Levels of Aminotransferases Among Schoolchildren in Jaipur, Rajasthan

We did cross-sectional study for normal values of amino-transferases in school children aged 2- 18 years. Median (IQR) AST and ALT values in study subjects were 30 (27- 34) U/L and 23 (19-29) U/L. We also provided age-and sex-related percentiles of aminotransferases of children. We observed a peak of median AST serum values in the age group 6-8 years followed by continuous decline with increasing age. While in ALT, we observed maximum values in age group 2-5 years followed by continuous decline. There was a statistically significant difference in values of amino-transferases between sexes.

Keywords: *Aspartate aminotransferase, Alanine aminotransferase, Normal values.*

Several studies have suggested that the upper limit of normal aminotransferases should be revised [1,2]. In the past seven years, several approaches have been made to establish new reference intervals or thresholds for liver enzymes in children [3-7], but most of these were for Western population. With the assumption that the current reference range for amino-transferases may need revision, we conducted this study to evaluate the normal values of aminotransferases in school children aged 2-18 years.

This school-based cross-sectional study was carried out in Jaipur in the year 2019 after institutional ethics committee clearance. Three schools were selected randomly from rural areas and two schools from urban areas of Jaipur, Rajasthan. Study population included children aged 2-18 years, after parental written consent. A total of 590 children and adolescents were initially screened. During the screening, participants were asked a comprehensive questionnaire regarding their basic demographic information, medical history including current history of febrile illness, medication use (including ayurvedic, growth and apetite stimulators) and social information which included age, sex and history of previous liver disease. Clinical history and general physical examination was done based on a predefined proforma. Height, weight and triceps skin fold thickness (by skinfold caliper) were measured. Five milliliter of non-fasting venous blood sample was collected and processed within 4 hours. We excluded 149 study subjects (active viral upper respiratory infection, 14;HBsAg positive, 5; IgAtTG positive, 7; those with aminotransferses values >3 standard deviation, 16; BMI less than 10th percentile, 50; BMI 90th percentile, 57) [7]. Finally, aminotransferases levels of 441 subjects (165 males) were analyzed.

Student *t* test and ANOVA (one-way analysis of variance) test followed by post hoc test were used for comparing the difference between the various groups. Pearson correlation was conducted to examine the relationship between aminotransferase levels and various parameters like age, sex, body mass index (BMI), triceps skin fold thickness etc.

Mean (SD) age of study subjects was 12.3 (7.4) years, and for analysis, we divided study subjects to different age groups (2-5, 6-8, 9-11, 12-15 and 16-18 years) with 22, 57, 77, 195, and 90 study subjects in each age group, respectively. Median (IQR) AST and ALT values in study subjects were 30 (27- 34) U/L and 23 (19-29) U/L (**Table I**). However, Poustchi, et al. [3] reported median ALT for boys and girls to be 16 U/L and 13 U/L which were quite lower than our median ALT values. The difference between sexes was statistically significant, similar to previous studies [4,7]. We found upper limit of normal (97th percentile) AST and ALT to be 44 U/L and 40 U/L, which were somewhat similar to as described by England, et al. [4] 40 and 35, respectively, but were higher than those reported by Dehghani, et

Table I Aspartate Aminotransferase and Alanine Aminotransferase (ALT) Percentiles Values Among School Children (*N*=441)

Study Population	*Aspartate aminotransferase levels (IU/L)*			*Alanine aminotransferase value (IU/L)*		
	3rd	*Median (IQR)*	*97th*	*3rd*	*Median (IQR)*	*97th*
All children[a]	21	30 (27-34)	44	15	23 (19-29)	40
Male	23	32 (28-34)	46	17	27 (22-32.3)	42
Female	21	29 (26-33)	43	15	21 (18-27)	38
Age group[b c]						
2-5 y	26	32 (27-36)	42.8	18	31 (24-33.7)	40.8
6-8 y	25.7	33 (29-37)	47.3	17.5	27 (22-31.5)	41.3
9-11 y	23.3	30 (27-33)	43	16	26 (21-32)	41.7
12-15 y	20.9	29 (26-32)	45.1	15	21 (18-27)	40.1
16-18 y	20.7	29 (26-33)	43.3	14.7	22 (18-27)	38.3

