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Original Research Article

Association of Liver Enzyme Levels with Metabolic Syndrome among the Selected Manipuri Population

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Abstract:

Introduction: A group of illnesses known as Metabolic Syndrome (MetS) increases the risk of diabetes and cardiovascular disease. Metabolic Syndrome is a serious public health concern. The correlation between MetS and liver enzyme levels has garnered interest, especially among groups experiencing abrupt lifestyle shifts.

Aim: This study aims to investigate the relationship between liver enzyme levels and the prevalence of metabolic syndrome among the selected Manipuri population.

Materials and Methods: A cross-sectional study was conducted among 300 adults aged 18 years and above in Manipur, India, from January 2022 to June 2022. Participants were recruited through community outreach programs, and individuals with known liver diseases, alcohol dependence, or chronic infections were excluded. Data were collected using structured questionnaires covering demographic information, lifestyle factors, and medical history. Anthropometric measurements and fasting blood samples were obtained for biochemical analyses, including liver enzyme levels (ALT and AST), fasting glucose, and lipid profiles. MetS has been diagnosed according to the International Diabetes Federation Criteria. Statistical analysis was performed using spss version 25.0, with logistic regression models applied to assess associations between liver enzyme levels and mets, adjusting for potential confounders.

Results: Out of the 300 participants, 32% were diagnosed with metabolic syndrome. Elevated ALT and AST levels were significantly associated with the presence of metabolic syndrome ($p < 0.05$). Notably, individuals with higher liver enzyme levels exhibited increased prevalence of abdominal obesity, elevated triglycerides, and insulin resistance.

Conclusion: This study highlights a significant association between liver enzyme levels and metabolic syndrome among the Manipur population. The findings suggest that liver function tests could serve as valuable biomarkers for identifying individuals at risk of metabolic disorders, emphasizing the need for targeted public health interventions.

Keywords: metabolic syndrome, liver enzymes, ALT, AST, public health.

Introduction

Metabolic syndrome (MetS) is a cluster of conditions, including obesity, hypertension, dyslipidemia, and insulin resistance that significantly increases the risk of cardiovascular diseases and type 2 diabetes [1].

The global prevalence of mets has risen alarmingly, particularly in developing regions like India, where rapid urbanization and lifestyle changes contribute to the increasing burden of non-communicable diseases [2]. Lifestyle shifts, including dietary changes and decreased physical activity, have been associated with a growing incidence of metabolic disorders, highlighting the urgent need for localized research on this public health issue. Liver enzymes, particularly alanine aminotransferase (alt) and aspartate aminotransferase (ast), are commonly used markers for liver function and integrity.

Recent studies have suggested a link between altered liver enzyme levels and metabolic syndrome, potentially reflecting the underlying metabolic derangements associated with this condition [3,4]. Elevated levels of these enzymes may indicate liver steatosis,

a condition that is frequently observed in individuals with mets, suggesting a complex interplay between liver health and metabolic abnormalities [5].

Research indicates that elevated liver enzyme levels are often associated with obesity and insulin resistance, two primary components of mets [6]. For instance, a study by mofidi et al. found that individuals with higher alt levels exhibited a greater prevalence of mets, indicating that liver function tests could serve as useful biomarkers in assessing metabolic risk [7]. Furthermore, the presence of non-alcoholic fatty liver disease (NAFLD), characterized by excessive fat accumulation in the liver, has been recognized as a common manifestation of metabolic syndrome, further underscoring the importance of monitoring liver enzymes in this context [8].

In the selected Manipuri population, there is a dearth of comprehensive studies exploring the relationship between liver enzyme levels and metabolic syndrome. Local dietary practices, genetic predispositions, and lifestyle factors may uniquely influence these associations, necessitating focused research to better understand the regional health landscape [9]. This study aims to investigate the association between liver enzyme levels and the prevalence of metabolic syndrome in the Manipuri population, contributing to the broader understanding of metabolic disorders in this demographic.

By exploring the link between liver enzyme levels and metabolic syndrome in this specific population, we hope to provide insights that could inform public health strategies and clinical practices tailored to the unique needs of the north eastern community. Such research could pave the way for preventive measures and targeted interventions that address both liver health and metabolic risks, ultimately improving health outcomes in the region. Understanding these associations is crucial, as metabolic syndrome continues to emerge as a significant health challenge globally and within India, particularly among populations undergoing rapid lifestyle transitions.

This study seeks to bridge the knowledge gap regarding liver enzymes and metabolic syndrome in the Manipuri population, emphasizing the need for localized research that can guide effective health interventions.

Aim: The aim of this study is to investigate the association between liver enzyme levels and metabolic syndrome among the Manipuri population.

