BLOOD GLUCOSE, HAEMOGLOBIN AND CHOLESTEROL IN THE PAKISTANI MALE ADULTS

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Blood glucose, haemoglobin and cholesterol contents of normal Pakistani male adults ranging in age between 21-50 years have been determined. The values of blood glucose and haemoglobin were noted to be somewhat lower than those reported in the literature. Plasma cholesterol concentration of subjects belonging to high income group (Group A) was substantially higher than that of low income group (Group B) and this difference is statistically significant in all the age levels of the two groups. It has also been observed that in Group "A" there is a direct correlation between age and cholesterol, but this effect is not seen in group "B". An attempt has been made to explain these findings on the basis of different dietary habits and physical activity of the two groups

Introduction

In the course of studies on an antidiabetic factor isolated from Karela (*Memordica charantia*), which involved its use on alloxan diabetic animals as well as human diabetic patients, random cases were noted, where the blood sugar values of normal human subjects were considerably lower than those reported in the literature.[1] Some interesting findings regarding the blood cholesterol content of Pakistanis were observed during the investigation of alkaloids and alkaloidal complexes isolated from indigenous plants employed in the treatment of cardiovascular ailments. These observations and also the fact that no data is available on any of the blood values of Pakistanis, led the authors to investigate the blood sugar, cholesterol and hæmoglobin levels in the normal Pakistani male adults. In view of the different climatic conditions, racial traits and dietary habits of our people when compared with the people of other countries, whose blood values are known these investigations become all the more significant, as all these factors have been reported to influence the values of some of the blood constituents, particularly that of cholesterol.[2,3]

It may, however, be stated that the values reported in the present paper are based on preliminary studies which will have to be extended and rechecked on a comprehensive scale in order to formulate dependable standard values for the population of the country. The subjects studied in this work came from various walks of life, but cannot be assumed to be representative of the population, because, although hailing from different parts of the country, they were all of them living in Karachi, under conditions which were not exactly identical to those prevailing in their home towns.

Experimental

Healthy male adults between the ages of 21-50 years were taken for all the assays reported below. No distinction was made between the East and the West Pakistanis but for the estimation of cholesterol values the volunteers were placed in two groups—"A" and "B", dependingup on their income and status in life.

Blood Collection.—1 to 1.5 ml. blood was obtained by venipuncture and was collected in glass stoppered tubes containing 5 mg. sodium citrate. The citrated tubes were prepared by pipetting 0.1 ml. of a 5% sodium citrate solution in a tube, rotating to produce maximal spreading and then drying at 100°C. For the determination of blood glucose, the volunteers were asked to fast for 15 to 18 hours.

Glucose Determination.—The blood filtrates were prepared by mixing 0.2 ml. citrated blood to 3 ml. of water. 0.4 ml. of 0.3N barium hydroxide was then added and after the mixture had turned brown, 0.4 ml. of 5% zinc sulphate was added. After a few minutes the mixture was filtered. One ml. of this filtrate was used for the determination of glucose by the Nelson's Photometric adaptation of the Somogyi method[4] The blue colour produced was read on the Fisher Clinical Electrophotometer using Filter No. 525 B. Results are given in Tables 1 and 2.

Plasma Cholesterol.—For cholesterol determination, all the volunteers were placed in the following two groups, depending upon their status in life:

GROUP "A": Comprising people from the middle and higher middle class families.

GROUP "B": Comprising skilled and unskilled labourers mostly engaged in works where physical activity is required. This group also included prisoners.

Duplicate analyses were done on plasma from 261 subjects. For each analysis 0.2 ml. plasma was treated with a mixture of alcohol-ether (3:1), thereby extracting cholesterol and precipitating proteins. The extract was evaporated to dryness and cholesterol in it was determined by adapting

