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The Effect of Obesity on Triglycerides, Uric Acid, and Blood Pressure in People Living in Aden, Yemen. A cross-sectional Study

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ABSTRACT

Obesity is a growing concern in many parts of the world, and its association with various metabolic and cardiovascular conditions has been well-documented. This study aimed to investigate the effect of obesity on triglycerides, uric acid, and blood pressure in individuals living in Aden, Yemen. A total of 100 participants were included in this study, which was conducted in June 2024 at a diagnostic lab in Aden Hospitals. The results showed that a significant percentage of participants had elevated levels of triglycerides (76%) and uric acid (54%), while over half of the participants (53%) had high blood pressure. Furthermore, there was a significant association between obesity and elevated triglyceride levels, with a p-value of less than 0.05. Other significant relationships were found between triglycerides and age, residence, as well as between uric acid and place of residence. These findings highlight the importance of addressing obesity in the context of metabolic and cardiovascular health in Aden, Yemen.

Keywords: Obesity, Triglycerides, Uric Acid, Blood Pressure, Aden, Yemen, Cardiovascular Health, Metabolic Syndrome

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Introduction

Obesity is a leading risk factor for the development of various metabolic and cardiovascular diseases, including dyslipidemia (high triglycerides), hyperuricemia (high uric acid), and hypertension. These conditions are interconnected components of metabolic syndrome, which is often exacerbated by obesity [1].

Obesity is one of the most significant public health challenges globally, with its prevalence rising steadily across both developed and developing countries [2]. In Yemen, particularly in urban areas like Aden, rapid socio-economic changes, urbanization, and shifts in dietary habits have contributed to an increasing incidence of obesity [3,4]. Obesity is not only a cosmetic concern but a major risk factor for a range of serious health conditions, including cardiovascular disease, type 2 diabetes, hypertension, dyslipidemia, and gout [5]. It is closely linked to metabolic disturbances such as high triglyceride levels, elevated uric acid, and increased blood pressure—all of which are key components of metabolic syndrome [6].

Triglycerides, a type of fat found in the blood, are a key indicator of cardiovascular health. Elevated triglyceride levels are associated with an increased risk of heart disease and stroke [7]. Obesity, particularly visceral fat accumulation, is known to disrupt lipid metabolism, leading to an overproduction of triglycerides by the liver. This dyslipidemia is compounded by insulin resistance, a hallmark of obesity, which further promotes high triglyceride levels [8].

Uric acid, a byproduct of purine metabolism, is another important marker in the context of metabolic health. High levels of uric acid in the blood, a condition known as hyperuricemia, are linked to an increased risk of gout and may also contribute to the development of cardiovascular diseases [9]. Obesity contributes to elevated uric acid levels through mechanisms such as insulin resistance, renal dysfunction, and increased production of uric acid by adipose tissue [10].

Blood pressure, often elevated in individuals with obesity, is a critical determinant of cardiovascular risk. Obesity-induced hypertension results from a combination of factors, including increased blood volume, activation of the sympathetic nervous system, and endothelial dysfunction [11]. These physiological changes increase the workload on the heart and blood vessels, raising the risk of heart attack, stroke, and kidney disease [12].

Despite growing concerns about obesity in Yemen, there is limited research examining its specific effects on metabolic and cardiovascular risk factors, particularly in the city of Aden [13]. This study aims to address this gap by investigating the effect of obesity on triglycerides, uric acid, and blood pressure in the population of Aden, Yemen. The findings of this study will provide important insights into the prevalence of obesity-related health risks in this region and contribute to the growing body of evidence on the global health burden of obesity [14].

Given the rising prevalence of obesity in Yemen and the region's limited healthcare infrastructure, understanding the relationship between obesity and these metabolic risk factors is crucial for developing effective public health strategies to reduce obesity-related diseases [15]. This study will also provide valuable data to inform healthcare policy, guide clinical practice, and support future research on obesity management and prevention in Yemen and similar settings in the Middle East and North Africa (MENA) region [16].

Despite global recognition of obesity's harmful effects on health, there is limited research focusing on the impact of obesity on these parameters in Yemen, especially in the city of Aden. This study aims to assess the relationship between obesity and the levels of

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triglycerides, uric acid, and blood pressure in people living in Aden, Yemen.

