

## Profile of Cardiorespiratory Fitness, Flexibility and Fat Percentage of Junior High School Students in Jatinangor

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### Abstract

**Background:** Obesity and physical inactivity is a major risk factor for non-communicable disease and global mortality in adolescent. Lack of physical activity will lead the condition into poor physical fitness, measured by cardio respiratory fitness (maximum oxygen volume, VO<sub>2</sub> max), and other components such as flexibility. The study aimed to describe VO<sub>2</sub> max, flexibility and fat percentage among junior high school students in Jatinangor.

**Methods:** The study was a descriptive observational study using descriptive analysis. VO<sub>2</sub> max was assessed using Astrand Ryhming step test, flexibility was measured using flexometer sit and reach test, and fat percentage was determined using bioelectrical impedance analysis scale. The subjects were junior high school students who were study in 1st, 2nd and 3rd grade in Jatinangor Junior High School based on stratification sampling method. It was conducted from September–October 2013.

**Results:** Total subjects were 110 students consisted of male (n=52) and female (n=58). The VO<sub>2</sub> max were in good and above category, 57.69% of male (50.37 ± 9.80 ml/kg/min), and 60.34% of female (37.66±7.03 ml/kg/min). The flexibility for both males and females were within excellent category (67.31%, 26.56 ± 7.14 cm and 67.24%, 27.29±6.64 cm respectively). The fat percentage in females were within healthy category (67.24%, 25.28 ± 6.85 %), meanwhile male were within underfat category (48.08%, 11.66 ± 5.83 %).

**Conclusions:** The majority of VO<sub>2</sub> max, and flexibility both in male and female were good. The fat percentages were good in female students, while in male students were under normal range.

**Keywords:** Adolescent, fat percentage, flexibility, VO<sub>2</sub> max, junior high school students

### Introduction

Flegal et al.<sup>1</sup> stated that overweight and obesity are the risk for global deaths. Besides that, the physical inactivity has been identified as one of the leading factor of mortality in the world.<sup>2</sup>

Jatinangor, which is categorized as periurban area because of the population and other facilities, may experience same lifestyle changes as urban does. These changes occur also in children and adolescent, for example junior high school students. Changes in lifestyle can lead to changes in nutritional status and physical fitness.

Obesity is defined as abnormal or excessive fat accumulation.<sup>3</sup> One method for measuring nutritional status is fat percentage. Measuring fat percentage can be done by several methods such as skin fold calliper, body mass index (BMI), hydrostatic weighing, Bod Pod, dual energy x-ray absorptiometry

(DEXA) and bioelectrical impedance analysis (BIA). Bioelectrical impedance analysis is an accurate, simple, fast, and cheap method to measure fat percentage.<sup>4</sup>

Physical fitness is defined as the capacity to carry out physical activity.<sup>5</sup> In relation to physical fitness and health related fitness, there are five components to be measured; (1) cardiorespiratory fitness which can be measured by maximum oxygen volume (VO<sub>2</sub> max); (2) muscle strength; (3) muscle endurance; (4) flexibility; and (5) body fat percentage.<sup>5</sup> The aim of this study was to describe VO<sub>2</sub> max, flexibility, and fat percentage among junior high school students in Jatinangor.

### Methods

This was a descriptive observational study. The population were junior high school students in

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Jatinangor, Sumedang, Jawa Barat. This study was conducted in each related school, the State Junior High School (*Sekolah Menengah Pertama Negeri*, SMPN 1, 2, and 3 Jatinangor) and was carried out from September to October 2013. The study was approved by The Health Research Ethics Committee Faculty of Medicine Universitas Padjadjaran and The School Committee.

Sample was taken using a stratified sampling method. The minimum sample of this study based on calculation is 110 people. From total population of 11 junior high schools, 3 schools were taken to be the sample. Thirty six students from every school were divided by each degree and gender resulting in minimum 6 male students and 6 female students for each degree in every school.

One hundred and ten subjects from 3 schools consisted of 52 male students and 58 female students were given their consent to be part of the study. The physiological physical categories of the subjects consisted of gender, age, weight, height, body mass index, blood pressure and pulse rate were then measured. Subsequently, the students' VO<sub>2</sub> max, flexibility and fat percentage were assessed respectively.

Astrand Ryhming step test was used for measuring VO<sub>2</sub> max of the students. Students were asked to use polar before measurement. Then they did up and down movement toward bench, different for each gender, for 5 minutes and said the heart rate each minute. The 5th heart rate then were noted and plotted to get VO<sub>2</sub> max.<sup>6</sup>

The flexometer sit and react test was used to measure flexibility. Subjects were asked to sit on the floor by extending the legs while tip of the finger touched the edge of flexometer. Then students were asked to push the edge of flexometer to their maximal point while

the legs were still extended. The result of 2–3 measurements then were divided to find the mean.

