Weight change and quality of life in a community-based population

A longitudinal relation

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Abstract

Objectives: This study investigates the longitudinal association between 5-year weight change and quality of life (QoL) in Dutch men and women.

Design: A prospective cohort study (1998, 2000, 2003) in a population based sample.

Subjects: 2,414 men and women from the Maastricht region of the Netherlands.

5 **Measurements:** QoL outcomes were measured by the RAND-36 (eight subscales and two overall composite scores, physical and mental health (PCS and MCS)). Weight was measured on a scale. Weight change was calculated as change in weight between 1998 and 2003. In addition, 5-year weight change was also categorized in three groups: weight losers, weight maintainers, and weight gainers. All analyses were stratified for gender.

10 **Results:** A total of 598 men (50%) and 646 women (54%) maintained their weight, 177 men (15%) and 163 women (14%) lost more than 2.5 kg, and 410 men (35%) and 379 women (32%) gained more than 2.5 kg. Associations between 5-year weight change and QoL were found for MCS ($\beta = 0.13$, 95% CI: 0.02|0.24) in women, and PCS ($\beta = -0.09$, 95% CI: -0.17|-0.00; $\beta = -0.10$, 95% CI: -0.19|-0.01) in men and women respectively. Moreover, associations between

15 weight change and QoL were most pronounced for women of normal weight and obese men. Furthermore, in both genders, weight gainers showed a greater reduction on all physical components of QoL compared with weight maintainers. However, after 5-years weight gainers and weight losers did not significantly differ from weight maintainers in the mean change of MCS and PCS.

20 **Conclusion:** Weight gain was inversely associated with the physical domains of QoL in women and obese men. Conversely, in women, weight gain was positively associated with the mental domains of QoL. No differences between weight losers and weight gainers were found in mean change of QoL compared with weight maintainers.

Key words: Quality of life; Weight change; Body mass index; RAND-36

Introduction

Worldwide, the prevalence of overweight and obesity is increasing rapidly. This increase is associated with considerable costs and higher risk of developing diseases. In the Netherlands, overweight and obesity are associated with major chronic disorders, i.e. cardiovascular diseases,

5   diabetes mellitus, certain types of cancer, and arthritis.[1-3]

Substantial evidence mainly from cross-sectional studies indicates that obesity seriously decreases peoples' quality of life (QoL). Indeed, these studies showed that, in women, overweight is associated with lower scores on QoL.[4-9] However, cross-sectional studies do not provide clues for cause or effect of these associations. Longitudinal analyses may partly overcome this

10   phenomenon. So far, few prospective studies exist on the association between weight change and QoL. Most of these studies are limited to obese subjects only.[5, 10-12] However, Fine et al.[13] investigated, prospectively, the impact of weight change on QoL in a large sample of women of the general population. They observed that weight gain was consistently associated with declines in physical functioning and vitality, as well as increased levels of pain among women of all ages

15   and baseline BMI levels. In addition, weight change was more strongly associated with the physical than the mental components of QoL. Leon-Munoz et al.[14] also show that weight change was associated with lower QoL in an older, predominantly female, population. Decrease in QoL was most noticeable in obese women who gain weight and non-obese women who lost weight. To our best knowledge, no prospective studies have investigated the effect of weight change and QoL

20   among men and women of the general population.

Therefore, the aim of the present study is to investigate the longitudinal association between weight change and QoL among a large Dutch population based sample. We hypothesize that weight gain is negatively associated with the physical components of QoL which is more pronounced in obese. We also hypothesize that weight gainers and weight losers differ in their

25   mean change in QoL compared with weight maintainers.

Methods

Study population

The study population consists of men and women participating in a cohort study conducted by the Dutch National Institute for Public Health and the Environment (RIVM).[15] In this cohort study,

5   weight change and QoL were monitored over a 5-year period and measured at baseline (1998), 2-year (2000), and 5-year (2003) follow-up. The source population consisted of 13,184 men and women living in the Maastricht region, who previously participated in a monitoring study of the RIVM, the MORGEN study.[16] From this group a gender- and age-stratified sample of 4,500 subjects was selected. The aim was to include only 3,000 subjects in the baseline measurement.