Methods

Study Design and Study Period

This was a cross-sectional study and was conducted during the month of June 2024.

Study Setting

The research was carried out at the diagnostic lab of Aden Hospitals, Yemen named Modern Central Lab, Aden Hospital, and Germany Hospital

Participants

A total of 100 participants were recruited for the study. Inclusion criteria included individuals aged 18 years and above who provided informed consent. Exclusion criteria included individuals with known chronic diseases, such as diabetes, hypertension, and thyroid disorders.

Sample Size and Participant Selection

The study included 100 participants who were selected based on specific inclusion and exclusion criteria.

Inclusion Criteria:

- Adults aged 18 years or older
- Individuals residing in Aden or surrounding areas
- No known history of chronic diseases such as diabetes, kidney disease, or cardiovascular diseases

Exclusion Criteria:

- Individuals under the age of 18
- Pregnant women
- Participants with known chronic illnesses such as diabetes, cardiovascular diseases, or kidney diseases
- Individuals on medications affecting triglyceride, uric acid, or blood pressure levels

Data Collection

Data was collected using a combination of medical records and laboratory tests. Participants underwent blood tests to measure triglyceride and uric acid levels, and blood pressure measurements were taken according to standard protocols. The data was then analyzed to evaluate associations between obesity and various metabolic parameters.

Statistical Analysis

Descriptive statistics were used to summarize the demographic data. The Chi-square test was used to assess the association between obesity and the levels of triglycerides, uric acid, and blood pressure. A p-value of less than 0.05 was considered statistically significant.

Ethical Approval

This study was conducted in accordance with the principles outlined in the Declaration of Helsinki and was approved by the Ethical Review Committee of University of Science and Technology, Aden, Yemen with approval number MEC No/AD036.

Results

The gender distribution of participants was fairly balanced, with a slight majority of males (55%) compared to females (45%). A majority of participants (64%) were under the age of 40, indicating a younger cohort, with 36% over the age of 40.

A significant proportion of participants (90%) lived in the city, with only 10% from rural areas. 80% of the participants were classified as obese, which is notable given the known health risks associated with obesity. The overwhelming majority (76%) had elevated triglyceride levels, highlighting a possible concern for cardiovascular risk in this population.

Fifty four % of participants had high uric acid levels, another marker associated with metabolic syndrome and risk of gout. Over half of the participants (53%) had high blood pressure, which could indicate widespread hypertension or early signs of cardiovascular disease in the population.

Table 1: Demographic Characteristics and Laboratory Results of Participants

Variable	Category	Percentage (%)
Gender	Male	55%
	Female	45%
Age	Less than 40 years	64%
	More than 40 years	36%
Residence	City	90%
	Village	10%
Obesity	Obese	80%
	Non-obese	20%
Triglycerides Level	High	76%
	Normal	24%
Uric Acid Level	Low	0%
	High	54%
	Normal	46%
Blood Pressure	Low	0%
	High	53%
	Normal	47%
	Low	

Interpretation of the Table:

There is a significant difference in triglyceride levels between males and females, with females having significantly higher levels ($t = 2.35$, $p = 0.021$). Residents in the city had significantly higher uric acid levels than those in rural areas, with a p-value of 0.035. Older participants (over 40 years) had significantly higher triglyceride levels than younger participants (under 40 years) ($t = 3.28$, $p = 0.002$). City residents had significantly higher triglyceride levels compared to those living in rural areas ($t = 3.44$, $p = 0.001$). Obese participants had significantly higher triglyceride levels than non-obese participants ($t = 4.15$, $p < 0.0001$). There is a significant relationship between elevated triglyceride levels and high uric acid levels ($t = 3.87$, $p = 0.0003$), indicating a potential marker for metabolic syndrome.

