Journal of Korean Society for Health Education and Promotion
Vol. 23, No. 5, 2006, pp.1-11

Rapidly Increasing Prevalence of Obesity and Their Confident Determinants in Korea

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Ⅰ. Introduction

Obesity is the most prevalent risk factor for common chronic diseases in the developed world(Bray et al., 1997; National Institute of Health and National Heart, Lung and Blood Institute, 1998). Obesity carries enormous health and economic costs and is recognized as a major risk factor for cardiovascular disease, type 2 diabetes mellitus, hypertension, and other debilitating conditions (Manson et al., 1987; Higgins et al., 1988; Pi-Sunyer, 1993; Thompson and wolf, 2001).

The increase in the prevalence of overweight and obese cases can be theoretically explained by one or a combination of the following three scenarios. The first scenario posits that the increase results from the fact that a large portion of the population is consuming more calories than individuals of past generations with no change in habitual daily energy expenditure. The second scenario suggests that the cause of the increase can be found in a decrease in daily energy expenditure with no change in caloric intake. Finally, the

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third scenario proposes that caloric intake per capita has actually declined compared to previous generations, but daily energy expenditure has, on the average, decreased even more(Bouchard, 1998).

The World Health Assembly adopted WHO's landmark global strategy on diet and health in 2003 to combat the epidemics of obesity and non-communicable diseases (NCD). The strategy was based on the WHO/FAO technical report 9161, and called for its recommendations to be translated into national guidelines(WHO, 2003). The technical report described the notable experience of the Republic of Korea (South Korea), Korea has largely maintained its traditional high-vegetable diet despite major social and economic changes, and had a lower rate of NCD and lower than expected levels of fat intake and obesity prevalence than other industrialized countries with similar economic development(Kim et al., 2002; Lee et al., 2002). However, in contrast to this description, the prevalence of obesity in Korea has recently been rapidly increasing.

The purpose of this study was to elucidate the determinants of this rapid growth of obesity prevalence in Korea. However, describing the trends in only one nation is not enough to clearly understand the problem, thus we compared the results of national nutrition surveys between Korea and Japan where genetics, weather, cultural background and lifestyle seem to be similar. Korea and Japan are the only two countries in Asia where nation-wide health and nutrition surveys are regularly conducted.

Ⅱ. Methods

The National Health and Nutrition Survey in Korea(Korean Ministry of Health and Welfare, 2006) and in Japan(Japanese Ministry of Health, Labour and Welfare, 2006) have been instituted every 3 years and every year, respectively.

In these surveys, obesity was defined as more than 25 of the Body Mass Index (BMI: body weight (kg) over height (m) squared) both in Korea and in Japan. However, different definitions for exercisers were used in Korea and in Japan.

In Korea, habitual exercisers were defined differently depending on the survey years; in '92 and '95, an exercise duration of $\geqq$20 min at one time and a frequency of $\geqq$2 times a week with moderate intensity; in '98 and '01, an exercise duration of $\geqq$20 min at one time and a frequency of $\geqq$3 times a week with moderate or hard intensity; in '05, an exercise duration of $\geqq$30 min at one time and a frequency of $\geqq$5 times a week with moderate intensity or an exercise duration of $\geqq$20 min at one time and a frequency of $\geqq$3 times a week with hard intensity was used. In

Japan, a habitual exerciser was defined as someone who exercised for ≧30 min at one time and a frequency of ≧2 times a week with moderate or hard intensity and a continuation for more than one year from 1992 to 2005.

The trends of obesity and exercisers in those aged 20 years and older in Korea from 1992 to 2005 and those in Japan from 1992 to 2004 are shown in the figure. Also the nutritional surveys of both countries were compared. Because the latest results from Japan were for 2004, the results of the 2005 Korean survey and the 2004 Japanese survey were compared.

Ⅲ. Results

Figure 1 shows the recent prevalence of obesity in Korea and Japan. The prevalence of obesity in males has been gradually increasing in both Korea and Japan since 1992. Until 1995, the prevalence of obesity in the Korean male population was less than that in Japan. However, after 1998 Korea surpassed Japan in the prevalence of obesity in males and a markedly increasing trend was observed. Recently the prevalence of obesity in males was more than 35% in Korea. In females, the increasing trend of obesity was slower than males in both Korea and Japan with the exception of 2005 in Korea. However, the prevalence of obesity was much higher in Korea compared with that in Japan. Recently the prevalence of obesity in females was more than 28% in Korea and 22% in Japan.

The percentage of habitual exercisers was about 30% in Japan and this prevalence is still low. However, the percentage of exercisers was much lower in Korea than in Japan. Although, the definition of an exerciser varies with the survey year and is different from that in Japan, almost 70% of the population was not regularly engaging in moderate or hard intensity exercise in Korea.

