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PROSPECTIVE STUDY ON IMPACT OF LIFESTYLE MODIFICATIONS ON BIOCHEMICAL PARAMETERS IN PATIENTS WITH CORONARY ARTERY DISEASE

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ABSTRACT

Backdrop: Coronary artery disease (CAD) remains a leading cause of morbidity and mortality, with lifestyle factors playing a key role in disease progression and recurrence.
Objective: To evaluate the effect of structured lifestyle modifications on biochemical parameters in patients with established CAD.
Methods: A prospective interventional study was conducted involving CAD patients who underwent lifestyle changes over a 6-month period. Interventions included dietary adjustments, physical activity, and cessation of smoking and alcohol. Biochemical markers were assessed before and after the intervention.
Discussion: The majority of participants were aged 51–70 years, predominantly male, and urban dwellers. Post-intervention data revealed significant reductions in total cholesterol, LDL-C, VLDL, triglycerides, hs-CRP, uric acid, and fasting blood sugar, along with increased HDL-C levels. These changes reflect improved metabolic status, reduced inflammation, and lowered cardiovascular risk.
Conclusion: Lifestyle modifications yielded substantial improvements in biochemical risk factors in CAD patients. Non-pharmacological interventions are vital for secondary prevention and long-term cardiovascular health enhancement.

Key-words: coronary artery disease, lipid profile, hsCRP, uric acid and life style modifications

INTRODUCTION

Coronary artery disease (CAD) remains the foremost cause of morbidity and mortality worldwide, primarily driven by modifiable risk factors including dyslipidemia, inflammation, hyperuricemia, and impaired glucose metabolism [1]. Lifestyle changes have emerged as effective, non-pharmacological tools to counteract these biochemical abnormalities and slow atherosclerotic progression [2]. Lipid profile abnormalities are central to the pathogenesis of CAD. Elevated total cholesterol, low-density lipoprotein cholesterol (LDL-C), and triglycerides (TG), along with reduced high-density lipoprotein

cholesterol (HDL-C), promote endothelial dysfunction and plaque formation [3]. Lifestyle interventions including dietary changes and physical activity are known to modulate lipid levels favorably [4]. High-sensitivity C-reactive protein (hs-CRP), an acute-phase reactant and a sensitive marker of systemic inflammation, is strongly associated with atherosclerotic burden and cardiovascular events [5]. Elevated hs-CRP levels are predictive of future cardiovascular risk even in individuals with normal lipid levels, underscoring the inflammatory component of CAD [6]. Hyperuricemia has been increasingly recognized as an independent cardiovascular risk factor. Uric acid, beyond its role in gout, contributes to oxidative stress, endothelial dysfunction, and smooth muscle cell proliferation—mechanisms integral to atherogenesis [7,8]. Elevated serum uric acid levels have been linked with higher incidence and severity of CAD [9]. Fasting blood sugar (FBS) levels, a marker of glycemic control, play a crucial role in cardiovascular health. Insulin resistance and hyperglycemia exacerbate endothelial dysfunction and oxidative stress, facilitating plaque instability and thrombosis [10]. Even mild elevations in FBS in prediabetic states can significantly increase CAD risk [11]. Lifestyle modifications—including adoption of a heart-healthy diet, regular exercise, smoking cessation, and stress reduction—have shown significant promise in altering these parameters [12]. Such interventions can help achieve better control of lipid levels, reduce inflammation, lower uric acid, and improve glycemic indices [13]. Given the rising burden of CAD and its strong association with lifestyle-related biochemical disturbances, evaluating the effect of lifestyle modifications on these parameters becomes critically important. This study aims to assess the impact of structured lifestyle changes on lipid profile, hs-CRP, uric acid, and fasting blood sugar in patients with established CAD.

OBJECTIVES OF THE STUDY: The Primary Objective of the study is to determine the impact of lifestyle modifications on key biochemical parameters in patients with coronary artery disease (CAD) over a 6-month period.

Specific Objectives:

1) To determine the risk factors of CAD at baseline.
2) To compare the baseline lipid profile (total cholesterol, LDL-C, HDL-C, and triglycerides) and Apolipoprotein B/A1 ratio with values obtained after 6 months of lifestyle intervention.
3) To assess changes in high-sensitivity C-reactive protein (hs-CRP), uric acid and fasting blood glucose levels from baseline to 6-month follow-up as a marker of systemic inflammation.

MATERIALS AND METHODS

Study Area: The prospective observational study was conducted in the department of Biochemistry, Department of Cardiology and General Medicine, National Institute of Medical Sciences and Research (NIMS&R), NIMS University Jaipur; Department of Cardiology, Department of General Medicine, IQ City hospital and Department of Biochemistry, IQ City medical college, Durgapur, West Bengal. **Study Population:** Clinically diagnosed and laboratory confirmed cases of coronary artery disease (CAD).

