Understanding of Physical Fitness Terminology and Exercise Habits

Comparing Cases in America and Japan

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Physical activity and fitness have been recognized as important objectives for people wishing to promote their health, as shown in *Healthy People 2000.*[17] This is a common trend in all industrialized countries including the United States and Japan. In these countries, where the ideas of convenience, labor-saving devices and mechanization are important, it seems difficult for people to conquer their inactivity without a conscious effort. As a matter of fact, the report of the national survey on health promotion and disease prevention (HPDP)[12] indicates that 40% of American adults participate in sports or exercise regularly, but only 28% of American adults are active at a high enough level to benefit from their physical activity. Moreover, inactive people, who are recognized to have a risk of cardiovascular disease, constitute 40% of all American citizens, according to Sallis and Mckenzie.[15]

Under these circumstances, there is a problem concerning how to encourage more people to participate in sports and other

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physical exercise activities, primarily through increasing the amount of physical activity in daily life. One important way to solve the problem is to enhance people's knowledge of physical fitness and its methods.[8,16] Having acquired such knowledge, people would be more likely to participate and do their exercise effectively and safely.

The HPDP[12] examined how many people know the appropriate exercises for maintaining or improving cardiovascular fitness of apparently healthy people; also Slava et al.[16] administered a knowledge test for college alumni to examine the effect of a special educational course. Aside from these two studies, few investigations regarding this issue for adults have been done. In Japan, there had been no surveys from this view point.

In 1992, the authors adopted a knowledge test as a part of a questionnaire which would investigate the awareness and true state of affairs regarding fitness activities of those Japanese who are users of public sports centers in Yokohama, Japan. Not long afterwards, we had an opportunity to conduct a survey using the same knowledge test in Eugene, Oregon. The knowledge test is short, but the basic questions to be answered in both countries are: (1) to what degree do people participate in exercise/fitness activities, and (2) how familiar are people with terminology used in relation to exercise/fitness topics.

Understanding the present status of such knowledge could help public awareness campaigns and educational activity organizations improve their principles and practices. Because this survey was conducted in limited areas in the two countries, the results can not be generalized themselves. Instead, they are treated as a case study. This paper describes interesting findings of common tendencies and differences comparing the two cases.

Method in survey and analysis

Items and form. This knowledge test was developed by the

authors who have had the opportunity to consult people and their fitness and training programs. Eight terms were adopted in this test. Although the term *fitness* has two relatively different concepts,[3] performance-oriented fitness and health-oriented fitness, there is frequently very little difference in the terminology. The fitness terms selected for the knowledge test were chosen with an interest in the field of health-oriented fitness.

The terms adopted were: *maximal heart rate* (indicated by HR), *maximal oxygen uptake* (indicated by VO), *overload* (indicated by OL), *10RM(repetition maximum)* (indicated by RM), *aerobics* (indicated by AE), *circuit training* (indicated by CI), *ST-segment depression* (indicated by ST), and *lactic acid* (indicated by LA). Each term was provided with five choices which consisted of one correct answer, three incorrect answers, and "don't know." With the exception of *ST-segment depression,* it seems that these are important basic terms and also can be used when people practice. In particular, *maximal heart rate* and *10RM* are concepts necessary to arrive at the quality of fitness programs people practice. *ST-segment depression* is a more medical term, but it was included because the term is rather well-known by patients with or at risk for cardiovascular disease, or by people who often receive exercise prescriptions for health-related fitness.

Areas of comparison. Identical questionnaires concerning the knowledge test of health-related physical fitness terms and additional questions regarding sex, age, and exercise participation (in aerobics, resistance exercise and calisthenics) were given to both America and Japanese subjects. The results of these portions of the questionnaire are analyzed here. However, questions I-E, asking learning experience, and I-H, asking experience of receiving exercise prescription, were not included in the Japanese questionnaire (See Appendix). Question I-M, motivation for participation in exercise and sports, is similar to a Japanese question in its content, but the form is different. In this paper, the responses to these informational questions will be described as supplementary

information.

Subjects for analysis. In Japan in March 1992, users of public sports centers in Yokohama were recruited as subjects for this survey. Questionnaires were completed by 997 subjects aged 20 to 54 years, the group finally adopted as the data which should be analyzed. Similarly in America, this survey was conducted for one month starting in the middle of July, 1992. Individuals surveyed were American citizens who lived in or were visiting Eugene, Oregon. The survey was conducted in public parks, on the streets, and on the campus of the University of Oregon. As a result, data were collected from 253 subjects between the age of 20 to 54 years old.

Methods. Before the survey, the following hypotheses were set: (1) the more one is interested in physical fitness, the more likely he or she is to have an understanding of physical fitness terms; and (2) people who live in areas or environments where physical fitness is well established are likely to know the terms well. Therefore, in general, Americans are likely to know physical fitness terms better than Japanese because the prevalence of physical fitness awareness in America has been experienced longer than that of Japan. In summary, it can be said that the more one is involved in something, the more one knows about it.

The data are treated as case studies because the method of sampling was not randomized in either location. Nevertheless, if our hypotheses are correct, the data will reflect that. Data are reported as the percentage of correct responses for each item, thus revealing knowledge of physical fitness terms among Americans and Japanese in these age groups and exercise habits groups. The degree to which people are knowledgable about physical fitness terms probably reflects the quality of people's activity in terms of fitness.

