



**The effects of intensive behavioural obesity
treatment with or without surgical intervention on
weight loss and mental health**

3-4 year follow up

Marianna Þórðardóttir

**Thesis for the degree of Master of Public Health Sciences
Centre of Public Health Sciences
School of Health Sciences
University of Iceland**



HÁSKÓLI ÍSLANDS

**The effects of intensive behavioural obesity treatment with or
without surgical intervention on weight loss and mental health
3-4 year follow up**

Marianna Þórðardóttir

Thesis for the degree of Master of Public Health Sciences

Supervisor: Ludvig Guðmundsson, MD

Masters committee: Arna Hauksdóttir, Ph.D and Unnur Valdimarsdóttir, Ph.D

Faculty of Medicine

Centre of Public Health Sciences

School of Health Sciences, University of Iceland

June 2013

**Áhrif atferlismeðferðar við offitu með eða án
magahjáveituaðgerðar á andlega líðan og þyngd
3-4 ára eftirfylgd**

Marianna Þórðardóttir

Ritgerð til meistaragráðu í lýðheilsuvísindum

Leiðbeinandi: Ludvig Guðmundsson, MD

Meistaránámsnefnd: Arna Hauksdóttir Ph.D og Unnur Valdimarsdóttir, Ph.D

Læknadeild

Miðstöð í lýðheilsuvísindum

Heilbrigðisvísindasvið Háskóla Íslands

Júní 2013

All rights reserved. This master's thesis in Public Health Sciences can not be copied without prior permission.

© Marianna Þórðardóttir 2013

Printed by: Háskólaprent

Iceland, June 2013

Abstract

Obesity is one of the most serious public health crises of our times. Obesity is strongly associated with several kinds of co-morbidities both physical and mental health problems, such as depression, anxiety disorders and psychosocial dysfunction. The objective of this study was to investigate the effect of intensive behavioural obesity treatment with or without Roux en Y gastric bypass surgery on depression, anxiety, obesity-related psychosocial problems and weight at 3-4 year follow-up.

This was a prospective, non-randomized intervention study conducted in the setting of the obesity department at Reykjalundur rehabilitation centre, Iceland. Of 120 patients completing a five week inpatient treatment at Reykjalundur rehabilitation centre from September 2007 to December 2008, 90 (75%) consented to participation at 3-4 year follow-up and were included in the study.

Three to four years post treatment we observed a reduction both in surgically and non-surgically treated patients' depression ($p<0.0001$), anxiety ($p<0.0001$), obesity-related psychosocial problems ($p<0.0001$) and weight ($p<0.0001$), compared to pre-intervention baseline data. Compared to non-surgically treated, surgically treated patients lost more weight ($p<0.0001$) and showed more improvements with respect to obesity-related psychosocial problems ($p<0.0001$). The magnitude of weight loss seemed to affect obesity-related psychosocial problems ($p<0.0001$) while no such effects were observed for depression ($p=0.6059$) and anxiety ($p=0.7568$).

The results of this study indicate that multidisciplinary intensive behavioural obesity treatment may have lasting positive impact on mental health and weight in morbidly obese individuals, irrespectively of whether they are surgically or non-surgically treated. Obesity is one of the most serious health crises of our time. Future studies should focus on long-term potential benefit of intense lifestyle interventions, in terms of individual health and societal benefits.

Ágrip

Offita er ein af helstu lýðheilsuógnum samtímans. Sterk tengsl hafa fundist á milli offitu og margra sjúkdóma, þar með talið ýmissa andlegra vandamála eins og þunglyndis, kvíða og félagslegrar líðanar. Markmið þessarar rannsóknar var að kanna áhrif þverfaglegrar atferlismeðferðar við offitu, með eða án Roux en Y magahjáveituaðgerðar, á þunglyndi, kvíða félagslega líðan og þyngd 3-4 árum eftir að meðferð lýkur.

Rannsókn þessi var framsýn óslembin íhlutunarrannsókn og var framkvæmd á offitusviði Reykjalundar. Af þeim 120 einstaklingum sem luku fimm vikna dagdeildarmeðferð á Reykjalundi á tímabilinu frá september 2007 til desember 2008 samþykktu 90 einstaklingar þátttöku (75%) í eftirfylgdarrannsókn 3-4 árum síðar.

Niðurstöður sýndu að 3-4 árum eftir að meðferð lauk höfðu ýmis einkenni vanheilsu minnkað, borið saman við ástand áður en meðferð hófst, bæði hjá þeim sem fóru í magahjáveituaðgerð og þeim sem ekki fóru í aðgerð. Þetta átti við um þunglyndi ($p<0.0001$), kvíða ($p<0.0001$), félagslega líðan ($p<0.0001$) og þyngd ($p<0.0001$). Þegar þeir sem fóru ekki í aðgerð voru bornir saman við þá sem fóru í aðgerð kom í ljós að þeir sem fóru í aðgerð léttust meira ($p<0.0001$) og bættu félagslega líðan sína meira ($p<0.0001$). Magn þyngdartaps virtist hafa áhrif á bætingu í félagslegri líðan ($p<0.0001$), en sömu áhrif sáust ekki fyrir þunglyndi ($p=0.6059$) eða kvíða ($p=0.7568$).

Niðurstöður þessar gefa til kynna að þverfagleg atferlismeðferð við offitu hafi langtíma áhrif á andlega heilsu og þyngd einstaklinga sem þjást af offitu, burtséð frá því hvort þeir hafi farið í magahjáveituaðgerð eða ekki. Offitan er ein helsta heilsufarsógn samtímans og er því mikilvægt að rannsaka enn frekar langtímaáhrif lífsstílsíhlutana á heilsu einstaklingsins og samfélagið í heild sinni.

Acknowledgements

I would like to take this opportunity to express my deepest gratitude to my supervisor Ludvig Guðmundsson for his guidance and advice. The seeds of my interest in the field were planted as an undergraduate by him and this project would not have been possible without his effort and enthusiasm. I would also like to express a deep sense of gratitude to my co-supervisors Unnur Valdimarsdóttir and Arna Hauksdóttir for their valuable guidance, support and encouragement throughout the process. Their knowledge and experience has had a profound effect on me.

