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Measuring perceived barriers to healthy eating in obese, treatment-seeking adults

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Abstract

Objective—To characterize perceived barriers to healthy eating in a sample of obese, treatment-seeking adults and to examine whether changes in perceived barriers are associated with energy intake and body weight.

Design/Setting—Observational study based on findings from a randomized, controlled behavioral weight-loss trial.

Participants—Participants were 113 women and 100 men. Mean age 48.8 years, 67% White, and mean BMI at baseline 34.9 kg/m².

Variables measured—Perceived diet barriers assessed using 39-item questionnaire. Energy intake assessed with Block Food Frequency Questionnaire. Body weight (kg) measured using calibrated scale. Height was measured using a wall-mounted stadiometer.

Analysis—Factor-based scales constructed from exploratory factor analysis (EFA). Linear regression models regressed 12-month energy intake and body weight on baseline to 12-month factor-based score changes. Statistical significance set at α -level 0.05.

Results—EFA yielded three factors: lack of knowledge, lack of control, and lack of time. Reported declines in lack of knowledge and lack of control from baseline to 12 months were associated with significantly greater energy restriction over 12 months, while reported declines in lack of control and lack of time were associated with significantly greater weight loss.

Conclusions—Our results suggest that declines in perceived barriers to healthy eating during treatment are associated with greater energy restriction and weight loss.

Keywords

perceived barriers; eating; obesity; weight loss

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Introduction

Dietary changes such as lowering fat intake and increasing fruit and vegetable consumption are useful strategies for weight control due to the lower caloric density and satiety of low-fat, high-fiber foods (1, 2). Indeed, an important component of behavioral weight loss programs is the promotion of healthy eating among participants. Despite an emphasis on healthy eating, current behavioral weight loss interventions are limited in their ability to sustain weight loss among successful participants (3). One possible explanation for this limitation is that obese individuals face unique obstacles to altering their diets and maintaining such changes long-term. Thus, gaining a better understanding of the barriers that obese individuals perceive when trying to eat healthy foods may facilitate the development of more effective weight loss interventions.

Perceived barriers refer to an individual's evaluation of the potential obstacles that may lessen the likelihood of engaging in a health behavior (4). The construct of perceived barriers has been included in several theories and models of health behavior, including the Health Belief Model, which posit that individuals simultaneously consider the perceived benefits and barriers prior to engaging in a particular behavior. Previous studies have observed a variety of perceived barriers to healthy eating in population-based samples, including lack of time (5-7), taste preferences (7, 8), lack of self-control or motivation (5-7, 9), and cost (6, 7). However, less is known about perceived barriers to healthy eating among obese individuals and instruments designed to measure barriers related to healthy eating in this population are needed.

The primary aim of this study was to characterize barriers to healthy eating among obese, treatment-seeking adults. To satisfy this aim, we tested the factor structure and internal consistency of an instrument designed to measure barriers related to healthy eating in a sample of obese adults enrolled in a weight loss trial. Factor-based scales were examined across the entire sample, as well as by gender and age. We also tested whether changes in perceived diet barriers during treatment were associated with changes in energy intake and body weight. It was hypothesized that a reduction in perceived barriers during treatment would be associated with greater energy restriction and weight loss over a 12-month period.

Methods

Data for the present study were collected as part of the Lose It Forever (LIFE) study, a behavioral weight-loss study conducted at The University of Minnesota Epidemiology Clinical Research Center. The University of Minnesota's Institutional Review Board approved this study. Details of the study design and primary outcomes for the LIFE study are described elsewhere (10).

Participants and Recruitment

Participants were recruited throughout the LIFE study using local newspaper advertisements, newsletters, and flyers. Eligible participants were at least 18 years of age, had a BMI between 30-40 kg/m², deposited a \$50 participation fee, and agreed to be randomized to either treatment condition. Individuals were excluded from participating if they reported current physical disease (e.g. heart disease, cancer, or diabetes), elevated fasting blood glucose or blood pressure levels (unless their physician provided consent), currently taking weight loss medications or antidepressants, or currently participating in another formal weight-loss program.

