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Evaluation of the Serum Lipid Profile and Dietary Intake in Patients Undergoing Cholecystectomy

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Abstract

Introduction: New findings suggest that gallbladder not only plays a role in control of concentration and storage of the bile acids, but also, may be effective on nutrients metabolism, in particular on fat metabolism. *Objective:* This study aimed to determine the effects of cholecystectomy on serum lipid parameters. *Materials and methods:* This cross-sectional study was conducted on seventy patients who were undergoing cholecystectomy. The serum concentration of lipoproteins, weight, BMI, and dietary intake of subjects were assessed before and one month after the cholecystectomy operation. *Results:* No significant difference was found regarding serum concentration of triglycerides, total cholesterol, low-density lipoprotein (LDL), and high-density lipoprotein (HDL) to LDL proportion, while, HDL concentration represented a significant reduction after the cholecystectomy. No significant difference was observed in terms of the dietary intake of energy, fat, protein, carbohydrate, fiber, saturated and unsaturated fat before and after the surgery. *Conclusion:* We showed that cholecystectomy decreases the HDL-C by the day of 30 after surgery, however, other biomarkers such as lipoproteins, weight, and BMI, did not differ significantly.Besides, the stability of the serum levels of lipoproteins pre- and post-cholecystectomy may be due to the insignificant changes in factors related to diet.

Keywords: Cholecystectomy, Lipid profile, Dietary intake

1. Introduction

Gallbladder disease is a major health-care problem and gallstones are regarded as the most common biliary problems leading to surgical interventions [1, 2]. Previous studies demonstrated that approximately 35% of gallstone diseases have resulted in cholecystectomy and more than 750,000 cases of cholecystectomy are operated each year in the US [2, 3]. Gallstones, about 80% of which are categorized as cholesterol stones, are likely influenced by both genetic and environmental factors [3]. The prevalence of gallstones is about 10–20% in adult population, affecting women more often than men. Data suggests that the significant risk factors are age, race, sex, pregnancy, obesity, diabetes, rapid weight loss, liver cirrhosis, hemolytic anemia, and the use of certain therapeutic agents, such as estrogens [3, 4].

Patients with dyslipidemia are at high risk of gallstone disease and this may particularly be developed in patients with a malfunctioning triglyceride metabolism [5]. A well-known pathophysiologic factor linked with obesity (as one of the important risk factors of gallstone formation) is cholesterol super saturated bile. The cholesterol gallstone may be correlated with lipid abnormalities [3, 6]. A low HDL cholesterol as well as hyper triglyceridemia has positive effects on developing the stones. One of the risk factors that may put women at more risk for gallstones is the reduced levels of HDL cholesterol among them [6]. Cholesterol

absorption by the gallbladder also decreases in patients suffering from cholesterol gallstones compared to the healthy controls [7].
On the other hand, the gallbladder not only concentrates and stores the bile acids, but also may influence the metabolism of nutrients, especially lipids, and consequently affects the serum levels of these nutrients. Therefore, the removal of this organ will probably lead to the metabolic changes that may alter the serum level of these biomarkers as a consequence [8, 9].
"Fgf19" is the hormonal factor synthesized by the epithelial of gallbladder, although, the secretion is negligible in comparison with the secretion by the ileum. Several studies indicated that it affects the metabolism and serum levels of glucose and lipids [10].
There are limited human studies analyzing the lipid parameters before and after cholecystectomy, and in several studies, these parameters have been compared to the healthy subjects. Moreover, only lipid profile has been measured and compared so far. However, some important and effective factors such as changes in lifestyle, anthropometric variables and daily dietary intakes after the surgery have been neglected so far.
Therefore, this study aimed to investigate the effects of cholecystectomy on serum lipid parameters and some factors including anthropometric variables and dietary intakes before and one month after the surgery.

