SUNTEXT REVIEWS

SunText Review of Pediatric Care
ISSN: 2766-5216

Open Access
Review Article
Volume 2:2

Anthropometeric Indices, Blood (Plasma, Erythrocytes, Leucocytes), Edema Fluid and Saliva Alterations as Indicators of Nutritional Status

Agarwal KN*, Agarwal DK and Mishra OP

Department of Pediatrics, Institute Medical Sciences, Varanasi, India

***Corresponding author:** Agarwal KN, Department of Pediatrics, Institute Medical Sciences, Varanasi, India; E-mail: kna.ped2020@gmail.com

Received date: 01 July 2021; **Accepted date:** 29 July 2021; **Published date:** 04 August 2021

Citation: Agarwal KN, Agarwal DK, Mishra OP (2021). Anthropometeric Indices, Blood (Plasma, Erythrocytes, Leucocytes), Edema Fluid and Saliva Alterations as Indicators of Nutritional Status. SunText Rev Pediatr Care 2(2): 120.

DOI: https://doi.org/10.51737/2766-5216.2021.020

Abstract

Anthropometric parameters in affluent Indian children offered tools to diagnose normal (Healthy), faltering growth, endocrinological and nutritional disorders i.e. dwarf, wasted, stunted, stunted-wasted and obese. These data served as national growth standards and in adolescence offered growth parameters in relation to sexual maturity rating. In blood plasma and erythrocyte FαAN (Free alpha amino nitrogen) and non-essential: essential amino acid ratios were neither definitive nor early indicators of hypoproteinemia. Erythrocytes showed significant increase in glutamic acid. Erythrocytes have a long survival time (around 100 days) therefore; may not represent the recent changes. The FαAN in leucocytes was reduced in hypoproteinemia. The leucocyte's life span is 13 to 20 days, thus fall in FαAN may be the earliest change in blood for diagnosis of protein deficiency.

The concentrations of protein, FαAN and non-essential and essential amino acids ratio distributions in plasma and edema fluid were similar in protein energy malnutrition (PEM), nephrotic syndrome, cirrhosis and congestive heart failure, so no further study was done. The studies on saliva showed that decrease in ferritin level in PEM was a sensitive early indicator, protein also decreased. The salivary iron was increased two times of serum level in PEM, unrelated to iron deficiency anemia, and compared to serum levels in iron overload conditions.

Keywords: Anthropometry; Growth Standards; Nutritional Status; PEM; FαAN; Nonessential: essential amino acid ratios; Plasma; Erythrocyte; Leucocyte; Hypoproteinemia; Nephrosis; Cirrhosis; Congestive heart failure; Edema fluid; Saliva; Ferritin; Arginase activity; Protein; Iron

Anthropometeric Indices in Diagnosing Nutritional Disorders

In literature review, no study was available for anthropometric data. These facts motivated us to undertake the following studies as per guidelines of Nutrition Sciences [1]. Growth pattern during the first year of life, in respect of height, weight and skull circumference of 25 Indian children (full term) receiving optimal nutrition, who needed Infant formula, were enrolled, and fed milk (Unilever, India), findings suggested that if, nutrition is provided, and morbidity is controlled child's growth will be optimal for their genetic potential [2].

Growth Studies

Nutrition Foundation of India, after series of academic discussions planned, data from geographically distributed centers (Ludhiana, Delhi, Varanasi, Kolkata, Kota, Bombay and Bangalore) are collected, prospectively. The selected centers were under academic Pediatricians assisted by a centrally trained Pediatrician / doctor and used calibrated tools- weighing (beam balance), infantometer and fiber glass tape (circumferences- skull, chest, and mid arm) were provided. The data were collected during 1989-1991. Only full term with birth weight ≥2500 g (boys 433 and girls 346) was followed during 3, 6, 9 months of age with minimum of 3 reading for every infant (cohort I). In cohort-II, children from 12 months + children followed in cohort-I also continued, 1011 boys and 874 girls were followed on their birthday and 6 monthlies with minimum of 3 for each child up to

72 months [3,4]. Children had received exclusive breast milk for 3-4 months of life in cohort I & II (as was prevalent in those years). Their pooled data showed values lower than European and NCHS (American) standards. Centre wise comparison Ludhiana children approached closer to the NCHS data. The differences in growth seem to be possibly due to lower velocity in children in 18 months than American children.

In a subsequent study [5], it was observed that at 18 months: infants ≥ 2.5 kg birth weight, on exclusive breast feeding for <6 months and receiving semisolids early, gained more length by 3.4 cm than those receiving, exclusive breast feeding for ≥6 months.

