JKU 14(4) (2025)

Jurnal Kedokteran Unram

https://journal.unram.ac.id/index.php/jku/submissions

The Relationship Between Body Mass Index and Human Sperm Motility

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DOI: https://doi.org/10.29303/jk.v14i4.8059

Article Info

Received : **November 11, 2025**

Revised : **November 23, 2025**

Accepted : **December 7, 2025**

Abstract:

Abstract: Approximately 17.5% of the adult population has experienced infertility, and this can cause significant stress, stigma from the community, disrupt financial capabilities, and affect mental health and psychosocial relationships in general. Sperm motility plays a crucial role in the fertilization of an egg by sperm. A fit body contributes to good sperm motility. A healthy body is supported by an ideal weight and height, as reflected in the body mass index (BMI). This study aims to determine the relationship between BMI and human sperm motility. This study used a cross-sectional method with a correlational analytical approach. Subjects were obtained through secondary data, including weight, height, and sperm motility data from infertile patients visiting the Duta Sehat Mataram Pharmacy. A total of 60 subjects were recruited, of which 16 cases were excluded, four with azoospermia and 12 with varicocele. The data were analyzed using the Spearman correlation test. In this study, 70.4% of cases were overweight, 27.3% were normal, and 2.3% were underweight from 44 data sets that met the inclusion criteria. Based on data analysis, there was no significant relationship between body mass index and human sperm motility. The Spearman correlation test showed p = 0.338 (p>0.05) and a correlation coefficient of -0.148. This study evaluated the relationship between men's body mass index and sperm motility, with results showing a weak trend and no statistically significant association.

Keywords: body mass index, sperm motility, infertility

Citation: Buanayuda, G.W. & Kresnapati, I.N.B.A. (2025). The Relationship Between Body Mass Index and Human Sperm Motility. *Jurnal Kedokteran Unram*, 14 (4), 174-177. DOI: https://doi.org/10.29303/jk.v14i4.8059

Introduction

The Obesity is a serious health problem affecting millions of people worldwide. More than 400 million adults are obese, and another 1.6 billion are overweight. Obesity is not only a problem in developed countries but is also spreading to developing countries. According to the WHO definition, obesity is measured by body mass index (BMI), which is weight divided by the square of height. A person is considered obese if their BMI exceeds 30 kg/m2 (Puri et al., 2020). Obesity not only increases the risk of heart disease and diabetes but can also affect male fertility. Excess weight can disrupt hormonal balance and increase oxidative stress, which negatively impacts sperm production and function. A significant number of people are affected by infertility at some point in their lives; approximately 17.5% of the adult population experiences infertility. Infertility issues tend to cause stress, environmental stigma, financial disruption, affect mental health and psychosocial relationships in general (Fernando et al., 2025).

The infertility of those affected by this problem demonstrates the need for widespread access to fertility treatments, ensuring that this issue is no longer sidelined in research and health policy. Safe, effective, and affordable ways to conceive are still needed for those in

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need (Antonim J, 2024). Male fertility status is determined, among other things, by sperm quality, including sperm motility or movement. Sperm motility plays a crucial role in transporting sperm to the fertilization site in the fallopian tubes. Several factors can affect a person's fertility, including lifestyle, diet, and physical activity, which can lead to excess weight (Putrid and Nadhiroh, 2023). There is a tendency for the incidence of excess weight to increase annually. Based on the Indonesian Health Survey, the prevalence of excess weight in West Nusa Tenggara was 14.2% in 2018, while in 2023 it was 18.7% (Indonesian Health Survey, 2023). Body Mass Index (BMI) is one way to define the anthropometric characteristics of height/weight of adults and categorize them into a group (Nuttal FQ, 2015).

Excess weight, including obesity, will affect male fertility. It is estimated that excess weight will affect the GnRH-FSH/LH pulsation system, which will then disrupt the gonadal system (Sertoli and Leydig cell function) in the spermatogenesis process. Previous research concluded that Body Mass Index (BMI) has a significant correlation with sperm quality (Heryantro et al., 2022). In addition, other research studies show a significant relationship between BMI and several sperm parameters such as semen volume, sperm concentration, and total sperm motility (En-Yin Wang et al., 2017), while in other studies, male BMI was not statistically significantly related to sperm parameters, including sperm motility (Ana Z. Nikolic et al., 2024).