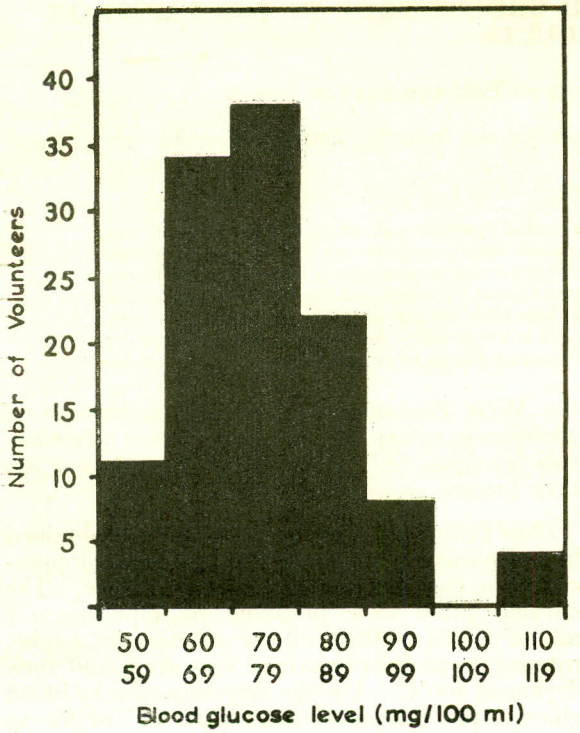

Fig.1.— Histogram showing the distribution of persons by whole blood sugar level.

the method of Liebermann and Burchard. The blue colour produced was read on the Fisher Clinical Electrophotometer, using Filter No. 650-A (red). The concentration of cholesterol in milligrams per 100 ml. plasma was calculated by reference to a calibration curve. Results are summarised in Table 3, as means of concentrations, while distributions are graphed in Figs. 2,3 and 4 from the data given in Table 4.

Blood Haemoglobin.—Blood hæmoglobin was determined by the Acid Hematin method. Blood was treated with dilute hydrochloric acid to produce a brown colour. This was then compared with the colour produced by similar treatment of a blood of known hæmoglobin content. 75% of the volunteers studied had their hæmoglobin between 11.25 g. and 13.00 g. per 100 ml. blood. Only 15% had their blood hæmoglobin above 13.00 g. per 100 ml. while the rest showed hæmoglobin between 10 g. and 11.25 g.

Discussion

The results, reported above, show some very interesting features. The sugar values range between 50 mg. and 90 mg. per cent, which are rather low when compared to those recorded in literature.[1] These values are, however, based on the blood sugar analyses of only 117 volunteers,

TABLE 1.—BLOOD SUGAR AND CHOLESTEROL OF PAKISTANI MALE ADULTS AGES 21-50 YEARS.

	Lower** 1%	Lower** 10%	Upper** 10%	Upper** 1%
Whole blood glucose (mg. per 100 ml.)	51	59	91	114
Plasma Cholesterol in Group "A" (mg. per 100 ml.)	120	141	256	295
Plasma Cholesterol in Group "B" (mg. per 100 ml.)	96	115	201	223

**1 per cent of normal subjects have blood glucose values lower than 51 mg., 9 per cent between 51 and 59 mg., 80 per cent between 59 and 91 mg., 9 per cent between 91 and 114 mg., and 1 per cent over 114 mg. per 100 ml. and so on.

TABLE 2.—DISTRIBUTION OF PERSONS BY WHOLE BLOOD SUGAR LEVEL.

Blood glucose level (mg /100 ml.)	Number
50—59	11
60—69	34
70—79	38
80—89	22
90—99	8
100—109	—
110—119	4

Note.—Total number of volunteers: 117

TABLE 3.—MEAN PLASMA CHOLESTEROL LEVEL IN THE TWO GROUPS.

Groups	Age		
	21-30	31-40	41-50
Group "A"	181.09	188.25	196.35
Group "B"	157.77	155.48	157.16
Number of persons			
Group "A"	41	40	47
Group "B"	44	47	42

and, as already stated, the results reported in the present paper are based on preliminary studies which will have to be extended on a comprehensive scale in order to formulate dependable standard values for the population of the country.

Blood hæmoglobin concentration noted in the present investigation is at a lower level than that reported in the literature.[1] The low levels found in the Pakistani population probably reflect moderate protein under-nutrition. Low hæmoglobin concentrations in a West Indian community (St. Kitts, W.I.) have also been explained on this very assumption by Stuart et al.[2]

As is evident from Table 3, there is a well defined difference between the average blood cholesterol values of Group "A" and "B". The cholesterol values in group "B" are consistently lower in all the age levels as compared to group "A". The subjects in group "B" being in lower income group differed from group "A" in two important aspects—diet and physical activity.

