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Original Research

Health Benefits of Weight Maintenance and Weight Change: Based on Males' Data from the Korea Health Panel in 2010 and 2011

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Abstract

Background: With the increase in obesity, weight change rather than weight maintenance is becoming more popular with the public, but studies evaluating the health benefits between them are rare. This study confirmed the health-related characteristics and benefits of each. **Methods**: Using 2 years (2010 and 2011) of data from the Korea Health Panel, this study investigated weight change of 5 kg or more within the past year among males after identifying the homogeneity of two years subjects ($p > 0.05$). Subjects were classified into weight maintenance and weight change categories of gain, recovery, and loss. The author identified the effect variables and health benefit variables, current health status as quality of life (QOL), days spent sick in bed during the past month, and annual out-of-pocket (OOP) expenditure by adjusted odds ratios (AORs) and ANCOVA. **Results**: Among males, the prevalence of weight maintenance was 89.1% and the prevalence of weight change categories was 10.9% overall, gain 4.8%, recovery 1.5%, and loss 4.6%. The AORs of the weight maintenance group for health-related characteristics were significant: young adult (AOR 0.5, 95% CI 0.4–0.6), no spouse (0.7, 0.6–0.8), overweight (0.7, 0.6–0.8), obesity (0.4, 0.4–0.5), no regular meal (0.7, 0.6–0.9), two meals per day (0.8, 0.7–0.9), four meals or more per day (0.4, 0.2–0.9), depression (0.7, 0.5–0.9), and suicidal impulse (0.7, 0.5–0.9). However, AORs of the weight change group showed among those who gained, no regular meals (AOR 1.3, 95% CI 1.1–1.7) and two meals per day (1.3, 1.1–1.7); among those who recovered, excessive drinking (1.5, 1.1–2.2) and suicidal impulse (2.2, 1.2–4.0); and among those who lost, underweight (2.0, 1.3–3.2) and current smoking (1.2, 1.1–1.5). Health benefits of the weight maintenance group differed significantly from the weight change group: current health status as QOL (74.3 *vs.* 70.1, $p < 0.0001$), days spent sick in bed during the past month (4.5 *vs.* 7.9, $p < 0.02$), and annual OOP expenditure ($366.3 *vs.* $562.9, $p < 0.0001$). **Conclusions**: The social alternative to obesity management needs to promote that maintaining a stable weight has more health benefits than weight change. It is also necessary to support the cognitive abilities of the public through evidence-based knowledge.

Keywords: obesity; weight maintenance; weight change; health behavior; psychological health; health benefit; QOL; days spent sick in bed; OOP expenditure

1. Introduction

Chubbiness is traditionally regarded as a symbol of abundance and generosity in Korea. However, with the rapid advent of globalization, the East has accepted multinational cultures and values, and Korea has witnessed cultural assimilation, in particular, the perception of fatness has changed greatly. The prevalence of obesity has increased in the past decade not only in the West but also in the East, especially in Korea [1,2]. Therefore, not only the expert health care society, but also the public, now recognize obesity as a health risk. Other societal changes such as paid fitness centers and life-sports are on the rise, along with diet industries, such as health food and complementary alternative medicine [3]. These industries are attracting attention from the public, who value quality of life (QOL).

Social efforts are being made to prevent unfair advantage due to cronyism in the workplace by blinding school names and places of birth in recruitment screenings and interviews. However, visible physical factors, such as body size, cannot be hidden. Thus, appearance and first impressions can be of greater importance to both recruiters and job seekers. The social prejudice against obesity is more severe in young adults and unmarried people. Some studies recognized obesity as social discrimination, as it occurs more frequently in low social classes [4]. Therefore, efforts to overcome obesity are attracting attention not only from the public but also from health and welfare policies to improve equity.

Weight change is the most commonly attempted response to obesity worldwide. Weight loss, which alleviates chronic diseases and reduces obesity-related mortality, prolongs life span in obese people when reviewing medical opinions [5,6]. However, few studies support this belief. There is also a report that people who experienced weight change, such as weight loss or weight gain, did not have positive health outcomes, but had a shorter survival period than those who maintained a stable weight [7–10]. Also, most of those who intentionally lost weight did not maintain the loss and gained again. When the body loses weight, it reduces resting energy expenditure and there is a metabolic mechanism to restore it to the previous state. The public tries to lose weight again using extreme methods, and in

the worst case, may be at risk of developing eating disorders [11].

For safe management of obesity, study results showing various negative effects of weight loss should be considered. The public must rethink the belief that weight loss is a necessary strategy to combat obesity. Experts need to test the paradoxical hypothesis that weight maintenance, rather than weight change, is beneficial to health. If the public can maintain a stable weight, it can avoid the Yo-Yo cycle often accompanied by depression and eating disorders. Weight maintenance is a low priority in Korean society. One reason may be that there is not much evidence for the health benefits of weight maintenance. In this context, the author designed this study to explore how many Koreans maintain or change their weight, what are the differences between these groups, and which approach is better for health?

In Korea, the prevalence of obesity among males was 46.3% in 2018, much higher than that of females (29.7%) [2]. Upper body obesity, which is associated with physical complications, occurs more frequently in males [12,13]. Therefore, males need to be given greater priority than females in the education of proper weight management. It will be necessary to consider the differences in gender characteristics in adult obesity treatment strategies. This study gives importance to gender homogeneity in the selection of study subjects. Several factors are known to impact weight maintenance differently among males and females such as pregnancy, childbirth, and menopause in females, and higher smoking and drinking rates in males.