I thank Thor Aspelund, statistician at Centre for Public Health Science, for his valuable help with data analysis and Jóhanna Eyrún Torfadóttir, research fellow, for her methodological advice and guidance.

I'm obliged to thank Reykjalundur rehabilitation centre for their co-operation during the period of my project and for granting me the access to the valuable data utilized in this study. I would also like to thank for their financial support. I thank Guðlaugur Birgisson, fellow researcher, for his partnership during the process. His effort is greatly appreciated.

Special thanks go to fellow students in Stapi, for their great advice and positive attitude. My very special thanks go to Helga Margrét Clarke, a great friend, who had a significant effect on the whole process with her valuable tips, advice and mental support. I thank my family for their endless support and finally I thank my partner for his constant encouragement when I needed motivation and for believing in me when things seemed insuperable. Your ability to focus on the positive things in life made this process so much easier.

Table of contents

Abstract	3
Ágrip.....	5
Acknowledgements	7
Table of contents	9
List of tables and figures - Introduction	11
List of tables and figures - Article.....	11
Introduction	12
Historical overview.....	12
Obesity and physical health.....	14
Obesity and mental health	16
Public health actions.....	17
Surgeries for obesity.....	18
Intervention effect on weight loss	19
Intervention effect on mental health.....	20
Measuring mental health	21
Obesity treatments in Iceland	22
Research on obesity treatment in Iceland	24
References	26
Article.....	33
Abstract	35
Introduction	36
Materials and methods	36
The treatment.....	36
Study design and participants.....	38
Measures.....	39
Statistical analysis.....	40

Ethical considerations.....	40
Results	41
Change from baseline to follow up.....	41
Difference between groups	42
Discussion	43
Weight	43
Mental health	44
Strengths and limitations	46
Conclusion.....	47
Acknowledgements	48
Funding.....	48
Disclosure of interest.....	48
Contribution to authorship	48
Details of ethical approval.....	48
References	49
Appendix 1: Beck's Depression Inventory II.....	55
Appendix 2: Beck's Anxiety Inventory	57
Appendix 3: Obesity-related Problem Scale	58
Appendix 4: Almennar spurningar (General questions)	59
Appendix 5: Kynningarbréf (Introductory letter).....	62
Appendix 6: Upplýst samþykki (Informed consent)	65
Appendix 7: Leyfi (Ethical approval)	66

List of tables and figures - Introduction

Table 1: Classification of adults according to body mass index (BMI).....	12
Table 2: Per capita consumption of energy from 1956-2007.....	14
Figure 1: Roux-en-Y gastric bypass surgery.....	18
Figure 2: Treatment timeframe at Reykjalundur.....	23

List of tables and figures - Article

Table 1: Characteristics of the surgically and non-surgically treated subjects at Reykjalundur - rehabilitation centre. Collected at the 3-4 year follow up.....	52
Table 2: Depression, anxiety, obesity-related psychosocial problems and weight before treatment and at 3-4 year follow-up at Reykjalundur - rehabilitation centre.....	53
Table 3: Frequency of patients with high depression, anxiety and obesity-related psychosocial problems before treatment (M1), during 5 week inpatient treatment (M2) and at 3-4 year follow-up (M3) at Reykjalundur - rehabilitation centre.....	54
Figure 1: Timeframe of the study.....	37
Figure 2: Flowchart of study participants.....	38
Figure 3: Trend in depression, anxiety, obesity-related psychosocial problems and weight in surgically and non-surgically treated patients at Reykjalundur - rehabilitation centre during the study period.....	54

Introduction

Obesity is one of the most serious health crises of our times. Due to increasing prevalence and health impact during the last decades, the World Health Organization (WHO) officially declared obesity as a disease in 1998.¹ Overweight and obesity are globally the fifth leading risk for deaths and are linked to more deaths worldwide than underweight.² Overweight and obesity are generally defined according to Body Mass Index (BMI) which is a simple index of weight-for-height that is commonly used to classify overweight and obesity. It is defined as a person's weight in kilograms divided by the square of his height in meters (kg/m^2) and is used to estimate people's body composition and works equally for men and women.² BMI provides the most useful population-level measure of obesity. Obesity is classified by WHO as BMI ≥ 30 (see table 1) and is primarily based on the association between BMI and mortality. BMI can thus be used to estimate the prevalence of obesity within a population and the risks associated with it.¹ The main limitation of the BMI is that it does not distinguish between weight associated with lean tissue and weight associated with fat. A slim muscular individual could therefore have a high BMI according to this definition, while on the other hand an individual in poor condition with normal BMI can have a relatively high proportion of body fat.³ Other beneficial measures for estimating obesity are waist circumference, waist to hip ratio and fat percentage to name a few.¹

Table 1: Classification of adults according to body mass index (BMI)¹

<i>Classification</i>	<i>BMI (kg/m^2)</i>
Underweight	<18.5
Normal range	18.5-24.9
Overweight	25.0-29.9
Obese class I	30.0-34.9
Obese class II	35.0-39.9
Obese class III	≥ 40.0

Historical overview

The human race has struggled to overcome food shortage for centuries. Increasing the average body size of the population was an important factor in the industrial revolution, both socially and politically. It was particularly important to increase the body size of the young

generations, i.e. soldiers and workers. It was therefore of great importance to move the average BMI from underweight to normality with regards to survival and productivity of the nation, a key element in the economic development of industrialized societies.^{4, 5} Consequently, historical records indicate that height and weight increased progressively in the 19th century in the developed countries. During the 20th century populations from these countries began to reach their genetic potential for growth while gaining proportionally more weight than height, resulting in increasing BMI. The human race reached a historical landmark by the year 2000. For the first time the number of adults with excess weight exceeded the number of those who were underweight.^{5, 6}

