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Impact of supplemental vitamin D3 and calcium on hypercholesterolemia

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ABSTRACT

Aim: In the present crossover study, we aimed to assess if calcium and vitamin D can help statins for treatment of hypercholesterolemia.

Method: This crossover study was conducted on 60 participants with newly diagnosed hypercholesterolemia. In first phase of study, all patients were administered one 20-mg tablet of atorvastatin every bedtime for sex weeks. Thereafter, in the second phase, all participants received 400 IU vitamin D3 and 1000 mg calcium in addition to previous regimen. After each phase, Lipid profile was evaluated for all participants.

Results: 60 individuals including 26 men (43.3%) and 34 women (56.7%) participated in this study. There was significant decrease in triglyceride, total cholesterol and LDL after six weeks treatment with atorvastatin. However, HDL showed no significant change. When blood lipid values after statin therapy was compared to the values after treatment with atorvastatin plus supplemental calcium and vitamin D3, none showed statistically significant change. BMI was found to decrease significantly in both phase of treatment, but blood pressure showed no change.

Conclusion: In summary, we observed that supplemental calcium and vitamin D3 have no significant impact on lipid profile and blood pressure. However, we found that supplemental calcium and vitamin D3 decreased BMI, but more studies are in need to support our results.

Keywords: hypercholesterolemia, hyperlipidemia, vitamin D3, calcium, statin

INTRODUCTION

Dyslipidemia account as an important risk factor of atherosclerosis and coronary artery disease (CAD) (1). Prevalence of dyslipidemia has been shown to be about 29.3% in adults (2) and there is an increase in the prevalence of dyslipidemia as a consequence of increasing rate of obesity (3).

There are studies tried to investigate role of dietary supplements to reduce blood cholesterol level (4). The consumption of dairy products has been found to have an inverse association with lipid profile and metabolic syndrome (5). Nevertheless, effect of supplemental calcium and vitamin D as complementary therapy in hypercholesterolemia is not well known.

There are very few studies evaluating effects of supplementary calcium and vitamin D on hypercholesterolemia, particularly in Iran. Therefore, in the present crossover study, we aimed to assess if calcium and vitamin D can use as complementary therapy to conventional statins therapy for treatment of hypercholesterolemia.

METHOD AND MATERIALS

This is a crossover study with no control group, which was conducted on 60 participants with newly diagnosed hypercholesterolemia, referred to internal medicine clinic at 501 Army Hospital, Aja University of Medical Sciences, Tehran, Iran in 2017. The study protocol was approved by ethic committee of Aja University of Medical Sciences (ref no. IR.AJAUMS.REC.1395.23). A written informed consent was provided by all participants. Criteria for inclusion were as follow: (1) LDL above 160 mg/dl without or with one of cardiovascular risk factors; (2) LDL above 130 mg/dl with two or more cardiovascular risk factors; (3) LDL above 100 mg/dl in diabetics and patients with history of CVD; (4) total cholesterol above 240. Participants with triglyceride above 400 mg/dl, those who take Lipid-lowering agent within one

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Table 1: *Characteristic of study participants*

Variables	Value
Mean Age ± SD, year	49.37 ± 10.58
Male (%)	26 (43.3%)
History of diabetes (%)	7 (11.7%)
History of CVD (%)	5 (8.3%)
History of HTN (%)	11 (18.3%)
History of fracture (%)	8 (13.3%)
History of osteoporosis (%)	8 (13.3%)

SD standard deviation; CVD cardiovascular diseases; HTN hypertension

Table 2: *Results of comparative analysis*

Variables	1	2	3	P-value	P-value
	At baseline	Statin	Statin + Vit D3 + Ca	1 vs. 2	2 vs. 3
SBP, mmHg	123.33	122.08	124	0.108	0.066
DBP, mmHg	79.08	79.08	79.67	1	0.441
BMI, Kg/m^2	25.67	25.55	25.41	0.002	0.001
Triglyceride, mg/dl	171.52	142.25	138.5	<0.001	0.446
Cholesterol ,mg/dl	253.75	153.76	154.43	<0.001	0.651
LDL, mg/dl	163	82.43	82.67	<0.001	0.903
HDL, mg/dl	52.88	50.92	50.25	0.081	0.458

