

## Adolescent Somatic Development of Junior High School Students in Denpasar

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**ABSTRACT** Junior high school adolescent represents a transition period from child to adult. In this period the growth and development takes place very rapidly. This study intended to understand adolescent somatic development of junior high school students in Denpasar; subjects were 450 students of grades I, II, III from 3 junior high schools in Denpasar selected randomly in February 1998. Anthropometric and blood pressure measurements were performed. The structured questionnaires were given to the parents, which were collected during the anthropometric measurement. The results were that only 428 subjects completed their data, consisted of 200 boys and 228 girls. At the age of 12 years the average anthropometric measurements were higher in girls, but at the age of 13, 14, 15 years, the boys was higher. The average systolic blood pressure was 101.67 mmHg and diastolic was 75.0 mmHg, no significant difference between boys and girls. Based on NCHS standard, it was found that 10 % of boys and 3.5% of girls had body weight below the normal limits, and 5.5% boys and 7.9% girls having body height below the normal limits. The average age of menarche was 12.47 years (range 11-14 years, SD 0.81). The somatic development of boys and girls of junior high school students which was investigated followed the normal development sequence. Only small number of adolescent found having body weight and height below the normal limits. [Paediatr Indones 1999; 39:154-162]

### Introduction

There are still many opinions about the term for adolescent.<sup>1,2</sup> Pediatric textbooks generally define adolescents as those who are already reaching 10 to 18 years for girl and 12 to 20 years for boy. WHO calls adolescents as those with the age from 10 years to

19 years. According to the law No. 4, 1979 concerning the child welfare it is mentioned that child is the people who is not reaching 21 years and not married yet. According to the Law of Labor, someone who is considered adolescent when he is 16 to 18 years or has already married or having own house. While, according to the Married Law No. 1, 1974 regarding the limit age of married, it is considered enough when someone minimally reaches 19 years for boys and 16 years for girls, whereas Department of Education and Culture considers child who is reaching the age of 18 years, is about the same as the age when someone graduated from high school. And so the use of the terms "puberty" and "adolescent" still found the confusion of use. According to Kreipe<sup>3</sup> and Sudiyanto<sup>5</sup>, what is considered as puberty is the term use for biological process, mainly in the ability to reproduction. While what is considered as adolescent is that which relates biopsychosocial transition from childhood to adolescent period.

The change of somatic development in adult takes place very rapidly depends on its stage. Based on the happenings which occur at the same time with biological growth and development, psychosocial and other social phenomena (biopsychosocial development), adolescent period can be divided into 3 stages that is early adolescent, middle adolescent and late adolescent.<sup>4</sup> Junior high school adolescent includes in early adolescent (10-13 years) and middle adolescent (14-16 years), where in this period the growth spurt of somatic development takes place very rapidly. The objective of this study is to understand the physical adolescent development of the junior high schools in Denpasar.

## Methods

The study was carried out by cross-sectional investigation toward junior high school students grade I, II, and III chosen randomly from three junior high schools (SLTPN I, SLTPN III, and SLTP Saraswati). The choice of those three junior high schools was done purposively; They were easy reach and may be represent many social grades found in Denpasar. From each class 50 students were chosen randomly, so that there were 450 students. Anthropometric measurements were done including body weight, height, arm circumference. Blood pressure measurement was also performed on the same day. Body weight was measured using a scale with total capacity of 120 Kg with 500 g accuracy. Body height was measured in standing position by using body height measurement which had 0.5 cm accuracy, while arm circumference was measured in the middle of the left upper arm by using plastic ribbon with accuracy of 0.1 cm. Blood pressure was measured by using Nova blood pressure device.

The nutrition status was determined based on body weight and height toward the age according to NCHS standard. Malnutrition was defined when the nutritional status was same as or less than percentile 3, while over-nutrition was judged when the nutritional status was more than percentile 50. Structured questionnaires were

given to their parents, and collected during the child investigation in each school. The staff members performed this survey from Growth and Development Subdivision who had been given special guidelines. Results were analyzed by using chi-square or student t-test by using SPSS-PC; 95% confidence intervals were provided.

