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Characteristics of body composition in male students with inactive life

Koji Taniguchi, Ichji Seino, and Hidetoshi Konari

Abstract

This study was made to find the characteristics of body composition, aerobic capacity, and grip strength in male students with inactive life. For the purpose above, we studied those of three groups; male students with inactive life, male students belonging to a college tennis club and male personnel with sedentary life. Body composition was estimated by a method of measuring skinfold thickness. Aerobic capacity was measured by carrying out submaximal work with Isopower Ergometer in a bicycle shape.

The results were as follows:

1) The indices of aerobic capacity represented well the usual exercise-levels by figures.
2) LBM influenced aerobic capacity for inactive men without distinction of the two ages.
3) As the value of LBM increased, all subjects had a tendency to put forth grip strength further.
4) A positive correlation was found between LBM and BFM of inactive students ($P < 0.05$).
5) Only inactive students had a significant correlation between aerobic capacity and BFM ($P < 0.05$).

From the above, we indicated that inactive students were in a poor state of exercise. As this result, for inactive students, BFM was found to be rather large, and aerobic capacity also was found to be on low level. Aerobic capacity, however, was within the permitted limit. Moreover, we could conclude the following: For the male students with inactive life, the function of BFM on cardiorespiratory system would be weight for providing them with a certain exercise intensity, not having a time for exercise in particular form. Thus it was considered that BFM has an effect on aerobic capacity.

It has been generally accepted that a human being evolved as one adapted to the life in the Stone Age[1). In the era, man would be required to fight the elements and hunt for his food: vigorous physical activities might be necessary to all human actions; obtaining food, protecting from enemies, moving a long distance, etc. Moderns have probably a genius for living in an active style, because we inherit the fortune from our ancestors. After the industrial revolution, a human being changed rapidly the form of manual labor. In particular, sedentary man who lives in an industrially advanced country, where materialistic civilization develops and motorization advances greatly, will lead an inactive life if he would have take exercise. How are we living our life?

As mentioned previously, the bodies of moderns cannot adapt well to inactive life in an industrially advanced country. In 1961, two American investigators indicated that persons who lead a sedentary life readily get "hypokinetic disease"[2]. Americans would therefore have begun to speak with physical activities of importance. Also in Japan, the same indication was done[3], we think that cases of coronary heart disease have increased rapidly. Consequently the adult have begun to recognize the necessity of physical exercise, then we can see the adult jogging, cycling, or playing tennis. However, we think that the adolescent are generally in a poor state of exercise, because they have lost play spaces owing to reckless carrying out town planning and playmates owing to fashions for private schools and "television games"[4]. Moreover, the life of students preparing for entrance examination will compel the adolescent to lead an inactive life.

About 500 freshmen matriculate in our college every year. We hope all the students of our college recognize the necessity of physical exercise and habituate themselves to that. Nevertheless, to our regret, only half of them at most take exercise. Therefore we wish to have knowledge on physical fitness and body composition in inactive students. Further we must enlighten them on the necessity of physical exercise. Then we got this study.

Methods

Subjects

Twenty-one male subjects participated in this study. They were 14 students and seven personnel in Muroran Institute of Technology. They were divided into three groups: Group A was composed of seven students (mean 19.3 yr), who led a inactive life; group B was composed of seven students (mean 19.1 yr), who belonged to the tennis club; and group C was composed of seven personnel (mean 33.4 yr), who led a sedentary life. Furthermore, members of group A were selected at random from 81 students who would be expected to lead an inactive life.

Body composition

Body composition was estimated by a method of measuring skinfold thickness with Eikenshiki skinfold caliper. The percentage of body fat was calculated by the modified method of Nagamine[5)] and that of Brozek et al[6)]. Lean Body Mass (LBM) was obtained from subtracting Body Fat Mass (BFM) from body weight.

Aerobic capacity (PWC_{170}・$\dot{V}O_2max$)

We have studied aerobic capacity with an apparatus for measuring PWC_{170} and $\dot{V}O_2max$ Takei machinery Co., Inc). PWC_{170} was measured by the method changed loads in three steps with an isopower ergometer[7)]. $\dot{V}O_2max$ was measured by the modified method of Åstrand et al[8)].

Grip strength

We measured continually 20 times of grip strength at intervals of ten seconds with grip dynamometer. Of the 20 values, we took the most high as the value of grip strength. We did the way above, because we intended to have found the differences in the course of decrease with time. We adapted grip strength to measure muscle strength, because we took care of male personnel.

Results and Discussion

Table 1 presents characteristics of the subjects dividing into three groups. There was no statistical difference between the values for the three groups.

Table 1 Characteristics of the subjects.

