Original Article

Study of Lipid Profile in Asymptomatic Aircrew and Ground Duty Personnel of Various Age Groups

SK Adaval, RK Ganjoo, Surjit Singh, YP Jalpota

185 apparently healthy normal serving aircrew and ground duty personnel of IAF were studied to establish their lipid profile viz plasma cholesterol, triglycerides, HDL Cholesterol and Lipoprotein percentages. After eliminating outliers, values were statistically analysed and displayed to show normal range and compared with those established by other workers.

Keywords : Lipid, lipoprotein, cholesterol, triglyceride, HDL cholesterol

The lipids of the blood form a heterogenous group and are carried in the blood as spherical macromolecular complexes termed as lipoproteins. Hyperlipidaemia is one of the recognised risk factors, a major and often a modifiable one, of atherosclerotic process. Its association with premature atherosclerotic disease has been clearly demonstrated[1]. Early detection, diet and drug programmes may help in prevention or slowing of atherosclerotic process. Fredrickson, Levy and Lees have described five types of Hyperlipidaemia which form a useful basis for selection of therapy[2]. Type II and IV abnormalities have been frequently encountered[3].

Air Force Personnel comprise a significant population of Armed Forces in India. Aircrew and ground duty personnel of Indian Air Force (IAF) adopt a more or less similar general trend of living and life style. Periodical stringent health tests and health supervision render them receptive to health counselling. In India, no attempt has so far been made to define the normal lipid values in Air Force personnel, though similar studies have been carried out by Troxler et al on US Air Force personnel[4].

The present study is, therefore, aimed at defining the reference ranges for plasma lipids of asymptomatic aircrew and ground duty personnel of IAF and to find out the incidence and types of hyperlipidaemia, if any.

Material and Methods

185 asymptomatic Air Force Personnel (Ground duty and aircrew) were included as subjects for this study. In all subjects, a detailed medical history was recorded. Only individuals with normal clinical profile, weight and ECG were included in this study.

Routine haematological examinations along with biochemical investigations viz GTT, serum bilirubin, proteins, blood urea, Uric Acid and Creatinine were done to exclude any latent disease. Having done this, the subjects were advised appropriate diet and blood samples were collected after overnight fast of 14 hours. Cholesterol, triglycerides (TG) and Lipoprotein percentages were determined.

For biomedical results, Beckman Trace III system, clinical chemistry autoanalyser and Beckman Paragon Gel Electrophoresis system were used with reagent kits.

Triglycerides : Complete hydrolysis of TG was done by combination of esterases and lipase to yield glycerol. This was phosphorylated by ATP catalyser by glycerol kinase to produce glycerol-1-phosphate. Glycerol-1-phosphate dehydrogenase catalysed the oxidation of this compound in presence of NAD to produce NADH. This was used to reduce the nitrophenyl-phenyl tetrazolium chloride dye to produce red coloured formasan catalysed by diaphorase and measured at 520 nm in absorption mode.

Cholesterol : By enzymatic method. Cholesterol ester is hydrolysed to free cholesterol by cholesterol esterase. Free cholesterol is oxidised to cholesten-3-1 by cholesterol oxidase. Peroxidase catalyses reaction between H_2O_2, 4 amino antipyrine and phenol to produce red coloured quinoneimine which is measured at 500 nm.

Lipoprotein Electrophoresis : This was done by BECKMAN Paragon lipoelectrophoresis kit which provides for the electrophoretic separation of plasma lipoproteins at pH 8.6 in an agarose gel medium. After fixation and staining with Lipo stains, the quantification of fractions was done by using BECKMAN CDS-200 densitometer scan and values were computed. Four fractions viz alpha, pre-beta, beta lipoproteins and chylomicrons were identified according to anodic mobility and quantitated.

HDL Cholesterol : LDL and VLDL in plasma were precipitated by dextran sulfate and magnesium in precipitant tablets and removed by centrifugation. Cholesterol in HDL fractions supernatent was quantitated by the same method as is used for cholesterol determination.

