Long-term weight loss maintenance and management following a VLCD: a 3-year outcome

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Disclosures

CR has received lecture honoraria and has attended national/international meetings as a guest of LighterLife Ltd, UK.

CR, IB have been involved with other companies with an interest in obesity.

IB, KLJ, SL are employed by LighterLife Ltd, UK.

IM has done consultancy work for LighterLife Ltd, UK

Abstract

Background: Effective weight loss treatment is important as obesity has severe health and socioeconomic repercussions. Emerging evidence suggests that rapid initial weight loss results in better long-term weight loss maintenance. This remains controversial and contradicts current recommendations for slower weight loss.

Aim: To determine the effect of a very-low calorie diet (VLCD) with group-based behaviour therapy on weight loss and long-term weight management by means of a retrospective database analysis.

Methods: Data for this retrospective analysis included participants who embarked on the LighterLife Total VLCD programme between 2007-2010, and whose weights at baseline and at least 12 months were available (n=5965). **Results:** Data were available for 5965 individuals at 1 year, 2044 at 2 years and 580 at 3 years. At baseline, the majority of individuals were Caucasian (n = 5155), female (n=5419), ≥40 years old (n=4272), 49% were within the body mass index (BMI) range of 30-35 kg/m^2 while 51% had a BMI >35kg/m^2. The average initial weight of the whole cohort was 99.1 kg (standard deviation 16.6). Initial weight and BMI at entry onto programme, as well as numbers of weeks of weight loss were all significantly associated with weight loss achieved on the first weight loss attempt. Weight lost during the initial weight loss phase was the only factor which was significantly associated with percentage weight loss maintenance for years 1,2, and 3.

Conclusion: The findings of this retrospective analysis suggest that provided a longer-term weight loss management programme is adhered to, large

amounts of initial weight loss can result in important longer-term weight loss maintenance in motivated individuals.

What's known?

The erroneous belief that rapid weight loss is associated with poorer long-term weight loss outcomes is unsubstantiated, but these cognitive biases are due to the repeated exposure of such claims (i.e through the media) despite no sound scientific evidence-base for these. Emerging evidence suggests that long-term weight loss is achievable providing that additional weight maintenance approaches are implemented in the weight maintenance phase of the programme.

What's new?

Our findings not only corroborate the mounting evidence that long-term weight loss is achievable following a VLCD in motivated individuals, but more importantly demonstrate that this can be achieved in a community-based setting where individuals are involved in group support, along with behavioural therapy. Furthermore, this weight loss regime should receive better long-term support from GPs and the scientific community for their value to be optimised.

Introduction

Effective weight loss treatment is of importance as obesity has severe health and socioeconomic repercussions including type II diabetes, hypertension, dyslipidaemia, gout, atherosclerotic heart disease, restrictive lung disease, gall bladder disease, degenerative arthritis, infertility and certain cancers (1-

4). In fact, data from the FORESIGHT report estimated that over half of the UK population could be obese by 2050, costing the UK NHS £10 billion per year (5). The current policy recommending dietary guidelines for a low fat, reduced energy diet, or its implementation, appears to be ineffective (6).

A very low calorie diet (VLCD) is defined as a diet of <800 kcal/day (7,8). A variety of synthetic and food-based formula diets are available, which give daily energy intakes below this threshold. These diets are designed to achieve weight loss while minimising the loss of lean body mass observed with weight loss in general, by providing high levels of protein supplemented with vitamins, minerals, electrolytes and fatty acids (9,10).

There is sufficient evidence in the literature demonstrating the safe use of VLCDs in the short-term (11,12). Based on this evidence, institutions such as the National Heart, Lung and Blood Institute (NHBLI) and National Institute for Health and Clinical Excellence (NICE) support the use of this approach for approximately 3 months in medically supervised conditions for obese and overweight individuals who meet specific criteria and who fail to meet a target weight loss with the standard low fat, reduced calorie approach. Despite this, there are still concerns about the rate and amount of weight regain following weight loss on a VLCD as well as concerns with regards to the purported detrimental health effects this type of diet may induce. Recently, Mulholland et al (13) published the results of a systematic review of the literature for studies using a VLCD, with a minimum follow-up of 12 months, published between January 2000 and December 2010. This review suggests that

significant weight loss and improvements in blood pressure, waist circumference and lipid profile are achievable in the longer term following a VLCD. Interpretation of the results was restricted and thus conclusions with which to guide best practice are limited due to heterogeneity between the studies. There is additional evidence that individuals who achieve large amounts of weight loss (>20kg) using a structured program are more likely to be successful at weight loss maintenance in the long term (14). These findings support the need for more evidence on the longer-term effects of VLCDs on weight loss and subsequent maintenance. Thus, we aimed to carry out a retrospective analysis to determine the effect of VLCD with an appropriate behaviour change and weight loss maintenance programme on weight loss and long-term weight management in obese individuals.