Many studies have investigated the relationship between Body Mass Index (BMI) and sperm quality. Some literature studies conclude that a BMI above 30 kg/m2 significantly reduces sperm quality through decreased testosterone and oxidative stress. However, other studies have shown no significant association, necessitating further study. The novelty of this literature study is its understanding of the relationship between BMI and a specific sperm quality parameter, namely sperm motility. Furthermore, this study sampled clinical data from a local andrology practice, making the research findings more specific to male sperm quality issues.

Materials and Methods

This study used a cross-sectional design where data collection was only at one time with an observational analytical approach (Ghazali M V et al., 2006). The independent variable is a variable that, if changed, will result in changes in other variables, while the dependent variable is a variable that experiences changes due to changes in the independent variable (Sastroasmoro S et al., 2006). In this study, body mass index (Kg/m2) is the independent variable obtained through body weight (kg) and height (cm) data, while sperm motility is the dependent variable obtained from records of sperm analysis laboratory results with WHO 2010 criteria recorded in the Andrology practice of Duta Sehat Mataram Pharmacy. Body mass index is categorized into underweigth categories (BMI <18.5 Kg/m2), normal categories (BMI 18.5-25 Kg/m2) and overweigth categories >25 Kg/m2) (Ministry of Health of the Republic of Indonesia, 2018). Sperm motility is categorized into two categories: normal motility where progressive motility is >/= 32%, while abnormal motility where progressive motility is <32% (WHO, 2010). The inclusion criteria for this study were laboratory data on sperm analysis using the WHO 2010 criteria, data on body weight (kg) and height (cm). The exclusion criteria were diseases such as diabetes, varicocele, and azoospermia or zero sperm concentration. This study was conducted from November 2024 to April 2025 and has undergone an ethical review by the Health Research Ethics Committee of the Faculty of Medicine and Health Sciences, University of Mataram No. 055/UN18.F8/ETIK/2025. The sample that met the inclusion and exclusion criteria amounted to 44 respondents. This study used a correlation and descriptive analysis approach, where descriptive analysis aims to explain the general description of data characteristics and correlation analysis aims to find the relationship between independent and dependent variables. The type of correlation data analysis used is the Spearman correlation test, which is a nonparametric statistical test where the data variables are ordinal (Sugiyono, 2006). 2006).

Result and Discussion

In From September 2023 to December 2024, 60 cases of infertility were obtained, of which 16 cases were excluded, with 4 cases of azoospermia and 12 cases accompanied by varicocele, so that the sample that met the inclusion and exclusion criteria was 44. There were 70.4% of cases with overweight BMI, 27.3% of cases with normal BMI and 2.3% with thin BMI from 44 data that met the inclusion criteria (Figure 1). Of the 31 people or 70.4% of cases with the overweight BMI category, 6 of them had sperm motility disorders. There were also 12 cases with normal BMI categories, of which only 1 had sperm motility disorders, and only one case with thin BMI categories with sperm motility categorized as normal (Table 1).

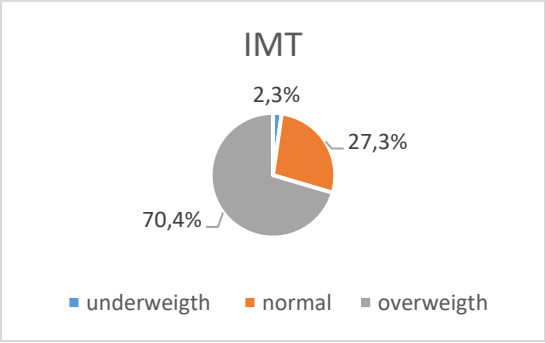

Figure 1. BMI Percentage

Table 1. Characteristics of Body Mass Index (BMI) with Sperm Motility

		Motilitas sperma		Total
		normal	abnormal	
IMT	underweigth	1	0	1
	normal	11	1	12
	overweigth	25	6	31
Total		37	7	44

The results of the Spearman correlation test (IBM SPSS 27) did not find a significant correlation (p = 0.338) between BMI and sperm motility (table 2).

