Serum Proteins Electrophoresis in Infants and Children

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Abstract

Total serum proteins and its fractions were estimated in 468 infants and children from birth to 4 years relation to age, sex and dietary pattern. The mean values of total serum proteins and its fractions show sonic changes with age, especially in gamma globulins, which was high at birth and showed a decrease the age of 3 months after which t increased and attained an adult level at the age of 18 months N - difference was noted between the two sexes. Completely breast fed infants had a significantly high protein and albumin levels at 3 months than completely weaned infants but no such difference was observed in other protein fractions in the same age groups (JPMA 46:252, 1996).

Introduction

It is generally agreed that one of the important environmental factors affecting health is nutrition. Its adequacy in infants and children is crucial to their well-being throughout their lives Adequately nourished infants and children achieve a normal rate of physiological and mental development as compared to inadequately nourished children In this respect, the role of proteins in nutrition has been much emphasized during the last many decades. Protein deficiency conditions as Kwashiorkar, have been identified to which weaned infants and young children are especially vulnerable.

Studies on congenital agammaglobulinemia[1,2] has stimulated further research into changes in serum proteins and its fractions, produced by other illnesses in paediatrics age groups. Electrophoretic studies of serum protein for the purpose are not new, Tiselius[3] is usually given credit for fractionating serum proteins. A considerable literature has evolved the changes in serum proteins occurring in health and pathological states[4-6]. Inorderto investigate changes in serum proteins and its fractions ill pathological states in infants and children it is necessary to first establish the normal range of values of serum proteins and its fractions in health) children.. This communication presents data of ser and its fractions in a specified number of healthy children from birth to four years. Moreover, undertaken to establish a base line for use in interpz protein changes that may occur with age, sex pattern.

Materials and Methods

The pattern of serum proteins was studied in infants and children at ages ranging from birth to for each completely breast-fed and completely wean ages 3 and 6 months and 100 adult males and female were collected during 1993-1-995. Hemoglobin, sedimentation rate and red and white cell count w and if any of these values varied markedly from I normal values, the subjects were exchided fror Subjects with congenital diseases, skin infections in stool were also excluded. Those included i belonged to average socio-economic groups. Blood samples were drawn by venipuncture and after clotting, serum was immediately separated by centiifugation. When it was not possible to analyze the sample immediately, the serum was stored by freezing for not more than 24 hours. Total serum proteins were estimated by Biuret method[7], protein fractionation by electrophoresis[8] and the result was obtained by densitometery[9]. A commodor model 8032 computer was used for analysis of data.

Results

Data for total serum proteins (TSP), albumin, alpha-i, alpha-2, beta and gamma globulins in male and female infants and children are presented in Tables I and II.

Table I. Total serum proteins (Gm. per dl) in male and female infants in relation to age.

Age	Males			Females		
	No of cases	Mean	SD	No of cases	Mean	SD
New Born	25	6.37	±0.143	25	6.48	±0.121
3 months	28	6.66	±0.182	28	6.68	±0.118
6 months	15	7.06	±0.160	15	7.02	±0.107
9 months	26	7.20	±0.160	26	7.15	±0.205
12 months	38	7.30	±0.152	38	7.37	±0.090
15 months	24	7.39	±0.101	24	7.40	±0.086
18 months	24	7.51	±0.102	24	7.50	±0.100
2 years	24	7.50	±0.127	24	7.52	±0.106
4 years	30	7.49	±0.205	30	7.50	±0.214

Table II. Total serum proteins and proteins fractions (electrophoresis Gm. per dl) in male and female infants in relation to age.