Materials and Methods

Source of Data

Data for this retrospective analysis was included from participants if they had embarked on the LighterLife Total VLCD programme between 2007-2010, and whose weights at baseline and a minimum of 12 months were available. Ethical permission for this analysis was obtained from the Robert Gordon University Ethics Committee.

Study Population

Participants on the LighterLife Total weight loss programme were self-referred, and prior to starting, their eligibility to join was assessed by their Family Medical Practitioner using a standardised form used by LighterLife which assesses health status. Requirement for any changes to existing medication was determined by the participant's Family Medical Practitioner and, where required, participants' doses were adjusted prior to the commencement as well as during the diet. Potential clients were included if they met the requirements above and were excluded from taking part in the LighterLife Total programme if the met any of the following exclusion criteria: type 1 diabetes; porphyria; total lactose intolerance; major cardiovascular or cerebrovascular disease; history of renal disorder or hepatic disease; active cancer; epilepsy, seizures, convulsions, major depressive disorder, psychotic episodes, schizophrenia, bipolar disorders, delusional disorders; current suffering from anorexia, bulimia or undergoing treatment for any other eating disorder; are pregnant or breastfeeding; have given birth or had a miscarriage in the last 3 months.

Weight loss and management programme

LighterLife Total is a commercial weight-management programme for individuals with body mass index (BMI) ≥30 kg/m^2. It consists of a tripartite approach comprising of a VLCD and group support, along with behavioural therapy. The programme aims to help participants achieve weight loss and to identify personal psychological motivation for over-consumption, thereby enabling participants to develop robust strategies for more successful weight management in the future. Following the weight loss phase, which can vary

between several weeks to several months, individuals can embark on the weight management programme during which time they continue to attend weekly group meetings, thus enabling active management of motivation and concordance, using group support to encourage long-term behavioural modification and weight management.

Both the LighterLife Total and subsequent management programmes were followed within a community based setting where appointments and group support were managed by trained weight management and behaviour change facilitators.

Diet and nutrition

The VLCD provides an average daily intake of 550kcal (50g protein, 50g carbohydrate, 17g fats i.e. 36 energy% protein, 36 energy% carbohydrate and 28 energy% fat) (8). The food packs (soups, shakes and bars) also contain ≥100% recommended daily allowances (RDA) for vitamins and minerals including Vitamins A, C, D, E, K, thiamine, riboflavin, niacin, B6, B12, folic acid, biotin, and pantothenic acid, calcium, phosphorous, iron, zinc, magnesium, iodine, potassium, sodium, copper, manganese, selenium, molybdenum, chromium, chloride, fluoride) (15,16).

Behaviour change therapy and group support

Participants undertook the VLCD alongside a behaviour-change programme developed specifically for weight management in the obese. This is informed by concepts from cognitive behavioural therapy and transactional analysis

(transactional cognitive behavioural therapy – TCBT™) and addiction/change theory (17-19). It is delivered in small, single-sex, weekly groups by weight-management counsellors who are specifically trained in the facilitation of behaviour change for the treatment of obesity.

Measurements

Measurements for height and weight took place at LighterLife centres and were carried out by the facilitators in-line with standardised protocols. The details of the equipment used for these measurements were not recorded. Measurements were taken during weekly meetings which took place at the same location and time each week.

Statistical Analysis

Predictors for weight loss during the initial weight loss phase were assessed using linear regression models for continuous normal data. The outcome variable was the log transform of the initial weight loss. The predictors considered were gender, ethnicity, age, initial weight and length of the weight loss phase. Univariate and multivariate results are presented.