10   Of these 3,000 subjects, 2,190 (73%) participated in the 2-year follow-up measurement (2000) and 2,414 (81%) participated in the 5-year follow-up measurement in 2003. All subjects were exposed to a community-based intervention project 'Hartslag Limburg'. Hartslag Limburg, Dutch for Heartbeat Limburg, started in 1998. The aim of that project was to decrease the prevalence of cardiovascular diseases in the general population of the Maastricht region (population 185,000)

15   by encouraging the inhabitants to become physically active, reduce their fat intake, and quit smoking.[15] A detailed description of the project and the study population is described elsewhere.[15, 17]

Data Collection

20   Baseline data collection and follow-up measurements started in August and lasted until February the next year. The measurements consisted of a physical examination and a self-administered questionnaire. The self-administered questionnaire consisted of questions on demographics, health status, QoL, smoking, physical activity, diet, and chronic diseases. During the physical examination, blood pressure (systolic and diastolic), height, weight, waist circumference, and total

25   and HDL cholesterol concentration were measured.

Quality of life

QoL was measured by the Dutch version of the RAND-36 Health Survey (RAND-36)[18], which was translated from the standardized SF-36 Health Survey.[19] The RAND-36 consists of 36

5   questions which comprise eight multi-item scales: physical functioning, social functioning, role limitations due to physical health problems, role limitation due to emotional problems, general mental health, vitality, bodily pain, and general health perception. In addition, two summary scores representing physical (PCS) and mental health (MCS) are generated. All scales were scored from 0 to 100, with higher scores indicate a better QoL.[20] The RAND-36 is a validated,

10   reliable, and responsive measure with good psychometric properties.[18] The RAND-36 comprises the same items as the SF-36[21], however, the methodology to derive the scores is different, but the effect on the final score is minimal.[19] It is suggested that a minimum of three to five points on any given scale may be considered clinically important.[22]

15   Body mass index categories

During the medical examination respondents were weighted wearing light indoor clothing after they had taken off their shoes and emptied their pockets. Body mass index (BMI) was calculated as actual measured weight divided by height squared (kg/m^2). In this calculation one kilogram was subtracted from the measured weight, in order to adjust for the light indoor clothing.

20   Participants were divided in three groups based on their BMI (Normal weight: BMI <25.0 kg/m^2; Overweight: BMI 25.0-29.9 kg/m^2; Obesity: BMI >30.0 kg/m^2). Cut off scores of BMI correspond to recommendations proposed by the World Health Organization.[23]

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Weight change groups

Longitudinal weight change was measured as the amount of weight change between 1998 and 2003. In addition, subjects were categorized in three weight change groups according to the magnitude of weight change over the 5-year period: weight loss, weight gain, and weight maintenance. The group *weight losers* consisted of people who lost 2.5 kg or more between 1998 and 2003 and did not gain more than 2.5 kg between 1998 and 2000. The group w*eight gainers* consisted of people who gained 2.5 kg or more between 1998 and 2003 and did not lose more than 2.5 kg between 1998 and 2000. The group *weight maintainers* consisted of people whose weight in 2003 was within 2.5 kg of their original weight in 1998. To control for the so called yoyo-effect, weight maintainers who lost or gained more than 2.5 kg between 1998 and 2000 were excluded (n=9) from analyses. The categorization of groups of weight change correspond to the methods also used by Fine.[13] The cut-off score of 2.5 kg was based on the average increase in weight of the Dutch population with approximately 0.5 kg per year.

Covariates

The covariates were assessed by questionnaire. Social economic status (SES) was defined by the highest level of education that was completed. Education was categorized into: low (primary school, lower occupational education or less), medium (secondary level education), and high education (university, higher occupational or corresponding education). Physical activity was assessed with questions covering time spent on leisure time activities such as walking, bicycling, odd jobs, sports, and gardening. Presence of chronic diseases at baseline was based on self-reported prevalence of one of the following diseases: myocardial infarction, stroke, cancer, or diabetes mellitus type 2. The occurrence of chronic diseases between baseline and follow-up is determined by the absence of a disease at baseline and the self-reported presence of one or more of the above mentioned diseases at follow-up.

