

Serum Cholesterol Levels of North American Women Living in Guatemala City

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HUMAN serum cholesterol levels throughout the world have received great attention during recent years, because of their association with the incidence of ischemic heart disease. The populations of most technically underdeveloped countries are relatively free of coronary artery disease and tend to have lower serum cholesterol values. In Central America persons in rural and urban lower socioeconomic groups have been found to have much lower serum cholesterol levels than those in an upper socioeconomic category.¹⁻³ Post-mortem studies indicate that the lower socioeconomic groups in Central America are relatively free of advanced lesions of atherosclerosis as compared with the United States white populations in New Orleans^{4,5} and Los Angeles.⁶

Environmental factors, such as economic, social and religious differences, play an important role in determining both the characteristic dietary pattern and the physical activity of populations. These in turn appear to be largely responsible for the variations in mean serum cholesterol levels among different population groups. In particular, quantity and quality of dietary fats, and the caloric intake have been shown to influence serum cholesterol levels among populations. This

has already been extensively reviewed.⁷⁻⁹ Immigrants who adopt the food pattern of the recipient country rapidly acquire its average serum cholesterol levels.¹⁰ It is also of interest to determine these levels in persons who change their environment without appreciably changing their food habits. The present report deals with a group of North American women who, as wives or relatives of North American men working in Guatemala City, have lived for at least two years in this region.

MATERIALS AND METHODS

Forty-two apparently healthy non-pregnant women volunteered for the present study. Their age range was from twenty to sixty years and special care was taken to obtain an even distribution among age groups. Most were married.

Age, weight, height and blood pressure were recorded and finger tip blood samples obtained for the determination of serum cholesterol levels. Relative weights as percentage of standard weights for height were calculated using the weight-height tables given by Keys.¹¹ Serum cholesterol was determined in 0.05 ml. samples by the method of Abell et al.¹²

A seven-day dietary questionnaire was filled out by two or three women selected at random from each age group. They recorded their own total daily food and beverage intake according to our detailed instructions. It is believed that full cooperation was given in recording foods and food intake accurately. Standard food composition tables¹³⁻¹⁵ were used to calculate the nutritional value of the diets. For the estimation of the dietary fatty acid content, the table of Hardinge and Crooks¹⁶ was used. Ninety-six per cent of the total fat intake was accounted for in these calculations.

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TABLE I
Age, Height, Weight and Blood Pressure of North American Women Residing in Guatemala City

	Age Groups in Years			
	20 to 29	30 to 39	40 to 49	50 to 59
Number studied	7	12	13	10
Mean age (yr.)	26	36	46	53
Height (cm.)				
Mean	167.6	165.1	162.6	162.6
Standard deviation	5.0	5.4	5.3	5.0
Weight (kg.)				
Mean	60.9	61.8	60.0	61.8
Standard deviation	12.4	11.2	8.9	8.8
Relative weight (%)	97.0	98.8	92.7	94.0
Blood pressure (mm. Hg)				
Systolic				
Mean	118	119	130	126
Standard deviation	12	9	10	13
Diastolic				
Mean	83	79	81	81
Standard deviation	12	8	6	6

RESULTS

The age, height, weight, relative weight and systolic and diastolic blood pressures are presented in Table I. The average body weights were constant in all groups. They

tended to be lower than the reference standards, although the large standard deviations reflected the great individual variation. The average height was similar in all groups, although the women under forty years of age were slightly taller than those over forty years of age. Systolic blood pressures were slightly lower in the younger groups but diastolic blood pressures did not vary appreciably. None had systolic and diastolic blood pressures above 140/90 mm. Hg.

In Table II the cholesterol levels obtained in the present study are compared with previous values for Guatemalan women residing in Guatemala and American women residing in the United States.¹ The mean serum cholesterol levels were lower than those of either the urban upper income women in Guatemala or the American women in the United States. Serum cholesterol levels increased significantly with age and the values for the older groups, forty to forty-nine and fifty to fifty-nine years, did not differ from the other two comparable socioeconomic groups of the same age. The proportion of calories derived from fat in the groups compared is also shown in Table II.

TABLE II
Comparison of Serum Cholesterol Levels of Different Guatemalan Population Groups with Those of North American Women Residing in Guatemala City

	Age Groups in Years				Proportion of Calories Derived from Dietary Fat (%)
	20 to 29	30 to 39	40 to 49	50 to 59	
North American women residing in Guatemala:					
Number studied	7	12	13	10	
Mean cholesterol*	164	178	217	238	39
Standard deviation	19	28	42	27	
North American women living in United States: ¹					
Number studied	43	51	108	48	
Mean cholesterol	189	203	219	247	40
Standard deviation	+69-51	+47-39	+48-29	+61-48	
Urban Guatemalan women (upper income): ¹					
Number studied	20	24	16	10	
Mean cholesterol	172	200	208	222	36
Standard deviation	+52-39	+45-36	+47-38	+41-35	
Rural Guatemalan women (lower income): ¹					
Number studied	22	15	11	9	
Mean cholesterol	147	156	172	138	8
Standard deviation	+34-28	+33-28	+35-29	+67-46	

* Serum cholesterol expressed in mg. per 100 ml.