Objectives:

1. To assess the prevalence of metabolic syndrome in the study population.
2. To evaluate liver enzyme levels (alt and ast) in individuals with and without metabolic syndrome.
3. To explore the relationship between liver enzyme levels and individual components of metabolic syndrome, including obesity, hypertension, and dyslipidaemia.

Materials and Methods

This cross-sectional study aimed to investigate the association between liver enzyme levels and metabolic syndrome among adults in Manipur. Ethical approval has been obtained from the institutional review board and informed consent was secured from all participants.

Study population: Participants aged 18 years and above were recruited through community outreach programs between January 2022 and June 2022.

Exclusion criteria: Individuals with known liver diseases, alcohol dependence, or chronic infections (e.g., hepatitis) were excluded to ensure that liver enzyme levels reflected metabolic conditions rather than hepatic pathology [10,11].

Sample size calculation: Sample size was determined using the formula for cross-sectional studies, assuming a prevalence of metabolic syndrome of approximately 30% in the population [12]. A total of 300 participants were enrolled to ensure adequate statistical power.

Data collection: Demographic and clinical data were collected via structured questionnaires, including age, sex, medical history, and lifestyle factors such as diet and physical activity. Standardized techniques were employed for anthropometric measurements, including weight, height, waist circumference, and blood pressure [13].

Laboratory measurements: Fasting blood samples were collected for biochemical analyses. Liver enzyme levels (alt and ast) were measured using standard enzymatic assays [14]. Additionally, blood samples were analysed for fasting glucose and lipid profiles (triglycerides, total cholesterol, LDL, and HDL) to evaluate components of metabolic syndrome according to international diabetes federation criteria [15].

Definition of metabolic syndrome: Metabolic syndrome was diagnosed based on the presence of at least three of the following criteria: abdominal obesity (waist circumference >90 cm for men, >80 cm for women), elevated triglycerides (≥150 mg/dl), reduced HDL cholesterol (<40 mg/dl for men, <50 mg/dl for women), elevated blood pressure (≥130/85 mmhg), and elevated fasting glucose (≥100 mg/dl) [16,17].

Statistical analysis: Data were analysed using SPSS version 25.0. Descriptive statistics are computed for clinical characteristics and demographic. The relationship between liver enzyme levels and metabolic syndrome was

assessed using logistic regression models, adjusting for potential confounders such as age, sex, and body mass index [18,19]. A p-value of <0.05 was considered statistically significant.

Results:

This study analysed data from 300 participants in Manipur to assess the association between liver enzyme levels and metabolic syndrome (MetS). The demographic characteristics of the study population are summarized in table 1.

Table 1: Demographic characteristics of participants

Characteristic	N (%)
Age (mean ± sd)	42.8 ± 8.1
Gender	
Male	150 (50.0)
Female	150 (50.0)
BMI (mean ± sd)	27.1 ± 4.5
Waist circumference (mean ± sd)	92.3 ± 10.1

Among the participants, 96 individuals (32%) were diagnosed with metabolic syndrome. The prevalence of the components of mets is illustrated in table 2.

Table 2: Prevalence of components of mets

Component	Prevalence (%)
Abdominal obesity	55
Elevated triglycerides	40
Reduced hdl cholesterol	35
Elevated blood pressure	30
Elevated fasting glucose	25

Liver enzyme levels (alt and ast) were significantly higher in participants with metabolic syndrome compared to those without. Results are presented in table 3.

Table 3: Liver enzyme levels in participants with and without metabolic syndrome

Group	Alt (u/l) (Mean ± SD)	Ast (u/l) (Mean ± SD)
Without metabolic syndrome	22.5 ± 5.1	23.4 ± 4.2
With metabolic syndrome	38.6 ± 10.3	35.2 ± 9.8

The difference in liver enzyme levels between the two groups was statistically significant ($p < 0.01$).

Correlation analysis: A correlation analysis revealed a positive association between liver enzyme levels and the individual components of metabolic syndrome, particularly with abdominal obesity and elevated triglycerides (table 4).

Table 4: Correlation between liver enzyme levels and components of metabolic syndrome

Component	Correlation coefficient (r)	P-value
Abdominal obesity	0.65	<0.001
Elevated triglycerides	0.58	<0.001
Reduced HDL cholesterol	-0.42	<0.01
Elevated blood pressure	0.35	<0.05
Elevated fasting glucose	0.40	<0.01

The results indicate that participants with metabolic syndrome exhibit significantly elevated liver enzyme levels, suggesting a link between liver health and metabolic abnormalities. Notably, elevated ALT and AST levels were strongly correlated with abdominal obesity and dyslipidaemia, indicating potential biomarkers for identifying individuals at risk for MetS in the Manipuri population.

