

KNOWLEDGE OF CARDIORESPIRATORY FITNESS EXERCISE AMONG JAPANESE PEOPLE

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Abstract

For some years now, recommendations have been made that people should make a habit of exercising in order to maintain or enhance their health and fitness. The expectation is that the general public has the knowledge to put these recommendations into practice. The purpose of this study was to investigate people's general knowledge of exercise for cardiorespiratory fitness, and to consider how educational activities might enhance the health and fitness movement. Data for this study were collected from the general public of Japanese adults (age 20-69 years) and university freshmen (age 18-19 years). Adult subjects were recruited during voluntary exercise service programs to complete a two-part questionnaire. Questions about the amount and duration of exercise necessary to achieve and maintain fitness (Test A) were drawn from the National Center for Health Statistics in the United States; two other questions concerning cardiorespiratory terminology (Test B) were developed by the authors. Student subjects were recruited during beginning classes of the school year and completed only Test B. The data revealed

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that among Japanese people, younger adults were more knowledgeable overall than either the elderly group or the university student group. Few Japanese people could answer questions on Test A correctly. Results indicated that basic knowledge of cardiorespiratory exercise and fitness information is far from an ideal level in Japan, suggesting that more educational opportunities and instruction for the general public should be provided.

Key words: knowledge test, cardiorespiratory fitness, Japanese people

Exercise science and fitness research has produced basic information about effective and safe exercise to achieve and maintain health and fitness. Based on such research knowledge, several recommendations for physical activity for fitness and health benefits have been publicly announced in many developed countries. Generally, such recommendations clearly indicate the quality and quantity of physical activity that is necessary for people to practice an adequate exercise program and can be effective as long as people are well-educated in fitness science. Accordingly, the effectiveness of recommendations for health and fitness purposes should be supported by educational activities that naturally contain some evaluation of the general public's knowledge of basic physical fitness information.

It is important to recognize the present status of physical fitness knowledge in order to develop public awareness campaigns and to help educational activity organizations improve their principles and practices. In the United States, for example, several researchers have investigated exercise fitness knowledge of adult joggers (Kimbrough, 1984) as well as the long term effects of a conceptual physical education program (Slava, Laurie, & Corbin, 1984). Further, the National Center for Health Statistics (1988, 1993) conducted two nationwide surveys of American's knowledge of good exercise habits in 1985 and again in 1990. However, in

Japan, there is insufficient information on how well people know and understand the basic concepts of fitness exercise and its terminology.

With this in mind, the authors developed a questionnaire and investigated people's knowledge of physical fitness terminology in several earlier studies, one of which compared Japanese people with Americans (Arimoto, Kijima, & Muramatsu, 1994). In the current survey, a newly modified and shorter questionnaire was used to focus primarily on cardiorespiratory fitness exercise knowledge for several age groups. With the new questionnaire, the purpose of this study was to gain a better understanding of how many people have correct knowledge of cardiorespiratory fitness exercise, and how the percentage of people with correct exercise knowledge differs among specific age, gender, and exercise habit groups. Also new in this study is an expanded number of age groups (four) and age range (18-69 year-olds). Findings from this study could be useful to discuss where and how increased effort toward educational and activities should be made to better support the fitness movement.

In an ideal situation, people should learn about cardiorespiratory fitness exercise knowledge well before they reach middle age. Recently in Japan, high school textbooks on physical education have addressed the topics of heart rate and maximal oxygen uptake during exercise. Therefore, it can be said that in general, people learn the terms and relevant knowledge concerning exercise and fitness while in high school — or at least they are exposed to the potential for gaining such knowledge. As they get older then, they face the increasing necessity of putting that knowledge into practice in order to develop and maintain good levels of cardiorespiratory fitness. In this sense, ideally, the percentage of people who have knowledge about exercise fitness increases rapidly during early adulthood to a point that nearly everyone is aware of basic exercise and fitness knowledge before they reach middle age.