### Results

Of the 450 students, only 428 had complete data, consisted of 200 boys and 228 girls. According to the child position in the family, 44.4% were the first child and 30.1% the second. Most families (73.4%) had 2-3 children. Most fathers were high school (41.8%) or university (38.8%) graduates. For mothers, the levels of education were 43.2% (high school) or 23.1% (university) graduates. Forty four percent of the fathers were government employees, and 53% were private workers/entrepreneurs. Most of the mothers (45.3%) were jobless and only 29.45% worked as government employee.

The average anthropometric measurement (body weight, height, arm circumference) peer group of age indicated that at the age of 12 years the anthropometric measurement of girls was higher than boys, whereas at the ages 13, 14, 15 years anthropometric measurement of boys was higher than girls. Overall, the average of body weight for boys (44.95 kg) was significantly different ( $p < 0.001$ ) from that of girls (42.66 kg). There was also significant difference ( $p < 0.05$ ) between average arm circumference on boys (22.27 cm) and girls (21.84 cm), while the average body height of boys was not significantly different than of girls (164.03 cm Vs girls 153.33 cm). See Table 1.

Table 1. The average body weight, height and arm circumference according to age and sex

Age (years)	Number		Body weight (kg)		Height (cm)		Arm circumference (cm)	
	Boy	Girl	Boy	Girl	Boy	Girl	Boy	Girl
11	0	2	-	44.75	-	158.0	-	22.25
12	36	52	38.35	39.83	149.54	150.97	20.88	20.93
13	66	78	42.55	41.85	156.89	152.51	21.51	21.47
14	66	61	48.39	43.81	160.31	153.76	23.17	22.35
15	26	31	51.48	45.92	162.06	158.03	23.67	23.02
16	5	3	45.0	54.50	158.80	154.83	22.60	24.67
17	1	1	54.0	46.0	169.00	160.00	25.00	22.00
			p=0.000		p=0.086		p=0.003	

The average of systolic blood pressure for boys was 107.82 mm Hg and was 106.14 mm Hg for girls, they were not different significantly ( $p > 0.05$ ). No significant difference was also found between the average of diastolic blood pressures for boys (68.94 mm Hg) and for girls (68.92 mm Hg). (Table 2).

Table 2. The average systolic and diastolic blood pressure according to age and sex

Age (years)	Systolic (mmHg)		Diastolic (mmHg)	
	Boy	Girl	Boy	Girl
11	-	105.00	-	67.50
12	102.78	104.02	66.43	66.86
13	109.62	104.94	70.45	67.79
14	108.56	107.79	70.08	70.57
15	109.81	109.84	67.31	71.13
16	104.00	101.67	64.00	75.00
17	90.00	90.00	50.00	70.00
Average	107.82	106.14	68.94	68.92
	p=0.687		p=0.821	

Table 3 illustrates the adolescent nutritional status based on the body weight toward age according to the NCHS standard. There was a significant difference ( $p < 0.05$ ) between adolescent boys and girls. Based on the body weight toward age, it was found that 10 % of boys and 3,5% girls had less nutritional status.

Table 3. Nutritional status based on the body weight against the age according to NCHS standard

Age (yr) Sex	Number	Body weight (kg)		Height (cm)		Arm circumference (cm)	
		Boy	Girl	Boy	Girl	Boy	Girl
Boy	200	20	10	179	89.5	1	0.5
Girl	228	8	3.5	218	95.6	2	0.9
		df=2; $\chi^2=7.50778$ , $p=0.02343$					

Table 4 illustrates the adolescent nutritional status was evaluated based on the body height toward age according to the NCHS standard, there was no significant difference ( $p > 0.05$ ) between boys and girls. This study indicates that 5.5% boys and 7.9% girls having less nutritional status based on the body height toward age.