This study evaluates the health benefits of weight maintenance and weight change in Korean adult males using data from the Korea Health Panel (KHP). The specific study goal is (1) to determine the distribution of those undergoing weight maintenance and weight change (2) to identify the characteristics of weight maintenance and each subgroup of weight change (weight gain, recovery, and loss), and (3) to evaluate current health status in terms of QOL, days spent sick in bed during the past month, and annual out-of-pocket expenditure (OOP). The author hopes this study allows better identification of characteristics of weight maintenance and weight change and suggests implications for appropriate weight management strategies.

2. Materials and Methods

2.1 Study Design

A cross-sectional descriptive study was designed that used the KHP long-format data from 2010 and 2011 to identify the distribution of weight maintenance and change among Korean males and to compare the relationship of these variables with health-related benefits.

2.2 Data and Survey Methods

KHP, one of Korea's representative statistical datasets, has sampled about 8000 households and about 12,000 household members belonging to that household through two-step probability-proportional stratified cluster extraction since 2008 to develop policies on the health level and medical use of Koreans. The survey data comprise about 500 variables, such as sociodemographic characteristics, health behavior and QOL, disease status, medical use, and OOP expenditure. In addition, KHP changed or abolished existing variables when necessary, and it included new variables when additional health issues arose. Experienced investigators visit homes and conduct face-to-face interviews.

2.3 Study Subjects

The author used data from KHP 2010 and 2011 because KHP investigated weight change with the same question only that year. There were 13,142 males aged 19 years or older among the long-format KHP data for the two years. However, in order to ensure the homogeneity of the subjects, this study included only 10,788 subjects after excluding sequentially the disabled (n = 1059), medical aid recipients (n = 361), and non-responders on weight change (n = 934).

2.4 Analytic Variables

2.4.1 Weight Maintenance and Weight Change (Weight Gain, Weight Loss, and Weight Recovery)

The primary variables of this study are weight maintenance and weight change. Study subjects were asked "Have you gained or lost 5 kg or more in weight within the past year (gained 5 kg or more; lost 5 kg or more; almost no change; recovered their weight 1 year ago after the change)?".

In this study, those reporting almost no change were grouped as weight maintenance and the remaining three variables, weight gain, weight recovery, and weight loss, were grouped as weight change.

2.4.2 Sociodemographic Variables

In this study, the sociodemographic variables used were age (young adult $<$40 years, middle-aged 40–59 years, and old age $\geq$60 years), academic background above college entrance (yes, no), spouse (yes, no), economic activity (yes, no), and household income quintile level (one is the lowest, five is the highest).

2.4.3 Physical Health Variables

The physical health variables used in this study were body mass index (BMI) and comorbidities. BMI is calculated as weight in kilograms per height in meters squared (kg/m^2). The author used BMI as either a continuous variable or a rank variable according to the Asian obesity criteria (underweight $<$18.5; normal weight 18.5–$<$23; overweight 23–$<$25; Obesity $\geq$25) [2]. Comorbidity refers to chronic diseases diagnosed by medical doctors such as hypertension, diabetes, hyperlipidemia, arthropathy, tuberculosis, ischemic heart disease, and cerebrovascular disease, etc. The author used the number of comorbidities as a nominal variable (yes, no) or as the mean of continuous variable.

Table 1. Sociodemographic characteristics of male subjects by year.

Classification	All	Year 2010	Year 2011	Chi-square or t/*p* value
	n (%)	n (%)	n (%)	
Subjects	10,788 (100)	5514 (100)	5274 (100)	
Mean age ± SD	47.6 ± 15.7	47.4 ± 15.6	47.9 ± 15.9	–1.80/0.07
Age group				
Young adult <40	3553 (32.9)	1867 (33.9)	1686 (32.0)	
Middle-aged 40–59	4562 (42.3)	2310 (41.9)	2252 (42.7)	4.62/0.01
Old age ≥60	2673 (24.8)	1337 (24.3)	1336 (25.3)	
College entrance				
Under	6045 (56.0)	3124 (56.7)	2921 (55.4)	1.77/0.18
Equal or more	4743 (44.0)	2390 (43.3)	2353 (44.6)	
Spouse				
Yes	8099 (75.1)	4156 (75.4)	3943 (74.8)	0.53/0.46
No	2689 (24.9)	1358 (24.6)	1331 (25.2)	
Economic activity				
Yes	8285 (76.8)	4228 (76.7)	4057 (76.9)	0.09/0.76
No	2503 (23.2)	1286 (23.3)	1217 (23.1)	
Household Income quintile				
1 (Lowest)	996 (9.2)	516 (9.4)	480 (9.1)	
2	1908 (17.7)	994 (18.1)	914 (17.3)	
3	2527 (23.5)	1252 (22.8)	1275 (24.2)	4.00/0.41
4	2682 (24.9)	1389 (25.2)	1293 (24.5)	
5 (Highest)	2661 (24.7)	1352 (24.6)	1309 (24.8)	
Weight maintenance and change				
Weight maintenance	9609 (89.1)	4900 (88.9)	4709 (89.3)	
Weight gain	512 (4.8)	272 (4.9)	240 (4.6)	1.73/0.63
Weight recovery	166 (1.5)	80 (1.5)	86 (1.6)	
Weight loss	501 (4.6)	262 (4.8)	239 (4.5)	

2.4.4 Health Behavior Variables

Health behavior variables included regular eating (yes or no to regular meals at a set time for the past week), the frequency of meals per day for the past week (1, 2, 3, or 4 or more meals), current smoking (yes/no), excessive drinking during the past month (yes when they drank 7 glasses of Korean distilled liquor (over 5 cans of beer)/no, and physical activity (moderate or high/no).

