

# Obesity Treatment in Adults:

## A Pilot Study of the Relation between Speed of Weight Loss and the Course of Autonomous Motivation

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## Abstract

Motivation is an important factor for weight loss and weight loss maintenance, but knowledge is needed on different weight loss interventions and how they affect motivation. Because it is assumed that a sustained motivation for dieting makes the patient more able to comply with the treatment and thus succeed in losing weight, identifying how different interventions affect motivation is of great importance. The current RCT therefore aimed to explore the course of motivation for dieting in two treatment groups who lost 10 % of their body weight with different speed; either during a four week very low calorie diet (VLCD) or a low calorie diet (LCD), lasting eight weeks. The participants ( $N=35$ , of which 26 were women) completed the Treatment Self-Regulation Questionnaire (TSRQ) at baseline (T1) and after four (T2) and eight weeks (T3), in addition to several bodily measures, as weight and height. The results showed that both groups' motivation was relatively stable during the treatment period, and there was no difference in the course of motivation between the two interventions. In conclusion, motivation was not differentially affected by the speed of weight loss.

*Keywords:* Motivation, weight loss, Self Determination Theory (SDT), VLCD, LCD, diet, speed of weight loss.

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### Obesity Treatment in Adults: A Pilot Study of the Relation between Speed of Weight Loss and the Course of Autonomous Motivation

Obesity has become a widespread health problem in Norway and across large parts of the world (Meyer, Fleten, & Hovengen, 2010; WHO, 2000), and the prevalence of obesity has nearly doubled since the 1980's (WHO, 2013). Today, 65 % of the world's population live in countries where more people are dying of conditions related to overweight and obesity than of underweight (WHO, 2013). Obesity is associated with both medical and psychological consequences such as cardiovascular diseases (CVD), diabetes, musculoskeletal disorders, cancer, sleep apnea, social exclusion, depression, pain and worry (Guh et al., 2009; Lobstein, Baur, & Uauy, 2004; WHO, 2013). Even though a 5-10 % weight loss is associated with health benefits in overweight and obese individuals (Wing et al., 2011), research shows that the majority of patients do not maintain the weight loss obtained (Pi-Sunyer, 1998; Wing & Hill, 2001). Studies suggest that motivation is an important predictor of successful weight loss in adults, as well as for weight loss maintenance (Deci & Ryan, 1985; Pi-Sunyer, 1998; Prochaska & DiClemente, 1983; Williams, Grow, Freedman, Ryan, & Deci, 1996). Motivation is noted as a key factor in international (Brown, 2006) and national guidelines (Mæhlum et al., 2011) for prevention, examination and treatment of overweight and obesity in adults. More and more interest is seen for the orientation of motivation, not only the level, as seen in for example intervention studies focusing on the effect of motivational enhancement on weight loss (e.g. Webber, Gabriele, Tate, & Dignan, 2010; Webber, Tate, & Bowling, 2008). Higher levels of controlled motivation (not self-determined) is detrimental for behavioral change in terms of weight loss, while high levels of autonomous motivation, which implies self-regulated behavior, through the intervention, is favorable for weight reduction (Webber et al., 2010). However, more knowledge is needed on how motivation is related to different kinds of obesity interventions. For example, interventions differ in regard to speed of weight loss, and speed of weight loss has shown to affect obtained, as well as maintained weight loss positively (Astrup & Rössner, 2000; Nackers, Ross, & Perri, 2010). A rapid weight loss over a short period of time will have a less negative effect on motivation than a more prolonged weight loss (Wadden et al., 2006). Because it is assumed that a sustained autonomous motivation for dieting makes the patient more able to comply with the treatment and thus succeed in losing weight, identifying how different interventions affect motivation is of great importance. The current study therefore aimed to examine the course of autonomous motivation in a randomized trial of two different dietary interventions in a sample of obese

participants; one group following a very low calorie diet (VLCD, giving a rapid weight loss), the other following a low calorie diet (LCD, giving a somewhat slower weight loss).

### **What Is Obesity?**

Obesity and overweight is defined as an abnormal or excessive accumulation of fat that may impair health (WHO, 2013). The WHO defines overweight as a body mass index (BMI [ $\text{kg}/\text{m}^2$ ])  $\geq 25$ , whereas obesity is defined as a BMI  $\geq 30$  (WHO, 2013). The risk for contracting lifestyle diseases, such as coronary heart disease, type 2 diabetes, osteoarthritis and some cancers increases with increasing BMI. The leading cause of death in 2008 was cardiovascular diseases (CVD), mainly heart disease and stroke (WHO, 2013). Overall, the public health consequences and the associated socio-economic costs are large (WHO, 2000). International and national guidelines recommend weight loss treatment for individuals with BMI over 30, and for individuals with a BMI over 25 suffering from weight-related comorbidities (Mæhlum et al., 2011; Pi-Sunyer, 1998).

### **Treatment of Obesity**

According to national guidelines, treatment of obesity and overweight should focus on changing diet and activity levels in order to affect the energy-balance and thus reduce weight. As noted in the National Institute for Health and Care Excellence (NICE) guidelines, multicomponent treatment is the treatment of choice (Brown, 2006; Mæhlum et al., 2011; Pi-Sunyer, 1998). More specifically, interventions need to apply behavioral change strategies to increase physical activity level, decrease inactivity, and improve eating behavior and the quality of the person's diet. This should be included in weight management programs. The NICE guidelines (Brown, 2006) specify that dietary treatment of obesity should hold a lower energy intake than expenditure as its main goal, preferably resulting in a weight loss of 5-10 %. These percentages are also specified in the Norwegian nutritional guidelines (Mæhlum et al., 2011), and the National Heart, Lung, and Blood Institute's (NHLBI) clinical guidelines (Pi-Sunyer, 1998). A weight loss in this range is shown to reduce hypertension, insulin resistance, plasma lipids and lipoproteins, and mild sleep disturbances, factors related to a higher mortality rate (Dattilo & Kris-Etherton, 1992; Peppard, Young, Palta, Dempsey, & Skatrud, 2000). The current study aims to follow these guidelines, as both diets are designed to make the participants lose 10 % of their body weight, only at different speed.

A meta-analysis shows that five years after completing structured weight loss interventions where the participants lost 10 % of their bodyweight or more, the average individual maintained only a 3 % weight loss compared to their initial weight (Anderson, Konz, Frederich, & Wood, 2001). According to a review from 2001, with a success criterion

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of one year maintenance of a 10 % weight loss of initial body weight, only 20 % of the individuals losing weight can be accounted for as successful (Wing & Hill, 2001).

The meta-analysis of (Anderson et al., 2001) reports that the individuals who either participated in a very low energy diet-intervention (VLED: less than 800 kcal intake/day, mean duration of diet 22 weeks) or had at least a 20 kg weight loss initially, showed a significantly greater weight loss 5 years later compared to participants in hypoenergetic balanced diets (HBD: calories not defined in analysis, mean duration of 12 weeks). These diets are fairly similar to VLCD and LCD, suggesting VLCD and LCD to be effective interventions. The authors note that the studies used in this meta-analysis has a higher success rate in terms of weight loss maintenance compared to other studies. Different guidelines also mention what kinds of diet should be used in weight loss interventions. The NHLBI guidelines was made based on a review of 86 randomized controlled trial (RCT) articles examining treatment strategies for constituting evidence based clinical guidelines on overweight and obesity (48 of which were included in the NHLBI guidelines). These guidelines conclude that LCDs are recommended for weight loss in obese and overweight individuals (Pi-Sunyer, 1998). The NICE guidelines recommend a deficit of 600 kcal/day (eating 600 kcal less than is expended a day), together with expert support and intensive follow-up for sustained weight loss. The NICE guidelines also point out low calorie diets (LCD, 1000-1600 kcal/day) and very low calorie diets (VLCD, less than 1000 kcal/day, typically only fluid meals as shakes and soups) as alternatives, but mention the possibility of nutritional incompleteness on a LCD diet (usually consisting of a mix of shakes, soups, bars and regular meals), and the need for a time limit on a VLCD, setting a maximum of 12 weeks continuously.

### **Dietary Interventions, Speed of Weight Loss and Motivation**

Overall, a rapid initial weight loss may be associated with greater weight loss and overall long-term success in weight management compared to a slow weight loss, and does not increase susceptibility to weight regain compared to slower weight losses (Astrup & Rössner, 2000; Nackers et al., 2010). As previously noted, motivation is also an important component in weight loss (Brown, 2006). Reviews have identified “internal motivation to lose weight” and “self-motivation” as positive predictors of weight control (Elfhag & Rossner, 2005; Teixeira, Going, Sardinha, & Lohman, 2005): Highly motivated patients are more likely to lose weight. Other studies recognize that it is important to sustain motivation for successful behavioral change and weight loss. It may be expected that after initially starting to lose weight, it may deteriorate motivation for the dieter when the amount of weight lost over

time decreases (Wadden et al., 2006). To exemplify this effect, a person could initially lose 4 kg the first week, 3 the next week, then 1 kg, then 300 grams the following week. If motivation is strongly related to amount of weight lost, motivation could be expected to drop as the amount of weight lost decreases. As mentioned, there is need for interventions that can improve weight loss maintenance. If the effect of weight loss on motivation is mediated by time on diet, it is important to make use of such knowledge to make better dietary interventions, aiming for higher maintenance rates. Thus, this exploration of the effect of speed of weight loss on the course of motivation may be an important first step towards making better treatment interventions for obesity. To the best of my knowledge, there are no studies exploring the effect of dieting over different time spans on motivation. That is, given a dietary intervention that takes a big toll on motivation, it may be very hard for the individual to maintain the results from the diet period if the motivation is severely weakened or altered. Dietary interventions that do not have a negative effect on motivation, or even have a positive effect on motivation, could be an important step in direction of interventions leading to higher success rates in terms of weight loss maintenance. I will therefore examine the effect of a rapid weight loss (VLCD) versus a slower weight loss (LCD) on motivation. It might be expected that losing weight over a shorter period may help sustain motivation to a larger degree than losing weight over a longer period of time.