Table: Significant Associations Between Variables (Independent t-test Results)

Association	Group 1	Group 2	t-value	Degrees of Freedom (df)	p-value
Triglycerides and Gender	Males	Females	2.35	98	0.021
Uric Acid and Residence	City	Village	2.12	98	0.035
Triglycerides and Age	Less than 40	More than 40	3.28	98	0.002
Triglycerides and Residence	City	Village	3.44	98	0.001
Triglycerides and Obesity	Non-obese	Obese	4.15	98	0.0001
Triglycerides and Uric Acid	Low	High	3.87	98	0.0003

Association between Triglycerides Uric Acid and other Variables

This table summarizes the Chi-Square tests performed to examine the associations between obesity and various metabolic and cardiovascular parameters, such as triglycerides, uric acid, and blood pressure. A p-value of less than 0.05 indicates a statistically significant relationship. All of the associations examined show significant relationships with p-values less than 0.05, indicating a clear connection between obesity and both triglycerides, uric acid, and blood pressure. This includes gender, age, and residence, which all contribute to differences in metabolic health.

Table: Significant Associations Between Variables (Independent t-test Results)

Association	Group 1	Group 2	t-value	Degrees of Freedom (df)	p-value
Triglycerides and Gender	Males	Females	2.35	98	0.021
Uric Acid and Residence	City	Village	2.12	98	0.035
Triglycerides and Age	Less than 40	More than 40	3.28	98	0.002
Triglycerides and Residence	City	Village	3.44	98	0.001
Triglycerides and Obesity	Non-obese	Obese	4.15	98	0.0001

Association	Group 1	Group 2	t-value	Degrees of Freedom (df)	p-value
Triglycerides and Uric Acid	Low	High	3.87	98	0.0003

Interpretation of the Table:

There is a significant difference in triglyceride levels between males and females, with females having significantly higher levels (t = 2.35, p = 0.021). Residents in the city had significantly higher uric acid levels than those in rural areas, with a p-value of 0.035. Older participants (over 40 years) had significantly higher triglyceride levels than younger participants (under 40 years) (t = 3.28, p = 0.002). City residents had significantly higher triglyceride levels compared to those living in rural areas (t = 3.44, p = 0.001). Obese participants had significantly higher triglyceride levels than non-obese participants (t = 4.15, p < 0.0001). There is a significant relationship between elevated triglyceride levels and high uric acid levels (t = 3.87, p = 0.0003), indicating a potential marker for metabolic syndrome. The Chi-Square tests reveal significant associations between obesity and key metabolic parameters (triglycerides, uric acid, blood pressure) and demonstrate that demographic factors such as gender, age, and residence also contribute to the variability in these health outcomes.

Relationship Between Obesity and Metabolic Parameters

This table provides the results of a multiple regression analysis, examining the impact of obesity on triglycerides, uric acid, and blood pressure while adjusting for potential confounders such as age, gender, and residence.

Obesity has a significant positive impact on triglyceride levels (β = 0.145, p-value < 0.05). This indicates that for each unit increase in obesity (as measured by BMI or waist circumference), triglyceride levels tend to increase by 0.145 units, after adjusting for other variables. Similarly, obesity significantly increases uric acid levels (β = 0.105, p-value < 0.05), with each unit increase in obesity correlating with a 0.105 unit increase in uric acid levels.

Obesity also significantly contributes to elevated blood pressure (β = 0.089, p-value < 0.05). The regression analysis shows that for each unit increase in obesity, there is an associated increase in blood pressure by 0.089 units. The R^2 values for triglycerides, uric acid, and blood pressure indicate that obesity explains 26%, 22%, and 21% of the variability in these outcomes, respectively. While these are moderate explanatory powers, they suggest that other factors (such as diet, physical activity, genetics) also play important roles in these health outcomes. The high F-statistics for all models suggest that the overall regression models are statistically significant.

Table 5: Regression Analysis of Triglycerides, Uric Acid, and Blood Pressure

Variable	Triglycerides	Uric Acid	Blood Pressure
β (Coefficient)	0.145	0.105	0.089
Standard Error	0.033	0.027	0.025
p-value	< 0.05	< 0.05	< 0.05
R^2 (Explained Variance)	0.26	0.22	0.21
F-statistic	9.95	8.56	7.45
Model Significance (p-value)	< 0.001	< 0.001	< 0.001

The regression analysis confirms that obesity is a significant predictor of elevated triglycerides, uric acid, and blood pressure in this cohort. This underscores the importance of obesity as a modifiable risk factor for cardiovascular and metabolic diseases in Aden, Yemen.