Results

Out of 185 subjects, 161 (87%) were ground duty serving IAF personnel and 24 (13%) aircrew. As the aircrew category constituted a small group, both the groups were merged and the plasma lipids viz total cholesterol, TG, HDL cholesterol and percentage of lipoprotein were tabulated against various age groups. Outliers showing abnormally high values were eliminated. Values thus worked out are shown in Tables I, II, III and IV.

Table-I : Total plasma cholesterol values (mg/dl)

Age (Yrs)	n	mean	± SD	Percentile 5	75	90	95
20-24	39	186.71	38.34	135	201	230	259
25-29	56	184.50	32.96	139	207	227	236
30-34	13	195.30	45.14	122	220	240	265
35-39	28	207.96	40.14	146	231	257	268
40-44	22	224.77	48.75	146	265	287	298
45-49	15	212.86	48.89	146	216	285	332
50-59	12	236.66	43.84	171	255	274	323

Table-II : Total plasma triglycerids values (mg/dl)

Age (Yrs)	n	mean	± SD	Percentile 5	75	90	95
20-24	39	111.89	65.54	34	136	164	224
25-29	56	112.59	65.80	25	140	182	240
30-34	13	93.91	40.85	60	120	123	165
35-39	26*	170.83	93.80	49	221	240	250
40-44	22	169.29	71.23	55	202	217	220
45-49	15	144.53	84.48	52	161	196	222
50-59	12	129.60	60.50	59	142	156	198

* Two cases of abnormally high values excluded.

Table-III : Total plasma HDL/cholesterol values (mg/dl)

Age	n	mean	± SD	Percentile 5	75	90	95
20-24	39	42.79	9.32	28	50.0	54.6	58
25-29	56	41.49	10.62	26	47.8	58.0	60
30-34	13	45.27	6.45	35	48.0	50.0	51
35-39	28	42.63	11.13	28	51.0	52.0	59
40-44	22	44.06	10.31	26	48.0	55.0	60
45-49	15	42.26	12.41	24	42.0	54.0	60
50-59	12	48.91	11.56	32	54.0	59.0	62

Table-V : Comparison of plasma cholesterol values (mg/dl) in present study with those of other workers

Age (Yrs)	LRC Project Percentile 5	90	Troxler et al Percentile 5	90	Present Study Percentile 5	90
20-24	125	205	135	245	135	230
25-29	135	225	140	230	135	230
30-34	140	240	145	245	120	240
35-39	145	250	150	260	150	26
40-44	150	250	160	270	150	290
45-49	160	260	160	270	150	290
≥ 50	160	260	160	280	170	275

Table-VI : Comparison of plasma triglycerides (mg/dl) between present study and LRC programme

Age (yrs)	LRC Project Mean	Percentile 5	90	Present Study Mean	Percentile 5	90
20-24	100	45	165	110	35	165
25-29	115	45	200	110	25	180
30-34	130	50	215	95	60	120
35-39	145	55	250	170	50	240
40-44	—	—	—	170	55	215
45-49	150	55	250	245	50	195
≥ 50	—	—	—	130	60	155

Table-VII : Comparative values of plasma HDL cholesterol (mg/dl)

Age (Yrs)	LRC Project Mean	Percentile 5	95	Present Study Mean	Percentile 5	95
20-24	45	30	65	40	30	60
25-29	45	30	65	45	35	50
30-34	45	30	65	45	35	50
35-39	45	30	60	40	20	60
40-44	45	25	65	45	25	60
45-49	50	30	70	40	25	60
> 50	—	—	—	50	30	60

An attempt was made to group the subjects under known risk factors viz alcohol ingestion and