Procedures

After screening for eligibility, participants attended a baseline clinic visit where they had their height and weight measured, provided blood samples, and completed a series of paper and pencil questionnaires about their demographics, diet and exercise behaviors, psychological state, and physical health. Participants were then randomly assigned to one of two behavioral weight-loss treatment groups, maintenance tailored treatment (MTT) or standard behavior treatment (SBT). Standard behavior treatment used a traditional approach with fixed calorie intake and expenditure, self-monitoring of eating and exercise behaviors, and discussion of strategies to achieve these goals. The MTT group differed from the SBT group by implementing different changes in treatment approaches over time, as well as focusing on adaptation to change as a primary treatment objective. Both groups emphasized increased physical activity and dietary modification, including caloric restriction, portion control, and adopting a low-fat, high-fiber diet, as methods to lose weight. Participants completed similar assessments, including weight measurements, blood draws, and paper and pencil questionnaires (described above), at additional clinic visits at 6 and 12 months.

Measures

The background questionnaire administered at baseline asked participants to report on demographic information including highest level of education completed, employment status, and marital status. Race, gender, and current age were assessed via telephone at screening.

Barriers to diet and exercise were assessed using a 39-item questionnaire that focused on environmental and motivational barriers to diet and exercise behaviors (Appendix A). The original form of the questionnaire consisted of 15 items and was developed by Jeffery et al. to measure practical barriers to treatment adherence among 202 adult men and women in a weight loss trial comparing the effects of standard behavior treatment, food provisioning, and monetary incentives (11). This questionnaire was later expanded by other researchers for use in a descriptive study of 155 overweight and obese men and women seeking weight loss treatment (12). The version of the questionnaire used in the present study was included as a treatment process variable measure and was not pretested for validity or reliability. Participants were asked to rate from 1-5 (1= Not at all true for me, 5= Very true for me) the extent to which a stated barrier has made it difficult for them to follow appropriate eating and exercise habits in the past 6 months. Examples of statements pertaining to diet barriers include, "Healthy foods are often not available when it is time for me to eat" and "It is difficult to motivate myself to eat appropriately." Higher summary scores indicate more perceived barriers to diet and exercise.

Usual dietary intake in the preceding year was assessed with the 60-item version of the Block Food Frequency Questionnaire (FFQ), which has established reliability and validity (13). The nutrient database for this FFQ allows for estimation of average daily energy intake in kcal/day.

Participants' weights (kg) were measured at all clinic visits using a calibrated scale while wearing light clothing and without shoes. Height (cm) was measured at the baseline clinic visit using a wall-mounted stadiometer. BMI was calculated by dividing an individual's weight in kilograms by his/her height in meters-squared (kg/m^2).

Data Analysis

All analyses were performed using SAS version 9.2 (SAS Institute, Cary, NC, 2008). The 15 items that specifically addressed barriers related to healthy eating were the focus of this analysis. Exploratory factor analysis was employed using an oblique (promax) rotation.

Based on statistical conventions (i.e. the 'Kaiser-Guttman rule'), only factors with Eigenvalues ≥ 1.0 were retained (14). A factor loading cutoff of 0.30 was adopted whereby items with factor loadings less than ± 0.30 were dropped and a new factor solution without the dropped item was undertaken (15). Factors were then named according to the underlying construct reflected by items with the highest factor loadings and factor-based scales were formed.

Scores for each factor-based scale were calculated by summing across individual items that comprised each scale. The factor-based scale approach to generating factor scores is advantageous due to its ease of interpretation (16). The internal consistency of each scale was assessed using Cronbach's coefficient alpha (Cronbach's α) (17), which is widely believed to indirectly indicate the degree to which a set of items measures a single latent construct. Values of Cronbach's α can range from 0-1, with higher values demonstrating greater reliability among items. In addition, the proportion of total variance explained by each factor was calculated.

Means for each factor-based scale were calculated and t-tests were conducted to compare perceived barriers in men to perceived barriers in women at baseline. Next, Pearson correlations between age and baseline factor-based scores were calculated. Additional Pearson correlations between baseline factor-based scores, energy intake, and body weight were conducted for the full sample and men and women separately. Finally, general linear regression models were fit regressing 12-month change in energy intake and body weight on baseline to 12-month factor-based score changes, respectively, in order to assess whether declines in perceived barriers were associated with 12-month changes in energy intake and body weight. Because there were no significant differences by treatment group at 12-months in regards to overall changes in energy intake, body weight, or perceived barriers, analyses for the present study were collapsed across treatment groups. All regression models were adjusted for treatment group, gender, age, and baseline values of the dependent variable. Highest education completed, employment status, and marital status variables were included as covariates in preliminary analyses; however, inclusion of these variables did not noticeably alter regression estimates and were thus excluded from the final models. Statistical significance was set at α -level 0.05.