Statistical analysis

Descriptive data (means, standard deviation, and percentage) of the baseline characteristics were presented for men and women separately. First, generalized linear models were used to investigate the cross-sectional association between baseline BMI and QoL. The independent

5 variable, BMI, was categorized in three groups: normal weight (BMI < 25.0 kg/m^2), overweight (BMI 25.0-29.9 kg/m^2), and obesity (BMI >30.0 kg/m^2). Second, generalized estimating equation (GEE) analyses were conducted to investigate, longitudinally, the association between 5-year weight change and QoL, stratified for gender and the three BMI categories. The outcome variable was QoL and weight change was the predictor variable. The outcome coefficient of interest (β)

10 shows the magnitude of the longitudinal relationship between weight change and QoL.[24] Finally, regression analyses were used to explore the association between weight change groups (weight loss, weight maintenance, and weight gain) and QoL. For this analysis, the referent group consisted of people classified as weight maintainers. All analyses were performed separately for men and women and adjusted for age, SES, physical activity, presence or occurrence of chronic

15 diseases, and mean of baseline and follow-up measurement of the variable under study. This last adjustment was done to neutralize possible effects of regression to the mean.[25] For all statistical testing, we used two-sided hypothesis testing with an alpha level of <0.05. Data were analyzed using SAS software version 9.1.

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Results

Study population

Baseline characteristics, measured in 1998, of participants who completed follow-up in 2003 by sex are shown in Table 1. Mean age of men and women was respectively 50.7 and 50.4 years.

5 Women had a lower level of education then men and a higher prevalence of diabetes mellitus type 2. Men more often had overweight, spent more time on leisure time activities, had a higher prevalence of a myocardial infarction and cancer, and scored higher on all domains of QoL, except for general health perception.

10 *Cross-sectional association of baseline body mass index and QoL*

Cross sectional associations between baseline BMI and QoL are shown in Table 2. Descriptive statistics show that in both men and women QoL decreases with higher BMI categories, most pronounced between overweight and obese subjects. For men, being obese at baseline was significantly associated with lower scores on physical functioning, physical role limitations,

15 vitality, bodily pain, social functioning, general health perception, and PCS compared with overweight and normal weight. For women, obesity was significantly associated with lower mean scores on the scales physical functioning, general health perception, and PCS in comparison with people with normal weight. These associations were also considered as clinically relevant.[22]

20 *Longitudinal association of weight change and QoL*

The longitudinal association between weight change and QoL, stratified by gender and BMI categories is presented in Table 3. For the total population, weight change was negatively associated with PCS for both men (β = -0.09, 95% Confidence Interval (CI): -0.17|-0.00) and women (β = -0.10, 95% CI: -0.19|-0.01), indicating that if women gain 1 kg their PCS decreases

25 with 0.10, while in men the PCS decreases with 0.09. Moreover, in women a positive association

between weight change and MCS ($\beta = 0.13$, 95% CI: 0.02|0.24) was found, caused by the subscales social functioning and emotional role limitations.

In women, stratified analyses showed that an increase in weight was associated with a lower score on physical functioning for normal weight, overweight, and obese people. Nonetheless, the positive relation with MCS, social functioning, and emotional role limitations was only observed in women with normal weight. Furthermore, for overweight women, weight gain was negatively associated with general health perception. Whereas, for obese, weight gain was positively associated with emotional role limitations

In men, weight gain was negatively associated with PCS, bodily pain, and general health perception and positively associated with vitality. For those with normal weight, weight gain was negatively associated with emotional role limitations.

Weight change groups and QoL

The association between groups of weight change (weight losers, weight maintainers, and weight gainers) and mean change in QoL is shown in Table 4. A total of 598 men (50%) and 646 women (54%) maintained their weight, 177 men (15%) and 163 women (14%) lost more than 2.5 kg, and 410 men (35%) and 379 women (32%) gained more than 2.5 kg. In both genders, weight gainers showed a greater reduction in the mean change of the physical components (physical functioning, physical role limitations, vitality, and bodily pain) of QoL compared with weight maintainers. However the only significant difference was found among men weight gainers with physical functioning (mean change: -1.7, standard deviation (sd): 14.5) and general health perception (-3.7, sd: 15.2) compared to weight maintainers. For both genders, weight losers did not significantly differ from the weight maintainers on any subscale, nor on the overall RAND-36 scales.

Discussion

To our knowledge this study is one of the first to show the longitudinal association between weight change and QoL among a large population-based sample of all ages. We found an inverse association between weight gain and PCS (in all women and obese men) and physical functioning (women). Furthermore, weight gain was also positively associated with emotional role limitations, social functioning, and MCS in women. The latter two only restricted to normal weight women.

