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**Socio-economic and Demographic Factors Affecting the Likelihood of Being an Overweight
Korean woman**

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Socio-economic and Demographic Factors Affecting the Likelihood of Being an Overweight Korean woman

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Abstract

Using data from urban Korean women survey the study examines factors associated with the BMI ≥ 25 , indicating overweight or obesity. Logit equation results identify low income, low education, household location and preference for convenience, sweet-tasting foods and home vegetable processing as characteristics linked to a high BMI.

Socio-economic and demographic factors affecting the likelihood of being an overweight Korean women

Introduction

The growing problem of weight management is a cause of concern for both developed and developing countries. The concerns are not without a scientific proof. Many clinical research studies have time and again proved that there is a strong association between the occurrence of overweight and obesity and the incidence of cardiovascular diseases, certain type of cancers, diabetes and hypertension (U.S. Department of Health and Human Services, 2003). Overweight is also strongly correlated with increased rates of morbidity and mortality (Loureiro and Nayga, 2005). The impact of obesity in causing chronic health conditions can be compared to that of twenty years of aging (Sturn, 2002). According to the World Health Organization (WHO, 2004) more than a billion adults are found to be overweight and 300 million of them are clinically obese. Surprisingly, this figure is greater than the number of malnourished people.

The weight management problem is not distributed evenly across the globe and is particularly prevalent in many European, Australasian and North American countries. In Asia, the weight management tends to be associated with some groups within a society and is linked to the income level. However, in a few high income countries, notably in the Republic of Korea there is a noticeable increase of people, who cannot maintain the desired body weight. The Republic of Korea has experienced an amazing economic growth. An increasing number of Koreans are adopting a western lifestyle that is reflected in eating more foods of animal origin, fats and oils than in the traditional Korean diet (Son, 2003) and in decreasing physical activity (Park et al., 2003). The 1998 National Health and Nutrition Survey reported an increase in the share of both obese and overweight individuals. The reported obesity rate was 1.7% and 3.0% (BMI of $\geq 30.0 \text{ Kg/m}^2$) and the rate of overweight 24.3% and 23.5% (BMI of 25.0-29.99 Kg/m^2)

among adult men and women (between the ages of 15 years and 79 years), respectively. However, recently, the OECD (2009) reported an obesity rate of 3.5% in South Korea with 3.3% and 3.7% for adult men and women, respectively, classified as obese. The ratios of overweight men and women are reported by OECD as 23.7% and 30.3%, respectively. The burgeoning weight management problem, occurring mostly as a result of the overconsumption of foods relative to energy spent, definitely warrants a suitable action on the part of the government, especially if the government is responsible for the supply of healthcare. Though the obesity rates in the Republic of Korea are the lowest among the OECD member countries, the overweight rates are increasing at an alarming rate and pose a potential threat to the well being of the population. In South Korea, various forms of cancer and cardiovascular diseases are already among major fatal causes and many such diseases have been linked to inability to maintain weight. In 2007 alone, cardiovascular diseases accounted for 23.5% of all deaths in that country (Chennell and Ridley, 2009). Apart from the health consequences, there may be serious social consequences as well as economic costs incurred due to enormous amount of health care provided to combat the consequences of overweight and obesity. A retrospective cohort study (Thompson et al., 2001) concludes that expected health costs are higher for persons who are overweight. The government agencies may want to know the segments of population that are prone to become obese or overweight to carry out the remedial measures in the form of educating the people and implementing various policies intended to reduce this malady.

This paper examines the influence of socioeconomic, demographic and attitudinal factors on the likelihood of being an overweight urban Korean woman. The share of obese or overweight women is higher than that of men suggesting that the profiles of persons at risk of unhealthy weight vary by gender. Knowledge of such profiles based on this study benefits government decision-makers in charge of updating health policy, planning investment in medical

services supply, or public education programs. Marketers of healthy foods and diet supplements gain from the knowledge of characteristics of the female segment at risk of weight management problems. The weight management sector learns whom to target and makes informed choices in deciding on the service mix aimed at potential customers.