### **Motivation and Health Behavior Change: The Self Determination Theory**

In later years, a lot of research on weight loss and motivation has been conducted. Motivation is what drives us to do something; if a person is motivated, she is moved to act (Ryan & Deci, 2000a). Thus, a person who does not feel any inspiration to act is unmotivated, while a person who works towards a goal is motivated (Ryan & Deci, 2000a). Motivation concerns direction, persistence, energy and equifinality (e.g. how the same end states or goals can be reached through different courses of action or experience). Motivation is related to the core of cognitive, biological and social regulation (Ryan & Deci, 2000b), thus also important for health behavior.

The theoretical framework of the current study is the Self Determination Theory (SDT, Deci & Ryan, 1985). The SDT is a widely used theory within health behavior change (Edmunds, Ntoumanis, & Duda, 2007; Ng et al., 2012; Teixeira, Carraca, Markland, Silva, & Ryan, 2012; Verstuyf, Patrick, Vansteenkiste, & Teixeira, 2012; Williams et al., 1996; Williams et al., 2002), and thus in diet change. Successful weight loss and maintenance, also long term, is expected when the reasons for self-regulation (in this case dieting behavior) are volitional or autonomous, according to the SDT (Deci & Ryan, 1985; West et al., 2011).

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**Autonomous and controlled motivation.** The SDT states that people differ not only in their level of motivation, but also in their orientation of motivation. One distinction can be made between intrinsic and extrinsic motivation. The former refers to doing something one finds inherently enjoyable or interesting (playing chess, mountain climbing), whereas the latter refers to doing something because it leads to a separable outcome (going to the gym in order to become a better mountain climber, or eating healthier in order to lose weight) (Ryan & Deci, 2000a).

Even though the distinction between intrinsic and extrinsic motivation is viewed as important, the main focus on orientation of motivation by the SDT is somewhat more nuanced. The SDT divides motivation into two main components: Autonomous and controlled motivation (Ryan & Deci, 2000b). Autonomous motivation can be seen as a measure of an individual's personal reasons to act, including both intrinsic, and some extrinsic regulatory styles. Autonomy implies self-regulation (Ryan, Kuhl, & Deci, 1997). The regulation of the given behavior (for example changing diet) is experienced as chosen by the individual itself, because she may think it is important for herself, or consciously values a better health resulting from a better diet. Controlled motivation is a measure of the extent to which the individual feels pressured from controlling forces (e.g. a doctor, wife, economic reasons, feelings such as shame or guilt etc.) to act (change diet). Controlled motivation is not experienced as self-determined, compared to autonomous motivation (Ryan & Deci, 2008; Williams et al., 1996). As stated by the SDT, a greater autonomous motivation is associated with greater likelihood of behavioral change (e.g. dietary changes), whereas more controlled motivation is associated with less chance of success in behavioral change (Ryan & Deci, 2008). A person can move along the continuum of extrinsic motivation. A movement in the direction of more autonomous motivation is made possible by the process of internalization of behavior regulation. With increasing internalization, the individual will have a greater sense of personal commitment, and thus a greater engagement, persistence and more positive self-perceptions (Ryan & Deci, 2000a). See Figure 1 for taxonomy of human motivation, and the different types of regulations categorized under extrinsic motivation.

The importance of the distinction between autonomous and controlled motivation is emphasized by Williams et al. (1996). Further, they argue that these concepts are useful for predicting health-relevant behavioral change as well as maintenance of such change, with autonomous motivation being positively correlated and controlled motivation being negatively correlated with successful behavioral change and maintenance. Autonomous motivation has received great theoretical and empirical attention in relation to obesity



treatment, as well as in relation to alcohol cessation (Ryan, Plant, & O'Malley, 1995) and tobacco cessation (Williams et al., 2006). Given that a rapid initial weight loss has proven to be favorable compared to a less rapid weight loss (Astrup & Rössner, 2000; Nackers et al., 2010) and the theoretical assumptions that time has a detrimental effect on motivation (Wadden et al., 2006), it is reasonable to expect that a rapid weight loss will have less negative effect on autonomous motivation than a slower weight loss, which will be tested in the current inquiry.

**Research on SDT and weight loss.** A review on motivation, self-determination and long term weight control concludes that the evidence is compatible with the idea that autonomous regulation is a crucial predictor of successful weight outcomes (Teixeira, Silva, Mata, Palmeira, & Markland, 2012), as stated by SDT. For example, Webber et al. (2010) reported that it was possible to enhance motivation for participants with high levels of controlled motivation for weight loss at baseline. Essentially, the motivation became more autonomous during the intervention study. Further, the motivational enhancement led to significantly greater weight loss than the participants receiving a standard behavioral weight loss intervention achieved, of the ones with high baseline levels of controlled motivation.

A study of SDT and its predictive value in the treatment of obesity through diet was performed by Williams and colleagues almost 20 years ago (Williams et al., 1996). The study showed the predictive value of the concepts from the SDT for behavioral change and – maintenance of this change in the domain of weight loss. The study was designed as a 6 month very low calorie diet (VLCD)-program with a 23 month follow up, and included 128 participants. This study showed that higher levels of autonomous motivation measured five to ten weeks into the program were predictive of a bigger weight loss after six months, mediated by attendance. The autonomous motivation for participating also predicted maintenance of weight loss at follow up after 23 months (Williams et al., 1996). In short, the results showed that the participant's autonomous motivation predicted program attendance, weight loss during the program, and most importantly, according to the authors, autonomous motivation predicted maintenance of weight loss. The current study also has a VLCD diet group, but in contrast to Williams et al. (1996), a control group (the LCD group) is added, to detect differences in the course of autonomous motivation. The current study has a shorter duration, hoping to detect motivational differences between the groups even earlier than the reported five to ten weeks by Williams et al. (1996).

Williams et al. (1996) found that autonomous motivation at baseline was less predictive on weight loss success, than autonomous motivation measured five to ten weeks

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after the participants had started their diet, indicating that autonomous motivation may be high for most participants in the beginning of weight loss treatment. Possibly, autonomous motivation will first be affected when the individuals start to experience the behavioral changes needed for losing weight. This is in accordance with other studies, such as Webber et al. (2010) who reported that for a group receiving motivational enhancement, as opposed to the control group who did not receive any motivational enhancements, motivation at four weeks predicted weight loss. However, they also reported that baseline controlled motivation moderated the effect of a motivational enhancement intervention, as noted earlier. In neither of these studies did they have a control group on another amount of calorie diet, which the current study has; thus I can elaborate their findings by combining speed of weight loss and focus on orientation of motivation. In the current RCT, the two groups will be on a diet for either four or eight weeks, aiming to lose the same percent of their body weight. I thus ask: Will there be a difference in motivation between the two dieting groups?

### **Summary and Aims of the Study**

There is evidence that a rapid initial weight loss, which will be obtained on a VLCD, is favorably in terms of greater initial weight loss and weight maintenance (Astrup & Rössner, 2000; Nackers et al., 2010). Motivation is a crucial factor in weight loss treatment, both for weight loss and maintenance (Pi-Sunyer, 1998; Wing & Hill, 2001). Autonomous motivation is especially important in both weight loss and maintenance of weight loss, as shown by research within a SDT-framework (Williams et al., 1996). There are indications that a slow weight loss might decrease motivation and thus negatively affect further weight loss or weight loss maintenance (Rothman, 2000; Wadden et al., 2006). However, the study of Wadden et al. (2006) only concerns amount of motivation, not orientation. Also, the time frame is several years in the Look AHEAD study (Wadden et al., 2006). It is currently not known whether speed of weight loss affects autonomous motivation for dieting. Knowledge on the effect of time on diet, or speed of weight loss on autonomous motivation for dieting, may be essential for designing better dietary interventions for overweight and obese patients in the future, both in terms of staying on the diet, and for weight maintenance. As a first step in exploring such a possible relationship between speed of weight loss and autonomous motivation, the current study therefore aims to explore how motivation for dieting is affected by speed of weight loss, by comparing a VLCD-group with a LCD-group, having the same goal of a 10 % weight loss with nutritionally comparable diets, only differing in time spent on diet. Even though the diets are matched, there is a big difference in time spent on cooking, grocery shopping, planning of meals etc. between the groups that may account for some variation and thus affect motivation,

not just caloric intake. The LCD group still has to make some meals, while the VLCD group only needs to mix their soups and shakes with water. Based on the literature reviewed above I hypothesize that there will be a difference in the course of autonomous motivation between the VLCD group and the LCD group from baseline to the end of treatment. More specifically, I expect that the LCD group will experience a decreased autonomous motivation during treatment compared to the VLCD group.

## Method

### Participants

35 participants were recruited through the NTNU intranet and St. Olavs Hospital's intranet, by advertisement in the local newspaper and flyers at local stores and cafés. The exact number of approached persons is therefore unknown. The potential participants contacted the treatment team themselves, so all participants were self-selected. The ones interested ( $N > 65$ ) made contact by email. Out of these, the first 44 who contacted the team were interviewed.

To be included, participants had to have been weight stable during the last three months ( $< 2\text{kg}$ ), not currently dieting to lose weight, and having a sedentary lifestyle. Sedentary lifestyle was defined as not engaging in strenuous work or in regular brisk leisure time exercise more than once a week or in light exercise for more than 20 minutes/day more than 3 times/week. The target group was adult (18-50 years old), obese, healthy volunteers ( $30 < \text{BMI} < 45 \text{ kg/m}^2$ ).

A history of endocrine/cardiovascular/pulmonary/kidney disease, anemia, gout, depression or other psychological disorders, eating disorders, irregular menstruation, drug or alcohol abuse within the last two years or current medication known to affect appetite or induce weight loss further constituted the exclusion criteria. In addition, those with a planned surgery during the study period or participating in another research study were not accepted to take part in this study. Flow of participants, including reasons for exclusion, is presented in Figure 2.