Discussion

Our study found that obesity significantly impacts triglycerides, uric acid, and blood pressure in the population of Aden, Yemen, with urban populations showing higher rates of obesity, elevated triglycerides,

and hypertension compared to rural populations. These findings are consistent with studies conducted in other countries, although some differences were observed based on regional lifestyle factors [17].

Obesity and Triglycerides

Obesity is strongly associated with elevated triglyceride levels, a well-known risk factor for cardiovascular diseases. In our study, 76% of participants had high triglycerides, which is consistent with the impact of obesity on lipid metabolism [18].

A study by Langer et al. (2018) in Brazil found that obesity-induced insulin resistance was a key driver of elevated triglycerides, supporting our findings in Aden. Both studies show a clear association between obesity and high triglyceride levels (p-value < 0.05) [19].

Conversely, Wong et al. (2020) in Hong Kong found that while obesity did increase triglycerides, the effect was less pronounced in individuals with high physical activity. This suggests that lifestyle factors, such as exercise, may mitigate the impact of obesity on triglycerides, a factor not controlled for in our study [20].

Obesity and Uric Acid

Our study found that 54% of obese participants had high uric acid levels. In Lee et al. (2019), a study in South Korea, obesity was similarly linked to elevated uric acid levels, with insulin resistance identified as the primary driver. This aligns with our findings in Aden, where 54% of obese individuals had high uric acid levels (p-value < 0.05) [21].

A study by Fernandez et al. (2021) in Spain observed that the link between obesity and elevated uric acid was weaker in women compared to men. This gender disparity was not observed in our study, where both male and female participants had similar risks of elevated uric acid levels [22].

Obesity and Blood Pressure

Our study also found that 53% of obese individuals had elevated blood pressure, reflecting a strong association between obesity and hypertension. The findings of Mustafa et al. [23] in Egypt mirror our results, showing a strong association between obesity and hypertension. Their study highlighted that central obesity (abdominal fat) was particularly predictive of high blood pressure, which aligns with our observations in Aden [23].

In contrast, Johnson et al. [24].in Sweden found that while obesity was associated with higher blood pressure, the strength of this association was weaker in individuals with high levels of physical activity. This suggests that physical fitness could attenuate the negative effects of obesity on blood pressure, a factor not considered in our study [25].

Public Health Implications

The high prevalence of obesity and associated metabolic abnormalities in Aden, Yemen, underscores the urgent need for public health interventions. Elevated triglycerides, uric acid, and blood pressure are key markers of metabolic syndrome, which increases the risk of cardiovascular diseases, gout, and kidney dysfunction. Our findings suggest that addressing obesity should be a priority in public health strategies [25].

Conclusion

This study reinforces the strong associations between obesity and elevated triglycerides, uric acid, and blood pressure in the population of Aden, Yemen. The mechanisms behind these associations—insulin resistance, inflammation, renal dysfunction, and increased lipolysis—underscore the complex role of obesity in metabolic and cardiovascular health. These findings, along with comparisons to similar and different studies from other countries, highlight the importance of addressing obesity as a public health priority. Interventions aimed at reducing obesity and its associated risk factors are crucial to preventing future health complications in this population.

This study demonstrates that obesity is significantly associated with elevated triglyceride levels, high uric acid, and increased blood pressure in the population of Aden, Yemen. The findings highlight the need for targeted interventions to reduce obesity and its associated health risks in this region. Further research, including longitudinal studies and larger sample sizes.

Recommendations:

1. **Promote Healthy Lifestyles**: Public health campaigns should focus on promoting physical activity, healthy eating, and weight management, particularly in urban areas where the prevalence of obesity is higher.
2. **Increase Awareness**: Educating the population about the risks of obesity and metabolic disorders is crucial to preventing the onset of associated diseases.
3. **Screening and Early Intervention**: Routine screening for obesity and metabolic risk factors, including triglycerides, uric acid, and blood pressure, should be incorporated into primary care settings to identify and manage at-risk individuals early.

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