Data collection and description

The study uses survey data collected in seven urban centers of the Republic of Korea in September 2007. The survey, implemented by a commercial market research company, involved 1,100 women responsible for food shopping and meal preparation. Respondents provided socioeconomic and demographic information, and shared views and opinions about various aspects of food consumption, preparation and processing. The surveyed females also reported their height and weight allowing the calculation of the body mass index (BMI). The empirical estimation uses 821 observations after the deletion of incomplete responses. Moreover, respondents answered questions probing for their views and opinions about food production technology, food-health relationship, and food attributes affecting and storage and preparation time. Table 1 shows descriptive statistics and variable definitions.

The dependent variable is a binary variable assuming the value of one if the $BMI \geq 25$ and zero otherwise. Therefore, the category with a value of one includes any person with excess weight management problem. The explanatory variables include socioeconomic and demographic characteristics, location and selected attitudinal variables based on responses provided by participants. Education, income and occupation are the important socio-economic factors usually included in similar studies. A review of literature by Sobal and Stunkard (1989) confirms the existence of a strong positive association between low socioeconomic status and obesity, especially among women. According to Goldblatt et al. (1965), the occurrence of obesity was six times higher among women of lower socioeconomic status than women with the

upper socioeconomic status. A study by Flegal et al. (1988) concludes that the mean BMI has a negative association with both education and income levels. Female labor participation was found to have a positive association with obesity rate according to a study by Loureiro and Nayga (2005).

The demographic variables included in earlier studies are the age of a respondent and the presence of children in the household. Park et al. (2003) report that prevalence of obesity in South Korea increases proportionately with an increase in age. Nayga (1999), analyzing a sample from the U.S., reports that persons with children in their households are more likely to become obese than those in households without children. The location of household may explain variations in obesity rates as observed by Nayga (1999). The current study distinguishes among the seven urban centers treating Seoul, the largest urban area in the country, as the reference location.

Attitudes appear important in maintaining body weight. The responses provided by the surveyed urban residents permitted the specification of several variables indicating various aspects of attitudes held by an individual. The aspects considered in the current study include health-oriented behavior, attachment to tradition and thrift, liking of fresh produce, preference for convenience and taste preferences. Among the variables, 'Smoke' represents a health behavior variable and was included in some of the previous studies including one conducted in the Republic of Korea (Park et al., 2003; Kim and Ruger, 2010). Loureiro and Nayga (2005) report a negative correlation between smoking and the BMI. Weight gain has been reported by people who quit smoking. It may result from change in behavior, for example the craving for smoking is replaced by spontaneous eating in-between meals, and in the effects of chemicals in the tobacco smoke on the body itself.

In each country, households engage in food preservation, but that inclination wanes as the income level increases. However, the importance and meaning of preservation of some foods may extend beyond simply consumption of it and is a part of cultural identity. In Korean society foods are not perceived exclusively as nourishment, but may pose non-tangible attributes benefiting a consumer. Therefore, a variable reflecting the overall preference for Korean foods ('Koreanfood') was included together with another variable, 'Cab,' accounting for a very specific traditional food. The variable 'Cab' is included to capture the effect of home pickling of cabbage. The cabbage is the main ingredient in kimchi, a Korean condiment, consumed daily in significant volume and a major source of fiber. The dietary fiber intake is helpful in weight management.

The preference for fresh fruit and vegetables is generally strong in the Republic of Korea. Vegetables have been a mainstay of the traditional diet and the fruit consumption has dramatically increased in recent decades. There is also epidemiological evidence that a high level of fresh produce consumption is associated with proper body weight. Therefore, the effect of the magnitude of the weekly expenditure on fresh vegetables is considered and captured through the inclusion of the variable 'Expv'.

The variables 'Easecook' and 'Willsweet' refer to preferences (Table 1). Urban lifestyles and the increasing participation of women in the labor force stimulate the demand for convenience. Food distributors and food service sector respond to the raising demand for convenience by providing partially or fully cooked meals and individual dishes, but often such dishes contain ingredients that are rich in calories. Consequently, frequent consumption of prepared dishes likely supplies more energy than a person needs in an urban setting (i.e., an environment that requires less energy to function than a rural environment) contributing to weight gain. The variable 'Willsweet' is a binary variable assuming the value of one when a

respondent expressed preference for sweet taste of foods. Refined sugar is relatively inexpensive and readily accessible to food manufacturers and households. Once the budget constraint is eased as a result of economic growth, Korean consumers may choose to indulge their preference for sweet-tasting foods.

