LIPID PROFILE IN NORMAL HEALTHY CHILDREN

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ABSTRACT

One hundred and fifty healthy children in the age group of 0-12 years were studied to establish normal levels of lipid profile. They were divided into six equal groups viz., newborns, 0-1 year, 1-4 years, 4-7 years, 7-10 years and 10-12 years. The mean values $\pm$ SD for total cholesterol, HDL cholesterol, LDL cholesterol and triglycerides were 70 ± 14.48 mg/dl, 35.1 ± 8.04 mg/dl, 23.8 ± 10.62 mg/dl and 50.9 ± 20.77 mg/dl respectively for male neonates and 71.8 ± 13.96 mg/dl, 34.6 ± 6.55 mg/dl, 25.5 ± 9.29 mg/dl and 57.2 ± 18.57 mg/dl respectively for female neonates. These values increased to 158.7 ± 21.23 mg/dl, 60.7 ± 11.70 mg/dl, 80.3 ± 19.26 mg/dl, 86.7 ± 28.80 mg/dl in males and 161.6 ± 23.09 mg/dl, 66.7 ± 8.75 mg/dl, 75.8 ± 20.26 mg/dl and 93.2 ± 44.09 mg/dl in females respectively between 10-12 years of age. The various lipid fractions were at the lowest level at birth and increased significantly during first year of life, there after showing a much slower rise in levels. There was no significant difference in values between male and female children.

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KEY WORDS : Lipid profile; Total cholesterol; HDL cholesterol; LDL cholesterol; Triglycerides

Introduction

Atherosclerosis has become the pathological hall mark of hypertension, coronary artery disease and cerebrovascular accident. Risk of coronary artery disease rises steadily with serum cholesterol [1,2]. Fatty streaks appear in the endothelium of aorta by six months of age [2]. The extent of these lesions in young age is related to the levels of both total cholesterol and low density lipoprotein (LDL) but inversely related to the high density lipoprotein (HDL) levels [3]. It has been estimated that 63% of the phenotype variation in serum cholesterol is genetically determined, whereas the remaining 37% is due to environmental influences such as diet. Beneficial effects of diet and drugs in lowering total cholesterol and LDL levels have been well documented [1,4,5]. It is important to establish the diagnosis of hyperlipidemia at an early age [6], if these measures

have to be effective.

The aim of the present study is to establish the normal levels of serum lipids in healthy children upto 12 years of age.

Material and Method

150 normal healthy children in the age group 0-12 years were included in the study. The children were studied for anthropometry, blood sugar and lipid profile. The blood sample for newborns were collected from umbilical cord in the labour room. For infants and children the blood samples were collected at the Well Baby Clinic, those admitted for minor surgical procedure and healthy siblings of indoor patients. Parents of these children were also studied for any evidence of coronary artery disease, hypertension or cerebrovascular accident. Children of those parents who had any evidence of the above ailment were not included in the study. The

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TABLE 1

Age, sex and weight distribution

Age Group in years	Neonates	0-1	1-4	4-7	7-10	10-12
Males (n-73)	12	12	14	10	12	13
Mean weight (kg)	2.6	4.6	11.3	18.3	20.6	25.7
Females (n-77)	13	13	11	15	13	12
Mean weight (kg)	2.8	5.8	12.9	14.1	21.0	26.3
Total (n-150)	25	25	25	25	25	25
Mean weight (kg)	2.7	5.2	11.7	15.8	20.8	26.1

subjects were divided into six equal groups viz. newborns, 0-1 year, 1-4 years, 4-7 years, 7-10 years and 10-12 years.

The blood samples were obtained after an overnight fast of 10 hours. Children below 5 years were allowed water till 2 hours before the samples were drawn. 3-4 ml of blood was collected in plain sterile bulbs and serum separated by centrifugation. The serum was stored at 0-4°C and lipid analysis was done within 24 hours of collection.

The parameters included under the head lipid profile were serum triglycerides (TG), serum total cholesterol (T Chol), serum low density lipoprotein cholesterol (LDL Chol) and serum high density lipoprotein cholesterol (HDL Chol)

Triglycerides, total cholesterol and HDL cholesterol were estimated by methods described by Foster, Zlatkis and Warnick [7-9] respectively. LDL Chol was calculated from the values derived for triglycerides, total cholesterol and HDL using Froedwald formula i.e. $LDL\ Chol = T\ Chol - (TG/5 + HDL\ Chol)$

Results

The subject group comprised of a total of 150 children between the age of 0-12 years. They were divided into six equal groups. Table 1 shows the age and sex distribution alongwith the mean weight for each group. M : F ratio was 1 : 1.05. Though the values

for mean weight were higher for girls, the difference was not statistically significant.

Table 2 shows the total cholesterol, HDL cholesterol, LDL cholesterol and triglyceride distribution. The mean values $\pm$ SD for T Chol in normal neonates were 70 ± 14.48 mg/dl for boys and 71.8 ± 13.9 mg/dl for girls. The mean $\pm$ SD values during the first year of life were 121.5 ± 32.05 mg/dl for males and 133 ± 33.61 mg/dl for females which increased to 158.7 ± 21.23 and 161.6 ± 23.09 mg/dl in males and females respectively at 10-12 years of age.