The participants ( $n=35$ ), were 26 women (74 %) and 9 men (26 %), aged 19-57 (mean 38.7,  $SD$  9.9). The gender ratio was 15:3 women to men in the VLCD group, and 11:6 women to men in the LCD group. The VLCD group had a mean age of 41.22 years ( $SD$  10.59), and the LCD group had a mean age of 35.94 years ( $SD$  8.50). The groups were not significantly different in either gender ratio or age. All participants were Caucasian except for one Asian. The participants had to be able to show up weekly at St. Olavs Hospital for tests and follow-

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ups during the study period, so all participants were living in or close to the municipality.

### **Procedure**

Data was collected at baseline (time 1, T1), week four (time 2, T2) and week eight (time 3, T3) in both groups. The participants had non-official weight measures at their weekly follow-ups with one of us in the treatment team, monitoring weight loss. Additionally, the participants went through more extensive anthropometric measurements at T1 (both groups), T2 (only VLCD group, who then ended their diet) and T3 (both groups).

The study was approved by the regional Ethics Committee (Midt Norge, Trondheim, Norway (REK no. 2013/888)). Written informed consent was obtained from all participants before they were enrolled in the study (see Appendix A). The study was registered at [clinicaltrials.gov](https://clinicaltrials.gov) under the number NCT01912742.

### **Research Design and Treatment**

The participants were randomized into one of two intervention groups: A rapid ( $n=18$ ) or a slow weight loss ( $n=17$ ). Groups were matched for age, gender ratio and BMI. Randomization was performed by a web-based randomization system developed and administered by Unit of Applied Clinical Research, Institute of Cancer Research and Molecular Medicine, Norwegian University of Science and Technology, Trondheim, Norway. This was done after the baseline assessments. The participants were instructed not to change their level of physical activity throughout the study.

The rapid weight loss group followed a commercial very-low calorie diet (VLCD). The participants allocated to this group followed a 550 (women) - 660 (men) kcal/day diet (provided by Allevo [Cederroth, Sweden]). The Allevo VLCD products provide 110kcal/pack and include a variety of milkshakes, smoothies and soups. In addition to VLCD products, the patients were allowed to have calorie-free drinks and some low-starch vegetables (maximum 2 cups/day) and they were advised to drink at least 2.5 liters of non-caloric liquids a day.

The slow weight loss group was prescribed an individualized low calorie diet (LCD) (1200-1500kcal/day) using both meal replacements (such as smoothies and cereal bars) and conventional foods. Both diets were in consonance with both national and international guidelines (Brown, 2006; Mæhlum et al., 2011; Pi-Sunyer, 1998).

### **Measures**

**Anthropometric measurements.** Anthropometric measurements (weight and height) were performed using standard procedures; body composition using air displacement plethysmography (Bod Pod, Life Measurement, Inc., Concord, CA, USA).

**Motivational instrument: The Treatment Self-Regulation Questionnaire (TSRQ).**

The Treatment Self-Regulation Questionnaire (TSRQ, Williams, Ryan, & Deci, 2014) was used to assess motivation for dieting (see Appendix B). The TSRQ assesses an individual's motivation in terms of their degree of autonomy and self-regulation, based on the approach developed by Ryan and Connell (1989). The TSRQ consists of 15 items, constituting three subscales, assessing autonomous regulatory style, controlled regulatory style and amotivation. The autonomous style is consistently associated with maintained behavioral change and positive health outcomes. It represents the most self-determined form of motivation. The TSRQ also has several versions adapted to other aspects of health behavior than diet, such as motivation for exercising or smoking cessation etc.

The respondents indicate to which extent each of the 15 listed reasons for eating a healthy diet is true for themselves. The 7-point Likert scale ranges from 1 (not true at all), through 4 (somewhat true) to 7 (very true). All 15 items are statements related to the question “The reason I would *eat a healthy diet* is...”. The autonomous items, (e.g. “*Because I feel that I want to take responsibility for my own health*”) can be averaged, and reflect the autonomous motivation for dieting, as can be done for the controlled (e.g. “*Because I would feel guilty or ashamed of myself if I did not eat a healthy diet*”) and amotivation items (“*I really don't think about it*”). The amotivation subscale was not used in the current study, due to low internal consistency, .27. By subtracting the average for the controlled reasons from the average of the autonomous reasons, a Relative Autonomous Motivation Index can be formed. Such index is used in several studies (e.g. Hagger, Chatzisarantis, & Harris, 2006; Markland & Ingledew, 2007; Muraven, 2008).

The TSRQ has been widely used in studies assessing motivation for behavioral change and dieting (Crane, Tate, Finkelstein, & Linnan, 2012; Juul, Maindal, Zoffmann, Frydenberg, & Sandbaek, 2011; Webber et al., 2010; West et al., 2011; Williams et al., 1996). It was thoroughly validated by Levesque and colleagues (2007). Construct validity have been confirmed and internal consistency of the indexes has been shown to be above 0.73 (Levesque et al., 2007). In the current study, internal consistency for the autonomous subscale was .89. For the controlled subscale, the internal consistency was .68.

### **Sample Size Estimation**

The sample size estimation was based on expected differences in postprandial release of glucagon-like peptide-1 (GLP-1) between groups. GLP-1 can be viewed as a satiety hormone (Blundell, 2006). A sample size of 12 participants would be needed to detect a difference of 4pM x hour/L in the postprandial AUC (area under the curve) for GLP-1 between the two intervention groups, assuming a standard deviation for this variable of 2 pM

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x h, at a power of 80%, and a significance level of 5%. However, to allow for a predicted drop-out rate of around 25%, a sample size of 15 participants per group was estimated to be necessary. Note that because of the primary focus of the larger study, these calculations were based bodily functions in the two groups and not psychological measures. Given a final sample size of 30 in two equally sized groups we had a power of .66 to detect an effect of  $d = .5$  and a power of .87 to detect an effect size of  $d = 1$ , both with two-sided test  $p < .05$ .

### **Statistical Analysis**

Analyses were performed using Windows version 21 of the Statistical Package for the Social Sciences (SPSS) and Mplus 7.0 (Muthén, 1998-2012). I used SPSS for calculating means, standard deviations and for comparing the means between the two different samples for BMI and weight, in addition to autonomous motivation, controlled motivation and relative autonomy at the three time points. Change in autonomous motivation, controlled motivation and relative autonomy was estimated using growth modeling in Mplus. A robust maximum likelihood estimator was applied and missing data were handled with a Full Information Maximum Likelihood procedure. The growth model yielded two parameters; the intercept (set at T1) which is the starting level of the growth; and the slope which represents overall linear change in the three motivational parameters. Growth modeling is a technique for modeling within-person change across repeated measures and between-person differences in those changes (Grimm & Ram, 2009)

### **Results**

Characteristics of all participants who completed the intervention can be seen in Table 1. The mean scores on autonomous motivation, controlled motivation and relative autonomy for the two groups are shown for all three time points in Table 2. There were no significant differences between the two groups in either autonomous or controlled motivation at the three points of measurements, although the differences in controlled motivation was bordering on significance at week 4. Notably, as can be seen in Table 2, the groups differed with regard to the relative autonomy index; there were significant differences for each measurement time. The VLCD group reported relatively higher scores on autonomy at T1, T2 and T3 than the LCD group. Motivational differences between the VLCD and the LCD group at T1, T2 and T3 can be seen in Table 2.

Change in motivation over time was estimated using growth modeling. Figure 3-5 graphically present the course of autonomous motivation, controlled motivation and relative autonomy respectively for the two intervention groups. A latent growth curve with intercept

and slope fitted the data for autonomous motivation ( $\chi = .02$ ;  $df = 1$ ;  $p = .90$ ; CFI=1.00; TLI=1.04; RMSEA=.00), controlled motivation ( $\chi=2.63$ ;  $df = 1$ ;  $p = .10$ ; CFI=.98; TLI=0.94; RMSEA=.22) and relative autonomy ( $\chi=1.61$ ;  $df = 1$ ;  $p=.20$ ; CFI=.99; TLI=.98; RMSEA=.13). Figures 3 to 5 illustrate that the course of motivation did not differ between the two groups for either of the motivational measures. Notably though, there was a significant difference in orientation of motivation at baseline between the two groups, even though the course of motivation for the two groups was the same.

To test whether the course of motivation was different in the two groups I fixed the slopes to be identical and compared the solution with a solution where the slopes were freely estimated. This change did not alter the model fit for either autonomous (Wald=.00;  $df=1$ ;  $p=.99$ ), controlled motivation (Wald=1.46;  $df=1$ ;  $p=.23$ ), or the relative autonomy index (Wald=.04;  $df=1$ ;  $p=.85$ ), confirming that the course of motivation did not differ between the two groups.

Both interventions were aimed to reach the same amount of weight loss, but at different speed. In accordance with such aim, there were no significant differences in weight loss between the groups at the end of the intervention, as can be seen in Table 1.

### Discussion

According to the SDT, autonomous motivation is important to promote weight loss (Deci & Ryan, 1985; West et al., 2011), it is therefore necessary to know how to improve or sustain the autonomous motivation of patients in obesity treatment programs. There is evidence that a rapid initial weight loss has positive effects in terms of weight loss and weight loss maintenance (Astrup & Rössner, 2000; Nackers et al., 2010), but it is not known how speed of weight loss affects the course of patient's motivation: Does it decrease or improve the level of autonomous motivation? The aim of the current study was therefore to investigate the relationship between speed of weight loss and autonomous motivation over time in 35 participants undergoing obesity treatment. The participants were randomized to a VLCD group (rapid weight loss) or a LCD group (slow weight loss). Both diets were designed to make the participants lose 10 % of initial body weight during their time on diet. Motivation was measured at three measurement points; at baseline (T1), week four (T2) and week eight (T3). In contrast to the expected results, there were no differences in the two groups' course of motivation for any of the three motivational parameters autonomous motivation, controlled motivation or relative autonomy (an index of autonomous motivation minus controlled motivation). Due to this, there were also no differences in the course of relative autonomy in

any of the three different time points between the groups. The difference between the groups on relative autonomy at T1 remained significant throughout the study. Most of the previous studies using a SDT framework are designed to affect motivation for dieting and weight loss by motivational enhancement (Webber et al., 2010; Webber et al., 2008). In the current study, there has not been any intervention to enhance motivation. To the best of my knowledge, this is the first study to investigate the relation between speed of weight loss and motivation, not only in a SDT framework, but in any theoretical framework.