The empirical model

A logit technique suits the estimation of a model where the response variable is a binary variable. The parameter estimates are interpreted in terms of the relative changes in the odds of an event occurring.

The empirical equation takes the following form:

$$Y = b_0 + b_1 \text{Income} + b_2 \text{Educ} + b_3 \text{Homemaker} + b_4 \text{Age} + b_5 \text{Child} + b_6 \text{Inchon} + b_7 \text{Daejeon} + b_8 \text{Daegu} + b_9 \text{Ulsan} + b_{10} \text{Busan} + b_{11} \text{Kwangju} + b_{12} \text{Smoke} + b_{13} \text{Cab} + b_{14} \text{Expv} + b_{15} \text{Koreanfood} + b_{16} \text{Eascook} + b_{17} \text{Willsweet}.$$

The above relationship is not linear. However, in the logistic regression a relationship becomes linear between the logit and the predictor variables. The logit technique estimates a parameter that is the log of odds of an event actually taking place, $\frac{\pi}{1-\pi}$, where π is the probability of $Y=1$ and $1-\pi$ is the probability of $Y=0$, respectively (Mendenhall and Sincich, 1996). The antilog of an estimate ($e^{\hat{b}_i}$) is the odds ratio and its value greater than one implies that the event (i.e., the likelihood of being an overweight woman) is more likely to happen in response to an increase in the explanatory variable; the odds ratio of less than one implies that the event is less likely to occur.

Results

The logistic regression employs maximum likelihood method to estimate the equation. The likelihood ratio test for the global null hypothesis is significant at <0.0001 probability level

indicating the overall explanatory power of the empirical model (Table 2). Table 2 shows the estimates, chi-square value, marginal effects, and odd ratios for the empirical equation. The results interpret the log of odds and odds ratios.

An increase in the household income is found to decrease the likelihood of having a BMI suggesting that the weight management is less of a problem if a respondent is from a high income household. The odds ratio associated with the household income is 0.799 and the marginal effect is -0.01 (Table 2). The income effect is consistent with the results reported in previous studies (Flegal et al., 1988; Lantz et al., 1998; Yoo et al., 2010). Low income households, given their budget limits, may have to contend with foods that contain relatively less expensive but energy-dense ingredients and, once eaten lead to a gain in body weight.

An increase in the educational attainment level of the respondent reduces the likelihood of becoming overweight. The odds ratio is 0.768 and the marginal effect is -0.12 (Table 2). Women with higher education might have acquired knowledge enabling them to make food choices helping to manage their body weight. The result supports the finding reported by Nayga (1999) that less educated individuals have higher probability of becoming obese than more educated individuals. Evidently, the higher educated have more awareness about the serious consequences of becoming overweight or obese.

Women from households located in Gwangju are more likely to become overweight than female respondents residing in Seoul. The odds ratio is 5.111 and the marginal effect is 0.14. Gwangju is an agricultural area and although the surveyed women were urban residents, there appears to be a distinctly different dietary pattern contributing to weight gain. Respondents from Seoul, the capital of the Republic of Korea are likely the first to learn and adopt new trends including health foods in comparison to Gwangju residents. The study by Nayga (1999) also

reports the relevance of regional differences with regard to the probability of falling into the obese category.

Females from households reporting processing cabbage are more likely to fall in the category having weight management problems than respondents who do not pickle cabbage. The odds ratio for this binary variable is 2.477 and the marginal effect is 0.033. Women-respondents who believe that the expenditure on fresh vegetables during the week preceding the survey was about normal or more than normal are less likely to be overweight than those who believe that the expenditure was less than normal. The odds ratio is 0.634 and marginal effect is -0.02. Several dietetic studies reported that a high consumption of fresh vegetables results in improved body weight management (Kahn et al., 1997; Williams et al., 1999; Bazzano et al., 2002; Tohill, 2005).

