

## Comparison of aerobic parameter and percentage of body fat in active exercising and inactive males.

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*Fourteen inactive young Thai subjects (aged  $24.95 \pm 1.40$  years) and 11 active exercise counter-parts (age  $23.55 \pm 0.90$  years) were presented with aerobic parameters, which composed of maximal oxygen uptake ( $Vo_{2max}$ ), anaerobic threshold (AT). The aerobic parameters were measured by indirect opened circuit calorimetry method. The prediction of obesity by 4 sites of skinfold measurement was used to determine the relative percentage of body fat. Maximal oxygen uptake, anaerobic threshold of active exercising group, were higher than those of the inactive group, where-as the percentage of body fat in the active exercising group was significantly lower than in the inactive group ( $p < 0.05$ ).*

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ชาญวิทย์ โคธีรานุรักษ์. การศึกษาเปรียบเทียบค่า แอโรบิก พารามิเตอร์ และเปอร์เซ็นต์ของไขมันในร่างกาย ในกลุ่มผู้ชายที่มีกิจกรรมการออกกำลังกายและไม่มีการออกกำลังกาย. จุฬาลงกรณ์เวชสาร 2534 มกราคม ; 35(1) : 9-16

ผู้ชายไทยที่ไม่มีกิจกรรมการออกกำลังกาย 14 คน อายุเฉลี่ย  $25.95 \pm 1.40$  ปี และที่มีกิจกรรมการออกกำลังกาย 11 คน อายุเฉลี่ย  $23.55 \pm 0.90$  ปี ได้รับการตรวจหาค่า aerobic parameters ซึ่งประกอบด้วย การใช้ออกซิเจนสูงสุด ( $Vo_{2max}$ ), แอนแอโรบิกเทรชโฮล (anaerobic threshold) โดยใช้วิธี indirect opened circuit calorimetry และได้รับการตรวจหาปริมาณไขมันในเนื้อเยื่อ โดยการวัดความหนาของชั้นไขมันใต้ผิวหนังที่ 4 บริเวณของร่างกาย ผลการทดลองปรากฏว่าค่าการใช้ออกซิเจนสูงสุดและค่าแอนแอโรบิกเทรชโฮล ในกลุ่มที่มีกิจกรรมการออกกำลังกาย สูงกว่ากลุ่มที่ไม่ได้มีกิจกรรมการออกกำลังกาย ในขณะที่ค่าเปอร์เซ็นต์ของไขมันใต้ผิวหนังในกลุ่มที่ไม่มีกิจกรรมการออกกำลังกาย สูงกว่ากลุ่มที่มีการออกกำลังกาย อย่างมีนัยสำคัญทางสถิติ (ค่า  $P < 0.05$ )

Body composition is usually described as having two components : fat tissue and lean mass. Lean mass consists of muscle, bone, and other organic factors. Fat tissue can be subdivided into essential fat and storage fat. Essential fat is located in bone marrow, nerve tissue and some specific organ tissue. Storage fat, as its name implies, is stored as an energy reserve in adipose tissue.<sup>(1)</sup>

Obesity, defined as adipose tissue 15 percent in excess of normal, is a definite cultural problem. It indicates that as the percentage of overweight increases, so does the risk of early death.<sup>(1)</sup> In development of obesity, should be put stress on the involvement of hereditary, environmental, or a combination of both factors.

When energy input is equally utilized by output, the body is said to be in calory balance.

Dietary control and active exercise are weight control principles and have been criticized<sup>(2)</sup> for a long time in many centers.

Underwater weighing is the "gold standard" for the measurement of body density.<sup>(1)</sup> But because of the difficulty of this method, the estimation techniques such as skinfold prediction have been utilized.<sup>(3)</sup>

However, the validity of skinfold measurement relative to underwater weighing, which it only moderately correlates with appears to be better for men than for woman.<sup>(1)</sup> The more accurate method of skinfold measurement was later established by Durnin and Womersley<sup>(4)</sup> and the test of validity by Housh et al.<sup>(5)</sup>

The endurance training resulted in substantial changes in body composition<sup>(6,7)</sup> and aerobic parameter : maximal oxygen uptake and anaerobic threshold.<sup>(8)</sup> Maximal oxygen uptake can be measured indirectly and directly. Until now the comparison of direct  $\dot{V}O_{2max}$  in Thai active exercising and inactive subjects has not done at any center. The purpose of this study was to compare the percentage of body fat, the direct  $\dot{V}O_{2max}$  and the anaerobic threshold between active exercising and sedentary males.

### Materials and Methods

Twenty-four healthy males were asked to fill up their personal history of exercising activities, whose characteristics are outlined in table 1. Volunteers who participated in the study were recruited by age and exercising activities.

Table 1. Physical data and acitvity background of the subjects.