It was almost identical in the Guatemalan urban women, the American women in Guatemala and the American women in the United States. For the rural Guatemalan women who represent a lower socioeconomic group, fat consumption and serum cholesterol levels were much lower.

The average daily dietary intake of the subsample studied is presented in Table III. The

TABLE III
Daily Dietary Intake of North American Women
Residing in Guatemala City

Dietary Intake	Average Intake (gm.)	Per cent of Total Calories	Dietary Intake	Average Intake (mg.)
Calories*	2068	...	Minerals:	
Total protein	74.1	14.3	Calcium	956
Animal protein	48.9	9.4	Phosphorus	1147
Carbohydrates	221.8	42.9	Iron	19.8
Total fat	89.3	38.9	Vitamins:	
Animal fat	47.5	20.6	Vitamin A†	5933
Fatty acids:			Thiamine	1.1
Saturated	32.7	14.2	Riboflavin	1.5
Unsaturated	49.2	21.4	Niacin	15.0
Oleic	38.0	16.5	Vitamin C	169
Essential	11.2	4.9		

* Including 100 calories derived from alcohol.

† International units.

requirements for calories, proteins, calcium, iron and vitamins were adequately fulfilled. Protein furnished 14.3, fat 38.9 and carbohydrates 42.9 per cent of total caloric intake. Of the total calories, 4.8 per cent were furnished by alcohol. Saturated fatty acids furnished 14.2 and unsaturated fatty acids, 21.4 per cent of total calories. Essential fatty acids constituted 22.8 per cent, and oleic acid 77.2 per cent of total unsaturated fatty acids.

COMMENTS

In both rural and urban low income Guatemalan population groups, cholesterol levels have been found to be lower than those of upper socioeconomic groups in Guatemala and the United States. Postmortem studies showed a low prevalence of cardiovascular atherosclerotic complications. Lower income population groups in Guatemala have much

less aortic^{4,5,18} and probably less coronary¹⁷ atherosclerosis than reported for the United States and European countries. Due to the difficulties in obtaining postmortem material representing upper income groups in Guatemala, there is no proof that they have a degree of atherosclerosis similar to the populations of technically more developed countries. There is, however, strong clinical evidence that they have far more deaths due to atherosclerotic complications than their lower income compatriots.

Dietary surveys have also shown marked differences in the amount and type of fat consumed among different socioeconomic groups in Guatemala. The rural highland Indian consumes about 8 per cent of his total calories as fat, almost entirely derived from corn. The upper income urban population consumes about 36 per cent of its total calories as fat, a large proportion of which is of animal origin; the types of fat are very similar to those consumed in the United States.

Systematically conducted dietary surveys in the United States agree fairly well in their estimates of calories derived from fat consumption.^{19,20} In the present study, the fat content and the general pattern of the diet of the American women living in Guatemala for at least two years did not differ appreciably from studies in the United States.¹⁹ Protein furnished 14.3, carbohydrates 42.9, and fat 38.9 per cent of total caloric intake as compared with the 16.2, 40.9 and 42.2 per cent, respectively, reported by Friedman and Rosenman.¹⁹ If alcohol ingestion is not taken into consideration, the percentages become 15.0, 45.1 and 40.8, respectively, and resemble even more closely the values reported for the United States. The distribution of fatty acids in the total dietary fat of the American women studied, closely resembled that of similar persons living in the United States.²¹

It is apparent from this study that with the exception of the younger groups, the serum cholesterol levels of American women living in Guatemala City are in the same order of magnitude as those reported for similar women residing in the United States.^{1,2,7,20} The lower serum cholesterol values found in the

younger groups, twenty to twenty-nine and thirty to thirty-nine years of age, may be due to errors in random sampling or to greater physical activity associated with a favorable climate and to careful control of body weight.

From the food consumption data given, it is evident that the American women in Guatemala had not changed their food pattern appreciably from that formerly consumed in their native country. Since serum cholesterol levels also appear to be unchanged, there can be no other factors in their environment or way of life in Guatemala City which influence serum cholesterol levels significantly.

SUMMARY

Serum cholesterol levels of forty-two apparently healthy non-pregnant North American women who have lived in Guatemala City for at least two years were determined. The groups were twenty to twenty-nine, thirty to thirty-nine, forty to forty-nine and fifty to fifty-nine years of age. Dietary histories were obtained from two to three subjects at random in each age group and the nutritive value of their diet was calculated. Fat consumption and dietary habits were found unchanged from the habits in their country of origin. The cholesterol levels were found to be slightly lower than the United States standards for women under forty years of age and to be similar for older groups.

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