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Original Research Article

The Pattern of Dyslipidemia and its Association with Dietary Habits in Individuals Attending BSMMU Outpatient Department

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Abstract

Introduction: Abnormal level of circulating lipids refers to dyslipidemia. Dyslipidemia mostly affects non-communicable diseases like CHD, CVD, cancer, autoimmune disease, etc. The population group most affected by non-communicable diseases (NCDs) in Bangladesh comprises middle-aged persons and the elderly, having a major share of the disease burden and mortality in the country. Changing dietary habits and lifestyle, rapid urbanization, growth of commuting, tobacco use, uncontrolled growth and consumption of processed foods and beverages, indoor air pollution, road-traffic injuries, lack of awareness about healthful behavioral patterns, and psychological pressure are among the important factors responsible for such non-communicable diseases. The present study was conducted with the goal of observing any association between dyslipidemia and dietary habits in men and women. ***Aim of the study:*** The aim of the study was to observe the association of dyslipidemia with dietary habits. ***Methods:*** This cross-sectional analytical study was conducted at the Department of Biochemistry, Bangabandhu Sheikh Mujib Medical University (BSMMU), Dhaka, Bangladesh. The study duration was one year, from March 2016 to February 2017. Non-probability sampling method was used to select a total of 245 dyslipidemia cases from the adult population attending the BSMMU outpatient department during the study period. ***Result:*** The majority of the dyslipidemic patients had isolated hypercholesterolemia. All types of dyslipidemia had a significantly higher prevalence among the male population. Mixed hyperlipidemia was significantly higher among the older population. Statistical significance was only observed among the total cholesterol levels and the male population and TG level and the female population of mixed hyperlipidemic subjects in regards to healthy food consumption. Unhealthy food consumption had a high correlation with dyslipidemia in both male and female population**.** ***Conclusion:*** The study shows that isolated hypercholesterolemia is prevalent. Food habits also have an impact on lipid profile among study subjects. Healthy foods are mostly associated with high HDL-C. Unhealthy food consumption has a high correlation with dyslipidemia in both male and female populations.

Keywords: Lifestyle, Dyslipidemia, Hyperlipidemia, HDL-C, Cholesterol.

INTRODUCTION

Dyslipidemia is defined as an abnormal amount of circulating lipids, which is a well-known risk factor for cardiovascular disease [1, 2] In comparison to any other area in the world, South Asian nations such as India, Pakistan, Bangladesh, Sri Lanka, and Nepal provide the largest amount of CVD burden [3]. According to the Bangladesh Ministry of Health and Family Welfare's 2015 health bulletin, deaths due to circulatory system diseases accounted for 33.2 percent of all deaths, followed by diseases originating in the perinatal period (15.93%) and diseases of the respiratory system (13.9%). Non-communicable disorders such as CHD, CVD, cancer, autoimmune disease, and others are commonly affected by dyslipidemia. A variety of factors contribute to non-communicable diseases, including changing dietary

habits and lifestyles, rapid urbanization, increased commuting, tobacco use, uncontrolled growth and consumption of processed foods and beverages, indoor air pollution, road traffic injuries, a lack of awareness about healthy behavioral patterns, and psychological stress [4]. Dyslipidemia is defined as high total cholesterol and high LDL-C levels, low HDL-C levels, and hypertriglyceridemia, either alone or in combination. The "Dyslipidemic Triad" is characterized by hypertriglyceridemia, low HDL-C, and tiny, dense LDL-C. They have been dubbed "atherogenic dyslipidemia" or "atherogenic lipoprotein profile" because they are biologically connected [5]. In industrialized nations, this dyslipidemia pattern has been linked to T2DM and cardiovascular disease [6]. The TC/HDL-C and LDL-C/HDL-C ratios are referred to as atherogenic indicators. Islam and others showed this. 9% had a high TC, 8.8% had a low HDL-C, and 15.7% had a high LDL-C [7]. Furthermore, among the sub-urban Bangladeshi population, 17.8% had high TG and 2% had extremely high TG. Dyslipidemia is a key factor in the progression of cardiovascular disease, which is now the leading cause of mortality in both developed and developing nations, including Bangladesh [8]. Nutrition, lifestyle, demographic shifts, increasingly poor diets, and physical inactivity are all contributing to rising dyslipidemia in South Asia [9]. The major risk factor for dyslipidemia is a diet heavy in fat, carbohydrates, and calories. Sedentary behavior and lack of physical exercise as a result of technological advancements are important factors in the development of dyslipidemia. Smoking has a significant deleterious impact on HDL-C levels. Dyslipidemia is also caused by irregular day-night sleep patterns and daily stress [7]. Moghadashi *et al*. found a negative association between the overall score of Breslow's lifestyle index and TC, LDL-C, and TG in their study [10]. This meant that people who lived unhealthy lives had greater levels of dyslipidemia. The same research found that a high-fat diet is one of the primary causes of dyslipidemia in their community [10]. So it is currently recommended that individuals with dyslipidemia be targeted for therapeutic lifestyle changes, which consist mainly of increases in physical activity and having a healthy diet [11]. The aim of the present study was to observe and evaluate the association of dyslipidemia in patients with their dietary habits, both healthy and unhealthy.

