ORIGINAL ARTICLE

Body-Mass Index and Mortality in Korean Men and Women

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ABSTRACT

BACKGROUND

Obesity is associated with diverse health risks, but the role of body weight as a risk factor for death remains controversial.

METHODS

We examined the association between body weight and the risk of death in a 12-year prospective cohort study of 1,213,829 Koreans between the ages of 30 and 95 years. We examined 82,372 deaths from any cause and 48,731 deaths from specific diseases (including 29,123 from cancer, 16,426 from atherosclerotic cardiovascular disease, and 3362 from respiratory disease) in relation to the body-mass index (BMI) (the weight in kilograms divided by the square of the height in meters).

RESULTS

In both sexes, the average baseline BMI was 23.2, and the rate of death from any cause had a J-shaped association with the BMI, regardless of cigarette-smoking history. The risk of death from any cause was lowest among patients with a BMI of 23.0 to 24.9. In all groups, the risk of death from respiratory causes was higher among subjects with a lower BMI, and the risk of death from atherosclerotic cardiovascular disease or cancer was higher among subjects with a higher BMI. The relative risk of death associated with BMI declined with increasing age.

CONCLUSIONS

Underweight, overweight, and obese men and women had higher rates of death than men and women of normal weight. The association of BMI with death varied according to the cause of death and was modified by age, sex, and smoking history.

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Although obesity is widely accepted as an important health risk, the optimal body-mass index (BMI) (the weight in kilograms divided by the square of the height in meters) and the effects of being either underweight or overweight on the risk of death are controversial. In the Cancer Prevention Study (CPS) II,[1] sponsored by the American Cancer Society, the rate of death was lowest among men with a BMI of 23.5 to 24.9 and among women with a BMI of 22.0 to 23.4; above and below these levels, the risk of death increased. However, being overweight was not associated with an increased risk of death in the National Health and Nutrition Examination Survey (NHANES) I, II, or III.[2] The results of other studies have been mixed[3,4] and may reflect differences in age, the number or extent of coexisting illnesses, and BMI distributions among subjects, as well as in analytic approaches.[1,5]

Since studies of the association between BMI and death have been conducted primarily in Western populations, it is uncertain whether the findings of these studies can be applied to other groups. Continental Asian populations have a higher percentage of body fat for a given BMI than do whites,[6] and a World Health Organization (WHO) Expert Consultation proposed a new BMI cutoff of 23.0 for public health action in Asia.[7] The use of this cutoff, however, was not directly supported by data on mortality.[8,9] Indeed, deaths from any cause were lowest among men with a BMI of 24.0 to 24.9 and women with a BMI of 25.0 to 26.9 in a representative group of Chinese subjects.[10,11]

We conducted a prospective cohort study of BMI and the risk of death from any cause and from specific diseases in more than 1 million Koreans in the Korean Cancer Prevention Study (KCPS).[12,13]

METHODS

STUDY POPULATION

We enrolled 1,329,525 Koreans between the ages of 30 and 95 years who had undergone one biennial medical evaluation through the National Health Insurance Corporation between 1992 and 1995.[12,13] Of the subjects, 784,870 (59.0 percent) were enrolled in 1992, 367,903 (27.7 percent) in 1993, 98,417 (7.4 percent) in 1994, and 78,335 (5.9 percent) in 1995.

To avoid confounding of the association between BMI and the risk of death by preexisting disease,[14,15] 904 subjects who died before January 1, 1993, were excluded from the study, as were 87,911 subjects who reported having atherosclerotic cardiovascular disease, cancer, liver disease, diabetes, or a respiratory disease at or before the initial study visit. In addition, 26,881 subjects with missing information about BMI or alcohol intake and those with an extremely low BMI (less than 16.0) or short stature (1.30 m or less) were excluded. The final sample included 1,213,829 subjects.

Because the study involved data that were routinely collected, consent was not specifically obtained. The institutional review boards of Yonsei University and the Johns Hopkins Bloomberg School of Public Health approved the study.

