleep quality is poor, can maintain a stable BMI. Conversely, insufficient sleep duration may impact BMI, though the effect is often not significant due to other contributing factors such as lack of physical activity and inadequate diet or nutrition (Wibisono, Sudibjo and Soekanto, 2020). Sleep duration that falls short of recommended guidelines can increase the risk of weight gain. Therefore, adopting a healthy lifestyle that includes ensuring adequate

Received: 25-02-2025, Accepted: 17-04-2025, Published Online: 05-03-2026

sleep is essential (Herlin Simanoah, Muniroh and Aditya Rifqi, 2022).

The stress level has a p-value greater than 0.05, indicating that there is no statistically significant relationship between stress levels and BMI. This aligns with the findings of Herlin et al., which also reported no relationship between stress and BMI This may be due to the moderate distribution of stress levels within the Semarang Runners (SR) community, which does not significantly impact BMI changes. As is known, emotional responses such as excessive food consumption or shifts in eating habits are common ways individuals cope with stress. For some, chronic stress can influence appetite. There are two types of eating behaviors in stressed individuals: overeating in response to stress (emotional eaters) and reduced food intake (non-emotional eaters). Emotional eaters are more likely to experience weight gain, as elevated levels of the hunger hormone ghrelin during stress can trigger increased food consumption (Rodiana, 2022).

There is no significant relationship between achievement and BMI ($p > 0.05$). This may be due to the frequency and intensity of community running activities, which help maintain BMI within normal ranges. As exercise intensity increases weekly, the maximum BMI tends to decrease. Conversely, more frequent exercise is associated with an increase in the minimum BMI value (Sutandijo and Nainggolan, 2023). Another study on martial arts athletes found that increased protein intake improves strength, which can lead to a rise in BMI and potentially enhance athletic performance and achievements (Hidayah and Muniroh, 2018)

Regarding dietary intake, including energy, protein, fat, and fiber, the adequacy of protein, fat, and fiber intake shows no significant association with BMI ($p > 0.05$). However, energy adequacy is related to BMI ($p < 0.05$). This may be due to the high proportion of respondents with low energy intake, despite moderate to high levels of physical activity, which can influence BMI within the SR community. Based on 24-hour food recall data, respondents consume various types of food. This finding aligns with other studies that demonstrate a link between energy intake and BMI. Excessive energy intake can lead to an increase in BMI and is a significant factor contributing to obesity (Irwanto, 2016). Other research suggests a positive correlation between energy intake and BMI; energy intake refers to the amount of energy consumed through food, necessary to meet the body's energy expenditure (Azizah, 2014). The greater the energy expenditure, the higher the required energy intake.

CONCLUSION

There is no significant relationship between respondent characteristics—such as age, gender, education, and occupation—and the body mass index (BMI) of the Semarang running community. Similarly, no relationships were found between the independent variables—such as physical activity, sleep quality, stress, achievement, and the adequacy levels of protein, fat, and fiber—except for energy adequacy levels, which are associated with BMI. A limitation of this study lies in the choice of physical activity measurement tools, which may have influenced the findings.

To enhance the validity of future research, more accurate physical activity measurement tools, such as accelerometers or pedometers, should be considered. Additionally, longitudinal studies are necessary to better understand changes in BMI over time. Furthermore, a more in-depth analysis of other factors—such as the type of exercise, dietary patterns, and hydration—could provide a more comprehensive understanding.

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Received: 25-02-2025, Accepted: 17-04-2025, Published Online: 05-03-2026