The KHP investigated physical activity based on International Physical Activity Questionnaire (IPAQ) and calculated the score of the metabolic equivalent task (MET-min) [14]. IPAQ scoring system calculated the total amount of physical activity into three grades and compared. They defined the low physical activity group as inactive. The moderate physical activity group had one of the following three: at least 20 mins of vigorous physical activity 3 days a week; moderate physical activity at least 30 mins or working 5 days a week more; achieved at least 600 MET-min/week by any combination of walking or moderate or vigorous physical activity for 5 days. The high physical activity had one of the following two: achieved at least 1500 MET-min/week by performing vigorous physical activity 3 or more days a week; achieved at least 3000 MET-min/week by any combination of walking 7 day more, and moderate or vigorous physical activity a week.

2.4.5 Social Psychological Variables

Social psychological variables included depression (yes/no), suicidal impulse (yes/no), and drug use (yes/no). Depression was defined as feeling sad enough to interfere with daily life for over 2 weeks in a row within the past year. Suicidal impulse was defined as having had thoughts of dying within the past year, and drug use was indicated if the subject had experienced using drugs such as antidepressants, tranquilizers, and sleeping pills to relieve depression, insomnia, and stress for the past year.

2.4.6 Health Benefit Variables

This study selected health benefit variables for weight maintenance or each stratum of weight change. Current health status was measured as QOL, days spent sick in bed during the past month, and annual OOP expenditure. Current health status displayed QOL on a score of 0 to 100 on the vertical scale of the EuroQol Visual Analogue Scale

Table 2. Sociodemographic characteristics according to male subject's weight change and maintenance.

Classification	Weight change			Weight maintenance	Chi-square or F/p value
	Gain	Recovery	Loss		
	n (%)	n (%)	n (%)	n (%)	
Subjects	512 (100)	166 (100)	501 (100)	9609 (100)	
Mean age ± SD	37.8 ± 14.1	40.1 ± 12.3	46.9 ± 17.1	48.3 ± 15.6	87.63/<0.0001
Age group					
Young adult <40	324 (63.3)	91 (54.8)	184 (36.7)	2954 (30.7)	
Middle-aged 40–59	141 (27.5)	62 (37.4)	188 (37.5)	4171 (43.4)	290.51/<0.0001
Old age ≥60	47 (9.2)	13 (7.8)	129 (25.8)	2484 (25.9)	
College entrance					
Under	219 (42.8)	78 (47.0)	281 (56.1)	5467 (56.9)	44.95/<0.0001
Equal or more	293 (57.2)	88 (53.0)	220 (43.9)	4142 (43.1)	
Spouse					
Yes	282 (55.1)	100 (60.2)	350 (69.9)	7367 (76.7)	149.24/<0.0001
No	230 (44.9)	66 (39.8)	151 (30.1)	2242 (23.3)	
Economic activity					
Yes	368 (71.9)	140 (84.3)	361 (72.1)	7416 (77.2)	19.36/0.0002
No	144 (28.1)	26 (15.7)	140 (27.9)	2193 (22.8)	
Household income quintile					
First (Lowest)	40 (7.8)	7 (4.2)	57 (11.4)	892 (9.3)	
Second	83 (16.3)	26 (15.7)	93 (18.6)	1706 (17.8)	
Third	110 (21.6)	42 (25.3)	117 (23.4)	2258 (23.5)	17.75/0.23
Fourth	149 (29.2)	51 (30.7)	117 (23.4)	2365 (24.6)	
Fifth (Highest)	128 (25.1)	40 (24.1)	116 (23.2)	2377 (24.8)	

(EQ-VAS) [15]. The days spent sick in bed refer to the days in which the subject had to spend most of the day in bed because of an illness or injury during the past month. The OOP expenditure for one year is the amount paid, including co-payments and non-reimbursement expenditure, for treatment and medication expenditures at the time of emergency room, outpatient visit, and hospitalization. All Korean citizens must subscribe to the National Health Insurance. Medical aid recipients, who fall under the extreme poverty class, are exempted from a copayment each time medical services are received. The KIHASA trained KHP subjects to record the OOP expenditure they paid each time in the medical account book and to collect receipts. In addition, every year, the KHP investigator reviewed whether the records were accurate and added them up as an annual OOP expenditure.

2.5 Statistical Analysis

The author evaluated the homogeneity of the study subjects through Chi-Square and the t-test then, analyzed the sociodemographic characteristics, physical health, health behaviors, and psychological characteristics between the weight maintenance and weight change subgroups. Multinomial logit model was used to determine the relationship between each independent variable on weight maintenance and each weight change subgroup.

In order to confirm the health benefits of weight maintenance, the author confirmed QOL (EQ-VAS), days spent sick in bed during the past month, and annual OOP expenditure by ANCOVA. The covariates input into the model were age, spouse, BMI, regular eating, frequency of meal per day, depression, and suicidal impulse. These were confounding variables that were significant in the AOR of weight maintenance.