Primarily, the knowledge test was designed to be administered and provide a formative or summative evaluation in school programs, and to screen people for special certification

programs.[5,9,11] This brief knowledge test was not intended to totally judge the fitness knowledge of each individual, but rather to arrive at an understanding of the prevailing knowledge regarding each term. Therefore, this could be called a process of formative evaluation for specialized groups. Accordingly, the percentages of correct answers to each item are analyzed by making comparisons among the groups categorized by some characteristic. The differences between groups are examined by Chi-squared (X^2) tests.

First, subjects were divided into four groups according to age and sex. The different age groups were divided by sex and by

Table 1. Number of Subjects

Age group	American			Japanese		
(in years)	Male	Female	Total	Male	Female	Total
20-24	47	31	78	71	58	129
25-29	12	14	26	92	48	140
30-34	17	13	30	64	63	127
20-34	76	58	134	227	169	396
35-39	9	22	31	57	116	173
40-44	11	32	43	82	118	200
45-49	16	18	34	52	82	134
50-54	6	5	11	44	50	94
35-54	42	77	119	235	366	601
Total	118	135	253	462	535	997

two different age groups, one classified as 34 years old and under (Younger Group), the other as 35 years old and over (Older Group). There are found in Table 1. There are two reasons that the division was decided between 34 and 35 years of age: to keep a balance of the numbers in groups and because this is an age breakdown commonly used in exercise testing.[2]

There are several ways to classify people's exercise habits. In

Table 2. Number of subjects comprising each group, categorized by exercise habits.

AMERICAN

Sex/age group	NHAB n (%)	SATIS n (%)	AERO n (%)	RESIS n (%)	UNKNOWN n (%)	Total n (%)
Younger male	15(19.7)	30(39.5)	16(21.1)	6(7.9)	9(11.8)	76(100.0)
Older male	13(31.0)	12(28.6)	6(14.3)	6(14.3)	5(11.9)	42(100.0)
Younger female	25(43.1)	21(36.2)	7(12.1)	3(5.2)	2(3.4)	58(100.0)
Older female	28(36.4)	15(19.5)	22(28.6)	8(10.4)	4(5.2)	77(100.0)
Total	81(32.0)	78(30.8)	51(20.2)	23(9.1)	20(7.9)	253(100.0)

JAPANESE

Sex/age group	NHAB n (%)	SATIS n (%)	AERO n (%)	RESIS n (%)	UNKNOWN n (%)	Total n (%)
Younger male	93(41.0)	82(36.1)	18(7.9)	34(15.0)	0(0.0)	227(100.0)
Older male	93(39.6)	61(26.0)	19(8.1)	58(24.7)	4(1.6)	235(100.0)
Younger female	100(59.2)	30(17.8)	15(8.9)	24(14.2)	0(0.0)	169(100.0)
Older female	191(52.2)	56(15.3)	77(21.0)	39(10.7)	3(0.8)	366(100.0)
Total	477(47.8)	229(23.0)	129(12.9)	155(15.6)	7(0.7)	997(100.0)

Explanation of Abbreviations: SATIS: Group consisting of people who satisfy ACSM criteria. AERO: Group consisting of people who satisfy the aerobic criteria of ACSM. RESIS: Group consisting of people who satisfy the resistance exercise criteria of ACSM. NHAB: Group consisting of people who do not satisfy any criteria of ACSM.

1990, the American College of Sports Medicine (ACSM)[1] stated a recommendation for apparently healthy adults, with criteria that people should do aerobics exercise lasting at least 20 minutes 3-5 days a week, and should do resistance exercises 2 days a week. In this paper, these criteria were used to classify our subjects. That is, a subject who answered that he or she does aerobic exercise 3 days or more and does resistance exercise 2 days or more per week was labeled *Satisfactory* (indicated by SATIS), and those who did not were labeled *Non-exercise habits* (indicated by NHAB). Also, those who did only aerobics 3 days or more a week were labeled AERO and those who did only resistance exercise were labeled RESIS. The number in each group can be seen in Table 2.

This 5-foil knowledge test and the same test with one wrong answer eliminated from each item (4-foil) were administered to 161 college students at the beginning and end of a one and a half hour class. This was to examine reliability of this test. The correlation coefficient of the total scores acquired in the two tests was .682. Probably, the results of a test-retest using the exact same test would produce a higher correlation coefficient. In addition, a correlation coefficient of reliability was calculated by comparing items in the 5-foil test that were answered correctly with the same item in the 4-foil test. Results of this comparison yielded a .943 correlation coefficient.

Results

Percentages of correct answers for each group, classified by sex and age, are found in Table 3. In the case of Americans, the highest percentage of correct answers is 79.4% for AE followed by CI, LA, HR, VO, ST, and LA in descending order. There are some big differences among the percentages.

Significances of percentage differences are found in Table 4. In comparing females and males, males' percentages are higher

Table 3. Percentages of correct answers for each group

AMERICANS

Item	Total	YM	YF	OM	OF	NHAB	SATIS	AERO	RESIS
AE	79.4	78.9	74.1	78.6	84.4	74.1	88.5	82.4	73.9
CI	57.7	73.7	46.6	42.9	58.4	51.9	71.8	56.9	34.8
LA	45.1	53.9	41.2	54.8	33.8	37.0	55.1	49.0	21.7
HR	27.3	31.6	25.9	35.7	19.5	23.5	28.2	37.3	8.7
RM	24.5	34.2	32.8	14.3	14.3	21.0	30.8	21.6	21.7
VO	20.2	25.0	22.4	14.3	16.9	12.3	28.2	23.5	21.7
ST	7.5	6.6	5.2	7.1	10.4	3.7	9.0	7.8	4.3
OL	7.1	5.3	12.1	7.1	5.2	2.5	14.1	5.9	4.3

