Acta Scientific NUTRITIONAL HEALTH (ISSN:2582-1423)

Volume 6 Issue 6 June 2022

Case Study

Is it "Diet Alone" or "Diet-with-Exercise" that Primarily Influence Blood HDL-C Concentration? a Case Study

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DOI: 10.31080/ASNH.2022.06.1064

Received: April 11, 2022

Published: May 25, 2022

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Abstract

Controversy exists in literatures concerning the effect of diet-alone or diet-with exercise in altering blood high-density lipoprotein-Cholesterol (HDL-C) concentration. This case study has assessed the influence of consuming high-CHO and high-fat diet in altering blood HDL-C alone or in combination with exercise. A healthy active subject, 29 years and 78 kg had a basal HDL-C level of 50.9 mg/dl with normal-balanced diet. 1. During diet-alone trial, the subject consumed a high-CHO diet (70% CHO, 18% fat, 12% protein) for 1-month and his HDL-C level was 36.3 mg/dl. After 7-days gap, he took high-fat diet (20% CHO, 68% fat, 12% protein) for 1-month and his HDL-C was raised to 71.4 mg/dl. 2. During diet with exercise trial, the subject took similar (i.e., high-CHO and high fat) diet and additionally performed an intensive (85% HRmax, 30 min), and moderate excise (50% HRmax, 90 min) tests with 7 days interval. Results indicated that high-CHO intake alone or with exercise, depressed blood HDL-C to the same degree (by about 28%), but to the contrary, intake of high-fat diet elevated HDL-C (by about 40%) compared to the basal diet. Exercise did not influence HDL-C concentration different from the dietary effect alone. This case report primarily indicates a greater sensitivity of HDL-C to diet than physical exercise in optimizing blood HDL-level. A cohort study that includes gender is necessary to reach to a reasonable conclusion.

Keywords: Diet; HDL-C; Exercise; High-Fat; Diet Alone

Introduction

Low blood HDL-C concentration (< 40 mg/dl) is positively associated with the development of cardiovascular disease risk [1]. Therefore, health professions and exercise physiologists advise people to raise blood HDL-C by consuming a healthy diet and engaging in aerobic exercise activities [2]. A previous study showed that an intake of high-fat increases blood HDL-C concentration [3], but the health benefit of increased HDL-C from high fat intake is not well explained. Other studies have shown the negative aspect of consuming excess fat on cardiac health [4] and immune function [5]. These differences indicate the need for further inquiry on diet and exercise in influencing the concentration of HDL-C in the blood.

Finding the same group of cohorts who would adhere to extreme dietary habits for weeks or months poses a problem. This was a sideway study that gave the opportunity to report the impact of excess dietary intake (high-CHO vs. high-fat diets) with or without exercise in altering plasma HDL-C and other blood metabolites on a healthy active volunteer. The information obtained from this case study may help to promote further research work on diet and exercise in altering the level of blood HDL-C for human health.

Method

An active healthy subject (age: 29 years and weight 78 kg) voluntarily joined the study.

Diet alone trial

The subject first consumed a balanced diet (58% CHO, 30% fat, 12% protein). Venous blood was withdrawn, and serum was prepared and stored at -20^{0}C**.** The subject then took a high-CHO diet (70% CHO, 18% fat, 12% protein) for a month, and after 7-days gap, he shifted to a high-fat diet (20% CHO, 68% fat, 12% protein) and took it for a month. Blood HDL-C and other serum metabolites were measured to standard laboratory procedures.

Diet with exercise trial

The same dietary procedures (i.e., high-CHO and high-fat diets) were followed, but 2-exercise tests were included. These were, an intensive (85%HRmax, 30 min), and moderate (50%HRmax, 90 min) cycle exercise tests performed with 7-days interval. A dietician prepared the dietary proportions. Blood samples collected following each dietary regimen were analysed for blood HDL-C, total-cholesterol (TC), FFA (free fatty acid), and lactate levels to standard laboratory procedures (Table 1). Finally, the different metabolic parameters obtained following each diet and exercise were compared to the basal diet and explained.

Diet Alone				**Diet with Exercise**			
HDL-C				Intensive (30 min)		Moderate (90 min)	
	N	HC	HF	HC	HF	HC	HF
	50.9	36.3	71.4	35.2	71.8	34.8	70.0

Table 1: Experimental design for HDL-C measurements following diet and exercise trials.

HDL-C is in mg/dl. N (normal-balanced diet), HC (high-CHO diet), HF (high-fat diet),

30 min (85%HRmax) exercise, 90 min (50%HRmax).

Result

Consumption of high-CHO without exercise (i.e., diet-alone) decreased blood HDL-C concentration (by about 28%) compared with normal-balanced diet (Figure 1). High-CHO with exercise decreased HDL-C to the same degree like that of the diet alone condition (Table 1 and Figure 1). High-CHO with intensive exercise showed a relative increase in blood lactate compared to basal diet (Table 2). To the contrary, the high-fat diet following the diet-alone and as well as diet with exercise, drastically elevated blood HDL-C (by about 40%) compared with the normal-basal diet (Table 1 and Figure 1). Blood total cholesterol (TC) was relatively low following high-CHO diet (Table 2). Body weight remained more or less constant at 78 kg throughout the dietary intervention test.

