

# Serum Ascorbic Acid and Cholesterol Levels of College Students in Korea

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= 국문초록 =

## 대학생의 혈청 Ascorbic Acid 및 Cholesterol 과 그 상관관계

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성인의 혈청 Ascorbic Acid 및 Cholesterol 의 정상치를 정하고, 이들간의 상관관계 존재여부를 밝히기 위해 32명의 남·녀 대학생(각 16명)을 대상으로 하여 연구한 결과, 여학생의 경우에 혈청 Ascorbic Acid 는 남학생보다 약간 높아서  $3.1 \pm 0.68$  mg/100 ml 였고 Cholesterol 은 상당히 낮아서(위험률 5%)  $190 \pm 20.4$  mg/100 ml 였다. 남학생의 경우에는 각각  $2.8 \pm 0.66$  mg/100 ml,  $202 \pm 14.9$  mg/100 ml 였다.

이 두가지 측정치 사이에는 위험률 5%로써 음(陰)의 상관관계가 있다고 말할 수 있으며, 그 상관계수는  $-0.36$  이었다. 즉, Ascorbic Acid 의 충분한 섭취는 혈청 cholesterol 을 낮출 수 있다고 생각된다.

Serum ascorbic acid and cholesterol levels were determined on 32 college students (16 males, 16 females). Female students had slightly higher serum ascorbic acid level of  $3.1 \pm 0.68$  mg% and significantly lower cholesterol level of  $190 \pm 20.4$  mg% than the male students, ascorbic acid of  $2.8 \pm 0.66$  mg% and cholesterol of  $202 \pm 14.9$  mg%. The levels of ascorbic acid and cholesterol was negatively correlated and correlation coefficient was  $-0.36$  and was significant. Dietary components which would lower the cholesterol level in the blood were discussed.

### Introduction

Ascorbic acid and cholesterol levels of human serum have received much attention, because their controversial role in the human nutrition. Considerable work has been reported on the possible role of ascorbic acid in atherosclerosis and hypercholesterolemia. Early lesions of atherosclerosis

are quickly resolved with the use of ascorbic acid therapy and it appears to be essential for the maintenance of the physiological integrity of arterial ground substance<sup>1)</sup>. Gushhait et al.<sup>2)</sup> reported the incorporation of  $4-C^{14}$  cholesterol into the bile acid fraction was depressed in scorbutic guinea pigs in vivo. In healthy people under the age of 25, cholesterol levels tended to fall when 1 g of ascorbic acid per day was added to normal diet. Six patients with atherosclerosis have not had recurrence of myocardial or cerebral infarction when they were given large doses of (1~3g daily) ascorbic acid for up to 30 months and concluded that the serum cholesterol could be lowered between 140 to 230 mg% by the intake of ascorbic acid<sup>3)</sup>. Sokoloff et al.<sup>4)</sup> studied the possible relationship between certain fat metabolism disturbances and alterations in ascorbic acid metabolism including the influence of long-term, heavy-dose ascorbic acid therapy on blood cholesterol. The total cholesterol was decreased

from 1234 to 308 mg% in rabbits and 545 to 170 mg% in rats receiving 150 mg/Kg body weight for 8 months. Deficient Guinea pigs accumulated serum and tissue cholesterol and had a lower output of  $^{14}\text{CO}_2$  than did the controls and concluded that the adequate tissue concentration of ascorbic acid were necessary for conversion of cholesterol to bile acids<sup>5)</sup>.

The purpose of this study was to have the normal value of cholesterol and ascorbic acid in healthy young adults in Korea, and whether the correlation would be existed between the levels of cholesterol and ascorbic acid.

### Materials and Methods

Serum was collected from 32 healthy students (16 males, 16 females) of 19 to 22 years old attending Seoul National University, Seoul, Korea. All subjects were well nourished and not obese. They showed no sign of any metabolic disease and no medication which would affect serum ascorbic

acid and cholesterol. All had normal levels of serum protein, blood urea nitrogen, and alkaline phosphatase (unpublished observations). Nonfasting samples were collected in the morning between July 1 to 25, 1978.

Ascorbic acid level was determined using 2,6-dichlorophenol indophenol dye<sup>6)</sup>. And cholesterol was determined by the method of Abell<sup>7)</sup> using Lieberman-Buchard reagent.

Correlation coefficient between the levels of ascorbic acid and cholesterol was calculated.