JAPANESE

Item	Total	YM	YF	OM	OF	NHAB	SATIS	AERO	RESIS
AE	58.5	61.2	65.1	56.6	54.9	55.3	67.2	52.7	59.4
CI	41.0	62.1	42.6	50.2	21.3	35.0	52.0	31.8	50.3
LA	39.1	51.1	35.5	47.2	28.1	35.0	49.3	38.0	38.1
VO	23.7	37.9	16.6	37.4	9.3	20.8	30.6	18.6	25.2
RM	19.1	38.3	14.8	24.3	5.7	13.0	33.2	14.0	21.3
HR	18.6	23.8	17.8	26.0	10.9	15.9	28.4	13.2	15.5
OL	12.4	16.3	14.2	11.5	9.8	11.9	17.5	7.0	10.3
ST	7.5	8.8	12.4	8.5	3.8	6.9	10.5	5.4	6.5

Note: YM, YF, OM and OF indicate younger male, yonger female, older male and older female.

than females' in five items: CI, LA, HR, RM, and VO, but only the differences in LA and HR are significant ($p<.001$; $p<.05$). In comparing the younger group and the older group, all items except ST are higher in the younger group, but the only significant difference is in RM ($p<.001$). Among the four sex/age

groups, percentages for the younger male group are slightly better in most items. Concerning the percentages of total correct answers, the younger male group has 38.7%, the younger female group has 32.5%, the older male group has 31.5%, and the older female group has 30.4%.

For the Japanese, the percentage of the highest correct answer is 58.5% in AE, followed by CI, LA, VO, RM, HR, OL, and ST in descending order. Comparing the sexes, the percentages of the male group in all items are higher than the female group and five significant differences are recognized among them. Also, all percentages of the younger group are higher than the older groups, and all differences are significant ($p<.05$; $p<.01$; $p<.001$). Regarding the percentages of total correct answers, the younger male group has 37.4%, the older male group has 32.7%, the younger female group has 27.4%, and the older female group has 18.0%. It is very clear that the percentage of correct female answers is low, and especially the older females' percentage is extremely low.

As American cases and Japanese cases in the groups of the same sex/age are compared, the significant differences are found in AE and CI (American>Japanese), and in VO and OL (Japanese>American) of the younger groups. Between the younger females, the significant difference that Americans are higher than Japanese is recognized only in RM. Between older males, Americans are significantly higher in OL and Japanese are significantly higher in VO. The common characteristics in comparison of the three groups is that the American correct answers to AE and CI are significantly higher than that of Japanese. Furthermore, in comparing the two older female groups, the Japanese percentages are considerably lower, and in six items there are significant differences. The lowest percentages of the female group are mainly responsible for the low percentages of the total Japanese cases.

Table 4. The results of X^2-tests on the differences between the percentages of correct answers among several groups

AMERICANS

ITEM	MAL-FEM	YOU-OLD	YM-YF	OM-OF	YM-OM	YF-OF	SATIS-NHAB	SATIS-AERO
AE	-	-	+	-	0	-	+*	+
CI	+	+	+***	-*	+***	-	+**	+*
LA	+**	+	+	+*	-	+	+*	+
HR	+*	+	+	+*	-	+	+	-
RM	+	+**	+	0	+**	+**	+	+
VO	+	+	+	-	+	+	+**	+
ST	-	-	+	-	0	-	+	+
OL	-	+	-	+	-	+	+**	+

JAPANESE

ITEM	MAL-FEM	YOU-OLD	YM-YF	OM-OF	YM-OM	YF-OF	SATIS-NHAB	SATIS-AERO
AE	+	+*	-	+	+	+*	+**	+**
CI	+***	+***	+***	+***	+**	+***	+***	+***
LA	+***	+**	+**	+***	+	+*	+***	+*
VO	+***	+**	+***	+***	0	+**	+**	+**
RM	+***	+***	+***	+***	+***	+***	+***	+***
HR	+***	+*	+	+***	-	+*	+***	+***
OL	+	+*	+	+	+	+	+*	+**
ST	+	+**	-	+**	0	+***	+	+*

Note: 1) Each name of the groups is represented as follows; MAL: male, FEM: female, YM: younger male, YF: younger female, OM: older male, OF: older female. 2) The plus and minus signs and the zeros are obtained by subtracting the latter from the former in each comparison. Differnces less than 0.5 are written 0. 3) Signs, *, **, and ***, indicate $p<.05$, $p<.01$ and $p<.001$.

Comparison in groups of different exercise habits. The percentages of correct answers of the groups with different exercise habits are shown in Table 3. The result of X^2 tests to examine the differences are shown in Table 4. In the American

case, between SATIS and AERO, only the difference in CI is significant, and SATIS and NHAB have significant differences in five items. Therefore, it must be recognized that the satisfactory exercise group is higher in fitness knowledge than the other groups. The members of RESIS were too few to test the difference from the other group.

In the Japanese cases (Table 3, 4), significant differences between SATIS and AERO, and also SATIS and NHAB are found in most items. However, between AERO and RESIS, only the difference in CI is significant ($p<.001$).