Life insurance companies in the United States started using body weight data to determine premiums as early as the 1930s, having identified an association between excess weight and premature death.⁵ In the early 1950s, Breslow⁴ proposed a direct link between the increasing prevalence of obesity and increasing rate of cardiovascular disease in the US population. However, obesity did not attract the attention of the mass media until recent decades although the prevalence in industrialized countries began to rise early in the last century.⁵

First measures on the Icelandic population physique were performed in 1967. For Icelandic adults (aged 45-64 years old), BMI remained almost unchanged from 1967-1981, but after that it increased rapidly. In 2007 average BMI was 28.0 kg/m² for men and 27.2 kg/m² for women and had increased by approximately two units in 40 years, mostly occurring after 1981. Prevalence of obesity in 2007 was 23% for men and 21% for women aged 25-84 years.⁷ That is well above average for OECD countries according to OECD's report on obesity; the average prevalence in 2009 or nearest year for OECD countries was 17.2% for women and 16.7% for men.⁸ In comparison, the prevalence of obesity in the United States in 2009-2010 was 35.5% for men over 20 years of age and 36.3% for women.⁹ New unpublished data indicates that the average BMI has remained the same in Iceland since 2007.¹⁰

The development of overweight and obesity has been similar in Iceland compared to other countries. What is the cause of this rapid increase? When investigating the development of overweight and obesity from 1975-1995 Thorgeirsdottir and co-workers suggested that the main reason for increased overweight and obesity was lifestyle, either different diet or reduced physical activity. Yet, when looking at per capita consumption of energy for the past decades (table 2) the intake has nearly remained the same.^{11, 12} Comparable results can be seen in other European countries with similar increase in obesity rates.¹³

Table 2: Per capita consumption of energy from 1956-2007¹¹

	1956-60	1966-70	1976-80	1986-90	1996-00	2005	2006	2007
Energy (kcal/day)	3212,0	2960,0	2948,0	3078,0	3100,0	3226,0	3174,0	3314,0

Is the logical explanation for this increase in prevalence of obesity then less physical activity? Findings from previous studies show that immobilization is a key factor in the development of obesity, and is even a more important factor than diet.^{14, 15} According to Statistics Iceland a significant reduction in work related activity and daily effort has occurred during the past decades in Iceland. Strenuous jobs have decreased while sedentary jobs have increased.¹² Similar trends can be seen in other countries.¹⁶ Although physical activity during leisure time has increased in Iceland⁷ it is considered unlikely that energy expenditure during physical activity in leisure time can offset energy expenditure during everyday activities and tasks as it was before industrialization.¹⁷ It can therefore be concluded that less intake of energy rich foods and increased physical activity both in leisure time and during daily tasks and activities are needed to lower the prevalence of obesity.⁷

Obesity and physical health

The increasing rate of obesity is associated with increasing risk of co-morbidities and mortality.¹⁸ BMI is an established risk factor for several causes of death including ischemic heart diseases,¹⁹ stroke²⁰ and several types of cancer.^{21, 22} A meta-analysis by Whitlock and co-workers found that for both sexes, mortality is usually lowest at about 22.5-25 kg/m². They also found that an addition in 5 kg/m² is associated with about 30% higher overall mortality.¹⁸ Another study did not find a significant increase in mortality for overweight (BMI 25-29.9 kg/m²), only for obesity (BMI \geq 30 kg/m²).²³ However, others have found that both overweight and obesity are associated with increased all-cause mortality and perhaps underweight as well.^{18, 24} The association between BMI and all cause mortality has been shown to be J-shaped for non-smokers and U-shaped for smokers, indicating higher all cause mortality rate for smokers classified within the lower categories of BMI than for non-smokers.^{18, 23, 24}

The co-morbidities that bring the greatest burden of disease for obese individuals are type 2 diabetes and cardiovascular diseases.²⁵ It is estimated that at least 75% of hypertension incidences is related to obesity and the combination of obesity and hypertension is considered to be the main cause for increased cardiovascular risk.²⁶ The relationship between obesity and

type 2 diabetes is well established.²⁷ A meta-analysis of 18 prospective studies investigated the association between obesity and the risk of developing type 2 diabetes. They found that after adjusting for age, family history of type 2 diabetes and physical activity that obese individuals were seven times more likely to develop type 2 diabetes compared to those with normal weight.²⁸ Another common co-morbidity of obesity is cancer. A systematic review and meta-analysis, including data from 282 137 individuals, assessed the strength of the association between BMI and different types of cancer. The findings indicated that excess bodyweight is associated with the risk of some common adult cancers, such as thyroid, colon, rectal, pancreatic, renal and postmenopausal breast cancers.³ Musculoskeletal disorders are a common complication of obesity due to an abnormal stress on bones and joints, and can lead to the development of chronic diseases such as osteoarthritis.²⁹⁻³² Musculoskeletal disorders related to obesity are mainly in hips,³³ knees,³¹ lower back,³⁴ ankles³⁵ and shoulders.³⁶ Studies have shown that weight loss decreases pain and increases mobility in obese individuals.³⁷ Obesity has repeatedly been found to have a detrimental effect on the female reproductive system.³⁸⁻⁴³ Obese women have higher rate of infertility compared with leaner women, mostly because of ovulation disorders caused by polycystic ovary syndrome (PCOS).⁴⁴ Obesity worsens the presentation of PCOS and weight loss and weight management has consistently shown to be beneficial for obese women with PCOS and is proposed as first-line treatment.^{38, 40, 42-46} PCOS has additionally been found to be related to pregnancy complications such as gestational diabetes, pregnancy-induced hypertension and pre-eclampsia, preterm birth and neonatal complications such as higher risk of neonatal intensive care unit admission and higher perinatal mortality.⁴⁷ Another common risk factor of obesity is obstructive sleep apnoea (OSA).⁴⁸⁻⁵⁰ It has been documented that an increase in BMI of one standard deviation is associated with a fourfold increase in risk for OSA.⁵¹ Some studies have shown that the link between obesity and OSA is reciprocal^{49, 50} and that OSA seems to worsen metabolism.⁵⁰ Weight loss has shown to be the optimal treatment for OSA.^{48, 49}