Group	Number	Age (yrs)*	Weight (kg)*	Height (cm)*
Inactive	14	24.95 ± 1.40	68.21 4.53	169.50 20.30
Active exercising	11	23.55 ± 0.90	66.14 ± 2.01	174.40 ± 14.20

\*The numbers are expressed as mean ± SD.

They were divided into active exercising and inactive of sedentary groups by individual daily activities. In the active exercising group the subjects performed active exercising at least 30 minutes everyday of every other day (at least 3 days per week).<sup>(9)</sup> The duration of exercise must not be less than 12 months and continued for more than 2 months prior to the test.

### Anthropometric and Physiologic Characteristecs.

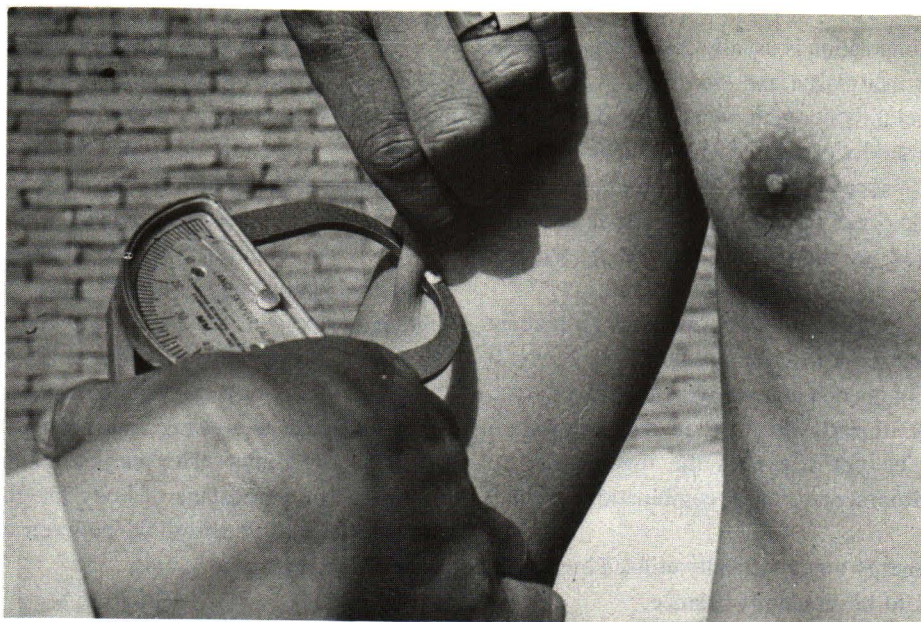
Skinfold thickness was measured three times

per site (A) with skinfold caliper (Cambridge Scientific Industries, Inc., England). The sites side of the body (Figure 1-4). The mean of skinfold thickness was used to calculate the percentage of body fat as in these formulae :

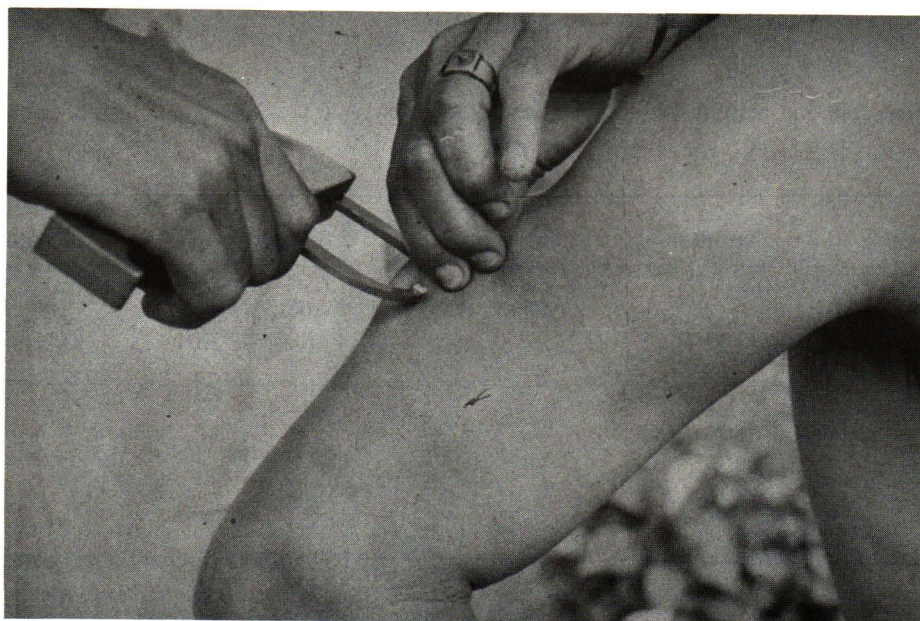
$$BD = 1.1610 - 0.632 \log A$$

$$\% \text{ Fat} = [(4.95/BD) - 4.50] \times 100$$

- A : Log of sum of skinfold thickness at 4 sides in millimeters  
BD : Body density  
% Fat : Body fat percentage