To assess predictors for weight 1, 2 and 3 years after exiting the initial weight loss phase, further linear regression models were fitted. These models contained an individual random effect to take into account correlation between weights for the same individual at different time points, a fixed effect to indicate the time point (year), and a fixed effect for weight exiting the initial weight loss phase. Predictors considered were, again, gender, ethnicity, age, baseline weight and length of the initial weight loss phase. Differing effects over time were assessed via interactions of each predictor with the time point variable.

Additional analyses assessed the association between initial BMI and age with the length of the initial weight loss phase (via linear regression models) and the differences between characteristics of participants who did and did not re-attempt weight loss (via Mann Whitney U tests).

Statistical analyses were conducted using the software package R and SPSS or Windows (version 17.0) (SPSS Inc., Chicago, IL, USA).

Results

Individuals, for whom at least one year data following an initial period of weight loss was available, were identified in the LighterLife database (n=5965). The baseline characteristics are available in Table 1. The majority of individuals were of Caucasian ethnicity, female, over 40 years of age and with a mean BMI 36.3 (standard deviation (SD) 5.1) kg/m^2 and 51% with a BMI >35kg/m^2. The mean initial weight of the whole cohort was 99.1 kg (16.6).

For the whole cohort, a significant positive association was observed between initial BMI and duration of the initial weight loss phase ($r = 0.54$, $p < 0.001$). Age was not associated with the length of initial weight loss phase ($r = 0.00$; $p = 0.896$).

Over the 3-year period, individuals underwent an initial phase of weight loss for mean of 20.0 weeks (SD 8.6) followed by a reintroduction of food and subsequent weight management programme. In addition, over 50% of individuals (n=3344) returned to the weight loss phase for a second attempt at

weight loss within this 3 year period. Further attempts at weight loss were made by some of these participants during this time (Table 2). Those who re-attempted weight loss were younger, had a higher BMI and starting weight , attended more weeks of weight loss and achieved greater weight loss during the weight loss phase (although this was no longer significant when baseline weight was corrected for)(Table 3). However, those who re-attempted weight loss had fewer weeks in the weight maintenance management programme (8.0 (5.7) weeks vs 10.4 (7.4) weeks, $p<0.0001$) and had less absolute (-17.3 (11.3) kg vs -20.0 (11.5), $p<0.0001$) and percent weight loss (16.9 (9.4) vs 20.0 (9.4), $p<0.0001$) at one year than those who had a single attempt at weight loss (Table 3).

A plot showing the mean weight trajectory for individuals for whom year-on-year data were available over the 3-year period (n= 580) is available in Figure 1. Although this only represents 10% of the total initial cohort, and embodies those individuals most engaged with the programme, these results demonstrate that those individuals who do well and engage with the programme continue to do well in the long term. Individuals regained weight on average from year to year but, weighed a mean of 12.9 (11.3) kg less at 3 years compared with their initial weight at the start of the weight loss phase (84.4 (14.9) kg vs 97.3 (16.0) kg, $p<0.0001$). Mean weight change at 1,2 and 3 years after termination of first weight loss phase compared with initial weight are presented in Table 4 for all available clients. Baseline weight and BMI were significantly less ($P<0.05$) in those who stayed engaged with the programme for 3 years post weight loss compared with those who stayed

engaged with the programme for only 1 year. The individuals who were still present at 2 and 3 years lost a significantly greater percentage of weight at the end of the weight loss phase than those who stayed for 1 year only ($p<0.0001$ and $p<0.05$ respectively). Furthermore, weight and percent weight change at year 1 were also significantly greater for the individuals who stayed engaged with the programme for 2 or 3 years as compared to those who only stayed for 1 year (Table 4). Only 2.6%, 5.6% and 8.6% of clients weighed more at Years 1, 2, and 3 respectively compared to their initial weight.

Predictors of weight loss during the initial weight loss phase

The mean weight loss during the initial weight loss phase for all individuals was 25.7 (11.0) kg. Results of fitting linear regression models to assess predictors for weight loss during this phase are given in Table 5.

In the first instance, males appeared to lose more weight than women, (28.3 (13.4) kg vs 25.4 (10.7) kg) but this was no longer significant when baseline weight was corrected for in the multivariate analysis.

Individuals of Caucasian ethnicity lost more weight (26.0 (11.1) kg) than Asian (21.4 (8.4) kg) or Black (23.8 (11.2) kg) participants. The box plot in Figure 2 demonstrates that most of the extreme weight losses were by Caucasian individuals.