A systematic review and meta-analysis from 2011 based on 44 022 individuals, indicated that bariatric surgery reduces the risk of cardiovascular mortality, all-cause mortality and global mortality (sum of cardiovascular and all-cause mortality) in morbid obesity.⁵² Two other studies indicated that bariatric surgery results in an improvement in co-morbid disease when compared with non-operated obese controls.^{53, 54} When surgical subjects are compared to the general population the rate is different; gastric bypass surgery seems to reduce the risk of diabetes and myocardial infarction to population level, but the risk of death remains increased.⁵⁵ Bariatric surgeries have also been linked to full remission in at least 80%

of surgical patients with type 2 diabetes due to either increased insulin sensitivity, insulin secretion or both.⁵⁶ Taken together, the evidence suggests that obesity is associated with increased risk of co-morbidities such as cancer, musculoskeletal disorders, cardiovascular diseases, PCOS, and OSA and that mortality increases with rising BMI.

Obesity and mental health

Being obese, and the perception of being obese, increases psychological distress.^{57, 58} The association between depression and obesity has repeatedly been established. A meta-analysis of 15 longitudinal studies, including data on 56 745 individuals, investigated the bidirectional relationship between obesity and depression. Obesity was found to increase the risk of developing depression and vice versa: Obese individuals had a 55% increased risk of developing depression over time, whereas depressed individuals had a 58% increased risk of becoming obese.⁵⁹

Anxiety disorders are considered to be the most prevalent psychiatric disorders in the developed world affecting quarter of the population during lifetime.⁶⁰ Obesity is considered to be one of the risk factors for anxiety disorders; however, evidence supporting the association is not clear. Various pathways between obesity and anxiety have been identified; for instance weight related discrimination and stigma can have a distressing effect on obese individuals^{61, 62} and the negative effect of obesity on health related quality of life can be stressful.⁶³⁻⁶⁵ A meta-analysis including 2 prospective and 14 cross-sectional studies investigating the association between obesity and anxiety disorders in the population indicated mixed results from the prospective studies while indicating a positive association from the cross-sectional studies (pooled odds ratio of 1.4). They concluded that a causal relationship from obesity to anxiety could not be found.⁶⁶

Psychosocial functioning is an important factor in the measurement of quality of life in obese individuals. Obesity is stigmatized around the world and humiliation and discrimination of obese individuals are widespread and concern most areas of social life. Obese individuals are therefore at high risk of becoming isolated and to develop psychosocial dysfunction. They become bothered with their weight and avoid public places and group activities.⁶⁷ Stereotyping overweight and obese individuals is widespread; they are thought to be lazy, less competent, unmotivated, lacking in self-discipline and sloppy.⁶⁸ These

stereotypes are rarely challenged in the western society, leaving them vulnerable to unfair treatment and impaired quality of life.⁶⁸⁻⁷¹

A review by Puhl and Heuer from 2009 documented how weight stigma can be seen in many different settings of people's life. The work place is one setting where discrimination against obese individuals is widespread. Obese individuals have disadvantage when it comes to being hired, receiving higher wages, getting promotions and have higher risk of being expelled because of their weight. In the health-care setting obese individuals are exposed to numerous forms of prejudice from physicians, nurses, psychologists and medical students including beliefs that they are lazy, lacking self-control and have low will power. In the educational setting, obese individuals have experienced weight-based stigmatization from teachers, peers and parents. Additionally, obese individuals, especially women, may also face stigma in close interpersonal relationships from romantic partners, family members and friends. The fifth setting is the media; it is an illustration of the social acceptability of weight stigmatization where the stigmatization can be found in comedies, cartoons, movies, advertisements and in the news.⁶⁷ The importance of developing sound evidence base for preventing and treating obesity through research as well as to eradicate weight stigma is therefore of great importance for the individual and the society.

Public health actions

The cause of the worldwide obesity epidemic is complex and includes many social, economic and cultural factors that determine the quality of the food and the amount of intake balanced against energy expenditure.⁷² A summary of systematic reviews and meta-analyses by Byers and Sedjo from 2007 on interventions targeting obesity and on selected obesity prevention guidelines issued as expert panel reports since 2000 concluded that these public health action plans call for education approaches to increase awareness about lifestyle choice, referring to food intake and physical activity habits. They furthermore emphasize that public health programs should be based on sound evidence of both need and efficacy.⁷²

The foundation of obesity prevention plans first and foremost focuses on the need to promote healthy eating patterns through life with regular physical activity and thus maintaining a healthy weight lifelong. The evidence is fair supporting screening for obesity, as is promoted in many action plans.⁷³ Most dietary guidelines proposed by various organizations emphasize a diet rich in nutrient-dense food such as fruits and vegetables and

whole grains combined with regular physical activity.⁷⁴⁻⁸¹ Other organizations promote healthy food choices with reasonable portion sizes in the home, schools, worksites and communities, and leisure time physical activity to reduce sedentary activity as well as to create environment that promotes physical activities in schools and in worksites.⁸² WHO has recommended policies to encourage favourable healthy choices similar to the tax on tobacco products.⁸¹ Regarding beneficial recommendations to encourage healthy food choices for children the focus has mostly been on limiting advertisement and marketing of unhealthy foods.⁸⁰ The need to reverse the obesity epidemic is clear. However, according to Byers and Sedjo the current evidence base is weak and only few interventions have proven to be effective.⁷² Others have further emphasized this by stating the importance of sound evidence base when implementing public health actions.⁸³