DATA COLLECTION

Enrollees in the National Health Insurance Corporation undergo standardized examinations every two years at local hospitals. During visits between 1992 and 1995, subjects reported on their smoking habits and alcohol consumption, and weight and height measurements were recorded while subjects were wearing light clothing. Subjects were seated for blood-pressure measurement. Blood samples were obtained after an overnight fast for white-cell counts and clinical chemical analysis. Quality-control procedures were performed in accordance with the Korean Association of Laboratory Quality Control.

FOLLOW-UP AND OUTCOME CLASSIFICATION

Deaths among subjects through December 31, 2004, were confirmed by matching the information to death records. Death certificates from the National Statistical Office were identified with the use of identification numbers assigned to subjects at birth. Abstractors coded causes of death according to the *International Classification of Diseases, 10th Revision*.[16] We used underlying causes as reported.

We attempted to minimize the effect of existing medical conditions on the baseline BMI by excluding all events that occurred among subjects during the first two years of follow-up. Thus, general follow-up began on January 1 of the third year after the baseline visit. In a sensitivity analysis, we excluded the first five years of follow-up.

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STATISTICAL ANALYSIS

Proportional-hazards models were used to evaluate the association between the baseline BMI and death.[17] The BMI was categorized as less than 18.5, 18.5 to 19.9, 20.0 to 21.4, 21.5 to 22.9, 23.0 to 24.9, 25.0 to 26.4, 26.5 to 27.9, 28.0 to 29.9, 30 to 31.9, or 32.0 or more. Analyses were performed separately in men and women and were adjusted for the following covariates: age at enrollment (continuous variable), alcohol intake (five categories based on grams consumed per day: 0, 1 to 24 g, 25 to 49 g, 50 to 99 g, and 100 g or more), and participation in regular physical activity (yes or no). Because the proportion of women who reported having smoked cigarettes was small, analyses in women were restricted to those who reported never having smoked. Analyses of men who reported having smoked were adjusted for smoking status (never smoked, former smoker, or current smoker) and the number of cigarettes smoked daily among current smokers (1 to 9, 10 to 19, and 20 or more).

Modification of the effect of BMI was assessed by the inclusion of interaction terms of BMI category indicators with indicator variables for sex, age (three categories), and smoking history (two

Table 1. Baseline Characteristics of the Study Population.*

Characteristic	Men (N = 770,556)	Women (N = 443,273)
Age — yr	45.0±11.1	49.4±12.1
BMI	23.2±2.6	23.2±3.1
Systolic blood pressure — mm Hg	124.5±16.0	121.5±19.1
Fasting serum glucose — mg/dl	92.1±23.1	89.9±22.4
Total serum cholesterol — mg/dl	191.1±37.7	194.4±39.3
Aspartate aminotransferase — U/liter	26.3±16.6	22.4±10.0
Alcoholic drinks — g per day	17.2±32.2	0.2±1.9
Smoking status — %		
Never smoked	20.8	93.8
Former smoker	20.1	2.0
Current smoker	59.1	4.1
Any alcohol use — %	76.8	14.3
Physical activity — %	28.6	16.6

* Data are from the KCPS, 1992–1995.[12,13] Plus–minus values are means ±SD. Percentages may not total 100 because of rounding. To convert the values for cholesterol to millimoles per liter, multiply by 0.02586. To convert the values for glucose to millimoles per liter, multiply by 0.05551.

Table 2. Differences in Baseline Systolic Blood Pressure and Clinical Chemical Analyses, According to BMI.*

BMI	Men				Women			
	Systolic Blood Pressure	Total Cholesterol	Fasting Serum Glucose	White-Cell Count	Systolic Blood Pressure	Total Cholesterol	Fasting Serum Glucose	White-Cell Count
	mm Hg	*mg/dl*		*cells/mm³*	*mm Hg*	*mg/dl*		*cells/mm³*
<18.5	–8.1	–19.9	–4.0	–94	–6.2	–14.3	–3.2	–360
18.5–19.9	–5.9	–15.8	–3.3	–143	–4.8	–10.9	–2.7	–350
20.0–21.4	–4.0	–11.4	–2.4	–97	–3.8	–8.0	–2.2	–266
21.5–22.9	–2.2	–5.9	–1.2	–56	–2.2	–4.4	–1.3	–138
23.0–24.9†	0	0	0	0	0	0	0	0
25.0–26.4	2.0	4.5	1.0	56	2.6	3.7	1.2	137
26.5–27.9	3.9	7.1	2.0	120	4.7	6.2	2.2	215
28.0–29.9	6.2	9.3	3.2	129	6.9	7.3	3.3	320
30.0–31.9	8.2	11.2	4.9	151	9.9	9.7	4.7	440
≥32.0	11.5	13.3	7.8	99	12.4	10.3	6.4	649

