

## **[Reference Materials]**

### **Standardization and explanation of terminology (definition of the terms)**

#### **1) Exercise and Physical Activity Quantity for Health Promotion 2006 (physical activity, exercise, and physical fitness)**

##### **Recommended Quantity of Exercise for Health Promotion (1989)**

The “required quantity” in the previously issued “recommended quantity of exercise needed for health promotion (1989)” is patterned after the concept of a recommended allowance for nutrition in “Recommended Dietary Allowance for Japanese, 4<sup>th</sup> Revision in 1989.” “This recommended allowance of energy and each nutrient (expressed in a quantity per day for each subject) for people to achieve healthy growth; and to maintain and promote health and to prevent diseases” is chosen as the “recommended quantity of exercise desirable for maintaining health.”

In practice, the risk factors for lifestyle-related diseases (called adult diseases then), in particular risk factors for developing coronary arteriosclerosis (expressed by systolic and diastolic blood pressures, total blood cholesterol and HDL cholesterol concentrations and percentage of body fat), heart rate at the maximum intensity using a bicycle ergometer, maximum oxygen uptake estimated from exercise intensity and heart rate were used to compute a central regression line. Next, from the intersection with an abnormal value of the above-mentioned risk factors for coronary arteriosclerosis, the maximum oxygen uptake for each gender and age level, at which none of the aforementioned risk factors for coronary artery disease is abnormal, was computed. Then the quantity of exercise to maintain this maximal oxygen uptake (time per week of exercise, in which the intensity requires 50% of the maximal oxygen uptake) was computed and set as the recommended quantity of exercise.

Because the concept of a dietary reference intakes was recently adopted in the field of diet, the expression, nutritional requirement, ceased to exist and the traditional recommended dietary allowance (RDA) was replaced by The Reference Dietary Intake for Japanese, 2005 edition). Therefore to conform to the terminology in the field of diet and nutrition, it was decided not to use the term, recommended amount, that appeared in the previous reference.

### **Method to determine the reference value**

#### *Quantity of physical activity and exercise*

The subjects of the epidemiological studies showing the relationship between physical activity, exercise and lifestyle-related diseases cover a wide range, starting from all physical activities in one's daily life to those with special reference to athletic endeavors. From these studies it was found that moderate level of physical activity, not necessarily called exercise, has an effect to prevent lifestyle-related diseases. Considering that in modern society, many have difficulty in exercising regularly, a number of studies selected not only aerobic exercises but also physical activity of at least an intermediate level as their focus since the CDC/ACSM (published in 1995).<sup>11)</sup> However, the literature extracted by our systematic review includes those reporting on epidemiological findings on exercise. Thus the current study sets references for health promotion through both physical activity and exercise.

From the systematic review, the borderline values of physical activity and exercise for the group with a significant reduction in risk for developing lifestyle-related diseases (compared to the group with the least amount of physical activity and exercise) or that of the group in which the risk for developing lifestyle-related diseases significantly increased (in comparison with the group with the most physical activity and exercise) was computed. If the figure is derived from a single study, the decision is easy. However, through the efforts of many researchers, a number of

research results have been presented and the values that have been reported tend to be widely scattered. The suspicion is that this was due to the research methods employed (e.g., numbers of groups, survey methods and subjects of the studies). Nevertheless, careful examination of these reports failed to show any systematic cause for this scattering. When examined with the data classified by gender and age, no logical basis was found for dividing subjects between the ages of 20 and 69 years by these parameters. Thus the means for these values were computed and a single value for quantity of physical activity and exercise (MET·hours/w) was used as the reference regardless of gender or age.

#### *Maximal oxygen uptake*

The maximal oxygen uptake was used in relation to the Recommended Quantity of Exercise for Health Promotion in 1989; it has been suggested in many of the recent studies that this maximal oxygen uptake is a risk factor for developing lifestyle-related diseases independent of the quantity of physical activity and exercise. A systematic review was conducted on this maximal oxygen uptake. Multiple borderline values of the maximal oxygen uptake were obtained for the groups in which the risk of developing lifestyle-related diseases is significantly reduced or increased (both compared with the group in which the maximal oxygen uptake is lowest). It is appropriate to set the reference value for the maximal oxygen uptake to prevent lifestyle-related diseases between the minimum and maximum that are stratified by gender and age (in decades); so a mean was computed and used as the reference.