The following hypotheses were set for this study: (a) the percentage of people who currently understand basic cardiorespiratory fitness exercise knowledge is relatively higher in younger adults and lower for middle aged and elderly persons, (b) people who have exercise fitness habits, are more likely to have basic cardiorespiratory fitness exercise knowledge, and (c) Americans are more knowledgeable in fitness exercise information than Japanese people. These hypotheses are similar to the authors' previous surveys and were supported by it; however, here they are examined with a different, shorter questionnaire and across a wider age range. More specifically, the following questions were examined: (a) What percentage of Japanese people have an adequate knowledge of cardiorespiratory fitness exercise? (b) What is the relationship between the prevailing level of cardiorespiratory fitness exercise knowledge and factors such as sex, age, and exercise habits? and (c) Is the prevailing level of Japanese knowledge of cardiorespiratory fitness different from that of Americans?

Methods

Knowledge tests. Two kinds of knowledge tests were adopted (see Table 1). Test A consisted of the same questions as those in the American National Center for Health Statistics survey (1988, 1993). Test B asks two four-foil knowledge tests questions to examine understanding of cardiorespiratory fitness terminology. In Test B, the phrase "Have you heard of ...?" was used before each term. Only the correct answers of people who indicated they had heard of the term were counted as correct answers.

Other information. In addition to the knowledge tests, subjects' sex, age, and exercise habits were recorded. To determine subject's exercise habits, two questions from the American survey (National Center for Health Statistics, 1988, 1993) were used: (1) In the past two weeks, how often did you do continuous exercise or

Table 1. Knowledge test used in this investigation

[Test A] These next questions are about strengthening the heart and lungs through exercise.

- (a) How many days a week do you think a person should exercise to strengthen the heart and lungs? () Days
- (b) For how many minutes do you think a person should exercise on EACH occasion so that the heart and lungs are strengthened? () Minutes
- (c) (During those [Number in (b)] minutes), How fast do you think a person's heart rate and breathing should be ---
 - () no faster than usual,
 - () little faster than usual,
 - () lot faster, but talking is possible,
 - () so faster than talking is not possible?

[Test B] Please circle the answer that most accurately conveys the meaning of the term.

- (d) Concerning MAXIMAL HEART RATE, in general,
 - 1. a 40-year-old person's maximal heart rate is about 180 beats per minute (bpm), and a 60-year-old person's is about 160 bpm.
 - 2. a 40-year-old's maximal heart rate is about 160 bpm, and a 60-year-old's is about 180 bpm
 - 3. there is no difference in one's maximal heart rate between the age of 20 and 40 years.
 - 4. there is some difference in one's maximal heart rate between the age of 20 and 40 years, but there is no difference among people over 40 years of age.
- (e) MAXIMAL OXYGEN UPTAKE
 - 1. means vital capacity.
 - 2. indicates cardiovascular endurance.
 - 3. indicates how long one can hold one's breath.
 - 4. is proportional to the maximal respiration rate per minute.

sport (number of days on average), and (2) How long did you do the exercise or sport continuously (number of minutes on average)?

Subjects and data collection. Adult subjects were recruited from among the general public who voluntarily participated in an exercise and fitness service program conducted to evaluate participants' level of physical fitness and to consult with them in ways to achieve improved fitness. The service programs were held four times on different days in 1995 for residents of Yokohama, Japan. The survey questionnaire was administered without prior notice at the beginning of the service program to people who spontaneously joined the program. Incomplete questionnaires were excluded from this analysis. In total, data were gathered for 257 subjects (152 women and 105 men) between the ages of 20 to 69 years.

For comparative purposes, data from 386 university students (134 women and 252 men) also were collected. The surveys for the university students were conducted at two universities during the first class of their academic year and limited to freshman 18 or 19 years old. The questionnaire presented to the students was different from that presented to the adults. The student questionnaire contained only Test B; additionally, the students were asked about their high school sports activity experience, that is, whether or not they had belonged to a high school sport club or team.