Figure 1 shows the correlative distribution of the percentages of correct answers of SATIS and NHAB. That all dots are located above the Y=X line also reveals that SATIS is superior to NHAB both in America and Japan. However, there would be a question about this statement, because the rate of the younger males in SATIS is higher than the rate in the other groups. Also, the rate of the older females in NHAB is higher than the rate in the other groups, as Table 5 indicates. This suggests that the reason the percentages of the correct answers of SATIS are higher is due to the bias of sex/age. Then, in each sex/age group of Japanese subjects, the percentages of SATIS and NHAB are compared, as the American subjects are too few to examine it with small groups. As a result, in the older groups, the differences between SATIS and NHAB are certainly small, but in almost all groups and items, the percentages in SATIS are higher, and many of those are significant.

Percentages of correct answers of items and their order. In comparing the two countries in SATIS and NHAB, the differences in CI and AE are significant in both the exercise habit groups. The order of the items in their correct answer percentages are not completely the same. Therefore, in this sense, the prevailing degree of knowledge about each term differs in the two cases. However, there are common trends. These trends are shown in

Figure 1. Paying attention to the order in both American and Japanese cases, the items having a relatively high percentage of correct answers are AE, CI, and LA; the items having an extremely low percentage are ST and OL; and the items lying in the middle of them are HR, VO, and RM. Thus, three layers (levels) of these distributions are recognized as their affinity. This affinity is also observed in the total subjects.

Figure 2 shows the result of SATIS and NHAB with American on the X axis and Japanese on the Y axis. The figure contains the same variables as Figure 1. On this figure, the dots gather at a line which is more gentle in slope than the line of Y= X. Each dot of SATIS is located where there is a slant in the upper position sliding along Y=X from the correspondent dot. The distance of two dots of ST is shorter than that of others.

The percentages relating to informational questions. Responses to the learning experience question, "Have you ever been a student or a specialist concerning physical education or physical fitness?" produced 21.3% "Yes" answers, 77.9% "No" answers, and 0.8% not responding. It was found that this question failed to discriminate between students studying in a physical education department, or some similar place, from those who were non-specialists. The percentages of correct answers in the group responding "Yes" were all higher than that in the group answering "No," and significantly higher in OL($p<.001$), CI ($p<.01$) and ST ($p<.05$).

In response to the question regarding subjects' experience of receiving exercise prescription, 24.9% of the subjects answered "Yes" and 74.3% of the subjects answered "No" to the question if they had ever had any exercise prescription or plan from a doctor or an exercise instructor. The "Yes" group had significantly higher percentages of correct answers in RM ($p<.001$), CI ($p<.05$), and ST ($p<.05$) than the "No" group.