#### **Concept of the reference value**

As stated earlier, the values for physical activity and exercise and the maximal oxygen uptake thus obtained represent the minimum for each index of the group in which the morbidity for each lifestyle-related disease undergoes changes that are statistically significant, rather than

for the group with its physical activity, exercise and physical fitness being at the lowest within the cohort. Therefore in a simple sense, these are the minimum values at which the effect of preventing lifestyle-related diseases is expected from physical activity, exercise and physical fitness. However, lifestyle-related diseases are not related to physical activity, exercise and physical fitness alone; they may be caused by diet and other components making up one's lifestyle. Therefore even if the reference values related to physical activity, exercise and physical fitness are met, people are not necessarily protected from lifestyle-related diseases. Thus use of the phrase, the "minimum values" for physical activity, exercise and physical fitness that will protect one from developing lifestyle-related diseases, is not appropriate. According to The Dietary Reference Intake for Japanese (2005), a tentative dietary goal (DG) for the proportion of energy from fat is set between 20 to 30% vis-à-vis prevention of lifestyle-related diseases. For physical activity and physical fitness, the references that are decided this time approximate this concept. However, the word, "goal", differs from our intentions in a strict sense: to conform with the discipline of nutrition, its use was avoided and the word, reference, was used instead.

### **Validity for reference values in view of the current quantity of physical activity and exercise**

#### *Quantity of physical activity*

The reference for the quantity of physical activity is 8,000 to 10,000 when converted to the number of steps. This is considered to be more than the current figure for the number of steps that people are believed to take according to the results of the National Health and Nutrition Survey in Japan in 2004 (7,532 and 6,446 steps for men and women, respectively). The reference corresponds to the target for "Healthy Japan 21" (over 9,200 and 8,300 steps for men and women, respectively) and is considered to be an appropriate target.

### *Quantity of exercise*

The reference, 4 MET·hours/w translated into 60 min/wk (30 min/number of occasions x two) for fast walking, corresponds to what those people who regularly engage in exercise, according to the National Health and Nutrition Survey (30 min or more on each occasion, twice or more per week, continued for at least one year). The proportions of those who engage in this exercise are 30.9% of men and 25.8% of women, indicating that two-thirds of the population do not meet the level shown by the reference. This value is the minimum at which the effect of preventing lifestyle-related diseases becomes evident and is believed to represent the target at which the majority of the population should aim.

### *Amount of maximal oxygen uptake*

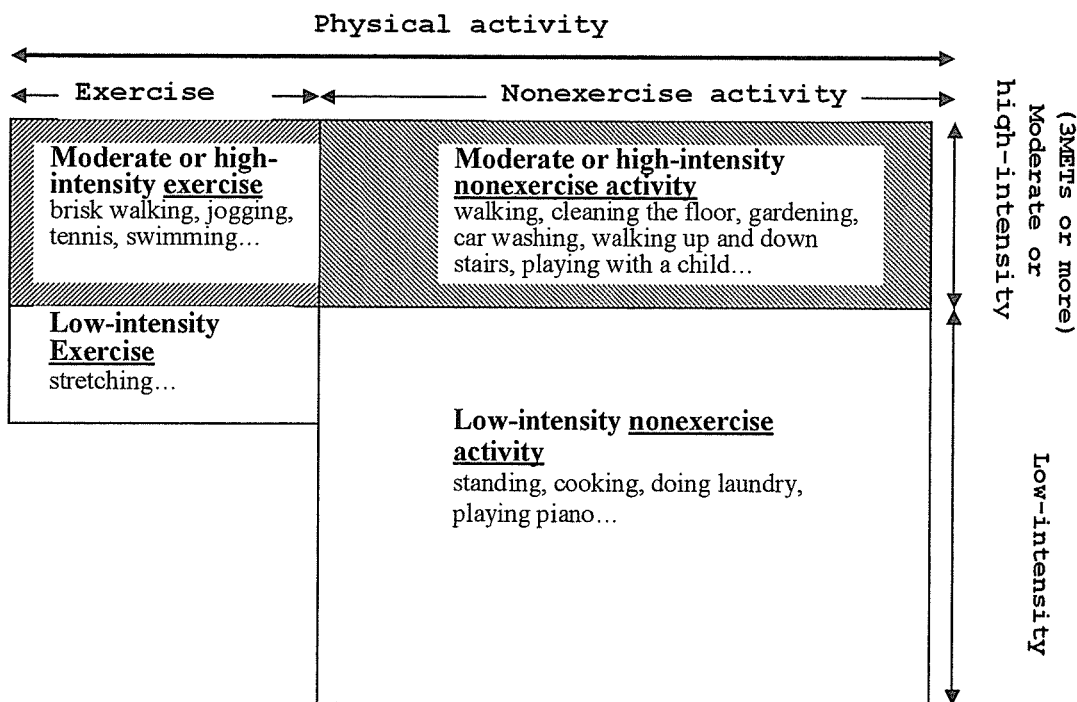
The reference for the maximal oxygen uptake was found to be slightly less than the mean maximum oxygen uptake by Japanese. This is the reference for those people whose physical fitness level is lower than what should be and who have a high risk for developing lifestyle-related diseases. Therefore it is considered to be both practical and appropriate.

