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ORIGINAL ARTICLE

The relationship between body mass index and blood sugar levels among menopausal women

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ABSTRACT

Decreased estrogen levels during menopause are often associated with various health problems, one of which is carbohydrate metabolism disorders characterized by changes in blood sugar levels. The purpose of this study was to analyze the relationship between body mass index (BMI) and blood sugar levels in menopausal women. This study is an analytic descriptive study with a cross-sectional design. The research sample involved all women aged 40-60 years who met the inclusion criteria. The results showed that most of the respondents (75%) were included in the late elderly category (age >56 years). Based on BMI, the majority of respondents (35%) were categorized as obesity I. Additionally, 51.7% of respondents had high blood glucose levels. Statistical analysis revealed a significant relationship between age status and blood glucose levels (p-value = 0.000). Similarly, there was a significant relationship between BMI and blood glucose levels (p-value = 0.026). These results indicate that age and obesity are factors associated with increased blood sugar levels in menopausal women.

Keywords: diabetes mellitus, body mass index, blood sugar levels, menopause

Introduction

The unavoidable increase in aging populations worldwide presents a significant challenge. This demographic shift drives higher socioeconomic costs due to age-related morbidity and mortality. With the number of older adults expected to increase significantly by 2050, understanding the physiological changes associated with aging becomes crucial. These changes contribute to a range of chronic conditions, including cardiovascular disease, diabetes, sarcopenia, osteoporosis, and cognitive decline—often exacerbated by lifestyle factors. Consequently, a key focus is determining whether these age-related hormonal and metabolic alterations are preventable or reversible.[1,2] Aging is associated with decreased hormone production and changes in secretion patterns, a phenomenon referred to by various terms such as menopause, andropause, adrenopause, and somatopause.[3,4]

Menopause is the stage in a woman's life when menstruation permanently ceases, characterized by a decline in the production of the hormone estrogen.[5] Menopause is a widespread experience, with approximately 25 million women transitioning into it each year. By 2030, an estimated 1.2 billion women

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are projected to be menopausal or postmenopausal worldwide. This underscores the substantial global scale of this natural life stage.[6] These hormonal changes can impact various aspects of health, including carbohydrate metabolism, which is reflected in blood sugar levels.[7] Menopausal women often report that weight gain tends to be more rapid than before menopause. One of the changes in body function that occurs as people age is an increase in body fat.[8] The menopausal transition is associated with weight gain for many women.[9] Body Mass Index (BMI) is a commonly used measure to evaluate nutritional status and overweight or obesity. BMI is calculated by dividing a person's weight in kilograms by the square of their height in meters. Several previous studies have shown an association between BMI and increased risk of associated diseases such as type 2 diabetes. However, the relationship between BMI and blood sugar levels in women going through menopause is not fully understood.[10]

Research indicates that menopause is associated with metabolic changes, which can increase the risk of disorders related to carbohydrate metabolism. The menopausal transition is linked to alterations in body composition, insulin sensitivity, and glucose tolerance, as noted by Szmuilowicz and Seely[11]. These changes contribute to an increased risk of impaired glucose tolerance, type 2 diabetes mellitus, and other components of metabolic syndrome, as highlighted by Stachowiak et al.[12]. Postmenopausal women often experience elevated blood levels of glucose, insulin, cholesterol, and triglycerides, along with increased abdominal visceral fat. These metabolic shifts resemble those observed in type 2 diabetes and may accelerate the atherogenic process, which potentially explains the increased cardiovascular risk among postmenopausal women.[13,14]

Despite existing studies, research specifically examining the relationship between BMI and blood glucose levels in menopausal women remains limited.[15] Multiple studies have demonstrated a significant association between body mass index (BMI) and blood glucose levels, particularly in women. Research conducted on pregnant women with a family history of diabetes found that higher BMI categories were linked to an increased risk of elevated postprandial blood glucose levels.[16] In an African population, females had significantly higher BMI than males. However, a positive but non-significant correlation between casual blood sugar and BMI was observed in women.[17] This study aims to address a gap in the literature by specifically investigating the intricate relationship between BMI and blood glucose levels in menopausal women. While prior research has explored this association in various populations, including pregnant women and specific ethnic groups, its impact on this unique demographic remains largely understudied. This research will contribute valuable insights into the metabolic changes experienced by menopausal women and may inform tailored interventions aimed at mitigating the risk of related health complications.

Method

This study adopted a cross-sectional design, a type of observational study that aims to describe and analyze the relationship between variables at a single point in time. The study population consisted of all women aged 40-60 years in Komplek X Martubung, Medan Labuhan. A sample of 60 respondents was selected from this population in November 2024.

In this study, primary data were collected directly from menopausal women. The data included body mass index (BMI) and the results of blood glucose level examinations conducted at any time. After obtaining informed consent, capillary blood samples were taken from the respondents. These blood samples were then analyzed to measure their blood glucose levels. Based on the examination results, blood glucose levels were categorized as either normal or high. All obtained data were subsequently analyzed univariately and bivariately using SPSS software version 27..

Results

This study involved 60 respondents. Based on age, the majority were categorized as late elderly, comprising 45 individuals (75%), while the remaining 15 individuals (25%) were classified as early elderly. Regarding BMI, the most prevalent category was obesity I, with 21 respondents (35%), followed by the normal category with 19 respondents (31.7%). The overweight category included 15 individuals (25%), Underweight accounted for 4 individuals (6.7%), and only 1 individual (1.7%) fell into the obesity II category. Concerning blood glucose levels, there was a slight difference between the number of respondents with normal blood glucose (29 individuals or 48.3%) and those with high blood glucose (31 individuals or 51.7%), with the latter slightly outnumbering the former.