Age	Males							Females						
	No.of cases	TSP	Alb	α_1 Glob	α_2Glob	β Glob	γGlob	No.of cases	TSP	Alb	α_1 Glob	α_2 Glob	β Glob	γGlob
New Born	25	6.37 ±0.143	3.80 ±0.13	0.32 ±0.03	0.46 ±0.02	0.62 ±0.02	1.07 ±0.02	25	6.48 ±0.121	3.89 ±0.078	0.33 ±0.022	0.45 ±0.027	0.65 ±0.031	1.04 ±0.017
3 months	28	6.66 ±0.18	4.33 ±0.16	0.31 ±0.03	0.66 ±0.05	0.61 ±0.04	0.78 ±0.08	28	6.68 ±0.118	4.39 ±0.130	0.29 ±0.021	0.54 ±0.038	0.60 ±0.030	0.81 ±0.046
6 months	15	7.06 ±0.16	4.40 ±0.18	0.32 ±0.03	0.79 ±0.04	0.92 ±0.04	0.76 ±0.03	15	7.02 ±0.107	4.30 ±0.101	0.32 ±0.032	0.75 ±0.025	0.92 ±0.022	0.73 ±0.034
9 months	26	7.20 ±0.19	4.43 ±0.16	0.33 ±0.03	0.82 ±0.02	0.96 ±0.03	0.73 ±0.03	26	7.15 ±0.205	4.39 ±0.16	0.33 ±0.023	0.81 ±0.026	0.92 ±0.038	0.72 ±0.028
12 months	38	7.30 ±0.152	4.52 ±0.12	0.28 ±0.03	0.77 ±0.04	0.96 ±0.03	0.79 ±0.04	38	7.37 ±0.09	4.52 ±0.081	0.29 ±0.023	0.77 ±0.034	0.97 ±0.025	0.80 ±0.048
15 months	24	7.39 ±0.10	4.52 ±0.08	0.27 ±0.032	0.71 ±0.033	0.98 ±0.034	0.87 ±0.031	24	7.40 ±0.086	4.52 ±0.087	0.28 ±0.021	0.73 ±0.026	0.98 ±0.026	0.87 ±0.028
18 months	24	7.51 ±0.102	4.53 ±0.079	0.27 ±0.025	0.75 ±0.39	0.99 ±0.033	0.93 ±0.015	24	7.50 ±0.100	4.53 ±0.078	0.27 ±0.025	0.78 ±0.034	0.99 ±0.024	0.93 ±0.022
2 years	24	7.50 ±0.127	4.52 ±0.10	0.26 ±0.024	0.76 ±0.026	0.99 ±0.028	0.94 ±0.032	24	7.52 ±0.106	4.54 ±0.067	0.27 ±0.029	0.76 ±0.024	0.98 ±0.029	0.94 ±0.029
4 years	30	7.49 ±0.205	4.50 ±0.125	0.29 ±0.036	0.77 ±0.045	0.97 ±0.042	0.91 ±0.064	30	7.50 ±0.214	4.49 ±0.143	0.27 ±0.037	0.77 ±0.041	0.97 ±0.033	0.91 ±0.061

TSP = Total serum proteins

Table i shows the values of TSP change from birth through infancy. The mean value of TSP at birth being. 6.37+0. 143 Old! for males and 6.48±0.121 Old for females. These values increased with age and showed significant difference (P<0.00 1) in the level of TSP between new born infants at birth and children at the age of four years. A level of 7,51±0.102 Old!, for males and 7.50±0.100 0/al, for females, was attained at the age of 18 months. These values were almost identical to the mean normal adult value i.e., TSP of 7.54±0.15 Old!. No significant difference in TSP was found between two sexes from birth through four years of age.

Serum albumin in both sexes gradually increased with age. At birth, the mean serum albumin in male infants was 3.80±0.13 Old! and females, 3.89±0.078 Old!. A significant difference (P<0.001) was observed between infants, at birth and at the age of 18 months in both sexes. Moreover, a level of 4.52±0.080 G/dl for males and 4.52+0.087 Old! for females was attained at the age of 15 months which

was similar to adult levels of 4.53±0.112 G/dl (Table II). The mean values for alpha-globulins reached the highest levels at the age of 9 months and then decreased with increasing age (Table II), the changes in alpha-2 globulins with increasing age were more striking. The mean alpha-2 globulins at birth was 0.46±0.020 Old! in males and 0.45±0.027 G/dl in females and attained a value of 0.82±0.02 G/dl, in males and 0.81±0.026 G/dl in females at the age of 9 months, showing significant difference (P<0.001)which then dropped by the end of the first year and stablized by 18 months in both sexes. No sigment licant difference was observed among two sexes. The mean values for beta globulins which was 0.62+0.02 G/dl in males and 0.65±0.031 G/dl in females at birth increased gradually with age in both sexes and stabilized by about the 9 months of life. The gamma globulins levels showed prominent changes with age. At birth the mean value of 1.07±0.02 G/dl for males and 1.04±0.017 G/dl for females declined sharply with age and reached to lowest levels of 0.73 ±0.03 G/dl in males and 0.72±0.028 G/dl in females at age of 9 months showing a significant difference (P<0.0001), after which the level increased steadily until at the age of 2 years, when the mean values in both sexes showed no significant difference from adults mean values of 0.99±0.034 G/dl (Table. II). When expressed as percentage of total proteins alpha-2 globulins (7-12%), beta globulins (8-13%) and gamma globulins (10-16%) were fairly constant in both sexes (Figures 1 and 2).

