Obesity as a Risk Factor for Various Diseases: Necessity of Lifestyle Changes for Healthy Aging

Kiyoji Tanaka¹⁾ and Tomoko Nakanishi²⁾

1) *Institute of Health and Sport Sciences and Center for TARA*, University of Tsukuba*

2) *Division of Health Counseling, Higashi Toride Hospital*

Abstract. Recent research observations indicate that obesity is a significant independent predictor of cardiovascular disease (particularly coronary heart disease and stroke). Aside from the metabolic abnormalities, there are severe social and psychological consequences of obesity. It is clear that obesity is associated, to a large extent, with lifestyle. There is no single best way to treat obesity. In general, the lifestyle therapies include behavioral modification, nutritional adjustments, and exercise conditioning. In treating obesity, the major emphasis is particularly placed upon decreasing energy intake and, to a lesser extent, upon increasing energy expenditure. However, food restriction induces a decline in resting energy expenditure which is related to the decline in body mass. Numerous reports indicate that, although decreasing energy intake is undoubtedly the most obvious and effective way to reduce fat, it also induces a significant amount of fat-free tissue loss. Regular exercise is a significant variable to consider in understanding and treating obesity, since it is the principal discretionary component of energy expenditure. In particular, aerobic exercise definitely plays an important role in preventing obesity in most persons. This article reviews the importance of lifestyle behaviors such as regular exercise and proper diet for prevention and maintenance of chronic diseases, along with definitions of some important words and multidimensional information regarding the epidemiology of obesity. Strategies for weight reduction are discussed.

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Introduction

It is indeed unfortunate that in our modern era of

technologic and scientific achievement, in which man has walked on the moon, developed surgical procedures to prolong and enhance the quality of life, and discovered many of the secrets of molecular interaction, there is no adequate explanation for a seemingly simple question: Why do people become too fat, and what can be done to prevent it? (McArdle et al., 1991, p. 656)

As long as physical problems or ailments are not evident, most individuals take their health for granted and consider it to be a permanent state. Well-being comes about as the result of positive lifestyle choices. We are particularly concerned about habitual physical activity, diet, smoking, alcohol consumption, sleeping patterns, perceived stress, and drug addiction, since these impact significantly upon health-related fitness and general health status. There is no question that the link between lifestyle and cardiovascular health is real and direct.

Obesity is linked to heart disease, hypertension, and diabetes mellitus, while individuals who are at or slightly below their desirable body mass are at relatively reduced risk for these conditions. The development of these diseases or illnesses is silent in most cases. By adopting a lifestyle geared to weight control, we will also be practicing habits designed to reduce the risks of cardiac and/or metabolic damage. Continuation of favorable lifestyle behaviors contributes to a good state of physical and psychological well-being. In particular, epidemiologic concerns about obesity center on the associated health risks such as increased morbidity and mortality.

Leading Causes of Death in Japan

Once a considerably high fat percentage is detected, persons try to find time to exercise and tend not to eat as much as they used to. Once a heart attack takes place, some may find time to exercise whereas others become more sedentary. Once high blood pressure is detected, most people become serious about salt in the diet. Once emphysema is evident, patients usually stop smoking tobacco. The leading causes of death in Japan are cancer,

*Tsukuba Advanced Research Alliance (Principal TARA researcher for Tanaka Project)

heart disease, and cerebrovascular disease (or stroke). All of these major causes of death, particularly the first two, are considered to be partial by-products of inappropriate lifestyle choices and habits; that is, lifestyle-related causes of death. Unfortunately however, some people do not understand the relatively close link between health and discretionary lifestyle.

Nearly one-third to two-fifths of all deaths are due to cardiac (or cardiovascular) disorders, and of these more than 90% are attributed to coronary heart disease (CHD). Sedentary lifestyle (sedentariness) has been implicated as a major risk factor for the development of CHD. The relationship between lifestyle and the incidence of CHD or cardiovascular mortality has been investigated in a number of epidemiological studies (Ornish et al., 1990; Ekelund et al., 1988; Kannel et al., 1986; Leon et al., 1987; Morris et al., 1980; Paffenbarger et al., 1986; Pekkanen et al., 1987; Shaw 1981). Obesity has been shown to be an independent risk factor for mortality (Sjostrom, 1992a), and for chronic diseases such as CHD, diabetes mellitus, and hypertension (Sjostrom, 1992b). Intra-abdominal fat seems to be the most important anatomical fat with respect to risk of morbidity and mortality from obesity-related disorders (Bray, 1992; Larsson et al., 1984; Kissebah et al., 1982; Lapidus et al., 1986).

