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ORIGINAL RESEARCH

Investigating the effect of a short-term low carbohydrate paleolithic diet on risk markers of cardiovascular diseases

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ABSTRACT

Background: The paleolithic diet which is a low carbohydrate diet has gained immense attention from medical professionals and the general population concerning its ability to control diabetes and weight loss with other added benefits. However, it is vital to assess its efficacy on levels of lipid and cardiovascular risk has not been answered. **Aim:** The present study was aimed to assess the impact of a short-term low-carbohydrate paleolithic diet on levels of lipids such as HDL (high-density lipoprotein), LDL (low-density lipoprotein), and TAG (triglycerides) along with cardiovascular risk markers such as ApoB (apolipoprotein) and ApoA1 (apolipoprotein A1). **Methods:** The present study assessed 212 subjects attending institute OPD for differing health concerns and were assessed after intervening with their dietary pattern. The diet prescribed to study subjects was the Paleolithic diet having a fat, carbohydrate, and protein ratio of 65:20:15, and were followed regularly for compliance. **Results:** Following three months of compliance, the study results showed that the paleolithic diet has a significant impact on decreasing the levels of triglycerides with p=0.001 and significantly increasing LDL, HDL, and ApoA1 levels with p=0.0008, 0.004, and 0.01 respectively. However, no significant change was seen in ApoB levels, LDL/ApoB ratio, and ApoB/ApoA1 ratio. **Conclusion:** The present study concludes that a short-term, low-carbohydrate paleolithic diet is not pro-atherogenic, however, it poses favorable alteration in cardiac markers and lipid profile and hence decreases the associated risk of CVD (cardiovascular disease).

Keywords: ApoB, ApoA1, LDL, HDL, Cardiovascular, Low carbohydrate, Paleolithic diet, Triglycerides

INTRODUCTION

CVD (cardiovascular diseases) are reported to high prevalence in India affecting the majority of the population and contributing to the cause of 28% of deaths in India. A few of the established risk factors for CVD (cardiovascular disease) include metabolic syndrome, dyslipidemia, and poor diet. Dyslipidemia is the result of either increased LDL cholesterol levels, decreased HDL cholesterol levels, increased triglyceride levels, or a combination of these factors. The study by ICMR-INDIAB depicts that 21% of Indians have high LDL levels and 32% and 67% of Indians have low HDL and high triglyceride levels. Also, India has one of the highest prevalence of metabolic syndrome affecting nearly 30% of subjects. It is also known that 12-15% of CVD cases are due to metabolic syndrome.[1]

The primary indicators of cardiovascular health are lipid profiles which include TAG, HDL, LDL, and total cholesterol which are primary indicators of cardiovascular health. Apolipoproteins such as ApoB and ApoA1 are given needed importance presently as they provide insight into cardiovascular risk and lipid metabolism in a subject. ApoA1 is the main apoprotein of HDL which is vital for reverse cholesterol transport and cholesterol efflux.

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Alternatively, ApoB, which is a primary protein of LDL articles is known as a more accurate predictor of cardiovascular disease than LDL cholesterol alone.[2,3]

Increased incidence of metabolic syndrome and dyslipidemia causing cardiovascular diseases has increased interest in dietary intervention to manage these conditions. The two main types of diet are low-carbohydrate diet and low fat/low-calorie diet. In the past two decades, there has been a considerable increase in low carbohydrate diet intake as ketogenic and paleolithic diets for metabolic disorders such as obesity, diabetes, and others.[4]

The paleolithic diet or paleo diet is a type of low-carbohydrate diet. Existing literature data has reported that the Paleo diet can improve inflammatory markers, glycemic control, and body composition. Depending on available evidence, the European Society of Cardiology has reported that a low carbohydrate diet can be given to subjects under the supervision of a medical professional.[5]

The paleo diet is characterized by low-carbohydrate intake with high-fat content and moderate protein consumption. Decreased intake of carbohydrates caused reduced serum insulin levels and increased lipolysis which can lead to improved lipid profile. Also, a low carbohydrate diet can increase HDL and decrease triglycerides. However, its effects on ApoB levels and LDL cholesterol remain controversial. Existing literature data depicted no change in LDL, but significantly improved triglyceride and HDL after 1 year following a low carbohydrate paleolithic diet on apoproteins and lipid profiles which are vital biomarkers of cardiovascular risk.[6]