Few studies have reported on the longitudinal association between weight change and QoL. Previous studies of Fine et al.[13] and Leon-Munoz et al.[14] are consistent with our results. However, stratified analyses showed that the association between weight change and Qol was not consistently in all BMI categories. For men, most associations were found in obese, whereas in women associations were mostly found among normal weight people. Yet, this is not in line with the results of Fine et al.[13], who consistently found an association between weight gain and the physical domains of QoL among women of all BMI levels.

In the present study, we found a positive association with weight change and MCS among women. Previous studies reported different finding on the association of weight and the mental domains of QoL.[9, 13, 14, 26] However, Lopez-Garcia et al.[27] and Huang et al.[28] report that obesity does not result in lower scores on the mental domains. Apparently, women do not struggle with their excess body weight in their social life. Though, Lopez-Garcia et al.[27] state that in future research the generic QoL questionnaire, like the RAND-36, should be accompanied by an obese-specific questionnaire, which includes topics on the impact of excess weight that are not included in the RAND-36.

We also investigated the relationship between weight change groups (weight losers, maintainers, and weight gainers) and QoL. Even though we found that, in both genders, weight gainers showed a greater reduction in the mean change of the physical components of QoL

compared with weight maintainers. We only found significant difference in the mean change of the domains physical functioning and general health perception between men weight gainers and weight maintainers. In contrast to our results, Burns et al.[4] and Fine et al.[13] consistently found a reduction in Qol with weight gain. The results of the present study may be different from previous studies, because the number of participants in our groups of weight change were relatively small to detect clinically relevant differences. Furthermore, Burns et al.[4] only found associations in older women. We did not stratify our results for age, because of relatively small numbers. However, the impact of weight change on QoL in different age groups might be dissimilar. In addition, Burns et al.[4] also found that the reduction in QoL was only apparent in women with weight gain greater then 10%. Yet, approximately 50% of all weight gainers and weight losers in our study population, gained or loosed more than 5 kg. So in our study, the magnitude of weight change seems sufficient to have found possible effects in QoL.

Consistently with previous studies, the present study also confirms that, in both genders, obese people report greater decrements on all domains of QoL than persons with a lower BMI.[4-8, 29] In concordance with previous studies, obesity was more strongly associated with the physical domains than the mental domains of QoL.[6, 8, 9, 28, 30] Previous studies also reported on gender differences in the relation between BMI and QoL. Some studies show that obese women report more problems than men.[26, 28] However in our study, we found a stronger relation between BMI and Qol for men.

The strengths of our study are its longitudinal design, using data of baseline, 2-year, and 5-year follow-up. The present results were obtained in a large community-based sample and not selected based on peoples' weight. Also, our data are based on measured weight and height instead of self-report. This is important, because men and women tend to underestimate their weight and overestimate their height.[31, 32] For our longitudinal analyses, we used GEE analyses. This method was very suitable in our study, because GEE takes into account that repeated

measurements within one individual are not independent. Besides that, in GEE, subjects with incomplete data were not excluded from analyses.[24] Finally, we used the RAND-36, which is a validated, reliable, and responsive questionnaire to measure QoL.[18]

This study also has some limitations that should be addressed. First, we did not stratify our

5 results for age. As mentioned above, the impact of weight change might differ among certain age groups. Fine et al.[13] found association with weight change and QoL among women of all ages. However, other studies show dissimilar impacts on QoL and weight among young and middle-aged.[8, 28] Because of small numbers, we did not stratify our results for age. Second, the study population consists of participants from the intervention region of the community-based

10 prevention program 'Hartslag Limburg'. They were exposed to an intervention program aimed at reducing the risk of cardiovascular diseases. The level of exposure of this community-based program might be dissimilar for each individual. Subsequently, this may reduce the generalizebility of this study. Third, this study lacked information whether or not weight change was intentional. Hence, we did not differentiate between intentional and unintentional weight loss.

15 Fourth, we did not control for all possible chronic diseases, because only information about chronic diseases (cardiovascular diseases, diabetes, and cancer) included in the questionnaire was available.