### **No Differences in the Course of Autonomous Motivation between the Groups**

The most probable explanation for this non-significant difference between the two groups' course of motivation is that there were no significant difference in weight loss over time between the two groups. Although intended by the intervention, and a premise for the current study of motivation, the VLCD group did not lose weight at a significantly faster rate than the LCD group.

Rothman (2000) and Wadden et al. (2006) pointed out that theoretically, deterioration of motivation may happen over time on diet. Based on the assumption that time on diet deteriorates motivation, I expected the VLCD group, the group with the shortest duration of diet, to sustain their autonomous motivation for dieting, which they did. Williams et al. (1996) report that autonomous motivation at time 2 (about five to ten weeks into their study), not baseline motivation, was predictive of attendance, which mediated weight loss. That is, it may take some weeks to produce significant changes towards more controlled motivation for dieting, while dieting. Some of the possible explanations for this stability in autonomous motivation may be that, first of all, the participants were self-selected, and thus had a relatively high autonomous motivation initially. Second, it can be motivating and reinforcing in itself to see that one is successfully losing weight. Another explanation may be that the dieting does not take its toll before some time has passed. Dieting includes restraining oneself, eating less food than usual, other kinds of foods, often changing meal routines, typically involving a lot of planning in the beginning etc., all of which may be perceived as demanding, strenuous and even unpleasant. Based on the theoretical proposal of Wadden et al. (2006), it could be assumed that the participants' motivation could have been affected negatively if the participants been on the diet for a longer period.

### **No Decreased Autonomous Motivation for the LCD Group**

I expected that the LCD group, which stayed on the diet for eight weeks, would show a tendency towards less autonomous motivation, e.g. more controlled motivation, both because they were on the diet for a longer period of time, and had to change their food



routines in a more strenuous fashion than the VLCD group. Such a development from autonomous towards more controlled motivation would consequently lead to a drop in their relative autonomy index. This assumption was based on earlier writings (Rothman, 2000; Wadden et al., 2006), theoretically describing how motivation would fall over time on diet. Also, the LCD group had to prepare and use more time on their meals than the VLCD group, since the latter only ate soups and shakes. The results did not show any decrease in relative autonomy or different courses of motivation between the two groups. Even though the most probable explanation is the non-significant difference in speed of weight reduction, another explanation can be given by comparing to the results from earlier, similar studies measuring autonomous motivation. The finding by Williams et al. (1996) indicates that it takes five to ten weeks to see an effect of diet on motivation. Given these findings, one could expect the LCD group's time on diet was too short to affect orientation of motivation. Another possibility is that their autonomous motivation was sustained due to successful dieting, and due to achieving the wanted results week by week (as there was a "nonofficial weighing" every week during the eight weeks for the LCD group). This may have worked as a continuous reinforcement, helping to sustain motivation throughout the diet. Also, the participants received encouragement and praise by the health workers at the weekly follow-ups. These encouragements may have been enough for sustaining their autonomous motivation, in line with Deci (1971), who reported that a subject who received verbal reinforcement and positive feedback kept their intrinsic motivation (e.g. their autonomous motivation, possibly including some extrinsic reasons) for maintaining their behavior. In support of such assumption, the participants were informed about, and thus possibly did not have higher expectations than what was the aim in terms of weight loss in this study; 10 % of initial body weight during each diet. This could lead the participants to feel that they were successfully moving towards the explicit goal every week.

Another possible explanation is that a decline in amount of motivation, which is what earlier writings suggests (Rothman, 2000; Wadden et al., 2006) is not easily comparable with orientation of motivation. The SDT states that the amount and orientation of motivation are two different dimensions of motivation (Ryan & Deci, 2000a). Strictly speaking, being on a diet might not affect orientation of motivation at all.

### **Limitations**

This study was originally designed as a RCT for examining the physiological consequences of different speeds of weight loss in terms of hormones, resting metabolism rate, etc., thus sample size was estimated based on suspected differences in these parameters.

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Alas, the study was not designed to capture differences in motivation between the two intervention groups. Fewer participants than needed to detect motivational differences were included, giving the current study unsatisfying statistical power. By post hoc analysis, the number of participants needed for claiming a reasonable strength in detecting significant motivational differences between the groups, giving a power of 80 % and  $\alpha = .05$  in the current study, is 58. Motivation is a complex and abstract concept, which makes it necessary to have larger populations than pure quantitative entities as hormones, weight and BMI. The respondents interpret the questions subjectively, which can lead two individuals to comprehend the same questions very differently. Further, participants were not matched on motivation, and as shown, the two groups had significantly different levels of motivation at T1. Due to the study being designed for physiological measures of weight loss, the time line makes comparison between groups more challenging, as I don't have motivational and biological measurements on the same chronological time points in terms of elapsed weeks, but in terms of how far the participants were in their diet (baseline, midway, end and at one month follow up). Thus I have data on the VLCD group at baseline, midway in their diet (at two weeks), at diet end (four weeks) and at one month follow up (eight weeks). For the LCD group I have data every fourth week for 12 weeks (baseline, midway at four weeks, end at eight weeks, one month follow up at 12 weeks). This left me with two alternatives. One was comparing the groups in terms of relative time on diet. Still, I chose to compare the groups at objective time points, because in order to have only one manipulation (actual time on diet), it had to be done this way, aiming to still make this study a randomized controlled trial (RCT). If not, the groups would have different times in addition to different diets. The difference in time between the end of the VLCD (week four) and the LCD (week eight) is small in this study, and motivation could be expected to be quite stable over such a short duration of time. Additionally, there was no significant difference in actual speed of weight loss due to the short time spans. The time span in the Look AHEAD study (Wadden et al., 2006) was several years, and thus, eight weeks may be too short time to show any differences in motivation. A bigger difference in time on diet between the groups could possibly lead to differences in autonomous motivation between groups given earlier indications (Rothman, 2000; Wadden et al., 2006; Williams et al., 1996). Also, one month follow up is perhaps too short if one wants to see changes in a psychological variable as autonomous motivation, when there are no intentions to affect it from the research team members.

In addition to the above-mentioned limitations, the generalizability of the findings could be questioned. Demographically, it could be argued that the population is quite

homogenous in age and ethnicity, as a further consequence of the small sample size. Still, the age span 19-57 is quite representative for the population mostly targeted for obesity interventions in Norway.

### **Conclusion and Future Research**

The current study is, to the best of my knowledge, the first to explore the relationship between speed of weight loss and orientation of motivation for dieting. The study aimed to examine differences between two groups on different diets, one for four weeks (the VLCD group), and the other for eight weeks (the LCD group), both groups aiming to lose 10 % of initial body weight. It was hypothesized that the LCD group would show a shift in their orientation of motivation from more autonomous motivation towards more controlled motivation, compared to the VLCD group. However, the course of motivation did not differ between the two groups. Orientation of motivation did not change significantly in our eight week study, in terms of either autonomous or controlled motivation, or relative autonomy in any of the two groups. Overall, speed of weight loss did not have any impact on motivation for dieting in the current RCT. Notably though, the results should be interpreted in light of several limitations, most importantly the short duration of the intervention, as well as the relatively low number of participants.

Given that autonomous motivation is important for health behavior change (Ryan & Deci, 2000b), and a rapid initial weight loss is shown to have a positive effect on obtained, as well as maintained weight loss (Astrup & Rössner, 2000; Nackers et al., 2010), it is reasonable to assume that knowledge on the relation between speed of weight loss and motivation can enhance treatment efficiency, the effect of speed of weight loss on level of autonomous motivation being of particular importance. Thus, although the current pilot did not confirm the assumption of the effect of speed of weight loss on autonomous motivation, future research should aim to examine this relation, applying larger samples giving more statistical power. Studies designed for assessing motivation in terms of motivational orientation could further give important insight into possible motivational benefits of a rapid weight loss. Adding a simple visual analogous scale (VAS) measuring level of motivation (e.g. “How motivated are you”) could also be useful in combination with measures of autonomous and controlled motivation, providing both level and orientation of motivation. Further, larger differences in time spent on diet are needed for conclusions to be drawn on the relationship between speed of weight loss and autonomous motivation for dieting. In summary, future studies designed according to these suggestions can hopefully gain knowledge that improves treatment of obesity.

