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Observational Study

Auxological and pubertal outcomes of children with Kawasaki disease: Experience from Chandigarh, India

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Abstract

BACKGROUND

Kawasaki disease (KD) is an acute childhood vasculitis with potential long-term cardiovascular sequelae. However, data regarding auxological and pubertal outcomes in children with KD, particularly from developing countries, remain limited.

AIM

To study physical and pubertal growth patterns in male and female children with KD. We also aimed to examine lipid profiles and their relationship with fat distribution in KD patients at higher risk for coronary abnormalities.

METHODS

The research employed a cross-sectional approach and incorporated anthropometric evaluations, puberty assessment, and analyses of lipid profiles. 47 children with KD (32 boys and 15 girls) who were over 8 years old and had been diagnosed at least 5 years prior to the study, along with 54 healthy control participants (35 boys and 19 girls) matched for age, gender, and socioeconomic background were included in this cross-sectional study.

RESULTS

Male patients with KD demonstrated significantly higher height-for-age *Z*-scores, while weight-for-age *Z*-scores and body mass index *Z*-scores were numerically higher compared to controls. Female patients with KD exhibited increased height-for-age *Z*-scores, skinfold thickness, as well as waist and hip circumferences in comparison to the control group. KD patients demonstrated normal pubertal development, with no signs of delayed or early pubertal onset. Thirteen KD subjects (27.6%) had coronary artery abnormalities.

CONCLUSION

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The study's findings have implications for the long-term follow-up and management of KD in pediatric populations, suggesting that children with KD generally demonstrate normal growth and pubertal development comparable to healthy controls.

Key Words: Auxology; Height-for-Age; Weight-for-Age; Normal growth; Kawasaki disease; Puberty; Sexual maturity rating

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Core Tip: Kawasaki disease (KD) is an acute childhood vasculitis with potential long-term cardiovascular sequelae; however, data regarding growth and pubertal outcomes remain limited. In this cross-sectional study, children with KD demonstrated auxological and pubertal parameters broadly comparable to healthy controls. Coronary artery abnormalities were not associated with major differences in anthropometric measures. These findings contribute to the limited literature on long-term developmental outcomes in KD, particularly from Indian populations, and highlight the need for larger longitudinal studies.

INTRODUCTION

Kawasaki disease (KD) is a medium vessel vasculitis that occurs predominantly in children < 5 years of age, with a peak incidence between 12 months and 24 months. KD has been reported in almost every country, with variable incidence[1]; Southeast Asian countries - Japan, Korea, and Taiwan have recorded the most instances[2]. KD is considered the leading cause of acquired heart disease in children in developed countries[3]. Children with KD are known to have lipid abnormalities in the acute phase,

potentially contributing to premature and accelerated atherosclerosis[4]. Altered body fat patterns linked to changes in lipid profile, resulting in abdominal adiposity and coronary artery disease have also been reported among children with KD[5,6].

Though not well studied in KD patients, long-term disease activity, pharmacological side effects, and co-morbid conditions may all impact growth and pubertal attainments of affected patients. Except for a few studies on fat patterning of children with KD conducted at our center[5,6], recognized for its extensive cohort of KD patients, there is complete lack of auxological information on Indian children with KD. With limited existing research, we aim to explore both physical and pubertal growth patterns in male and female KD patients. Furthermore, our study will delve into the relationship between lipid profiles and fat distribution in children with KD, especially those at risk for coronary abnormalities.

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MATERIALS AND METHODS

Study design

Forty-seven children (male: 32, female: 15), aged > 8 years, diagnosed as KD as per American Heart Association guidelines[7] whose diagnosis had been established at least 5 years before enrolment, were included in this cross-sectional study. Fifty-four (male: 35; female: 19) age, sex, and socio-economic status wise matched healthy children enrolled from Growth Clinic served as controls. The mean age of children with KD (11.85 ± 3.05 years) and controls (11.78 ± 2.82 years) was comparable. This study was approved by the Institutional Ethics Committee of Postgraduate Institute of Medical Education and Research (Approval No. INT/IEC/2022/SPL-1836), before the conduct of this study. Prior to participation, written informed consent from parents/guardians and patients' assent were obtained. The study was conducted in accordance with the Declaration of Helsinki.

