

CORRELATION BETWEEN BODY MASS INDEX AND LIPID PROFILE AMONG HEALTHY ADULTS: ANALYSIS OF ICPSR-BASED DATA

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ABSTRACT

Background: The prevalence of obesity has increased in the majority of developing countries notwithstanding the considerable incidence of undernutrition. The elevated lipid levels associated with obesity may lead to a variety of metabolic and cardiovascular problems. The purpose of this study is to determine the association between body mass index and lipid profiles in healthy adults (BMI).

Methods: The prevalence of metabolic syndrome, its risk factors, and the related lifestyle in adult Myanmar citizens were examined in the Inter-University Consortium for Political and Social Research Study (ICPSR146521) using data that had been obtained prospectively. The patient's lipid profiles, and demographic data were statistically analyzed using the statistical MedCalc tool. Statistical significance was determined using a 0.05 p-value.

Results: A total of 32 subjects, ranging in age from 18 to 90, were examined. Of the individuals, 48.34% were of normal weight, 32.12% were obese, and 19.54% were overweight. 79.66% of the participants who were obese belonged to the class 1 category. A high TG level, a high LDL level, a high total cholesterol level, and a low HDL level were present in 33.11%, 58.28%, 40.40%, and 6.29% of the individuals, respectively.

Conclusion: Body mass index had a positive correlation with TG levels and a negative correlation with age. As a result, as BMI rises, TG levels rise as well, but BMI falls as age rises. Age and TC levels have a positive correlation; as a result, TC levels rise with age.

INTRODUCTION

The body mass index is a calculation that compares a person's weight to their height (BMI). By dividing the subject's squared height in meters by squared weight in kilos, it can be calculated [1]. As a result, the only unit of measurement employed is kg/m². The WHO defines a person's BMI as normal if it is between 18.5 and 25 kg/m², as overweight if it is between 26 and 30 kg/m², and as obese if it is greater than 30 kg/m². BMI is frequently used to calculate obesity (excess body fat) [2]. According to the International Obesity Task Force, there are 312 million obese adults and 1.1 billion obese children worldwide (3). Overweight and obesity rates are increasing. With an estimated 2.6 million fatalities and 2.3% of the world's illness burden attributed to obesity, it is currently thought to be the second biggest cause of mortality and morbidity [4]. There is general agreement that obesity increases the chance of developing conditions such hypertension, diabetes mellitus, and dyslipidemia, which increase the likelihood of developing cardiovascular illnesses and shorten life expectancy [5,6].

An extensive class of hydrophobic chemical compounds known as lipids is isolated from tissues and nonpolar solvents. The structures of biological lipids, such as membrane-associated lipids, triacylglycerol (TAG) droplets in adipose tissue, and lipids attached to albumin during plasma transportation, are used to classify them because they are not soluble in water. Long-chain fatty acids (LCFAs) are those fatty acids with 12 carbons or more, while short- and medium-chain fatty acids (SCFAs) have fewer than 12 carbons (MCFAs). FA chains may be saturated (no double bonds) or unsaturated (one or more double bonds) [7]. In blood, there are five main lipoproteins: Chylomicrons are the first,

followed by very low-density lipoprotein (VLDL), intermediate-density lipoprotein (IDL), low-density lipoprotein (LDL), high-density lipoprotein, and finally, low-density lipoprotein (HDL). Each of these kinds of lipoproteins carries triglycerides and cholesterol to their intended locations [8].

The progression of cardiovascular illnesses is significantly influenced by cholesterol levels. A increased risk of developing atherosclerotic cardiovascular disease is associated with hyperlipidemia, also known as a high level of lipids in the serum, particularly cholesterol and triglycerides (CVD). A lipid profile typically consists of triglycerides, total cholesterol, high-density lipoprotein (HDL) cholesterol, and low-density lipoprotein (LDL) cholesterol [8]. Lipotoxicity is the term for the accumulation of lipid intermediates and final products in tissues and organs where they normally do not accumulate, and it is believed to have a significant role in heart failure, obesity, and diabetes. According to estimates, 25% of US adults suffer from lipotoxicity [9]. Risk factors for heart disease, the main cause of death, include high cholesterol, high triglycerides, poor HDL, diabetes, hypertension, gender, and smoking [10]. Adults with higher LDL levels have an increased chance of developing coronary heart disease. Meanwhile, a high HDL level is often protective. There is evidence that lowering cholesterol levels through diet and/or the use of lipid-lowering drugs can reduce the frequency of atherosclerotic events [11].

Understanding the age-related dynamic features of blood lipid levels in the general population is crucial for the classification of dyslipidaemia and for assessing the relationship between dyslipidaemia and the onset and progression of atherosclerotic cardiovascular disease (ASCVD). The standard ASCVD risk factors of age and blood lipid

levels are also present. It may be crucial to know age-related variations in lipid levels in order to improve the current ASCVD risk-estimator approaches. This investigation looked at the connection between blood lipid levels and aging.