Women who agreed with the statement that the aim of new technologies should address the ease of cooking are more likely to have the high BMI than those who disagree with the statement or who have no opinion about that statement. The odds ratio associated with this variable is 1.528 and the marginal effect is 0.02. The ease of cooking is a proxy for the preference for convenience foods and a high consumption of convenience foods (i.e., fully or partially prepared) could contribute to the unwanted body weight gain increasing the BMI. Women willing to pay more for foods that taste sweeter are also more likely to have the BMI exceeding 25 than those who are not willing to pay a premium for such foods. The corresponding odds ratio is 1.821 and the marginal effect is 0.031. The preference for sweetness is a proxy for specific food choices. Because sweeter foods might contain refined sugar or starches they may be high in calories or be quickly metabolized and contribute indirectly to the body weight gain by inducing the feeling of being hungry and encourage eating.

Implications

Overall, results show that urban Korean women at risk of having weight management problems share characteristics of similar groups from other countries and continents. Also, factors that reduce the risk of being overweight or obese are alike. The similar profile of women at risk of having a high BMI suggests that despite different cultures, traditions, and history of economic development, the factors contributing to weight gain are the same and affect kindred population groups. Although in case of the Republic of Korea, the incidence of overweight or obesity is lower than in most developed economies, it is increasing and, given the right amount of time, it will reach levels of countries that already experience epidemic levels of unhealthy weight.

Among key factors reducing prevailing unhealthy weight gain are household income level and education of an individual. Income and education tend to be inversely related complicating a strategy preventing weight gain measured by the BMI. Public education programs are recommended but unlikely to evenly influence behavior of low income, low education urban women. The results indicate that the location of a household also matters. An agency in charge of public education may concentrate its efforts in a specific region, but it is warranted to further investigate regional differences in inclination to gain extra weight.

An indirect way to prevent urban Korean women from gaining weight may require the cooperation of public and private sectors. The promotion of eating fresh fruit and vegetables seems to have a strong positive effect on maintaining the proper weight. Increased fresh produce consumption directly benefits retailers, but also creates additional demand for domestic and imported fresh produce.

The cooperation of public health agency and the food manufacturing and distribution sectors in preventing the weight management matter to absorb an increasing share of country's

resources may be effective in modifying the urban lifestyle. The urban lifestyle must dominate in a country where about 80% of the population resides in urban areas. Such concentration of consumers facilitates food distribution and, therefore, also makes it easier to reach consumers with education and information campaigns about nutrition and available foods that help balanced nutrition, while assisting in weight management. The urban consumer demand for convenience was confirmed in the current study suggesting that many urban women want food products to be convenient. The specific solutions must account for local urban setting and culture because the exact meaning of convenience may vary across countries. For example, the perception of what constitutes a reasonable amount of time to conveniently prepare a meal may be different in the Republic of Korea than in the United States. Also, given the character of a Korean main meal, which often includes numerous side dishes and condiments, meeting consumer expectations of convenience requires knowledge of local dietary pattern and traditions if the goal of preventing excess weight gain is the ultimate goal.

The preference for sweet-tasting foods is natural. Studies suggest that people have preference for sweetness, especially children. If the importance of preference for sweetness as a contributor to weight gain is to be reduced, product formulations, controlled by food manufacturers, may require changes. The changes could increase production costs and negatively influence revenues. A thoughtful and gradual way of affecting sweet-tasting foods is likely to have a greater impact if content of public sector's education campaign coincides with the actual offerings of modified food products, among others.

The BMI is only one measure of person's well-being. It is of interest to economists, among others, because the body weight is linked to the amount and type of consumed food. The association between unhealthy weight and disease incidence has been established and one way of preventing weight gain is to change food choices. A change in food choices implies a shift in

demand away from specific foods and food in general. A decrease in food demand negatively influences the food sector revenues and may lead to a conflict between that sector and efforts that aim at preventing consumers from gaining weight. The latter are typically undertaken by government agencies in many countries across the world. This study generated a profile of urban Korean woman in risk of having an unhealthy weight. Results, in general, coincide with those from earlier studies conducted in other countries. Therefore, it is worthwhile to consider sustained, coordinated international efforts in combating the overweight and obesity problem. Although several initiatives have been undertaken in that area, the international coordination across scientific disciplines or sectors of economy is very limited. An accelerated effort will generate world-wide benefits in preventing and reducing the excess weight management problem.

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Table 1. Descriptive statistics of variables included in the empirical equation.