Lifestyle Choices

There is nothing an individual can do about age, gender, and heredity, but there is something that can be done to reduce or eliminate the other risk factors for diseases of heart and blood vessels. Certain fundamental lifestyle choices ultimately dictate health and longevity for each individual. These choices include: (1) diet: what and how much to eat, (2) exercise: whether or not to be physically active on a regular basis, (3) stress: whether to manage or ignore it, (4) smoking: whether or not to start, continue or break the habit, and (5) alcohol: how much to consume. These are the controllable aspects of lifestyle that count, either for or against good health. The ill effects of bad diet, lack of exercise, high stress, smoking, and alcohol abuse are cumulative and interconnected. As a result of such interconnected ill effects, people can readily become obese.

At first glance it seems unnecessary to define either "overweight" or "obesity." For the vast majority of people, "overweight" is defined simply as "overfat." However, overweight differs from overfat or obesity. Today, in highly industrialized nations, which include not only the United States and some western countries, but also Japan, the incidence of obesity as well as overweight is higher than it was in the early and/or middle parts of the 20th century. This may be related to living in a much more automated world as well as ingestion of large quantities of food. Obesity has been classically defined as a

condition resulting from an imbalance between energy intake and energy expenditure. Thus, it is logical to assume that either an increase in participation in physical activity or reduced food intake or both may contribute to a lower incidence of obesity.

The total energy expended during a day is determined by the sum of three factors: (1) the resting metabolic rate (that includes basal and sleeping conditions plus the added cost of arousal): 60-75%, (2) the thermogenic influence of food consumed: 10%, and (3) the energy expended during and in recovery from physical activity above the resting state: 15-30%. Energy expenditure during the basal metabolic test usually range between 0.8 and 1.43 kcal/min (oxygen uptake of 160 to 290 ml/min), depending upon a variety of factors, especially the size and body composition of the subject. Basal metabolic rate is about 5 to 10% lower in women (35 kcal/m²/h) than in men (38 kcal/m²/h) because women generally possess more body fat than men of similar size, and fat is metabolically less active than muscle (McArdle et al., 1991). It has been estimated that muscle (approximately 100 kcal per gram) is 25 times as active metabolically as the same amount of fat (4 kcal per gram). An average man experiences a 0.5% reduction in resting metabolic rate each year between 20 and 60 years of age. The gradual loss of muscle each year is primarily responsible for this metabolic slowdown. It should be noted that the dramatic and sustained reduction in resting metabolic rate occurs during weight loss only through dieting (Elliot et al., 1989; Mole et al., 1989). Daily exercise may reverse the drop in resting metabolic rate associated with severe energy restriction (Mole et al., 1989). Therefore, a simultaneous attempt of building muscle and losing fat (through vigorous exercise and modest diet) is an ideal approach (Hagan et al., 1986; Tanaka et al., 1986, 1989; Weltman et al., 1980; Zuti and Golding, 1976). Abundant willing power (an ability of self-control or self-management) is also a very important factor for the maintenance of slimmed body.

Questions Raised in This Article

With the above in mind, this article is divided into the following twelve seemingly simple questions: (1) What are the consequences of unhealthy lifestyle habits?, (2) How is human body composition assessed?, (3) Decreasing the prevalence of obesity: choice or necessity?, (4) What is obesity?, (5) What are the ideal fat percentages?, (6) What are the results of long-term obesity?, (7) How is obesity managed?, (8) What constitutes proper diet?, (9) How much energy is expended by physical activity?, (10) What are the effects of exercise on CHD?, (11) What kind of exercise program is recommended?, and (12) What are the effects of regular exercise and/or proper diet on obesity? Despite their simplicity, definitive solutions are not

readily available for any of the above questions. The authors will attempt to answer these questions as precisely as possible.

1. What are the consequences of unhealthy lifestyle habits?

In modern society, not all but many people, regardless of age and gender, pick up unhealthy lifestyle habits. Even children do so at an early age. Many people in all the world smoke tobacco, experience stress, avoid exercise, overeat and overdrink. If we as adults are very much concerned about proper diet, regular exercise, stress control and not smoking, so will our children. When we make positive lifestyle choices, we impose not only our own well-being but that of our offspring (children) as well. Accumulated epidemiological research evidence suggests that sedentariness (sedentary living) is highly associated with a high incidence of CHD, thromboembolic stroke, hemorrhagic stroke, and site-specific cancers such as gastrointestinal cancer. Independent of its effect on energy expenditure and body mass, vigorous physical activity may beneficially affect cardiorespiratory function, muscular fitness, substrate utilization, and psychological well-being.