Table 2. Spearman correlation test

Correlations

			IMT	motilitas_ progresif
Spearman's rho	IMT	Correlation Coefficient	1.000	-0.148
		Sig. (2-tailed)	.	0.338
		N	44	44
	motilitas_ progresif	Correlation Coefficient	-0.148	1.000
		Sig. (2-tailed)	0.338	.
		N	44	44

This study evaluated the relationship between men's body mass index (BMI) and sperm motility, with results showing a weak direction (-0.148) and no statistically significant relationship (p = 0.338). The results of this study are in accordance with research conducted by Ana Z. Nikolic which stated that men's BMI was not statistically significantly related to sperm parameters including sperm motility, however, in the in-vitro fertilization process, significantly lower embryo quality was found in the group of men with obese BMI (Ana Z. Nikolic et al, 2024). In Ana Z Nikolic's study, it was found that the majority of men had an overweight or obese BMI and the least number were thin men, this is similar to the distribution of men's BMI in this study. It is important to note that fertilization requires well-moving sperm to reach the site of fertilization of the egg, namely the ampulla of the fallopian tube. It is possible that the sperm of men with a fat BMI have good sperm motility so they can reach the fallopian tube and fertilize a woman's egg, but to get a good pregnancy, of course, a good embryo is also needed, where in Ana Z Nikolic's study found low embryo quality in obese men. In a study conducted by En-Yin Wang, the opposite was found, namely that male BMI has a significant relationship with sperm motility, especially in men with an overweight BMI with a tendency for poor sperm motility. In the study by En-Yin Wang, the exclusion criteria were men with azoospermia and oligozoospermia with a sperm concentration of 1x106/ml or below, which is slightly different from this study which only excluded men with azoospermia or zero sperm concentration (En-Yin Wang et al, 2017).

There is a wealth of evidence-based medical data showing a global trend toward declining sperm quality and an increasing prevalence of male infertility. However, little research has focused on the potential causes and risk factors for this phenomenon. Some of the causes and risk factors for male infertility include biological, physiological, psychological, environmental, genetic, and behavioral and lifestyle factors. Among these risk factors, behavioral and lifestyle factors are the most likely to be successfully addressed and prevented (Okunofua et al., 2022). Inadequate body mass is a risk factor for reproductive disorders in men, often caused by inappropriate lifestyle, eating, and dieting. Therefore, healthcare professionals, including male reproductive specialists, are required to provide an explanation of ideal body weight. In this study, the majority of men with decreased fertility were obese. Previous research has shown no correlation between semen motility in normal men and obese men, or men with a BMI above 30 kg/m2 (Gill et al., 2025).

Obesity is a chronic disease accompanied by metabolic disorders and various comorbidities such as diabetes, hypertension, and endocrine disorders caused by changes in the hypothalamic-pituitary-testicular axis, which can further cause gonadal dysfunction at the level of steroidogenesis and spermatogenesis. Obesity is associated with the production of pro-inflammatory cytokines and pathological amounts of reactive oxygen species (ROS) due to oxidative stress, which also negatively impacts male gonadal function or hypogonadism, namely decreased basic semen parameters, abnormal sperm chromatin maturity and

integrity, and epigenetic changes in male gametes (e.g., DNA methylation, histone modifications, and non-coding RNA alternation). Abnormal sperm chromatin status and epigenetic reprogramming can reduce the possibility of conception, negatively impact embryogenesis, and result in abnormal offspring phenotypes (Gill et al., 2025). However, the results of this study actually found the opposite, namely no correlation between obesity and sperm motility. This is also supported by Pavan-Jukic et al., who found no correlation between BMI and sperm motility in patients with Non-Obstructive Azoospermia (NOA), but did find that serum testosterone and gonadotropin levels correlated with BMI, which may affect male fertility (Pavan et al., 2020). Furthermore, other studies have also shown no correlation between BMI and sperm motility (Fernando et al., 2025).

Conclusion

This study concluded that there was no statistically significant relationship between body mass index and human sperm motility. Further research should consider other risk factors that may be associated with sperm motility, such as psychological factors, environmental factors, abdominal circumference, subcutaneous fat thickness, and semen viscosity.

Acknowledgements

This research was conducted independently and the authors received no financial support for the research, writing, or publication from any external party. The authors would like to thank the Ethics Team of the Faculty of Medicine and Health Sciences, University of Mataram, for their advice during the ethical review process.

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