OBJECTIVE

General Objective

- To observe the association of dyslipidemia with dietary habits.

Specific Objectives

- To evaluate the association between consumption of healthier foods and different types of dyslipidemia.
- To evaluate the association between consumption of less healthy foods and different types of dyslipidemia.

METHODS

This cross-sectional analytical study was conducted at the Department of Biochemistry and Molecular Biology, Bangabandhu Sheikh Mujib Medical University (BSMMU), Dhaka, Bangladesh. The study duration was one year, from March 2016 to February 2017. Non-probability sampling method was used to select a total of 245 dyslipidemia cases from the adult population attending the BSMMU outpatient department during the study period. The initial sample size was 510, which contained both normolipidemic and dyslipidemic cases, among whom 48% were dyslipidemic cases. The participants were selected following the inclusion and exclusion criteria and informed written consent was obtained from each participant prior to their admission to the study. Ethical approval was also obtained from the ethical review committee of the study hospital. Dyslipidemia was defined as having at least one of the following: high TC, high LDL-C, low HDL-C, and high TG. A structured questionnaire and data collection sheet were prepared for the purpose of the study, which included all the variables of interest. Fasting blood samples were collected from study subjects to estimate the serum TC, TG, and HDL-C. Diet was assessed using a 13-item food-frequency questionnaire. Collected data was checked and edited and then processed with the help of the software Statistical Package for Social Sciences (SPSS) program.

Inclusion Criteria

- Age between 20-60 years.
- Only dyslipidemia cases
- Patients who had given consent to participate in the study.

Exclusion Criteria

- Mentally ill.
- Unable to answer the criteria question.
- Chronic liver disease
- Chronic renal disease
- Regular medication for dyslipidemia for the last 3 months
- Acute or chronic infection
- Pregnancy
- Malignancy

RESULTS

Table-1: Distribution of study subjects according to lipid disorder pattern (N=245)

Pattern of dyslipidemia	Frequency (n)	Percentage (%)
Isolated hypercholesterolemia	99	40.41%
Isolated hypertriglyceridemia	78	31.84%
Mixed hyperlipidemia	68	27.76%

Among the total 245 dyslipidemia patients, a majority (40.41%) had isolated hypercholesterolemia, 31.84% had isolated hypertriglyceridemia, and the remaining 27.76% had mixed hyperlipidemia.

Table-2: Distribution of study subjects according to pattern of dyslipidemia and age (N=245)

Age	Isolated hyper cholesterolemia (%)	"p"	Isolated hyper triglyceridemia (%)	"p"	Mixed hyper lipidemia (%)	"p"
20-40	19.3	>0.05	13.8	**<0.05**	12.2	**<0.05**
41-60	19.6		18.7		16.4	

The participants were divided into two primary age groups, 20-40 years and 41-60 years. Isolated hypercholesterolemia did not show a significant difference between the two age groups but isolated hypertriglyceridemia and mixed hyperlipidemia were higher in the advanced age group than younger, which were statistically significant.

Table-3: Distribution of study subjects according to the pattern of dyslipidemia and sex (N=245)

Sex	Isolated hyper Cholesterolemia (%)	"p"	Isolated hyper Triglyceridemia (%)	"p"	Mixed hyper lipidemia (%)	"p"
Male	22.2	**<0.05**	21.8	**<0.05**	18.5	**<0.05**
Female	18.5		10.3		8.7	

The table showed the different patterns of dyslipidemia and their frequency in both sexes. It was observed that male prevalence was higher in all types of dyslipidemia, which was statistically significant.