Motivation for participation in exercise and sports. The reasons

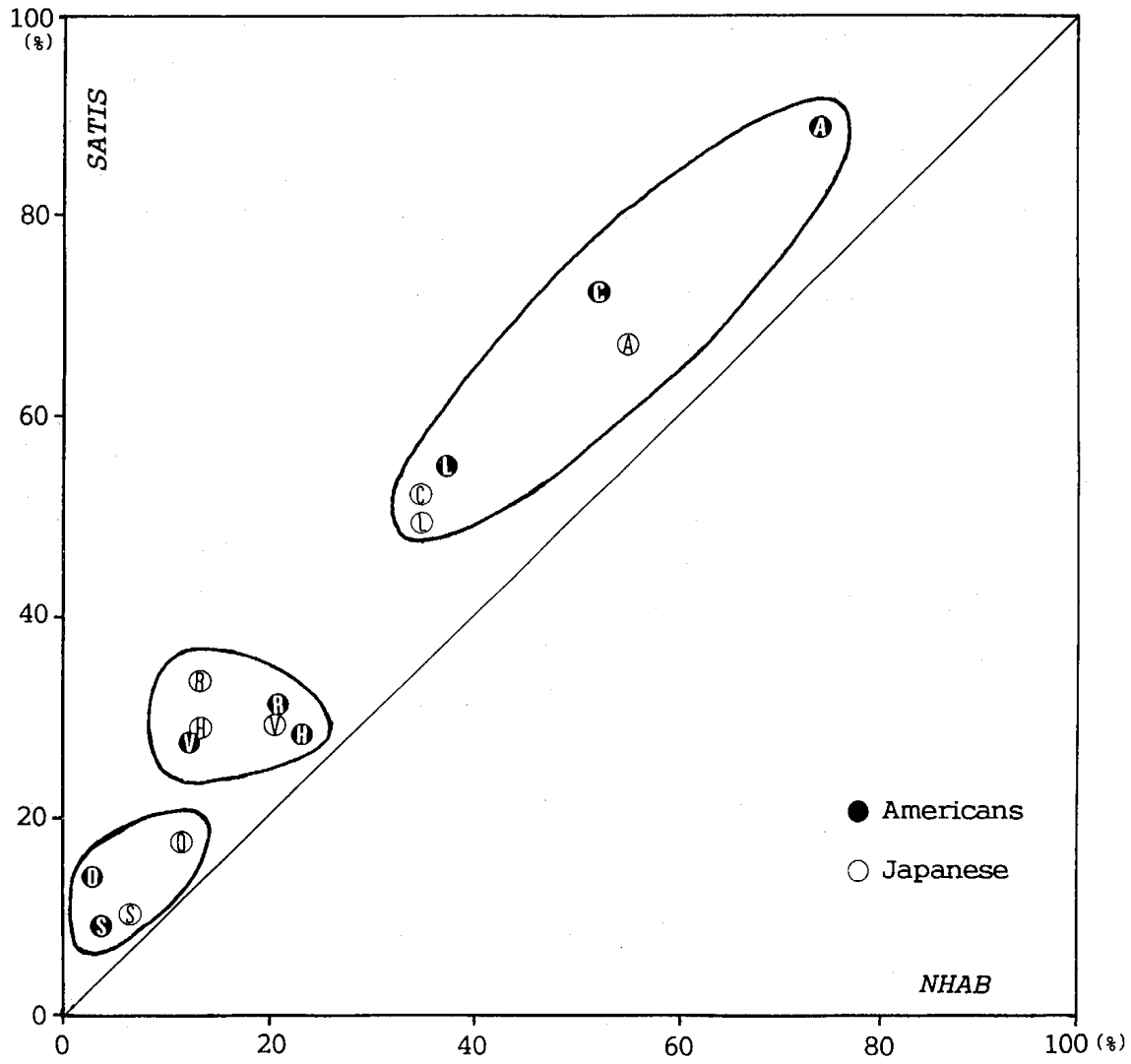

Figure 1. The percentages of correct answers to the meanings of fitness terms in the good exercise-habit groups (SATIS) and in the non-exercise-habit groups (NHAB).

why a subject participates in exercise or sport activity were provided as questions as follows: (1) to improve health and fitness level, (2) for my own pleasure and amusement, (3) to keep peace of mind or enhance emotional strength, (4) to spend spare time with friend(s) or family, (5) to look better or to lose weight, and (6) for competition and winning. The subjects in the survey were requested to answer either, "Not at all," "Somewhat," or "Very much." Those who circled "Very much" for reason (1), to

Table 5. The percentages of the members of each group categorized by sex and age into Satisfactory and Non-exercise-habit groups.

Groups	Total	YM	YF	OM	OF
AMERICANS					
Satisfactory	78(100.0)	30(38.5)	21(26.9)	12(15.4)	15(19.2)
Non-habit	81(100.0)	15(18.5)	25(30.9)	13(16.0)	28(34.6)
JAPANESE					
Satisfactory	229(100.0)	82(35.8)	30(13.1)	61(26.6)	56(24.5)
Non-habit	477(100.0)	93(19.5)	93(19.5)	100(21.0)	191(40.0)

Note: The figures without parentheses are the number of people in each group and the figures within parentheses are the percintages of each group compared to the total.

improve health and fitness level, or (5), to look better or to lose weight, were compared with those who answered "Somewhat" or "Not at all." The group that answered "Very much" for reason (1) or (5) had significantly higher percentages of correct answers in VO and AE ($p<.05$). Those who circled "Very much" for reason (5) were compared with those answering "Somewhat" or "Not at all" for reason (5), and had significantly lower percentages of correct answers in HR, RM, and AE. However, those who were satisfactory in the exercise criteria did not have lower percentages for the most part.

Implementing daily light exercise. Subjects in the survey were asked if they do any exercises, such as stretching or limbering-up, almost every day. Those who answered "Yes" had higher percentages of correct answers in all of the health-oriented terminology compared with those who did not, and were significantly higher in HR, AE, CI, and LA ($p<.05$), and in OL ($p<.01$). The percentages of correct answers for each group in the sex and age groups were not significantly different; however,

in SATIS and AERO, the number of those who do light exercises almost every day was significantly large, 85.9% in SATIS, 62.7% in AERO, 43.5% in RESIS, and 18.5% in NHAB. Similarly results were found in Japan.

Wrong answer analysis. Our main interest was in the percentages of the correct answers. However, large numbers of wrong answers should be paid attention to because people could be prevented from making a mistake if the cause is found. The wrong choices answered by 20% or more of all subjects were as