Grouping subjects by exercise habits. Subjects were divided into two exercise habit groups: those characterized by having an aerobic exercise habit (HAB) who usually did continuous exercise one day a week or more, and those who had no exercise habit (NHAB) and participated in continuous exercise less than one day a week or not at all. This grouping of subjects having a good exercise habit does not follow the criteria recommended by the American College of Sports Medicine (1990), that is, doing continuous exercise at least three days a week for 20 minutes or

more (and later revised to a minimum of 15 minutes of continuous exercise per session designed to encompass activity that may enhance health without having a major impact on fitness) (American College of Sports Medicine, 1991). Because there were too few subjects who exercised at least three times per week to make a reasonable group size, the numbers of exercise sessions per week used to qualify subjects for the exercise habit group was reduced from three or more times per week to one or more times per week. However, the duration of exercise per session required for the exercise habit group remained as recommended by ACSM (1990). The adult subjects were divided into 12 groups characterized by sex, age, and exercise habits (Table 2). Again, because the number of subjects in each of the smallest groups was too few to apply statistical analysis, six groups collapsed over the variable sex were used. The student subjects were divided by sex and whether or not they had belonged to sport or teams (Table 3).

Table 2. Number of subjects in groups classified by sex/age and exercise habits

Sex/Age	HAB	NHAB	TOTAL
Male 20-34	13	19	32
Female 20-34	13	12	25
Male 35-54	24	22	46
Female 35-54	33	46	79
Male 55-69	15	12	27
Female 55-69	22	26	48
Total	120	137	257

Table 3. Number of student subjects in groups classified by sex and their experience in high school sports activities (clubs or teams)

<u>Sex</u>	<u>Belonged</u>	<u>Did not belonged</u>	<u>Total</u>
Male	136	116	252
Female	48	86	134
Total	184	202	386

Results

Status of spreading knowledge. The correct answer in the American knowledge test was defined as the one specifying that exercise needs to be performed three times per week and maintained 20 minutes per session in order to strengthen the heart and lungs (National Center for Health Statistics, 1988 & 1993). Only three men and three women who were identified in the middle-aged group and having no exercise habit could specify these exercise criteria to strengthen the heart and lungs; they represented 2.3% of the total adult subjects. The percentages of correct answers for each group are shown in Table 4.

Table 4. Percentage of subjects who specified that exercise needs to be performed 3 times per week and maintained 20 minutes per session in order to strengthen the heart and lungs, by sex/age and exercise habits.

Sex	Age									
	20-34		35-54		55-69		HAB		NHAB	
	M	F	M	F	M	F	M	F	M	F
%	0.0	0.0	6.5	3.8	0.0	0.0	0.0	0.0	5.7	3.6

The percentages of people who understood the exercise terms in Test B are shown in Figures 1 and 2 (sex \times age groups), and in Figure 3 (age \times exercise habits). The percentage of correct answers among males for the maximal heart rate term (indicated by HR) was, from youngest to oldest groups, 16.3, 34.4, 10.9, and 22.2, respectively. And for the female groups, again from youngest to oldest, the percentage of correct answers was 20.1, 24.1, 15.2, and 10.4, respectively (see Figure 1). For the question concerning maximal oxygen uptake (indicated by VO), the percentage of correct answers in each male group was, from