	Height (cm)	Weight (kg)	% Fat (%)	BFM (kg)	LBM (kg)	Grip S. (kg)
A	172.4±5.2	67.0±13.9	23.8±7.7	16.8±9.2	50.2±5.2	52.0±7.1
B	173.1±5.9	62.9± 9.1	18.2±4.9	11.7±5.0	51.1±5.2	56.3±4.0
C	167.4±5.7	62.4± 8.7	22.0±7.2	14.2±6.2	48.2±4.0	47.7±6.7※

Values are means ± S. D. ※ means significant difference ($P < 0.05$) against the value of group B by t-test.

However, the weight in group A was heavier than that in groups B and C. That was an excess of BFM. The indicies of aerobic capacity were presented in table 2. Those in group B were significantly than those in other two groups. Thus we found that those of aerobic capacity represented well the usual exercise levels. Moreover, grip strength and relative grip strength were higher in group B. These results indicated that physical exercise developed muscle. Table 3 presents the coefficients of correlation between the values of measurement.

As mentioned previously, physical activity is innate in human being. However, at the present day, we are apt to lack in exercise when we have no consciousness of it. Then, extreme lack of exercise brings on follows: Adipose tissue displaces muscular tissue, muscular tissue is atrophied, aerobic capacity is reduced, etc. Pupils and students must have more physical activities than the adult. However, we can obtain the preceding studies indicated the increase in

Table 2 Aerobic capacity.

	PWC_{170} (Watt)	$\dot{V}O_2max$ (l/min)	$\dot{V}O_2max/Wt$ (ml/min/kg)	$\dot{V}O_2max/LBM$ (ml/min/kg)
A	144.3±24.1※	2.67±0.41※	40.2±2.7※※	52.9±3.1※
B	177.3±22.0	3.19±0.42	51.4±8.7	62.8±9.4
C	140.7±29.0※	2.35±0.41※※	37.8±5.2※※	48.6±5.8※

Values are means ± S. D. ※ and ※※ mean significant difference ($P<0.05$ and $P<0.01$, respectively) against the value of group B by t-test.

BFM, the decrease in muscle strength, the loss of flexibility in muscle tissue, and further the decline of the activity level in cerebrum[9),10)]. To study characteristics of inactive students, now we will find the relation between the three indices: Body composition, aerobic capacity, and grip strength.

Each of groups had the high correlation between LBM and grip strength. Nevertheless, from the correlation between BFM and grip strength, in sedentary adultmen, not all of BFM was advantageous to put forth muscle strength. On the other hand, in member of tennis club, BFM was advantageous to put forth muscle strength. Thus we estimated that the optimum BFM for member of an athletic club was more than we expected. A significant correlation was found between LBM and aerobic capacity in groups A and C. This indicated that LBM of inactive men influenced aerobic capacity irrespective of age. Kitagawa et al[11)]. gave the indication similar to ours in the study that they adopted members of a soccer club and non-athletic students as subjects, and investigated the relation of LBM to $\dot{V}O_2max$. Thus inactive men tend to have the following: the larger LBM ones have, the larger aerobic capacity ones have. While $\dot{V}O_2max$ per kg of body weight is regarded as the index at maximal working, we could find no similarity to the indices of the two inactive groups. Thus it seems that $\dot{V}O_2max$ per kg of body weight is influenced by not activity but age.

Table 3 Correlation coefficients. $r \times 10^{-3}$

	PWC170			
	Height	Weight	% Fat	BFM
A	396	898※※	781※	853※
B	211	267	170	186
C	708	522	174	245

	$\dot{V}O_2max$ (l/min)			
	Height	Weight	% Fat	BFM
A	242	968※※	877※※	928※※
B	141	201	89	103
C	693	597	253	324

	LBM				
	Height	Weight	BFM	PWC_{170}	$\dot{V}O_2max$
A	220	942※※	861※	897※※	952※※
B	898※※	884※※	547	281	247
C	557	756※	405	747	786※

	Grip strength						
	Height	Weight	% Fat	BFM	LBM	PWC_{170}	$\dot{V}O_2max$
A	254	692	494	549	881※※	697	761※
B	833※	965※※	836※	925※※	776※	394	325
C	546	474	106	176	749	855※	863※

※ : $P<0.05$, ※※ : $P<0.01$

Of three correlation coefficients between LBM and BFM, in particular, the one in group A showed the significance. Furthermore, we also obtained the significant correlation between aerobic capacity and BFM in group A. That is much the same thing that Kitagawa[12) estimated a function of BFM in the study on the effect of obesity on cardiorespiratory system, i.e. even in general, inactive students, the weight of BFM, itself acts as a load and keeps the intensity of the usual physical activity. In this way, for inactive students, BFM contributes to aerobic capacity. We conclude the above. However, the means of our students with inactive life was found in the lower part of the suitable range for health ($\dot{V}O_2max$ / weight; 40 and over ml / kg / min), as Konno et al.[13] and Cumming et al.[14] indicated. We are anxious about their health after graduation, because we expect they will be in a poor state of exercise. Finally we will guide all our students in recognition of the necessity for taking exercise. Furthermore, we will study the range of the optimum BFM for students.

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