* Data are from the KCPS, 1992–1995.[12,13] The reference category was a BMI of 23.0 to 24.9. All differences were adjusted for age (continuous). To convert the values for cholesterol to millimoles per liter, multiply by 0.02586. To convert the values for glucose to millimoles per liter, multiply by 0.05551.
† This group served as the reference group.

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categories, one consisting of current and former smokers and one of lifetime nonsmokers). All analyses were conducted with the use of SAS software, version 9 (SAS Institute).

RESULTS

The average BMI was 23.2 for both sexes (Table 1), and the majority of subjects had a BMI below 25.0. The BMI was below 18.5 in 2.2 percent of men and 4.7 percent of women; above 25.0 in 23.8 percent and 26.8 percent, respectively; and above 30.0 in 0.8 percent and 2.4 percent, respectively. Systolic blood pressure, total serum cholesterol, fasting serum glucose level, and white-cell count had strong, progressive associations with increasing BMIs (Table 2).

During follow-up, 58,312 men died (including 22,249 from cancer, 10,486 from atherosclerotic cardiovascular causes, and 2442 from respiratory causes) and 24,060 women died (including 6874 from cancer, 5940 from atherosclerotic cardiovascular causes, and 920 from respiratory causes). The shape of the curve showing the association between BMI and the risk of death from any cause was similar in men, regardless of their smoking history, and in women who reported never having smoked (Fig. 1A). The hazard ratio was higher at the lowest and highest BMI values.

Men with a BMI of 23.0 to 24.9 who reported never having smoked had the lowest risk of death from any cause (Table 1 of the Supplementary Appendix, available with the full text of this article at www.nejm.org). As compared with men with a BMI of 23.0 to 24.9, men who reported never having smoked had a hazard ratio for death from any cause of 1.29 (95 percent confidence interval, 1.15 to 1.44) in association with a BMI of less than 18.5, a hazard ratio of 1.04 (95 percent confidence interval, 0.98 to 1.10) in association with a BMI of 25.0 to 29.9, and a hazard ratio of 1.71 (95 percent confidence interval, 1.44 to 2.03) in association with a BMI of 30.0 or more. As compared with men with a BMI of 23.0 to 24.9, men who reported having smoked had a hazard ratio for death from any cause of 1.36 (95 percent confidence interval, 1.30 to 1.42) in association with a BMI of less than 18.5, a hazard ratio of 0.98 (95 percent confidence interval, 0.95 to 1.01) in association with a BMI of 25.0 to 29.9, and a hazard ratio of 1.31 (95 percent confidence interval, 1.18 to 1.45) in association with a BMI of 30.0 or more.

Among women (with the analysis restricted to those who reported never having smoked), the risk of death from any cause was lowest for those with a BMI of 23.0 to 24.9 and similar for those with a BMI of 20.0 to 26.4 (Fig. 1A, and Table 2 of the Supplementary Appendix). As compared with women with a BMI of 23.0 to 24.9, women with a BMI of less than 18.5 had a hazard ratio for death from any cause of 1.17 (95 percent confidence interval, 1.09 to 1.26), women with a BMI of 25.0 to 29.9 had a hazard ratio of 1.04