### Results

Table 1 shows the levels of ascorbic acid and cholesterol in male and female students. Serum ascorbic acid level of male students was 1.7~4.0 mg%, average of  $2.8 \pm 0.66$  mg% and female 2.0~4.6 mg%, average of  $3.1 \pm 0.68$  mg%. Female students had slightly higher serum ascorbic acid level than the male but not significant at 5% level. Average of ascorbic acid level reported for

Table 1: Levels of Ascorbic Acid and Cholesterol in Male and Female Students (mg/100 ml)

Subject number	Male		Female	
	ascorbic acid	cholesterol	ascorbic acid	cholesterol
1	2.3	217	2.0	181
2	1.7	216	3.1	209
3	3.2	186	2.6	212
4	2.9	200	2.7	207
5	3.3	189	2.9	201
6	2.7	208	2.3	187
7	2.9	191	3.5	182
8	2.3	201	2.0	183
9	3.1	208	3.3	198
10	3.8	166	4.0	186
11	1.7	182	3.0	175
12	3.0	207	3.5	225
13	3.2	211	3.6	161
14	2.2	219	3.2	203
15	2.7	213	4.6	143
16	4.0	212	3.6	199
Mean	2.8	202	3.1	190
$\pm$ SE	0.66	14.9	0.68	20.4

the American is 0.5~2.0 mg%<sup>6)</sup> and our value was significantly higher than the American. Serum ascorbic acid levels of Costa Rican students in rural area was 1.47 mg% and in urban 1.28 mg%. In El Salvador it was 2.65 mg% in rural and 1.85 mg% in urban, in Honduras 2.66 mg% in urban, in Guatemala 1.14 mg% in rural, and in Panama 1.37 mg% in urban<sup>8)</sup>. These results showed that the students in urban area have lower serum ascorbic acid than the students in the rural area.

Cholesterol level was 166~219 mg% in male, average of  $202 \pm 15$  mg% and  $143 \sim 225$  mg% in female, average of  $190 \pm 20$  mg%. Cholesterol level was significantly lower in female students than the male students. Normal range of serum cholesterol is 150~270 mg% in healthy American adult<sup>9)</sup>. Cholesterol levels of 20~29 year old women of high-income in the city was 172 mg% and of low-income in the rural 147 mg% in Guatemala<sup>9)</sup>. American women living in Guatemala City shown the level of 189 mg%.

Serum cholesterol and ascorbic acid was negatively correlated and the correlation coefficient was  $-0.36$  (Fig. 1) and was significant at 5% level. In scorbutic guinea pig, cholesterol was slowly converted to bile acid and serum ascorbic acid and liver cholesterol was negatively correlated<sup>3)</sup>.

## Discussion

The present study showed the negative correlation between the serum ascorbic acid and cholesterol. In other words, ascorbic acid intake could have influenced on the level of cholesterol in the blood. Since the serum ascorbic acid is reflected by the recent intake of ascorbic acid, our result showed significantly higher ascorbic acid levels in the serum than the North American countries. It can be explained that the serum ascorbic acid was measured in July when the fresh fruits and vegetables are abundant.

Dietary protein<sup>10~11)</sup> and fiber<sup>12)</sup> are reported to lower cholesterol levels in the blood. Plasma cholesterol level was significantly lowered on the soy protein diet than on the animal protein diet<sup>10~</sup>

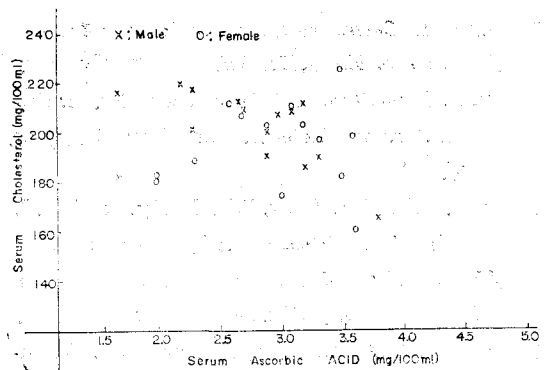


Fig. 1. The relationship between serum ascorbic acid and cholesterol.

<sup>11)</sup> Soy protein have also high fiber content. Vegetarians had lower plasma cholesterol levels than nonvegetarians<sup>13)</sup> and the dietary intake of cholesterol and the percentage absorption of cholesterol were lower in vegetarians than in nonvegetarians<sup>14)</sup>. This would account for the fiber and ascorbic acid<sup>3~5)</sup> contents of the fruits and vegetables.

Our students food intakes consist of rice, vegetables, fruits, and small amount of meats and this has reflected the cholesterol levels in the blood. The present study shows that higher the intake of ascorbic acid lower the serum cholesterol level. And also shows the advantages of ascorbic acid and fiber intake by consuming the fruits and vegetables.

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