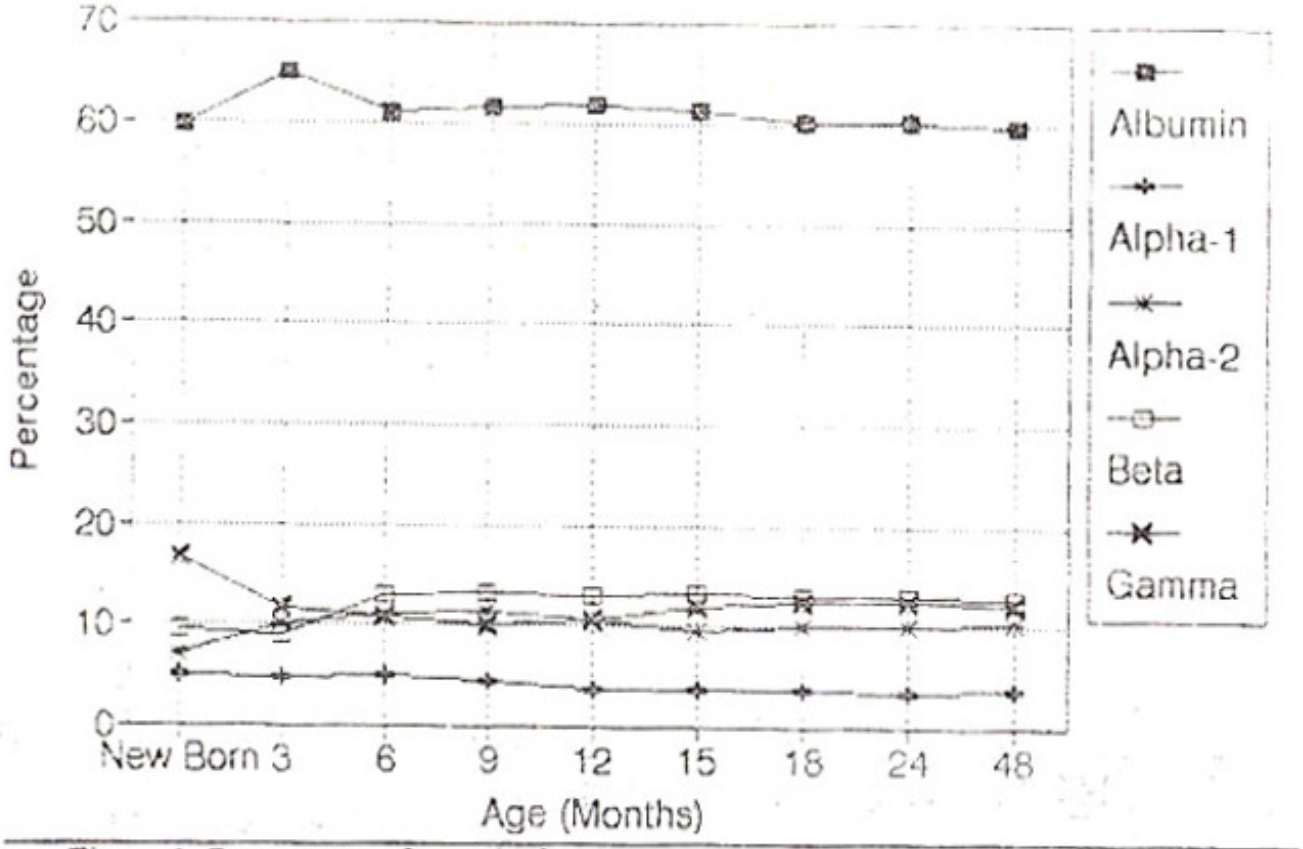

Figure 1. Percentage of protein fractions with respect to total protein (Males).