As described above, the references adopted for the present revision are designed for the overall purpose of preventing lifestyle-related diseases. They are considered suitable for those people who are not exerting themselves enough in physical activity and not exercising adequately. At a low level of physical fitness, they should recognize the importance of physical endeavors in preventing these lifestyle-related diseases and start exercising. Needless to add, those people who exceed the reference values for physical activity, exercise and physical fitness should try to exceed these references.

## **2) Physical activity**

Physical activity is defined as that which is accompanied by the contraction of skeletal muscles and energy expenditure in excess of that while at rest. The activity includes nonexercise activity (termed as life-style activity), for example, everyday work, labor involved in housekeeping, and exercise or athletic activities for leisure. It should be noted that the present reference is concerned with physical activity at an intensity exceeding 3 METs or more (see the figure below).

**Fig 1: Physical activity and exercise**



### 3) Exercise

Exercise is defined as a type of physical activity: in particular, it is conducted continuously according to a well-organized plan to maintain and promote physical fitness (including that related to health and physical fitness for competitive sports). For the current reference, exercises at an intensity of 3 METs or more, such as brisk walking, jogging, running,

bicycling, swimming, tennis, badminton and soccer are concerned. Those activities at lower intensity (such as stretching) are excluded.

#### **4) Physical fitness**

There have been various definitions of physical fitness: and the expression encompasses a wide range of conditions. In setting this reference quantity of physical fitness for health promotion, physical fitness is interpreted to be a composite of multifaceted elements (latent potentials) related to the capacity to perform physical activity; or in a narrower sense, it is interpreted to be a state that can be comprehended objectively and quantitatively. It is composed of the following: 1) endurance, 2) muscular strength, 3) balancing capacity, 4) flexibility and 5) others.

#### **5) Maximal oxygen uptake ( $\text{V}_{\text{O}_2\text{max}}$ )**

Maximal oxygen uptake is defined as the maximum amount of oxygen one can take in per unit time (L/min or mL/kg/min). The amount of oxygen taken in during exercise reflects the amount of energy in the active muscles. The greater its maximum value is (i.e., maximal oxygen uptake), the greater the capacity to produce energy, indicating a capability to engage in exercise of greater intensity for a longer duration. In other words, the maximal oxygen uptake is an index for evaluating one's endurance.

The maximal oxygen uptake is measured by physical activity in which a large muscle group is used. It is often determined by walking or running on a treadmill or by a bicycle ergometer. The amount of oxygen that is taken up at the increment of exercise intensity is measured by analyzing the expired gas. With the increase in exercise intensity, oxygen uptake linearly increases and its highest amount is called maximal oxygen uptake. Confirmation of the

leveling off of oxygen uptake in response to an increment of exercise intensity is important in this process; and it is clearly differentiated from the peak oxygen uptake, which is defined as the highest level of oxygen uptake that is determined by the protocol of a graded exercise load.<sup>12)</sup> However, the peak oxygen uptake may often be used as a substitute for the maximal oxygen uptake. In general, the maximal oxygen uptake, determined while running, is 5 to 10% higher than that measured by a bicycle ergometer.<sup>13)</sup> Of the maximal oxygen uptake from the current systematic review, about 70% was based on treadmill reading, while the remainder was based on a bicycle ergometer. Therefore, the current reference reflects the results of a running exercise. Care should be taken when exercise is conducted using a bicycle ergometer.

