

MEAT CONSUMPTION AND SERUM LIPIDS AND LIPOPROTEINS IN MAN
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Introduction

The composition of the diet is an important factor in serum lipids and lipoprotein concentrations in man. Red meat consumption was associated with the risk of atherosclerosis. Meats have an important role to play in supplying the body with proteins (essential amino acids), vitamins and minerals. There is no doubt that meat is the most valuable source of dietary iron.

According to Hamm (1991) 80 g of lean meat per day or a portion of about 150 g three times a week in patients with disorders of fat metabolism or elevated uric acid levels are consistent with the recommendations for low-fat and low-cholesterol alimentation and helps to ensure a balanced diet.

The aim of this study was to determine the time required to modify serum lipid and lipoprotein levels in healthy male volunteers under three different types of meats administered in a loading-dose.

Materials and Methods:

Nine male volunteers(1), from a group of 15, with an average age of 29.4 (24-34) years old were selected. They had normal lipid concentrations in comparison to Lipid Research Clinic Program Prevalence Study. We excluded volunteers who were taking plasma lipid lowering medication or had organic or metabolic disease, hyperlipidemia, alcoholism or hypertension. During the study the volunteers body weights were kept constant adjustment of calories.

Three volunteers per each diet consumed similar diets which only differed in the type of meat but not in the amount (300 g/day). The meats tested were red meat from grass fed steers (PRM), red meat from grain fed steers (GRM) or poultry meat (PM). Lunch and dinner were prepared by a commercial catering company. The volunteers prepared their own breakfasts as instructed. The average composition for the daily different intakes were: 1600 cal (46, 24 and 30%); 2420 cal (52, 18, 30%) and 2975 cal (53, 17 and 30%) for carbohydrates, protein and fat percentages respectively. Diets were balanced in composition and also nutritionally adequate. Standard menu plans were established for all feeding periods.

Blood samples were obtained at the beginning and at the 3rd, 6th and 9th weeks of each diet period to test modifications in the studied parameters.

Random samples from the different meals were selected and analyzed for protein, fat and fiber content according to AOAC methods. The TBA number was also determined in the selected meals to control the oxidative status of the different meals (Witte et al., 1970). Fatty acid composition and cholesterol content were determined using gas liquid chromatography of methyl esters and a colorimetric-enzymatic method applied to the saponified lipid for cholesterol determinations (Garcia et al., 1992).

Blood samples were drawn after 14 hour fasting in tubes with 1 mg/ml of EDTA. An aliquot sample was used for the determination of total cholesterol and triglycerides (Standard Boehringer methods), HDL-chol. (Assman et al. 1983) and LDL-chol (Wieland & Seidel, 1983). Another aliquot sample was used for the isolation of LDL by sequential ultracentrifugation (Schumaker & Puppione, 1986). LDL chemical composition and its susceptibility towards "in vitro" oxidation were determined by incubation with CuCl₂ during 60 and 120 min. at 37°C. LDL lipid peroxides were measured by the TBA method (Wasowicz, et al. 1993).

The main parameter was the level of total serum cholesterol and we considered significant the differences >8% taking in account both biological and methodological variations.

Results and discussion

Fat percentages, cholesterol content and fatty acid composition of the tested meats are shown in Table 1. The values of TBA in the different meals were variable and depending of the cooking method. Average values were 1.41±1.42, 1.43±1.23 and 2.20±2.16 mg MA/kg for PRM, PM and GRM based meals respectively.

In Table 2 are shown the percentage of absolute differences in total serum cholesterol detected between basal values and those observed in the 3rd, 6th and 9th weeks higher than previous established. Differences were also observed in other parameters (Tables 3, 4 and 5).

Conclusions

This study shows that at least 9 weeks of a loading-dose diet is required to modify serum total cholesterol, lipoprotein concentrations and LDL-susceptibility to "in vitro" oxidation.

References

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Table 1
Total fat, cholesterol content and fatty acid composition of tested meats

	PRM	GRM	PM
Fat%	2	3,9	2,5
Chol (mg/100g)	49	56	60
14:0	3	2,5	1
16:0	30,2	28,7	18,2
16:1	2,3	2,3	6,8
18:0	18,7	16,2	7,9
18:1	34,1	37,5	30,9
18:2	1,7	1,9	25,8
18:3	1,3	0,7	2,1
20:3	0,7	0,6	0,4
20:4	0,7	0,9	3,4

Chol: cholesterol

Table 3
Percentage of differences (D%) between basal and 3rd, 6th and 9th week serum levels of TG, LDL-C, HDL-C and TC/LDL-C

Volunteer N°	TG	LDL-C	HDL-C	TC/LDL-C
1	34	34,4	17	6,8
2	41	12,5	2,2	11,1
3	12,2	6,4	13,5	9,3
4	16,5	6,5	1,7	6,5
5	134,1	4,3	34,6	70
6	7	1,3	1,9	4,4
7	51,3	6,3	25	15
8	26,9	26,6	25,9	12,8
9	68,1	9,6	26,3	22,2
\bar{X}	43,5	12	18,5	17,6
STD	36,9	10,4	11,7	19,2

D% was calculated using absolute values of the difference
TG: triglyceride, LDL-C: Low Density Lipoprotein-Cholesterol, HDL-C: High Density Lipoprotein-Cholesterol, TC: Total Cholesterol.

Table 2
Percentage of differences (D%) between basal and 3rd, 6th and 9th week total serum cholesterol levels

Volunteer N°	3 weeks	6 weeks	9 weeks
1	25,4	21,1	23,9
2	3,8	0	8,1
3	0,9	12,9	6,2
4	6	4,4	4,9
5	22,3	7,1	10,4
6	7,9	8,8	6,7
7	1,4	7,7	11,7
8	7,5	15	22,5
9	20,4	8,3	10,2
\bar{X}	10,6	9,5	11,6
STD	8,9	5,8	6,5

D% was calculated using absolute values of the difference

Table 4
Percentage of differences (D%) between basal and 9th week chemical composition of serum LDL and TBARS values of oxidized LDL

Volunteer N°	Chol	TG	PL	P	TBARS
1	7,5	31,8	15,8	20,7	171,5
2	0,8	21	23,5	34,1	168,1
3	0,8	11,9	45,4	32,3	36
4	14,1	1,2	11,8	18,4	325,8
5	16,1	81,2	48,9	32,2	126,7
6	36,6	8,6	51,3	1,5	31
7	3,6	3,4	77,5	31,3	11,7
8	14,9	1,4	4,9	34,1	10,9
9	36,2	22,4	35,6	57,3	11,2
\bar{X}	14,6	17	34,0	29,1	99,4
STD	13,6	17,8	21,9	14,2	102,2

D% was calculated using absolute values of the difference
Chol: cholesterol, TG: triglyceride, PL: Phospholipids, P: protein, TBARS: TBA reactive substances

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(1) Informed consent was obtained from each volunteer