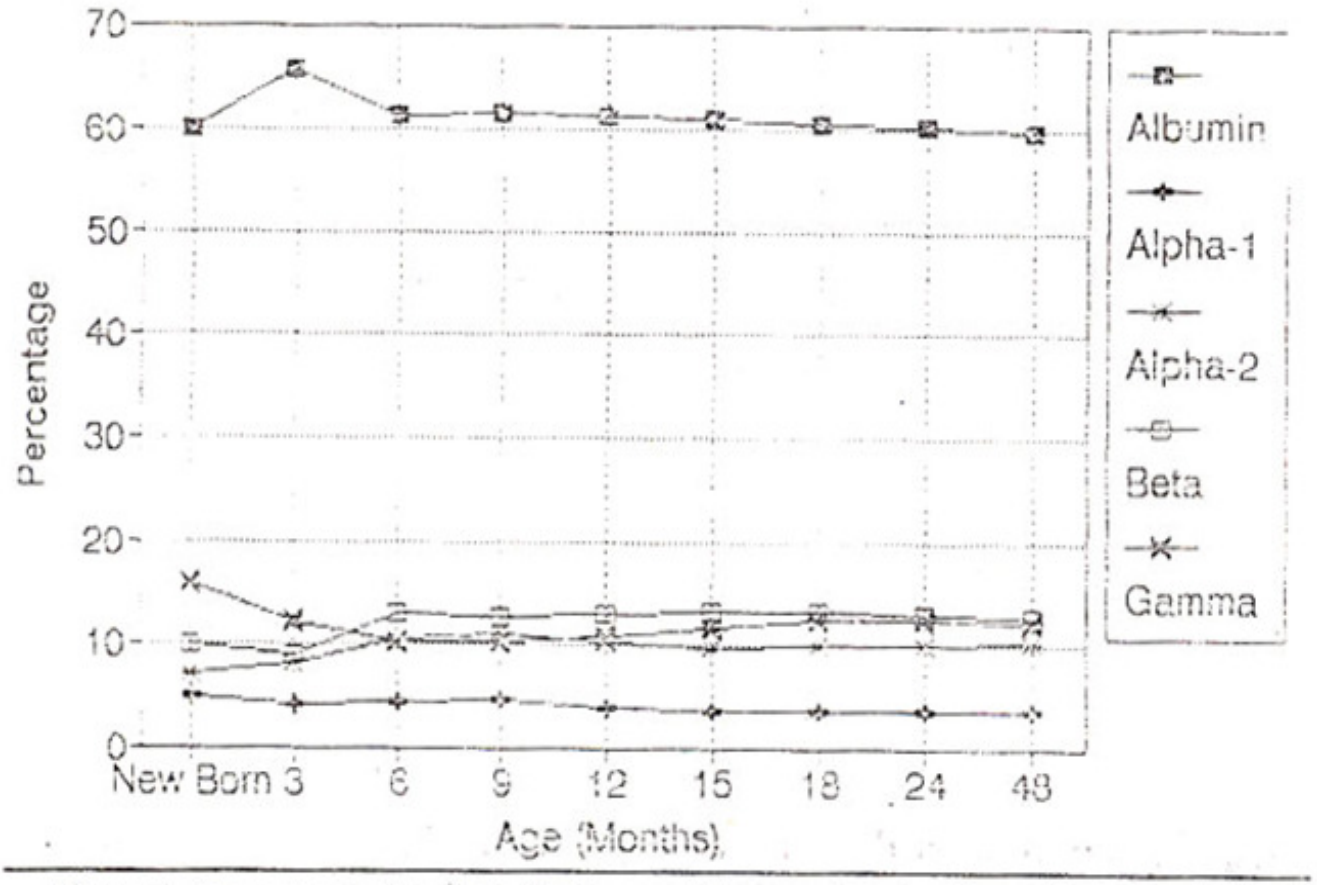

Figure 2. Percentage of protein fractions with respect to total protein (Females).

Table III. Total serum proteins and proteins fractions (electrophoresis G/dl) in infants in relation to and dietary pattern.