Surgeries for obesity

Treating obesity surgically is not a dieting alternative but rather a method to enforce dieting.⁸⁴ Conventionally, four types of bariatric procedures are used, two of which are mostly used worldwide: the Roux-en-Y gastric bypass surgery (RYGB) (see figure 1) and the laparoscopic adjustable gastric band. The other two are the biliopancreatic diversion and the biliopancreatic diversion with duodenal switch. They have a long-established history but during the past decades the use has dropped. The choice of method depends on various factors like regional knowledge and experience in different techniques. Mean weight loss following RYGB worldwide is 25-35% and excess weight loss at 3-5 years is 60%.⁸⁵

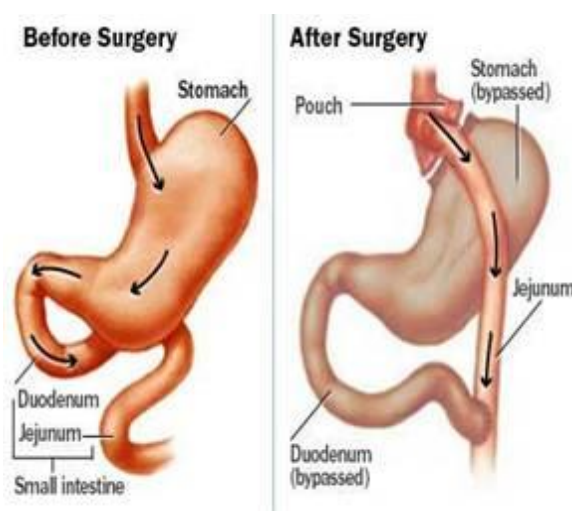


Figure 1: Roux-en-Y gastric bypass surgery⁸⁶

Risk of short term negative side effects associated with bariatric procedures is generally low and similar to those of gallbladder surgery.^{87, 88} Key complications are abdominal pain, staple-line leak, stomach ulcer, intestinal obstruction, gallstones, nutritional deficiency and weight regain. 30 day post-operative mortality is 0.3-0.5%, major 30 day morbidity is 4.8 – 7.8% (depending on surgical method) and one year morbidity is 14.9%. Nutritional concerns regarding bariatric surgeries are mostly related to moderate deficiency in iron, vitamin B12, folic acid, calcium, vitamin D, copper and zinc and lifelong follow-up requirements along with nutritional support is needed for optimal outcome.⁸⁵

Intervention effect on weight loss

Overall, weight loss interventions have yielded mixed results. Bariatric surgeries and pharmacological treatments have been shown to be effective methods for weight reduction.^{89, 90} However, behavioural, non-pharmacological interventions promoting dietary changes have shown to be useful in producing moderate but short term weight loss.^{89, 91-93} A summary of selected systematic reviews and meta-analyses by Byers and Sedjo from 2007 covering nutritional topics affecting obesity concludes that clinical interventions in adults using pharmaceuticals or behavioural methods have modest effect on obesity but bariatric surgeries have substantial effect.⁷²

The Swedish Obese Subjects (SOS) intervention study is a controlled longitudinal trial of the health effects of weight loss in severely obese individuals that started in 1987. The study compares surgically treated patients with non-surgically treated patients regarding weight loss and mental factors. The non-surgically treated were offered conventional treatment at their regular primary health care centre. Results from a 10 year follow-up showed that surgically treated subjects had lost 25.3% of their initial weight one year after surgery, then a weight regain was observed between one and six years, and weight reduction at six years was 16.9%. Thereafter the weight regain levelled off and weight loss after 10 years averaged 16%. The same was not observed for non-surgically treated subjects. Average weight loss was 1.2% after six months, but the weight loss was regained after two years and a weight increase of 1.6% was noted after four years. Mean weight was more or less stable between four and ten years and the average weight increase from baseline to 10 year follow-up reached 1.5%. The investigators concluded that bariatric surgery is a favourable option for the treatment of severe obesity, resulting in long-term weight loss. However, difficulties can

be found among some surgically treated patients to control and maintain weight loss over time.⁸⁹ Buddeberg-Fischer and co-workers investigated the weight loss with and without bariatric surgery in a 4 ½ year follow-up study in 131 obese individuals. They found that both groups lost a significant amount of weight; however, the weight loss was significantly greater in surgically treated subjects than in non-surgically treated subjects, which also strongly decreased the risk of developing obesity-related co-morbidities.⁹⁴ Findings from a Dutch study on the long-term effect of bariatric surgeries on weight loss in 236 patients not attending protocol follow-up visits indicated that after surgery patients lost a maximum of 48.2 kg or 70.8% of excess weight. However, the patients regained weight in the following years resulting in an overall weight loss of 32.1 kg or 45.2% of excess weight during an average of 8.2 year post-surgery follow-up, indicating that surgically induced weight loss is satisfactory in the long-term, even in patients not attending follow-up.⁹⁵ Another study on a 10 week treatment including behaviour modification and very-low-energy diet in a two year follow-up study on 67 individuals found that the mean weight loss was significant, or 14.6 kg at the end of treatment, 7.1 kg at one year follow-up and 3.3 kg at two year follow-up.⁹³

Taken together, the evidence suggests that bariatric surgery is the favourable option for long-term weight loss. A slight weight regain following surgically induced weight loss is observed in most studies and therefore important to continue monitoring the long-term effect of bariatric surgeries on weight loss. However, most of the previously mentioned studies do not include behavioural treatment alongside the procedure which could be beneficial for weight loss maintenance.