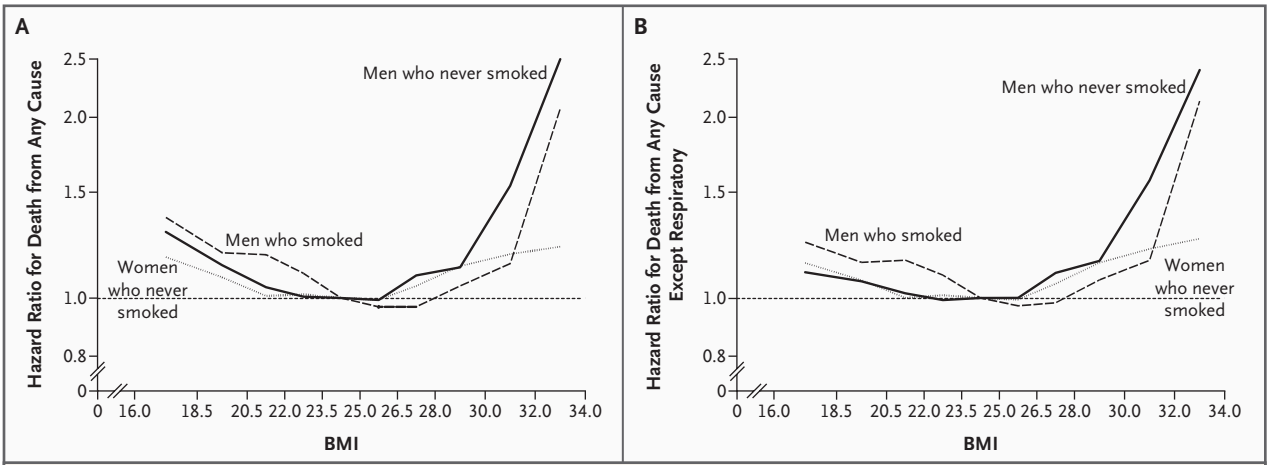

Figure 1. Hazard Ratios for Death from Any Cause and from Any Cause Except Respiratory, According to BMI and Smoking History.

Data are from the KCPS, 1993–2004.[12,13] The reference category was a BMI of 23.0 to 24.9. Results for men who reported having smoked cigarettes were further adjusted for whether the subject was a former smoker or a current smoker and the number of cigarettes smoked per day (1 to 9, 10 to 19, and 20 or more). All hazard ratios were adjusted for age.

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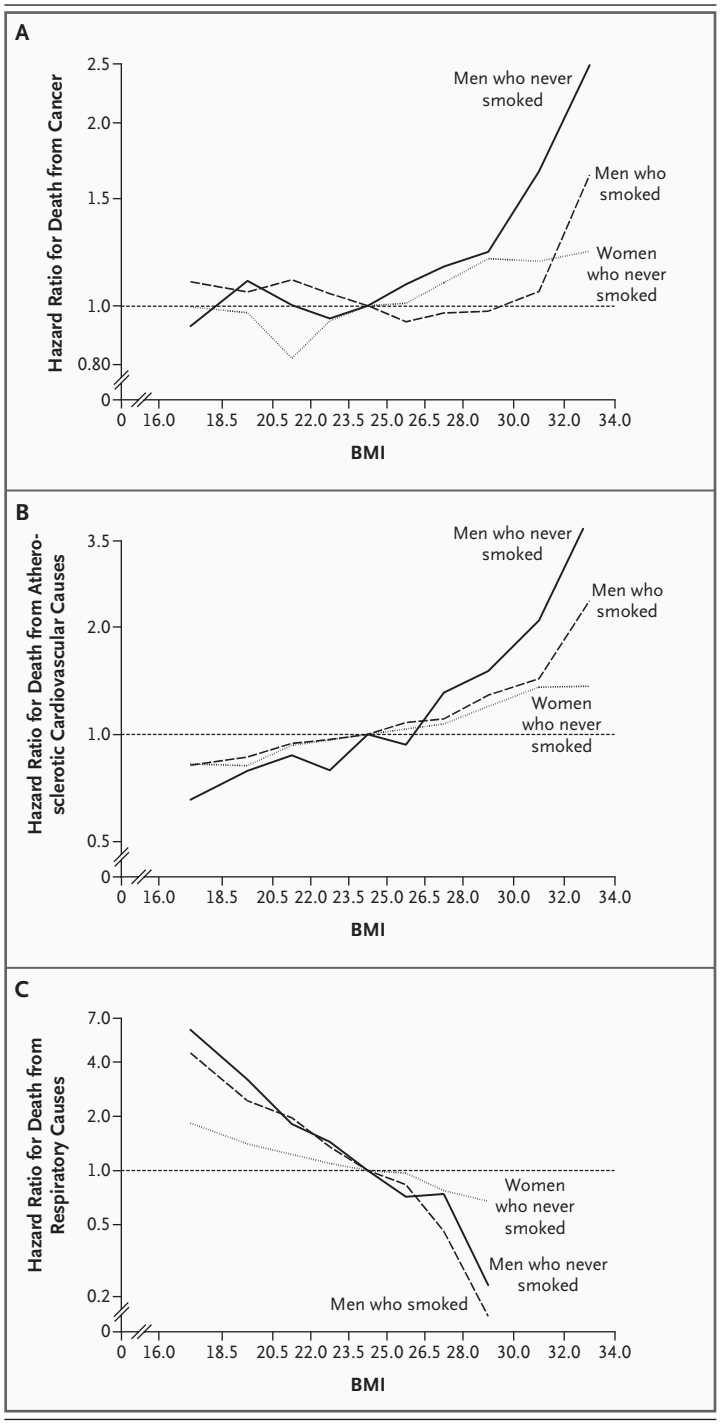

