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Relationship between Lipid Profile and Serum Uric Acid in Non-Hypertensive Non Diabetic Adults

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Abstract **Original Research Article**

Background: The study aimed to investigate the relationship between lipid profiles and serum uric acid levels in a specific population of non-hypertensive, non-diabetic adults. The focus was on understanding how these biochemical markers interact in individuals without major comorbidities, which are often confounding factors in such studies. ***Methods:*** This cross sectional observational study was conducted with a total of 172 participants recruited from the OPD of CMH, Cumilla. Data were collected on demographic characteristics, anthropometric measurements, and vital signs. Blood samples were analyzed for lipid profile and serum uric acid levels. Bivariate correlation and linear regression analyses were employed to explore the relationships between the variables. ***Result:*** The mean age was 33.33 years (SD ± 9.41), with 38.37% aged between 21-30 and 40.70% between 31-40. Gender was balanced with 53.49% males. The mean BMI was 27.22 (SD ± 4.18), with 46.51% overweight and 27.91% obese. For cholesterol, 44% had normal levels, 38.1% borderline high, and 17.9% high. LDL levels were high in 50.6% of participants. Serum uric acid was normal in 95.2% of participants. Pearson correlation showed strong positive correlation between cholesterol and LDL ($r = .756$, $p < 0.001$). Linear regression revealed a positive association between cholesterol and serum uric acid (Beta = 0.403, $p = 0.046$) and a negative association with HDL (Beta = -0.345, $p = 0.007$). ***Conclusion:*** The study provided a nuanced perspective on the relationship between lipid profile and serum uric acid levels in non-hypertensive, non-diabetic adults. The findings suggest that the relationship is complex and may be influenced by various factors, including age, gender, and overall metabolic health. Despite limitations such as a small sample size and the exclusion of individuals with metabolic disorders, the study offers valuable insights that warrant further investigation in a more diverse population.

Keywords: Lipid, Cholesterol, Cardiac, Serum Uric, Non-Hypertensive.

INTRODUCTION

The study of lipid profiles and serum uric acid levels has garnered significant attention in the medical community due to their implications for various health conditions. Lipid profiles, which include measurements of cholesterol, triglycerides, and other fatty substances in the blood, are well-established indicators of cardiovascular health. Elevated levels of low-density lipoprotein (LDL) cholesterol and triglycerides, along with low levels of high-density lipoprotein (HDL) cholesterol, are associated with an increased risk of cardiovascular diseases such as atherosclerosis, coronary artery disease, and stroke [1, 2]. Conversely, serum uric acid, a byproduct of purine metabolism, has been traditionally linked to conditions such as gout and kidney stones. However, emerging research suggests that elevated serum uric acid levels may also be associated with metabolic syndrome, a cluster of conditions that increase the risk of heart disease, stroke, and type 2 diabetes [3, 4]. Metabolic syndrome is characterized by a range of symptoms including central obesity, hypertension, elevated fasting blood glucose, and abnormal lipid profiles [5]. The relationship between lipid profiles and serum uric acid has been explored in various patient populations, including those with hypertension and diabetes. For instance, a study conducted in Trinidad found a greater prevalence of myocardial infarction in hypertensive type 2 diabetic patients with dyslipidemia than in non-diabetic

hypertensive patients [6]. Another study reported that higher serum levels of uric acid may affect insulin clearance, thereby impairing hepatic insulin sensitivity [7]. These findings suggest that serum uric acid could be a useful biological marker for assessing the progression of metabolic status [8]. However, the relationship between lipid profiles and serum uric acid in non-hypertensive, non-diabetic adults remains less understood. This gap in knowledge is particularly relevant given the increasing prevalence of metabolic disorders even among individuals without hypertension or diabetes. Several studies have indicated that elevated levels of serum uric acid are significantly associated with metabolic syndrome and its components [9]. Moreover, a study focusing on non-diabetic, non-hypertensive subjects found that central obesity significantly affected serum lipid parameters, including triglycerides and HDL cholesterol [10]. The importance of understanding the relationship between lipid profile and serum uric acid in non-hypertensive, non-diabetic adults is further underscored by the potential for early intervention. Identifying correlations between these biochemical markers could provide valuable insights into the risk factors for developing metabolic and cardiovascular diseases in this population. Moreover, understanding these relationships could pave the way for targeted preventive measures, such as lifestyle modifications or pharmacological interventions, to mitigate the risk of developing these conditions [11]. Therefore, this study aims to investigate the relationship between lipid profile and serum uric acid in non-hypertensive, non-diabetic adults. The present study aims to fill the existing gap in the literature by providing new insights into the biochemical markers that may be indicative of metabolic and cardiovascular risks in this specific population.