[a]*P<0.01 for comparison between males and females for both AST and ALT,* [b]*P=0.01 for comparison between 6-8y and 9-11y age-group for AST and* [c]*P=0.02 for 9-11y vs 12-15y for ALT.*

al. [5] (29 and 21, respectively).

We observed peak of median AST serum values in age group 6-8 years followed by continuos decline with increasing age. However in a study by Bussler, et al. [7], the AST serum values were showing peak at age group 1-3 years followed by continuos decline with increasing age. While in ALT, we observed maximum values in age group 2-5 years followed by continous decline and we did not find any peak around puberty. The initial decrease in ALT has also been described by previously [4], and apart from the missing ALT peak in early puberty in boys, Zierk, et al. [6] presented similar patterns of ALT with age. However, others reported initial fall in ALT with increasing age followed by peaking around puberty [7].We found that both AST and ALT were significantly negatively related to age (P<0.001). Bussler, et al. [7] showed that AST also decreases with increasing age, with no significant effect of age on ALT. Reverse association of ALT increase with increasing BMI, with weak negative association with AST was previously reported [7], but we did not observe such an association.

We provide age- and sex-related percentiles of aminotransferases of children from a limited data set from a single center in Northern India. In addition to the small sample size, our sample was not equally distributed between males, females and different age groups, so it was not representative of the population. Also, our data cannot be generalized to others parts of the country. We did not use ultrasound or fibroscan to exclude pediatric non-alcoholic fatty liver disease (NAFLD). We didnot do C-reactive protein levels to exclude occult sepsis. Tanner staging was not done to see effect of puberty on transaminases. We did not take into account the other factors like timing of day, effect of exercise and day to day variation of aminotransferases. However, our findings underscore the need for large multi-centric studies to document normal aminotransferase levels children.

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Clinical Profile of Adolescents With Delayed Puberty

One year study on forty-eight adolescents with delayed puberty revealed etiology of constitutional delay, hypogonadotrophic hypogonadism (HH), hypergonadotrophic hypogonadism, chronic systemic disease, hypothyroidism and sex reversal in 14(29.2%), 13 (27%), 12 (25%), 5 (10.4%), 3 (6.3%) and 1 (2.1 %) cases, respectively. Earlier presentation, male preponderance, significant normal variants and utility of GnRH analogue testing observed.

Keywords: *Hypogonadism, Pubertal disorder, Thelarche.*

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Delayed puberty has heterogeneous etiology in adolescents. Data on delayed puberty are available from the Western world [1-3] and from some parts of India [4]. Hence, we conducted this study between June, 2017 and May, 2018 to describe the clinical, biochemical and radiological profile of adolescents with delayed puberty in a tertiary care hospital in Southern India.

After approval from the institutional ethics committee, adolescents referred to an endocrine clinic with delayed puberty or delayed sexual maturity rating were recruited. Delayed puberty was defined as absence of thelarche by 13 years or no menarche 5 years after thelarche (girls) or no progression of secondary sexual characters for 18 months after onset of puberty [5], or no testicular enlargement (≥4mL) by 14 years (boys). Details of age, sex, history of pubertal onset, growth, systemic disease, family history of delayed puberty and previous illnesses were retrieved. Anthropometric measurement and sexual maturity rating (SMR) assessments were performed on girls with minimal clothing in complete privacy with a female staff nurse and mother, for boys in the presence of father. Breast stage and pubic hair (in girls) and testicular volume (using Prader orchidometer) and gonadal stage (in boys) were classified into stages described by Tanner [6].