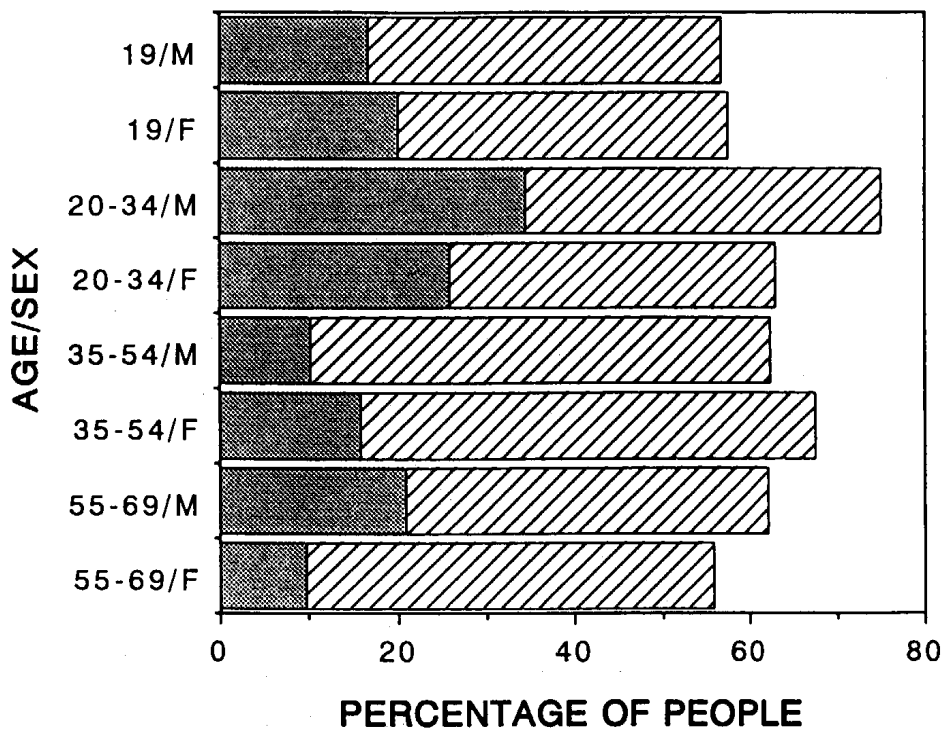


Figure 1. The percentage of people who had heard of the term *maximal heart rate*, and the percentage of correct answers in the each sex/age group. *Note:* The striped part in each bar shows the percentage of people who had heard the term but did not understand it. The dark bar indicates the percentage of people who had heard the term and understood it.

youngest to oldest groups, 19.0, 31.3, 30.4, and 18.5. For the female groups, youngest to oldest, the percentage of correct answers was 13.4, 16.0, 6.3, and 0.0 (see Figure 2).

In the groups characterized by having aerobic exercise habits, the percentage of correct answers for HR was, from youngest to oldest groups, 38.5, 17.5, and 24.3, respectively. In the no exercise habit groups, the percentages were 22.6, 10.3, and 5.3 for youngest to oldest. For VO, in the same manner, the percentage correct in exercise habit groups was 34.6, 21.1, and 13.5. In the no habit groups, the percentages were 16.1, 10.3, and 0.0,

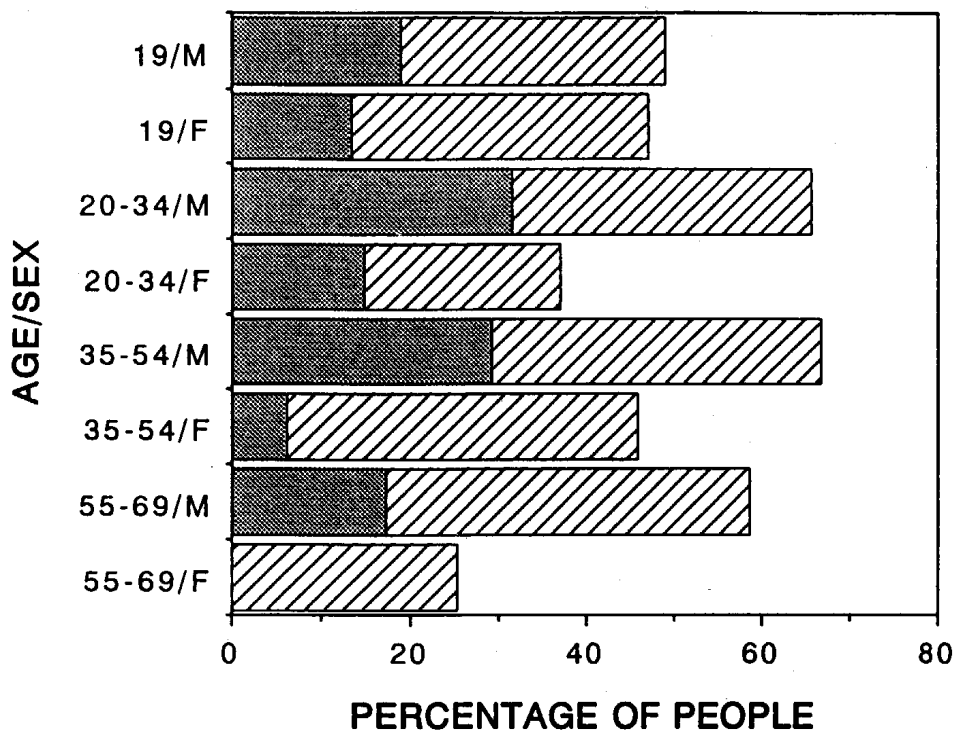


Figure 2. The percentage of people who had heard of the term *maximal oxygen uptake*, and the percentage of correct answers in each sex/age group. *Note:* The striped part in each bar shows the percentage of people who had heard the term but did not understand it. The dark bar indicates the percentage of people who had heard the term and understood it

respectfully (see Figure 3). The percentage of HAB among all subjects, 47%, is almost the same as the Japanese standard (The Prime Minister's Office, 1998).