Determining the maximal oxygen uptake requires not only an expensive piece of equipment, such as one for exercise loading, a device for the analysis of exhaled air and a recording device for electrocardiography: it also requires a number of personnel who are skilled in analysis. Therefore simple methods to estimate the maximum oxygen uptake have been designed (such as one that does not impose the maximum load on the test subject and another obviating the analysis of expired gas). Confirmed for their adequacy and reproducibility, they have been utilized in many studies.

## **6) Muscular strength**

The value for muscular strength varies widely, depending on the method adopted or the site where the measurement is made. Commonly used methods for evaluating muscular strength include: 1) isometric maximal muscular strength that is determined in such a state that the muscular length remains unchanged [maximum voluntary contraction: MVC (kg weight)] and 2) isotonic maximum muscular strength that is determined in a state in which the tension applied to the muscle remains unchanged while the muscle length is shortened [maximum elevating weight:



1 RM (kg weight)]. By adopting these methods, muscular strength in the articular movement of the extremities and truncal region is determined.

To determine the isometric maximum muscle strength of handgrip exercise, grip strength (kg weight) has been used because of its safety and simplicity. For the references for this value stratified by age and gender, nationwide data are compiled according to sex and age, based on the results of a sports test (a test for physical fitness) conducted by the Ministry of Education, Culture, Sports, Science and Technology and other related studies. These data are used as an index for muscular strength in epidemiological studies, both domestically and internationally.

#### **7) MET**

MET (metabolic equivalent) is an index for exercise intensity, calculated as energy expenditure (oxygen uptake, mL/kg/min) during specific physical activity and exercise divided by energy expended during resting in a sitting condition (equivalent of 3.5 mL/kg/min in oxygen uptake).

#### **8) MET · hour**

MET·hour is defined as METs multiplied by hours spent in physical activity and exercise. If the oxygen consumption of 1.0 liter is converted into the energy expenditure of 5.0 kcal, 1.0 MET·hour corresponds to 74 and 63 kcal with a body weight of 70 and 60 kg, respectively. For a standard body constitution, 1.0 MET·hour is energy expenditure generally equal to body weight. MET·hour is frequently used to quantify physical activity. The energy expenditure for 2, 4, 10 and 23 MET·hours used for the current references, is shown below. It should be noted that these values are total energy expenditure for physical activity or exercise: they do not represent the increment over that when the subject is at rest.

MET·hours and corresponding kcal

MET·hours	With body weight of 60 kg (kcal)	With body weight of 70 kg (kcal)
2	130	150
4	250	200
10	630	740
23	1450	1690

The following computation was made with a metabolism at rest set at 3.5 mL/kg/min and 5.0 kcal per L of oxygen uptake:

Example: energy expenditure for a person weighing 60 kg with 4 MET·hours:

$$= (3.5 \text{ ml/kg/min} \times 60 \text{ kg}/1000) \times 5.0 \text{ kcal/L} \times (4 \times 60 \text{ min})$$

$$\cong 250 \text{ kcal}$$

To simplify, energy expenditure (kcal) may be calculated from MET·hours, using METs and body weight (kg) as follows:

$$1.05 \times \text{MET·hours} \times \text{body weight (kg)}$$

MET values for major activities are shown below.