From 1995, the total energy intake was increased by 9.8% in Korea but it was decreased by 6.9% in Japan. Presently, the energy intake per capita per day is 2,019 kcal in Korea and 1,902 in Japan. The difference in total energy intake was small between the two countries, however, remarkable increases in the intake of "meat and poultry", "vegetable oils and fats", and "milk and dairy products" were observed in Korea from 1995 to 2005. Consequently, in 2005, the proportion of energy intake from fat and the proportion of food intake from the animal food products (%) were 20.3% and 22.3% respectively, and both exceeded 20% in Korea for the first time. On the other hand, the proportion of energy intake from fat and the proportion of food intake from animal food products were decreased by 4.2% and 17.6% respectively during the same period in Japan.

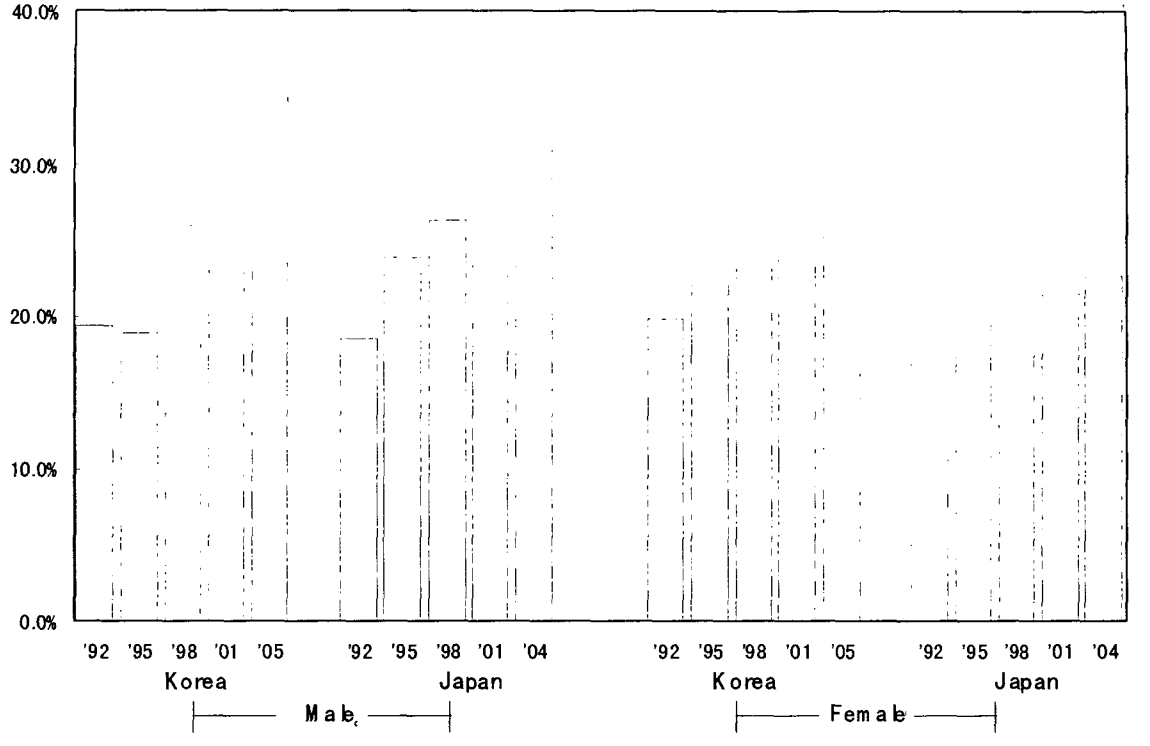

Figure 1. Recent trends of obesity in the Republic of Korea and Japan
BMI= body weight (kg)/height $(m)^2$. Obesity; 25"BMI.

Ⅳ. Discussion

Less energy expenditure because of decreased daily physical activity level is likely to be one of the major factors contributing to an increase of overweight and obese people in Korea, as well as increasing trends of total energy intake, energy intake from fat and the proportion of food intake from animal food products. Although, in Korea, the definition of exercisers varied depending on the survey year and it is different from that in Japan, only around 30% of the population are engaging regularly in moderate intensity exercise and almost 70% of the population are inactive in their daily lifestyle in Korea. Of course, daily physical activity by exercise does not represent all of the energy expenditure. However, the rapid increase in the prevalence of obesity could be due to the low prevalence of habitual exercisers as well as an increasing intake of energy and fat.

Body weight is a function of energy and nutrient balance over an extended period of time. Energy balance is determined by

macro-nutrient intake, energy expenditure, and energy or nutrient partitioning. Positive energy balance over weeks and months will result in weight gain while negative energy balance will have the opposite effect.