Each child was examined for height (cm), weight (kg), body mass index (BMI; kg/m^2), hip circumference (cm), waist circumference (cm), waist-hip ratio, triceps skinfold

thickness (mm), and subscapular skinfold thickness (mm) using standardized anthropometric methodologies and instruments[8,9].

Body weight (kg) was measured using an electronic weighing scale (make: Avery, India; capacity: 150 kg; least count: ± 50 g) while participants wore minimum clothing to maintain privacy. Height (cm) was measured with a stadiometer (make: Holtain Ltd., Crymych, United Kingdom; least count: ± 1 mm). BMI was calculated by dividing weight in kilograms by the square of height in meters (kg/m^2). A non-stretchable measuring tape was used to measure waist and hip circumference. Waist circumference was measured at the midpoint between the lowest margin of the last palpable rib and the topmost point of the iliac crest. Hip circumference was measured at the level of maximum protrusion of the buttocks. The waist-hip ratio was calculated as the ratio of waist circumference to hip circumference. Triceps and sub-scapular skinfold thickness was measured using a Harpenden skinfold caliper (make: Holtain Ltd., Crymych, United Kingdom; least count: 0.2 mm).

In the presence of a parent/guardian, pubertal evaluation (Tanner[10] 1962) of KD patients and healthy controls was conducted in a separate growth laboratory room. Information concerning different stages of breast development (B1-B5), presence or absence of pubic and axillary hair as well as age of onset of menarche was recorded in female subjects. While, in case of male subjects, genitalia staging (G1-G5), testicular volume (TV), stretched penile length and presence or absence of pubic and axillary hair was noted. TV was measured using a Prader orchidometer, while stretched penile length was measured using a sliding calliper (make: Holtain Ltd., Crymych, United Kingdom; least count: 0.1 mm).

Age at diagnosis, disease duration, and treatment received were noted for KD patients. In addition, fasting lipid profile of KD patients using commercially available test kits was also performed once during the study. A clinical assessment of the cardiovascular system was performed as part of the overall examination of patients with KD. This assessment included two main components: (1) General examination, which involved evaluating the heart rate, blood pressure, and any signs of cardiovascular distress; and (2)

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Cardiovascular system examination, where murmurs, abnormal heart sounds, and signs of heart failure were assessed. Echocardiography was the primary imaging technique used to evaluate coronary artery abnormalities (CAA).

Parent's height (mother's height and father's height) was recorded for each subject and mid-parental height (MPH) was calculated. MPH = (height of father in centimeters + height of mother in centimeters)/2 ± 6.5. Target height range was obtained by adding (+) and subtracting (-) 6.0 cm to the MPH.

Statistical analysis

Height-for age *Z*-score (HAZ), weight-for-age *Z*-score (WAZ), BMI-for-age *Z*-score (BMIZ), waist circumference *Z*-score and triceps skinfold thickness *Z*-score were calculated from absolute values using Indian Academy of Pediatrics references[11-13]. For normally distributed data, represented as mean ± SD, a Student's *t*-test was used for group comparisons. Non-normally distributed (skewed) data, presented as median (interquartile range), underwent comparisons between two groups (based on gender) using the Mann-Whitney *U* test. In cases involving more than two groups (breast stages, genitalia stage), skewed data comparisons were conducted with the Kruskall-Wallis test, followed by Mann-Whitney tests. Categorical variables were reported as *n* (%). χ^2 test/Fisher's exact test was used for group comparisons. Non-parametric Spearman's correlation coefficient was applied to study association of anthropometric and puberty parameters with age at diagnosis, disease activity and disease duration. Comparison of median (interquartile range) of skinfold thickness, waist circumference and lipid profile of KD Patients with and without coronary artery aneurysm was done using Mann-Whitney-*U* test. A $P < 0.05$ was considered significant. Version 22.0 of IBM SPSS Statistics was used for analysis.