In recognition of the outstanding research, ICMR granted a Nutrition Center in the Institute Medical Sciences, Varanasi, cross sectional multicentric data for physical growth and sexual development for 5 to 18 years (9 states- 23 schools: 12893 boys and 10,941 girls). The measurements were collected during 1989-1991 [6]. These two data sets (4,6) are collected around same time "Birth to adolescence". The same medical team with trained workers conducted examination in all the schools (measured anthropometry, instruments were checked repeatedly and assessed sexual development). These data sets on physical growth and sexual development will continue to serve as the baseline reference [4,7-10]. It is recommended that girls from 10th year and boys after 12th be measured and compared to the sexual maturity [8]. To assess sexual development child can be provided the Tanner's sexual maturity rating diagrams and he/she will simply write the STAGE [I-V]. For boys Prader's orchidometer will measure privately the testicular volume. As a boy at 14 yrs. of age may measure 150 cm in Sexual Maturity Rating G-II, while other in G IV may measure 162 cm [6-10].

The above studies contributed growth monitoring curves, also in relation to sexual maturity. Z scores for assessment of Malnutrition < 5 year of age to identify under nutrition, and wasted stunted children are also calculated [7-12]. Presently, WHO growth curves overestimate stunting in Indian children Natale and Rajgopalan [13]. The IAP 2015 growth chart (5-18 yr), on comparing the differences between 3rd and 97th percentile values as compared to Agarwal [6] data regulates underweight (undernourished) overweight (obese) children, thus unsuitable [8-10]. India should plan to do a fresh prospective study to collect data for New Growth curves and nutrition indices.

Blood Alterations in Nutritional Disorders

a) **Plasma**- Free α-amino nitrogen (FαAN) decreased in pregnancy, severe hypoproteinemia, cirrhosis, anemia, and pregnancy. The non-essential: essential amino acid ratios, were increased in hypoproteinemia and anemia [14].

b) **Erythrocyte-** FαAN content increased in early hypoproteinemia, but values became lower than normal in severe hypoproteinemia. There was rise of FαAN in anemia, due to increased cellular non-essential amino acids [14].

The erythrocyte enzymes of glutamic acid metabolism (glutaminase I, glutaminase II, glutamic acid decarboxylase and glutamine synthetase) and related amino acids (glutamine, glutamic acid, aspartic acid, alanine, and γ-aminobutyric acid) increased in hypoproteinemia. The concentration of glutamic acid was increased suggesting increase in intracellular production [15], besides glucose, it may be an additional nutrient for cell function [16-18].

c) **Leucocyte**- The leucocytes life span is 13 to 20 days, thus fall in FαAN could be the earliest change in blood for diagnosis.

Edema Fluid

Plasma/edema ratios were 36: 1, 49: 1, 32: 1 and 52: 1 in PEM, nephrosis, cirrhosis, and CHF, respectively. Ratios were 4:1 and (21:1) in epidemic dropsy and nephritis. The free alpha amino nitrogen and essential and non-essential amino acid in these two compartments were in equilibrium [19]. As plasma and edema fluid ratios were similar in PEM, nephrosis, cirrhosis and CHF, thus no further work was done.

Saliva

Saliva is basically an ultra-filtrate from serum, containing various substances i.e. protein, ferritin, enzymes (amylase, arginase catalase, peroxidase), and sodium, potassium, thiocyanates, iodides and metals (iron, zinc, copper and chromium). Therefore, blood changes in protein, enzymes, may be reflected in PEM. The salivary ferritin showed progressive fall in serum and saliva in PEM grade I (early malnutrition). In grade III the mean ferritin value was 3.28 ± 0.75 ug/L as compared to 169.3 ± 21.9 ug/L for normal children [20]. It was possible that these children with PEM also had associated anemia. The salivary iron in iron deficiency (IDA), thalassemia major and aplastic anemia was significantly higher. IDA children with hypoalbuminemia had significantly reduced serum and salivary protein, but iron concentrations in saliva was 2 times of the serum level. The salivary iron levels were increased in IDA as well as in iron overload. The mean salivary/serum iron ratio was twice in IDA (2.6), in thalassemia major (1.2) and aplastic anemia (1.1) times. Salivary iron levels are higher in iron deficiency [21], thus can be used for the diagnosis of iron overload and deficient states [22,23].

Conclusions

Anthropometric indices assess growth and nutritional disorders in children < 5years, growth faltering indicator of malnutrition i.e undernutrition or overnutrition. The fall of leucocyte FαAN, and salivary ferritin were sensitive diagnostic indicators of PEM.

Salivary iron levels remain high in iron deficiency as well as in iron overload conditions.