METHODS

Description of retrieved datasets

The information for this investigation came from the Inter-University Consortium for Political and Social Research Study on the Prevalence of Metabolic Syndrome, Its Risk Factors, and Associated Lifestyle in Adults in Myanmar (ICPSR146521) [12]. The researcher, data collectors, and participants all used Covid-19 preventative measures, which led to a five-day home visit data collection process in November 2020. Five registered nurses with experience in community health were trained and rechecked in order to minimize observer bias when collecting sociodemographic, lifestyle, and anthropometric measurements in the community. Blood samples were taken by three phlebotomists to analyze blood glucose levels and lipid profiles. By using the convenience sampling method, adults over the age of 18 who have resided in the study area for at least one year and are free of pregnancy-related issues and medical conditions like cardiac diseases, diabetes, and renal disorders were chosen from three municipal wards of the chosen township. This study excluded participants who were on anti-diabetic, anti-hypertensive, and lipid-lowering medications and were unable to participate in anthropometric measures. The objective of the investigation, body size measures, and the invasive blood-drawing procedure were fully explained to prospective participants who

indicated an interest in participating in the study. All persons who are available for physical examinations and blood testing provided informed written consent.

The ICPSR website's data on the prevalence of metabolic syndrome, its risk factors, and the associated lifestyle in adult Myanmar citizens were downloaded [13]. The following variables are included in this data set: occupation, age, sex, HbA1c, fasting blood sugar, total cholesterol, triglycerides, HDL, and LDL; body weight, height, BMI, waist circumference; systolic and diastolic blood pressures; and waist circumference [13]. Our regional institutional review board determined that this study was exempt.

Statistical Analysis

Statistical analyses were performed on the patient's lipid profiles and demographic data using the statistical MedCalc program [14]. Chi-square test was employed to determine the significance of the relationship between categorical variables. Statistics were considered significant when the P-value was less than 0.05. Correlation was utilized to determine any associations between continuous variables.

RESULTS

The majority (45.03%) of the 302 healthy subjects were in the 18–40 age range. In terms of gender, there were significantly more women (69.54%) than men (30.46%). The distribution of body mass index (BMI) revealed that nearly half of the subjects (48.34%) were normal, 32.12% were overweight, and 19.54% were obese. 79.66% of the participants who were obese belonged to the class 1 category (Table 1).

Table 1*Socio-demographic characteristics of the participants*

Variables	Frequency	Percent %
Age (years)		
18-40	136	45.03
41-60	123	40.73
61-90	43	14.24
Sex		
Female	210	69.54
Male	92	30.46
BMI (kg/m²)		
Normal weight (18.5-24.9)	146	48.34
Overweight (25-29.9)	97	32.12
Obesity (≥30)	59	19.54
Class 1 Obesity (≥30-34.9)	47	79.66
Class 2 Obesity (35-39.9)	11	18.64
Class 3 Obesity (≥40)	1	1.69

Table 2's presentation of the subjects' lipid profiles reveals that 33.11% of them had elevated TG levels. Similar to this, 40.40% of the individuals had high total cholesterol levels, while 58.28% had high LDL values. 6.29% of the patients, however, had poor HDL values.

Table 2*Lipid Profile of the participants*

Variables	Frequency	Percent %
LDL		
High	176	58.28
Normal	126	41.72
TC		
High	122	40.40
Normal	180	59.60
TG		
High	100	33.11
Normal	202	66.89
HDL		
Low	19	6.29
Normal	283	93.71

Table 3*Gender wise mean and standard deviation of continuous variables*

Variables	Overall		Female		Male		p-Value
	Mean	SD	Mean	SD	Mean	SD	
Age	44.066	14.522	43.114	13.354	46.239	16.768	0.11602
BMI	25.545	4.9943	26.371	5.0598	23.658	4.3046	0***
TC	193.86	39.869	195.9	39.571	189.21	40.372	0.18409
TG	142.21	84.156	134.11	74.707	160.69	100.55	0.02446***
LDL	108.37	35.138	59.133	18.092	55.007	14.158	0.03391***
HDL	57.876	17.074	111.68	33.973	100.81	36.743	0.01669***

***statistically significant at $p < 0.05$

The age distribution was 44.066 14.522 years, on average. Men's mean age was 46.239 years, and women's mean age was 43.114 years, with an SD of 13.354 years. BMI had a mean and SD overall of 25.545 and 4.59943. The overall mean±SD of TG levels was 142.56 84.156, whereas the mean±SD TG levels of males and females were 160.69 100.55 and 134.11 74.707, respectively. LDL levels overall had a mean±SD of 108.37 35.138, while males had a mean±SD of 55.007 14.158 and females had a

mean±SD of 59.133 18.092. The mean HDL values for all people were 57.87617.074 whereas the mean HDL levels for women were 111.6833.973 and for men were 100.8136.743. (Table 3).