2. Research Design and Method

Approval of this cross-sectional study was granted by the Ethics Committee of Tehran University of Medical Sciences. All subjects provided an informed written consent form. The participants were selected from the patients who were referred to Alimoradian hospital in Nahavand city for cholecystectomy. Patients who fulfilled the selection criteria were enrolled into the study. The aforementioned variables such as weight, height, BMI, triglyceride (TG), total cholesterol (TC), low-density lipoprotein (LDL), high-density lipoprotein cholesterol (HDL-C), daily intake of calorie, fat, protein, carbohydrate, fiber, saturated and unsaturated fat were analyzed before and one month after the cholecystectomy. Then baseline and completion characteristics were compared (Figure 1).

Figure 1: The process of the research

Exclusion criteria were body mass index higher than 29.9 kg/m^2, suffering from any other disease, smoking, drug addiction, alcohol abuse and pregnancy or lactation. A total of seventy-eight patients were enrolled into the study.

Demographic information such as age, sex, weight, and height were determined and recorded. Body weight and height were measured without heavy clothes by using a Seca scale (Seca, Hamburg, Germany) and a statio-meter (Seca), respectively.
Blood samples were taken after a 12 hour fasting state at the baseline and completion of the study and were kept in -70 ºC until they were assessed. Serum concentrations of triglyceride (TG), total cholesterol (TC), high-density lipoprotein cholesterol (HDL-C), were measured before and 30 days after the surgery by using specific kit (Parsazmon, Tehran, Iran) and the serum concentration of low-density lipoprotein cholesterol (LDL-C) were calculated through the Friede Wald formula [14].
Dietary intakes of participants were assessed using a 3-day dietary recall questionnaire, before and 30 days after the surgery. Dietary data were analyzed using Dorosti Food Processor (DFP), created by the National Research Institute of Nutrition and Food Science (Tehran, Iran). Questioners targeted daily intake of two weekdays and a weekend.

Statistical analysis was performed using the Statistical Package for the Social Sciences (Version 16 for windows; SPSS, Inc). Quantitative data were noted as mean ± standard deviation (SD). Kolmogorov–Smirnov test was used in order to evaluate the normality of variable's distribution. Differences in mean values were analyzed using paired t-test. The level of statistical significance was set to < 0.05.

3. Results

Eight patients were excluded from the study due to the unwillingness to continue (6 patients) and gastrointestinal discomfort (2 patients). Therefore, the data was analyzed on 16 males (23%) and 54 females (77%). The mean age of participants was 51.4±14 years old. The mean ± SD of weight and BMI values are presented in Table 1.

Table 1: The mean of weight and BMI pre and post-cholecystectomy

Characteristic	Pre-cholecystectomy Mean ± SD	Post-cholecystectomy Mean ± SD	P value*
Weight (kg)	68.6± 9.7	67.7 ± 9.7	<0.001
BMI (kg/m^2)	26.2 ± 2.38	25.65 ± 2.39	<0.001

*Statistical significance was a value of P< 0.05

Table 2 presents the mean ± SD of daily intake of calorie, fat, protein, carbohydrate, fiber, saturated and unsaturated fat before and a month after the cholecystectomy. Additionally, Table 3 provides the percent of calorie provided by fat, protein, carbohydrate, saturated and unsaturated fat. No significant difference was found considering these variables during the study period.

Table 2: The mean of daily dietary intake pre and post- cholecystectomy

Variable	Pre-cholecystectomy Mean ± SD	Post-cholecystectomy Mean ± SD	P value
Daily calorie intake (Kcal/day)	2138 ± 461	2110 ± 442	0.40
Daily fat intake (g/day)	94.2 ± 27.8	91.6 ± 27.0	0.542
Daily protein intake (g/day)	63.7 ± 17.4	63.3 ± 17.7	0.856
Daily carbohydrate intake (g/day)	273.9 ± 82.7	273.8 ± 82.8	0.998
Daily saturated fat intake (g/day)	34.0 ± 13.4	36.1± 13.5	0.331
Daily unsaturated fat intake (g/day)	60.6 ± 22.7	55.7 ± 22.2	0.214
Daily fiber intake (g/day)	34.5 ± 11.7	33.8 ± 11.5	0.714