References

1. International Union of Nutrition Sciences. The creation of growth standards. A committee report of meeting in Tunis. Am J Clin Nutr. 1971, 25: 218-220.
2. Manwani AH, Agarwal KN. The growth pattern of Indian infants during the first year of life. Hum Biol. 1973; 45: 341-349.
3. Agarwal KN, Agarwal DK, Benkappa DG, Gupta SM, Khanduja PC, Khatua SP, et al. Growth performance of affluent Indian children (Under-Fives). Nutrition Foundation of India Sci Rep. 1991.
4. Agarwal DK, Agarwal KN. Physical growth in affluent Indian children (birth- 6 years). Indian Pediatr. 1994; 31: 377-413.
5. Agarwal KN, Agarwal DK, Gupta A, Bansal AK. *Relationship of exclusive breast feeding* for *6* mo to *linear growth up* to *18 mo of age*. Indian J Pediatr. 2013; 80: 11-15.
6. Agarwal KN, Agarwal DK, Upadhaya SK, Mittal R, Prakash R, Rai S. Physical and sexual growth pattern of affluent Indian Children from 5 - 18 years of age. Indian Pediatr. 1992; 92: 1203-1282.
7. Agarwal KN, Saxena A, Bansal AK, Agarwal DK. Physical growth assessment in adolescence. Indian Pediatr. 2001; 38: 1217-1235.
8. Agarwal KN. The Growth Infancy to Adolescence, 3rd edition. New Delhi: CBS Publishers. 2015; 1-40, 87-93.
9. Agarwal KN, Bansal AK, Agarwal DK. Growth pattern in Indian Children. Statistics and Applications. 2015; 13: 11-23.
10. Kumaravel V, Vanishree S, Anithorani M, Mahadevan, S, Balamurgan AN, Sathiyawekaran BWC. Are the current Indian growth charts really representative? Analysis of anthropometeric assessment of school children in a South Indian district. Ind J Endocrinol Metab. 2014, 18: 56-62.
11. Agarwal KN, Agarwal DK. Adolescence in Indian Children. Ann Pediatr Res. 2020; 4: 1-8.
12. Natale V, Rajagopalan A. Worldwide variations in human growth and the World Health Organization growth standards: A systemic review. BMJ Open. 2014; 4: 1-11.
13. Agarwal KN, Agarwal DK, Upadhyay SK, Agarwal S 2020. Early Life Nutrition Deprivation and Mental Functions. SunText Rev Pediatr Care. 1: 108.
14. Gupta M, Agarwal KN. Free amino acid patterns of plasma, erythrocytes and leucocytes in hypoproteinaemia. Br J Nutr. 1973; 29: 151-157.
15. Agarwal KN, Bhatia BD, Butta RK, Singla PN, Shankar R. Erythrocytic enzymes and amino acids related to glutamic acid metabolism in childhood hypoproteinemic states. Am J Clin Nutr. 1981; 34: 924-927.
16. Newsholme P, Lima MMR, Procopio J, Pithon-Curi TC, Doi SQ, Bazotte RB, et al. Glutamine and glutamate as vital metabolites. Braz J Med Biol Res. 2003; 36: 153-163.
17. Peng Li, Defa Li Y, Kim SW, Guoyao Wu. Amino acids and immune function. Brit J Nutr. 2007; 98: 237-252.
18. Agarwal KN. Indian Dahi as Immunonutrient- A pilot study. Acta Scientifica Paediatr. 2018; 11: 02-04.
19. Tripathi AM, Agarwal, KK Agarwal KN. Oedema fluid composition in childhood disorders. Acta Paeditr Scand. 1983; 72: 741-745
20. Agarwal PK, Agarwal KN, Agarwal DK. Biochemical changes in saliva of malnourished children. Am J Clin Nutr. 1984; 39: 181-184.
21. Mishra OP, Agarwal KN, Agarwal RMD. Salivary iron status in children with iron deficiency and iron overload. J Trop Pediatr. 1992; 38: 64-67.
22. Canatan D, Akdeniz SK. Iron and ferritin levels in saliva of patients with thalassemia and iron deficiency anemia. Mediterr J Hematol Infect Dis. 2012; 4: e2012051.
23. Kodati S. Correlation of serum and salivary ferritin levels in iron deficiency anemia patients. Int J Biol Med Res. 2018; 9: 6317-6320.

Citation: Agarwal KN, Agarwal DK, Mishra OP (2021). Anthropometeric Indices, Blood (Plasma, Erythrocytes, Leucocytes), Edema Fluid and Saliva Alterations as Indicators of Nutritional Status. SunText Rev Pediatr Care 2(2): 120.