Intervention effect on mental health

Unfortunately, interventions for obesity have yielded mixed results regarding mental health improvements.^{89, 93, 94} The goal of bariatric surgery is not only to reduce weight and co-morbidities, but also to improve mental health. Majority of data suggest that surgical treatment along with behavioural treatment for obesity may be the most effective intervention for long-term results.^{89, 94, 96, 97}

A 10-year follow-up in the SOS study found that depression decreased significantly in both groups, even more for the surgically treated subjects. Reduction in anxiety was also significant for both groups, however, no differential effects were found for the two groups.⁸⁹ Buddeberg-Fischer and co-workers found that both surgically treated and non-surgically

treated subjects showed significant improvements in depression, but not in anxiety and that there was no difference between the groups regarding these factors.⁹⁴ A prospective study on whether changes in self-reported physical health was predictive of changes in mental health found that anxiety and depression was high before surgery but became normalized one and two years afterwards. The degree of improvements in self-reported physical health was associated with statistically significant reduction in the symptoms of anxiety ($P=0.003$) and depression ($P=0.004$) at two year follow-up.⁹⁸

Findings from a prospective study on 531 obese individuals indicated that those with pre-surgery mental disorders tend to lose less weight following bariatric surgery than obese individuals without these disorders. That was not found in non-surgically treated individuals. Moreover, a trend to gain weight was seen in obese controls with disorders whereas controls without mental disorders at baseline lost some weight. These results emphasize the importance of addressing mental disorders in obese patients before weight loss intervention, especially patients undergoing bariatric surgery.⁹⁹

A ten year follow up of quality of life from the previously mentioned SOS study showed significant reduction in obesity-related psychosocial problems following bariatric surgery and that surgically treated subjects improved significantly more than non-surgically treated subjects.⁸⁹ Findings from another study indicated that health-related quality of life improved during treatment but had two years later returned to baseline levels.⁹³ Only obesity-related psychosocial problems measured using the OP-scale¹⁰⁰ was still improved relative to baseline.⁹³

Measuring mental health

Various assessment scales have been used to identify depression and anxiety in obese populations. For measuring depression and anxiety, our study at Reykjalundur - rehabilitation centre included the Beck Depression Inventory, second edition (BDI II), and Beck Anxiety Inventory (BAI). BDI II is a self-assessment scale measuring the severity of depressive symptoms. It was developed by Aaron T. Beck in 1961¹⁰¹ and modified to current version in 1996¹⁰² with the goal to measure the intensity and depth of depression in individuals. BAI is a 21 item self-report inventory for measuring the severity of anxiety. It was developed by Aron T. Beck to address the need for an assessment scale that would differentiate anxiety from depression while presenting convergent validity.¹⁰³ These scales are widely used to measure

depressive symptoms and anxiety in the health care system in various populations, including obese individuals.^{89, 104-107}

Various assessment scales have been used to measure psychosocial functioning in obese populations. This study used the Obesity-related Problem Scale (OP-scale) which is an obesity-specific measurement developed in 1987 to evaluate the impact of obesity on psychosocial functioning. It is comprised of eight questions concerning how bothered individuals are by their obesity in different aspects of their everyday life, such as attending social events, travelling and being part of intimate relations. Although the scale is relatively new it is widely used.^{89, 93, 105, 106}

Obesity treatments in Iceland

In Iceland, treatment for obesity is available at six health care institutions: Neskaupsstadur Hospital, NLFI Spa and Medical Clinic in Hveragerdi (NLFI), Saudarkrokur Hospital, Kristnes Hospital in Akureyri, Husavik Health Centre and Reykjalundur rehabilitation centre in Mosfellsbaer. The participants for our study were recruited at Reykjalundur rehabilitation centre.

At Reykjalundur an interdisciplinary team of professionals has been treating patients for obesity since 2001. The treatment, which is completed by approximately 100 patients every year, includes an intensive behavioural obesity treatment for severely obese individuals ($\text{BMI} \geq 35 \text{ kg/m}^2$). The aim of the treatment is to help patients to improve their quality of life focusing on weight loss, increased physical activity and reorganizing daily life schedule. The treatment involves education on nutrition, exercise and other factors related to obesity. Physical education is a big part of the treatment, as well as focus on self-image and relaxation. Despite the fact that this is a group treatment it is also individually based and the patients can get additional support from a psychologist, nutritionist and physical therapist when needed.¹⁰⁸

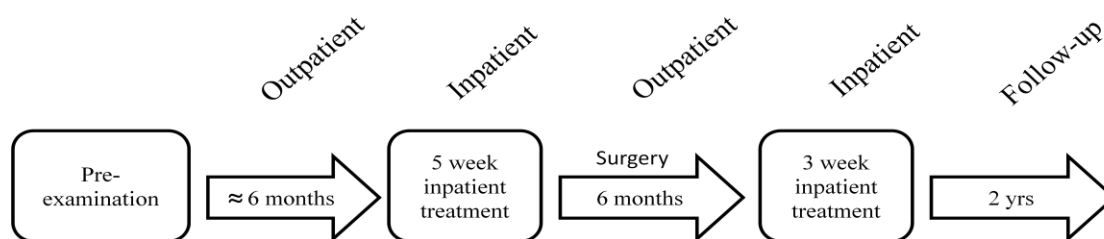


Figure 2: Treatment timeframe at Reykjalundur

Certain criteria need to be met before starting treatment at Reykjalundur, including: Being classified with severe obesity ($\text{BMI} \geq 35 \text{ kg/m}^2$), having referral from a physician, being able to follow the treatment program and showing intention to work with lifestyle changes. Lastly, smokers are required to quit smoking and alcohol and/or drug abusers are required to stay abstinent. The treatment starts with pre-examination followed by an outpatient treatment where the patient is required to lose 6-8% of his initial body weight to get further on in the treatment. During the outpatient treatment the patient is invited to get support from various professionals of the obesity treatment team every two or three weeks. The inpatient treatment is initiated when the patient has reached the required weight loss minimum. The inpatient treatment is divided into two periods. The first period is five weeks and the second is three weeks, with approximately six months in between. During that period the patients come in for one visit in groups, and they can get additional private support from members of the obesity treatment team if needed. The patient is then invited for a follow-up every six months for two years.¹⁰⁸