**Nonexercise physical activity of 3 METs or more (included in the computation of the reference for the quantity of physical activity)**

(The time equivalent of 23 MET·hours is expressed per day, not per week)

METs	Examples of activity	Time (min/day) corresponding to 23 MET·hours
3.0	Walking at a normal speed (on level ground, 67m/min. with a small child or a dog, e.g., shopping)	66
3.0	Fishing (sitting in a boat) 2.5 to (fishing in a stream) 6.0	66
3.0	House cleaning, putting away household items, carpentry, packing, etc.	66
3.0	Playing a guitar in a rock and roll band (standing)	66

3.0	Loading/unloading a car	66
3.0	Walking down the stairs	66
3.0	Child care (standing)	66
3.3	Carpet sweeping and sweeping floors	60
3.3	Walking (on level ground, 81 m/min., e.g., commuting)	60
3.5	Mopping, vacuuming, packing boxes and carrying a light load	56
3.5	Electrical work and plumbing	56
3.8	Scrubbing floor and bathroom cleaning	52
3.8	Walking for exercise (on level ground, pace = 94 m/min.)	52
4.0	Walking at a brisk pace (on level ground, pace = around 95 to 100 m/min.)	49
4.0	Bicycling :< 16 km/h, as a leisure activity, to commute to work or for pleasure	49
4.0	Playing with a child or a pet (walk or run, at a moderate intensity)	49
4.0	Removing snow from the roof	49
4.0	Playing a drum	49
4.0	Pushing a wheelchair	49
4.0	Playing with a child (walk or run, at a moderate intensity)	49
4.5	Planting trees, weeding or cultivating a garden	44
4.5	Farming: feeding domestic animals	44
5.0	Playing with a child or a pet (walking or running vigorously)	39
5.0	Walking at a very brisk pace (on level ground, very brisk pace = 107 m/min.)	39
5.5	Mowing the lawn (walking while pushing a power mower)	36
6.0	Moving or transporting household items or furniture	33
6.0	Shoveling snow	33
8.0	Carrying heavy loads	25
8.0	Farming: baling hay, cleaning the barn, poultry work, with vigorous effort	25
8.0	Climbing the stairs	25
9.0	Carrying a load upstairs	22

**Exercise of 3 METs or more (included in the computation of the reference for the quantity of exercise)**

METs	Examples of activity	Time (min/day) corresponding to 4 MET·hours
3.0	Bicycling using a stationary ergometer: 50 watts, requiring very light effort	80
3.0	Weight lifting (light to intermediate intensity)	80
3.0	Bowling	80
3.0	Playing with a Frisbee	80
3.0	Playing volleyball	80
3.5	Doing calisthenics at home (requiring light or moderate effort)	69
3.5	Playing golf, using a powered cart	69
3.8	Walking for exercise (on level ground, pace = 94 m/min.)	63
4.0	Walking at a brisk pace (on level ground, pace = around 95-100 m/min.)	60
4.0	Doing water exercises or water calisthenics	60
4.0	Playing table tennis or ping-pong	60
4.0	Doing Tai chi	60
4.0	Doing aquabics or water aerobics	60
4.5	Playing badminton	53

4.8	Doing ballet or modern dance, twist, jazz or tap dancing	50
5.0	Playing softball or baseball	48
5.0	Doing children's games (stone kicking, dodge ball, playing with a toy, or marbles, etc.)	48
5.0	Walking at a very brisk pace (on level ground, very brisk pace = 107 m/min.)	48
5.5	Bicycling using a stationary ergometer: 100 watts, requiring light effort	44
6.0	Weight lifting (of high intensity, power lifting or body building)	40
6.0	Doing slimnastics, jazzercise	40
6.0	Jogging-walking combination (jogging component lasting less than 10 min)	40
6.0	Playing basketball	40
6.0	Swimming with slow strokes	40
6.5	Doing aerobics	37
7.0	Jogging	34
7.0	Skating	34
7.0	Playing soccer	34
7.0	Playing tennis	34
7.0	Swimming, backstroke	34
7.0	Skating or skiing	34
7.0	Skiing	34
7.5	Mountain climbing carrying a 1 to 2 kg load	32
8.0	Cycling (approx. 20 km/h)	30
8.0	Running: 134 m/min.	30
8.0	Swimming, slow crawl (approx. 45 m/min.), light to intermediate intensity	30
10.0	Running: 161 m/min.	24
10.0	Doing judo, jujitsu, karate, kick boxing and tae-kwan-do	24
10.0	Playing rugby	24
10.0	Swimming, breaststroke	24
11.0	Swimming, butterfly	22
11.0	Swimming, fast crawl (approx 70 m/min.), requiring a vigorous effort	22
15.0	Running up the stairs	16