Positive energy balance is required for weight gain to happen, therefore dietary habits play a key role in the prevalence of overweight and obesity(Heymsfield et al., 1995). In developed countries, the availability of highly palatable foods in almost unlimited abundance is undoubtedly contributing to the overweight and obesity epidemic(Forey et al., 1997; Grundy, 1998). The proportion of calories derived from fats is also potentially involved, particularly in those who consume a high-fat diet while living a sedentary life(Asturp et al., 1997; Bray and Popkin, 1998) as is happening in Korea; however, the exact contribution of a high-fat diet to the current obesity epidemic remains controversial(Seidell, 1998; Willett, 1998).

There are several prospective studies that have demonstrated the presence of a significant and inverse relationship between the level of habitual physical activity and weight gain over a number of years(Rissanen et al., 1991; Klesges et al., 1992; French et al., 1994). It is not infrequent in these studies to show that the level of physical activity is a better predictor of weight gain than estimates of caloric or fat intake. One of the most impressive demonstrations of the strong role of a sedentary mode of life, compared to caloric or fat intake in the growing prevalence of overweight and obesity cases, comes from the analysis of survey data in the UK collected over a period of four decades(Prentice and Jebb, 1995). The results of the data shows that energy expenditure associated with habitual physical activity is a key determinant in the prevalence of excess body weight(Prentice, 1997).

The increase in the prevalence of overweight and obesity cases worldwide is occurring against a background of a progressive reduction in the energy expended for work and occupational activities as well as for the accomplishment of personal chores and daily necessities(Prentice and Jebb, 1995; Haskell, 1996; Weinsier et al., 1998).The reduction in energy expenditure associated with physical activity brought about by automation and changing job and professional environmental circumstances has been nothing but dramatic in the second half of this century. In contrast, the energy expenditure of leisure time physical activity, the most important discretionary component of total daily energy expenditure, may have increased slightly, but not enough to keep pace with the changes brought about by urbanization and automation.

It has been estimated that the current deficit of energy expenditure from physical activity compared to that of the recent past ranges on

average from about 300 to 800 kcal/day(James, 1995; Schoeller et al., 1997).If this range of estimates is close to the true values, it implies that adults would have to add one to three hours of brisk walking every day to their current daily regimen to be in energy balance at a normal body weight level. This seems to be a major public health challenge(Bouchard, 2000).

The majority of obese people in both Korea and Japan are in the overweight status of the WHO definition. Those with a BMI of 30 and more are small in number in contrast with westernized countries. One implication is that a sedentary lifestyle or a low level of habitual physical activity has the potential to account for a large proportion of the adult overweight cases. For instance, a non-resting daily energy expenditure kept under about 300 kcal will generate chronic positive energy balance and translate into a surplus of calories consumed of more than 100,000 kcal over a year. This would undoubtedly result in body weight gain that may be as high as 50 percent of the total yearly caloric surplus caused by a sedentary lifestyle. If we assume that one kg of body mass is, on the average, the equivalent of about 7,000 kcal, then a reduction of the daily level of habitual physical activity by 300 kcal would be associated with a body weight gain of 6 to 8kg a year. The weight gain would be progressively less with time as the resting metabolic rate and the energy cost of moving the body would increase with body mass accretion. After a while, energy balance would be restored but at a new body mass level that would then be in the overweight range.

A physically inactive lifestyle is a risk factor for weight gain with age. Moreover, obese individuals are generally sedentary, as their excess body mass constitutes a major obstacle in adopting a more physically active lifestyle. Furthermore, a sedentary lifestyle in overweight or obese persons increases the probability that they will be affected by the common morbidities of excess weight or that they will die prematurely.

The rationale supporting the view that a good fraction of obesity causes could have been prevented is based on the following considerations(Bouchard, 1996; Lee et al., 2006). First, the level of heritability of obesity or body-fat content is only moderate. Second, most intermediate phenotypes that can be defined as determinants of body-fat content are also characterized by low to moderate levels of heritability. Third, the prevalence of overweight and obese people has been steadily increasing over the last 50 years or so, and population studies seem to indicate that the prevalence is still rising. This increase has occurred over a period of time that is too short to be caused by changes in the frequency of obesity genes or susceptibility alleles. Fourth, the increase in the prevalence of obesity can therefore only be due to the fact that a greater

number of children and adults are in chronic positive energy balance. Fifth, the large number of people in positive energy balance for sustained periods can only be explained by the three scenarios defined in the introduction(Bouchard, 1998). All of these scenarios are applicable to the current trend of obesity in Korea.

A more physically active lifestyle is likely to be the cornerstone of a prevention strategy centered on the concept of the promotion of a healthy weight(Bouchard et al., 1993). However, it is equally important to recognize that energy balance will be easier to achieve in the long term if the physically active lifestyle is associated with a low-fat diet. Energy balance, and particularly balance between lipid intake and lipid oxidation, is quite difficult and perhaps impossible to sustain when dietary fat intake is high(Stubbs et al., 1995).