The author calculated annual OOP expenditure (Korean Won, KRW) in USD dollars ($) as of July 1, 2011 (1$ = 1065.88 KRW) [16]. After excluding missing data, statistical tests were conducted for all analyses. Statistical significance was reported when p values were less than alpha <0.05 in a two-sided test using SAS 9.4 (SAS Institute, Cary, NC, USA).

3. Results

3.1 Sociodemographic Characteristics of Study Subjects by Years

The subjects were 10,788 males, 5514 (51.1%) in 2010 and 5274 (48.9%) in 2011 (Table 1). There was no difference in any sociodemographic characteristic examined across study years ($p > 0.05$).

Weight maintenance subjects were 9609 (89.1%) of the study sample. Among the weight change subjects (10.9%), 512 people (4.8%) gained 5 kg or more, 166

people (1.5%) recovered after the weight change, and 501 (4.6%) people lost 5 kg or more within the past year.

3.2 Exploring Sociodemographic Characteristics by Weight Maintenance and Weight Change

When looking at the sociodemographic characteristics of weight maintenance and weight change, there were statistical differences in age, education, spouse, and economic activity, excluding household income quintile (Table 2). The mean age of each weight change subgroup was 37.8 years, 40.1 years, 46.9 years and 48.3 years in the weight gain, recovery, loss and weight maintenance groups, respectively ($p < 0.0001$). College entrance or more was 57.2%, 53.0%, 43.9% and 43.1% across weight change groups respectively ($p < 0.0001$). No spouse was distributed as 44.9%, 39.8%, 30.1% and 23.3%, respectively ($p < 0.0001$) across weight change groups, and no economic activity was 28.1%, 15.7%, 27.9% and 22.8%, respectively ($p < 0.001$) (Table 2).

3.3 Physical, Health Behavioral, and Psychological Characteristics by Weight Change and weight Maintenance

When looking at the physical, health behavior, and psychological health characteristics of weight change and weight maintenance, there were statistical differences in BMI, comorbidities, regular meals, the frequency of meals per day, currently smoking, and depression excluding physical activity and drug use (Table 3). The distribution of these variables varied across weight change subgroups.

For each subgroup of weight gain, recovery, loss, and maintenance, the mean BMI was 25.6, 24.7, 23.3 and 23.4, respectively ($p < 0.0001$); obesity 55.1%, 38.0%, 26.4%, and 26.1%, respectively ($p < 0.0001$); the mean of comorbidities 0.75, 0.88, 1.39 and 1.19, respectively ($p < 0.0001$); no regular meals 35.9%, 41.6%, 27.2% and 20.9%, respectively ($p < 0.0001$); two meals per day 36.5%, 36.8%, 27.5% and 20.1%, respectively ($p < 0.0001$); currently smoking 51.4%, 49.4%, 50.3% and 45.2%, respectively ($p < 0.005$); excessive drinking 63.1% 69.3% 54.1% and 53.6%, respectively ($p < 0.0001$); depression 6.8%, 9.0%, 8.6% and 4.7%, respectively ($p < 0.0001$); suicidal impulse 5.5%, 10.3%, 7.7% and 4.2%, respectively ($p < 0.0001$).

3.4 Adjusted Odd Ratios of each Weight Change and Weight Maintenance

Table 4 shows two models. Model 1 describes the AORs of weight gain (n = 471), weight recovery (n = 156), and weight loss (n = 453) for explanatory variables using weight maintenance as a reference group (n = 8587). Model 2 describes the AORs of weight maintenance (n = 8587) for explanatory variables using weight change as a reference group (n = 1080). The input variables for Models 1 and 2 were significant variables of the proportion difference between weight change and weight maintenance, or the attention factors in academia: physical activity and drug use.

In Model 1, the AORs (AOR, 95% CI) of weight gain by each explanatory variable were young adult (4.4, 3.0–6.7), middle-aged (1.5, 1.0–2.3), no spouse (1.6, 1.3–2.1), overweight (2.0, 1.5–2.6), obesity (4.9, 3.8–6.2), no regular meals (1.3, 1.1–1.7), two meals per day (1.3, 1.1–1.7) and 4 meals or more per day (4.4, 1.8–10.9). The AORs (AOR, 95% CI) of weight recovery by each explanatory variable were young adult (4.9, 2.4–10.2), middle-aged (2.2, 1.1–4.3), no spouse (1.5, 1.0–2.3), no economic activity (0.6, 0.3–0.9), overweight (1.9,1.3–2.9), obesity (2.2, 1.5–3.3), irregular meals (2.0, 1.4–2.9), excessive drinking (1.5, 1.1–2.2), and suicidal impulse (2.2, 1.2–4.0). The AORs (AOR, 95% CI) of weight loss by each explanatory variable were spouse absence (1.3, 1.0–1.7), the underweight (2.0, 1.3–3.2), and the current smoker (1.2, 1.1–1.5).

In Model 2, the AORs (AOR, 95% CI) of weight maintenance by each explanatory variable was young adult (0.5, 0.4–0.6), no spouse (0.7, 0.6–0.8), overweight (0.7, 0.6–0.8), obesity (0.4, 0.4–0.5), no regular meals (0.7, 0.6–0.9), two meals per day (0.8, 0.7–0.9) or 4 meals or more per day (0.4, 0.2–0.9), depression (0.7, 0.5–0.9), and suicidal impulse (0.7, 0.5–0.9).