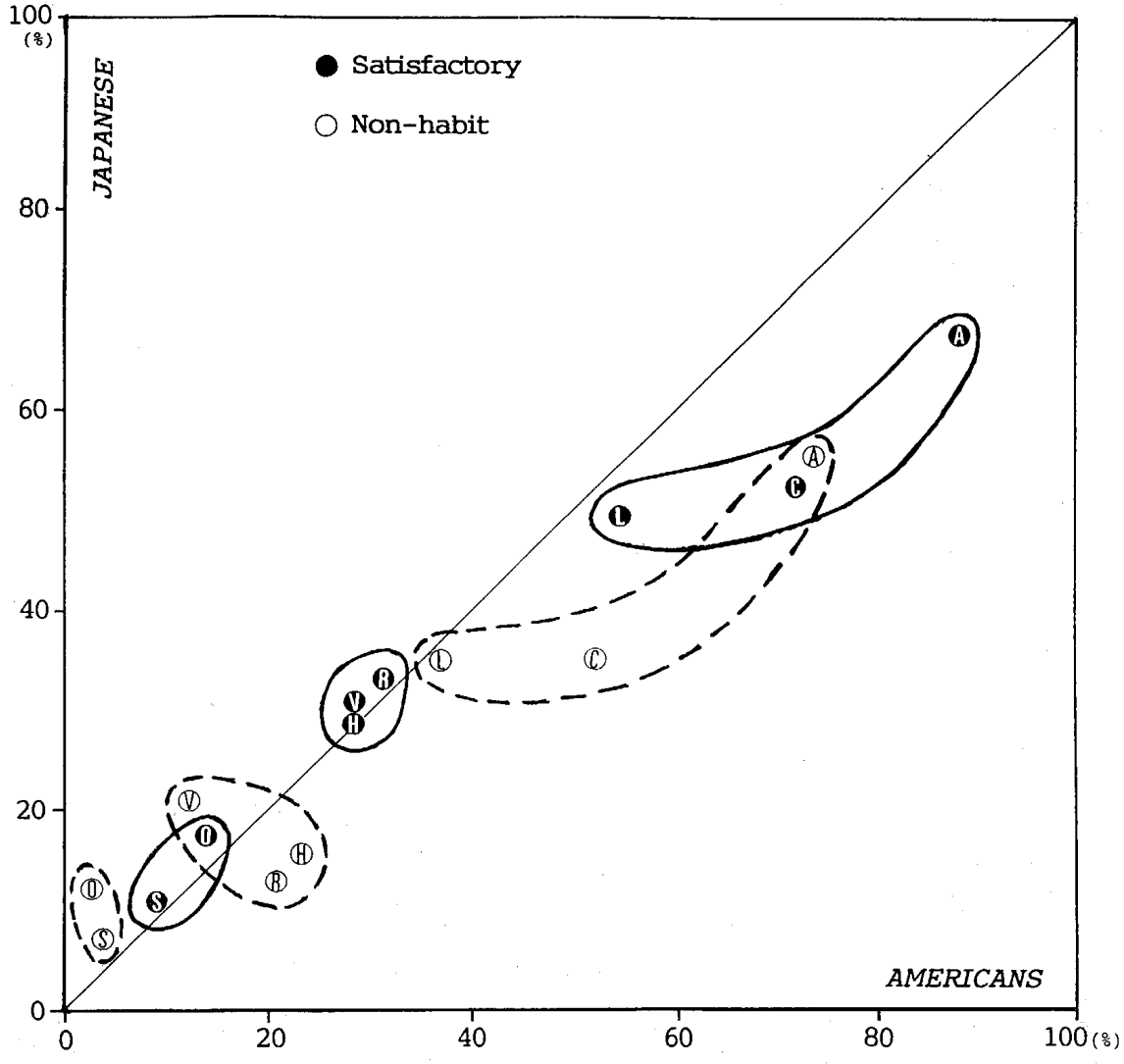

Figure 2. The percentages of correct answers to the meanings of fitness terms from the American respondents and the Japanese respondents.

follows. The Americans wrongly thought that "maximal oxygen uptake" means "regulating your breathing" (26.1%). The Japanese wrongly answered that "overload" means "the work load over the maximal load" (39.4%), that "maximal oxygen uptake" means "vital capacity" (23.8%), and that "aerobics" means "moving the body with music" (22.2%).

Reliability coefficient and item analysis. The Kunder-Richardson Formula 21 and item analysis using ETS methods recommended by McGee and Farrow[10] were applied to calculate reliability coefficients and examine test validity for both the American version and Japanese version of the knowledge test. In the American test, the mean correct scores of the 8-item multiple choice section obtained was 2.7 with a standard deviation of ±1.66, yielding a reliability coefficient of .403. The index of discrimination for the 8 items ranged from 5 to 10, which is acceptable. Regarding item difficulty, two items, ST and OL, fell below the acceptable range (below 3). The remaining two items were acceptable. In the Japanese cases, the mean was 2.1 and the standard deviation was ±1.79, with a reliability coefficient of .590. The item analysis indicated that both the difficulty rating and the index of discrimination were within the acceptable range.

Discussion

The reliability coefficients calculated from the statistical values of these cases, also applied by Kunder-Richardson Formula 21 were not acceptable, perhaps caused by the very short test length and test difficulty.[18] Basically, this formula is very conservative and estimates the lower limit of what the real reliability of the test may be, according to McGee and Farrow.[10] However, because the reliability coefficient calculated by the test-retest method was extremely high, no problem of test reliability was considered. Nevertheless, before this knowledge

test is administered again, it would be better to improve or substitute some other content for questions about OL and ST. Regardless, since the test was designed to understand which terms people know well, it appears to succeed in characterizing the common usage situation of some terms, while also indicating which are difficult terms.

Validity is a basic issue as well as reliability. Relating to validity, the basic problem in interpreting the results is determining to what degree these results reflect people's knowledge in the physical fitness field. For example, someone who does not know what maximal heart rate is might know how to control one's intensity of exercise. Or, there is the fact that there are some active people who lack knowledge, and some inactive people who possess great knowledge.[16] Or, the test score in the knowledge test does not always reflect amount of knowledge proportionally that subjects have. Also, a correct-incorrect answer does not explain the depth to which a subject knows about the term. These are basic problems in the knowledge test. With this in mind, our interpreting stands on an assumption that if one knows a term, he or she would know some related knowledge about the term and be likely to participate in some exercise properly. Below, some characteristics shown in the previous results section are considered.

First, consider the difference between the percentages of the good exercise-habit group and non-exercise habit group. The difference between the two groups is very clear. It is easily convinced that having good exercise-habits is related to having more knowledge. Then, what we have to consider is what causes that. It is disappointing to realize that fact alone does not explain if knowledge promotes forming good exercise-habits, if good exercise-habits cause sufficient knowledge, or if it is some combination of mutual influence.

What, then, does promote the acquisition of knowledge? NCHS[12] suggested that people with higher incomes and education

have a tendency toward superior knowledge about physical fitness. However, even if people's educational levels are the same, their interests and experience also influence their knowledge. For example, in a survey conducted by Brynteson and Adams II[4] on college graduates, their participation in exercise or sport activity after graduation depends on their physical education programs in the university. Slava et al.[16] evaluated the attitudes, knowledge, and activity behavior of college graduates who completed a lecture-laboratory course in physical education during their undergraduate study. They found that knowledge development was relatively high in the class and likely to contribute to participation in fitness and exercise. Likewise, in our survey, those who had experience in any class about fitness and exercise, and received any exercise prescription, produced more correct answers. Probably, people would gain fitness knowledge even without special motivation to do so during their fitness activity. Therefore, it would be reasonable that, as Rejeski and Kenney[13] recommend, people should be educated during the process of their fitness activity, for example, as they participate at a sport center or club.