Even though individuals bear responsibility for maintaining healthy weights, national surveys in developed countries and the compendium of data around the world by the International Obesity Task Force indicate that programs with a focus on individuals are not enough. Of course, we must continue and expand the education efforts aimed at teaching people about healthy diets and physically active lifestyles. Promoting healthy weights through controlled behaviors and increased awareness should remain on the agenda(James, 1995; Weinsier et al., 1998). However, it is obvious that this approach will not be sufficient, as it has not succeeded in containing the present obesity epidemic (WHO, 1998).

The tools necessary to reverse this unhealthy trend are remarkably simple in appearance, as they center on the promotion of eating regular and healthy meals, avoiding snacking, drinking water instead of energy-containing beverages, keeping dietary fat consumption levels down, cutting down on TV viewing time, walking more, participating more in sports and other energy-consuming leisure activities, and other similar measures(Bouchard, 1996). However, it will be a daunting task to change the course of nations that have progressively become quite comfortable with an effortless lifestyle in which individual consumption is almost unlimited. It will require massive resources and an unprecedented level of concentration among all public health agencies and private organizations to begin reversing the trends that have emerged over the last decades(WHO, 1998).

What is needed is a series of major policies aimed at transforming our environment and the way we live and work. Indeed, nothing short of a paradigm shift has any chance of success in the efforts to curtail the increase in the number of people who are chronically in positive energy balance. City

planning, building codes, mass transit systems, car use, safe footpaths and cycling paths, pedestrian-only city centers, school schedules and programs, and the media are among the areas that will require transformation(Egger and Swinburn, 1997).

Nowhere are the consequences of the present level of low energy expenditures more obvious than on energy balance and body weight regulation. Because the health consequences of excess body fat do not become immediately manifest, the current epidemic of obesity will translate later in unprecedented numbers of cases of type 2 diabetes, hypertension, cardiovascular disease, gall bladder disease, postmenopausal breast cancers, osteoarthritis of the knees, back pain, and physical and mental disabilities(Wolf and Coliditz, 1998).

The rapid changes in diet and lifestyle occur along with rapid economic changes, and the sedentary lifestyle is prevalent in Korea. The recent small increase in the prevalence of exercisers could be due to the publicity emphasizing the importance of physical activity as a protection against obesity and NCD. However, the majority of exercisers seem to be well-educated, relatively young, and affluent people.

V. Conclusion

The prevalence of obesity in Korea is increasing and has surpassed that of Japan. The current trends could be attributed to the low prevalence of habitual exercisers, and an increase in energy intake and the proportion of energy intake from fat.

Although the WHO technical report(WHO, 2003) gave a positive description of the Korean diet, obesity and NCD, a nation-wide population strategy emphasizing the benefits of diet, nutrition and physical activity are needed to prevent obesity and NCD.

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ABSTRACT

Objectives: The 2003 WHO/FAO technical report described that Korea has largely maintained its traditional high-vegetable diet despite major social and economic changes, and had lower than expected levels of obesity prevalence than other industrialized countries. However, the prevalence of obesity in Korea has recently been rapidly increasing. The aim of this study was to elucidate the determinants of this rapid growth of obesity prevalence in Korea and to compare the results of national nutrition surveys between Korea and Japan.

Methods: The trends of the National Health and Nutrition Survey in Korea instituted every 3 years and that in Japan conducted every year were compared. The results of obesity prevalence defined as more than 25 of the Body Mass Index, the percentage of habitual exercisers and the results of the nutritional surveys were examined from 1992 to 2005 in Korea and from 1992 to 2004 in Japan.

Results: The prevalence of obesity in males has been gradually increasing in both Korea and Japan since 1992. Though until 1995 the prevalence of obesity in the Korean male population was less than that in Japan, after 1998 Korea surpassed Japan and a markedly increasing trend was observed. In females, the increasing trend of obesity was slower than males in both Korea and Japan. However, the prevalence of obesity was much higher in Korea compared with that in Japan. The percentage of exercisers was much lower in Korea than in Japan. Although, the definition of an exerciser varies with the survey year in Korea and is different from that in Japan, almost 70% of the population was not regularly engaging in moderate or hard intensity exercise in Korea. From 1995, the total energy intake was increased by 9.8% in Korea but it was decreased by 6.9% in Japan. Presently, the energy intake per capita per day in Korea exceeded that in Japan. Remarkable increases in the intake of meat and poultry, vegetable oils and fats, and milk and dairy products were observed in Korea from 1995 to 2005. On the other hand, these values decreased during the same period in Japan.

Conclusion: The prevalence of obesity in Korea is increasing and has surpassed that of Japan. The current trends could be attributed to the low prevalence of habitual exercisers, and an increase in energy intake and the proportion of energy intake from fat.

Key Words: Obesity Prevalence, Exercise, Energy Intake, National Nutrition Survey