## References

- Anderson, J. W., Konz, E. C., Frederich, R. C., & Wood, C. L. (2001). Long-term weight-loss maintenance: a meta-analysis of US studies. *The American Journal of Clinical Nutrition*, 74(5), 579-584. Retrieved from <http://ajcn.nutrition.org/>
- Astrup, A., & Rössner, S. (2000). Lessons from obesity management programmes: greater initial weight loss improves long-term maintenance. *Obesity Reviews*, 1(1), 17-19. doi: 10.1046/j.1467-789x.2000.00004.x
- Blundell, J. E. (2006). Perspective on the Central Control of Appetite. *Obesity*, 14(S7), 160S-163S. doi: 10.1038/oby.2006.298
- Brown, T. J. (2006). Obesity: guidance on the prevention, identification, assessment and management of overweight and obesity in adults and children. NICE Clinical Guideline 43 *National Institute for Health and Clinical Excellence* (pp. 84).
- Crane, M. M., Tate, D. F., Finkelstein, E. A., & Linnan, L. A. (2012). Motivation for Participating in a Weight Loss Program and Financial Incentives: An Analysis from a Randomized Trial. *Journal of Obesity*, 2012, 9. doi: 10.1155/2012/290589
- Dattilo, A. M., & Kris-Etherton, P. M. (1992). Effects of weight reduction on blood lipids and lipoproteins: a meta-analysis. *Am J Clin Nutr*, 56(2), 320-328. Retrieved from <http://ajcn.nutrition.org/>
- Deci, E. L. (1971). Effects of externally mediated rewards on intrinsic motivation. *Journal of Personality and Social Psychology*, 18, 105-115. doi: 10.1037/h0030644
- Deci, E. L., & Ryan, R. M. (1985). *Intrinsic Motivation and Self-Determination in Human Behavior* (E. Aronson Ed.). New York: Plenum Press.
- Edmunds, J., Ntoumanis, N., & Duda, J. L. (2007). Adherence and well-being in overweight and obese patients referred to an exercise on prescription scheme: A self-determination theory perspective. *Psychology of Sport and Exercise*, 8(5), 722-740. doi: 10.1016/j.psychsport.2006.07.006
- Elfhag, K., & Rossner, S. (2005). Who succeeds in maintaining weight loss? A conceptual review of factors associated with weight loss maintenance and weight regain. *Obes Rev*, 6(1), 67-85. doi: 10.1111/j.1467-789X.2005.00170.x
- Grimm, K. J., & Ram, N. (2009). Nonlinear Growth Models in Mplus and SAS. *Structural Equation Modeling: A Multidisciplinary Journal*, 16(4), 676-701. doi: 10.1080/10705510903206055
- Guh, D., Zhang, W., Bansback, N., Amarsi, Z., Birmingham, C. L., & Anis, A. (2009). The incidence of co-morbidities related to obesity and overweight: A systematic review and meta-analysis. *Bmc Public Health*, 9(1), 88. doi: 10.1186/1471-2458-9-88
- Hagger, M., Chatzisarantis, N. D., & Harris, J. (2006). The Process by Which Relative Autonomous Motivation Affects Intentional Behavior: Comparing Effects Across Dieting and Exercise Behaviors. *Motivation and Emotion*, 30(4), 306-320. doi: 10.1007/s11031-006-9046-5
- Juul, L., Maindal, H., Zoffmann, V., Frydenberg, M., & Sandbaek, A. (2011). A cluster randomised pragmatic trial applying Self-determination theory to type 2 diabetes care in general practice. *BMC Family Practice*, 12(1), 130. doi: 10.1186/1471-2296-12-130
- Levesque, C. S., Williams, G. C., Elliot, D., Pickering, M. A., Bodenhamer, B., & Finley, P. J. (2007). Validating the theoretical structure of the Treatment Self-Regulation Questionnaire (TSRQ) across three different health behaviors. *Health Educ Res*, 22(5), 691-702. doi: 10.1093/her/cyl148
- Lobstein, T., Baur, L., & Uauy, R. (2004). Obesity in children and young people: a crisis in public health. *Obes Rev*, 5 Suppl 1, 4-104. doi: 10.1111/j.1467-789X.2004.00133.x

- Markland, D., & Ingledew, D. K. (2007). The relationships between body mass and body image and relative autonomy for exercise among adolescent males and females. *Psychology of Sport and Exercise*, 8(5), 836-853. doi: <http://dx.doi.org/10.1016/j.psychsport.2006.11.002>
- Meyer, H. E., Fleten, C., & Hovengen, R. (2010). Folkehelse rapport 2010 Helsetilstanden i Norge. (pp. 111-113). Oslo: Nasjonalt folkehelseinstitutt.
- Muraven, M. (2008). Autonomous self-control is less depleting. *Journal of Research in Personality*, 42(3), 763-770. doi: <http://dx.doi.org/10.1016/j.jrp.2007.08.002>
- Muthén, L. K. a. M., B.O. (1998-2012). Mplus User's Guide. Retrieved from <http://www.statmodel.com/>
- Mæhlum, S., Malterur, K., Kulseng, B., Tonstad, S., Buhl, C., Arctander, I., . . . Aadland, A. A. (2011). *Forebygging, utredning og behandling av overvekt og fedme hos voksne. Nasjonale retningslinjer for primærhelsetjenesten*. Oslo: Helsedirektoratet Retrieved from [http://helsedirektoratet.no/publikasjoner/nasjonal-faglig-retningslinje-for-forebygging-utredning-og-behandling-av-overvekt-og-fedme-hos-voksne.pdf](http://helsedirektoratet.no/publikasjoner/nasjonal-faglig-retningslinje-for-forebygging-utredning-og-behandling-av-overvekt-og-fedme-hos-voksne/Publikasjoner/nasjonal-faglig-retningslinje-for-forebygging-utredning-og-behandling-av-overvekt-og-fedme-hos-voksne.pdf).
- Nackers, L. M., Ross, K. M., & Perri, M. G. (2010). The association between rate of initial weight loss and long-term success in obesity treatment: does slow and steady win the race? *Int J Behav Med*, 17(3), 161-167. doi: 10.1007/s12529-010-9092-y
- Ng, J. Y. Y., Ntoumanis, N., Thogersen-Ntoumani, C., Deci, E. L., Ryan, R. M., Duda, J. L., & Williams, G. C. (2012). Self-Determination Theory Applied to Health Contexts: A Meta-Analysis. *Perspectives on Psychological Science*, 7(4), 325-340. doi: 10.1177/1745691612447309
- Peppard, P. E., Young, T., Palta, M., Dempsey, J., & Skatrud, J. (2000). Longitudinal study of moderate weight change and sleep-disordered breathing. *JAMA*, 284(23), 3015-3021. Retrieved from <https://jama.jamanetwork.com/journal.aspx>
- Pi-Sunyer, F. X. (1998). Clinical guidelines on the identification, evaluation, and treatment of overweight and obesity in adults: executive summary. Expert Panel on the Identification, Evaluation, and Treatment of Overweight in Adults: National Institutes of Health.
- Prochaska, J. O., & DiClemente, C. C. (1983). Stages and processes of self-change of smoking: Toward an integrative model of change. *Journal of Consulting and Clinical Psychology*, 51(3), 390-395. doi: 10.1037/0022-006X.51.3.390
- Rothman, A. J. (2000). Toward a theory-based analysis of behavioral maintenance. *Health Psychol*, 19(1 Suppl), 64-69. doi: 10.1037/0278-6133.19.Suppl1.64
- Ryan, R. M., & Connell, J. P. (1989). Perceived locus of causality and internalization: Examining reasons for acting in two domains. *Journal of Personality and Social Psychology*, 57(5), 749-761. doi: 10.1037/0022-3514.57.5.749
- Ryan, R. M., & Deci, E. L. (2000a). Intrinsic and extrinsic motivations: Classic definitions and new directions. *Contemporary Educational Psychology*, 25(1), 54-67. doi: 10.1006/ceps.1999.1020
- Ryan, R. M., & Deci, E. L. (2000b). Self-determination theory and the facilitation of intrinsic motivation, social development, and well-being. *American Psychologist*, 55(1), 68-78. doi: 10.1037//0003-066x.55.1.68
- Ryan, R. M., & Deci, E. L. (2008). A self-determination theory approach to psychotherapy: The motivational basis for effective change. *Canadian Psychology/Psychologie canadienne*, 49(3), 186-193. doi: 10.1037/a0012753
- Ryan, R. M., Kuhl, J., & Deci, E. L. (1997). Nature and autonomy: An organizational view of social and neurobiological aspects of self-regulation in behavior and development.

- Development and Psychopathology*, 9, 701-728. Retrieved from <http://journals.cambridge.org/action/displayJournal?jid=DPP>
- Ryan, R. M., Plant, R. W., & O'Malley, S. (1995). Initial motivations for alcohol treatment: relations with patient characteristics, treatment involvement, and dropout. *Addict Behav*, 20(3), 279-297.
- Teixeira, P. J., Carraca, E. V., Markland, D., Silva, M. N., & Ryan, R. M. (2012). Exercise, physical activity, and self-determination theory: A systematic review. *International Journal of Behavioral Nutrition and Physical Activity*, 9. doi: 10.1186/1479-5868-9-78
- Teixeira, P. J., Going, S. B., Sardinha, L. B., & Lohman, T. G. (2005). A review of psychosocial pre-treatment predictors of weight control. *Obes Rev*, 6(1), 43-65. doi: 10.1111/j.1467-789X.2005.00166.x
- Teixeira, P. J., Silva, M. N., Mata, J., Palmeira, A. L., & Markland, D. (2012). Motivation, self-determination, and long-term weight control. *Int J Behav Nutr Phys Act*, 9, 22. doi: 10.1186/1479-5868-9-22
- Verstuyf, J., Patrick, H., Vansteenkiste, M., & Teixeira, P. J. (2012). Motivational dynamics of eating regulation: a self-determination theory perspective. *International Journal of Behavioral Nutrition and Physical Activity*, 9. doi: 10.1186/1479-5868-9-21
- Wadden, T. A., West, D. S., Delahanty, L., Jakicic, J., Rejeski, J., Williamson, D., . . . Kumanyika, S. (2006). The Look AHEAD study: a description of the lifestyle intervention and the evidence supporting it. *Obesity (Silver Spring)*, 14(5), 737-752. doi: 10.1038/oby.2006.84
- Webber, K. H., Gabriele, J. M., Tate, D. F., & Dignan, M. B. (2010). The effect of a motivational intervention on weight loss is moderated by level of baseline controlled motivation. *Int J Behav Nutr Phys Act*, 7, 4. doi: 10.1186/1479-5868-7-4
- Webber, K. H., Tate, D. F., & Bowling, J. M. (2008). A randomized comparison of two motivationally enhanced Internet behavioral weight loss programs. *Behaviour Research and Therapy*, 46(9), 1090-1095. doi: <http://dx.doi.org/10.1016/j.brat.2008.06.008>
- West, D. S., Gorin, A. A., Subak, L. L., Foster, G., Bragg, C., Hecht, J., . . . Wing, R. R. (2011). A motivation-focused weight loss maintenance program is an effective alternative to a skill-based approach. *Int J Obes (Lond)*, 35(2), 259-269. doi: 10.1038/ijo.2010.138
- WHO. (2000). Obesity: preventing and managing the global epidemic: report of a WHO consultation *WHO technical report series 894*. Geneva: World Health Organization.
- WHO. (2013). Obesity and Overweight, fact sheet 311. Retrieved 08.02.2014, from <http://www.who.int/mediacentre/factsheets/fs311/en/index.html>
- Williams, G. C., Grow, V. M., Freedman, Z. R., Ryan, R. M., & Deci, E. L. (1996). Motivational predictors of weight loss and weight-loss maintenance. *Journal of Personality and Social Psychology*, 70(1), 115-126. doi: 10.1037/0022-3514.70.1.115
- Williams, G. C., McGregor, H. A., Sharp, D., Levesque, C., Kouides, R. W., Ryan, R. M., & Deci, E. L. (2006). Testing a self-determination theory intervention for motivating tobacco cessation: Supporting autonomy and competence in a clinical trial. *Health Psychology*, 25(1), 91-101. doi: 10.1037/0278-6133.25.1.91
- Williams, G. C., Minicucci, D. S., Kouides, R. W., Levesque, C. S., Chirkov, V. I., Ryan, R. M., & Deci, E. L. (2002). Self-determination, smoking, diet and health. *Health Education Research*, 17(5), 512-521. doi: 10.1093/her/17.5.512
- Williams, G. C., Ryan, R. M., & Deci, E. L. (2014). Health-Care, Self-Determination Theory Packet. Scale description. Retrieved 02.02, 2014, from <http://selfdeterminationtheory.org/questionnaires/10-questionnaires/51>