Table 4. Nutritional status based on height against the age according to NCHS standard

Age (yr) Sex	Number	Less than normal		Normal		Above normal	
		Number	%	Number	%	Number	%
Boy	200	11	5.5	188	94.0	1	0.5
Girl	228	18	7.9	210	92.1	-	-

$$df=2, \chi^2=2.08287, p=0.35295$$

Not all adolescents which were chosen as samples having habitude to have breakfast, only 50% boys and 47.4% girls having breakfast routinely (Table 5). Most of them having rice and side dish for breakfast, and the others having bread/its kind or instant noodles. The favorite food for adolescent, most of them answering that their favorite food was ice cream, chocolate, instant noodles, and any kind of fast food such as hamburger, pizza, or fried chicken. The habit of drinking milk regularly found in boys was 27% and girls was 18.4%. Eating fruits routinely was 21.5% for boys and 29.8% for girls. Eating vegetables routinely 55.5% for boys and 57.0% for girls. Two hundred and three (89%) girls had menarche out of 228 adolescent girls who were chosen as samples. The average menarche age was 12.47 years (range 11-14 years, SD 0.81).

Table 5. The habit of having breakfast

The habit of having breakfast	Boy		Girl	
	Number	%	Number	%
Never	10	5.0	8	3.5
Occasionally	90	45.5	112	49.1
Routinely	100	50.0	108	47.4

## Discussion

The physical development in the adolescent period must be differentiated between girls and boys. The physical changes in the adolescent period are of the same sequence, but the age of beginning, the speed, and the age for its ending period vary between boys and girls. Growth spurt starts earlier in girls than in boys. i.e. around 10 years for girls and 12 years for boys. The ending is also earlier in girls (around 18 years) than in boys (around 20 years). The peak of the growth spurt for girls is around 11-13 years and for boys around 13-15 years. At the beginning of the growth spurt there is a rapid acceleration development. The peak of the growth spurt for boys is higher than girls. After the peak growth spurt is reached, the growth will find out deceleration and finally ceases at the age of 18 years for girls and 20 years for boys. The average rate of body height for the period of growth spurt is around 20 cm, with the speed per year for girls was 9 cm and for the boys 10.3 cm.

This study showed that at the age of 12 years the average anthropometric measurements (body weight, height, arm circumference) for girls were higher than those for boys, but at the age of 13, 14, 15 years the average anthropometric measurement for boys were higher than those in girls. This indicates that growth spurt has taken place earlier for girls, than for boys. After that the development decelerates and finally stops. When menarche happens, most adolescent girls had reached adult body height (in this study 89% students has menarche), so that for adolescent girls in this period their development has experienced deceleration and finally stops and reaches adult body height. The adult body height can be predicted based on the body height of his/her father and mother,<sup>2</sup> bone age, RWT (Roche Wainer Thissen) method or KR (Khamis Roche) method.<sup>7</sup> The average rate development of adult body height of a nation represents an indicator of the welfare development (nutritional improvement, social economic, and health care), when the genetic potency has not optimally reached. Likewise the inter-nations marriage as the result of the migration, having contribution on the change of this secular body height.

Studies in England and Scotland<sup>8</sup> indicate that there was arising adult body height 1cm on English child and 2 cm on Scottish child during the period of 1972-1994. In addition the thickness of the skin fold in triceps area, there was an increasing 7-8% in England and 10-11% in Scotland, this indicated that there was an increasing child who had obesity in both countries. Adult body height can also be influenced by the emotion problem on the childhood. From the Pine et al research (1996) indicating that those who experience emotional problem during the childhood, there was a tend to have a lower body height at the beginning of the adolescent period, especially on the adolescent girl. This condition caused by the emotional disturbance that can reduce the growth hormone secretion. The short stature can also be influenced by zinc deficiency in the childhood.<sup>11</sup> The short stature often results in feeling anxiety on the child and find it difficult to get school/job which has the requirement on certain body

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height, so it is necessary to do the efforts as early as possible in order to have the optimal child body height.