In the past decades many cross-sectional studies have been conducted and showed a relation between weight, and particularly between excess weight, and QoL. In this study, the

20 longitudinally association between 5-year weight change and QoL was investigated. The present study contributes to a better understanding of this association and shed a better light upon the possibilities of developing effective strategies to prevent the adverse effects of excess weight on the physical domains of QoL. However, future research is needed and should address with the possible diverse effects of young and older aged study populations. Furthermore, the possible

25 positive influence of gaining weight on the mental domains of QoL should be explored more

deeply, because this could have important implications for peoples' benefits of losing weight. Finally, future research should also use a obese-specific questionnaire to measure QoL to assess the association between weight change and QoL.

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Table 1: Baseline characteristics by sex.

	Total (N=2412)	Men (N=1207)	Women (N=1207)
Demographics			
Age (years)	50.6 (10.2)	50.7 (10.2)	50.4 (10.3)
Low socioeconomic status [%]	52	*44*[a]	59
Body mass index			
Normal weight BMI <25.0 [%]	45	*36*[a]	53
Overweight, BMI 25.0-29.9 [%]	43	*51*[a]	35
Obesity, BMI ≥ 30.0 [%]	13	13	13
Physical activity			
Total leisure time (hrs/week)	17.5 (13.4)	*19.7 (14.7)*[a]	15.4 (11.6)
Diseases (self reported)			
Myocardial infarction (%)	2	*3.2*[a]	0.7
Stroke (%)	0.7	0.9	0.6
Cancer (%)	2.2	*2.9*[a]	1.5
Diabetes Mellitus (%)	3.1	*2.0*[a]	4.3
Quality of Life			
Physical functioning	87.3 (16.7)	*89.3 (15.4)*[a]	85.3 (17.6)
Role limitations physical	83.7 (32.1)	*87.0 (28.4)*[a]	80.4 (35.1)
Vitality	66.2 (18.1)	*68.8 (17.6)*[a]	63.5 (18.2)
Bodily pain	82.2 (22.3)	*84.7 (20.9)*[a]	79.7 (23.3)
Social functioning	86.8 (20.0)	*88.7 (18.9)*[a]	84.9 (20.9)
Role limitations emotional	87.5 (29.4)	*89.4 (27.0)*[a]	85.6 (31.6)
General mental health	76.1 (16.4)	*78.7 (15.6)*[a]	73.5 (16.9)
General health perception	69.0 (17.7)	69.6 (17.2)	68.4 (18.3)
PCS	50.4 (8.2)	*51.1 (7.4)*[a]	49.7 (8.9)
MCS	50.2 (9.5)	*51.3 (9.0)*[a]	49.1 (9.9)

[a] Difference between men and women (*p<0.05*) (bolded)

[b] Unless otherwise indicated, data are presented as mean (SD).

[c] Abbreviations: MCS, Mental Health Composite score of RAND-36; PCS, Physical Health Composite score of RAND-36.

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	Men			Women		
	<25.0	**25.0-29.9**	**>30.0**	**<25**	**25.0-29.9**	**>30.0**
	(N=440)	**(N=610)**	**(N=157)**	**(N=637)**	**(N=417)**	**(N=153)**
Quality of Life						
Physical functioning	**92.1 (12.4)[a,b]**	89.6 (15.1)[b,c]	80.5 (20.3)[a,c]	**88.4 (14.9)[a,b]**	82.9 (19.7)[b,c]	79.0 (19.4)[a,c]
Role limitations physical	**89.7 (26.1)[a]**	87.3 (28)[c]	78.2 (34.2)[a,c]	81.6 (34.1)	79.8 (35.8)	77.3 (37)
Vitality	**69.9 (16.6)[a]**	69.2 (17.7)[c]	64.5 (19.5)[a,c]	64.3 (18.7)	63.2 (16.7)	60.8 (19.6)
Bodily pain	**87 (19.3)[a]**	84.9 (20.4)[c]	77.7 (25.1)[a,c]	80.4 (22.9)	79.9 (23.4)	76.2 (24.7)
Social functioning	**89.8 (17.3)[a]**	89.1 (19.3)[c]	84.1 (21.0)[a,c]	84.6 (21.4)	86.3 (19.4)	82 (22.3)
Role limitations emotional	90.4 (26.0)	89.5 (26.6)	85.8 (30.8)	86.3 (30.5)	86.5 (30.9)	80.2 (37.5)
General mental health	78.4 (14.7)	79.2 (15.8)	77.6 (17)	73.6 (16.7)	73.8 (16.2)	72.1 (19.1)
General health perception	**71.5 (16.4)[a]**	69.8 (16.7)[c]	63.8 (19.9)[a,c]	**70.3 (18.7)[a,b]**	67.0 (17.1)[b]	64.1 (18.7)[a]
PCS	**52.4 (6.6)[a,b]**	51.1 (7.3)[b,c]	47.3 (8.6)[a,c]	**50.7 (8.3)[a,b]**	48.9 (9.2)[b]	47.7 (9.7)[a]
MCS	51.2 (8.7)	51.5 (9.1)	50.9 (9.6)	48.9 (9.8)	49.8 (9.3)	48.3 (11.8)