Initial weight, and numbers of weeks on weight loss were significantly associated with initial weight loss (Table 5). Although there was a statistically

significant association between initial weight loss and initial age, this was a very weak association (r = -0.13) and was therefore unlikely to be of clinical importance.

Predictors for participants achieving >5%, >10% and >20% weight loss at Year 1, 2, 3

Table 6 demonstrates the number and percentages of individuals who were able to maintain >5%, >10% and >20% weight loss compared with baseline at Year 1, 2, 3.

To investigate the factors predicting the likelihood of achieving >5%, 10% and 20% of weight loss, univariate and multivariate logistic regression analysis was applied. The variables included were gender, ethnicity, initial age, initial weight, BMI, weeks of weight loss, weeks of management and weight lost during the weight loss phase. For years 1,2, and 3 only weight lost during the weight loss phase was significantly associated with percentage weight loss maintenance (Table 7).

Discussion

Although data available at 3 years only represent 10% of the initial cohort, the findings of this retrospective analysis suggest that provided a longer-term weight loss management programme is adhered to, large amounts of initial weight loss can result in important longer-term weight loss maintenance in a community-based setting. This is in agreement with a mounting body of evidence, including the meta-analysis by Anderson et al (14) who suggest

that individuals who achieve >20kg weight loss obtain the best weight loss outcomes in the longer term (5 years).

In our analysis we observed that participants tended to remain on the initial weight loss phase longer if they presented with a higher BMI at baseline and that over 50% of the overall participants reattempted a weight loss phase. Counter intuitively, those who re-attempted weight loss had been on the weight loss phase for longer. Despite this, those who only had a single attempt at weight loss had an overall greater absolute and percentage weight loss than those who had several attempts at weight loss at Year 1. However, these latter individuals had attended significantly fewer weeks in the weight maintenance management phase following the weight loss phase.

It would be interesting to identify the reasons for which the former group was more successful at weight maintenance at 1 year. One explanation is that those who had a single attempt at weight loss stayed longer in the weight management phase. This suggests that the group support and the behaviour therapy received during the weight maintenance management may play an important role in the avoidance of weight regain. Although the benefits of support and behaviour therapy have previously been reported (20, 21), assessment of the factors (i.e. support vs behaviour therapy and lifestyle changes made) should be further investigated in future, perhaps by means of focus groups, to better understand the reasons behind these findings and to look to implement these to improve weight loss maintenance following other weight loss strategies.

As expected following any weight loss approach (22), weight was regained over the 3 year period following the initial weight loss phase, however, weight was still significantly lower at 3 years than at baseline. Based on trajectory of weight regain following initial weight loss phase (Figure 1), it will be interesting to see the longer term data as the trajectory seems to be reaching a plateau.

Nearly 80% of people who were still engaged in the programme at 3 years still presented with a clinically significant weight loss (≥5%). As mentioned above, the only significant factor for achieving long-term weight loss maintenance (i.e. at 1,2, and 3 years) was the amount of weight lost during the initial weight loss phase. Hence, it would appear that the greater the weight loss achieved, the greater the weight loss maintenance. It remains to be determined, however, whether the rate of weight loss is also a predictor of long-term weight loss maintenance. In the review by Astrup and Rössner (23), they suggest that long-term weight loss maintenance after a major weight loss is a multifactorial trait and it is likely that substantial variations in weight loss maintenance between patients are due to variability in physiological and psychosocial factors. They also suggest that that increased initial weight loss produces better long-term weight loss maintenance providing that additional weight maintenance approaches are implemented in the weight maintenance phase of the programme. This was also supported by Nackers et al (24) who suggested that rapid weight loss, when utilised in conjunction with an appropriate longer-term weight management programme is successful in maintaining clinically significant reductions in weight over time.

The ‘yo-yo’ effect of rapid weight loss and regain associated with VLCD’s has previously been criticised (25). However, several studies have demonstrated that intermittent VLCD use does not have any detrimental effect on metabolic parameters such as RMR, fasting insulin, Insulin resistance, leptin, inflammatory markers, lipids or BP (25-28). This was recently supported by Cassazza et al (29) who clearly state that the perceived damaging effects of rapid weight loss and weight regain appear to be no more than a presumption and that there is no evidence either way. The reality of weight loss attempts (no matter the approach) is that if individuals regain weight, then they clearly have not found a successful way to manage their weight and should not be a reflection on the weight loss approach used. There is also evidence (13) that achieving weight loss and regaining it still results in better long-term cardiovascular outcomes than if the weight had never been lost.