Results

Participant Characteristics

At baseline, participants were 213 (n=113 women and n=100 men) individuals ranging in age from 23-77 years (Mean= 48.8, SD $\pm$ 10.5). Sixty-seven percent identified themselves as White, while 23.5% identified themselves as Black. Approximately 70% had a college degree, 90% were currently employed, and 66% were married. The mean weight for female participants at baseline was 95.3kg (SD $\pm$ 11.9) and body mass index (BMI) was 34.8kg/m² (SD $\pm$ 2.8). Among male participants, the mean weight at baseline was 112.1kg (SD $\pm$ 11.0) and BMI was 35.0 kg/m² (SD $\pm$ 2.9). Baseline average daily energy intake was 1649.9 (SD $\pm$ 752.2) kcals for women and 2346.3 (SD $\pm$ 957.4) kcals for men. A total of 179 participants (87 men, 92 women) completed the 12-month follow-up clinic visit.

Exploratory Factor Analysis

Exploratory factor analysis of the 15 items yielded three factors. Factor 1 consisted of four items, Factor 2 consisted of eight items, and Factor 3 consisted of three items. The item (Q23) that read, "My friends/family do not support my efforts to change my diet" was subsequently dropped from the factor analysis due to its low factor loading on Factor 3 (0.22) and because its meaning relative to the other two items was unclear. After re-running

the exploratory factor analysis without Q23, the final 3 factors were formed into three respective scales: Lack of Knowledge, Lack of Self-control, and Lack of Time. The final rotated factor loadings of each item and internal consistency (Cronbach's α) of each factor-based scale are presented in Table 1. Among the 14 survey items, the common variance constituted about 51% of the total variance present.

Mean Factor-based Scores at Baseline

Mean factor-based scores at baseline are shown in Table 2. Both men and women rated items on the Lack of Self-control scale the highest. T-tests showed that men reported significantly higher scores on the Lack of Knowledge scale compared to women (3.1 vs. 2.8, $p=0.02$). In addition, age was negatively correlated with scores on the Lack of Knowledge ($r=-0.23$, $p<0.01$) and Lack of Time ($r=-0.38$, $p<0.001$) scales. In other words, younger participants, on average, reported that Lack of Knowledge and Lack of Time were greater barriers to healthy eating than older participants.

Factor-based Scores and Energy Intake

Pearson correlations for baseline data showed that Lack of Knowledge factor-based scores were positively associated, although modestly, with average daily energy intake among all participants ($r=0.15$), and particularly among men ($r=0.34$). In other words, men who rated items on the Lack of Knowledge scale higher also reported consuming more kcals/day on average. For women, Lack of Self-control factor-based scores were positively correlated, again modestly, with average daily energy intake ($r=0.22$).

General linear regression models were fit regressing 12-month change in energy intake on baseline to 12-month change in factor-based scores, and adjusting for treatment group, gender, age, and baseline levels of the outcome variable. Results shown in Table 3 indicate that baseline to 12-month change in Lack of Knowledge and Lack of Self-control factor-based scores were significantly associated with 12-month change in energy intake. For example, participants who reported a one unit decrease on the Lack of Self-control factor-based scale from baseline to 12 months reduced their caloric intake by approximately 229 kilocalories per day at 12 months compared to those with no change in self-control barriers during this time period.

Factor-based Scores and Body Weight

Pearson correlations showed no significant associations between factor-based scores and body weight at baseline (data not shown). General linear regression models were fit regressing 12-month change in body weight on 12-month change in factor-based scores, and adjusting for treatment group, gender, age, and baseline weight. Results shown in Table 3 indicate that baseline to 12 month changes in the Lack of Self-control and Lack of Time factor-based scales scores were significantly associated with 12-month change body weight. Specifically, a one unit decrease on the Lack of Self-control factor-based scale from baseline to 12 months was associated with significantly greater weight loss, 6.0 kg on average, by 12 months. Similarly, a one unit decrease on the Lack of Time factor-based scale from baseline to 12 months was associated with significantly greater weight loss, 2.5 kg on average, by 12 months.