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RESULTS

The median age at diagnosis for 47 KD patients enrolled was 2.5 years and median disease duration was 6.75 years. Majority of patients (76.6%) were from Punjab, Haryana

and Chandigarh and majority belonged to upper (44.7%), followed by upper-middle (27.6%), lower-middle (21.3%), and upper-lower (6.4%) socio-economic classes. None of the parents of the study participants had a history or features of KD. At enrollment, patients with KD had mean total cholesterol levels (136.5 ± 29.3 mg/dL) that were below the normal reference range. Mean triglycerides (97.2 ± 37.7 mg/dL), high-density lipoprotein (48.2 ± 11.6 mg/dL), and low-density lipoprotein (84.2 ± 21.4 mg/dL), however, were all within normal limits. Interestingly, 2.1%, 4.3%, and 12.8% of KD patients had high total cholesterol, high-density lipoprotein, and low-density lipoprotein levels, respectively, and 36.2% had elevated triglycerides. Thirteen (27.6%) KD subjects had CAA, with aneurysms in ten, giant aneurysms in two, and ectasia in one. Of the 47 KD patients enrolled, 38 (80.8%) had received intravenous immunoglobulin (IVIg).

Male KD patients were broadly comparable to age-matched controls for most auxological parameters, with significantly (P = 0.01) higher HAZ observed among KD patients (Table 1). Female KD patients, had lower WAZ (0.15 ± 1.11) and BMIZ (0.14 ± 1.13) than their healthy counterparts (WAZ: 0.26 ± 1.28; BMIZ: 0.31 ± 1.44). Mean HAZ, skinfold thickness, waist and hip circumference were higher in females with KD than their normal counterparts. Inter-group differences for all anthropometric parameters were non-significant among females. For both KD cases and controls, the mean waist-to-hip ratio was almost the same and stayed within normal limits. Only one male KD patient was short statured (< -2.19 Z-score) and underweight[12]. As per MPH, 8% (n = 2) were short stature. 21.3% (n = 10) of KD patients were overweight, and 14.9% (n = 7) were obese. Merely 2.1% (n = 1) of the participants were thin. Seven (14.9%) KD children, were at risk of metabolic syndrome (waist circumference for age > 70th centile)[12].

Forty percent KD girls had attained menarche (mean age: 14.26 ± 3.03 years). Appearance of pubic hair (13.2 ± 2.73 years) and axillary hair (13.24 ± 2.89 years) preceded the attainment of menarche (Tables 2 and 3). 33.3% of KD girls were in pre-pubertal stage of breast development-B1 and 66.7% were in breast stages B2-B5 (Table 4). Mean age at which our KD girls entered puberty, *i.e.*, stage-B2, was 10.0 years, whereas they reached breast stage-B5 at 16.3 ± 2.2 years. Pubertal development among females with KD was

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not significantly different from that of healthy controls. 25% of our male KD subjects were in pre-pubertal stage of genitalia development (stage G1) while, 9 (28.1%) in G2, 4 (12.5%) in G4 and 11 (34.4%) had attained adult genitalia stage G5 at 15.1 ± 1.68 years (Table 4). Compared to controls, our KD males achieved different stages of genitalia, earlier. However, differences were significant for G2 stage (P = 0.02). Mean age at which pubic and axillary hair appeared in KD boys was recorded at 12.98 ± 3.08 years and 14.80 ± 1.65 years, respectively (v). Mean right (11.2 mL) and left (11.3 mL) TV and stretched penile length (5.7 cm) was greater among KD patients compared to controls (TV right: 7.2 mL, TV left: 7.5 mL, stretched penile length: 4.6 cm). Statistical significance was noticed only for stretched penile length (P = 0.006).