- Wing, R. R., & Hill, J. O. (2001). Successful weight loss maintenance. *Annu Rev Nutr*, 21, 323-341. doi: 10.1146/annurev.nutr.21.1.323
- Wing, R. R., Lang, W., Wadden, T. A., Safford, M., Knowler, W. C., Bertoni, A. G., . . . Wagenknecht, L. (2011). Benefits of modest weight loss in improving cardiovascular risk factors in overweight and obese individuals with type 2 diabetes. *Diabetes Care*, 34(7), 1481-1486. doi: 10.2337/dc10-2415

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Table 1

*Characteristics of participants by weight and BMI based on the t-test*

<u>Baseline (T1)</u>						
Group	Unit	Mean (SD)	<i>t</i>	<i>df</i>	<i>p</i>	CI
VLCD	BMI (kg/m <sup>2</sup> )	33.13±3.10	45.27		17 .00	[31.59, 34.67]
(n=18)	Body weight (kg)	95.54±12.61	32.15		17 .00	[89.27, 101.81]
Group	Unit	Mean (SD)	<i>t</i>	<i>df</i>	<i>p</i>	CI
LCD	BMI (kg/m <sup>2</sup> )	33.36 ± 2.58	53.27		16 .00	[32.04, 34.70]
(n=17)	Body weight (kg)	98.29±12.57	32.25		16 .00	[91.83, 104.75]
<u>Week four (T2)</u>						
Group	Unit	Mean (SD)	<i>t</i>	<i>df</i>	<i>p</i>	CI
VLCD	BMI (kg/m <sup>2</sup> )	30.32 ± 2.90	43.10		16 .00	[28.83, 31.82]
(n=17)	Body weight (kg)	87.7 ± 11.5	31.58		16 .00	[81.81, 93.58]
Group	Unit	Mean (SD)	<i>t</i>	<i>df</i>	<i>p</i>	CI
LCD	BMI (kg/m <sup>2</sup> )	31.81±2.33	54.68		15 .00	[30.57, 33.05]
(n=16)	Body weight (kg)	94.31±11.31	33.36		15 .00	[88.28, 100.33]
<u>Week eight (T3)</u>						
Group	Unit	Mean (SD)	<i>t</i>	<i>df</i>	<i>p</i>	CI
VLCD	BMI (kg/m <sup>2</sup> )	29.42±2.57	42.87		13 .00	[27.94, 30.91]
(n=14)	Body weight (kg)	86.16±12.40	26.00		13 .00	[79.00, 93.31]
Group	Unit	Mean (SD)	<i>t</i>	<i>df</i>	<i>p</i>	CI
LCD	BMI (kg/m <sup>2</sup> )	30.45±2.39	49.44		14 .00	[29.13, 31.77]
(n=15)	Body weight (kg)	90.65 ± 10.87	32.29		14 .00	[84.63, 96.68]

*Note:* Values are presented as mean +/-standard deviation (SD). CI = Confidence interval, *df* = degrees of freedom  
Probability value = *p*.



Table 2

*Motivational differences between the VLCD and the LCD group at baseline, week four and week eight*

	Baseline (N=35) Mean (SD)	Week 4 (N=33) Mean (SD)	Week 8 (N=29) Mean (SD)	Difference in means at baseline (T1)			Difference in means week 4 (T2)			Difference in means week 8 (T3)		
				t	df	p	t	df	p	t	df	p
<b>Autonomous motivation</b>												
VLCD	6.21±.80	6.20±.65	6.27±.57									
LCD	5.69±1.90	5.72±.97	5.73±.97	1.65	33	.11	1.67	31	.11	1.84	27	.08
<b>Controlled motivation</b>												
VLCD	3.09±1.08	2.86±1.27	3.08±1.27									
LCD	3.54±.98	3.74±1.21	3.88±1.19	-1.27	33	.22	-2.03	31	.05	-1.67	27	.11
<b>Relative autonomy</b>												
VLCD	3.12±1.25	3.33±1.32	3.19±1.59									
LCD	2.15±1.37	1.98±1.09	1.86±1.19	2.18	33	.04	3.20	31	.00	2.57	27	.02

*Note:* Values are presented as mean  $\pm$ SD. Df= degrees of freedom.

P-value for the comparison between intervention groups.

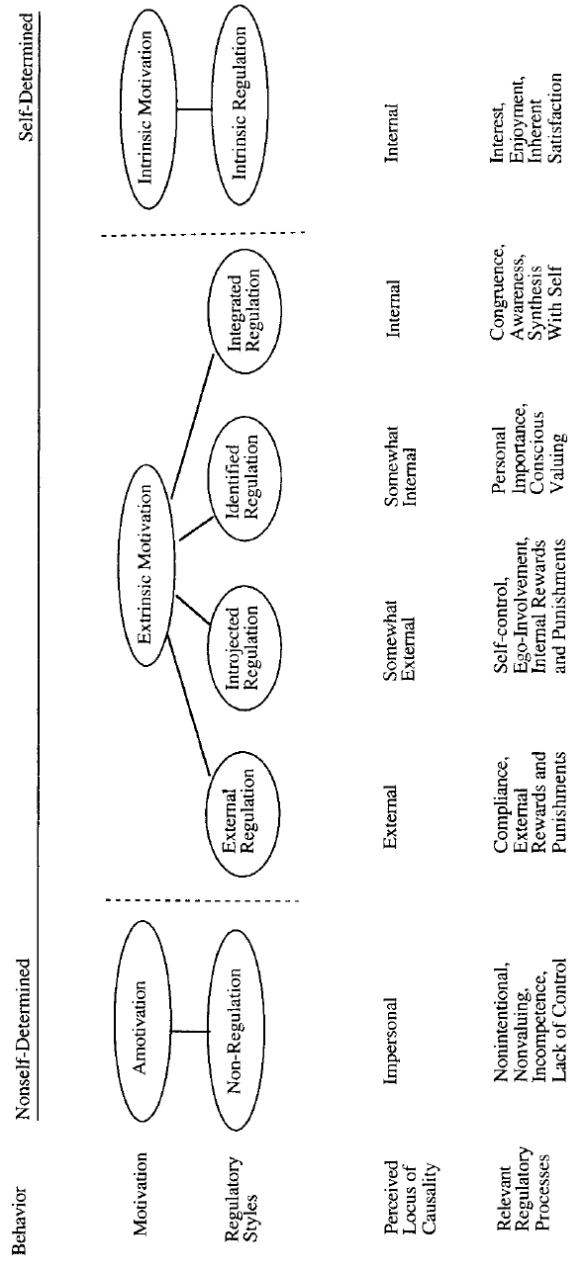


Figure 1. Taxonomy of motivation (from Ryan & Deci, 2000b, p.