Inclusion Criteria: Clinically diagnosed and laboratory confirmed CAD patients (prior myocardial infraction, unstable angina, history of coronary artery bypass grafting (CABG) surgery, history of coronary angiography and coronary angioplasty, non-invasive investigations for CAD, documented use of drugs for CAD, hospital admission for CAD, family history of ischemic heart disease, hypertension, dyslipidaemia, stroke and coronary risk factors in the age group 30-70 years who are willing to provide voluntary informed consent were included in the study. Pregnant women, patients taking medicine for other underlying diseases i.e rheumatic heart disease (RHD), chronic kidney disease (CKD) and patients who had undergone surgery in the last three months were excluded from the study.

Sample collection and analysis: Baseline and 6 months follow-up whole blood samples were collected from 300 CAD patients included in the study. The biochemical parameters lipid profile, apo

B, apo A1, hsCRP, uric acid and fasting blood glucose were measured using fully automated biochemistry analyser.

Statistical analysis: the data was entered into Microsoft excel sheet and the statistical analysis was carried out using SPSS20.

RESULTS

Table 1: Frequency distribution of age of patients

Age Interval	n = 300	In %
30 - 40	17	5.67%
41 - 50	54	18.00%
51 - 60	120	40.00%
61 - 70	109	36.33%

Table 2: Frequency distribution of gender of patients

Gender	n = 300	In %
Male	184	61.33%
Female	116	38.67%

Table 3: Frequency distribution of habitat of patients

Habitat	n = 300	In %
Rural	96	32.00%
Urban	204	68.00%

Table 4: Distribution of Clinical and Family History of Cardiovascular Events Among Patients

Variables	Yes		No	
	n = 300	In %	n = 300	In %
H/o Prior Myocardial infarction	93	31%	207	69%
H/o Unstable Angina	185	61.7%	115	38.3%
H/o CABG surgery	51	17%	249	83%
Coronary angiography and angioplasty	100	33.3%	200	66.7%
Hospital admission for CAD	68	22.7%	232	77.3%
Family H/o ischemic heart disease	81	27%	219	73%
Stroke	86	28.7%	214	71.3%

Table 5: Association of life style modification with habits of patients by using McNemar test

Variables		Yes	No	McNemar test	P-Value	Significance
Diet	**Yes**	37	16	63.075	< 0.0001	All are significant
	No	104	143			
Physical Activity	**Yes**	94	2	96.24	< 0.0001	
	No	104	100			
Smoking Habits	**Yes**	138	21	9.191	0.0024	
	No	47	94			
Alcoholic	**Yes**	76	16	7.579	0.0059	

	No	3	205			

Table 6: Descriptive statistics of lipid profile parameters, Apolipoprotein B/A1 ratio of patients at baseline & follow up

Variables		**Minimum**	**Maximum**	**Median (IQR)**
Triglyceride (mg/dL)	**Baseline**	180	242	212 (194-228)
	Follow up	156	239	196 (180-216)
Total Cholesterol (mg/dL)	**Baseline**	190	274	235 (215-252)
	Follow up	172	269	225 (204-242)
HDL (mg/dL)	**Baseline**	26	43	35 (30-39)
	Follow up	26	50	38 (34-42)
LDL (mg/dL)	**Baseline**	130	200	168 (148-185)
	Follow up	110	193	154 (136-170)
VLDL (mg/dL)	**Baseline**	35	48.4	39 (37-43.25)
	Follow up	30	48	37 (34-41.2)
Apolipoprotein B/A1 ratio	**Baseline**	0.51	1.24	0.745 (0.59-1.02)
	Follow up	0.54	1.16	0.66 (0.6-0.96)

Table 7: Effectiveness of life style modification on lipid profile parameters by using paired t-test

Variables	**Baseline**	**Follow up**	**Paired t-test**	**P - Value**	**Significance**
Triglyceride	211 ± 18.88	197.6 ± 20.94	34.41	< 0.0001	All are significant
Total Cholesterol	233.6 ± 23.86	223.1 ± 24.31	38.91	< 0.0001	
HDL	34.65 ± 5.23	38.19 ± 5.39	-28.16	< 0.0001	
LDL	166.3 ± 20.2	153 ± 20.55	51.83	< 0.0001	
VLDL	40.3 ± 3.95	37.77 ± 4.32	25.02	< 0.0001	
Apolipoprotein B/A1 ratio	0.813 ± 0.237	0.764 ± 0.201	5.189	< 0.0001	Significant

Table 8: Descriptive statistics of biochemical parameters of patients at baseline & follow up

Variables		**Minimum**	**Maximum**	**Median (IQR)**
HS-CRP	**Baseline**	0.19	34.1	2.4 (1.19-3.51)
	Follow up	0.11	29.82	2.27 (1.14-3.26)
Uric Acid	**Baseline**	2.2	13.9	5.85 (4.5-7.83)
	Follow up	2.3	10.3	5.8 (4.5-6.9)
Fasting blood Sugar	**Baseline**	30	466	108 (96-140)
	Follow up	70	413	104 (93-128)

Table 9: Effectiveness of life style modification on biochemical parameters by using paired t-test

Variables	**Baseline**	**Follow up**	**Paired t-test**	**P - Value**	**Significance**
HS-CRP	2.57 ± 2.52	2.33 ± 2.30	5.14	< 0.0001	All are significant
Uric Acid	6.15 ± 2.03	5.85 ± 1.75	3.977	0.0001	
Fasting blood sugar	123.7 ± 52.63	116.84 ± 40	5.047	< 0.0001	