Figure 2. Hazard Ratios for Death from Cancer and from Atherosclerotic Cardiovascular and Respiratory Causes, According to BMI and Smoking History.

Data are from the KCPS, 1993–2004.[12,13] The reference category was a BMI of 23.0 to 24.9. Results for men who reported having smoked cigarettes were further adjusted for whether the subject was a former smoker or a current smoker and the number of cigarettes smoked per day (1 to 9, 10 to 19, and 20 or more). The number of deaths from respiratory causes among subjects with a BMI of 30.0 or more was too small to yield a reliable estimate of relative risks. All hazard ratios were adjusted for age. Panels A, B, and C have different scales for hazard ratios in the vertical axes.

(95 percent confidence interval, 1.00 to 1.08), and women with a BMI of 30.0 or more had a hazard ratio of 1.20 (95 percent confidence interval, 1.10 to 1.30).

The association between BMI and the risk of death according to the cause of death had a similar pattern of variation for both sexes (Fig. 2, and Tables 1 and 2 of the Supplementary Appendix). The risk of death from respiratory causes decreased progressively with increasing BMI, whereas the risk of death from atherosclerotic cardiovascular causes increased steadily with increasing BMI. The risk of death from cancer increased at a BMI above 26.0 to 28.0. Deaths from respiratory causes explained some of the increase in the risk of death at a low BMI (Fig. 1B). For deaths associated with lung disease, the association between BMI and the risk of death was similar for the major categories of pulmonary illnesses, including tuberculosis, chronic obstructive pulmonary disease (COPD), asthma, and pneumonia; the association persisted after the exclusion of the first five years of follow-up. With this exclusion, the hazard ratio for death from respiratory causes that was associated with a decrease in BMI of 1.0 was 1.26 (95 percent confidence interval, 1.20 to 1.31) among men who reported never having smoked, 1.25 (95 percent confidence interval, 1.22 to 1.27) among men who reported having smoked, and 1.08 (95 percent confidence interval, 1.05 to 1.12) among women.

The relative increase in the risk of death from any cause that was associated with a high BMI was dependent on age (Fig. 3). For both sexes, the highest relative risks associated with a high BMI were observed among subjects younger than 50 years of age. An increase in BMI to more than 25.0 was not associated with an increased risk of death from any cause among men or women who were 65 years or older at baseline. The interaction between BMI and age was significant ($P<0.001$), as were interactions between BMI and sex and BMI and smoking history ($P<0.001$ for both).