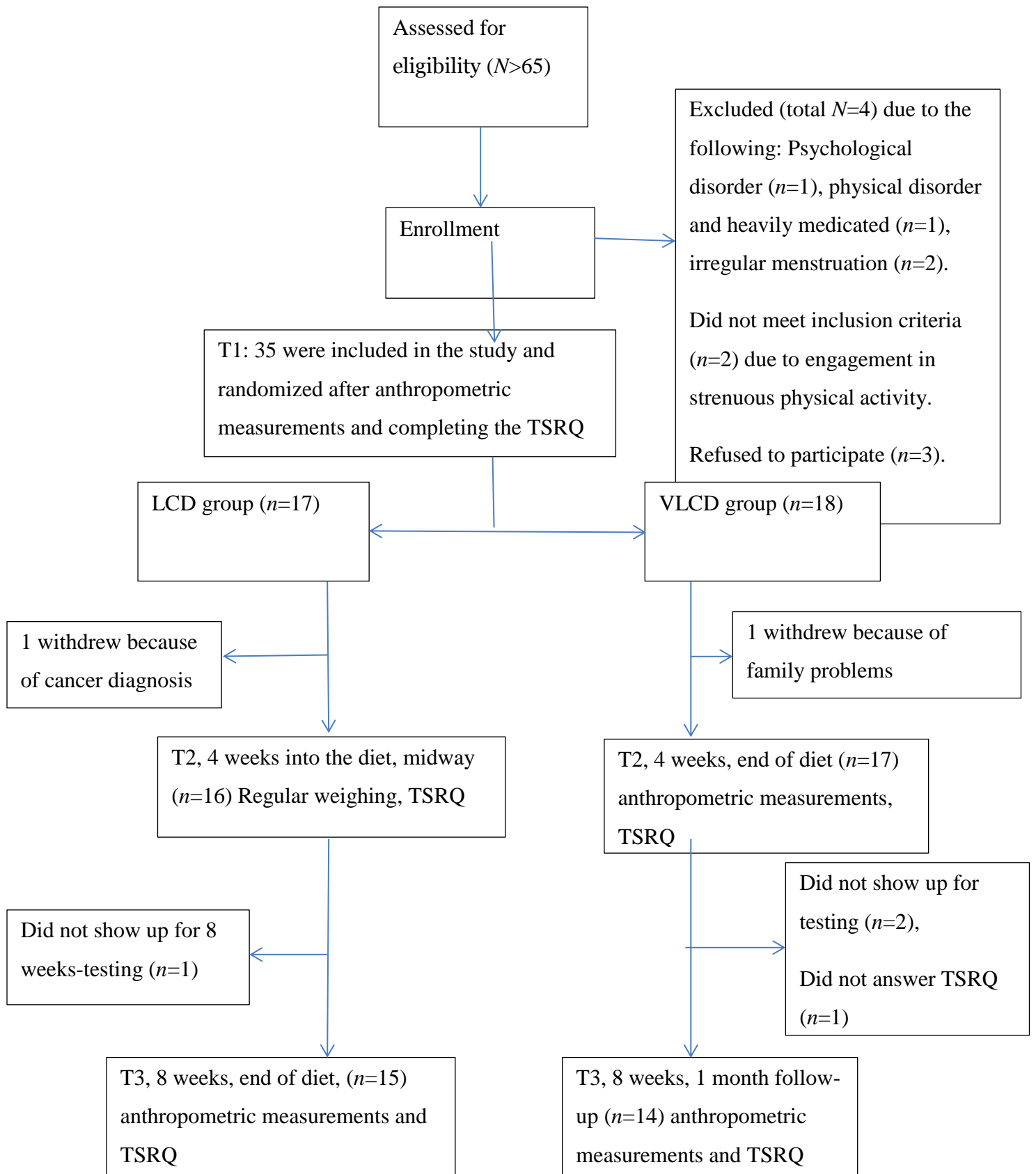


Figure 2. Flow of participants through each stage of the study.

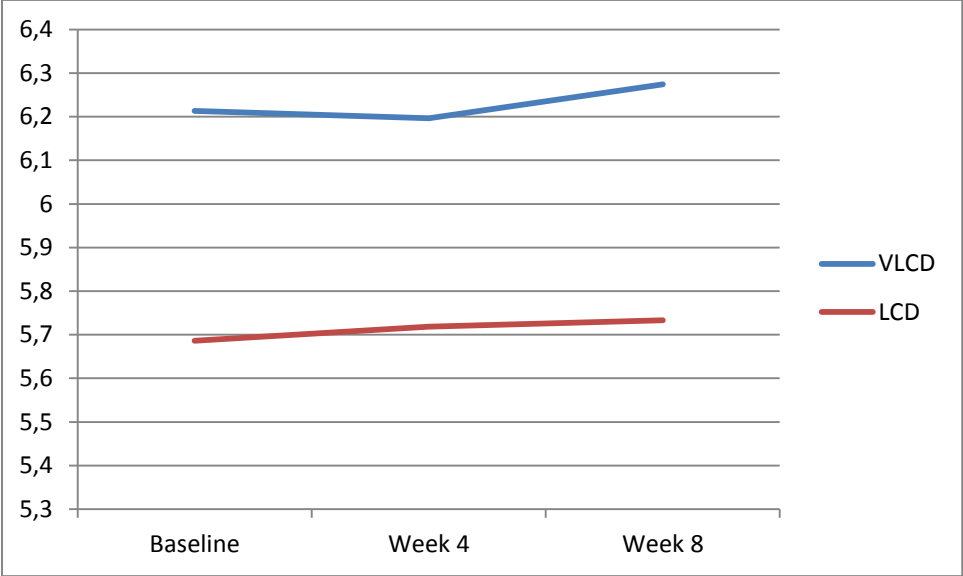


Figure 3. Course of autonomous motivation from baseline to week eight for the two groups.

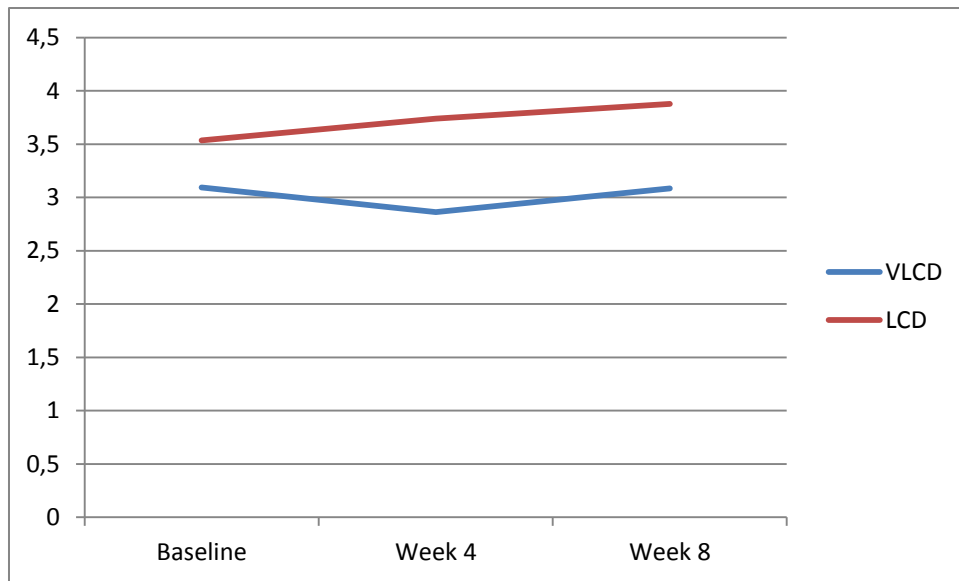


Figure 4. Course of controlled motivation from baseline to week eight for the two groups.

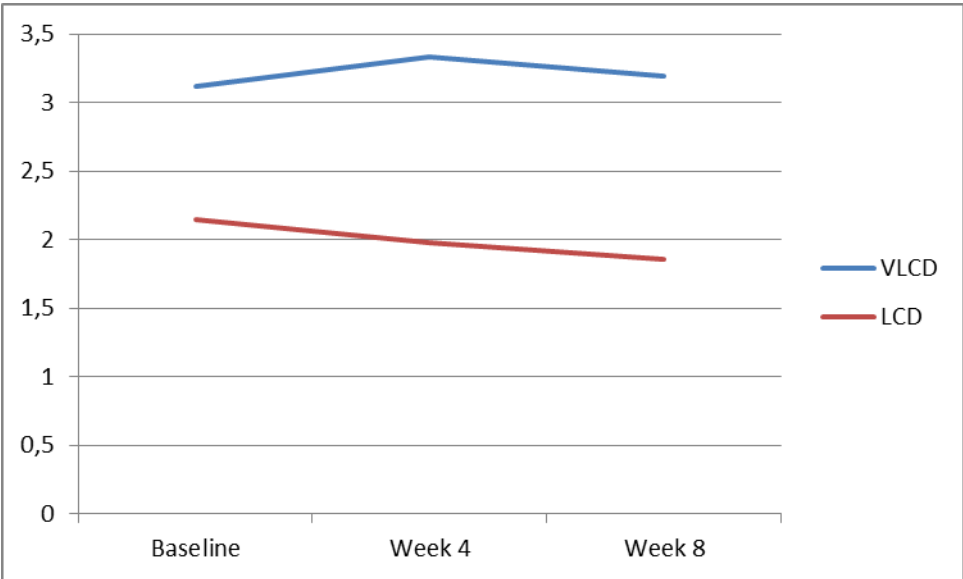


Figure 5. Course of relative autonomy from baseline to week eight for the two groups.

## Appendix A

## Forespørsel om deltakelse i forskningsprosjekt

### *Hastighet av vekttap og kompensatoriske mekanismer som aktiveres under vekttap*

#### **Bakgrunn og hensikt**

Vi vet i dag at når man slanker seg iverksetter kroppen en rekke mottiltak (såkalte kompensatoriske mekanismer) for å opprettholde sin opprinnelige vekt. Dette dreier seg om ulike appetitthormoner, samt justeringer i forbrenning, som trolig har stor betydning for risiko for tilbakefall/vektøkning.

Hensikten med denne studien er å sammenligne effekten av et raskt vekttap sammenlignet med å gå ned i vekt på en mer langsom måte, med fokus på hvilke effekter hastigheten har for de kompensatoriske mekanismene. Vi vil også undersøke hvilke konsekvenser hastigheten har for kroppssammensetning (muskelvev, fettvev).

Motivasjon er også viktig når man skal endre kostholdsvaner. Vi ønsker å kartlegge hvorfor deltakerne i studien ønsker å endre kostholdsvaner, og hva som gjør at de klarer å opprettholde et sunt kosthold.

#### **Hva innebærer studien?**

I studien vil halvparten av deltakerne trekkes ut (ved loddtrekning) til å følge en diett som skal gi et raskt vekttap (fire ukers vektnedgang), mens den andre halvparten får diett med hensikt å gi et mer langsomt vekttap (i løpet av åtte uker). Vi tar sikte på å oppnå 10 % vekttap ved å begrense kaloriinnholdet i føden i varierende grad.