	3 months							6 months						
	Completely breast fed			Completely weaned				Completely breast fed			Completely weaned			
Serum protein	No.	Mean	SD	No.	Mean	SD	P	No.	Mean	SD	No.	Mean	SD	P
Males														
TSP	25	6.65	±0.123	25	6.53	±0.121	<0.05	25	7.04	±0.181	25	6.91	±0.269	<0.05
Alb	25	4.32	±0.093	25	4.06	±0.086	<0.001	25	4.33	±0.219	25	4.14	±0.208	<0.001
Alpha 1 Glob	25	0.29	±0.034	25	0.24	±0.032	N.S	25	0.24	±0.024	25	0.29	±0.020	NS
Alpha 2 Glob	25	0.56	±0.056	25	0.56	±0.062	N.S	25	0.75	±0.032	25	0.77	±0.028	N.S
Beta Glob	25	0.62	±0.061	25	0.67	±0.049	N.S	25	0.91	±0.031	25	0.89	±0.044	N.S
Gamma Glob	25	0.81	±0.087	25	0.80	±0.050	N.S	25	0.73	±0.038	25	0.73	±0.031	N.S
Females														
TPS	25	6.65	±0.124	25	6.50	±0.122	<0.05	25	7.08	±0.181	25	6.91	±0.267	<0.05
Alb2	25	4.32	±0.116	25	4.02	±0.160	<0.001	25	4.37	±0.201	25	4.16	±0.224	<0.001
Alpha 1 Glob	25	0.29	±0.033	25	0.24	±0.032	N.S.	25	0.29	±0.031	25	0.29	0.028	N.S
Alpha 2 Glob	25	0.56	±0.049	25	0.57	±0.061	N.S	25	0.75	±0.036	25	0.77	±0.028	N.S
Beta Glob	25	0.62	±0.056	25	0.67	±0.047	N.S	25	0.92	±0.036	25	0.89	±0.047	N.S
Gamma Glob	25	0.82	±0.088	25	0.80	±0.058	N.S	25	0.73	±0.047	25	0.74	±.0.038	N.S

Table III presents the relation between diet and the levels of the TSP and its fraction in 3 and 6 months old male and female infants. At 3 months, the mean value of TSP was significantly higher (P<0.001) both for males and females in completely breast fed than in completely weaned infants. The mean values of serum albumin were 4.32±0.093 G/dl in completely breast fed infants at the age of 3 months in males and 4.3 2±0. 116 G/dl in females, whereas, the mean values of serum albumin in completely weaned male infants were 4.06±0.086 G/dl and 4.02±0.160 G/dl in females, showing significant difference (P<0.001); this difference was also observed between two groups at the age of 6 months for both sexes. No significant difference was found in the mean values of other protein fractions between

completely breast fed and completely weaned at the age of 3 and 6 months in both sexes.

Discussion

The data presented demonstrate that the mean value of TSP shows variations with age. The results presented here are consistent with the earlier studies[4] which showed that the TSP rises after birth and that the adult level being attained by 15 to 18 months. In our study the adult level is reached at the age of 18 months in both sexes.

Although the albumin fraction shows no significant changes between two sexes, however, the mean values for seurm albumin changes with age, which supports the finding of others[5,10,11]. Mean values for serum albumine reported in this study reached adult levels at the age of 15 months in contrast to that reported by Trevarrow et al[12], who showed that adult levels are attained sometime between 6 and 12 months. The mean value for serum albumin, when expressed as percentage of total proteins is remarkably constant (60-61%) for all age groups, except at the age of 3 months, where the value reaches 65.0% in males and 65.7% in females. The highest value of albumin at 3 months reflect a compensatory rise to offset the fall in gamma globulins, since the alpha and beta globulins are little altered during this period. These findings are almost identical to those of Oberman et al[11]

Amongst the globulins, the most striking changes was observed in gamma globulin, which shows a sharp decline from high values in newborn to unusually low levels in infancy, both in terms of percentage (Figure i) and absolute concentrations. These values steadily increased with age and attained normal adult levels at the age of eighteen months. This supports the reports of previous authors[13,14]. These changes may be related to loss of passive immunity received by the infants from their mothers and the accumulation of antibodies and the development of active immunity in the children. At the age of 3 to 6 months, the infants are therefore, more susceptible to disease since it is at this time, that the immune system is depressed due to low immunoglobulins.

Total serum proteins and albumin levels significantly differ, for both sexes, between breast fed and weaned infants at the age of 3 and 6 months, whereas, no singificant difference is observed for the mean values of other protein fractions. The difference in TSP and albumin may be due to the fact that utilization efficiency of proteins of mothers milk by infants is assumed to be 100% or due to low quality proteins in artificial feedings.

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