Gender did not appear to be a predictor of weight loss nor of weight loss maintenance. Ethnicity, however did, suggesting that Caucasians were able to achieve greater weight loss than the Asian and Black individuals. This is in support of current literature which demonstrates that there is an ethnic variation in response to weight loss, not only to dietary approaches (30) but also in response to weight loss medication (31) and even bariatric surgery (32) where Caucasians are generally found to lose more weight than their ethnic counterparts. As Kuminyaka (33) suggests, special attention should be paid to weight interventions in ethnic minorities as there is concern that typical

weight loss strategies are not as effective in these populations as compared with others.

Limitations

There were several limitations encountered in this retrospective analysis. One of the main limitations is that we do not know what happens to those individuals who do not remain engaged with the programme for the 3 year duration. These individuals are also difficult to account for within the analysis as they cannot be treated as drop outs as this was a participant-driven choice rather than a planned intervention. It remains unclear if participants no longer choose to engage with the programme because they had either achieved and/or maintained their target weight loss; they were dissatisfied with this approach; or if they had to stop for other reasons (ie. pregnancy, surgery, disease etc). Nevertheless, one of the strengths of this study is the inclusion of all participants who started the programme without selection during the 3 year period. As Bischoff et al (34) suggest, this partly overcomes the limitation that this was not a randomised controlled study as our results may have been biased if only participants from selected centres were included in our analysis.

Another limitation of this analysis was the lack of available information with regards to the approaches used to achieve weight loss maintenance (i.e exercise, reduced calorie diet, intermittent fasting etc), which should be addressed in future research.

In addition, the population investigated here was heavily biased towards Caucasian women 40 years and above, so it may be difficult to fully assess the impact of gender and ethnicity and to generalise these findings for more specific populations. Nevertheless, this does demonstrate that Caucasian women aged 40 should be considered appropriate targets for this intervention.

Conclusion

It has been suggested that the erroneous belief that rapid weight loss is associated with poorer long-term weight loss outcomes is unsubstantiated, but that these cognitive biases are due to the repeated exposure of such claims (i.e through the media) despite no sound scientific evidence base for these (30). Although data available at 3 years only represent 10% of the initial cohort, our findings suggest that large amounts of initial weight loss, when subsequently supported by a weight management programme can result in important long-term weight loss maintenance in individuals motivated enough to continue engaging in the programme. The best predictor of long term weight loss was a large initial weight loss, however, Long-term support from LighterLife facilitators, GPs or other healthcare professionals is crucial for the long-term success of weight loss maintenance. Caucasian women aged 40 in particular did well on this intervention, and we suggest that GPs and other healthcare professionals should support commercial weight loss programmes to improve outcomes. Nevertheless, weight loss and weight loss maintenance approaches remain to be developed to specifically target different age, gender and ethnic groups.

Author Contributions

CR, IB and IM designed the retrospective analysis. Data were collected by SL. Data analyses were done by CR and Lynne Cresswell. Writing of manuscript was carried out by CR and KLJ. Data were interpreted by CR, IB, KLJ, and IM. All authors had final approval of the submitted and published version.

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Table 1: Baseline characteristics (n=5965)

Characteristic	
Mean Age (years)	45.6 (10.2)
Age categories (years)	
18-29	360 (6.0 %)
30-39	1333 (22.3 %)
40-49	2218 (37.2 %)
>=50	2054 (34.4 %)
Gender	
Female	5419 (90.8%)
Male	546 (9.2%)
Ethnicity	
Undisclosed	351 (5.9%)
Bangladeshi	2 (<0.1%)
Black African	30 (0.7%)
Black Caribbean	47 (0.8%)
Black Other	22 (0.4%)
Caucasian	5155 (86.4%)
Chinese	1 (<0.1%)
Indian	87 (1.5%)
Pakistani	20 (0.3%)
Other	250 (4.2 %)
Height (m)	1.65 (0.08)
Weight (kg)	99.1 (16.6)
Mean BMI (kg/m^2)	36.3 (5.1)
BMI categories(kg/m^2)	
<30	1 (<0.1%)
30-35	2940 (49.3%)
35-40	1860 (31.2%)
40-45	750 (12.6%)
45-50	298 (5.0%)
>=50	116 (1.9%)

Data are presented as means (standard deviation) or sum (percentage of overall population).