Table-4: Correlation of blood lipid profile and "*more healthy*" food consumption pattern in subjects with isolated hypercholesterolemia

More healthy foods	Total cholesterol				HDL-C				LDL-C				Triglyceride			
	Male		Female		Male		Female		Male		Female		Male		Female	
	r	p	r	p	r	p	r	p	r	p	r	p	r	p	r	p
Bread	-0.103	0.450	-0.034	0.828	0.100	0.462	-0.016	0.918	-0.156	0.255	0.052	0.742	0.066	0.630	-0.159	0.309
Chicken	-0.044	0.747	0.010	0.948	-0.095	0.484	-0.226	0.146	-0.053	0.701	0.087	0.578	0.180	0.183	0.069	0.662
Fish	-0.017	0.901	-0.271	0.079	-0.076	0.580	-0.136	0.383	0.023	0.865	-0.267	0.084	-0.024	0.859	0.020	0.898
Egg	0.060	0.662	-0.221	0.154	0.070	0.606	-0.090	0.568	0.045	0.745	-0.256	0.097	-0.082	0.547	0.072	0.647
Milk	-0.050	0.715	0.178	0.255	0.021	0.876	0.026	0.869	-0.036	0.797	0.128	0.414	-0.119	0.382	0.132	0.400
Vegetables	0.024	0.860	-0.202	0.195	0.019	0.887	-0.076	0.629	0.037	0.790	-0.104	0.506	-0.048	0.723	-0.167	0.283
Fruits	-0.092	0.501	-0.251	0.104	0.002	0.987	0.122	0.437	-0.075	0.586	-0.223	0.150	0.071	0.605	-0.251	0.104

Table 4 showed the correlation between the blood lipid profile and consumption of healthy food in subjects with isolated hypercholesterolemia. A negative correlation was observed between almost all the food categories and lipid profiles, but no significant association was found.

Table-5: Correlation of blood lipid profile and "*more healthy*" food consumption pattern in subjects with isolated hypertriglyceridemia

More healthy foods	Total cholesterol				HDL-C				LDL-C				Triglyceride			
	Male		Female		Male		Female		Male		Female		Male		Female	
	r	p	r	p	r	p	r	p	r	p	r	p	r	p	r	p
Bread	-0.084	0.541	-0.2	0.35	0.17	0.22	-0.2	0.3	-0.1	0.69	-0	1	-0	0	-0	0.32
Chicken	-0.108	0.432	-0.2	0.29	-0.1	0.48	-0.2	0.4	-0.1	0.56	-0	0	-0	1	0	0.86
Fish	0.125	0.363	-0.1	0.59	0.11	0.44	-0.1	0.7	0.1	0.6	-0	1	0.2	0	-0	0.23
Egg	-0.173	0.206	-0.1	0.65	0.03	0.34	-0.1	0.5	-0.2	0.16	-0	1	0.1	1	0	0.93
Milk	-0.019	0.893	0.07	0.75	-0	0.79	-0.2	0.4	-0.1	0.66	0	1	0.2	0	0	0.36
Vegetables	0.315	**0.019**	-0.3	0.24	-0.1	0.45	-0.1	0.7	0.4	**0.003**	-0	0	-0	1	0	0.28
Fruits	-0.009	0.95	0.2	0.37	-0	0.79	0.18	0.4	-0	0.87	0	1	0.1	0	0	0.32

Table 5 showed the correlation between the blood lipid profile and consumption of healthy food in subjects with isolated hypertriglyceridemia. A significant positive correlation was observed among the male population with vegetables and total cholesterol levels, and between vegetables and LDL-C levels.

Table-6: Correlation of blood lipid profile and "*more healthy*" food consumption pattern in subjects with mixed hyperlipidemia

More healthy foods	Total cholesterol				HDL-C				LDL-C				Triglyceride			
	Male		Female		Male		Female		Male		Female		Male		Female	
	r	p	r	p	r	p	r	p	r	p	r	p	r	p	r	p
Bread	-0.137	0.357	-0.14	0.55	0.161	0.280	-0.121	0.601	-0.11	0.472	0.192	0.40	0.084	0.574	-0.007	0.98
Chicken	0.223	0.133	0.294	0.20	0.272	0.064	0.004	0.988	0.286	0.057	0.08	0.73	-0.17	0.252	-0.353	0.12
Fish	0.016	0.917	-0.015	0.95	0.073	0.624	-0.296	0.193	-0.09	0.552	0.197	0.39	0.137	0.357	0.212	0.36
Egg	0.018	0.904	0.225	0.33	0.146	0.327	-0.261	0.254	-0.02	0.879	0.167	0.47	-0.01	0.976	-0.444	**0.04**
Milk	-0.014	0.923	0.016	0.94	-0.066	0.658	0.232	0.311	0.094	0.538	0.163	0.48	-0.16	0.269	0.014	0.95
Vegetables	-0.109	0.464	-0.046	0.84	0.095	0.523	-0.282	0.215	-0.07	0.658	0.015	0.95	0.09	0.547	0.11	0.64
Fruits	0.148	0.322	0.02	0.93	0.028	0.851	-0.073	0.753	0.152	0.319	0.159	0.49	0.124	0.404	0.029	0.9