3.5 Health Benefits for Weight Change and Weight Maintenance

Table 5 presents health benefits according to each weight change subgroup and weight maintenance. Covariates that affected the AOR of weight maintenance were age, BMI, spouse, regular meals, frequency of meal per day, depression, and suicidal impulse.

QOL (EQ-VAS) was 72.5 for weight gain, 70.1 for recovery, 72.4 for weight loss, and 74.3 for weight maintenance ($p < 0.0001$). In addition, days spent sick in bed during the past month were 3.8 days for the weight gain, 7.9 days for the weight loss and 4.5 days for weight maintenance ($p < 0.05$). Annual OOP medical expenditures were \$408.0 for weight gain, \$401.8 for weight recovery, \$562.9 for weight loss, and \$366.3 for weight maintenance ($p < 0.0001$).

4. Discussion

Motivation precedes action. There are many social stimulus factors that may induce weight change in our society such as the preference for a slim body. The preference for slim and handsome celebrities, along with distribution of images via various mass media technologies in the era of the 4th industrial revolution has created a universal framework for beauty. The reaction of the public often is to set their perception of the ideal weight as BMI lower than the standard BMI and then try to change their weight routinely. Because possessing a body type that others prefer is a powerful motivation, the cycle of trying to lose weight, recovering, and trying to lose again continues, and seemingly, is never-ending. The cycle of Yo-Yo dieting is perceived as a reasonable health practice. Studies on weight change

Table 3. Physical, health behavioral, and psychological characteristics by males' weight change and weight maintenance.

Classification	Weight change			Weight maintenance	Chi-square or F/*p* value
	Gain	Recovery	Loss		
	n (%)	n (%)	n (%)	n (%)	
Subjects	512 (100)	166 (100)	501 (100)	9609 (100)	
Mean of BMI	25.6 ± 3.46	24.7 ± 3.06	23.3 ± 3.10	23.4 ± 2.78	104.17/<0.0001
BMI group					
Underweight <18.5	2 (0.4)	1 (0.6)	29 (5.8)	253 (2.6)	
Normal 18.5–<23	109 (21.3)	46 (27.7)	200 (39.9)	4103 (42.7)	253.66/<0.0001
Overweight 23–<25	119 (23.2)	56 (33.7)	140 (27.9)	2744 (28.6)	
Obesity ≥25	282 (55.1)	63 (38.0)	132 (26.4)	2509 (26.1)	
Mean of comorbidities	0.75 ± 0.08	0.88 ± 0.13	1.39 ± 0.08	1.19 ± 0.02	14.93/<0.0001
Comorbidity					
Yes	192 (37.5)	69 (41.6)	248 (49.5)	4840 (50.4)	36.54/<0.0001
No	320 (62.5)	97 (58.4)	253 (50.5)	4769 (49.6)	
Regular meals					
Yes	328 (64.1)	97 (58.4)	365 (72.9)	7602 (79.1)	108.64/<0.0001
No	184 (35.9)	69 (41.6)	136 (27.2)	2007 (20.9)	
Frequency of meal per day					
One meal	5 (1.0)	2 (1.2)	7 (1.4)	45 (0.5)	
Two meals	187 (36.5)	61 (36.8)	138 (27.5)	1934 (20.1)	143.20/<0.0001
Three meals	313 (61.1)	103 (62.1)	354 (70.7)	7599 (79.1)	
≥four meals	7 (1.4)	0 (0.0)	2 (0.4)	31 (0.3)	
Currently smoking					
Yes	263 (51.4)	82 (49.4)	252 (50.3)	4344 (45.2)	12.65/0.0054
No	249 (48.6)	84 (50.6)	249 (49.7)	5263 (54.8)	
Excessive drinking					
Yes	323 (63.1)	115 (69.3)	271 (54.1)	5150 (53.6)	32.86/<0.0001
No	189 (36.9)	51 (30.7)	230 (45.9)	4459 (46.4)	
Physical activity					
Yes	275 (53.7)	99 (59.6)	286 (57.1)	5399 (56.2)	2.24/0.5240
No	237 (46.3)	67 (40.4)	215 (42.9)	4210 (43.8)	
Depression					
Yes	32 (6.8)	14 (9.0)	39 (8.6)	399 (4.7)	23.04/<0.0001
No	439 (93.2)	142 (91.0)	414 (91.4)	8189 (95.4)	
Suicidal impulse					
Yes	26 (5.5)	16 (10.3)	35 (7.7)	359 (4.2)	26.12/<.0001
No	445 (94.5)	140 (89.7)	418 (92.3)	8229 (95.8)	
Drug use [(1)]					
Yes	9 (1.9)	2 (1.3)	15 (3.3)	164 (1.9)	4.78/0.1884
No	462 (98.1)	154 (98.7)	438 (96.7)	8424 (98.1)	

[(1)] The subject had experience using drugs such as antidepressants, tranquilizers, and sleeping pills for the past 1 year.

have presented both positive [5,6] and negative impacts on health [7–11]. Paradoxically, studies on the health benefits of weight maintenance are rare.