Discussion

One of the primary aims of this study was to test the factor structure and internal consistency (reliability) of an instrument designed to measure barriers related to healthy eating in a sample of obese, treatment-seeking adults. Results from the exploratory factor analysis show acceptable reliability (19) and the three factors described, Lack of Knowledge, Lack of Self-

control, and Lack of Time, are comparable to perceived barriers observed in other populations. Lack of knowledge was identified as a barrier to healthy eating in a clinic-based sample of British adults (9), while lack of time and lack of self-control were indicated as the most common barriers to healthy eating among a population-based sample of European Union adults (5).

At baseline, summed items from the Lack of Self-control scale were rated highest among all participants, on average. Researchers who used a modified version of the diet barriers questionnaire used in this study similarly found that a majority (>60%) of prospective weight loss participants reported that self-control and motivation barriers were “somewhat” or “very” important barriers to healthy eating (12). High perceived lack of self-control in this sample may reflect the tendency for obese adults to lack dietary restraint and to overeat in response to environmental cues (20, 21). Furthermore, perceived diet barriers are likely shaped by previous experience with weight control. Overweight and obese individuals often make repeated attempts to alter their diets in an effort to lose weight (12), and the inability to achieve or sustain new diet behaviors in the past may be attributed as a problem of self-control.

In addition to reporting high perceived self-control barriers at baseline, men rated knowledge barriers higher than women did, on average. Gender differences in nutrition knowledge have been observed in other cross-sectional studies (22, 23), and men's relative lack of knowledge related to healthy eating may reflect an overall gender difference regarding food behavior. For example, women have historically been more involved in food-related activities, such as grocery shopping and cooking (24), and attach greater importance to healthy eating and body weight (25).

A second aim of this study was to describe the relationship between perceived barriers to healthy eating and energy intake and body weight. We found that lack of knowledge was significantly positively correlated with men's energy intake at baseline while lack of self-control was significantly positively correlated with women's energy intake. Although both men and women perceived lack of self-control to be the greatest barrier to healthy eating, this latter finding suggests that women's perceptions more accurately reflect a true lack of self-control in regards to total energy intake. We also observed a lack of correlation between factor scores and baseline weight, a finding that is likely due to our sample being restricted to those with a BMI in a pre-defined range ($< 30\text{kg}/\text{m}^2$) who volunteered to participate in a weight control program. In addition, there are undoubtedly factors other than environmental and motivational barriers, such as biological susceptibility, that contribute to body weight.

Our findings support the hypothesis that a reduction in perceived barriers during treatment is associated with lower energy intake and better weight loss outcomes. A decline in perceived knowledge and self-control barriers from baseline to 12 months was associated with significantly fewer calories consumed per day at 12 months. A similar, yet non-significant, trend was observed for a decline in perceived time barriers and daily average energy intake at 12 months. A decline in perceived self-control and time barriers from baseline to 12 months was also associated with lower body weight at 12 months. Reduction of perceived diet (and exercise) barriers is an underlying goal of behavioral weight loss treatment. In the LIFE study, participants were provided with nutritional information, as well as tips and strategies for incorporating healthy foods into their busy lifestyles. Goal setting and self-monitoring of diet behaviors were also used to bolster participants' self-efficacy for weight loss. Thus, declines in perceived barriers to healthy eating likely reflect the efficacy of behavioral weight loss treatment, and reductions in energy intake and body weight are logical outcomes of overcoming such barriers.

Implications for Research and Practice

Strengths of this study include a large sample size, a lengthy weight loss period, substantial mean weight losses, good participant retention, and inclusion of nearly 50% men. The current study is limited by the absence of potentially relevant diet barriers, such as the cost of healthy foods and individual taste preferences. In addition, potential covariates such as income and women's menstrual phases were not measured in this study and thus were not included in any of the analyses. This study also has the same limitation for causal inference as all observational studies. Specifically, it is unknown whether changes in perceived barriers cause changes in diet and weight, whether changes in diet behaviors and weight cause changes in perceived barriers, or whether the two are both caused by a third unmeasured factor. Nonetheless, this study contributes to the current state of knowledge of perceived barriers to healthy eating by focusing on a sample of obese, treatment-seeking men and women, and is strengthened by its prospective design which allows for both cross-sectional and longitudinal analyses.