Mean $\pm$ SD values for HDL cholesterol in males varied from 35.1 ± 8.04 mg/dl at neonatal period to 60.7 ± 11.70 mg/dl at 10-12 years of age. In females values ranged from 34.6 ± 6.55 mg/dl at neonatal period to 66.7 ± 8.75 mg/dl at 10-12 years of age. The difference of values in both sexes was not significant statistically. The mean $\pm$ SD values for LDL cholesterol at neonatal period was 23.8 ± 10.62 mg/dl which increased to 80.3 ± 19.26 at 10-12 years in males, whereas in females the increase was from 25.5 ± 9.29 to 75.8 ± 20.26 mg/dl during the same period. The difference in sexes was not statistically significant.

The mean $\pm$ SD values for triglycerides varied from 50.9 ± 20.77 mg/dl at neonatal period to 86.7 ± 28.80 at 10-12 years of age in males and from 57.2 ± 18.57 to 93.2 ± 44.09 mg/dl in females during the same period. The

TABLE 2

T Chol, HDL Chol, LDL Chol and TG distribution according to age group and sex (mg/dl)

	Neonates	0-1Yr	1-4Yrs	4-7 Yrs	7-10 Yrs	10-12 yrs
T CHOL						
Males	70.0 ± 14.48 (50-92)	121.5 ± 32.05 (94-190)	137.0 ± 20.02 (100-168)	139.1 ± 16.91 (120-173)	145.1 ± 25.38 (100-196)	158.7 ± 21.23 (129-188)
Females	71.8 ± 13.96 (52-116)	133.0 ± 33.61 (80-196)	126.0 ± 22.04 (88-178)	143.5 ± 18.76 (111-190)	156.4 ± 27.82 (92-200)	161.6 ± 23.09 (90-210)
HDL CHOL						
Males	35.1 ± 8.04 (23-58)	43.7 ± 11.52 (23-60)	51.8 ± 14.17 (28-80)	50.2 ± 9.72 (33-71)	53.5 ± 7.03 (44-62)	60.7 ± 11.70 (42-78)
Females	34.6 ± 6.55 (24-46)	57.3 ± 11.96 (45-86)	46.8 ± 13.66 (31-62)	54.7 ± 19.04 (28-109)	61.0 ± 11.77 (46-78)	66.7 ± 8.75 (52-85)
LDL CHOL						
Males	23.8 ± 10.62 (3-39)	63.0 ± 24.92 (34-131)	69.1 ± 25.43 (25-110)	68.5 ± 13.41 (47-93)	76.4 ± 20.30 (38-114)	80.3 ± 19.26 (50-114)
Females	25.5 ± 9.29 (12-38)	58.1 ± 24.27 (20-115)	66.4 ± 18.92 (46-92)	71.9 ± 28.32 (50-119)	75.3 ± 24.60 (37-109)	75.8 ± 20.26 (48-106)
TRIGLYCERIDES						
Males	50.9 ± 20.77 (30-105)	72.5 ± 36.77 (38-198)	77.7 ± 20.80 (48-126)	99.9 ± 60.37 (88-192)	84.0 ± 15.92 (38-96)	86.7 ± 28.80 (38-137)
Females	57.2 ± 18.57 (34-95)	86.6 ± 38.52 (54-120)	63.0 ± 12.82 (50-80)	88.1 ± 25.71 (47-120)	98.5 ± 54.41 (58-200)	93.2 ± 44.09 (40-186)

p > 0.05 for differences in all values between males and females.

Figures in parenthesis () denote range.

difference in sexes was not statistically significant.

Discussion

In the present study, the mean values ± SD for T Chol in normal neonates were 70 ± 14.48 mg/dl with range of 50-92 mg/dl for boys and 71.8 ± 13.96 with range of 52 - 116 mg/dl for girls. Our results are comparable to those found by Tsang [10]. Similar findings have been found in two other Indian studies [6,11]. Much lower values ranging from 44-48 mg/dl have been reported by some other workers [12,14]. We found no significant relation to sex while higher values for female neonates have been reported by some [14]. Our values of T Chol of 137.0 ± 20.02 mg/dl and 126.0 ± 22.04 mg/dl in male and female, children of 1-4 years of age are similar to other studies [14,15].

The mean ± values for HDL Chol in neonates were 35.1 ± 8.04 mg/dl with range of

23-58 mg/dl and there was no difference in males and females. Comparable figures were found by Tsang and Haridas [10,16]. Our values for males in the 1-4 years of age were 51.8 ± 14.17 mg/dl and these increased to 60.7 ± 11.70 mg/dl at 10-12 years of age. Amongst females these values were 46.8 ± 13.66 mg/dl and 66.7 ± 8.7 mg/dl respectively. Connor et al [17] found similar values at 6-15 years of age in males and females as in our study. The LRCP [15] recommends a mean value of 55 mg/dl in 5-14 years old children of both sexes. Higher values through-out childhood were reported by Mirza [18].