We compared the mean lipid profile, HAZ, WAZ, waist circumference Z-score, and skinfold thicknesses in KD children with CAA (n = 13) and those without CAA (n = 34) (Table 5). Mean total cholesterol and LDL cholesterol were significantly lower in KD with CAA as compared to those without CAA (P < 0.05). Despite being statistically non-significant, HAZ, WAZ, waist circumference and skinfold thickness was found to be lower in KD children with CAA.

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DISCUSSION

Patients with KD were taller than their age-matched controls. Other auxological markers including weight, BMI, waist, and hip circumference were also numerically greater among male KD patients. Female KD patients had lower weight and BMI, but greater waist and hip circumference than controls, although these differences were statistically non-significant. Similarly, a study done previously at our center[6] showed that KD patients were significantly taller, heavier and possessed greater waist and hip circumferences than controls from 8-15 years. Narsaria *et al*[5], reported that KD children > 10 years possessed non-significantly higher auxological values than controls. Our findings are consistent with those of McCrindle *et al*[14], who found no significant variations in percentage ideal weight for height and BMI between KD children and controls. Silva *et al*[15] reported no significant changes in mean BMI between Canadian

KD children and controls. However, comparable contemporary studies evaluating growth outcomes in children with KD remain limited, particularly from Asian populations. Furthermore, available studies were conducted in North American populations nearly two to three decades ago, and secular trends in growth as well as ethnic, environmental, and dietary differences may limit direct comparability with contemporary Indian children. Although KD is an inflammatory vasculitis disorder with potential long-term cardiovascular and psychosocial implications, most children in our cohort demonstrated auxological and pubertal parameters comparable to healthy controls. This may possibly reflect resolution of systemic inflammation after the acute phase, timely treatment with IVIg in the majority of patients, relatively stable long-term clinical status, and favorable socioeconomic and nutritional backgrounds within our cohort.

The current study also investigated the quantitative distribution of subcutaneous fat. Male KD patients and healthy controls had comparable subcutaneous fat deposition in the triceps and subscapular areas. Despite being statistically insignificant, it was discovered to be higher in female patients than in controls. Narsaria *et al*[5] showed similar results of increased skin-folds in female KD patients. Suthar *et al*[6] found that female KD patients above the age of 11 had higher subcutaneous fat deposition in the triceps area. In the present study, only one male KD patient had growth failure in terms of short-stature and under-weight. Interestingly, 36% of our study children were obese and overweight and 15% were at risk for metabolic syndrome. Obesity and metabolic syndrome are associated with dysregulated inflammation. This finding raises concern whether the current treatment regime induces the obesity phenotype in KD children. To clarify, we investigated the effect of treatment type (aspirin, aspirin + statin/warfarin, and/or IVIg) on KD patients' growth outcomes. Interestingly, the type of treatment administered had no effect on any of the bodily components.

Our study girls were comparable in achieving stage B2 of breast development (10.0 years) with their Chandigarh (10.3 years)[16] counterparts and earlier than affluent Indian girls (10.9 years)[17]. Although our KD girls began puberty earlier, they developed

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their breasts to full maturity (stage BII-BV) slightly later (6.3 years) than their well-off Chandigarh (5.8 years) and affluent Indian (5.3 years) counterparts. Attainment of menarche in our study patients (14.3 years) was delayed in comparison to their normal affluent Indian (12.6 years) and Chandigarh (12.4 years) peers. Our KD boys reached stage 2 of genitalia at an average age of 9.4 years, which was much younger than their affluent Indian (13.3 years)[17] and well-off Chandigarh boys (11.5 years)[18]. Pubertal onset and progression in our study participants with KD were broadly comparable to healthy controls. Remarkably, none of our KD patients showed signs of delayed or early pubertal onset.