METHODS

The cross sectional observational study was conducted at the Outpatient Department (OPD) of Combined Military Hospital (CMH), Cumilla, Bangladesh, with a total of 172 participants selected over a period of 6 months. Ethical approval for the study was obtained from the Institutional Review Board of CMH, Cumilla. Participants were recruited using a convenience sampling method, and informed consent was obtained from each participant prior to data collection. The study included non-diabetic and normotensive adults aged between 18 and 60 years who were willing to participants in the study. Patients who were diagnosed with diabetes, hypertension, hepatic disorders, or cardiovascular diseases were excluded from the study. Demographic data, including age, sex, and medical history, were collected through a structured questionnaire. Blood samples were collected from each participant after a 12-hour fasting period. Serum uric acid levels were measured using the enzymatic colorimetric method, and lipid profile, including total cholesterol, low-density lipoprotein (LDL), high-density lipoprotein (HDL), and triglycerides, was assessed using standard enzymatic methods. All biochemical analyses were performed using an automated chemistry analyzer. Statistical analyses were conducted using SPSS version 25. Descriptive statistics were used to summarize the demographic and biochemical data. Pearson's correlation coefficient was employed to assess the relationship between serum uric acid levels and lipid profile parameters. Multiple linear regression analysis was conducted to control for potential confounding variables. A p-value of less than 0.05 was considered statistically significant.

RESULTS

Table 1: Demographic and Baseline Characteristics (n=172)

Variables	Frequency	Percentage
Age		
≤20	8	4.65%
21-30	66	38.37%
31-40	70	40.70%
41-50	20	11.63%
51-60	4	2.33%
>60	4	2.33%
Mean Age	33.33 ± 9.41	
Age Range	17-64	
Gender		
Male	92	53.49%
Female	80	46.51%
Anthropometric Measurement		
Mean Height (in cm)	155.90 ± 6.31	
Mean Weight (in kg)	66.31 ± 11.39	
Mean BMI	27.22 ± 4.18	
Weight Class Distribution		
Underweight	4	2.33%
Normal Weight	40	23.26%
Overweight	80	46.51%
Obese	48	27.91%

The study comprised a total of 172 participants, with a mean age of 33.33 years (SD ± 9.41), ranging from 17 to 64 years. The age distribution showed that the majority of the participants fell within the 21-40 age range, with 66 participants (38.37%) aged between 21-30 years and 70 participants (40.70%) aged between 31-40 years. Only a small fraction of the participants were either younger than 20 years (4.65%) or older than 50 years (4.66%). In terms of gender distribution, the sample was fairly balanced, with 92 males (53.49%) and 80 females (46.51%). Anthropometric measurements revealed a mean height of 155.90 cm (SD ± 6.31) and a mean weight of 66.31 kg (SD ± 11.39). The mean Body Mass Index (BMI) was calculated to be 27.22 (SD ± 4.18). When categorized based on weight class, the majority of the participants were either overweight (46.51%) or obese (27.91%), while only a small percentage fell within the underweight (2.33%) and normal weight (23.26%) categories.

Table 2: Distribution of Lipid profile among the participant (n=172)

Variable	Frequency	Percentage
Cholesterol Values		
Normal	76	44
Borderline High	66	38.1
High	30	17.9
Mean ± SD	198.89 ± 43.82	
LDL		
Normal	28	16
Borderline High	58	33.3
High	88	50.6
Mean ± SD	134.52 ± 40.06	
HDL		
Normal	82	47.1
Borderline High	90	52.9
Mean ± SD	41.18 ± 18.67	
Triglyceride		
Normal	102	59.5
Borderline High	44	25
High	26	15.5
Mean ± SD	138.48 ± 52.97	