Bioelectrical impedance analysis scale was calibrated using the subject's gender, age, and height. Subjects with minimal clothes then stood on the scale and the fat percentage result was noted and plotted based on the age.

The results were also categorized based on their valid category. These results were then tabulated to show the percentage of each category.

## Results

Total subjects were 110 students consisted of 52 males and 58 females. The characteristic of the subjects based on the first measurement consisted of age, weight, height, BMI, systolic pressure, diastolic pressure, and pulse rate (Table 1).

The VO<sub>2</sub> max, flexibility, and fat percentage were then measured (Table 2), divided into male and female and then categorized (Table 3). The VO<sub>2</sub> max were categorized into very poor, poor, fair, good, excellent and superior. Flexibility were categorized into poor, fair, good, very good and excellent while fat percentage were categorized into underweight, healthy, overweight and obese.

The majority of VO<sub>2</sub> max in male students was within fair category (38.46%) while female students were within superior category (27.59%). The total percentage of students with VO<sub>2</sub> max within good category and above were 57.69% for male and 60.35% for female (Table 2).

The flexibility of both male and female were within excellent category as 67.31% and 67.24% respectively (Table 2). The majority of fat percentage in female students was

**Table 1 Respondents Characteristics**

Characteristics	Male (n=52)	Female (n=58)
	Mean±SD	
Age (year old)	13.54±0.96	13.38±0.64
Weight (kg)	41.99±8.75	42.94±7.41
Height (cm)	154.45±7.75	148.52±5.47
Body mass index (kg/m <sup>2</sup> )	17.47±2.73	19.41±2.81
Systolic (mmHg)	106.04±12.54	101.53±11.74
Diastolic (mmHg)	66.46±13.00	65.57±9.35
Pulse rate	90.31±10.21	90.97±9.84

Note : SD=Standard Deviation

**Table 2 Cardio Respiratory Fitness, Flexibility and Fat Percentage Results**

Variable	Male	Female	Total
	Mean ± SD	Mean ± SD	Mean ± SD
VO2 Max (ml/kg/min)	50,37 ± 9,80	37,66 ± 7,03	43,66 ± 10,56
Flexibility (cm)	26,56 ± 7,14	27,29 ± 6,64	26,94 ± 6,86
Fat Percentage (%)	11,66 ± 5,83	25,28 ± 6,85	18,84 ± 9,33

Note : SD = Standard Deviation

within healthy category (67.24%), while male majority were within under the category value (48.08%), even though healthy male were 44.23% (Table 2).

## Discussion

This study result showed that most of students had good cardiorespiratory fitness. Cardiorespiratory fitness is determined by many factors such as age, gender, body composition, and degree of training.<sup>5</sup>

In this study, the good result in cardio respiratory fitness might be caused by their physical activity and body fat composition. Many students must go to school on foot for miles from their house because of their location and socioeconomic status. Eventhough Jatinangor is a periurban area, there are aspects that do not meet the standard

of criteria. One of the aspect is transportation. In Jatinangor, the quality of transportation is below standard, mostly because of the quality of the road. The quality and the amount of land transportation such as public transportation are also contributed to quality of transportation. From this condition, student has no option except walking for miles to their school.

Walking or cycling to school has been associated with higher daily physical activity and increased daily energy expenditure in children and adolescents compared to those going by car.<sup>7</sup> The study in 2006 from Danish by Cooper et al.<sup>7</sup> showed that children and adolescents who actively go to school were five times significantly fitter. Socioeconomic status, as mentioned above, also has a strong connection to the cardiorespiratory fitness. In 1998, Prista et al.<sup>8</sup> conducted a

**Table 3 Cardio Respiratory Fitness, Flexibility and Fat Percentage Results Based on Category**

Variable	Category	Male		Female	
		Normal Value	% (n=52)	Normal Value	% (n=58)
VO2 Max (ml/kg/min)	Very Poor	<35.0	0.00	<25.0	0.00
	Poor	35.0–38.3	3.85	25.0–30.9	13.79
	Fair	38.4–45.1	38.46	31.0–34.9	25.86
	Good	45.2–50.9	17.31	35.0–38.9	17.24
	Excellent	51.0–55.9	13.46	39.0–41.9	15.52
	Superior	>55.9	26.92	>41.9	27.59
Flexibility (cm)	Poor	1–5	1.92	2–6	0.00
	Fair	6–11	0.00	6–11	0.00
	Good	12–17	9.62	12–18	10.34
	Very Good	18–23	21.15	19–23	22.41
	Excellent	>23	67.31	>23	67.24
Fat Percentage (%)	Underweight	<12	48.08	<16	8.62
	Healthy	12–22	44.23	16–29	67.24
	Overweight	22–27	3.85	29–33	18.97
	Obese	>27	3.85	>33	5.17

study in Mozambique and suggested that socioeconomic status was an important determinant of fitness in Mozambique, especially because of influence on body size, composition, and physical activity.