DISCUSSION

In this study evaluating the effect of lifestyle modifications on biochemical parameters in patients with coronary artery disease (CAD), the demographic data revealed that the majority of patients were in the age group of 51–60 years, followed by 61–70 years. This is consistent with established epidemiological trends indicating an increased incidence of CAD with advancing age, likely due to cumulative exposure to cardiovascular risk factors over time [14]. A higher prevalence of CAD among males (61.33%) was also observed, which aligns with earlier studies suggesting that men are at a greater risk of developing CAD, particularly before the age of 60, due to protective effects of estrogen in premenopausal women and differences in risk factor profiles [15]. Urban residents constituted 68% of the study population, suggesting a higher burden of CAD in urban settings. This could be attributed to sedentary lifestyles, higher stress levels, increased consumption of processed food, and reduced physical activity, which are more commonly associated with urban living [16]. The clinical history of patients indicated that a substantial number had previous cardiovascular events or interventions, including prior myocardial infarction (31%), unstable angina (61.7%), and coronary angioplasty (33.3%). These figures underscore the chronic and recurrent nature of CAD, reinforcing the need for secondary prevention strategies beyond pharmacotherapy [17]. Lifestyle modifications showed a significant association with positive changes in patient habits. Dietary adherence improved markedly, and a significant increase in physical activity was reported over the 6-month follow-up. Smoking and alcohol consumption also decreased significantly, as revealed by the McNemar test (Table 5). These findings are clinically meaningful, as behavioral modifications form the cornerstone of long-term risk factor management in CAD. Regular physical activity and dietary changes have been shown to improve endothelial function, reduce sympathetic activity, and attenuate inflammatory responses—all of which contribute to reduced cardiovascular risk [18]. Smoking cessation and reduction in alcohol intake further aid in improving vascular health and reducing thrombotic potential [19]. Biochemical analyses demonstrated significant improvements in lipid profile parameters following lifestyle interventions. There was a marked decrease in triglycerides, total cholesterol, LDL-C, and VLDL, accompanied by a significant increase in HDL-C (Table 6). These results are in agreement with several large-scale studies and meta-analyses that have shown favorable lipid changes in response to dietary patterns such as the Mediterranean or DASH diets, combined with regular aerobic activity [20]. An increase in HDL-C is particularly beneficial, given its role in reverse cholesterol transport and anti-inflammatory effects, while the reduction in LDL-C and VLDL directly translates into lower atherogenic risk [21]. The significant reduction in the ApoB/ApoA1 ratio from baseline to follow-up indicates a favorable shift in lipid profile associated with reduced atherogenic risk. This ratio is a strong predictor of cardiovascular events, reflecting the balance between pro-atherogenic and anti-atherogenic lipoproteins. The observed decrease suggests improved lipid metabolism, likely due to effective lifestyle or pharmacological interventions. Such changes are indicative of a reduced burden of cardiovascular disease in the studied population [19-21]. The inflammatory marker hs-CRP also decreased significantly after 6 months, indicating a reduction in systemic inflammation. Elevated hs-CRP is a well-established independent predictor of cardiovascular events and is considered a surrogate marker for vascular inflammation and plaque vulnerability [22]. The observed reduction in hs-CRP may reflect not only improvements in lifestyle but also stabilization of atherosclerotic plaques, potentially lowering the risk of acute coronary syndromes. Uric acid levels were significantly reduced after lifestyle changes, a finding that adds to the growing body of evidence linking hyperuricemia with cardiovascular disease. Elevated uric acid has been associated with oxidative stress, endothelial dysfunction, and vascular inflammation—all of which contribute to atherosclerosis [10]. The reduction seen in this study may be attributed to improved dietary quality (e.g., reduced purine and fructose intake) and enhanced renal clearance facilitated by regular physical activity. Similarly, fasting blood sugar (FBS) levels decreased significantly after lifestyle interventions. Hyperglycemia, even at prediabetic levels, is known to impair endothelial function, increase oxidative stress, and promote prothrombotic states. Lifestyle interventions, particularly those focused on weight

reduction, increased insulin sensitivity, and improved dietary glycemic load, have demonstrated a clear benefit in glucose homeostasis [13]. Overall, the findings from this study emphasize the significant role lifestyle interventions can play in modifying biochemical risk factors associated with CAD. These non-pharmacological measures complement standard therapies and offer a sustainable approach to long-term cardiovascular risk reduction. The results are particularly encouraging in populations with established disease, highlighting that secondary prevention through lifestyle change is not only feasible but also highly effective.

CONCLUSION

Lifestyle modifications significantly improved key biochemical parameters—including lipid profile, apo B/apo A1 ratio, hs-CRP, uric acid, and fasting blood sugar—in patients with coronary artery disease. These findings highlight the pivotal role of non-pharmacological interventions in secondary prevention. Regular physical activity, a heart-healthy diet, and cessation of harmful habits contributed to favorable metabolic outcomes. Incorporating structured lifestyle changes can greatly enhance long-term cardiovascular health and reduce disease progression.

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