Therefore, this study reports the distribution of weight change and weight maintenance, sociodemographic and physical health, health behaviors and psychological health, and health benefits for Korean adult males. The KHP conducted a questionnaire on weight maintenance and changes for only two consecutive years, 2010 and 2011. Age, education, spouse, economic activity, household income quintile, and weight change did not differ in distribution ($p >$ 0.05) between the two groups. This study analyzed two years of males' information from a long format panel data. The reason that it included only males was that they had significant differences with females in prevalence of obesity, physiological characteristics, smoking and drinking rate, and social pressure about body image [17]. This discussion summarizes the significant characteristics of each weight change and weight maintenance group, and examines the health benefits between them.

As a result of analyzing data on 10,788 males in 2010 and 2011, weight gain, weight recovery, and weight loss

Table 4. The adjusted odd ratios of weight change and maintenance by male subject's characteristics.

Classification		Model 1 [1][3]		Model 2 [2][3]	
		Weight gain	Weight recovery	Weight loss	Weight maintenance
		n = 471	n = 156	n = 453	n = 8587
Criteria	Reference.	AOR (95% CI)	AOR (95% CI)	AOR (95% CI)	AOR (95% CI)
Young adult <40	Old age ≥60	4.4 (3.0–6.7)	4.9 (2.4–10.2)	1.1 (0.8–1.6)	0.5 (0.4–0.6)
Middle-aged 40–59		1.5 (1.0–2.3)	2.2 (1.1–4.3)	0.9 (0.7–1.2)	0.9 (0.7–1.1)
<College entrance	≥College entrance	0.9 (0.8–1.2)	1.1 (0.8–1.6)	1.0 (0.8–1.3)	1.0 (0.9–1.1)
No spouse	Yes	1.6 (1.3–2.1)	1.5 (1.0–2.3)	1.3 (1.0–1.7)	0.7 (0.6–0.8)
No economic activity	Yes	1.3 (1.0–1.7)	0.6 (0.3–0.9)	1.1 (0.9–1.4)	0.9 (0.8–1.1)
Underweight <18.5		0.3 (0.1–1.1)	0.4 (0.1–3.1)	2.0 (1.3–3.2)	0.8 (0.5–1.2)
Overweight 23–<25	Normal weight 18.5–<23	2.0 (1.5–2.6)	1.9 (1.3–2.9)	1.1 (0.9–1.4)	0.7 (0.6–0.8)
Obesity ≥25		4.9 (3.8–6.2)	2.2 (1.5–3.3)	1.1 (0.9–1.5)	0.4 (0.4–0.5)
No comorbidity	Yes	0.9 (0.7–1.1)	0.9 (0.6–1.2)	1.0 (0.8–1.2)	1.1 (0.9–1.3)
No regular meals	Regular	1.3 (1.1–1.7)	2.0 (1.4–2.9)	1.1 (0.9–1.4)	0.7 (0.6–0.9)
One meal per day		1.5 (0.6–4.1)	1.8 (0.4–7.7)	2.1 (0.9–5.1)	0.6 (0.3–1.1)
Two meals per day	Three meals per day	1.3 (1.1–1.7)	1.3 (0.9–1.8)	1.3 (1.0–1.6)	0.8 (0.7–0.9)
≥Four meals per day		4.4 (1.8–10.9)	No subjects	1.3 (0.3–5.6)	0.4 (0.2–0.9)
Currently smoking	No	1.1 (0.8–1.2)	0.9 (0.8–1.5)	1.2 (1.1–1.5)	0.9 (0.8–1.0)
Excessive drinking	No	1.2 (0.9–1.4)	1.5 (1.1–2.2)	1.0 (0.8–1.2)	0.9 (0.8–1.0)
No physical activity	Yes	1.0 (0.9–1.3)	0.9 (0.6–1.2)	0.9 (0.8–1.1)	1.0 (0.9–1.2)
Depression	No	1.4 (0.9–2.2)	1.6 (0.8–3.0)	1.5 (1.0–2.2)	0.7 (0.5–0.9)
Suicidal impulse	No	1.2 (0.7–1.9)	2.2 (1.2–4.0)	1.4 (1.0–2.2)	0.7 (0.5–0.9)
Drug use [4]	No	1.0 (0.5–2.2)	0.6 (0.1–2.4)	1.2 (0.7–2.2)	0.9 (0.6–1.5)

[1] Model 1 by multinominal logistic regression, weight maintenance group used as the reference category (n = 8587).

[2] Model 2 by multiple logistic regression, weight change group used as the reference category (n = 1080).

[3] Observations were 10,788 for Model 1 or Model 2 and 1121 were deleted due to missing values for the response or explanatory variables.

[4] The subject had experience using drugs such as antidepressants, tranquilizers, and sleeping pills for the past 1 year.

Table 5. Comparison of health benefits according to weight change and maintenance by ANCOVA [1].

Classification	Current health status as QOL (EQ-VAS)	Days spent sick in bed during the past month	Annual OOP Expenditure [2]
	n = 9668	n = 320	n = 9664
	Mean score ± SE	Mean days ± SE	Mean USD ($) ± SE
Weight gain	72.5 ± 0.6	3.8 ± 1.5	408.0 ± 42.9
Weight recovery	70.1 ± 1.1	2.0 ± 2.5	401.8 ± 73.0
Weight loss	72.4 ± 0.6	7.9 ± 1.1	562.9 ± 42.7
Weight maintenance	74.3 ± 0.1	4.5 ± 0.4	366.3 ± 9.8
F/*p* value	8.88/<0.0001	3.18/0.0243	6.89/0.0001

[1] The covariates were age, spouse, BMI, regular eating, frequency of meal per day, depression, and suicidal impulse.