Gruppen som trekkes ut til rask vektreduksjon skal spise et variert utvalg av diettprodukter (milkshakes, smoothies, supper) og litt grønnsaker tilsvarende et daglig energiinntak på 550 kcal (kvinner) og 660 kcal (menn) i fire uker. Den andre gruppen som skal ha et mer langsomt vekttap og får en diett sammensatt av måltidserstatninger/diettprodukter (smoothies og barer) og vanlig mat tilsvarende et daglig energiinntak på 1200 kcal (kvinner) og 1500 kcal (menn) i åtte uker.

Det vil være ukentlig oppfølging av ernæringsfysiolog ved NTNU som gjennomgår kostdagboken og evt bivirkninger. Veiing inngår som en del av dette. Gruppen med raskt vekttap vil også måtte avgi urinprøve. Etter vektreduksjonsperioden vil alle få time hos ernæringsfysiolog for å få en diett bestående av normal kost som vil hjelpe de til å opprettholde vekttapet.

Undersøkelsene i studien er stort sett de samme uansett hvilken diettgruppe du trekkes ut til og innebærer blodprøver, målinger av energibehov, fysisk aktivitet, kroppssammensetning, treningseffektivitet og motivasjon før og etter intervensjon. Et spørreskjema vill også bli brukt til å kartlegge søvnkvalitet.

#### **Mulige fordeler og ulemper**

Fordelen med å delta kan være at man går ned i vekt og oppnår bedre helse. Behandlingen anses ikke som risikabel, men kan innebære forbigående bivirkninger (du kan lese mer i kapittel A).

Undersøkelsene innebærer blodprøvetaking.

### **Hva skjer med prøvene og informasjonen om deg?**

Prøvene tatt av deg og informasjonen som registreres om deg skal kun brukes slik som beskrevet i hensikten med studien. Alle opplysningene og prøvene vil bli behandlet uten navn og fødselsnummer eller andre direkte gjenkjennende opplysninger. En kode knytter deg til dine opplysninger og prøver gjennom en navneliste. Det er kun autorisert personell knyttet til prosjektet som har adgang til navnelisten og som kan finne tilbake til deg. Det vil ikke være mulig å identifisere deg i resultatene av studien når disse publiseres.

### **Frivillig deltakelse**

Det er frivillig å delta i studien. Du kan når som helst og uten å oppgi noen grunn trekke ditt samtykke til å delta i studien. Dette vil ikke få konsekvenser for din videre behandling. Dersom du ønsker å delta, undertegner du samtykkeerklæringen på siste side. Dersom du senere ønsker å trekke deg eller har spørsmål til studien, kan du kontakte studiekoordinator Catia Martins på telefon 72825358.

Studien er godkjent av Regional etisk komité for medisinsk og helsefaglig forskningsetikk, REK Midt-Norge.

**Ytterligere informasjon om studien finnes i kapittel A – utdypende forklaring om hva studien innebærer.**

**Ytterligere informasjon om personvern og forsikring finnes i kapittel B – Personvern, økonomi og forsikring.**

**Samtykkeerklæring følger etter kapittel B. Kapittel A – Utdypende forklaring om hva studien innebærer**

### **Kriterier for deltakelse**

De som kan delta i denne studien må:

1. ha BMI mellom 30 og 45 kg/m<sup>2</sup>,
2. være vektstabil i de siste 3 måneder (< 2kg variasjon)
3. være frisk
4. være inaktive (det vil si, som ikke trener/mosjonerer regelmessig)
5. tar p-piller eller ikke være i menstruell alder (for kvinner)

De med melkeintoleranse kan ikke delta i studie siden slankeprodukter som skal benyttes i studien inneholder melk.

### **Undersøkelser (før og etter vektreduksjon og i uke 13):**

- Dag 1: Du møter fastende (10 timer faste og uten å ha mosjonert eller inntatt alkohol siste døgn). Du ville bli bedt om en urinprøve. Etterpå, du ville få en kanyle i blodåren for blodprøvetaking. Deretter får du en standardisert frokost. Etter måltidet og i de følgende tre timene vil det bli tatt en serie blodprøver for å måle kostens effekt på appetitthormonene. Du må også fylle ut et spørreskjema angående appetitt. I slutten vil vi måle treningseffektivitet og oksygenopptak ved sykling med ulik motstand (cirka 40 min). Totalt vil dette ta cirka 3,5 timer.

- Dag 2: Du møter opp fastende (10 timer faste) for følgende undersøkelser: Høyde, vekt og hoft/midjemål, hvilestoffskiftet (liggende med en plasthette i ca 30min) og undersøkelse av kroppsmassesammensetning (10 min). Totalt vil dette ta cirka 1 time.

I perioder av studien må du gå med et spesielt armbånd som registrerer din fysiske aktivitet. Varighet er en uke. Dette skjer på tre tidspunkt: Før diettstart, midtveis, og i siste uke av dietten.

Du vil også bli bedt om å fylle ut to korte spørreskjema annenhver uke fra du starter i prosjektet (opp til fem ganger totalt). Spørsmålene dreier seg om hvorfor du vil legge om til et sunnere og mer kalorifattig kosthold, og om opprettholdelse av et sunnere kosthold.



**Mulig ubehag/bivirkninger**

Rask vektreduksjon kan ha flere forbigående bivirkninger. Omfanget av disse varierer fra person til person. Mens noen ikke vil få noen symptomer i det hele tatt, vil andre oppleve ganske plagsomme bivirkninger. Mulige bivirkninger er:

- slapphet
- svimmelhet
- forstoppelse
- hårtap
- tørr hud
- neglene kan bli sprø
- kvalme
- diaré
- forstyrret menstruasjonssyklus
- økt kuldefornemmelse

**Studiedeltakerens ansvar**

Det er studiedeltakerens ansvar å møte til avtalt tid.

**Kompensasjon**

Det gies ingen honorar for å delta i studien, men du vil få diettproduktene gratis. Vi kan dessverre ikke gi kompensasjon for reiseutgifter.

**Kapittel B - Personvern, økonomi og forsikring****Personvern**

Opplysninger som registreres om deg er konfidensielle. Ingen utenforstående forskere vil ha tilgang til dataene.

**Biobank**

Det biologiske materialet som blir tatt vil bli lagret i den spesifikke forskningsbiobanken "Speed of Weight Loss" ved Institutt for Kreftforskning og Molekylær Medisin (NTNU). Materialet vil bli analysert for ulike metabolitter/hormoner som er involvert i appetittregulering. Professor Magne Børset er ansvarshavende for denne forskningsbiobanken. Det biologiske materialet kan bare brukes etter godkjenning fra Regional komité for medisinsk og helsefaglig forskningsetikk (REK).

**Rett til innsyn og sletting av opplysninger om deg og sletting av prøver**

Hvis du sier ja til å delta i studien, har du rett til å få innsyn i hvilke opplysninger som er registrert om deg. Du har videre rett til å få korrigert eventuelle feil i de opplysningene vi har registrert. Dersom du trekker deg fra studien, kan du kreve å få slettet innsamlede prøver og opplysninger, med mindre opplysningene allerede er inngått i analyser eller brukt i vitenskapelige publikasjoner.

**Økonomi**

Studien og biobanken er finansiert gjennom forskningsmidler fra "Fundacao Ciencia e Tecnologia" (Det portugisiske forskningsrådet).

Allevo, en slankekostprodusent, vil gi alle slankeprodukter.

**Forsikring**

Studiedeltakerne omfattes av Norsk pasientskedeforsikring, jf. pasientskadelovens §1.

**Informasjon om utfallet av studien**

Du er berettiget til å motta informasjon om utfallet av studien.

## **Samtykke til deltakelse i studien**

Jeg er villig til å delta i studien

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(Signert av prosjektdeltaker, dato)

Jeg bekrefter å ha gitt informasjon om studien

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## Appendix B

**Treatment self-regulation questionnaire (TSRQ)**

TSRQ (kosthold)

Spørsmålene nedenfor dreier seg om hvorfor du vil legge om til et sunnere og mer kalorifattig kosthold. Det kan være ulike årsaker til at mennesker endrer sine kostholdsvaner. Nedenfor har vi listet opp en rekke årsaker formulert som påstander, og vi å kartlegge hvorvidt disse påstandene stemmer for deg.

**Vær vennlig å indikere i hvilken grad hver av årsakene stemmer for deg ved å bruke følgende 7-poengskala**

1	2	3	4	5	6	7
Stemmer overhodet ikke			Stemmer til en viss grad			Stemmer helt

**Jeg ønsker å ha et sunt kosthold fordi:**

		1	2	3	4	5	6	7
1	Jeg ønsker å ta ansvaret for min egen helse.							
2	Jeg ville føle skyld eller skam hvis jeg ikke spiste et sunt kosthold.							
3	Jeg personlig tror det er det beste for helsen min.							
4	Andre ville bli opprørt over meg hvis jeg ikke							

Skjema er oversatt til norsk etter gjeldende retningslinjer av Hege Gade (PhD stipendiat), Senter for sykkelig overvekt i Helse Sør-Øst, Sykehuset i Vestfold, Tønsberg. Rettigheter for bruk i prosjekt med REK nr. 2013/888 er inngått.

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	gjorde det.							
5	Jeg tenker virkelig ikke så mye på det.							
		1	2	3	4	5	6	7
6	Fordi jeg har tenkt grundig gjennom det og mener det er veldig viktig for mange aspekter ved livet mitt.							
7	Fordi jeg ville få dårlig samvittighet hvis jeg ikke spiste sunt.							
8	Fordi dette er et viktig valg for meg.							
9	Fordi jeg føler press fra andre til å gjøre det.							
10	Fordi det er lettere å gjøre det jeg blir fortalt enn selv å tenke på det.							
11	Fordi dette samsvarer med mine mål i livet.							
12	Fordi jeg ønsker å bli godtatt av andre.							
13	Fordi det er veldig viktig for meg å leve så sunt som mulig.							
14	Fordi jeg ønsker at andre kan se at jeg kan greie det.							
15	Jeg vet egentlig ikke hvorfor.							