Our survey indicates that having a motivation to look better or to lose weight has a positive relationship with having fitness knowledge. However, those who motivate themselves to look better or to lose weight and do not do physical exercise in the amount recommended by ACSM produce less correct answers. As long as the motivation to become physically active is never put into action, people lose opportunities to gain valuable knowledge about fitness. Thinking about fitness, by itself, is not enough —— one must *do* it.

Next, the difference of knowledge level among Japanese cases was particularly distinctive between the sexes; female groups' levels were considerably lower than males, especially the older female group which was extremely low. That reflects the different sex situation regarding social roles. Though women are

advancing into sport and exercise activity as sex equality has been sought in Japan, the inequality between sexes might still remain; perhaps, too, the inequality of social conditioning in the past continues to influence women, especially older women. Or, though the prejudice against women's participation in sport and exercise activity has largely become a thing of the past, the situation in which women tend to be responsible for house-keeping duties, in general, has continued. This situation seems to lower women's opportunity to learn.

Aside from the differences between groups mentioned earlier, physical educators and fitness instructors should think about setting specific goals for fitness knowledge and understanding. There is a statement[19] on the results of the HPDP survey which deplores the fact that too many people do not understand ACSM recommendations and exercise prescription. In our survey, the percentages of correct answers to HR, RM and VO were only about 30%, even among those who have good exercise-habits, and even though these terms are directly concerned with participation in health-related fitness. This knowledge level on average is less than adequate for safe and effective health-related fitness participation. The authors believe that the knowledge level expected nowadays for apparently healthy people should be great enough for people to participate in a safe and effective exercise program by themselves referring to some exercise recommendations such as ACSM's. Even if people do not develop their own exercise plan, or if he or she is a person with disease, it should be expected that people can understand any exercise prescription given by a reputable exercise prescriber.

As exercise/fitness science has developed, people in their exercise program should adopt its scientific procedures as well as their own physical sense of exertion control. Low-fit people and patients under a doctor's care in particular should be able to understand any exercise prescription because exercise exertion with a lack of knowledge could possibly lead to a dangerous

situation. It is expected that physical educators and fitness instructors should introduce people to these terms as basic, minimum knowledge about exercise. Instructors might often use easier words to let clients get the meaning instead of using technical terms. However, using the proper term not only enhances the level of people's scientific appreciation, but also people's expertise.

How about social conditions that could contribute to people's knowledge? How does mass communication treat these fitness terms? We researched how often these terms appeared in the Japanese newspapers which are recognized as important contributors of information in Japan. Nineteen newspapers issued from December 1990 to November 1992 were monitored. The frequency of using these terms was low. *Aerobics* appeared 132 times, *maximal oxygen uptake* appeared 45 times, *lactic acid* appeared 15 times, *maximal heart rate* appeared 8 times, *circuit training* appeared only 1 time, and the other terms did not appear. Under these circumstances, people would hardly know these fitness terms via the newspaper. On the other hand, it seems that although the number of fitness magazines have increased, the general public's knowledge of fitness terminology is still not so satisfactory, at least not according to our results.

Concerning television program's influence, on fitness knowledge, there is an interesting point to note. Previously shown in the Japanese cases, the term *aerobics* had many correct answers, but it had 22.2% wrong choices. The term *aerobics* was imported by Japan in the mid-1970s. At that time, aerobic dancing, which was called "aerobics" often appeared on the television. Consequently, the general public equated aerobic dancing as the same *aerobics* described by K. Cooper.[6] It seems that many wrong answers to the term *aerobics* are brought about by such a process. If so, the influence of mass communication should not be neglected.

Finally, let us pay attention to a common trend in both America and Japan. In comparing levels of understanding of each

term, the analysis indicated that there were several differences between the American respondents and the Japanese respondents, especially the percentages of correct answers in AE and CI. However, a common point also was discovered in that the eight terms adopted in the test were located in three levels of understanding; that is, the same items were located in the same level. In both American and Japanese cases of good exercise-habits, the upper group (AE, CI, LA) was on the 50% level and over, the middle group (RM, VO, HR) was around the 30% level, and the lower group (OL, ST) was located around the 10 to 15% level. It could be said that terms belonging to the upper group are relatively well known and have become familiar even to those who are not interested in fitness and exercise. It could also be said that terms belonging to the middle group are commonly used by those who are interested in fitness programs. Likewise, terms in the lower group could be considered as not coming into general use, and are still the jargon of exercise specialists. For example, the term *overload,* which is in the lower level, has been used as a basic term by specialists in the fitness field. However, instead of knowing the term *overload* and understanding its principle, the general public uses phrases such as "use it or lose it"[7] which has a similar, but different meaning.

Thus, in gaining fitness knowledge or enhancing people's knowledge, of course, individuals' motivation and participation in sports and exercise play an important role. At the same time, the process of gaining knowledge seems to be influenced by various social mechanisms, such as educational opportunity and methods, public service information campaigns, the mass media and even amount of leisure time.