Table 2 shows that both age and BMI significantly associate with blood sugar levels. Advanced age and high BMI, particularly obesity, are recognized risk factors for elevated blood sugar levels. In the early elderly group, a majority exhibited normal blood sugar levels (23.3%), while a small proportion had high blood sugar levels (1.7%). In contrast, the late elderly group predominantly exhibited high blood sugar levels (50.0%), with a smaller proportion maintaining normal levels (25%). This indicates that as a person ages, the risk of experiencing high blood sugar levels increases.

Table 1. Subject characteristics (n=60)

Characteristic	n	%
Age		
Early elderly	15	25,0
Late elderly	45	75,0
Body Mass Index		
Underweight	4	6,7
Normal	19	31,7
Overweight	15	25,0
Obesity I	21	35,0
Obesity II	1	1,7
Blood glucose		
Normal	29	48,3
High	31	51,7

Individuals classified as underweight had an equal proportion of normal and high blood sugar levels (3.35% for each). In the normal BMI category, a greater number of individuals had normal blood sugar levels (23.4%) compared to those with high levels (8.3%). As BMI categories increased (overweight, obesity I, and obesity II), the proportion of individuals with high blood sugar levels also rose. In the obesity I category, the proportion of individuals with high blood sugar levels (27.0%) was significantly greater than those with normal levels (8.3%). Notably, only one individual in the obesity II category had high blood sugar levels (1.7%). This suggests that higher BMI, especially in the obese categories, correlates with an increased risk of elevated blood sugar levels.

Table 2. Relationship between age and BMI with blood glucose levels

Variable	Blood glucose				p
	Normal		High		
	n	%	n	%	
Age					
Early elderly	14	23,3	1	1,7	0,000
Late elderly	15	25	30	50,0	
Body Mass Index					
Underweight	2	3,35	2	3,35	0,000
Normal	14	23,4	5	8,3	
Overweight	8	13,3	7	12,0	
Obesity I	5	8,3	16	27,0	
Obesity II	-	-	1	1,7	

Discussion

This study explored the relationship between age, body mass index (BMI), and blood glucose levels in a sample of 60 individuals. The participant group was predominantly composed of late elderly individuals (75%), with the remaining 25% classified as early elderly. Regarding BMI, obesity I was the most prevalent category (35%), followed by normal weight (31.7%). Overweight individuals comprised 25% of the sample, while underweight and obesity II categories represented smaller proportions (6.7% and 1.7%, respectively). Interestingly, the distribution of blood glucose levels was almost even, with a slight majority exhibiting high blood glucose (51.7%) compared to those with normal levels (48.3%).

The analysis revealed a strong association between both age and BMI with blood glucose levels. This finding aligns with established knowledge that advancing age and elevated BMI, particularly obesity, are risk factors for increased blood sugar. Examining the interplay of age and blood glucose, a clear trend emerged. Within the early elderly group, a larger proportion maintained normal blood sugar levels (23.3%), with only a small fraction exhibiting high levels (1.7%). Conversely, in the late elderly group, high blood sugar was considerably more prevalent (50.0%) compared to normal levels (25%). This shift underscores the increasing susceptibility to elevated blood sugar with advancing age.

Research consistently indicates a strong association between age, body mass index (BMI), blood glucose levels, and diabetes risk. With age, individuals become more susceptible to elevated blood sugar.[18,19] However, the link between obesity and hyperglycemia seems to diminish with age.[20] In younger adults, each unit increase in BMI correlates with a 23% higher risk of developing diabetes.[18] Age directly affects blood glucose, cholesterol, and blood pressure; BMI primarily influences blood pressure. The interaction between age and BMI is complex, with BMI mediating the effects of age on both blood glucose and cholesterol levels.[21]These findings emphasize the necessity of maintaining a healthy BMI—especially in younger adults—to reduce the risk of diabetes and cardiovascular factors as they age.

Numerous studies demonstrate a positive correlation between body mass index (BMI) and blood glucose levels. Research in the United States found that elevated BMI is associated with a higher risk of diabetes complications, particularly at lower BMI levels in women compared to men.[22] A study in Nigeria revealed a strong positive correlation between BMI and blood glucose levels, especially among female undergraduates.[23] Similarly, a study in Qatar reported a positive association between BMI and blood sugar levels, indicating that higher BMI categories are linked to an increased risk of type 2 diabetes mellitus.[24] Collectively, these findings emphasize the importance of maintaining a healthy BMI to mitigate the risk of elevated blood glucose levels and related health complications.

Conclusion

The majority of respondents were classified as elderly (75%), while the remaining respondents were categorized as early elderly (25%). According to BMI classifications, the most prevalent category was obesity I (35%), followed by normal weight (31.7%), overweight (25%), underweight (6.7%), and obesity II (1.7%). The distribution of blood glucose levels was nearly uniform, with a slightly higher proportion of respondents exhibiting high blood glucose levels (51.7%) compared to those with normal levels (48.3%). The results indicated a significant relationship between age, BMI, and blood glucose levels. As the BMI category increased, the proportion of respondents with high blood glucose levels also rose, particularly among those classified in obesity category I (27%). These findings align with previous studies indicating that advanced age and elevated BMI—especially obesity—are significant risk factors for increased blood glucose levels and diabetes. These findings underscore the importance of maintaining a healthy BMI from a young age to mitigate the risk of diabetes and cardiovascular issues later in life.

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