A strong positive correlation between height and weight was observed in our patients with KD, particularly in relation to advanced stages of breast and genital development. This suggests that more advanced pubertal development is closely associated with larger overall body size. Our KD males reached different stages of genital development earlier than the control group, and they also exhibited greater TV compared to the controls. This may explain why KD patients tend to be taller. However, the early advancement of puberty might negatively impact their adult height. Our study results are also suggestive that longer KD duration may lead to advanced breast development. While, the timing of KD diagnosis may not have a direct impact on auxological development.

KD patients with CAA depicted significantly lower mean total cholesterol and low-density lipoprotein cholesterol compared to those without aneurysms. However, no significant differences were found in triglycerides, high-density lipoprotein cholesterol, and anthropometric parameters between the two groups. Currently, there is no clear pathophysiological explanation for why KD children with CAA show lower levels of lipid parameters compared to those without CAA. Notably, it has been previously reported that coronary artery disease can occur in Asian-Indians at much lower levels of total cholesterol and low-density lipoprotein[19]. Thus, fat accretion seems to have no bearing on coronary artery anomalies in children with KD of the present study, although abnormal lipid levels do.

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It is clear that children with KD have normal growth and pubertal development, at par with healthy controls. The study's findings may help reassure parents and healthcare providers that KD does not have a significant impact on the growth and pubertal development of children. The reasons underlying these observations remain unclear and require further longitudinal evaluation. Given that the majority of our study participants were from the upper socioeconomic class, the treatment offered may have had a cumulative effect. However, due to the small sample size from a single center, it would be imprudent to extrapolate and make generalizations. Further research is required to explain the processes underlying this apparent growth advantage and to validate the long-term repercussions of KD on growth and development in Pediatric populations.

CONCLUSION

The present study adds to the limited literature on auxological and pubertal outcomes in children with KD, particularly from Indian populations. Future longitudinal studies with larger cohorts are needed to further evaluate growth trajectories and the potential influence of coronary involvement on developmental outcomes.

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Footnotes

Institutional review board statement: This study was approved by the Institutional Ethics Committee of Postgraduate Institute of Medical Education and Research (Approval No. INT/IEC/2022/SPL-1836).

Informed consent statement: Prior to participation, written informed consent from parents/guardians and patients' assent were obtained.

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Table 1 Gender differences and inter-group comparison of anthropometric variables in male and female children with Kawasaki disease and healthy controls