Conclusion

The main findings in this survey were that, first, men between the age of 20-30 years in both countries have a relatively good

understanding of fitness terms. There were not distinct differences among sex/age groups in the American cases, but clearly there were differences among the sex/age groups in the Japanese. Women's groups have significantly lower results, especially women between the ages of 35-54 years. Secondly, it appears that those who have good exercise habits have a better understanding of fitness terms than those who do not. Finally, different levels of knowledge about eight physical fitness terms were observed in both America and Japan, but the levels of knowledge followed similar patterns in both countries. That is, *aerobics, circuit training,* and *lactic acid* are the terms which are relatively well known and prevail in public use, while *maximal oxygen uptake, repetition maximal,* and *maximal heart rate* are terms which are not as widely known. *Overload* and *ST-segment depression* are almost unknown terms, except among specialists. However, the common usage of the two terms *aerobics* and *circuit training* differs distinctly in the American cases and Japanese cases. The Japanese scored much lower in their knowledge of both of these terms.

Through the analysis, we found that having health-related fitness knowledge is related to having good exercise habits as we predicted. Further, the prevailing fitness knowledge level of the public is insufficient to promote satisfactory levels of fitness in America and Japan. If a person learns the correct information, he or she gets turned in the right direction to do exercise safely and effectively. To know is not necessarily to do, but knowledge must be the origin of wise behavior. For this reason the authors emphasize the importance of having fitness knowledge.

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付記）アメリカ人に対する本調査は，有本の在米中に実施された．1991年9月からの１年間，有本を国外研究員としてオレゴン大学に派遣された横浜商科大学に対し，心から感謝の意を表します．

Appendix

STUDY OF PHYSICAL FITNESS KNOWLEDGE AND EXERCISE HABITS

Please circle the most appropriate number in each item.

Part I. ABOUT YOURSELF

A. Gender 1. Male 2. Female

B. Age
1. 19 years & under
2. 20-24 years
3. 25-29 years
4. 30-34 years
5. 35-39 years
6. 40-44 years
7. 45-49 years
8. 50-54 years
9. 55-59 years
10. 60 years & over

C. Are you an American citizen?
1. Yes 2. No

D. Where do you live?
1. Urban area of Oregon
2. Rural area of Oregon
3. Urban area of another state
4. Rural area of another state

E. Have you ever been a student or a specialist concerning physical education or physical fitness?
1. Yes 2. No

F. What is your primary occupation? (Circle only one.)
1. Full time student
2. Part time student
3. Full time employee
4. Part time employee
5. Not employed

G. If you are employed, circle all activities for which more than 25% of your time is spent. (*If not employed, skip to the next question.*)
1. Sitting at desk
2. Lifting or carrying loads
3. Standing
4. Walking
5. Driving

H. Have you ever had any exercise prescription or plan from a doctor or an exercise instructor?
1. Yes 2. No

I. Do you do any light exercises such as stretching or limbering-up almost everyday?
1. Yes 2. No

J. Do you usually do any resistance exercises (e.g., push-ups, pull-ups, sit-ups, weight training, etc.) two times or more a week?
1. Yes 2. No

K. On average, how often and how much do you engage in continuous exercise and/or sports? (Circle one for each category.)

HOW OFTEN	HOW MUCH
1. Not at all	1. Not at all
2. Less than 1 day/week	2. Less than 20 min./day
3. 1-2 days/week	3. 20-40 min./day
4. 3-4 days/week	4. More than 40 min./day
5. 5-7 days/week	

If you answered "1" in HOW OFTEN, please skip to Part II, FITNESS TERMS on back.

L. Please list the most frequent then second most frequent exercise or sport activity in which you engage.

1._____ 2._____

M. How important is each of the following statements concerning the reason why you participate in exercise and/or sport activity?

1 = Not at all 2 = Somewhat 3 = Very much

1. To improve health and fitness level	1	2	3
2. For my own pleasure and amusement	1	2	3
3. To keep peace of mind or enhance emotional strength	1	2	3
4 To spend spare time with friend(s) or family	1	2	3
5. To look better or to lose weight	1	2	3
6. For competition and winning	1	2	3

Continue on next page

For each item below, please circle the answer that most accurately conveys the meaning of the term.

Part II. FITNESS TERMS

A. 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'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 ages of 20 and 40 years.
4. there is some difference in one's maximal heart rate between the ages of 20 and 40, but there is no difference among people over 40 years of age.
5. do not know the answer.

B. *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.
5. do not know the answer.

C. *Over load*

1. means that the body reacts excessively.
2. means the work load necessary to have a training effect.
3. means the pace in a race that is faster than usual.
4. means the work load over the maximal load.
5. do not know the answer.

D. *10RM (Repetition Maximum)*

1. means 10 repetitions with the maximal weight that a person can lift.
2. means that 10 repetitions produce the maximal effect regardless of what weight a person uses to lift.
3. means the maximal number of repetitions that a person can lift 10 pounds of weight.
4. means the maximal weight that a person can lift 10 times.
5. do not know the answer.

E. *Aerobics*

1. means moving the body with music.
2. means regulating your breathing.
3. means training using air resistance.
4. means exercise that requires the utilization of oxygen.
5. do not know the answer.

F. *Circuit training*

1. has a positive effect on muscular strength.
2. has a positive effect on endurance performance.
3. has a positive effect on both muscular strength and endurance performance.
4. has a positive effect on flexibility and balancing ability.
5. do not know the answer.

G. *ST-segment depression*

1. is a term that concerns an electrocardiogram.
2. is a term that concerns a lung function test.
3. is a term that concerns an electroencephalogram.
4. is a term that concerns a motor ability test.
5. do not know the answer.

H. *Lactic acid*

1. is one of the substances that transports oxygen in blood.
2. is one of the substances that accumulates as a result of exhausting exercise.
3. is one of the nutrients needed for exercise.
4. is one of the substances in blood broken down by vigorous exercise.
5. do not know the answer.