There is also a strong relationship between VO<sub>2</sub> max and body weight, BMI and body fat composition.<sup>9</sup> Those who are have normal body weight, BMI, or body fat composition will have higher cardiorespiratory fitness than those who are obese.<sup>9</sup> This study is known that body weight, BMI, and body fat of subjects are normal.

This result also revealed that most of students had excellent flexibility. The age and their high degree of physical activity may also be the major determinant of this flexibility results.<sup>5</sup> There is also an association between students who live in rural area and degree of flexibility. The study from Turkey in 2005 by Özdirenç et al.<sup>10</sup> stated that the children living in the urban areas were more inactive and obese, which resulted in a decrease in their flexibility. This means children in rural area will have higher flexibility.

From fat percentage perspective, the research showed that most of female students had healthy fat percentage. In contrast, most male students had under category (48.08%), even though there is a little difference from those who were healthy (44.23%). The significant difference between male and female result might caused by gender differences. This condition are caused by the effect of hormones. In males, there are several hormones including testosterone which made the body lean and build more muscle, so there is higher muscle composition. Females, in the other hand, have several hormones including estrogen and progesterone which made a deposit of fat in the body instead of muscle, so there are higher fat composition.<sup>3</sup> There are many factors that influence fat percentage, such as genetic, age, gender, nutrition, and physical activity.<sup>11</sup>

Increased in physical activity is inversely associated with high fat mass.<sup>12</sup> It means high physical activity is associated with lower fat percentage. It was stated in the study from Spain that the higher intensity of physical activity from activity such as walking to school for miles can also lower their fat mass.<sup>13</sup> In addition, male students tend to be more active than female students. This condition makes even lower fat mass for male students in this study.

The area of living and their socioeconomic status might influence the fat percentage results. Socioeconomic status will influence

their lifestyle and eating behaviour. The study from Mozambique<sup>9</sup> and Turkey<sup>10</sup> as mentioned before explained about the correlation between socioeconomic status, area of living and body fat composition. There was also a study from US, conducted by Fox et al.<sup>14</sup> in 2009, that stated school food environment might influence students BMI and fat mass, even though this might be not much related to the study.

One of the limitation of this study is in using Astrand Ryhming step test to measure cardiorespiratory fitness because of malfunction of the heart rate monitor. The short time interval of this study also made the sample limited and some of variable not normally distributed.

In conclusion, most of students had good cardiorespiratory fitness and excellent flexibility. From fat percentage prespective, most of female students had healthy fat percentage whereas most male students were within under category.

It is recommended that the physical fitness, including cardiorespiratory fitness and flexibility, should be maintained and improved by doing a lot of physical activities. The WHO recommends children and youth aged 5–17 to accumulate at least 60 minutes of moderate to vigorous intensity physical activity which is equal to 75–85% of maximum heart rate.<sup>15</sup> The type of physical activity should be aerobic and activity that strengthen muscle, bone, and flexibility at least 3 times a week.<sup>15</sup> There are also other guidelines for maintaining and improving physical fitness.

The fat percentage for female students should be also maintained in contrary, for male students, it should be improved because of the importance of fats in the body. Vitamins A, D, E, and K are fat-soluble, they can only be digested, absorbed, and transported in conjunction with fats. Fats are sources of essential fatty acids, an important dietary requirement and play a vital role in maintaining healthy skin and hair, insulating body organs against shock, maintaining body temperature, and promoting healthy cell function. Fats also serve as energy stores for the body and are broken down in the body to release glycerol and free fatty acids. The glycerol can be converted into glucose by the liver and thus used as a source of energy.<sup>3</sup> Fats, in the form of steroid hormones, are also used in many body function, including testosterone for secondary development in adolescent. Although their nutritional status is normal, low fat percentage will lead to health problem.

Meal planning is used to improve fat percentage. To increase the fat percentage, a person must take higher intake based on their energy requirement. Before conducting meal planning, a person must undergo several steps to determine nutritional status, such as physical exam, anthropometric measurement, and lab examination. After nutritional status known, recommendation of intake must be calculated. The recommendation for adequate intake for children is 80–100 Cal/kg BW and 25 % of the total calory intake must be in the form of fat. The meal is then planned based on the type, amount, and time. The type and amount is suited for individual. It is best to have three heavy meals (in the morning, afternoon, and evening) and also two snack times (in the morning and afternoon).<sup>11</sup>

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