For cholesterol values, 76 participants (44%) had normal levels, 66 (38.1%) had borderline high levels, and 30 (17.9%) had high levels, with a mean cholesterol value of 198.89 mg/dL (SD ± 43.82). In terms of LDL levels, only 28 participants (16%) had normal levels, while 58 (33.3%) had borderline high levels, and a notable 88 participants (50.6%) had high levels. The mean LDL level was 134.52 mg/dL (SD ± 40.06). As for HDL levels, 82 participants (47.1%) had normal levels, and 90 (52.9%) had borderline high levels, with a mean HDL level of 41.18 mg/dL (SD ± 18.67). Lastly, triglyceride levels were normal in 102 participants (59.5%), borderline high in 44 (25%), and high in 26 (15.5%), with a mean triglyceride level of 138.48 mg/dL (SD ± 52.97).

Table 3: Distribution of Serum Uric Acid level among the participants (n=172)

Uric Acid level	Frequency	Percentage
Normal	162	95.2
Elevated	10	4.8
Mean ± SD	4.58 ± 1.07	

In terms of serum uric acid levels among the 172 participants, the majority had normal levels, with 162 participants (95.2%) falling within the normal range. Only a small fraction, 10 participants (4.8%), had elevated levels of serum uric acid. The mean serum uric acid level for the entire cohort was 4.58 mg/dL with a standard deviation of ± 1.07.

Table 4: Mean ± SD vital signs among the participants (n=172)

Variable	Mean	± SD
Pulse	79.52	8.98
Systolic Blood Pressure	117.86	12.713
Diastolic Blood Pressure	75.6	9.229

The mean pulse rate was found to be 79.52 beats per minute with a standard deviation of ± 8.98. The mean systolic blood pressure was 117.86 mmHg, with a standard deviation of ± 12.713, and the mean diastolic blood pressure was 75.6 mmHg with a standard deviation of ± 9.229.

Table 5: Bivariate correlation Between Lipid Profile and Serum Uric Acid (n=172)

Correlations		Cholesterol	LDL	HDL	Triglyceride	Uric acid
Cholesterol	Pearson Correlation	1.00	.756**	.238*	.412**	0.02

	Sig. (2-tailed)	--	**<0.001**	**0.03**	**<0.001**	0.85
LDL	Pearson Correlation	.756**	1.00	-0.03	.283*	0.06
	Sig. (2-tailed)	**<0.001**	--	0.76	**0.01**	0.60
HDL	Pearson Correlation	.238*	-0.03	1.00	-0.05	-0.10
	Sig. (2-tailed)	**0.03**	0.76	--	0.65	0.35
TG	Pearson Correlation	.412**	.283*	-0.05	1.00	0.01
	Sig. (2-tailed)	**<0.001**	**0.01**	0.65	--	0.91
Uric acid	Pearson Correlation	0.02	0.06	0.10	0.01	1.00
	Sig. (2-tailed)	0.85	0.60	0.35	0.91	--

The Pearson correlation coefficient revealed a strong positive correlation between cholesterol and LDL ($r = .756$, $p < 0.001$). Cholesterol also showed a moderate positive correlation with triglycerides ($r = .412$, $p < 0.001$) and a weak positive correlation with HDL ($r = .238$, $p = 0.03$). LDL displayed a weak positive correlation with triglycerides ($r = .283$, $p = 0.01$). However, no significant correlation was observed between LDL and HDL ($r = -0.03$, $p = 0.76$). HDL did not show any significant correlation with triglycerides ($r = -0.05$, $p = 0.65$). Importantly, serum uric acid levels did not show any significant correlation with any of the lipid profile parameters: cholesterol ($r = 0.02$, $p = 0.85$), LDL ($r = 0.06$, $p = 0.60$), HDL ($r = -0.10$, $p = 0.35$), and triglycerides ($r = 0.01$, $p = 0.91$) via bivariate correlation.