Differences among groups and tendencies. As shown in Figures 1-3, there are two groups, the 55-69 year-old female group and the 55-69 year-old non-exercise group, that had no correct answers, creating large numerical differences among several groups. The other differences among the correct answer percentages shown were examined with the Chi-Square test. Results indicated significant differences between the following groups: for the

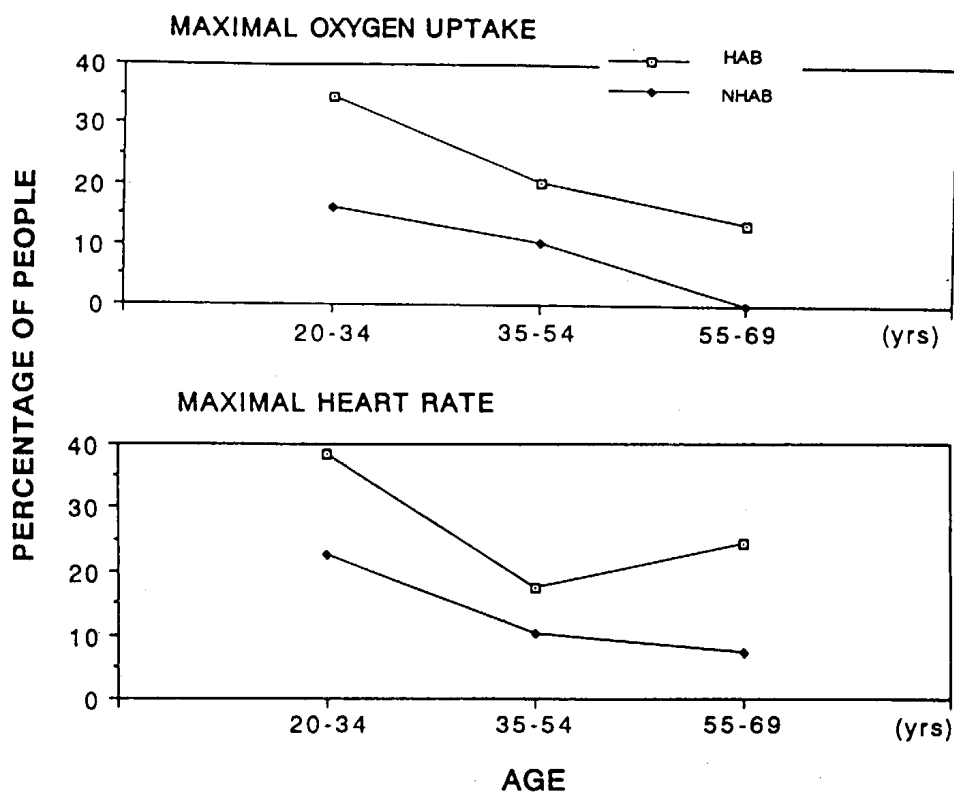


Figure 3. The percentage of people in each group characterized by exercise habits who had heard of the term and answered the question correctly. *Note:* HAB indicates people who have exercise habits. NHAB indicates people who do not have exercise habits.

correct answers to HR, the 20-34 year-old male group and the male student group ($\chi^2=6.095$, $p<0.05$); the 20-34 year-old male group and the 35-54 year-old male group ($\chi^2=6.289$, $p<0.05$); for VO, the male and female groups of the 35-54 year-olds ($\chi^2=13.07$, $p<0.001$). For the exercise habit variable, significant differences were found between the two 55-69 year-old groups for HR ($\chi^2=5.524$, $p<0.05$), and between the whole group of HAB and that of NHAB both for HR ($\chi^2=6.927$, $p<0.01$) and for VO ($\chi^2=8.419$, $p<0.01$).