Table 2: Attempts at weight loss

Attempt Number	No. Participants
1	2621
2	1741
3	923
4	394
5	171
6	68
7	33
8	9
9	3
10	2
Total	5965

Table 3: Comparison between participants who had a single attempt at weight loss and those who had at least a second attempt at weight loss

	Single Attempt (n=2621)	Re-attempt (n=3344)	P
Start age	46.5 (10.3)	45.0 (10.1)	<0.0001
Start BMI	36.0 (4.9)	36.6 (5.2)	<0.0001
Start weight	97.9 (16.1)	100.0 (16.8)	<0.0001
Attendance for weight loss (weeks)	17.9 (7.3)	18.6 (7.5)	<0.0001
Percent attendance for weight loss	92.6 (8.5)	92.2 (8.7)	0.075
Weight change at end of weight loss phase	-25.3 (10.5)	-26.0 (11.3)	0.026
Percent weight change at end of weight loss phase	25.3 (7.3)	25.4 (7.6)	0.723
Attendance for management (weeks)	10.4 (7.4)	8.0 (5.7)	<0.0001
Percent attendance during management	76.3 (20.5)	74.9 (22.1)	0.100
Weight change at 1 year from baseline.	-20.0 (11.5)	-17.3 (11.3)	<0.0001
Percent weight change at 1 year from baseline	20.0 (9.4)	16.9 (9.4)	<0.0001

Table 4: Mean weight change at 1,2 and 3 years after termination of first weight loss phase compared to initial weight

	Participants available at 1 year only (n=3921)	Participants available for up to 2 years (n=1464)	Participants available for up to 3 years (n=580)
Baseline weight (kg)	99.5 (16.6)	98.7 (16.6)	97.3 (16.0)[b]
Baseline BMI (kg/m^2)	36.3 (5.1)	36.1 (5.0)	35.8 (4.6)[b]
Weight at end of weight loss phase 9kg)	74.0 (11.4)	72.5 (10.6)[a]	71.3 (10.5)[a,d]
Weight change at end of weight loss phase (kg)	-25.47 (10.8)	-26.2 (11.4)[a]	-26.0 (10.7)[a,c]
% weight loss at end of weight loss phase	25.1 (7.4)	25.9 (7.7)[a]	26.1 (7.3)[b]
Weight at year 1 (kg)	81.5 (14.5)	79.2 (13.6)[a]	77.7 (13.0)[a,d]
Weight change at year 1 (kg) (compared to baseline)	-18.0 (11.4)	-19.5 (11.6)[a]	-19.6 (11.1)[a]
% weight loss at 1 year (compared to baseline)	17.6 (9.5)	19.2 (9.5)[a]	19.6 (9.1)[a]
Weight at year 2 (kg)	-	83.8 (15.2)	82.1 (14.1)[d]
Weight change at year 2 (kg) (compared to baseline)	-	-14.9 (11.4)	-15.2 (10.8)
% weight loss at 2 year (compared to baseline)		14.7 (10.0)	15.2 (9.2)
Weight at year 3 (kg)	-	-	84.4 (14.9)
Weight change at year 3 (kg)	-	-	-12.9 (11.3)
(compared to baseline)			
% weight loss at 3 year (compared to baseline)	-	-	12.9(10.0)

Values presented as mean (standard deviation)

a- Significantly different to year 1 ($p<0.0001$)
b- Significantly different to year 1 ($p<0.05$)
c- Significantly different to year 2 ($p<0.0001$)
d- Significantly different to year 2 ($p<0.05$)

Table 5: Univariate and multivariate results of weight loss during first weight loss attempt (in which linear regression models have been fitted to the log of weight loss)