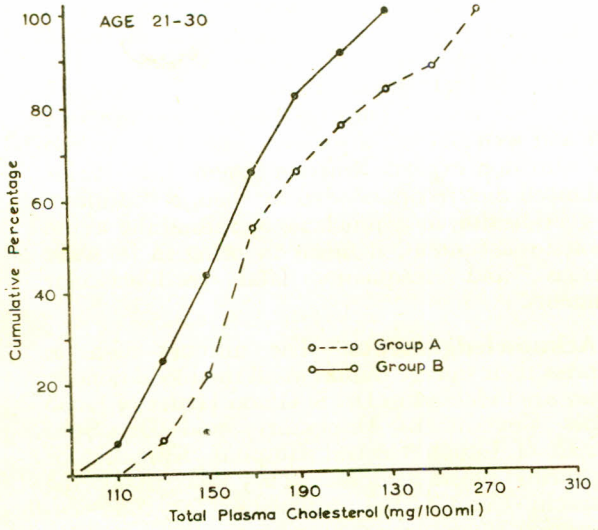

Fig. 2.— Cumulative frequency distribution of total plasma cholesterol. Groups "A" and "B" aged 21-30.

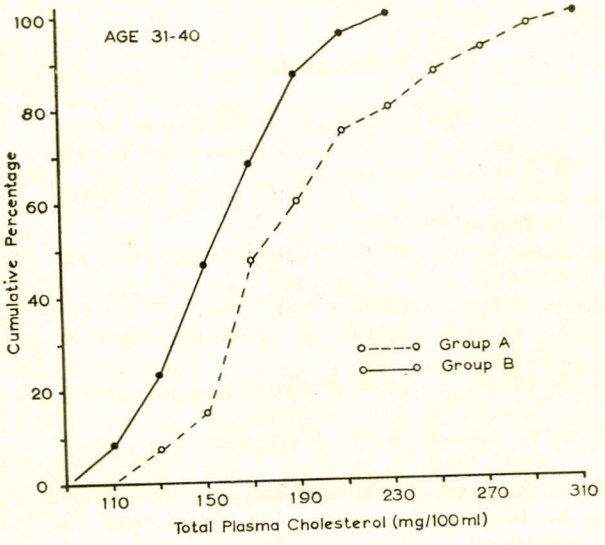

Fig. 3.— Cumulative frequency distribution of total plasma cholesterol. Groups "A" and "B" aged 31-40.

In the absence of a detailed dietary survey of the lower income group, the present authors relied mostly on the verbal account of their daily

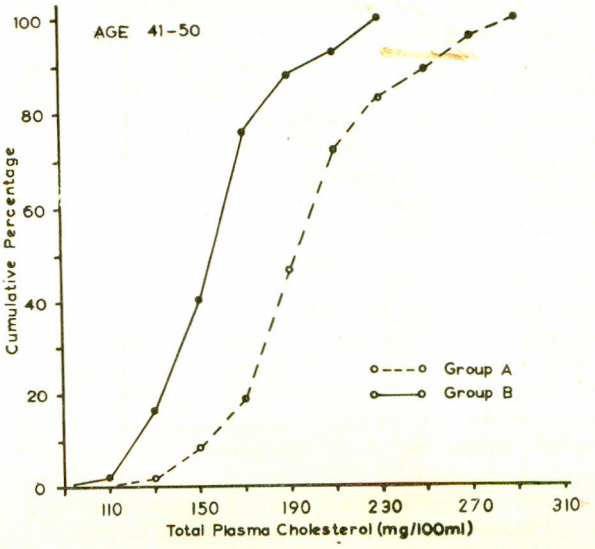

Fig. 4.— Cumulative frequency distribution of total plasma cholesterol. Groups "A" and "B" aged 41-50.

diets. It was noted that the diet of the lower income group differed from that of the higher income group in respect of the following factors: 1. Preponderance of carbohydrates. 2. Most of the proteins consumed were of plant origin. 3. In majority of the cases, vegetable oils were the only kind of fat consumed. 4. Fat contributed only 10 to 20% of the total calories taken by group "B".