MATERIALS AND METHODS

The present study aimed to assess the impact of a short-term low-carbohydrate paleolithic diet on levels of lipids as HDL (high-density lipoprotein), LDL (low-density lipoprotein), and TAG (triglycerides) along with cardiovascular risk markers as ApoB (apolipoprotein) and ApoA1 (apolipoprotein A1). The study subjects were from the Outpatient Department of the Institute. Verbal and written informed consent were taken from all the subjects before participation.

The study assessed subjects who visited the Institute within the defined study period. The exclusion criteria for the study were subjects on triglyceride or cholesterol medications, lactating females, pregnant females, critically ill subjects, alcoholics, chronic kidney disease history, and CVD (cardiovascular disease) history. The study assessed subjects aged 25 to 75 years of age.

Nearly 262 subjects were included in the present study from both the genders. Anthropometric data were assessed 2mL of venous blood was collected and centrifuged and various parameters were assessed. Triglycerides, HDL, LDL, and total cholesterol levels were assessed using standard enzymatic assays. ApoB and ApoA1 levels were assessed using immunoassay. Individual dietary preferences were considered and subjects were advised for either mixed, ovo-vegetarian, or vegetarian diet. Individual calorie need was calculated depending on anthropometric data and diet was planned.

A carbohydrate: protein: fat ratio of 20:15:65 was used. A model diet chart (Table 1). The diet recipes and plan were advised by consulting the dietician. Non-vegetarian regimen allowed 64 grams of carbohydrates and 1640 kcal/day, whereas, in vegetarian regimen provided 66g carbohydrates/day and 1870 kcal/day. Depending on weight and height, calories were adjusted to deliver an isocaloric menu.

An isocaloric diet is a diet that allows and provides per day energy needs of a person which is calculated using anthropometric measurements and providing the same calories. This is done for the prevention of bias on whether the diet effects are from calorie deficiency or diet per se when a hypocaloric diet is used. Dietary intake was monitored via regular consultations and food diaries to ensure compliance and subjects were asked to send photos of food plates via WhatsApp daily.

The photos were then specified and verified and the corrections were provided by the dieticians. Weekly phone calls were planned to ensure compliance. Subjects were then advised to continue with the current medications for their comorbid illness and were advised to continue with the same level of physical activity as before. Blood samples were gathered at the end of the study period to assess apolipoprotein and lipid profile levels.

The data gathered were analyzedstatistically using SPSS (Statistical Package for the Social Sciences) software version 24.0 (IBM Corp., Armonk. NY, USA) for assessment of descriptive measures, Student t-test, ANOVA (analysis of variance), and Chi-square test. The results were expressed as mean and standard deviation and frequency and percentages. The p-value of <0.05 was considered.

RESULTS

The present study aimed to assess the impact of a short-term low-carbohydrate paleolithic diet on levels of lipids as HDL (high-density lipoprotein), LDL (low-density lipoprotein), and TAG (triglycerides) along with cardiovascular risk markers as ApoB (apolipoprotein) and ApoA1 (apolipoprotein A1). The present study assessed 212 subjects attending institute OPD for differing health concerns and were assessed after intervening with their dietary pattern. The mean age of the study subjects was 43.4 years. There were 144 males and 68 females in the present study. Mean BMI was 32.1kg/m2 before intervention and was 28.7kg/m2 in study subjects after intervention. HbA1c levels before and after intervention were 7.2 and 5.8 (Table 2).

The study results showed that on assessing the mean values of biochemical parameters before and after diet intervention, LDL/ApoB ratio, ApoB/ApoA1 ratio, ApoB, and total cholesterol levels were statistically

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non-significant before diet intervention and after diet intervention with p>0.05. ApoA1 levels were 130.4mg/dl before diet intervention and increased significantly to 136mg/dl after diet intervention with p=0.01. Total triglycerides decreased significantly after diet intervention with p=0.001. Total HDL and LDL levels increased significantly after diet intervention with p=0.004 and 0.0008 (Table 2).