Table 6: Association between serum uric acid and lipid profile via linear regression method (n=172)

Linear Regression Model	Unstandardized Coefficients		Standardized Coefficients	t	Sig.
	B	Std. Error	Beta		
Cholesterol	0.01	0.005	0.403	2.03	**0.046**
LDL	0.01	0.005	0.341	1.879	0.064
HDL	0.041	0.015	-0.345	-1.802	**0.007**
TG	0.002	0.003	0.109	0.871	0.387

Linear regression analysis was performed to assess the association between serum uric acid levels (dependent variable) and lipid profile parameters (independent variables), including cholesterol, LDL, HDL, and triglycerides. The unstandardized coefficients (B) and standardized coefficients (Beta) were calculated along with their respective standard errors. The analysis revealed a positive association between cholesterol and serum uric acid levels, with an unstandardized coefficient (B) of 0.01 and a standardized coefficient (Beta) of 0.403. The association was statistically significant with a t-value of 2.03 and a p-value of 0.046. LDL showed a positive but non-significant association with serum uric acid levels, with a B of 0.01, Beta of 0.341, t-value of 1.879, and a p-value of 0.064. HDL exhibited a significant negative association with serum uric acid levels, with a B of 0.041, Beta of -0.345, t-value of -1.802, and a p-value of 0.007. Triglycerides did not show any significant association with serum uric acid levels, with a B of 0.002, Beta of 0.109, t-value of 0.871, and a p-value of 0.387.

DISCUSSION

The study aimed to explore the relationship between lipid profiles and serum uric acid levels in a specific population of non-hypertensive, non-diabetic adults. Importantly, the study selected only patients without any major comorbidities, which might have influenced some of the findings. The demographic data revealed a fairly balanced gender distribution and a concentration of participants in the 21-40 age range. This was consistent with a study that found a similar age distribution in a non-hypertensive, non-diabetic population [12]. The majority of participants were either overweight or obese, which aligned with global trends indicating an increasing prevalence of obesity [13]. Insights into the lipid profile of the participants showed a significant proportion had borderline high or high levels of cholesterol and LDL. This was noteworthy given that elevated levels of these parameters are well-established risk factors for cardiovascular diseases [14]. Conversely, the majority of participants had normal serum uric acid levels. This finding was in contrast to a study that found elevated serum uric acid levels in a population with metabolic disorders [15]. The vital signs were within normal ranges, which was an expected finding in a non-hypertensive, non-diabetic population. However, the lack of significant variations in these parameters limited their interpretive value in the context of this study. Bivariate correlation analysis did not reveal any significant association between serum uric acid and lipid profile parameters, except for a weak correlation between cholesterol and HDL. This was somewhat surprising given that previous studies indicated a potential relationship between these biochemical markers [14]. One possible explanation for this discrepancy could have been the exclusion criteria, which eliminated individuals with diabetes and hypertension, potentially reducing the variability in metabolic markers. However, linear regression analysis provided a different perspective. HDL showed a negative association with serum uric acid, while cholesterol

showed a significant positive correlation. This contrast between the bivariate correlation and linear regression findings was intriguing. It suggested that the relationship between lipid profile and serum uric acid was complex and may have been influenced by various factors, including age, gender, and overall metabolic health. This complexity was supported by a study that found a positive correlation between serum uric acid and lipid parameters in a population with metabolic disorders but not in a healthier cohort [16]. In summary, limitations were present, including a relatively small sample size and the exclusion of individuals with metabolic disorders, which may have limited the generalizability of the findings. The selection of patients without any major comorbidities could have also played a role in these outcomes. Future research should consider including a more diverse population to validate these results.

Limitations of The Study

The study was conducted in a single hospital with a small sample size. So, the results may not represent the whole community.

CONCLUSION

The study aimed to elucidate the relationship between lipid profiles and serum uric acid levels in a unique cohort of non-hypertensive, non-diabetic adults. Importantly, the study selected only patients without any major comorbidities, which likely influenced the outcomes. While bivariate correlation analysis did not reveal a significant association between serum uric acid and lipid profile parameters, linear regression analysis provided a more nuanced perspective, suggesting a complex relationship influenced by various factors. Despite the limitations, including a relatively small sample size and the exclusion of individuals with metabolic disorders, the findings offer valuable insights into the intricate relationship between lipid profile and serum uric acid levels. Future research should aim to include a more diverse population to validate these results and explore the underlying mechanisms that may explain these associations.

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Conflict of interest: None declared

Ethical approval: The study was approved by the Institutional Ethics Committee

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