Table 3: The percent calorie intake from macronutrients pre and post-cholecystectomy

Variable	Pre-cholecystectomy	Post-cholecystectomy	P value
	Mean ± SD	Mean ± SD	
Fat	39.6 ± 7.9	39.0 ± 8.1	0.734
Protein	12.0 ± 2.7	12.1 ± 2.7	0.884
Carbohydrate	51.1 ± 9.2	51.7 ± 9.2	0.728
Saturated fat	14.3 ± 4.8	15.4 ± 5.1	0.281
Unsaturated fat	25.5 ± 5.8	23.7 ± 7.9	0.250

Table 4 indicated that no significant difference was found regarding to the serum concentration of TG, TC, LDL-C and HDL/LDL, while, HDL-C concentration represented a significant reduction after the surgery (p=0.036).

Table 4: The mean of serum level of lipid profiles pre and post- cholecystectomy

	Pre-cholecystectomy	Post-cholecystectomy	P value
	Mean ± SD	Mean ± SD	
Total cholesterol (mg/ dl)	182.7 41.8	181.5 36.6	0.718
Triglyceride (mg/ dl)	153.5 79.0	153.0 76.7	0.916

Table 4: (Continued): The mean of serum level of lipid profiles pre and post-cholecystectomy

HDL-C (mg/dl)	43.2 11.7	41.7 10.8	0.036
LDL-C (mg/dl)	110.5 37.7	107.5 32.6	0.390
HDL-c /LDL-C	0.44	0.428	0.543

4. Discussion

The results of this study revealed a significant reduction in HDL-C concentration 30 days after the cholecystectomy compared to the concentrations measured prior to the operation; however, no significant change was observed by considering the other target parameters such as lipoproteins, weight, BMI, and dietary intake.

The significant decrease in HDL one month after cholecystectomy may result from the followings:

a) Rabbit model studies revealed a reduction in HDL-C receptors on hepatocytes during cholesterol gallstone formation. This was followed by a transient elevation in HDL-C receptor, and then a down regulation of these receptors probably occurs during the rest period [11].

b) The mean of daily dietary intake of fat decrease after operation (from 94.2 g/day to 91.6 g/day) and this decrease of fat intake (however not significant) can decrease of HDL-C [15].

Moazeni-Bistgani and colleagues showed a significant increase in TG concentrations three days, one month, and one year after cholecystectomy and a significant decrease in total cholesterol, HDL, and LDL levels three days post-operation. Although, no significant difference was noted in terms of the total cholesterol, HDL, and LDL levels 30 days after cholecystectomy [5]. Total plasma and LDL cholesterol levels decreased significantly in cholecystectomy patients on day 3 after the operation, thereafter, the values returning to the pre-operative level [9]. Other studies demonstrated that LDL cholesterol levels showed a significant increase three days after the surgery, while, it had a significant decrease one month after surgery [11]. A study by Jawad et al, demonstrated that cholecystectomy resulted in a significant increase in plasma levels of TC, TG, VLDL, and LDL and a significant reduction in HDL levels compared to the normal control rabbits [13]. It seems that serum lipid profiles show changes as time passes after the removal of gallbladder, suggesting that their concentrations should be measures during several intervals.

We observed about 0.9kg and 0.4kg/m^2 reduction in body weight and BMI after cholecystectomy, respectively. This slight decrease is probably due to the surgical complications. In spite of being statistically significant, this reduction is much less

likely to have any effect on the lipid parameters. Moreover, we did not observe any significant changes in dietary intakes of the participants during the study. Therefore, these variables could not have a confounding effect on serum lipid profiles. The strength point of this study was attributed to analysis of the dietary intakes of participants.

In conclusion, we showed that cholecystectomy decreases the HDL-C by the day of 30 after surgery, however, other biomarkers such as lipoproteins, weight, BMI, and dietary intake did not differ significantly, suggesting that their concentrations should be measured during several intervals. Besides, the stability of the serum levels of lipoproteins pre and post-cholecystectomy may be due to the insignificant changes in factors related to diet.

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