It was also seen that measuring apolipoproteins provided vital information. HDL and ApoA1 levels increased significantly, however, ApoB levels remained unchanged after diet intervention. To assess why levels of LDL elevated and ApoB were the same. The study assessed two ratios namely LDL/ApoB and ApoB/ApoA1 ratio that were assessed and no increase was seen in the ratio. Although, mean LDL levels increased by 10mL following diet, there was no change in levels of ApoB and no difference was seen before and after the intervention.

Table 1: Model diet chart in study subjects

S. No	Meal	
1.	**Breakfast**	50-80 almonds/50-100 grams of boiled or roasted peanuts or 100 grams of raw coconut/ 30g butter mixed in 200mL milk/tea/coffee
2.	**Lunch**	Ovo-vegetarian/non-vegetarian: 4 whole eggs+30g cheese+200g vegetables Vegetarian-50g of raw cocnut+50g cheese+300g vegetables
3.	**Snacks**	One cup coconut (50grams)/150grams vegetables 1-2amla/salted lemon juice (1-2 lemon)/veg/non-veg soups 50g pistachio/100mL milk/100g one raw guava/100mL curd
4.	**Dinner**	Vegetarian/ovo-vegetarian-100-200g of mushrooms/paneer+30g cheese Non-vegetarian-150-300g meat (fish/mutton/chicken)

Avoid millets, lentils, tuberous vegetables, juices, fruits, breads, sweets and sugar of all kinds

Table 2: Demographic data of study subjects

S. No	Characteristics	Before intervention	After intervention
1.	**Total number**	212	212
2.	**Gender**		
a)	Males	144	
b)	Females	68	
3.	**Mean age (years)**	43.4	
4.	**Mean BMI (kg/m2)**	32.1	28.7
5.	**HbA1c**	7.2	5.8

Table 3: Mean values of biochemical parameters before and after diet intervention

Parameters	Before diet intervention	After diet intervention	p-value
LDL/ApoB ratio	1.27	1.42	>0.05
ApoB/ApoA1 ratio	0.76	0.7346	>0.05
ApoA1 (mg/dl)	130.4	136	**0.01**
ApoB (mg/dl)	98.2	99	>0.05
Triglycerides (mg/dl)	142.5	113.1	**0.001**
HDL (mg/dL)	43.1	47	**0.004**
LDL (mg/dl)	129.9	139.7	**0.0008**
Total cholesterol (mg/dl)	195	205	>0.05

DISCUSSION

The present study assessed 212 subjects attending institute OPD for differing health concerns and were assessed after intervening with their dietary pattern. The mean age of the study subjects was 43.4 years. There were 144 males and 68 females in the present study. Mean BMI was 32.1kg/m2 before intervention and was 28.7kg/m2 in study subjects after intervention. HbA1c levels before and after intervention were 7.2 and 5.8. These data were comparable to the previous studies of Harvey C et al[7] in 2019 and Paoli A et al[8] in 2021 where authors assessed subjects with diet modification and demographic data comparable to the present study.

It was seen that on assessing the mean values of biochemical parameters before and after diet intervention, LDL/ApoB ratio, ApoB/ApoA1 ratio, ApoB, and total cholesterol levels were statistically non-significant before diet intervention and after diet intervention with p>0.05. ApoA1 levels were 130.4mg/dl before diet intervention and increased significantly to 136mg/dl after diet intervention with p=0.01. Total triglycerides decreased significantly after diet intervention with p=0.001. Total HDL and LDL levels increased significantly after diet intervention with p=0.004 and 0.0008. These results were consistent with the studies of Volek JS et al[9] in 2004 and Păunică I et al[10] in 2023 where results for