Furthermore, with sustained sedentariness, there may be a decrease in fat-free mass, which in turn, would reduce resting metabolic rate. Obesity, as well as cigarette smoking, drug abuse, type A personality, sedentary way of life, and abnormal lipids and lipoproteins, are all major lifestyle risk factors. Arthritis, hypertension, heart disease, and diabetes mellitus are among the related health problems—all of them worsened by either physical inactivity or obesity—that both men and women suffer from. The grossly obese have a higher morbidity or mortality risk.

2. How is human body composition assessed?

The accurate measurement of adiposity in a living organism is undoubtedly difficult. Although a number of methods have been developed, none has been proven to be both theoretically and empirically an unquestioned validating criterion method for the estimation of human body composition. A commonly used standard of practice is determination of body density by underwater weighing, which utilizes Archimedes' principle to measure body volume by weighing a person's body mass in water compared with that in air (Keys and Brozek, 1953; Brozek et al., 1963; Lukaski, 1987; Nakadomo et al., 1990; Tanaka et al., 1992a). This technique requires the subject to completely submerge under water while maximally exhaling to residual lung volume. The disadvantages of this system include time-consuming determination of mass in water and necessity for expensive instruments such as a helium dilution (or nitrogen washout) respirometer. In addition, underwater weighing is difficult for many spe-

cial populations like the obese, elderly, and disabled.

As a more convenient method, body fat percentage can be estimated with the use of a simple tape measure. However, this technique is considered to have a plus or minus 10% margin of error (Wilmore, 1986). If, after such circumferential measurement, we calculate that someone is 25% fat, for example, applying the margin of error will create a body fat range of 15% to 35%. Therefore, it is very difficult to figure out just how many Japanese are obese in a certain year, since obesity is defined as being overfat.

Other currently available indirect methods for the assessment of body composition are (1) the determination of total body water, (2) quantification of total body potassium, (3) measurement of urinary creatinine excretion, (4) anthropometric estimation by skinfold thickness, (5) determination of bioelectrical impedance, (6) total body electrical conductivity, (7) computerized tomography, (8) measurement of subcutaneous adipose tissue thickness by soft-tissue roentgenography, the ultrasonic technique, and infrared interactance, (9) magnetic resonance imaging, and (10) determination of total body bone mineral content and fat-free mass by dual-photon absorptiometry (Lukaski, 1987). Unfortunately however, no method is available that meets stringent criteria: inexpensive, little inconvenience for the subject, high reproducibility, and high accuracy.

3. Decreasing the prevalence of obesity: Choice or necessity?

A decrease in the prevalence of obesity to no more than 20% of the U.S. population was one of the goals established by the U.S. Public Health Service in Healthy 2000: National Health Promotion and Disease Prevention Objectives (Public Health Service, 1990). However, approximately two-fifths of the U.S. adult population and approximately one-tenth of the Japan adult population are currently classified as obese or overweight, respectively; and this phenomenon is on the rise in both countries. It is clear that the incidence of obesity in children is also increasing (Gortmaker et al., 1987). Metabolic abnormalities associated with abdominal obesity include hyperinsulinemia, insulin resistance, noninsulin-dependent diabetes mellitus, reduced high-density lipoprotein cholesterol, hypertriglyceridemia, hypertension, etc. Research suggests that these abnormalities correlate well with increased risk for stroke, myocardial infarction, and premature death (Larsson et al., 1984). For patients with newly diagnosed mild hypertension, a fat-loss program along with other lifestyle changes should be tried for at least 3 to 6 months before considering drug therapy (JNC-V, 1993). Aside from the above-mentioned metabolic abnormalities, there are severe social and psychological consequences of obesity.