[a] Difference between people with a normal BMI and people with obesity (p<0.05).

[b] Difference between people with a normal BMI and people with overweight (p<0.05) .

[c] Difference between people with overweight and people with obesity (p<0.05).

[d] **Bolded,** the overall difference between the three body mass index categories (*p<0.05*)

[e] Normal weight: BMI <25.0 kg/m^2; Overweight: BMI 25.0-29.9 kg/m^2; Obesity: BMI >30.0 kg/m^2.

[f] Abbreviations: MCS, Mental Health Composite score of RAND-36; PCS, Physical Health Composite score of RAND-36.

	Men				Women			
Table 3: longitudinal association of 5-year weight change and quality of life[b,e], by gender and body mass index categories[d].								
	Total	**Normal weight**	**Overweight**	**Obese**	**Total**	**Normal weight**	**Overweight**	**Obese**
	(N=1207)	**(N=440)**	**(N=610)**	**(N=157)**	**(N=1207)**	**(N=637)**	**(N=417)**	**(N=153)**
Quality of Life								
PF	-0.14 (-0.28 | 0.01)	-0.06 (-0.32 | 0.21)	-0.15 (-0.37 | 0.07)	-0.22 (-0.55 | 0.11)	*-0.50 (-0.65 / -0.36)[a]*	*-0.41 (-0.64 / -0.18)[a]*	*-0.56 (-0.83 / -0.29)[a]*	*-0.56 (-0.85 / -0.27)[a]*
RP	-0.28 (-0.68 | 0.13)	0.11 (-0.66 | 0.87)	-0.28 (-0.88 | 0.31)	-0.63 (-1.53 | 0.27)	-0.21 (-0.62 | 0.20)	-0.17 (-0.84 | 0.50)	-0.56 (-1.28 | 0.17)	0.03 (-0.79 | 0.86)
VT	-0.09 (-0.18 | 0.16)	-0.20 (-0.53 | 0.12)	-0.06 (-0.31 | 0.20)	*0.33 (0.01 / 0.65)[a]*	-0.06 (-0.22 | 0.11)	-0.06 (-0.33 | 0.21)	-0.01 (-0.31 | 0.30)	-0.15 (-0.46 | 0.16)
BP	-0.23 (-0.48 | 0.02)	0.27 (-0.20 | 0.75)	-0.29 (-0.65 | 0.07)	*-0.57 (-1.08 / -0.06)[a]*	-0.02 (-0.26 | 0.21)	0.06 (-0.33 | 0.45)	-0.02 (-0.42 | 0.39)	-0.17 (-0.64 | 0.31)
SF	-0.01 (-0.24 | 0.23)	-0.08 (-0.53 | 0.37)	0.20 (-0.13 | 0.54)	-0.31 (-0.82 | 0.21)	*0.28 (0.06 / 0.50)[a]*	*0.51 (0.14 / 0.88)[a]*	0.09 (-0.30 | 0.48)	0.19 (-0.25 | 0.62)
RE	-0.23 (0.59 | 14)	*-0.97 (-1.65 / -0.28)[a]*	-0.02 (-0.55 | 0.51)	0.12 (-0.67 | 0.92)	*0.73 (0.33 / 1.12)[a]*	*0.77 (0.14 / 1.40)[a]*	0.54 (-0.15 | 1.24)	*0.85 (0.03 / 1.66)[a]*
MH	0.06 (-0.09 | 0.21)	0.12 (-0.16 | 0.40)	0.01 (-0.21 | 0.23)	0.09 (-0.20 | 0.39)	0.14 (-0.01 | 0.29)	0.23 (-0.02 | 0.48)	0.12 (-0.15 | 0.39)	0.01 (-0.27 | 0.30)
GH	-0.15 (-0.31 | 0.01)	-0.12 (-0.43 | 0.20)	-0.02 (-0.26 | 0.22)	*-0.50 (-0.83 / -0.17)[a]*	-0.14 (-0.30 | 0.02)	-0.03 (-0.30 | 0.24)	*-0.40 (-0.68 / -0.12)[a]*	-0.05 (-0.34 | 0.24)
PCS	*-0.09 (-0.17 / -0.00)[a]*	0.02 (-0.14 | 0.17)	-0.04 (-0.17 | 0.09)	*-0.28 (-0.44 / -0.12)[a]*	*-0.10 (-0.19 / -0.01)[a]*	-0.06 (-0.21 | 0.08)	-0.15 (-0.32 | 0.01)	-0.14 (-0.31 | 0.03)
MCS	0.07 (-0.03 | 0.17)	0.05 (-0.16 | 0.26)	0.11 (-0.04 | 0.25)	0.06 (-0.14 | 0.27)	*0.13 (0.02 / 0.24)[a]*	*0.20 (0.03 / 0.38)[a]*	-0.03 (-0.21 | 0.16)	0.17 (-0.06 | 0.39)