Table 6 showed the correlation between the blood lipid profile and consumption of healthy food in subjects with mixed hyperlipidemia. Here, a significant negative correlation was observed between female triglyceride levels and egg consumption.

Table-7: Correlation of blood lipid profile and *"less healthy"* food consumption pattern in male subjects with isolated hypercholesterolemia

Unhealthy	Total cholesterol				HDL-C				LDL-C				Triglyceride			
	Male		Female		Male		Female		Male		Female		Male		Female	
	r	p	r	p	r	p	r	p	r	p	r	p	r	p	r	p
Red meat	0.188	0.166	**-0.047**	0.763	0.009	0.949	-0.068	0.666	0.218	0.110	-0.074	0.638	-0.138	0.309	0.081	0.604
Cake	0.122	0.370	-0.027	0.862	-0.106	0.435	-0.030	0.850	0.104	0.449	0.083	0.596	0.173	0.202	-0.235	0.130
Soft drinks	-0.048	0.727	-0.044	0.777	0.162	0.233	-0.216	0.164	-0.060	0.661	-0.107	0.494	-0.063	0.647	-0.108	0.489
Chocolate	0.161	0.237	0.094	0.550	-0.186	0.171	-0.040	0.800	0.193	0.158	0.120	0.445	0.135	0.320	0.004	0.981
Ice cream	0.088	0.517	-0.123	0.432	-0.218	0.106	-0.100	0.522	0.081	0.555	-0.067	0.670	0.164	0.228	-0.062	0.691
Deep fried snacks	-0.094	0.492	0.058	0.714	-0.109	0.423	-0.117	0.456	-0.071	0.608	0.107	0.497	-0.016	0.908	0.031	0.842

We found a negative correlation of HDL-C with cake, chocolate, ice cream, and deep-fried snacks among the male population but did not show statistical significance. No significant association was found among the female population in many instances.

Table-8: Correlation of blood lipid profile and *"less healthy"* food consumption pattern in male subjects with isolated hypertriglyceridemia

Unhealthy	Total cholesterol				HDL-C				LDL-C				Triglyceride			
	Male		Female		Male		Female		Male		Female		Male		Female	
	r	p	r	p	r	p	r	p	r	p	r	p	r	p	r	p
Red meat	0.080	0.564	-0.013	0.952	-0.008	0.953	-0.347	0.104	0.159	0.261	0.061	0.781	-0.104	0.450	-0.079	0.721
Cake	-0.122	0.374	0.131	0.550	0.002	0.991	-0.074	0.737	-0.056	0.692	0.182	0.407	-0.125	0.362	-0.099	0.652
Soft drinks	0.020	0.883	0.462	**0.026**	-0.115	0.403	0.055	0.802	-0.013	0.924	0.504	**0.014**	0.041	0.769	-0.067	0.760
Chocolate	-0.149	0.279	-0.182	0.406	-0.226	0.097	-0.233	0.307	-0.187	0.185	-0.077	0.727	0.109	0.427	-0.246	0.258
Ice cream	0.013	0.925	0.105	0.632	-0.105	0.444	0.156	0.478	-0.015	0.918	0.106	0.631	0.140	0.307	-0.052	0.814
Deep fried snacks	-0.288	**0.033**	0.125	0.569	-0.173	0.206	-0.196	0.370	-0.266	0.056	0.163	0.459	-0.030	0.825	0.007	0.976

A correlation between blood lipid profile and less healthy food consumption pattern in male isolated hypertriglyceridemic subjects was observed. A negative relationship between TC and deep-fried snacks was found here among the male which was statistically significant. A statistically significant positive correlation between soft drinks with TC and LDL-C in female isolated hypertriglyceridemic subjects was observed.