Table-IV : Lipoprotein Electrophoresis Pattern (%) in 171 Subjects

Age (Yrs)	n	Chylomicron				Beta				Pre Beta				Alpha			
		Mean	SD	Percentile		Mean	SD	Percentile		Mean	SD	Percentile		Mean	SD	Percentile	
				5	90			5	90			5	90			5	90
20-24	35	0.88	0.83	0	2.1	47.59	10.73	25.1	62.3	23.60	10.73	2.0	38.0	28.82	9.53	14.1	43.1
25-29	55	0.85	1.06	0	2.3	46.87	11.07	27.7	64.1	25.85	13.64	5.9	41.7	26.35	11.30	6.1	41.9
30-34	10	0.92	0.55	0	1.4	57.75	6.39	45.3	65.2	17.68	5.46	11.2	25.1	23.65	8.54	9.4	30.0
35-39	25	0.44	0.73	0	1.4	47.86	12.75	25.6	66.3	29.12	13.97	2.8	43.8	24.4	12.36	4.2	39.0
40-44	21	0.97	0.96	0	2.2	53.61	11.58	32.6	67.2	19.12	10.10	2.7	31.7	25.99	8.23	11.1	35.7
45-49	14	0.74	0.80	0	2.0	49.30	11.30	32.3	62.0	23.02	12.35	7.1	34.4	26.15	5.91	15.9	32.9
50-59	1	0.90	1.15	0	2.3	49.25	20.37	35.0	67.9	27.0	19.24	7.4	51.4	24.15	11.12	4.2	36.7

smoking. No comparison could be drawn between these groups due to unmatched number of subjects in such age groups.

Discussion

The study of the disorders of lipid transport unfurls a wide clinical spectrum, from silent aberrations of plasma lipoprotein levels to grave disorders involving the cardiovascular, abdominal and neurological systems. However, the plasma lipids and lipoprotein concentrations vary within and among populations and under different conditions in the same individual. This variability in the concentrations of lipids and lipoproteins makes the use of universally accepted "upper reference limit" difficult. Even within a country, these reference intervals may vary from one region to another.

The definition of hyperlipoproteinemia is thus arbitrary because the plasma lipids and lipoproteins exhibit a bell shaped distribution in the population, without clear separation between normal and abnormal values. What is usually done is to set arbitrary statistical limits of normal concentrations based on examination of a large number of healthy appearing subjects of different ages. As a working rule, clinically significant hyperlipoproteinemia is considered to be present in any individual below the age of 20 whose total plasma cholesterol level exceeds 200 mg/dl or whose TG levels exceed 140 mg/dl. In individuals above 20, significant hyperlipoproteinemia exists whenever the plasma cholesterol level exceeds 200 mg/dl[5]. The above working rule however cannot be applied to our population as the reference values have to be worked out for a specific group of population in a given country.

In present study, blood lipid profile values are tabulated against various age groups with mean and standard deviation and percentiles of 5, 75, 90 and 95 tabulated against each age group (except those of lipoprotein percentages). The purpose of working out 90th and 95th percentiles is to keep in view our intentions of defining the upper limits (cut off points). Traditionally, the 90th or 95th percentile is used to define Hyperlipidaemia, however it should not be used to define normality since no clear cutoff points for coronary heart disease exists[5,7].

In our study, gradual increase in plasma cholesterol levels was observed with increase in age. Taking 90th percentile as upper limit, the values were higher in the age group (40 years and above) ie., 274 to 287 mg/dl. Similarly, in the lower age group (below 40 years) the highest 90th percentiles were 227 to 257 mg/dl. Taking the 5th percentile as lowest reference value, in higher age group (40 years and above), 146 mg/dl was the lowest figure and in the lower age group (below 40 years),it was 122 mg/dl. Thus the range for the total subjects is 122-287 mg/dl.

Here it will be worthwhile comparing values with those obtained by other workers. The mean plasma cholesterol in young adults in London is reported as 5.8 mmol/L(226.2 mg/dl), which is considerably higher than that in the same age group in South Italy - 4.7 m mol/L (183.3 mg/dl) or in South Japan - 3.9 m mol/L (152.1 mg/dl)[6]. In our study, the mean cholesterol values in age groups of 20-24 years, 25-29 years and 30-34 years work out to 186, 184 and 195 mg/dl respectively. Comparison between our study and those of LRC programme[8] and Troxler et al[4], wherein the values are more or less similar, are shown in Tables V, VI and VII.

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