Our LDL Chol values in male and female newborns were 23.8 ± 10.62 mg/dl and 25.5 ± 9.29 mg/dl respectively. Almost similar values have been reported by Hardell [13] and Tsang [10]. Lower values have been reported by Vikari et al [14] where as higher figures of 59.2 ± 6.0 mg/dl were reported by Haridas

[16]. No significant difference was found between males and females by us as well as others [13]. The values between 1-4 years in males were 69.1 ± 25.43 mg/dl and in females were 66.4 ± 18.92 mg/dl. The values at 10-12 years were 80.2 ± 19.2 mg/dl and 73.8 ± 20.2 mg/dl for male and female children respectively. Most of other studies reported higher values [14,15].

The mean values for triglycerides in neonates were 50.9 ± 20.77 with a range of 30-105 mg/dl and no significant differences in both sexes. The lower figures of 26.76 ± 12.7 mg/dl have been reported by Dogra [6]. Desai [11] found level of 62.0 ± 21.0 mg/dl with range of 6-128 mg/dl which are higher than our values. The values between 1-4 years were 77.7 ± 20.80 mg/dl for males and 63.0 ± 12.82 mg/dl for females respectively. Vikari [14] reported very similar values of 71 mg/dl and 74 mg/dl for males and females respectively at 3 years of age. Our values at 10-12 years were 86.7 ± 28.80 mg/dl and 93.2 ± 44.09 mg/dl for males and females respectively. Mirza's [18] figures of 55.0 ± 4.6 mg/dl are much lower than our values. Children aged 6-15 years were found to have values of 56.1 ± 28.7 mg/dl and 60.7 ± 19.2 mg/dl for males and females respectively in another study [17]. Statistically no significant difference was found in male and female children.

The various lipid fractions had the lowest levels at birth and increased significantly during the first year of life, thereafter showing a much slower rise in levels. There was no significant difference between males and females. More work will be required to study the children of high risk group viz. those with family history of coronary artery disease, hypertension and diabetes mellitus to suggest any intervention at an early age.

REFERENCES

1. American Heart Association. *Circulation*, 1970; XLI : Suppl I 185-7.
2. Mitchell S, Blount SG Jr, Blumenthal S. The pediatrician and atherosclerosis, Commentary. *Pediatrics* 1972; 49 : 165-8.
3. The Bogalusa Heart Study. Relation of serum lipoprotein levels and systolic blood pressure to early atherosclerosis. *N Engl J Med* 1986; 314 : 138-44.
4. Council on Scientific Affairs, American Medical Association. Dietary and pharmacological therapy for the lipid risk factors. *JAMA* 1983; 250 : 1873-9.
5. Committee on Nutrition of American of Pediatrics. Childhood diet and coronary heart disease. *Pediatrics* 1972; 49 : 305-7.
6. Dogra J, Sengar GS, Mathur HC, Mishra SN. Serum lipids in neonatal cord blood in families with diabetes mellitus Type I. *Indian Pediatr* 1988; 25 : 267-71.
7. Foster LB, Dunn RT. Stable reagents for determination of serum triglycerides by a colorimetric Hantzsch condensation method. *Clin Chem* 1973; 19 : 338-42.
8. Zlatkis A, Zak B, Boyle AJ. A new method for direct determination of cholesterol. *J Lab Clin Med* 1953; 41 : 486-92.
9. Warnick GR, Albers JJ. *Report of high density lipoprotein workshop*. Ed. Lippel K. NIH Publication 1981; p 33.
10. Tsang RC, Fallat RW, Glueck CJ. Cholesterol at birth and age I. Comparison of normal and hypercholesteremic neonates. *Pediatrics* 1974; 53 : 458-70.
11. Desai M, Patil K, Shah R, Mudholkar R. Cord Blood lipids and lipoproteins in normal neonates. *Indian Pediatr*. 1977; 15 : 373-8.
12. Sporik R, Johnstone JH, Cogswell JJ. Longitudinal study of cholesterol values in 68 children from birth to 11 years of age. *Arch Dis Child* 1991; 66 : 134-7.
13. Hardell LI. Serum lipids and lipoproteins at birth based on a study of 2815 newborn infants. Concentrations and distributions of triglycerides and cholesterol. *Acta Paediatr Scand Suppl* 1981; 285 : 5-10.
14. Vikari J, Akerblom HK, Rasanen L, Kalavainen M. Cardio vascular risk in young firms. *Acta Paediatr Scand*. 1990; 365 : 13-9.
15. Rifkind BM, Segau P. Lipid Research Clinics Programme reference values for hyperlipidemia and hypolipidemia. *JAMA* 1983; 250 : 1869-72.
16. Haridas N, Acharya PT. Serum lipid status in neonates. *Indian Pediatr* 1984; 21 : 327-34.
17. Conner SL, Connor WE, Sexton G. The effects of age, body weight and family relationship on plasma lipoproteins. *Circulation* 1982; 65 : 1290-8.
18. Mirza K, Ahmad P, Bilgramil NL, Ullah MS. Lipids and lipoproteins values in normal children. *Indian Pediatr* 1984; 21 : 313-7.