In general body height below normal is caused by chronic conditions, while body weight below normal can be caused by acute or chronic conditions. In this study, when adult nutrition status viewed from body height toward age according to the NCHS standard, there is any significant difference between adolescent boys and girls. The significant difference in this study may be caused by the following conditions: in that age period the development of muscle on boys higher than girls, 50% of boys having breakfast routinely, and 27% boys drinking milk routinely.

Apart from additional body measurement as a result of the increasing length of the leg and spinal during adulthood, also changes in the pelvic, shoulder, muscle composition and fat, neuro-endocrine, respiratory system, reproduction organ, and cardiovascular system. In this study the blood pressure between boys and girls is not different significantly.

Based on the reproduction maturity, differentiated between early adolescent period, middle adolescent and late adolescent; and also differentiated between boys and girls. In the early adolescent period for girl there is breast development (telarche) which represents the manifestation of maturational reproduction that takes place first. On the average, telarche begins at the age of 13 years (range 9-13 years). The growing of pubic hairs takes place on the average at the age of 11.5 years as the result of the androgen adrenal hormone and there is no correlation with thelarche. The growing of the sexual organ for girls, has been taken place since early adolescent, where the growing of the uterine, cervix, ovarian and other internal sexual organ has taken place rapidly. The followed by the increasing of estrogen hormone production, the change of vagina epithel, and very often found liquid vagina secretion which happens a view months before menarche.

The important thing happens during this adulthood is that the menarche. According to Kreipe, menarche happens at the average age of 12.5 years, 95% of adults experience menarche between 10.5 years of age up to 14.5 years. The age of menarche very various depends on the ethnic, social-economic, and athlete or not. At normal adult girl, menarche happens between 1.5-2.5 years after thelarche or 9-12 months after the ultimate spurt of body height or three months after the ultimate spurt of body weight. According to the Metcalf research 1983 (quoted from Kreipe 1992), 25% of adolescent girls experience regular ovulation cycles 2 years after menarche and 45% happens 2-4 years after menarche. In this research found that 89% of adult has experienced menarche, and the average age of menarche is 12.47 years (range 11-14 years). The menarche age in this research is not different from that of adolescent girls in other countries.<sup>3,7,12</sup>

The first sign of puberty for boys is that the enlargement of testis. Biro et al,<sup>10</sup> stated that the enlargement of the testis the same or larger than 3 cc represents the

early puberty period on the boys. Whereas for the boys spermarche is signaled by the finding of sperms in the urine in the morning, on the average happens at the testis volume 6-10 cc, generally at the age of 13 years, range 12-15.7 years.<sup>11</sup> The sign of spermarche which is the most easiest to be asked is a wet dreaming on adolescent boys. In this study the development of sexual organ for boys is not investigated.

This study represents the preliminary study on the somatic development of adolescent in junior high school students. We haven't done investigation on the development of other somatic such as hearing, sight, development of primary /junior high reproduction organ. In USA monitoring of growth and development every child carried out routinely since childhood up to adulthood.<sup>6</sup>

The results indicated the growth spurt of body weight, height and arm circumference in adolescent girls took place earlier than that of boys. It was still found that adolescent having malnutrition status, in both boys and girls. The blood pressure did not have any significant different between adolescent boys and girls. Eighty nine percents of adolescent girls had menarche. It is suggested to do the monitoring continuously concerning the somatic development of adolescent of the junior high school students in Denpasar, as what has been done in UKS (School Health Program) in the elementary school, because for the time being adolescents in junior high school have been ignored. Whereas in this period the child development is very rapid, which also represent a dangerous period toward the problem of malnutrition.

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