The RYGB performed laparoscopically is the most performed procedure in Iceland (figure 1). In 2002 Reykjalundur and Landspítali – University Hospital of Iceland (LSH) started their cooperation involving preparation of patients at Reykjalundur for surgery at LSH. Unpublished data from 2010 on the first 424 RYGB surgeries in Iceland indicate that early complications (≤ 30 days postoperatively) are relatively rare. Of all 424 laparoscopic cases no deaths have occurred, 2.4% of patients encountered intestinal leak, 3.1% encountered haemorrhage, 0.2% encountered abdominal wall hernia, 0.7% encountered urinary tract infection, 0.5% pneumonia, 0.2% deep venous thrombosis and 0.2% pulmonary embolism. Regarding late serious complications (>30 days postoperatively), 206 cases were available for >2 year follow-up, 2.4% of them encountered intestinal obstruction and 17.0% encountered ulcer.¹⁰⁹

Research on obesity treatment in Iceland

In the Icelandic setting, few studies on the effectiveness of obesity treatment on mental health and weight have been conducted. Hannesdottir and co-workers investigated the health effects of the obesity treatment at Reykjalundur on 47 women. They found that the women lost an average of 11 kg ($p < 0.001$) from baseline to middle of treatment and significantly improved their mental health, i.e. depression, anxiety and obesity-related psychosocial problems.¹⁰⁵ A two year follow-up study by Njalsdottir and co-workers on 42 women found that weight loss was significant and that depression and obesity-related psychosocial problems improved significantly from treatment baseline to two year follow up, but not anxiety. When comparing surgically treated patients to non-surgically treated patients the surgically treated lost significantly more weight and improved their obesity-related psychosocial problems more than non-surgically treated subjects. No difference was found between the groups regarding depression and anxiety.¹⁰⁶ Fridfinnsdottir and co-workers investigated if treatment at Reykjalundur including a gastric bypass surgery at LSH affected depression and anxiety. Their results indicated that treatment including surgery does have a positive effect on depression and anxiety, at least in the short-term.¹⁰⁷

The need for long-term results of the effects of obesity treatment in Iceland is necessary for future treatment approach. Using prospectively collected data, the current study was designed to provide information on long-term effects of obesity treatment with and without gastric bypass surgery on weight, depression, anxiety and obesity-related psychosocial problems.

The aims were:

1. To investigate whether intensive behavioural treatment for obesity affects important long-term outcomes of patients such as depression, anxiety, obesity-related psychosocial problems and weight.
2. To determine if there is a difference between surgically treated subjects and non-surgically treated subjects regarding depression, anxiety, obesity-related psychosocial problems and weight.

We hypothesized that intensive behavioural treatment for obesity would have a long-term effect on depression, anxiety, obesity-related psychosocial problems and weight and that surgically treated subjects improve more than non-surgically treated subjects regarding these factors.

References

1. WHO. Obesity: Preventing and managing the global epidemic. Geneva: WHO Technical Report Series, No. 894; 2000.
2. WHO. Obesity and overweight: Fact sheet N°311. World Health Organization; 2011.
3. Renehan AG, Tyson M, Egger M, et al. Body-mass index and incidence of cancer: a systematic review and meta-analysis of prospective observational studies. *Lancet*. 2008; **371**(9612): 569-78.
4. Breslow L. Public health aspects of weight control. *Am J Public Health Nations Health*. 1952; **42**(9): 1116-20.
5. Caballero B. The Global Epidemic of Obesity: An Overview. *Epidemiologic Reviews*. 2007; **29**(1): 1-5.
6. Gardner G, Halweil B. Underfed and overfed: the global epidemic of malnutrition. Washington DC: Worldwatch Institute; 2000.
7. Thorsson B, Aspelund T, Harris TB, et al. [Trends in body weight and diabetes in forty years in Iceland]. *Laeknabladid*. 2009; **95**(4): 259-66.
8. OECD. Obesity Update 2012. Paris: Organisation for Economic Co-operation and Development (OECD) 2012.
9. Flegal KM, Carroll MD, Kit BK, et al. Prevalence of obesity and trends in the distribution of body mass index among US adults, 1999-2010. *JAMA*. 2012; **307**(5): 491-7.
10. Thorisdottir AL. BMI-stuðull Íslendinga stendur í stað. 2012 28.09.2012 [cited; Available from: http://www.mbl.is/frettir/innlent/2012/09/28/bmi_studullinn_stendur_i_stad/]
11. Embætti Landlæknis. Næring - tölur. 2012 [cited; Available from: <http://www.landlaeknir.is/tolfraedi-og-rannsoknir/tolfraedi/heilsa-og-lidan/naering%20%20%20/>]
12. Thornorgeirsdottir H, Steingrimsdottir L, Olafsson O, et al. [Trends in overweight and obesity in 45-64 year old men and women in Reykjavik 1975-1994.]. *Laeknabladid*. 2001; **87**(9): 699-704.
13. Serra-Majem L, Ribas-Barba L, Salvador G, et al. Trends in energy and nutrient intake and risk of inadequate intakes in Catalonia, Spain (1992-2003). *Public Health Nutr*. 2007; **10**(11A): 1354-67.
14. Heini AF, Weinsier RL. Divergent trends in obesity and fat intake patterns: the American paradox. *Am J Med*. 1997; **102**(3): 259-64.
15. Prentice AM, Jebb SA. Obesity in Britain: gluttony or sloth? *BMJ*. 1995; **311**(7002): 437-9.
16. Choi B, Schnall PL, Yang H, et al. Sedentary work, low physical job demand, and obesity in US workers. *Am J Ind Med*. 2010; **53**(11): 1088-101.
17. Costanza MC, Beer-Borst S, Morabia A. Achieving energy balance at the population level through increases in physical activity. *Am J Public Health*. 2007; **97**(3): 520-5.