There is evidence that severe (excessive) obesity

carries risks for long-term health (Garrow, 1988; Hubert et al., 1983; van Itallie and Abraham, 1985). Excessive fatness (particularly increased intra-abdominal fat), high waist/hip circumference ratio, and high body mass index (BMI) in the obese are well associated with increased risk of hypertension, diabetes mellitus, and CHD. According to the U.S. Dietary Goals, established by the Senate Select Committee on Nutrition and Human Needs (1977), it is estimated that for each 10% decrease in body mass there is a 30% reduction in the risk of heart disease. Since fat is the most variable component of the body, obesity as well as overweight are treatable. In the later sections of this article, an attempt will be made to describe the significant role of increased physical activity on healthy living. Only then can we make a decision as to whether promoting an active and favorable lifestyle is a choice or necessity.

4. What is obesity?

National Health and Nutrition Examination Survey indicates that despite a \$33 billion weight-loss industry, Americans are getting rather than losing weight. It is estimated that one-third of adults aged 20-74 yr were overweight (BMI > 27.8 for men, > 27.3 for women) (Kuczmarski et al., 1994). There are many individuals, however, who are overweight on the basis of the standard height-weight tables, yet have a normal or lower than normal amount of body fat. Others fall within the prescribed range of weights for their heights and frame size, yet have more than a normal amount of body fat. Overweight simply implies that the individual exceeds a range of weights specified by gender, height, and frame size. Tables for determining one's ideal or desirable weight are not accurate. We should concern ourselves with evaluating the degree of obesity/leanness of each individual, and not be overly concerned with whether that individual is overweight, underweight, or of normal weight (Wilmore, 1986).

Obesity, a common clinical problem, can be defined simply as a state of excessive fatness. National Institutes of Health Consensus Development Panel (1985) defines obesity as "an excess of body fat frequently resulting in a significant impairment of health," which is associated with reduced longevity and increased incidence of cardiovascular disease, diabetes mellitus, osteoarthritis, and certain types of cancer as well as adverse psychological factor. It is generally accepted that genetic, hormonal, and metabolic factors play an etiological role in the development of obesity, while a long-term energy imbalance is the major pathophysiological disturbance that results in increased fatness. Whether fatness is excessive or not is evaluated by determining the proportion of fat to other tissues in the body. In general, middle age is associated with increasing fatness. In women fatness may increase following pregnancy or with the onset of menopause;

while in men it may be a feature of the fourth or fifth decade of life. Unfortunately however, there is no consensus on either the "desirable" (ideal) amount of fat, or the degree of fat deposition which is considered "normal." Heredity is usually not considered a direct inducer of obesity, but it is clear that inherited differences exist in the susceptibility to become obese under given behavioral and lifestyle conditions. Thus, along the lines of individualism in the development of obesity, successful therapy of obesity must be conducted.

5. What are the ideal fat percentages?

As mentioned in the preceding section, no consensus exists as to the ideal (optimal) degree of fatness. Some proportion of increase in total body mass are accounted for by an increase in fat-free mass, so that the amount of total body mass lost is not perfectly equal to fat loss. Furthermore, changes in one anatomical area of adipose (fat) tissue should not be assumed to be equivalent to changes elsewhere in the body. Therefore, it is difficult to determine the maximum amount of body fat a healthy person should have. Fat represents more than 50% of body mass in some individuals and as little as 5% of body mass in others, such as male marathon runners. Ideal fat percentages differ with age and gender. There is a disparity between ideal and average fat percentages. Average population values do not become the reference standard, and should not subsequently be accepted as normal. We assume the ideal range for middle-aged males as 14% to 24%, and 19% to 29% for middle-aged females. The range decreases slightly for young adults, while it may increase for older adults. Individualism is an important factor to consider when treating the obese.

6. What are the results of long-term obesity?

The control of body mass and body fat may be the key factor in producing a lifestyle that promotes overall physical health. To lose body mass successfully and maintain that loss, no more than 1 kg should be lost each week. Quick weight loss or fluctuations between weight loss and weight gain are harmful to health and are not recommended (Hamm et al., 1989). Strictly speaking, it is not total body mass that affects health and appearance; but rather excessive body fat. Of and by itself, excess fat is a risk factor for CHD. The body fat component, not total body mass, is what needs to be reduced. The strong prejudice against obese people is evident in children as young as 6 years of age (Wadden and Stunkard, 1985). Moreover, it should be kept in mind that a lifestyle that promotes overfatness (obesity) is very likely to be such a lifestyle that also promotes elevated blood lipids, high blood pressure, excess stress, and drug addiction (medications).