Anthropometric parameters	Males					Females					Gender differences *Z* (*P* value)	
	KD		Healthy control		Inter-group differences	KD		Healthy control		Inter-group differences		
	mean ± SD	Median (interquartile rage)	mean ± SD	Median (interquartile rage)	*Z* (*P* value)	mean ± SD	Median (interquartile rage)	mean ± SD	Median (interquartile rage)	*Z* (*P* value)	KD	Controls
Height (cm)	150.25 ± 18.84	145.9 (135.95-167.60)	146.72 ± 15.70	142.90 (132.80-161.90)	0.71 (0.47)	143.78 ± 14.50	145.70 (131.3-157.00)	143.03 ± 8.29	146.90 (136.10-148.60)	0.26 (0.79)	1.18 (0.24)	0.55 (0.58)
HAZ	0.41 ± 1.04	0.59 (0.00-1.01)	-0.04 ± 0.81	-0.15 (-0.60 to 0.27)	2.50 (< 0.01[a])	0.11 ± 0.95	0.39 (-0.78 to 0.92)	-0.03 ± 0.92	0.03 (-0.71 to 0.64)	0.50 (0.61)	0.98 (0.32)	0.48 (0.63)
Weight (kg)	43.98 ± 19.76	41.80 (27.40-57.42)	39.36 ± 14.57	34.20 (26.90-50.20)	0.69 (0.48)	38.94 ± 12.88	36.60 (30.00-49.80)	40.28 ± 13.61	35.00 (29.20-57.40)	0.19 (0.84)	0.32 (0.75)	0.45 (0.65)
WAZ	0.23 ± 1.09	0.03 (-0.54 to 1.06)	-0.12 ± 0.89	0.00 (-0.73-0.26)	1.15 (0.24)	0.15 ± 1.11	0.001 (-0.63 to 1.10)	0.26 ± 1.28	0.51 (-1.00 to 1.43)	0.19 (0.84)	0.22 (0.81)	1.07 (0.28)
BMI (kg/m^2)	18.60 ± 4.85	17.64 (14.57-21.74)	17.55 ± 3.59	17.14 (14.85-20.39)	0.71 (0.47)	18.33 ± 3.65	18.80 (14.65-20.31)	19.42 ± 5.38	17.24 (14.70-24.90)	0.61 (0.54)	0.13 (0.90)	1.19 (0.23)
BMI (*Z*-score)	0.03 ± 1.22	-0.09 (-1.03 to 1.10)	-0.18 ± 0.99	-0.04 (-0.86 to 0.45)	0.76 (0.44)	0.14 ± 1.13	-0.05 (-0.63 to 1.28)	0.31 ± 1.44	0.27 (-1.22 to 2.09)	0.46 (0.64)	0.36 (0.71)	1.27 (0.20)
Triceps skinfold thickness (*Z*-score)	0.01 ± 0.94	-0.76 (-0.69 to 0.91)	0.02 ± 1.05	0.009 (-0.75 to 0.98)	0.18 (0.85)	0.21 ± 1.28	0.36 (-0.67 to 1.38)	-0.24 ± 1.15	-0.42 (-1.00 to 0.54)	1.12 (0.26)	0.75 (0.45)	0.95 (0.34)
Triceps skinfold thickness (mm)	11.73 ± 5.47	9.80 (7.45-17.00)	12.12 ± 5.66	11.00 (7.2-18)	0.20 (0.84)	15.57 ± 6.95	14.20 (10.60-23.00)	12.98 ± 5.77	11.2 (8.4-19.00)	1.04 (0.29)	1.77 (0.07)	0.81 (0.41)
Subscapular skinfold thickness (mm)	10.83 ± 6.66	8.20 (6.30-15.35)	10.81 ± 6.83	8.4 (5.6-14.00)	0.17 (0.86)	15.28 ± 8.38	12.20 (7.40-23.60)	12.71 ± 8.27	9.4 (7.4-15.00)	0.83 (0.45)	1.83 (0.06)	1.25 (0.21)
Waist circumference (cm)	65.32 ± 13.86	62.65 (53.38-75.57)	63.04 ± 10.84	60.00 (54-71.70)	0.36 (0.71)	62.61 ± 8.32	60.60 (57.20-69.00)	60.01 ± 8.37	57.45 (54.88-63.50)	1.08 (0.27)	0.28 (0.77)	0.68 (0.49)
Waist circumference (*Z*-score)	-1.2 ± 1.62	-1.56 (-2.63 to 0.21)	-1.40 ± 1.47	-0.38 (-2.64 to -0.51)	0.24 (0.80)	-1.38 ± 1.32	-1.15 (-2.58 to -0.37)	-1.87 ± 1.58	-2.01 (-3.18 to -0.81)	1.04 (0.29)	0.16 (0.87)	0.94 (0.34)

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Hip circumference (cm)	74.95 ± 13.99	74.80 (62.62-83.62)	70.54 ± 10.72	67.25 (63.12-78.00)	1.24 (0.21)	77.88 ± 13.23	79.00 (68.30-89.00)	73.82 ± 11.01	71.00 (65.97-80.25)	0.95 (0.33)	0.81 (0.41)	1.23 (0.21)
Waist-hip ratio	0.87 ± 0.06	0.87 (0.82-0.90)	0.88 ± 0.05	0.88 (0.84-0.93)	0.94 (0.34)	0.81 ± 0.06	0.82 (0.76-0.85)	0.81 ± 0.05	0.82 (0.78-0.85)	0.03 (0.97)	2.57 (< 0.01[a])	3.60 (< 0.001[b])

[a]$P < 0.01$.