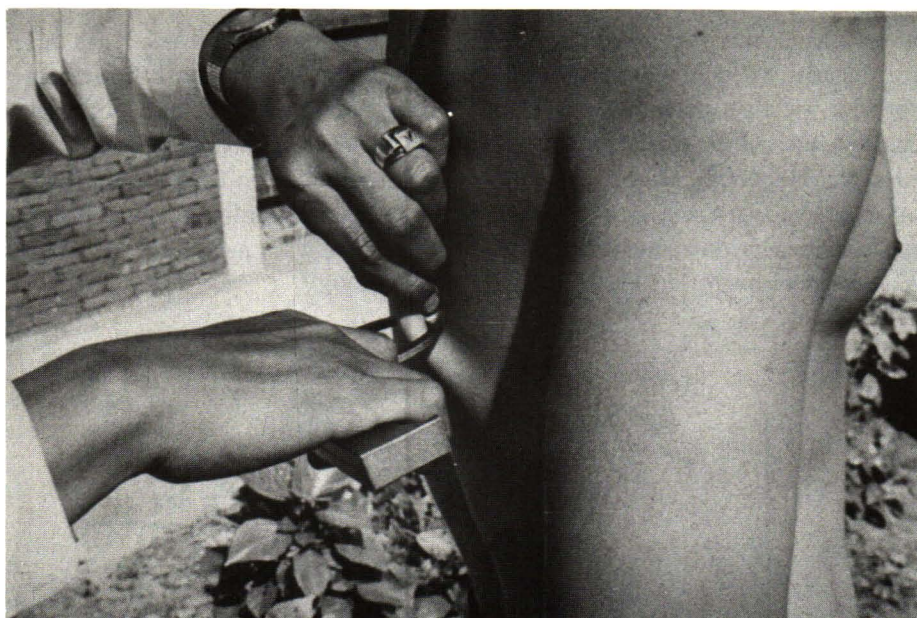


**Biceps**



**Triceps**





**SUBSCAPULAR**



**SUPRAILIAC**

**Figure 1-4** Locate and measure each skinfold for determining percentage of body fat.<sup>(4)</sup>

Maximal oxygen uptake was measured with cycle ergometer (Monark, Sweden) with a gradually increase in load of 12.5 watts per minute. Every effort was made to encourage each subject to perform cycling at 50 rpm until exhaustion (Figure 5). Minute ventilation and percentage of expired oxygen and carbon dioxide were measured by the indirect open-circuit method which were recorded by a pneumotachograph (Fleisch i/a 7320

NO 2, Instrumentation Associated Inc., USA, a Pressure transducer (PT5A, Grass Instruments Inc., USA), an oxygen analyzer (OM-11, Beckmann Instruments Inc., USA), and a carbon dioxide analyzer (LB-2 Beckmann Instruments Inc., USA), Calculation of these values were made according to Jones's method<sup>(10)</sup> Anaerobic threshold was measured by Wasserman's method (Figure 6).<sup>(8)</sup>

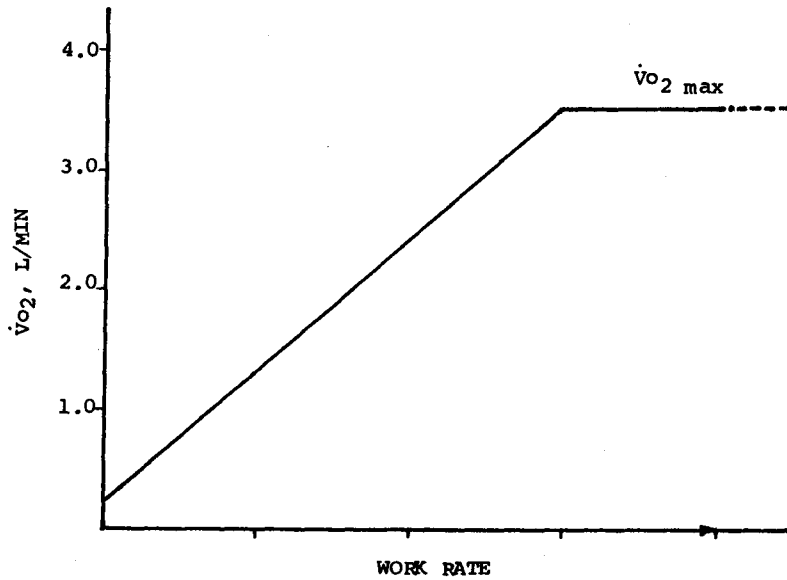


Figure 5. Relationship between work rate and oxygen uptake  $\dot{V}O_2$ .<sup>(16)</sup>