**Reference: Activities of less than 3 METs (those that cannot be included in the computation of the reference for the quantity of physical activity and exercise)**

METs	Examples of activity
1.0	Sitting quietly (or lying down) while watching television or listening to music; reclining; riding in a car
1.2	Standing quietly
1.3	Reading a book or newspaper (in a sitting position)
1.5	Conversing or talking on the phone, reading, eating, operating a car, doing light desk work, knitting, doing a manual craft and typing (in a sitting position)
1.5	Taking care of a pet (in a sitting position, light intensity)
1.5	Bathing (while sitting)
1.8	Conversing or talking on the phone, reading and doing a manual craft (while standing)
2.0	Cooking or preparing food (standing or sitting)
2.0	Putting away laundry, washing and packing (standing)
2.0	Playing guitar, classical or folk (sitting)
2.0	Dressing

2.0	Talking and eating or eating only (standing)
2.0	Grooming (e.g., tooth brushing, hand washing and shaving)
2.0	Showering, toweling off (standing)
2.0	Walking slowly (on level ground, outdoors or indoors, slow pace = less than 54 m/min.)
2.3	Washing dishes (standing) and ironing, putting away clothes or laundry
2.3	Casino gambling and operating a duplicating machine (while standing)
2.3	Working while standing (working in a store or factory)
2.5	Stretching and doing yoga
2.5	Light cleaning (dusting, straightening up, changing linen and carrying out trash)
2.5	Serving food, setting table, cooking or food preparation, and putting away (walking), etc.
2.5	Watering plants
2.5	Playing with a child (sitting, light intensity) and taking care of a child or pet
2.5	Caring for a child (sitting)
2.5	Playing piano or organ
2.5	Farming, operating a harvester, cutting hay, doing irrigation work and other light activities
2.5	Playing catch (football or baseball)
2.5	Operating a motor scooter or motorcycle
2.5	Pushing a baby stroller or walking with a child
2.5	Walking at a slow pace (on level ground; slow pace = 54 m/min.)
2.8	Playing with a child (standing, light intensity), taking care of a pet (walking or running, at light intensity)

\* Indicates exercise: the others are classified as physical activities.

(Ainsworth BE, Haskell WL, Whitt MC, et al. Compendium of physical activities: an update of activity codes and MET intensities. Med Sci Sports Exerc, 2000; 32 (Suppl): S498-S516.)

Note 1: When there are multiple values for a single activity, the one that is considered to appear more frequently is listed (c.f., taking the value for leisure activity over that for competitive sport).

Note 2: Each value represents that while engaged in activity, not while resting.

## 8) The target values of “Healthy Japan 21” in comparison with provisionally selected most recent actual value

The target values of “Healthy Japan 21” in comparison with provisionally selected most recent actual value.

Target		Baseline value for setting the reference	Goal	Provisionally selected most recent actual value
<b>ADULT(20 years or older)</b>				
2.1	Increase in the number of people who consciously try to exercise	Male 51.8% <sup>1)</sup>	63% or more	54.2% <sup>2)</sup>
		Female 53.1% <sup>1)</sup>	63% or more	55.5% <sup>2)</sup>
2.2	Increase in the number of steps taken during daily life	Male 8,202 steps <sup>3)</sup>	9,200 steps or more	7,532 steps <sup>4)</sup>
		Female 7,282 steps <sup>3)</sup>	8,300 steps or more	6,446 steps <sup>4)</sup>
2.3	Increase in those who habitually exercise	Male 28.6% <sup>3)</sup>	39% or more	30.9% <sup>4)</sup>
		Female 24.6% <sup>3)</sup>	35% or more	25.8% <sup>4)</sup>
<b>Elderly</b>				
2.4	Increase in the number of people who have a positive attitude toward going out	Male (60-yr or older) 59.8% <sup>5)</sup>	70% or more	51.8% <sup>2)</sup>
		Female (60-yr or older) 59.0% <sup>5)</sup>	70% or more	51.4% <sup>2)</sup>
		All (60-yr or older) 46.3% <sup>5)</sup>	56% or more	38.7% <sup>2)</sup>
2.5	Increase in the number of people who are involved in some form of regional activities	Male (60-yr or older) 48.3% <sup>6)</sup>	58% or more	66.0% <sup>2)</sup>
		Female (60-yr or older) 39.7% <sup>6)</sup>	50% or more	61.0% <sup>2)</sup>
2.6	Increase in the number of steps taken during daily life	Male (70-yr or older) 5,436 steps <sup>3)</sup>	6,700 steps or more	5,386 steps <sup>4)</sup>
		Female (70-yr or older) 4,604 steps <sup>3)</sup>	5,900 steps or more	3,917 steps <sup>4)</sup>