Future research in this area should consider broadening this or similar questionnaires to include additional barriers to healthy eating, such as taste preference and cost, as well as testing the reliability and validity of this questionnaire in other samples of obese adults. Such measures may be useful in future studies and clinic settings for measuring individuals' progress in overcoming diet barriers throughout obesity treatment. Strategies to overcome diet barriers in the context of treatment may include nutrition education; improving time management skills, including strategizing to incorporate healthy foods into one's busy lifestyle; and goal setting and self-monitoring of diet behaviors. Individuals who struggle to reduce barriers throughout the course of treatment may need additional support and resources to ensure successful behavior change and weight loss.

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Appendix A: Questionnaire measuring perceived barriers to diet and physical activity in the LIFE study

Barriers to Diet and Exercise

Listed below are some things that participants report can make changing their eating and exercise habits difficult. For each item, please indicate the extent to which this factor has made it difficult for you to follow appropriate eating and exercise habits in the past 6 months. [*Please choose only **one** answer for each question.*]

		1 Not at all true for me				5 Very true for me
1.	It is difficult to motivate myself to eat appropriately.	1 ☐	2 ☐	3 ☐	4 ☐	5 ☐
2.	It is difficult to motivate myself to exercise.	1 ☐	2 ☐	3 ☐	4 ☐	5 ☐
3.	Often the amount of effort I need to put into controlling what I eat doesn't seem worthwhile.	1 ☐	2 ☐	3 ☐	4 ☐	5 ☐
4.	Exercising is rewarding when I do it, but I have trouble getting myself started.	1 ☐	2 ☐	3 ☐	4 ☐	5 ☐

5.	Losing weight is rewarding, but I have trouble keeping motivated to maintain weight loss.	1□	2□	3□	4□	5□
6.	I get bored easily with exercise.	1□	2□	3□	4□	5□
7.	When my efforts to control my eating don't result in weight loss, I have trouble staying motivated.	1□	2□	3□	4□	5□
8.	I can't find anything at all appealing or positive about exercise.	1□	2□	3□	4□	5□
9.	When I'm very hungry I have trouble controlling what I eat.	1□	2□	3□	4□	5□
10.	Often the amount of effort I need to put into exercising doesn't seem worthwhile.	1□	2□	3□	4□	5□
11.	When I start eating something that I think I shouldn't, I have trouble stopping eating.	1□	2□	3□	4□	5□
12.	I have difficulty exercising when I get busy.	1□	2□	3□	4□	5□
13.	I have difficulty exercising when I am in a bad mood.	1□	2□	3□	4□	5□
14.	When my efforts to exercise regularly don't result in weight loss, I have trouble staying motivated.	1□	2□	3□	4□	5□
15.	Sometimes I have cravings for foods that aren't good for me (e.g., chocolate, sweets), that I have difficulty controlling.	1□	2□	3□	4□	5□
16.	I don't have the right equipment to exercise.	1□	2□	3□	4□	5□
17.	Many kinds of exercise require a level of skill/ coordination that I don't have (e.g., aerobics, tennis, rollerblading).	1□	2□	3□	4□	5□
18.	I have difficulty exercising when I feel tired.	1□	2□	3□	4□	5□
19.	The thought of not being able to eat what I want, when I want it, depresses me.	1□	2□	3□	4□	5□
20.	My friends/family do not support my efforts to change my exercise patterns.	1□	2□	3□	4□	5□
21.	I have difficulty exercising when my family/ friends want me to spend time with them.	1□	2□	3□	4□	5□
22.	I have difficulty exercising when I am slightly sore from the last time I exercised.	1□	2□	3□	4□	5□
23.	My friends/family do not support my efforts to change my diet.	1□	2□	3□	4□	5□
24.	It is difficult for me to find good places to exercise.	1□	2□	3□	4□	5□
25.	My life is so busy that I have trouble finding time to eat properly.	1□	2□	3□	4□	5□
26.	I have difficulty exercising when I am away from home.	1□	2□	3□	4□	5□
27.	I often find myself in situations where eating a lot of food seems to be expected (e.g., holiday, social occasions, work functions, business trips).	1□	2□	3□	4□	5□
28.	My life is so busy that I have trouble finding time to exercise.	1□	2□	3□	4□	5□
29.	Healthy foods are often not available when it is time for me to eat (e.g., healthy choices not available at home, work, or in restaurants).	1□	2□	3□	4□	5□
30.	I have difficulty finding people to exercise with.	1□	2□	3□	4□	5□
31.	I don't know what types of exercise or how much I need to exercise in order to lose weight.	1□	2□	3□	4□	5□
32.	I have trouble estimating portion sizes.	1□	2□	3□	4□	5□
33.	I have trouble estimating the calorie and fat content of food.	1□	2□	3□	4□	5□
34.	I have trouble figuring out how much exercise I have done.	1□	2□	3□	4□	5□
35.	I have difficulty figuring out how to fit exercise into my daily life.	1□	2□	3□	4□	5□
36.	I don't know what foods I should eat to lose weight.	1□	2□	3□	4□	5□
37.	I don't know how to prepare healthy foods.	1□	2□	3□	4□	5□
38.	I have difficulty exercising when I haven't exercised in a while.	1□	2□	3□	4□	5□
39.	I have difficulty exercising when I just want to relax and enjoy myself.	1□	2□	3□	4□	5□