Vit vitamin; Ca calcium; SBP systolic blood pressure; DBP diastolic blood pressure; BMI body mass index; LDL low-density cholesterol; HDL high density cholesterol

month before recruitment or supplementary calcium and vitamin D in last 6 months were excluded from study. A general practitioner conducted general medical assessments including blood pressure measurements and body mass index (BMI) calculation at baseline and after each phase of study. In addition, self-reported information on diary consumption, income, education and past medical history were collected. Blood pressure was measured is sitting position after five minutes of rest via a standard mercury sphygmomanometer. Weight was measured with indoor clothing using stand body scale and standing height was measured without shoes by measuring rod. In first phase of study, all patients were administered one 20-mg tablet of atorvastatin (Amin Pharmaceutical Company) every bedtime for sex weeks. After six weeks, Lipid profile was evaluated for all participants. Thereafter, in the second phase, all participants treated with oral calcium-vitamin D3 tablets (CalTrex) twice daily (each tablet contains 200 IU vitamin D3 and 500 mg calcium) in addition to previous regimen. To be exact, in the second phase, each patient was administered 20 mg atorvastatin, 400 IU vitamin D3 and 1000 mg calcium every day for six weeks. Lipid profile was rechecked after second six weeks. Participant were informed before each visit by phone call. Normal distribution of variables was assessed using Kolmogorov–Smirnov test. To compare values before and after first phase, as well as before and after second phase, we employed paired sample t test and Wilcoxon rank sum test for normally and non-normally distributed variables, respectively. P-values < 0.05 were considered statistically significant. We used SPSS, version 20 for statistical analysis.

RESULTS

Sixty individuals including 26 men (43.3%) and 34 women (56.7%) participated in this study. The mean age and BMI of participants were 49.37 ± 10.58 years (ranged from 30 to 70 years) and 25.68 ± 3.84, respectively. Among participants, 11.7% and 8.3% were diabetics and had history of cardiovascular disease, respectively. Detailed characteristic of participants is presented in **Table 1**. At the baseline, values of Triglyceride, total cholesterol, LDL and HDL were 171.52, 253.75, 163 and 52.88 mg/dl, respectively. There was significant decrease in triglyceride, total cholesterol and LDL after six weeks treatment with atorvastatin. However, HDL showed no significant change. When blood lipid values after statin therapy was compared to the values after treatment with atorvastatin plus supplemental calcium and vitamin D3, none showed statistically significant change. BMI was found to decrease significantly in both phase of treatment. Despite all this, we realized that systolic and diastolic blood pressures had no change. Results of comparative analysis are provided in **Table 2**.

DISCUSSION AND CONCLUSION

This study was preformed to evaluate the effect of supplemental vitamin D3 and calcium as additive therapy to statin for treatment of hypercholesterolemia. We observed that addition of supplemental vitamin D3 (400 IU daily) and calcium

(1000 mg daily) to conventional atorvastatin had no significant effect on lipid profile values, but BMI was significantly decreased. .

Zemel et al. in a clinical trial study followed 32 obese patients and found that increase in dietary calcium induces weight and fat loss secondary to caloric restriction. In addition, they revealed that dairy products are more effective in making weight loss (6). There are confirmative reports that showed dairy calcium is 50% to 100% more effective that supplemental calcium in term of reduction of adipose tissue (7). It is explained by action Intracellular Ca2+ as a modifying factor of adipocyte lipid metabolism and triglyceride storage. Nevertheless, there are evidences that reject the theory that say supplemental calcium reduces body weight (8,9). Role of vitamin D3 and lipid profile is still a matter of debate. Saedisomeolia et al. in a cross-sectional study evaluated association between serum level of vitamin D and lipid profile. They observed significant inverse association between serum level of vitamin D and triglyceride (10). In another study, Tehrani et al. showed that supplemental vitamin D3 has no significant impact on BMI (11). Although, we detected that supplemental calcium and vitamin D3 have no effect on triglyceride and cholesterol, but BMI decreased significantly after consumption of calcium and vitamin D3. Since people with hyperlipidemia are more advised to change their life style, we believe that decrease in BMI in both phases is mainly due to increase in physical activity and reduce in dietary fat intake.

It has been shown that supplemental calcium has a small and transient hypotensive effect (8). Low serum vitamin D3 level has been postulate as a risk factor of hypertension (12). Margolis et al. in their study evaluated role of supplemental vitamin D3 and calcium on blood pressure. They revealed that supplemental vitamin D3 and calcium have no effect on blood pressure (13). As well as, a clinical trial, showed supplemental vitamin D3 with antihypertensive regimen have stronger therapeutic effect than antihypertensive drug alone (14). Despite all the facts, we observed no association between supplemental calcium and vitamin D3 and blood pressure.

We had some limitation in this study. We had no control group in this study and all phases of study conducted on same patients. Second, we had short follow up time for each phase of study that real effect of vitamin D3 and calcium might not show off. Third, some important factors such as physical activity and dietary fat intake were not evaluated.

In summary, we observed that supplemental calcium and vitamin D3 have no significant impact on lipid profile and blood pressure. However, we found that supplemental calcium and vitamin D3 decreased BMI, but more studies are in need to support our results.

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