Discussion

the effect of diet-alone or diet in combination with exercise in altering blood HDL-C was assessed in this case study to realize which factor greatly influences blood HDL-C concentration. Consequently, the decrease in HDL-C concentration (from 50.9-to-36.3 mg/dl, by about 28%) observed after consuming high-CHO diet (Figure 1), suggests the inhibitory effect of CHO-rich diet on the synthesis of HDL-C in the body. The result is supported by previous works that saw a decreases in blood HDL-C concentration resulting from high-CHO intake [6]. Carbohydrate foods are usually rich in plant-fibres and plant-fibres have the capacity to decrease the absorption of cholesterol from the small intestine [7]. This decreased absorption of cholesterol may have promoted the decrease in HDL-C concentration as has been registered in this study as well (Table 1 and Figure 1). The carbohydrate-induced increase in plasma insulin concentration can also exert a powerful inhibitory effect on adipose tissues reducing circulating plasma FFA concentration (Table 2). Following high-CHO diet, blood total cholesterol (TC) concentration was lower compared to basal diet (Table 2), implying that consuming high CHO diet for relatively longer period has the potential to lower blood TC concentration (Table 2). The relative increase in blood lactic acid observed following the intense exercise (85%HRmax) with high-CHO diet might show a greater degree of CHO oxidation (Table 2).

In this case study, consumption of fat-rich diet (70% of the total calorie) for a month with or without exercise drastically elevated HDL-C concentration (by about 40%) compared with basal level, showing that fat rich diet increases synthesis of HDL-C in the body (Table 1, Figure 1). Some previous studies have come to the same conclusion and suggested that the presence of fat rich diet favours HDL-C production causing its increment in the body [8,9]. However, long-term intake of fat rich diet is considered unhealthy because of its association with cardiovascular disease risk [3] and in weak-

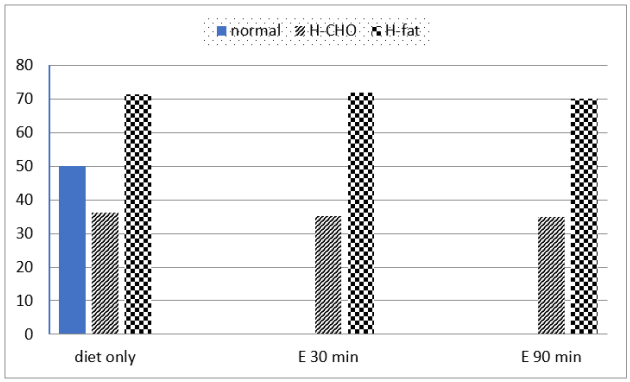

Figure 1: Results of HDL-C with diet-only or diet with exercise (E). Basal HDL-C for normal-balanced diet was (~50 mg/dl), for high-CHO (~35 mg/dl), and for high-fat was (~70 mg/dl). Diet-only and diet with exercise (intensive or moderate) showed a similar trend of change on HDL-C level.

Diet with Exercise				
	Type	Diet alone	Intensive (30min) (85 %HRmax)	Moderate (90min) (85 %HRmax)
FFA (mmol/l)	Balanced	9.7	-	-
	High-CHO	11.3	10.4	9.8
	High fat	13.2	20.2	11.9
Lactate(mmol/l)	Balanced	0.7	-	-
	High-CHO	0.8	1.1	0.6
	High fat	0.5	0.6	0.3
TC (mmol/l)	Balanced	182	-	-
	High-CHO	158	157	156
	High fat	199	200	188

Table 2: Blood metabolites measured following intakes of normal-balanced diet, high-CHO and high fat diet for HDL-C and other blood metabolites during rest (diet-alone) and during (diet with intensive and moderate) exercise.

Blood metabolites measured after normal and high CHO and high-fat diets.

Values were compared with normal-balanced diet.

ening the immune system [5]. However, other papers do not share such views [1]. A recent work by Beata., *et al.* [10] has elaborated that having higher-HDL-C is not protective against cardiovascular disease and may even be harmful for health. Whether increase in HDL-C obtained by consuming fat-rich diet is beneficial for health or not requires further investigation. The body weight of our subject (78 kg) remained unaltered even during the high-fat intake, may be because of the increased fat oxidation.

Limitation

This is not a population study supported by statistical tests. It is a case study that primarily showed the trend of change in blood HDL-C induced by diet and exercise; two factors that remained a point of interest on changes of blood HDL-C. The dietician did not state weather the fat diet was saturated or unsaturated. Generally, a cohort study that includes gender is necessary to justify this case study and reach to a reasonable conclusion. Its strength is that it may be used as a pilot study to explore further research on lipid metabolism and its relation to cardiovascular disease risk.

Conclusion

this case report has shown the great sensitivity of HDL-C to diet than physical exercise. The study emphasizes the need to prioritize dietary intake than exercise to control HDL-C and thereby avoid cardiac risk. This is not to undermine physical exercise, because exercise has many beneficial effects apart from changes on blood HDL-C.

Acknowledgement

The author thanks the research fellow who allowed this work to proceed as a sideway investigation.

Conflict of Interest

The author obtains no financial support and no conflict of interest exists.

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