Long-term obesity is likely to affect bone density, muscle mass, and cardiac size due to the increased body

mass and blood volume the body system have to support, and these will contribute to the increased fat-free mass. It was calculated by Forbes and Welle (1983) that 40% of the excess body mass index was due to the increase in lean or fat-free mass. Garrow (1988) estimates, for every 1 kg gain in body mass associated with obesity, 25% of the increase is fat-free tissue. However, it is very clear that medical problems associated with long-term obesity are induced, some of which may contribute to the rise of mortality.

7. How is obesity managed?

For patients who are overweight it is important to emphasize the need for weight reduction and exercise training along with appropriate dietary recommendations, behavior modification, and/or psychological counseling. Obesity or fat management has two aspects: (1) fat loss for those individuals who are remarkably overfat, and (2) prevention of further/future fat gain for everyone except the extremely underfat person. For these purposes, the impact of lifestyle changes is most appreciated. These include exercising regularly, maintaining a low-fat diet, quitting smoking, and adhering to lipid-lowering medications if required. Obese persons tend to be poorly motivated to participate in exercise programs, due to perceived negative consequences, such as shame and embarrassment at bodily exposure, real or imagined negative attention or ridicule from those more fit than themselves, and anxiety about time taken away from family or other pleasurable activities (Knapp, 1988). Somehow, healthy lifestyle habits such as exercise habit formation and maintenance must be reinforced.

Overfat cardiac patients should be encouraged to lose body mass by as much as 4.5 kg (10 lb) in order to improve risk factors associated with CHD, such as blood pressure, serum lipids, etc (Clark, 1995). Patients should be cautioned to lose only as much fat as they can comfortably maintain. Drastic limitations of food items must be avoided. In general, gradual dietary changes will often be better maintained. Although many persons are likely to gain fat upon cessation of smoking, they should be reminded that the health risks of continuing to smoke far outweigh the addition of a few kilograms of body mass.

8. What constitutes proper diet?

We are particularly concerned about energy intake and dietary composition, because dietary factors and eating behaviors affect body composition and body mass. The modern Japanese dietary pattern has changed dramatically since World War II, and even in the last few decades: higher in fat, salt and total calories, lower in fiber and essential nutrition, and fast foods. These dietary changes also reflect the modern reliance on processed foods, which, like other fast-food counterparts, are rich in fat, salt and calories, and low in fiber. In modern society,

food from boxes and cans has become the norm.

Health care professionals such as medical doctors, nurses, medical technicians, medical coordinators, medical social workers, physical therapists, dieticians, health counselors, and others should be prepared to provide primary counselling and support for dietary management. The dietary recommendations that nondietitians can reinforce are: (1) replace high-fat foods (e.g., meats, whole-fat dairy products, and fried foods) with lower fat items (e.g., poultry (chicken) and fish, fresh fruits and vegetables, breads and grains); (2) follow a regular exercise program, etc. (Clark, 1995). Patients being counselled by health care professionals should be able to select a wide variety of foods to achieve a diet that is palatable for them over the long term. It should be kept in mind that, as body mass decreases, energy expenditure also declines, resulting in a weight loss plateau.

9. How much energy is expended by physical activity?

Various teams of researchers have reported that daily rates of energy expenditure for various occupational groups of different ages (McArdle et al., 1991). It has been estimated that the elderly retired expends approximately 2,330 kcal/d, ranging from 1,750 to 2,810 kcal; while forestry workers spend 2,860 to 4,600 kcal/d (mean = 3,670 kcal/d). If a highly skilled 70-kg man spends 50 min for a judo workout, his total energy expenditure would be 500-800 kcal, but only 45 kcal while sitting quietly and watching television for 1 hour. Golf requires about 6 kcal per minute, or 360 kcal per hour, for a person of similar body size.

It should be noted that even if a person displays a reduced level of exercise, obesity could only result if the energy intake was inappropriately high for the person's overall level of energy expenditure. When an obese person begins an exercise program, a condition of negative energy balance develops unless there is compensation for the increased exercise energy expenditure. The compensation usually consists of increased energy intake and decreased spontaneous activity. Thus, physical activity is a complex behavior which generally accounts for at least 15% to 40% or more of an individual's total energy expenditure. This behavior encompasses physical activity on the job, discretionary leisure-time activities, self-care, household chores, and transportation.

In order to determine the minimum duration of exercise for improving the aerobic capacity of patients with CHD, twenty-three females aged 52.8 (SD 8.7) years were investigated (Takeda et al., 1994). Interestingly, the improvement in aerobic capacity remained almost the same within a range of exercise duration of 20 to 60 minutes. It was suggested that the minimum exercise duration for improving the aerobic capacity of female patients with CHD is 20 to 30 minutes per day or 140 minutes or more per week.