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Table 1
Final rotated factor loadings for perceived barriers to healthy eating questionnaire items

	Factor		
	1	2	3
	Cronbach's $\alpha=0.79$	Cronbach's $\alpha=0.69$	Cronbach's $\alpha=0.62$
Proportion of variance explained	0.50	0.29	0.21
Q33. I have trouble estimating the calorie and fat content of food.	0.82	0.004	0.01
Q32. I have trouble estimating portion sizes.	0.75	0.14	0.002
Q36. I don't know what foods I should eat to lose weight.	0.61	-0.12	0.31
Q37. I don't know how to prepare healthy foods.	0.56	-0.02	0.43
Q15. Sometimes I have cravings that aren't good for me, that I have difficulty controlling.	-0.06	0.63	-0.02
Q11. When I start eating something I think I shouldn't, I have trouble stopping eating.	0.004	0.56	-0.04
Q1. It is difficult to motivate myself to eat appropriately.	0.05	0.53	0.10
Q9. When I'm very hungry I have trouble controlling what I eat.	0.001	0.51	-0.10
Q19. The thought of not being able to eat what I want, when I want it, depresses me.	-0.14	0.47	0.16
Q3. Often the amount of effort I need to put into controlling what I eat doesn't seem worthwhile.	0.08	0.39	0.02
Q7. When efforts to control my eating don't result in weight loss, I have trouble staying motivated.	-0.05	0.35	0.07
Q27. I often find myself in situations where eating a lot of food seems to be expected.	0.11	0.32	0.12
Q25. My life is so busy that I have trouble finding time to eat properly.	0.10	0.22	0.62
Q29. Healthy foods are often not available when it is time for me to eat.	0.14	0.007	0.62

Table 2
Mean factor-based scores (SE) at baseline, by gender

Factor	Total (n=211)	Men (n=99)	Women (n=112)	<i>p</i>
1-Lack of Knowledge	2.9 (0.1)	3.1 (0.1)	2.8 (0.1)	0.02
2-Lack of Self-control	3.5 (0.1)	3.5 (0.1)	3.5 (0.1)	0.42
3-Lack of Time	2.9 (0.1)	2.8 (0.1)	2.9 (0.1)	0.25

Note: *p*-values are from *t*-tests comparing mean factor-based scores for men vs. women

Table 3
Regression coefficients ($\pm$ SE) for baseline to 12-month change in factor-based scores
associated with 12-month changes in energy intake and body weight

	Factor 1 Lack of Knowledge	Factor 2 Lack of Self-control	Factor 3 Lack of Time
Energy intake (kcal/day)	116.9 $\pm$ 45.1 *	228.5 $\pm$ 67.5 **	75.2 $\pm$ 46.5
Body weight (kg)	0.7 $\pm$ 0.7	6.0 $\pm$ 1.0 **	2.5 $\pm$ 0.7 **

SE=standard error

**
P<0.01,

*
P<0.05

Note: All regression models were adjusted for treatment group, gender, age, and baseline values of the dependent variable.