Discussion

This study investigated the association between liver enzyme levels and metabolic syndrome (MetS), revealing significant findings that highlight the relationship between liver health and metabolic abnormalities. Our results indicated that participants diagnosed with MetS exhibited notably elevated levels of alanine aminotransferase (alt) and aspartate aminotransferase (ast). This suggests a critical connection between liver function and metabolic health, reinforcing the idea that liver enzymes could serve as potential biomarkers for identifying individuals at risk of developing mets. The prevalence of mets observed in our study was 32%, which aligns with findings from similar studies in urban populations across India [20]. The rising incidence of MetS reflects broader trends influenced by lifestyle changes, including sedentary behaviour,

dietary shifts, and increased stress levels. These changes have been particularly pronounced, necessitating urgent public health interventions.

Our results demonstrated that elevated ALT and AST levels were significantly associated with components of MetS, particularly abdominal obesity and dyslipidemia. This finding is consistent with previous studies that have linked liver dysfunction to metabolic disorders [21,22]. The correlation coefficients indicated a robust relationship, particularly with abdominal obesity, which has been recognized as a central feature of MetS. This association underscores the role of the liver in regulating metabolic processes, such as lipid metabolism and glucose homeostasis. The relationship between liver enzyme levels and metabolic syndrome can be partly explained by the pathophysiology of non-alcoholic fatty liver disease (NAFLD). NAFLD is characterized by excessive fat accumulation in the liver, often associated with insulin resistance and dyslipidaemia. Elevated liver enzymes, particularly ALT and AST, are commonly observed in individuals with NAFLD. As the prevalence of obesity and metabolic syndrome increases, so does the incidence of NAFLD, creating a feedback loop that exacerbates liver dysfunction and metabolic abnormalities.

Our findings also have implications for public health strategies aimed at preventing and managing MetS. The identification of elevated liver enzymes as potential biomarkers for MetS emphasizes the importance of routine liver function tests in metabolic assessments. Monitoring liver health could facilitate early detection of individuals at risk, allowing for timely interventions to promote lifestyle modifications. These interventions could include dietary counselling, increased physical activity, and behavioural therapies aimed at reducing weight and improving metabolic profiles. Furthermore, the relationship between liver enzyme levels and abdominal obesity highlights the need for targeted strategies addressing weight management. Given that abdominal obesity is a significant risk factor for both MetS and liver disease, addressing this issue could have a profound impact on reducing the overall burden of metabolic disorders in the Manipur population. Community-based programs focusing on nutrition education, physical activity promotion, and health screenings could play a pivotal role in addressing these challenges.

While this study provides valuable information, certain limitations can be acknowledged. The cross-sectional design restricts our ability to establish causal relationships; therefore, longitudinal studies are necessary to better understand the temporal dynamics between liver enzyme levels and the development of MetS. Additionally, the study sample consisted of adults from a specific geographic region, which may limit the generalizability of the findings to other populations. Future research should consider a broader demographic to capture diverse factors influencing liver health and metabolic syndrome. The mechanisms underlying the relationship between elevated liver enzyme levels and metabolic syndrome may also warrant further investigation. For instance, inflammation, oxidative stress, and the gut-liver axis have been implicated in the pathogenesis of both liver disease and metabolic disorders. Understanding these underlying mechanisms could provide insights into potential therapeutic targets and inform the development of effective interventions.

In light of the growing burden of metabolic syndrome in India, addressing lifestyle factors through public health initiatives is crucial. Strategies that incorporate community engagement and cultural sensitivity can enhance the effectiveness of these interventions. Collaborating with local stakeholders to develop programs tailored to the unique needs of the Manipuri population could foster a more supportive environment for healthy lifestyle changes.

Conclusion

This study highlights a significant association between elevated liver enzyme levels and metabolic syndrome. Our findings suggest that liver function tests may serve as valuable biomarkers for identifying individuals at risk for MetS. The strong correlation between liver enzyme levels and components of MetS, particularly abdominal obesity and dyslipidaemia, underscores the need for targeted public health strategies aimed at addressing the rising prevalence of metabolic disorders. Through proactive measures focusing on lifestyle modifications and regular health screenings, it may be possible to mitigate the growing burden of metabolic syndrome and improve overall health outcomes in this region.

Limitations of this study

Includes its cross-sectional design, which does not allow for causal inferences. Longitudinal studies are warranted to further investigate the temporal relationship between liver enzyme levels and the development of metabolic syndrome. Additionally, while the study controlled for potential confounding factors, genetic predispositions and other environmental factors influencing liver health and metabolic status should be considered in future research.

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