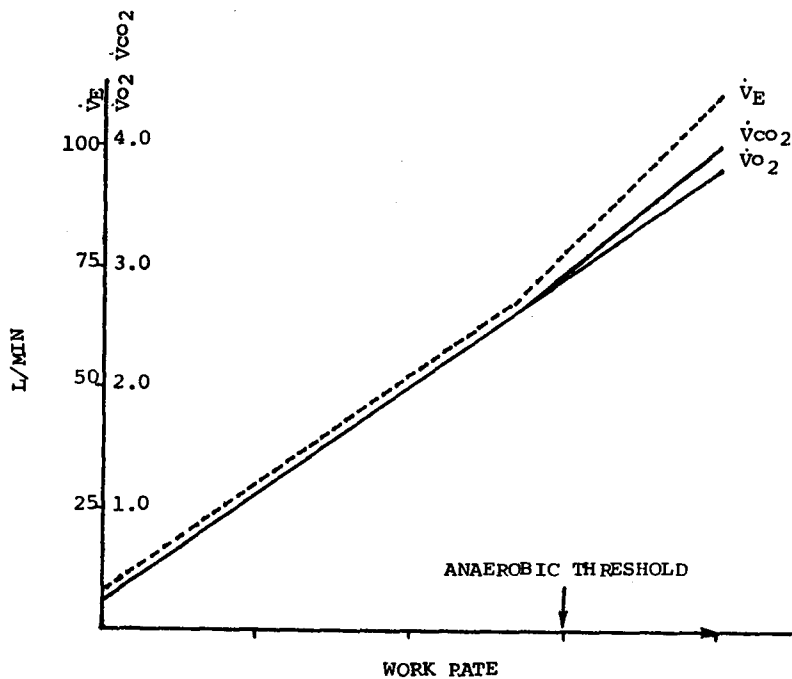


Figure 6. Relationship between work and rate and  $\dot{V}O_2$ ,  $\dot{V}CO_2$ , and  $\dot{V}E$ .<sup>(4)</sup>

## Statistical Procedures

All statistics were calculated using an independent t-test. A probability level of 0.05 was selected as the criteria for statistical significance.

## Results

The active exercising and inactive groups were

comparable in age, weight and height (Table 1). The active exercising group was leaner than the inactive group in terms of percentage body fat. The  $\dot{V}O_{2max}$  and anaerobic threshold in the active group were significantly greater than in the inactive group ( $p < 0.05$ ). All the parameters are shown in table 2.

Table 2. Anthropometric and physiologic characteristics of inactive and active subjects.

Groups	Maximal Oxygen Uptake (ml/min/kg)*	Anaerobic Threshold (ml/min/kg)*	Body fat (%)*
1. Inactive	35.68 $\pm$ 10.23	27.25 $\pm$ 3.30	23.88 $\pm$ 3.07
2. Active	44.36 $\pm$ 7.44	40.91 $\pm$ 11.25	19.35 $\pm$ 3.07
p value	1 < 2, p < 0.05	1 < 2, p < 0.05	1 > 2, p < 0.05

\*The numbers are expressed as mean  $\pm$  SD.

## Discussion

In this study we tried to explain the usefulness of exercise on the body composition. Utilization of fat for energy in exercising subjects appeared to have significantly different effects in the active and inactive groups (Table 2).

Both groups showed greater body fat than previous studies<sup>(11-12)</sup>, which may have been due to the effect of different bodily composition and race. The previous subjects were students who may be rather active or may be younger. The greater percentage of body fat agree with the lower anaerobic thresholds in both

groups when compared to Arkarapan's study.<sup>(11)</sup> Maximal oxygen uptake in this study is lower than in the report of Wrestlers<sup>(13)</sup> which may be due to the effects of different measurements by treadmill and bicycle ergometer. However the maximal oxygen uptake in this study is higher than in the study of Pollock<sup>(14)</sup> which may be due to the effect of the severity of exercise and mean age.

Optimal aerobic exercise can develop good aerobic parameters<sup>(9)</sup> that may affect longevity by improving cardiovascular and pulmonary function.<sup>(2)</sup> Some investigations compared the response of exercise intensity starting from 25 to 100 percent of maximal oxygen uptake, correlated with density of muscle mass<sup>(15)</sup>

which occurred in most athletes and most people in the Western world. Another view, increasing in lean muscle mass mean fitness, also indicated that as the percentage of overweight increase by increasing percentage of body fat, so does the increasing risk of early elderly death from coronary artery diseases.<sup>(1)</sup> These reports, anthropometric and physiologic in parameters, indicate that active exercising men have higher  $\dot{V}O_{2max}$  and anaerobic threshold and lower percentage of body fat than sedentary ones. Therefore active men have proper body composition, less body fat, and increased aerobic parameters which tend to decrease cardiac risk factors and increase body performance and longevity.

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