[2] Annual OOP expenditure (South Korean Won, KRW) converted to USD ($) based on the exchange rate on July 1, 2011 (1$ = 1065.88 KRW).

reached an overall 10.9%: underwent weight change, 4.8% gained, 1.5% recovered, and 4.6% lost weight. The majority (89.1%) maintained weight. The mean age across weight gain, weight recovery, weight loss and weight maintenance groups were 37.8, 40.1, 46.9 and 48.3 years, respectively ($p < 0.0001$) and the mean BMI was 25.6, 24.7, 23.3 and 23.4, respectively ($p < 0.0001$).

After controlling for all possible confounding variables, the weight gain group and the weight recovery group showed similarly that subjects were relatively young, had a higher rate of having no spouse, a higher prevalence of obesity, and had a higher rate of irregular eating. This study evaluated the effects of each variable on the AOR (95% CI) with weight gain and weight recovery: the young adult was 4.4 (3.0–6.7) and 4.9 (2.4–10.2) with them, and middle-

aged were 1.5 (1.0–2.3) and 2.2 (1.1–4.3) with them, respectively. In previous studies, weight gain was inversely proportional to age, and it was more powerful than diet in predicting weight gain [18,19]. With no spouse, it was 1.6 (1.3–2.1) and 1.5 (1.0–2.3) with them, respectively. Significant results for weight loss and spouse were not consistent throughout the study [20,21], but in this study, when there was no spouse, the AOR (95% CI) on all weight change groups was higher. However, the question remains what role spouses play in these outcomes. Obesity was 4.9 (3.8–6.2) and 2.2 (1.5–3.3) with them, and overweight was 2.0 (1.5–2.6) and 1.9 (1.3–2.9) with them, respectively. No regular meals were 1.3 (1.1–1.7), 2.0 (1.4–2.9) with them, respectively.

In particular, the eating habits of the weight gain subjects were worse with AORs of 1.3 (1.1–1.7) and 4.4 (1.8–10.9) when eating two meals per day and four or more meals per day. This result cannot rule out the possibility that the subject may control the weight by reducing the number of meals or that the cause of weight gain is overeating. Earlier studies demonstrated that when subjects restricted diet for weight loss, sensitivity to food increased, leading to binge eating, which led to failure of weight loss, which was also linked to depression and guilt [22,23]. In the present study, the author did not know whether the weight recovery was re-gain or re-loss because of no survey information. In previous studies, failures in weight loss were associated with reduced energy consumption at rest, hormonal changes, decreased practice of major lifestyles, low self-efficacy, and feelings of depression [24–27]. In the present study, especially in the weight recovery group, excessive drinking and suicidal impulses were the highest among the weight change groups at 69.3% and 10.3% ($p < 0.0001$), respectively, and corresponding AORs (95% CI) were 1.5 (1.1–2.2) and 2.2 (95% CI 1.2–4.0), respectively. Subjects with weight gain and recovery are relatively young and have a high distribution of singles, thus, they may be more sensitive to social stimuli that emphasize slimness. Therefore, it is highly likely that they will try dieting again in the future, and then the cycle of weight loss and weight regain will be repeated.

In the weight loss group, subjects with no spouse were 30.1%, the lowest proportion among those with weight changes ($p < 0.0001$). However, even within this loss group, when no spouse, the AOR (95% CI) of weight loss was 1.3 (1.0–1.7). In this group, the proportion and AORs (95% CI) of the underweight were 5.8% and 2.0 (1.3–3.2), and the proportion and AORs (95% CI) of current smoking was 50.3% and 1.2 (1.1–1.5). In previous studies, smokers often tried to change their health behaviors, and also lost weight when they quit smoking [28,29]. Although KHP did not examine information on whether weight loss was due to deliberate dieting or health problems, implications may be drawn for weight management strategies. The author can infer those social networking systems replace spousal support, and smoking cessation programs can help with weight loss.

The weight maintenance group had the oldest age among all subjects and showed better results in health-related characteristics. The AORs (95% CI) of weight maintenance were 0.5 (0.4–0.6) for young adults; 0.7 (0.6–0.8) for no spouse; 0.7 (0.6–0.8) for overweight; 0.4 (0.4–0.5) for obesity; 0.7 (0.6–0.9) for irregular eating; 0.8 (0.7–0.9) for 2 meals per day; 0.4 (0.2–0.9) for 4 or more meals per day; 0.7 (0.5–0.9) for the depression; 0.7 (0.5–0.9) for suicidal impulse. In previous studies, older adults showed more fidelity to weight management [30,31]. Weight was maintained well when a spouse was present [20]. When considering weight management strategies, the public should know that maintaining a stable weight is a better option than changing it, even if it is to lose weight.

Findings from this study confirm household income quintile, college entrance, comorbidities, physical activity, and drug use were not significantly different between those with weight maintenance and those with weight change. One can assume that the public recognized the importance of weight management regardless of economic level or educational level in Korea. In other words, almost everyone knows that weight management is important. In future studies, it is necessary to check whether there are variations in weight maintenance and fluctuations according to occupation or labor. In addition, although this study used comorbidities as an explanatory variable as a proxy for physical health, it was not significant after adjusting for confounding variables. The reason may be that the study subjects were all adult males, and relatively healthy young adults under the age of 40 accounted for 32.9%. Also, in this study, information on severe diseases related to weight change could not be analyzed in detail. In future studies, it is necessary to confirm the results of studies that only target patients with severe diseases such as cancer and metabolic diseases. Also, the relationship between psychiatric drug use or physical activity and weight management will require further in-depth studies.