1) Survey on Health and Welfare, 1996

2) National Health and Nutrition Survey in Japan, 2003

3) National Nutrition Survey in Japan, 1997

4) National Health and Nutrition Survey in Japan, 2003

5) Survey on Attitude of the Aged toward Daily Life, 1999

6) Survey on Attitude of the Aged toward Participation in Local Community, 1998

Notes:

Data for the “provisionally selected most recent actual value” are those collected as of March 8, 2006.

\* Marks a difference between the results of the survey for the baseline at setting the reference and for the survey to obtain the provisionally selected most recent actual value.

\*\* Marks a value that requires conversion of percentage weight change associated with the revision of the food composition table.

## 9) Systematic review

### (1) Purpose

A systematic review was conducted to set reference quantity of physical activity and exercise for health promotion: the target of the review was healthy individuals, as well as those who were found to have slight abnormalities (such as hypertension and a high blood glucose level) at a health examination and told to improve their lifestyle.

### (2) Method for search

A literature search was conducted on observational studies on the effects of physical activity, exercise and physical fitness (major components of reference quantity of exercise to build a healthy body) on the development of lifestyle-related diseases.

- ① Databases where the search was made: PubMed and “Igaku Chuo Zasshi”
- ② Search period: ending on April 11, 2005
- ③ Search format: PubMed: (“physical activity” OR exercise OR “physical training” OR fitness) AND (each disease entity) AND (follow\* OR observation\* OR prospective OR longitudinal OR retrospective)
- ④ Search limit: human (studies on humans)
- ⑤ Studies searched: original articles
- ⑥ Age: from school age (6 years and older) to the aged
- ⑦ Lifestyle-related diseases searched: obesity, hypertension, hyperlipemia, diabetes mellitus, cerebrovascular disorders, death due to circulatory diseases, osteoporosis, ADL and total mortality

### (3) Inclusion criteria

Articles that met the following criteria were selected to obtain the necessary quantitative information that was retrieved through the search.

- ① Those studies in which individuals who, as a rule, were free of severe illnesses (healthy people or those having mild symptoms but capable of doing exercise) were observed and their mortality or incidences of disease were analyzed according to physical activity, exercise, and physical fitness.
- ② Those studies clearly indicating information on quantity of physical activity and exercise that were evaluated by quantitative methods (type, intensity, duration: min/wk or min/day, frequency: x times/wk). Without this information, data may be computed from “type, intensity and min/wk.”
- ③ Those studies clearly indicating information on physical fitness that was determined by quantitative methods.
- ④ Those studies in which quantity of physical activity and exercise and physical fitness are grouped and sectioned and the cutoff lines are set, all in a logical manner.
- ⑤ Those studies in which the effects of physical activity and exercise are individually analyzed [statistical adjustments were made for the factors other than physical activity and exercise (sex, age, smoking, metabolic risk factors, etc.)].
- ⑥ The number of subjects is determined by the method of analysis or the accuracy of measurement.

#### (4) Results

The search formula given above retrieved 8,134 articles. Through a primary screening by examining their titles and abstracts, the number was reduced to 794. The entire text for each of these articles was obtained for a thorough examination. Finally, the articles that satisfied the inclusion criteria given above numbered 84.



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## **II. Literature used in selecting reference quantity of exercise in addition to those listed above.**

### *1) Literature referred to in determining the quantity of physical activity and exercise required in maintaining and promoting health*

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