Variable name	Description and units of measurement	Mean or share ^a	Std dev.
Dependent variable			
Bmi25	= 1 if bmi \geq 25 and 0 otherwise	0.0828258	0.2757868
Independent variables			
<i>Socio-economic factors</i>			
Income ^b	7 categories of monthly household income in US dollars	4.3934227	1.4600052
Educ	Respondent's education in years	13.0389769	2.1855269
Homemaker	= 1 if the respondent is a homemaker and 0 otherwise	0.4226553	0.4942827
<i>Demographic variables</i>			
Age	Age of the respondent in years	41.5919610	8.2862145
Child	= 1 if the household has children, 0 otherwise	0.6504263	0.4771260
<i>Household location</i>			
Inchon ^c	=1 household located in Incheon, 0 otherwise	0.1071864	0.3095386
Daejeon ^c	=1 household located in Daejeon, 0 otherwise	0.0755177	0.2643859
Daegu ^c	=1 household located in Daegu, 0 otherwise	0.0913520	0.2882847
Ulsan ^c	=1 household located in Ulsan, 0 otherwise	0.0389769	0.1936578
Busan ^c	=1 household located in Busan, 0 otherwise	0.1266748	0.3328111
Kwangju ^c	=1 household located in Kwangju, 0 otherwise	0.0828258	0.2757868
<i>Other variables</i>			
Smoke	=1 If the respondent smokes and 0 otherwise	0.0280146	0.1651151
Cab	=1 if the household pickles cabbage and 0 otherwise	0.8124239	0.3906113
Expv	Weekly expenditure on fruits and vegetables (1 if it is less than normal, 2 if normal and 3 if above normal)	2.0401949	0.5056674
Korean food ^d	Response to the question 'how important it is for you to have food be of Korean origin'	2.8733252	0.4202581
Easecook ^e	Response to the question 'do you agree with the statement that new agricultural and food technologies should aim at easing cooking'	2.4652862	0.7556782
Willsweet	=1 if the respondent is willing to pay more for foods that taste sweeter, 0 otherwise	0.3142509	0.4644998

^a Share in case of a binary variable.

^b Monthly income categories: 1= <\$1700 ; 2= \$1700 to \$2299 3= \$2300 to \$2899; 4= \$2900 to \$3499 ; 5= \$3500 to \$4499; 6= \$4500 to \$5499; 7= >\$5499.

^c Seoul is the benchmark for measuring the effects of location.

^d 1= not important; 2= neutral; 3= important.

^e 1= disagree; 2= neutral; 3= agree.

Table 2. Estimation results.

Variable name	Parameter Estimate	Wald Chi-Square	Odds ratio	Marginal effect
Intercept	0.2828	0.0218	---	---
Income	-0.2241**	4.0665	0.799245	-0.0102114
Educ	-0.2642***	12.2655	0.767783	-0.0120415
Homemaker	-0.2026	0.4856	0.816589	-0.0091145 [#]
Age	0.025	1.5354	1.025346	0.0011406
Child	-0.3033	0.8544	0.738387	-0.0144407 [#]
Inchon	-0.0695	0.0141	0.932869	-0.0030898 [#]
Daejeon	0.1597	0.0698	1.17313	0.0077403 [#]
Daegu	0.0123	0.0005	1.012303	0.0005597 [#]
Ulsan	-0.2624	0.0618	0.769208	-0.0107343 [#]
Busan	0.5174	1.4243	1.677744	0.0282405 [#]
Kwangju	1.6314***	15.2111	5.110969	0.1412308 [#]
Smoke	0.0496	0.0039	1.050908	0.0023113 [#]
Cab	0.9071*	3.2782	2.47789	0.0327558 [#]
Expv	-0.4559*	3.0309	0.633869	-0.0207755
Koreanfood	-0.292	0.8461	0.746731	-0.0133084
Easecook	0.4238*	3.6768	1.52783	0.0193146
Willsweet	0.5996**	4.1948	1.82144	0.0305175 [#]

Note: *, ** and *** denote significant at 10%, 5%, and 1% levels, respectively

(#) dy/dx is for discrete change of binary variable from 0 to 1.

Likelihood Ratio chi-square: 91.8219; P-value: <0.0001