This study analyzed the health benefits of weight change and weight maintenance by ANCOVA. To determine health benefits, the author selected three variables, current health status as QOL (EQ-VAS), days spent sick in bed during the past month, and annual OOP expenditure. Covariate variables were age, BMI, spouse, regular meals, number of meals per day, depression, and suicidal impulse. Weight change and weight maintenance may have a short longitudinal relationship with current health status or days spent sick in bed during the past month, but the annual OOP expenditure can be interpreted as a cross-sectional relationship.

As a result, current health status was 72.5, 70.1 and 72.4 out of 100 for weight gain, recovery, and loss, respectively, whereas the weight maintenance group had a higher score of 74.3 ($p < 0.0001$). It is similar in that those with

higher BMI reported more subjective health complaints and reduced quality of life [32,33]. Over the past month, days spent sick in bed were 3.8 and 7.9 in the weight gain group and weight loss group, whereas the weight maintenance group was 4.5, which was more favorable than the weight loss group ($p < 0.02$). Lying down characterized very low energy expenditure and more extreme than sedentary behavior, with increased cardiovascular disease and all-cause mortality [34,35]. Annual OOP medical expenses were \$408.0, \$401.8 and \$562.9 in the weight gain, weight recovery and weight loss group, respectively, but the weight maintenance group use \$366.3 ($p < 0.0001$). In previous studies, the medical cost was related to obesity [36,37].

The first limitation of this study is to use of relatively old data from 2010 and 2011, and the results are difficult to generalize to the present. Second, results may be difficult to generalize to the entire population by targeting only males. Third, there was a lack of detailed information on deriving the implications of weight change, so the author often interpreted the study results by assumption. For example, it is not possible to know the intention of the subject in weight loss, and with weight recovery, it is not possible to know whether weight was regained or lost again. Fourth, height and weight in this study are self-reported, not measured, so there may be differences from the true values. Fifth, the weight change variable of 5 kg or more was standardized for international comparison of research results. However, the meaning of 5 kg or more and the effect on health may differ depending on the body type, age, and disease history of the subject. In some studies, a weight change of less than 3% was defined as weight maintenance [38]. Sixth, growth after adolescence can continue until the early 20s depending on nutritional status, and it was confirmed that Koreans grow up to the age of 22 [39]. Therefore, among the subjects of this study, there may be young adults who have not yet finished growing, which may cause bias in the study results.

Strengths of this study include identification of the characteristics associated with weight change and weight maintenance using data representative of Korean males. Therefore, it can be expected that it may be helpful in giving priority to males and optimizing male-dependent weight management strategy. For obesity management, this study may provide some evidence that weight maintenance is more important than weight change, which differs from the public perception and societal response. In addition, this study may suggest that the public should maintain a stable weight through cognitive processes such as thinking, learning, observation, and self-directed decision rather than obesity management based on the behaviorism of stimulus and response.

5. Conclusions

With the increase in the obese population, social concerns about the health risks of obesity are also increasing. The public is trying to change their weight after setting their ideal weight lower than their normal healthy weight. However, the effect of weight change on health differs from study to study making it difficult to conclude that weight change is beneficial. Conversely, there are relatively few studies on the benefits and disadvantages of weight maintenance, firmly establishing the public perception that weight management is synonymous with changing weight.

This study confirmed the characteristics of weight maintenance and weight change using adult male data (n = 10,788) from KHP, and compared the health benefits of the two groups. The author presented basic data on weight management strategies for each target group by identifying the sociodemographic and health status characteristics associated with each weight change group. In addition, this study confirmed health benefits using three outcome variables, current health status as QOL (EQ-VAS), days spent sick in bed during the past month, and annual OOP expenditure. Findings showed that there are positive effects when maintaining weight rather than undergoing weight change. Based on some evidence in this study, the public needs to re-conceptualize their desirable weight. Strengthening the health cognitive competence to decide and manage the desirable weight may be one key to creating a new public perception. In addition, health policy for obesity management needs to pay more attention to the evidence on the importance of weight maintenance, and should consider a smart society that reflects the health value of weight maintenance in various mass media activities such as advertisements, dramas, and performances that stimulate the public.

Abbreviations

KHP, Korea Health Panel; QOL, quality of life; OOP, out-of-pocket; KIHASA, Korea Institute for Health and Social Affairs; BMI, body mass index; IPAQ, International Physical Activity Questionnaire; MET, metabolic equivalent task; EQ-VAS, EuroQol Visual Analogue Scale.

Author Contributions

SMS designed the research study, analyzed the data, wrote the manuscript. SMS also checked editorial changes in the manuscript and read and approved the final manuscript.

Ethics Approval and Consent to Participate

Korea Institute for Health and Social Affairs (KIHASA), KHP Data Management Agency, conducted the survey according to the guidelines of the Declaration of Helsinki. The author submitted the study plan to the KIHASA, and accepted the data. The Institution Review Board officially approved the use of KHP data (KIHASA 2016–01).

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Conflict of Interest

The author declares no conflict of interest.

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