Table 4 shows the connection between BMI with lipid profile. BMI showed a positive link with TC, TG and LDL levels while with HDL levels, BMI exhibited a negative correlation. Only the link with TG was determined to be statistically significant ($p = 0.0016$).

Table 4*Correlation between BMI and lipid profile*

	TC	TG	HDL	LDL
BMI (Kg/m ²)	0.218	0.258	-0.109	0.207
p-Value	0.9673	0.0016	0.3935	0.0682

Table 5*Correlation between age with lipid profile and BMI*

	TC	TG	HDL	LDL	BMI
Age (Years)	0.331	0.206	0.0137	0.26	-0.0142
p-Value	0.0159	0.0521	0.945	0.4974	0.0409

Age and BMI had a substantial ($p = 0.0409$) negative connection, according to the correlation between age and lipid profile and BMI. Age positively linked with TG, TC, HDL,

and LDL, although only the connection between age and TC was determined to be statistically significant ($p = 0.0159$) (Table 5).

DISCUSSION

In our study, the majority (45.03%) of the participants were in the 18–40 age range. Females made up 69.54% more people overall than males did (30.46%). This is comparable to research by Zeqollarie *et al.*, which discovered that there were more women (56%) than men (44%) [15-16]. The results of Chamba *et al.*, who discovered that 50.42 percent of his patients were male, are in contrast [17]. In the current study, the age distribution overall was 44.06614.522 years. Men's mean age was 46.239 years, and women's mean age was 43.114 years, with an SD of 13.354 years.

In this study, none of the participants were underweight. While 32.12% of the individuals were overweight and 19.54 percent were obese, 48.34% of the subjects were of normal weight.

This indicates that roughly 51.66 percent of the participants were overweight or obese. In which class 1 obesity was present in 79.66% of the participants. No participant was underweighted, 36.0% were normal weight, and 64% were either overweight or obese, according to Omotoye *et al.* [18]. In our study, the average BMI and standard deviation (SD) were 25.5454.59943, 26.3715.0598 and 23.6584.3046 for males and females, respectively. As a result, it was found that both the overall and female mean values were overweight, whereas the male mean values were normal.

33.11% of the participants in the current study exhibited elevated TG levels. 58.28% of the individuals had high levels of LDL, 40.40% had high levels of total cholesterol, and 6.29% had low levels of HDL.

The overall mean±SD of TG levels was 142.56 84.156, whereas the mean±SD TG levels of males and females were 160.69 100.55 and 134.11 74.707, respectively. LDL levels overall

had a mean±SD of 108.37 35.138, while males had a mean±SD of 55.007 14.158 and females had a mean±SD of 59.133 18.092. The mean HDL values for everyone were 57.87617.074 whereas the mean HDL levels for men and women were 100.8136.743 and 111.6833.973, respectively.

In the current investigation, TG levels and BMI were revealed to be significantly positively correlated. BMI and the levels of TC, HDL, and LDL were not shown to be significantly correlated. This result is consistent with another research [19–21]. However, our findings did not agree with the Saudi Arabian Al-Ajlan study [22]. Blood pressure, cholesterol levels, and triglyceride levels can all be negatively impacted metabolically by being overweight or obese [23]. Adipose tissue releases substantial amounts of free fatty acids (FFA), which in turn triggers an increase in TG secretion from the liver. HDL cholesterol is decreased by hypertriglyceridemia [24].

Since there were more female participants in the research than male, this could be one explanation for the trend in the association between BMI and lipid levels. Some studies have identified higher associations between BMI and blood lipids in males compared to females [25,26]. The gender-related changes in body composition that begin early in childhood due to the effects of the sex steroid hormones may be the cause of the gender differences in levels of aberrant lipid profiles [27,28].

The results of the current investigation revealed a substantial inverse relationship between age and BMI. This suggests that BMI drops as people get older. This result contradicts a prior study's [29] conclusion that age and BMI significantly correlated. Age and TC levels also showed a statistically significant positive connection, indicating that TC levels rise with age. This result is consistent with that

of [30], which found a substantial positive connection between TC levels and age. Age did not significantly correlate with TG, HDL, or LDL values, though. The patients had higher mean total cholesterol, TG, LDL, and lower mean HDL, indicating a chance that they may have high BMI with a likelihood of having abnormal lipid levels, even if age did not indicate a significant association with the various aberrant lipids. Additionally, it has been demonstrated that the various plasma lipids are under the multifactorial control of genetic as well as environmental factors, such as geographic, sociocultural, economic, dietary habits, age, and gender differences [31], which may have affected the results of this investigation. These variables, however, were not gathered for this investigation.

CONCLUSION

Body mass index had a positive correlation with TG levels and a negative correlation with age. As a result, as BMI rises, TG levels rise as well, but BMI falls as age rises. Age and TC levels have a positive correlation; as a result, TC levels rise with age. Despite the fact that age and BMI did not significantly correlate with the various aberrant lipids, the participants had higher mean total cholesterol, TG, LDL, and lower mean HDL values.

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