10. What are the effects of exercise on CHD?

Recently, interest has increased with regards to the effects of exercise conditioning as a major component of the rehabilitation of patients after myocardial infarction and those with CHD. An excellent outcome in terms of physical performance is characterized by the adherence to exercise after cardiac transplant (Kavanagh et al., 1987; Spuires et al., 1983) and the completion of a full marathon by a cardiac transplant runner (Kavanagh et al., 1986).

Although an excellent exercise training program has been demonstrated to elicit beneficial effects in CHD patients of the United States, Canada, Japan and European countries (Ballantyne et al., 1982; Bonnano and Lies, 1974; Detry et al., 1971; Froelicher et al., 1984; Goldberg, 1989; Hedback and Perk, 1990a; Hedback and Perk, 1990b; Kavanagh, 1989; O'Connor, 1989; Ornish et al., 1990; Rechnitzer et al., 1975; Takeda et al., 1996; Tanaka et al., 1992b), exercise therapy has still been a highly controversial issue (Franklin, 1990; May et al., 1982). We hypothesize that exercise conditioning would (1) control major risk factors related to CHD (hypertension, obesity, hypercholesterolemia, and low aerobic capacity generally associated with physical inactivity), and (2) alter the physical status of CHD patients. Therefore, we have attempted to determine the effects of our cardiac rehabilitation program on various physiological and anthropometric variables, including risk factors in Japanese patients with CHD.

Tanaka et al. (1994) evaluated the effects of a 6-month exercise program on vital age in 24 female patients with CHD or essential hypertension. Approximately one-third of them were mildly obese. Although mean vital age was found to be significantly higher than chronological age at the onset of the study, the vital age decreased significantly and approximated the mean chronological age after participation in the exercise program. Significant decreases were observed also in body mass (~2%), abdominal girth (~2%), skinfold thickness at various sites (~10 ~ 15%), systolic blood pressure (~9%), and triglycerides (~20%), while there were significant increases in oxygen uptake corresponding to lactate threshold, peak oxygen uptake, stepping side to side, balancing on one leg with eyes closed, and standing trunk flexibility.

11. What kind of exercise program is recommended?

The risks of adopting aerobic exercise with low impact are small, especially for a moderately obese population. Such risks consist primarily of musculoskeletal injuries due to beginning exercise at excessive intensities. It is clear that severe obesity (e.g., body mass index of 40 or above) should be considered separately from moderate obesity. In many cases, a severely obese population suffers from the occurrence of arthritis, venous stasis lesions, thermal stress, and skin rashes, so

that their exercise tolerance is considerably limited.

With these possible risks associated with exercise in mind, we have developed a land-based exercise program for obese middle-aged women (Tanaka et al., 1986, 1989; Nakanishi et al., 1996). In general, the program included a 5- to 10-min calisthenic warm-up, 5 to 10 min of stretching, 25 to 45 min of continuous jogging/cycling at the approximate intensity of lactate (ventilatory) threshold, 15 to 25 min of modified recreational ball games involving sustained total body movement or step exercise, and a 10-min cool-down, including stretching. The intensity of jogging/cycling in the prescribed program was elevated immediately after the completion of the second lactate threshold test (2 months). It should be noted, however, that intensity of effort is less important for weight loss. Therefore, strict adherence to a target heart rate is usually not required. Instead the prescription focuses on exercise duration for creating a negative energy balance, possibly combined with reduced food intake. It is not unusual that several months are taken (necessary) for a sedentary obese patient to become sufficiently fit to exercise at a level that burns a significant number of calories (Wood, 1984).

An alternative to the modified recreational ball games was *progressive aerobic circuit exercise* (so-called PACE) training with Hydra-Fitness machines. It is a new and innovative workout, not only for athletes but also for children or elderly that combines music with conditioning for muscle strength and cardiorespiratory endurance. The PACE training consisted of hydraulic resistance training with use of 7-10 different machines and various rhythmic exercises between machine training. This training was accomplished by having persons alternatively train on each machine for 20-25 seconds or exercise rhythmically on a floor for 25-30 seconds with a total work time of 20-30 minutes. Each person was allowed to exert at nearly 100% overload throughout the full range of motion. PACE may be considered as a well-rounded exercise reconditioning program. Svendsen et al. (1993) have reported that, in overweight postmenopausal women, the addition of both aerobic and anaerobic exercise to a high-protein, low-calorie diet preserves fat-free mass and increases maximal oxygen uptake, fat loss, and resting metabolic rate.