[b]$P < 0.001$.

HAZ: Height-for age Z-score; WAZ: Weight-for-age Z-score; BMI: Body mass index; KD: Kawasaki disease.

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Table 2 Mean age (years) of emergence of pubic and axillary hair in female children with Kawasaki disease and healthy controls

	n (%)		χ^2 (*P* value)	KD (Females)		Healthy control		Mann-Whitney *U*
	KD (females)	Healthy control		mean ± SD	Median (interquartile rage)	mean ± SD	Median (interquartile rage)	*Z* (*P* value)
Pubic hair (present)	10 (66.7)	16 (84.2)	1.434 (0.231)	13.2 ± 2.73	12.5 (11.1-15.2)	12.57 ± 2.92	11.9 (10.2-14.7)	0.74 (0.46)
Pubic hair (absent)	5 (33.3)	3 (15.8)		8.58 ± 0.54	8.8 (8.0-9.0)	8.50 ± 0.79	8.9 (7.6-9.0)	0.30 (0.76)
Axillary hair (present)	9 (60)	14 (73.7)	0.717 (0.397)	13.24 ± 2.89	12.1 (10.7-15.9)	12.73 ± 2.92	11.9 (10.6-15.4)	0.57 (0.57)
Axillary hair (absent)	6 (40)	5 (26.3)		9.30 ± 1.83	8.9 (8.0-10.0)	9.70 ± 2.57	8.9 (7.8-12.0)	0.00 (1.00)

KD: Kawasaki disease.

Table 3 Mean age (years) of emergence of pubic and axillary hair in male children with Kawasaki disease and healthy controls

	n (%)		χ^2 (*P* value)	KD (males)		Healthy control		Mann-Whitney *U*
	KD (males)	Healthy control		mean ± SD	Median (interquartile rage)	mean ± SD	Median (interquartile rage)	*Z* (*P* value)
Pubic hair (present)	22 (68.8)	26 (74.3)	0.252 (0.616)	12.98 ± 3.08	13.3 (9.72-15.2)	12.42 ± 2.67	11.95 (10.1-14.2)	0.83 (0.41)
Pubic hair (absent)	10 (31.3)	9 (25.7)		9.64 ± 1.19	9.7 (8.5-10.9)	9.59 ± 1.59	9.0 (8.2-11.3)	0.20 (0.83)
Axillary hair (present)	15 (46.9)	13 (37.1)	0.651 (0.420)	14.80 ± 1.65	14.9 (13.2-15.9)	13.91 ± 2.82	14.2 (12.0-16.0)	0.81 (0.42)
Axillary hair (absent)	17 (53.1)	22 (62.9)		9.40 ± 1.07	9.0 (8.4-10.2)	10.37 ± 1.60	10.1 (8.9-11.8)	1.95 (0.05)

KD: Kawasaki disease.

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Table 4 Mean age (years) of attainment of breast development stage in Kawasaki disease girls and genitalia stage in Kawasaki disease boys