We explored whether the association between

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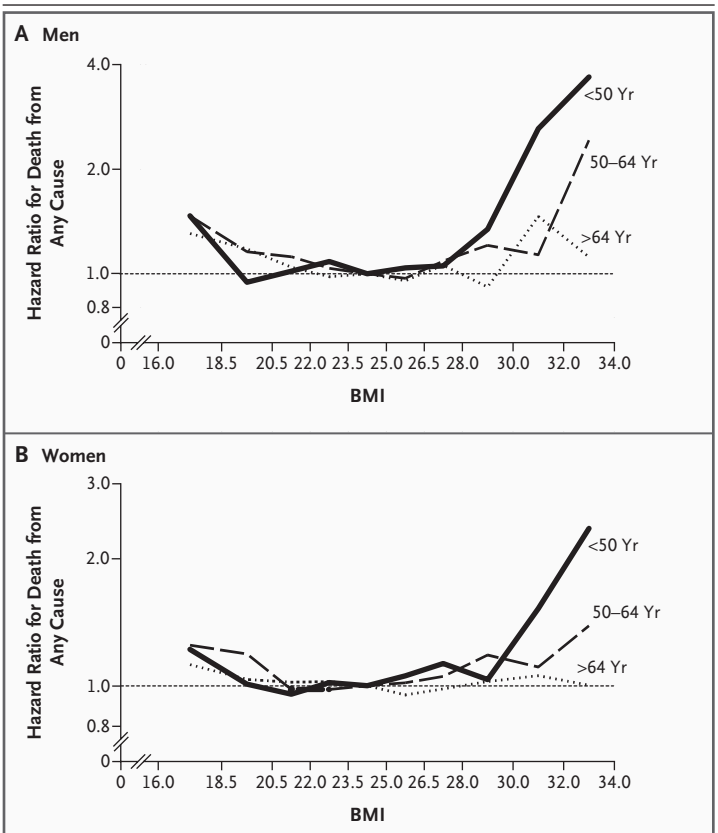

Figure 3. Hazard Ratios for Death from Any Cause among Men and Women with No History of Smoking, According to Age Group and BMI.

Data are from the KCPS, 1993–2004.[12,13] The reference category was a BMI of 23.0 to 24.9. All hazard ratios were adjusted for age. Panel A and Panel B have different scales for hazard ratios.

BMI and the risk of death from atherosclerotic cardiovascular disease could be explained by systolic blood pressure or levels of blood glucose or cholesterol. As expected, adjustment for these factors attenuated this association (Table 3). Analyses of death from any cause, from cancer, and from respiratory causes adjusted for risk factors are shown in Tables 3, 4, and 5, respectively, of the Supplementary Appendix.

DISCUSSION

Our study confirms the findings of previous studies demonstrating that the relationship between death from any cause and BMI follows a J-shaped pattern.[18] This curve reflects the association between BMI and the risk of death from all the major diseases. Among subjects with a low BMI, the increased risk was driven by respiratory and other causes, whereas among those with a high BMI, it was associated with cancer and cardiovascular diseases. Similar patterns were observed in smokers and those who reported never having smoked, implying that confounding by a history of smoking cannot explain the J-shaped relationship. This J-shaped risk relationship has been documented in several of the largest, but not all, cohorts.[2,11] The patterns in the Korean, Chinese, and Western[1,4] cohorts appear to be similar, suggesting that the risk of death associated with obesity among Asians is not apparent at lower BMI values, as compared with that among Western populations.

Because of the weight distribution of the subjects, the KCPS probably contains substantially more information about people with lower BMI values than do studies with Western cohorts. At a BMI of less than 18.5, hazard ratios for death were significantly increased, with the excess due, in part, to respiratory causes. In the Nurses' Health Study, Hu et al.[5] showed that an increased risk in the leanest group was primarily due to an increase in COPD and cirrhosis. Other studies have also noted a substantially increased risk of death among subjects with a low BMI,[1,2] although they did not provide information about the cause of death. He et al.[10] identified an increased risk of death among underweight Chinese subjects, which persisted after the exclusion of subjects with baseline cardiovascular disease, cancer, renal disease, or COPD, and an increased risk of death during the first three years of follow-up. In the CPS II study, Calle et al.[1] showed a greater increase in the risk of death associated with being underweight among those with a history of disease at enrollment than among those without such a history; relative risks in CPS II were similar to estimates in the KCPS for BMI values of less than 18.5. In NHANES,[2] relative risks were higher overall (values were as high as 3.0 across the age and smoking strata), but analyses included subjects with coexisting illnesses and included deaths during the entire follow-up period.