Water-exercise programs have recently been getting popular (Shigematsu et al., 1996; Van Norman, 1995). They can safely meet the needs of the obese or older adult population. Water-exercise classes begin with a warm-up that involves gentle range-of-motion activities designed to promote circulation. Classes usually consist of an aerobic phase that lasts from 15 to 25 min. Typical exercises are water-walking, small prances, bicycling, flutter kicks, neck range-of-motion exercise, shoulder movement, arm swings, torso movement, hip circles, toe-drawing, side leg lifts, mermaid side to side, mermaid

front to back, pinwheel, scissors, arm jug work, rocking horse front (or side), jogging through the water, flappers front (or side, back), and so on.

12. What are the effects of regular exercise and/or proper diet on obesity?

Although there are still some researchers and clinicians who seriously question the need for exercise in the prevention of chronic disease such as CHD, hypertension, and diabetes mellitus, physical inactivity (sedentariness) has been listed as a risk factor for these diseases. Recent studies strongly support the recurrent finding that individuals who are totally sedentary in their occupation, as well as in leisure time, are at a substantially greater risk for the early development of CHD when compared to active counterparts.

The U.S. Public Health Service recommends regular physical exercise not only for heart disease and cancer prevention, but also for delaying the onset of or preventing hypertension, obesity, osteoporosis, diabetes mellitus and some mental health problems. It may also reduce the incidence of stroke and help to maintain the mobility and independence of older people. In fact, there is ample evidence that regular physical exercise can reduce the risk of dying from CHD by almost 50% in people who have never had a heart attack, and by 25% in people who have (Berlin and Colditz, 1990; Oldridge et al., 1988). In general, exercise conditioning along with appropriate dietary recommendations is necessary to lower serum lipids and raise high-density lipoprotein cholesterol.

The major emphasis of various exercise programs (e.g., jogging) appears to be oriented towards the development of a healthier and more efficient cardiovascular system (Wilmore et al., 1970). A number of studies (Franklin et al., 1979; Gillett et al., 1996; Hagan et al., 1986; Moody et al., 1969; Tanaka et al., 1986, 1988) have shown significant alterations in aerobic capacity (power) and body composition following continuous involvement in dynamic exercise such as jogging or similar types of exercise programs. These studies have found that exercise contributes not only to fat reduction but also to the degree of fatness. Exercise has also been shown to have beneficial effects on lipid profiles (Duddleston and Bennion, 1970; Hagan et al., 1983, 1986; Hartung and Rangel, 1981; Sopko et al., 1985; Weltman et al., 1980) and to lower blood pressure (Hagberg et al., 1989; Kiyonaga et al., 1985; Nho et al., 1996). Furthermore, exercise can have a positive impact on other health-related behaviors such as dietary modification, smoking cessation, and stress management. With increasing fitness due to continuous involvement in dynamic exercise, people tend to become more active in other dimensions of their lifestyle.

Summary

It was emphasized in this article that the successful management of obesity often requires comprehensive lifestyle restructuring with attention to increased physical activity, healthy eating habits, behavioral modification, and/or psychological coping strategies. Particularly, it is suggested that continuation of physical activity (aerobic exercise training), either supervised at a research lab or home-based, is the most important factor for successful maintenance of lost fat (weight) and that improved self-esteem and increased feelings of self-control associated with participation in a sound exercise and diet program may be of secondary importance. Exercise programs offered to obese, older individuals should be convenient and age-appropriate. Exercise is aerobic if it attains and maintains an elevated heart rate for at least 20 minutes. The best way of evaluating the motivation and increased understanding of the need for maintenance of aerobic exercise must be identified so as to achieve long-term retention of fat loss, and the associated health benefits. The suffering and death from diseases of heart and blood vessels might not occur if an individual would make a few changes in exercise, diet, and other lifestyle habits. The earlier in life that these changes are made, the better. It is never too late to initiate healthy habits to slow progression of obesity and associated risk factors.

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Correspondence to: Kiyoji Tanaka, Institute of Health and Sport Sciences, University of Tsukuba, 1-1-1 Tennodai, Tsukuba 305, Japan