Physical activity is another factor which differentiates group "A" from "B". People belonging to group "A" are mostly educated and well placed economically and their jobs require little physical activity. On the other hand, people from group "B" are mostly labourers, and their earnings depend upon the extent of their physical work.

Table 3 shows another major difference between group "A" and "B" cholesterol values. Whereas in group "A" there is a direct correlation between age and cholesterol—there being a progressive rise in cholesterol with advancing age—this effect is not seen in group "B". This finding also probably implies the important role of diet and physical activity in the maintenance of cholesterol level. High fat diet coupled with low physical work tends to raise the blood cholesterol level with age and the longer the period of high fat diet the higher the cholesterol level in blood. The effect of diet on the blood cholesterol has been studied by a number of workers. Schettler et al[5] have noted an average decrease in total blood cholesterol from 191 to 160 mg. 100 ml. plasma in 10 to 20 normal persons during 1942-47, and concluded that lowered fat metabolism was due

to poor nutrition. Bronte-Stewart et al[6] presented a study of 364 men aged 40 to 58 years from cape Town. The subjects included persons of three major racial groups and a wide range of economic status. A stepwise increase in serum lipide levels, with the Bantus lowest, Cape coloured intermediate, and Europeans highest was observed. Similarly, in a study of the lipoprotein and cholesterol concentration in sera of Nigerians, Mann et al[7] observed that the mean serum cholesterol of 46 Nigerians was 130 mg.100 ml. compared to a value of 213 mg.100 ml. for an age and weight matched group of the U.S.A. population. Although these workers observed a lower dietary fat intake in the Nigerians, they suggested that a relationship of energy expenditure to serum lipides might be more pertinent.

TABLE 4.—GROUP AND AGE DISTRIBUTION OF PERSONS BY PLASMA CHOLESTEROL LEVEL.

Cholesterol level (mg./100ml.)	Group "A"			Group "B"		
	21-30	31-40	41-50	21-30	31-40	41-50
All levels	41	40	47	44	47	42
91-100	—	—	—	1	1	—
101-110	—	—	—	2	3	1
111-120	1	—	—	2	2	3
121-130	2	3	1	4	5	3
131-140	2	1	2	6	4	4
141-150	4	2	1	4	7	6
151-160	8	4	2	4	4	8
161-170	5	9	3	6	6	7
171-180	3	4	6	7	5	3
181-190	2	1	7	—	4	2
191-200	3	4	10	3	2	2
201-210	1	2	2	2	2	—
211-220	2	1	3	1	1	1
221-230	1	1	2	2	1	2
231-240	1	1	1	—	—	—
241-250	1	2	2	—	—	—
251-260	2	1	2	—	—	—
261-270	3	1	1	—	—	—
271-280	—	1	1	—	—	—
281-290	—	1	1	—	—	—
291-300	—	1	—	—	—	—
Mean=	181.09 ±6.6	188.25 ±7.1	196.35 ±5.2	157.77 ±5.3	155.48 ±4.5	157.16 ±4.3

There is reason to believe that the degree of physical activity may influence the level of serum cholesterol. In some areas it is easy to show that the more prosperous men, who are usually less active physically than the rest of the local population, tend to have higher cholesterol values than men representing the rest of the community. Keys et al found this applicable in Madrid[8] in Naples[9] and in Capetown[6]. On the basis of their data they have suggested that the cholesterol differences are causally related to physical activity, since men in the more prosperous groups often tend to be physically less active.

The close relationship between high blood cholesterol level and onset of atheromatous changes in blood vessels with resultant coronary heart disease and other cardio-vascular complications, has been emphasised by many workers. The presence of high blood cholesterol level amongst group "A" which comprises people who are well fed and well placed in society, poses the question for nutrition experts, whether them full value balanced diet recommended by them is conducive to good health, in as much as, by raising the serum cholesterol content, it seems to bring in its wake serious and frequently fatal cardiovascular ailments.

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