To reduce the potential for attributing an excess risk of being underweight to weight loss associated with illness, we excluded from all analyses subjects reporting diagnoses of certain chronic diseases at enrollment, as well as during the first two years of follow-up, and we conducted sensitivity analyses that excluded the first five years of follow-up. Although this analytic strategy may be effective if the illness causing rapid weight loss

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Table 3. Hazard Ratios for Death from Atherosclerotic Cardiovascular Causes, According to BMI.*

BMI	Men			Women		
	Adjusted for Age	Adjusted for Covariates†	Adjusted for Covariates and Intermediate Variables‡	Adjusted for Age	Adjusted for Covariates†	Adjusted for Covariates and Intermediate Variables‡
	hazard ratio for death (95 percent confidence interval)					
<18.5	0.85 (0.76–0.94)	0.78 (0.70–0.86)	1.07 (0.96–1.19)	0.86 (0.76–0.98)	0.80 (0.70–0.91)	0.97 (0.85–1.11)
18.5–19.9	0.90 (0.83–0.97)	0.85 (0.79–0.92)	1.08 (0.99–1.17)	0.90 (0.81–1.00)	0.86 (0.77–0.96)	1.00 (0.90–1.12)
20.0–21.4	0.97 (0.91–1.03)	0.93 (0.87–0.99)	1.07 (1.00–1.14)	0.96 (0.88–1.05)	0.93 (0.85–1.02)	1.02 (0.93–1.12)
21.5–22.9	0.95 (0.90–1.01)	0.93 (0.88–0.99)	1.02 (0.96–1.09)	0.94 (0.86–1.02)	0.93 (0.86–1.02)	0.98 (0.90–1.07)
23.0–24.9§	1.00	1.00	1.00	1.00	1.00	1.00
25.0–26.4	1.04 (0.97–1.11)	1.04 (0.97–1.12)	0.98 (0.91–1.05)	1.03 (0.94–1.13)	1.03 (0.94–1.13)	0.97 (0.88–1.06)
26.5–27.9	1.13 (1.04–1.24)	1.15 (1.05–1.26)	1.02 (0.94–1.12)	1.02 (0.91–1.13)	1.02 (0.91–1.14)	0.91 (0.81–1.01)
28.0–29.9	1.32 (1.18–1.49)	1.36 (1.20–1.52)	1.09 (0.97–1.23)	1.13 (1.01–1.28)	1.15 (1.02–1.30)	0.99 (0.88–1.12)
30.0–31.9	1.58 (1.29–1.95)	1.58 (1.28–1.95)	1.21 (0.98–1.50)	1.31 (1.09–1.57)	1.33 (1.11–1.59)	1.08 (0.90–1.30)
≥32.0	2.75 (1.98–3.82)	2.86 (2.05–3.97)	1.94 (1.39–2.71)	1.28 (1.01–1.62)	1.30 (1.02–1.65)	1.04 (0.82–1.32)

* Data are from the KCPS, 1993–2004.[12,13]
† Covariates are age (continuous); cigarette smoking, including status (never smoked, former smoker, or current smoker) for both sexes and the number of cigarettes smoked per day (1 to 9, 10 to 19, or ≥20) for men, alcohol intake (0, 1 to 24, 25 to 49, 50 to 99, or at least 100 g per day for men and 0 g per day or any intake for women), and level of participation in physical exercise.
‡ Intermediate variables are fasting blood glucose levels, systolic blood pressure, and serum cholesterol levels (all continuous).
§ This group served as the reference group.

leads to death, reverse causation may influence risk estimates if the disease course is lengthy and accompanied by weight loss.[19] COPD has these characteristics, and subjects with more severe disease had greater weight loss over time.[20] In several studies, after adjusting for lung function, the BMI remained a significant predictor of death.[21,22] Thus, for COPD, the relationship between BMI and the risk of death may represent both reverse causation and a true causal role for body weight in determining prognosis. For tuberculosis, wasting at the time of diagnosis is a feature of the disease, and body weight predicts the short-term risk of death.[23-25] The exclusion of the first two years of follow-up should address any acute contribution of active tuberculosis to body weight.

Since the distribution of respiratory causes of death may differ between Koreans and inhabitants of Western countries, it may not be possible to generalize our findings to other populations. Deaths from respiratory causes were due to tuberculosis in 19.3 percent of subjects, to pneumonia in 27.9 percent, to COPD in 27.8 percent, and to asthma in 24.7 percent.