	Univariate analysis			Multivariate analysis	
	Coefficient (SE)	P	Pearson's R	Coefficient (SE)	P
Male	0.08 (0.02)	<0.001		-0.21 (0.01)	<0.001
Ethnicity:					
Caucasian	0			0	
Asian	-0.19	<0.001		-0.08 (0.02)	<0.001
Black	-0.09	0.019		-0.09 (0.03)	<0.001
Baseline weight (kg)	0.02 (0.0002)	<0.001	0.69	0.01 (0.0003)	<0.001
Weeks in the initial weight loss phase	0.03 (0.0004)	<0.001	0.57	0.01 (0.0005)	<0.001
Baseline Age (years)	-0.01 (0.0005)	<0.001	-0.13	-0.003 (0.0003)	<0.001

BMI – body mass index; SE- standard error

Table 6: Number of individuals who were able to maintain ≥5%, ≥10% and ≥20% weight loss compared to baseline at Year 1, 2, 3

	Year 1 (n= 5965)	Year 2 (n= 2044)	Year 3 (n= 580)
< 5% weight loss	458 (7.7)	294 (14.4)	118 (20.4)
≥ 5% weight loss	629 (10.5)	335 (16.4)	100 (17.2)
≥ 10% weight loss	2398 (40.2)	837 (40.9)	229 (39.5)
≥ 20% weight loss	2480 (41.6)	578 (28.3)	133 (22.9)

Values are presented as absolute numbers (percentage).

Table 7: Association between weight loss during the weight loss and percentage of weight loss maintained at year 1, 2 and 3.

	Weight lost during the weight loss phase											
Dependent variables	≥5%				≥10%				≥20%			
	Univariate		Multivariate		Univariate		Multivariate		Univariate		Multivariate	
	Coefficient (SE)	P value	Coefficient (SE)	P value	Coefficient (SE)	P value	Coefficient (SE)	P value	Coefficient (SE)	P value	Coefficient (SE)	P value
Year 1	0.11 (0.01)	<0.001	0.16 (0.01)	<0.001	0.11 (0.005)	<0.001	0.17 (0.01)	<0.001	0.11 (0.004)	<0.001	0.18 (0.01)	<0.001
Year 2	0.07 (0.01)	<0.001	0.11 (0.01)	<0.001	0.06 (0.01)	<0.001	0.11 (0.01)	<0.001	0.08 (0.005)	<0.001	0.13 (0.01)	<0.001
Year 3	0.06 (0.01)	<0.001	0.11 (0.02)	<0.001	0.06 (0.01)	<0.001	0.10 (0.2)	<0.001	0.08 (0.01)	<0.001	0.10 (0.02)	<0.001

SE - standard error

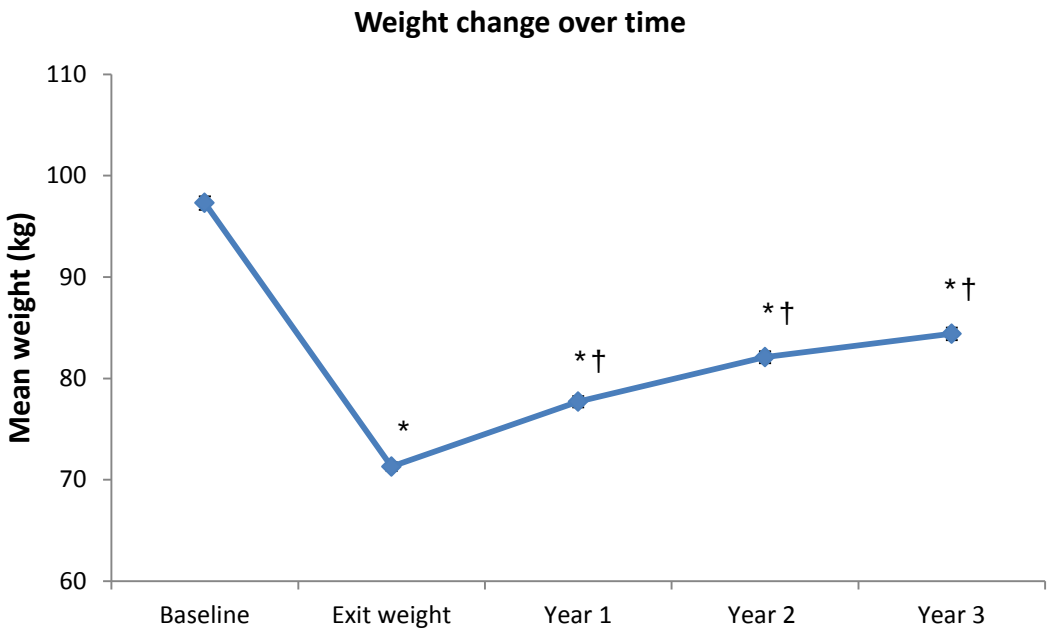

Figure 1: Weight change over time for participants available at year 3 (n=580). * displays a significant difference from baseline ($p<0.0001$); † displays a significant difference from the previous time point ($p < 0.0001$).