The trends for correct answers revealed higher rates of knowledge in young adults, and lower knowledge levels in the middle-aged, elderly, and university students group. In other words, the curve for exercise knowledge is shaped like a butte having a pinnacle at the young adults group (see Figure 4). However, the level of the rates in every group is far below the desirable knowledge level hypothesized earlier. In comparing habitual exercisers (HAB) with non-exercisers (NHAB), the

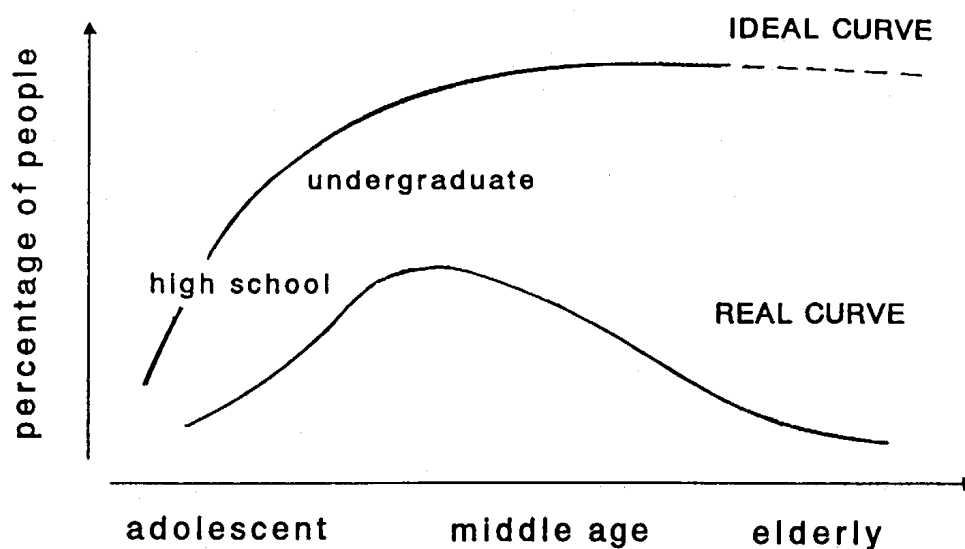


Figure 4. A conceptual picture showing the ideal percentage and the real percentage of people who have a basic knowledge of cardiorespiratory fitness exercise.

percentage of correct answers among HAB tends to be higher than among NHAB for both exercise terms used in Test B. Further, the continual decline in knowledge that occurs across age groups is observed for both HAB and NHAB groups for both exercise terms.

Comparative consideration. First, to understand the meaning of the results in Test A, the trend in the 1990 American survey (National Center for Health Statistics, 1993) should be examined. In the US survey, the percentage of American people who had correct answers was 5.2% of all the respondents. Although the age groups were divided differently from age groups in our examination, both the male and female groups of 30-44 year-olds in the American survey were the most knowledgeable (6.0% and 7.5%, respectfully). In the current study, the 35-54 year-old groups, similar to the American results, have higher correct rates than the others, but the percentage of knowledgeable people is further limited overall.

This extremely low percentage of correct answers among Japanese people was predictable because the American fitness exercise recommendation has not been introduced and publicized to the general population except perhaps to university students or to some special interest groups. It is likely, therefore, that the percentage of correct answers among Japanese people should be interpreted as the percentage of people who guessed correctly rather than who had actual knowledge. Nevertheless, it does reveal differences between people's thoughts and the exercise recommendations.

Although there are a few different procedures in testing knowledge in Test B from the authors' earlier 1992 survey (Arimoto, Kijima, & Muramatsu, 1994), it is instructive to compare the two studies' results. The previous survey suggested that among Japanese people, younger adults (20-34 year-olds) have more knowledge than older people (35-54 year-olds), few older females have correct exercise knowledge, and people who already have

exercise habits tend to be more knowledgeable. These findings did not differ from those in the current study whose respondents were recruited from a wider age range and divided into more age groups than previously.