Table-9: Correlation of blood lipid profile and *"less healthy"* food consumption pattern in male subjects with mixed hyperlipidemia

Unhealthy	Total cholesterol				HDL-C				LDL-C				Triglyceride			
	Male		Female		Male		Female		Male		Female		Male		Female	
	r	p	r	p	r	p	r	p	r	p	r	p	r	p	r	p
Red meat	-0.069	0.645	-0.168	0.466	-0.038	0.798	0.229	0.319	-0.018	0.907	-0.116	0.616	0.005	0.972	0.210	0.361
Cake	-0.165	0.266	-0.139	0.547	-0.069	0.645	-0.019	0.935	-0.082	0.594	0.183	0.427	0.152	0.307	-0.099	0.671
Soft drinks	-0.071	0.633	-0.015	0.947	0.003	0.984	0.164	0.477	-0.146	0.340	0.306	0.177	0.203	0.171	-0.019	0.934
Chocolate	-0.314	**0.032**	0.065	0.779	-0.152	0.309	-0.092	0.691	-0.280	0.063	0.357	0.112	0.033	0.824	0.094	0.687
Ice cream	-0.288	**0.049**	0.193	0.401	-0.330	**0.023**	-0.034	0.884	-0.186	0.221	0.604	**0.004**	0.104	0.485	-0.115	0.620
Deep fried snacks	0.234	0.113	-0.116	0.618	0.161	0.280	0.031	0.185	0.221	0.144	-0.110	0.633	0.130	0.385	0.188	0.415

Among the male population, a significant negative correlation between chocolate and total cholesterol was observed. A significant negative relationship between ice cream with TC and HDL-C was also observed among the male population. We found a significant positive relationship between ice cream and LDL-C in female mixed hyperlipidemic subjects.

DISCUSSION

This cross-sectional study aimed to evaluate the pattern of dyslipidemia and its association with dietary habits in individuals attending the BSMMU outpatient department. The study showed the prevalence of hyperlipidemia and its association with dietary habits among participants. The study observed a rise in dyslipidemia subjects compared to previous studies. This rise in dyslipidemia cases can be attributed to the change in dietary habits of the present society [7]. Among the participants, isolated hypercholesterolemia was the most frequent among all, and mixed hyperlipidemia had the lowest prevalence of all hyperlipidemia. This result was supported by the findings of Islam *et al*., but contradictory results were also observed in another study where hypertriglyceridemia had a higher prevalence in both male and female populations [7, 10]. This difference was attributed to the difference in dietary habits between the two countries. The study also showed the age distribution of the participants and their association with the pattern of dyslipidemia. Among the different age groups, Isolated hypercholesterolemia did not show a significant difference between the two age groups, but isolated hypertriglyceridemia and mixed hyperlipidemia were found more in the older age group, which was significant. These findings were also supported by the findings of Islam *et al*. and were attributed to the older generation having less physical activities compared to the younger generation [7]. The male population had a greater prevalence of all three forms of dyslipidemia found in our study than the female population. This was most likely due to the male population's varied eating habits and excessive fat-rich food intake. Another possible explanation for the low incidence of female dyslipidemia patients is the presence of certain hormones seen in women under the age of 40 that reduce their chances of developing dyslipidemia. The patients' good eating habits were assessed using a 13-item food-frequency questionnaire developed by Soori *et al*. [12]. Our study found a significant negative correlation between bread consumption and total cholesterol and LDL, a significant negative correlation between chicken consumption and LDL in males, a significant negative correlation between egg consumption and HDL in males, and a significant positive correlation between milk and fruit with HDL-C and fruit with TG in males, and a significant positive correlation between vegetables and HDL in females. In females, there was also a substantial positive connection between fruits and total cholesterol and TG. In addition, the study found a substantial negative link between veggies and total cholesterol and TG in men, as well as a significant negative correlation between LDL-C and chicken in men. In males, there were substantial negative associations between HDL-C with red meat, cake, and soft drinks, while in females, there were significant negative correlations between HDL-C and cake, soft drinks, chocolate, and deep-fried appetizers. Our study also found a strong positive link between TG and soft drinks, as well as a significant positive correlation between soft drinks and total cholesterol and HDL-C in females. Deep-fried foods, on the other hand, had a positive connection with total cholesterol in men. Chocolate and ice cream were shown to have a substantial positive link with total cholesterol in men, and a significant positive correlation with LDL-C in women. These findings were similar to those of another 2010 study, which found that unhealthy meals are the leading cause of dyslipidemia in both men and women [10].

Limitations of The Study

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

CONCLUSION

The study shows that isolated hypercholesterolemia is prevalent. Food habits also have an impact on lipid profile among study subjects. Healthy foods are mostly associated with high HDL-C. Unhealthy food consumption has a high correlation with dyslipidemia in both male and female populations.

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