For deaths from atherosclerotic cardiovascular disease, the hazard ratio increased steadily with increasing BMI, similar to the findings in a smaller cohort study of insured Koreans.[26] Information on selected cardiovascular risk factors showed an increasingly unfavorable profile with increasing BMI, but these risk factors alone did not explain the excess risk of death from atherosclerotic cardiovascular causes associated with obesity. Although misclassification of cardiovascular risk factors, particularly those that vary during follow-up, could partially explain the persistent risk, the metabolic syndrome, sleep-disordered breathing, and other consequences of increased BMI are also likely to contribute to the risk associated with cardiovascular disease. The association of BMI with the risk of death from atherosclerotic cardiovascular causes was substantial, as has been shown in many other studies.[27] A few large cohorts provided reasonably precise estimates of the risk of death from cardiovascular causes according to BMI. Similar, progressive increases in risk associated with BMI were seen in some studies, including the Nurses' Health Study,[5,14] nonsmokers in the Physicians' Health Study,[4] and the CPS I,[28] but not in others, including CPS II,[1] a U.K. cohort of particularly lean people,[29] men with cardiovascular disease in the Physicians' Health

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Study,[30] and a representative sample of Chinese men and women.[11]

The risk of death from cancer increased slightly among overweight men and women and more substantially among subjects with a BMI above 30.0 at enrollment; we observed no excess risk among subjects who had a low BMI at enrollment. In a meta-analysis by McGee,[27] pooled estimates of the risk of death from cancer that compared obese subjects with those of normal weight were much smaller — 1.10 for women and 1.06 for men — than in our study. The Nurses' Health Study reported risks similar to those in our study, but risks in similar BMI strata were lower in CPS I and II.[1,31] Distributions of deaths according to the type of the primary tumor differ between Korean and U.S. populations.[32] Nonetheless, our findings indicate that obesity does contribute to Korea's cancer burden.

As has been reported in other populations, we found that the association between BMI and the risk of death varied according to age, with little evidence of increased risk among obese subjects over the age of 65 years. This effect modification has been the subject of controversy because BMI is less well correlated with adiposity in the elderly and because of the increased probability of undiagnosed diseases and survivor effects in this age group.[33] Substantial interest exists, however, in conducting an estimation of the future burden of obesity as today's obese children and young adults grow older.[2,34,35] In other studies, investigators showed that an older age at enrollment (the variable used in our analysis) attenuated the risk associated with obesity.[28,36] In fact, in CPS I, overweight and obesity were not associated with an increased risk of death among subjects older than 85 years.[28] In a recent report by Flegal et al.[2] of follow-up data from NHANES I, II, and III, subjects in the oldest age group (70 years or older) who had a BMI of more than 25 were not at increased risk for death. Our evidence provides support for this modification of effect by age, but this effect has not been observed in all populations.[4]

The association of BMI in the overweight and obese range with an increased risk of death from atherosclerotic cardiovascular causes and cancer suggests that control of excess adiposity may reduce the two most important causes of death among Koreans. The inverse association between BMI and the risk of death from respiratory causes partly explains the J-shaped relationship between BMI and the risk of death from any cause, but further research is warranted to examine the extent of reverse causation and to consider the role of other causes of an increased risk of death in association with a low BMI.

In considering whether the findings of the KCPS can be applied to other populations, we recognize that Asian populations generally have a higher percentage of body fat than do Western populations at the same BMI level.[7] In a meta-analysis of the predictive ability of BMI to estimate the percentage of body fat among various ethnic groups, Deurenberg et al.[6] found that for the same percentage of body fat, BMI among subjects from various East Asian countries was lower by 1.9 to 3.2 than that of white subjects. Although contributing factors are not completely understood,[7] Asians generally have a slighter body build than do whites, and slighter people tend to have less muscle mass and connective tissue.[37] Consequently, the WHO recommends that cutoff values in the definition of overweight and obesity should be lower for Asian populations than for Western populations.[7,38] Our observations may prove to be useful in the evaluation of this recommendation.

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