Discussion

An educational perspective. The concepts of maximal heart rate and maximal oxygen uptake are so important for developing and maintaining physical fitness for most people, the topics are now a part of high school textbooks. It should be realized from the results of this study that the real curve indicating the public's general exercise fitness knowledge level is far below ideal levels. In concert with this information, the previously mentioned ideal curve should be set as a societal exercise and fitness knowledge goal. Accordingly, teachers, instructors, and counselors who are in charge of exercise programs such as physical education and training, fitness exercise, and exercise regimens are urged to make a greater effort in their professions.

One explanation of the current exercise and fitness knowledge level could be described as follows. First, high school students do not learn the information satisfactorily, for several reasons. For example, high school students are busy with other subjects studying for college entrance examinations. Also, physical educators do not always give teaching exercise and fitness science a high priority. On the contrary, in many universities where the theory of physical education or fitness science is offered as a course, students are likely to learn the basic concepts. As a matter of course, not all people have studied in the university, but Japan has maintained a relatively high level, more than 30%, of university attendance in its population. Some people in the 20-34 year-old age group studied in such university courses. Most people over 35 years of age, however, were students when scientific knowledge about maximal heart rate and maximal oxygen uptake

were not stressed in the educational programs. For example, a well-known book on an aerobic exercise program written by Kenneth Cooper was first published in 1970. It was translated into Japanese (Hirota & Isikawa, 1972), and the first Japanese scientific guidelines on the relationship between oxygen uptake and heart rate were published years later (Research Center of Physical Education, 1976). Recently, a committee of Ministry of Health and Welfare (Health Services Bureau, 1994) has directed a desirable amount of exercise for health by using the terms oxygen uptake and heart rate.

Although practicing a health and fitness exercise program has been recommended, and as a matter of course the administrative measure has been implemented, there are a number of people who never have had exercise and fitness instruction in their educational programs. For people in this circumstance, social activities seem not to have been an effective way to spread exercise and fitness knowledge. Therefore, two recommendations to improve the situation are made as a result of this study. One is to improve teaching about fitness and exercise in high schools; the other is to strengthen social opportunities that include exercising. In criticizing traditional physical education programs in the United States in which motor skill acquisition is the exclusive focus, Rate & Hohn (1994) recommended that programs in physical education should focus more on the promotion of lifelong activity and fitness, emphasizing knowledge and attitudes. The same recommendation should apply to physical education in Japan, too.

Finally, the finding of no difference in exercise knowledge between students who either belonged to sport clubs and teams in high school or did not, was unlike the adult tendency of more knowledge among exercisers. Concerning cardiorespiratory fitness knowledge, both groups of university freshmen had very little exercise knowledge. This indicates perhaps that their previous physical activities were mostly occupied by practice to enhance sport skills, not to strengthen physical fitness by applying scientific

principles. Or, although students may have had a training program, teaching information about cardiorespiratory fitness might have been neglected. In this aspect, the substantive elements of sports and physical activities participated in by students and the general adult public might be often different from each other.

In its review of several studies, the US surgeon general's report (US Department of Health and Human Services, 1996) states, "Although previous physical activity during adulthood has been consistently related to physical activity among adults and stage of change, history of physical activity during youth has been unrelated to adult physical activity (p.216)." It would be conceivable that physical activity containing health-oriented programs during youth will promote participating in physical activity in their adulthood. This point, however, should be probed in another study.

Conclusion

The percentage of people who understood the meaning of cardiorespiratory fitness exercise terms was considerably lower when compared with the ideal percentage. Sports activities in conjunction with physical training are likely to be the opportunities in which people become aware of the information to promote physical fitness and enhance their knowledge about health exercise. The results in this survey indicate that this trend is true for adults' activity. However, at the same time, the current investigation suggests that the sports process in which people participate falls short of providing an opportunity for people to learn basic knowledge to enhance cardiorespiratory exercise fitness, especially in school club activities. Therefore, it should be emphasized that in order to increase everyone's knowledge about exercise and fitness, more educational opportunities should be provided.

Note: This paper has been revised, with additional information, from a poster presented by M. Arimoto at the 1996 International Pre-Olympic Scientific Congress at Dallas, Texas. The idea and data in this paper are the same as the poster.

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