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biochemical parameters before and after diet intervention as triglycerides decreased significantly after diet intervention and HDL and LDL levels increased significantly after diet intervention similar to the present study was also reported by the authors in their respective studies.
The study results showed that measuring apolipoproteins provided vital information. HDL and ApoA1 levels increased significantly, however, ApoB levels remained unchanged after diet intervention. To assess why levels of LDL elevated and ApoB were the same. The study assessed two ratios namely LDL/ApoB and ApoB/ApoA1 ratio that were assessed and no increase was seen in the ratio. Although, mean LDL levels increased by 10mL following diet, there was no change in levels of ApoB and no difference was seen before and after the intervention. These findings were in agreement with the studies of Tani S et al[11] in 2017 and Chawla S et al[12] in 2020 where authors reported no increase in LDL/ApoB and ApoB/ApoA1 ratio as seen in the results of the present study.

CONCLUSIONS

Within its limitations, the present study concludes that a short-term, low-carbohydrate paleolithic diet is not pro-atherogenic, however, it poses favorable alteration in cardiac markers and lipid profile and hence decreases the associated risk of CVD (cardiovascular disease). However, the study had a few limitations small sample size and one-time assessment. Hence, further longitudinal studies with larger sample sizes and longer monitoring are needed to reach a definitive conclusion.

REFERENCES

1. Sniderman AD, Cianflone K. Measurement of apolipoproteins A-I and B: clinical significance and future directions. Clin Chem. 1993;39:249-52.
2. Ford ES. Risks for all-cause mortality, cardiovascular disease, and diabetes associated with the metabolic syndrome: A summary of the evidence. Diabetes Care. 2005;28:1769–78.
3. Meher T, Sahoo H. The epidemiological profile of metabolic syndrome in Indian population: a comparative study between men and women. Clin Epidemiol Glob Health. 2020;8:1047–52.
4. Anjana RM, Pradeepa R, Deepa M, et al. Prevalence of diabetes and prediabetes (impaired fasting glucose and/or impaired glucose tolerance) in urban and rural India: phase I results of the Indian Council of Medical Research-INdiaDIABetes (ICMR-INDIAB) study. Diabetologia. 2011;54:2-7.
5. Arnett DK, Blumenthal RS, Albert MA, et al. 2019 ACC/AHA guideline on the primary prevention of cardiovascular disease: executive summary: a report of the American College of Cardiology/AmericanHeart Association Task Force on clinical practice guidelines. Circulation. 2019;140:e563-95.
6. Ruhil, R. India has reached the descending limb of the tobacco epidemic. Indian J Comm Med. 2018;43:153–6.
7. Harvey C, Schofield GM, Zinn C, et al. Low-carbohydrate diets differing in carbohydrate restriction improve cardiometabolic and anthropometric markers in healthy adults: a randomized clinical trial. PeerJ. 2019;7:e6273.
8. Paoli A, Cenci L, Pompei P, et al. Effects of two months of very low carbohydrate ketogenic diet on body composition, muscle strength, muscle area, and blood parameters in competitive natural bodybuilders. Nutrients. 2021;13:374.
9. Volek JS, Sharman MJ, Gomez AL et al. Comparison of a very low-carbohydrate and low-fat diet on fasting lipids, LDL subclasses, insulin resistance, and postprandial lipemic responsesin overweight women. J Am Coll Nutr. 2004;23:177–84.
10. Păunică I, Mihai AD, Ștefan S, Pantea-Stoian A, Serafinceanu C. Comparative evaluation of LDL-CT, non-HDL/HDL ratio, and ApoB/ApoA1 in assessing CHD risk among patients with type 2 diabetes mellitus. J Diabetes Complications. 2023;37:108634
11. Tani S, Yagi T, Atsumi W, Kawauchi K, Matsuo R, Hirayama A. Relation between low-density lipoprotein cholesterol/apolipoprotein B ratio and triglyceride-rich lipoproteins in patients with coronary artery disease and type 2 diabetes mellitus: a cross-sectional study. Cardiovasc Diabetol. 2017;16:123.
12. Chawla S, Tessarolo Silva F, Amaral Medeiros S, et al. The effect of low-fat and low-carbohydrate diets on weight loss and lipid levels: a systematic review and meta-analysis. Nutrients. 2020;12:3774.