[a] Indicates P-value < 0.05 *(bolded)*.

[b] Data are presented as regression coefficient and 95 % confidence interval.

[c] Adjusted for age, SES, physical activity, chronic diseases, and the mean of baseline and follow-up of the variable under study.

[d] Normal weight: BMI <25.0 kg/m^2; Overweight: BMI 25.0-29.9 kg/m^2; Obesity: BMI >30.0 kg/m^2.

[e] Abbreviations: PF, physical functioning; RP, role limitations physical; VT, vitality; BP, bodily pain; SF, social functioning; RE, role limitations emotional; MH, general mental health; GH, general health perception; PCS, physical health composite score; MCS, mental health composite score.

Table 4: Mean change (SD) in quality of life per group of weight change over a 5-year period.

	Men				Women		
	Weight loss	**Weight maintenance**	**Weight gain**		**Weight loss**	**Weight maintenance**	**Weight gain**
	(N=177)	**(N=598)**	**(N=410)**		**(N=163)**	**(N=646)**	**(N=379)**
Quality of Life							
Physical functioning	-0.4 (12.5)	0.2 (14.7)	***-1.7 (14.5)***[a]		-1.4 (18.0)	-1.5 (15.3)	-1.9 (16.4)
Role limitations physical	-3.1 (32.2)	-1.4 (33.3)	-1.9 (35.0)		-4.3 (38.9)	-2.1 (41.7)	-5.4 (41.9)
Vitality	0.7 (15.5)	-0.4 (16.5)	-0.6 (16.2)		-1.1 (17.7)	-0.2 (16.5)	-1.2 (16.5)
Bodily pain	-1.4 (22.8)	-1.5 (22.1)	-1.8 (22.1)		-1.0 (24.5)	-2.6 (22.2)	-2.7 (23.5)
Social functioning	-1.6 (20.7)	-0.6 (19.1)	-0.3 (22.3)		-1.5 (23.3)	-0.7 (22.9)	-0.3 (21.9)
Role limitations emotional	0.8 (32.4)	0.0 (30.5)	-2.3 (34.1)		-1.5 (43.8)	-1.3 (36.5)	1.4 (34.4)
General mental health	-0.3 (14.7)	-0.6 (13.7)	-0.2 (15.3)		-1.8 (17.6)	0.1 (14.9)	0.8 (15.0)
General health perception	-1.6 (15.9)	-1.8 (13.8)	***-3.7 (15.2)***[a]		-2.6 (17.6)	-3.1 (15.2)	-2.9 (15.7)
PCS	-0.7 (6.7)	-0.4 (7.6)	-0.9 (7.3)		-0.9 (9.1)	-1.1 (8.4)	-1.5 (8.7)
MCS	0.2 (9.8)	-0.2 (8.5)	-0.1 (9.5)		-0.6 (12.2)	0.0 (9.9)	0.8 (9.7)

[a] Indicates p-value <0.05 *(bolded)*.

[b] Adjusted for age, SES, physical activity, chronic diseases, and the mean of baseline and follow-up of the variable under study.

[c] MCS, Mental Health Composite score of RAND-36; PCS, Physical Health Composite score of RAND-36.