	n (%)		χ^2 (*P* value)	KD		Control		Mann-Whitney *U*
	KD	Control		mean ± SD	Median (interquartile rage)	mean ± SD	Median (interquartile rage)	*Z* (*P* value)
Breast stage								
B1	5 (33.3)	2 (10.5)	4.36 (0.35)	8.6 ± 0.54	8.83 (8.00-9.04)	8.2 ± 0.94	8.25 (5.68-10.97)	0.78 (0.43)
B2	1 (6.7)	5 (26.3)		10.0 ± 0.00		9.2 ± 0.84	9.0 (8.50-10.00)	0.94 (0.34)
B3	4 (26.7)	7 (36.8)		12.4 ± 1.90	12.50 (10.52-14.16)	12.5 ± 1.48	12.00 (1.33-14.00)	0.18 (0.85)
B4	2 (50)	2 (10.5)		13.7 ± 0.35	11.75 (8.62-12.02)	13.3 ± 0.76	12.29 (8.81-12.45)	0.77 (0.44)
B5	3 (20)	3 (15.8)		16.3 ± 2.20	17.16 (13.83-18.00)	17.3 ± 0.63	17.00 (16.83-18.00)	0.00 (1.00)
Genitalia stage								
G1	8 (25)	7 (20)	7.80 (0.09)	9.38 ± 1.29	9.12 (8.12-10.81)	9.63 ± 1.63	9.00 (8.41-11.66)	0.46 (0.64)
G2	9 (28.1)	17 (48.6)		9.42 ± 0.91	9.00 (8.62-10.16)	10.77 ± 1.35	10.91 (10.00-11.87)	2.35 (0.02[a])
G3	0 (0)	3 (8.6)				11.25 ± 2.81	12.75 (8.00-13.00)	
G4	4 (12.5)	3 (8.6)		13.81 ± 1.24	13.87 (12.62-14.93)	14.83 ± 1.60	15.50 (13.00-16.00)	1.24 (0.21)
G5	11 (34.4)	5 (14.3)		15.16 ± 1.68	15.08 (13.33-16.00)	16.10 ± 1.87	16.00 (14.25-18.00)	1.13 (0.25)

[a] $P < 0.05$.

KD: Kawasaki disease.

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Table 5 Comparison of skinfold thickness, waist circumference and lipid profile of Kawasaki disease patients with and without coronary artery aneurysm

Variables	KD with coronary artery aneurysm (n = 13)		KD without coronary artery aneurysm (n = 34)		Mann-Whitney U
	mean ± SD	Median (interquartile rage)	mean ± SD	Median (interquartile rage)	Z (P value)
Total cholesterol (mg/dL)	121.0 ± 24.9	116.5 (103.7-134.2)	141.8 ± 29.1	143.0 (118.0-157.0)	2.23 (0.03[a])
Triglycerides (mg/dL)	89.6 ± 30.9	83.0 (71.0-99.0)	99.8 ± 39.9	96.0 (67.0-118)	0.66 (0.51)
HDL Cholesterol (mg/dL)	47.1 ± 9.7	50.1 (40.0-53.6)	48.6 ± 12.3	49.0 (38.0-55.5)	0.32 (0.75)
LDL Cholesterol (mg/dL)	73.9 ± 20.4	66.7 (58.6-85.2)	87.7 ± 20.8	88.0 (70.4-99.3)	2.21(0.03[a])
Waist circumference (Z-score)	-1.56 ± 1.42	-1.56 (-2.71 to -0.05)	-1.20 ± 1.6	-1.58 (-2.47 to 0.23)	0.66 (0.51)
Triceps skinfold thickness (mm)	12.4 ± 5.3	12.3 (7.4-18.0)	13.1 ± 6.5	11.2 (8.0-18.0)	0.32 (0.75)
Subscapular skinfold thickness (mm)	11.3 ± 5.5	8.9 (6.7-16.2)	12.6 ± 8.1	9.4 (6.2-19.0)	0.05 (0.96)
HAZ	0.04 ± 1.29	0.13 (-1.21 to 0.95)	0.42 ± 0.89	-0.65 (-0.03 to 1.01)	1.00 (0.317)
WAZ	0.05 ± 0.99	-0.27 (-0.81 to 0.93)	0.27 ± 1.13	0.08 (-0.54 to 1.11)	0.88 (0.380)

[a]$P < 0.05$.

HDL: High-density lipoprotein; LDL: Low-density lipoprotein; HAZ: Height-for age Z-score; WAZ: Weight-for-age Z-score; KD: Kawasaki disease.

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