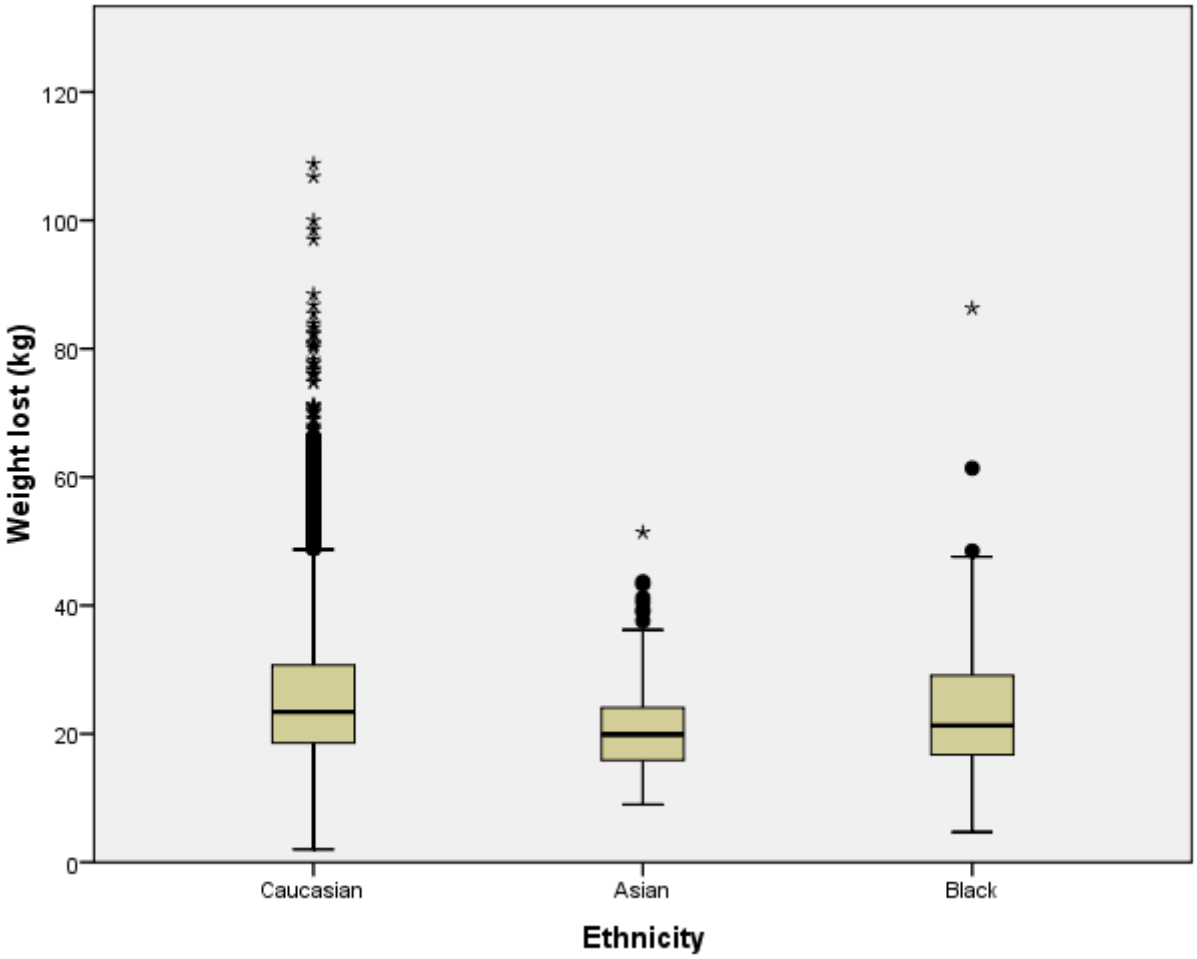

Figure 2: Comparison of weight loss during the initial weight loss phase for different ethnic groups