18. Whitlock G, Lewington S, Sherliker P, et al. Body-mass index and cause-specific mortality in 900 000 adults: collaborative analyses of 57 prospective studies. *Lancet*. 2009; **373**(9669): 1083-96.
19. Manson JE, Colditz GA, Stampfer MJ, et al. A prospective study of obesity and risk of coronary heart disease in women. *N Engl J Med*. 1990; **322**(13): 882-9.
20. Song YM, Sung J, Davey Smith G, et al. Body mass index and ischemic and hemorrhagic stroke: a prospective study in Korean men. *Stroke*. 2004; **35**(4): 831-6.
21. Calle EE, Rodriguez C, Walker-Thurmond K, et al. Overweight, obesity, and mortality from cancer in a prospectively studied cohort of U.S. adults. *N Engl J Med*. 2003; **348**(17): 1625-38.
22. Reeves GK, Pirie K, Beral V, et al. Cancer incidence and mortality in relation to body mass index in the Million Women Study: cohort study. *BMJ*. 2007; **335**(7630): 1134.
23. Faeh D, Braun J, Tarnutzer S, et al. Obesity but not overweight is associated with increased mortality risk. *Eur J Epidemiol*. 2011; **26**(8): 647-55.
24. Berrington de Gonzalez A, Hartge P, Cerhan JR, et al. Body-mass index and mortality among 1.46 million white adults. *N Engl J Med*. 2010; **363**(23): 2211-9.
25. Vest AR, Heneghan HM, Schauer PR, et al. Surgical management of obesity and the relationship to cardiovascular disease. *Circulation*. 2013; **127**(8): 945-59.
26. Landsberg L, Aronne LJ, Beilin LJ, et al. Obesity-related hypertension: pathogenesis, cardiovascular risk, and treatment: a position paper of the obesity society and the american society of hypertension. *J Clin Hypertens (Greenwich)*. 2013; **15**(1): 14-33.
27. West KM, Kalbfleisch JM. Influence of nutritional factors on prevalence of diabetes. *Diabetes*. 1971; **20**(2): 99-108.
28. Abdullah A, Peeters A, de Courten M, et al. The magnitude of association between overweight and obesity and the risk of diabetes: a meta-analysis of prospective cohort studies. *Diabetes Res Clin Pract*. 2010; **89**(3): 309-19.
29. Busija L, Buchbinder R, Osborne RH. Quantifying the impact of transient joint symptoms, chronic joint symptoms, and arthritis: a population-based approach. *Arthritis Rheum*. 2009; **61**(10): 1312-21.
30. Wearing SC, Hennig EM, Byrne NM, et al. Musculoskeletal disorders associated with obesity: a biomechanical perspective. *Obes Rev*. 2006; **7**(3): 239-50.
31. Toivanen AT, Heliovaara M, Impivaara O, et al. Obesity, physically demanding work and traumatic knee injury are major risk factors for knee osteoarthritis--a population-based study with a follow-up of 22 years. *Rheumatology (Oxford)*. 2010; **49**(2): 308-14.
32. Pedersen BK, Saltin B. Evidence for prescribing exercise as therapy in chronic disease. *Scand J Med Sci Sports*. 2006; **16 Suppl 1**: 3-63.
33. Williams BS, Cohen SP. Greater trochanteric pain syndrome: a review of anatomy, diagnosis and treatment. *Anesth Analg*. 2009; **108**(5): 1662-70.
34. Leboeuf-Yde C. Body weight and low back pain. A systematic literature review of 56 journal articles reporting on 65 epidemiologic studies. *Spine (Phila Pa 1976)*. 2000; **25**(2): 226-37.
35. Japour C, Vohra P, Giorgini R, et al. Ankle arthroscopy: follow-up study of 33 ankles--effect of physical therapy and obesity. *J Foot Ankle Surg*. 1996; **35**(3): 199-209.

36. Miranda H, Viikari-Juntura E, Martikainen R, et al. A prospective study of work related factors and physical exercise as predictors of shoulder pain. *Occup Environ Med.* 2001; **58**(8): 528-34.
37. Larsson UE. Influence of weight loss on pain, perceived disability and observed functional limitations in obese women. *Int J Obes Relat Metab Disord.* 2004; **28**(2): 269-77.
38. Franks S, Kiddy D, Sharp P, et al. Obesity and polycystic ovary syndrome. *Ann N Y Acad Sci.* 1991; **626**: 201-6.
39. Salehi M, Bravo-Vera R, Sheikh A, et al. Pathogenesis of polycystic ovary syndrome: what is the role of obesity? *Metabolism.* 2004; **53**(3): 358-76.
40. Brewer CJ, Balen AH. The adverse effects of obesity on conception and implantation. *Reproduction.* 2010; **140**(3): 347-64.
41. Jungheim ES, Lanzendorf SE, Odem RR, et al. Morbid obesity is associated with lower clinical pregnancy rates after in vitro fertilization in women with polycystic ovary syndrome. *Fertil Steril.* 2009; **92**(1): 256-61.
42. Pasquali R, Gambineri A, Pagotto U. The impact of obesity on reproduction in women with polycystic ovary syndrome. *BJOG.* 2006; **113**(10): 1148-59.
43. Barber TM, McCarthy MI, Wass JA, et al. Obesity and polycystic ovary syndrome. *Clin Endocrinol (Oxf).* 2006; **65**(2): 137-45.
44. Wilkes S, Murdoch A. Obesity and female fertility: a primary care perspective. *J Fam Plann Reprod Health Care.* 2009; **35**(3): 181-5.
45. Escobar-Morreale HF, Botella-Carretero JJ, Alvarez-Blasco F, et al. The polycystic ovary syndrome associated with morbid obesity may resolve after weight loss induced by bariatric surgery. *J Clin Endocrinol Metab.* 2005; **90**(12): 6364-9.
46. O'Connor A, Gibney J, Roche HM. Metabolic and hormonal aspects of polycystic ovary syndrome: the impact of diet. *Proc Nutr Soc.* 2010; **69**(4): 628-35.
47. Boomsma CM, Eijkemans MJ, Hughes EG, et al. A meta-analysis of pregnancy outcomes in women with polycystic ovary syndrome. *Hum Reprod Update.* 2006; **12**(6): 673-83.
48. He M, Stubbs R. Gastric bypass surgery for severe obesity: what can be achieved? *N Z Med J.* 2004; **117**(1207): U1207.
49. Ong CW, O'Driscoll DM, Truby H, et al. The reciprocal interaction between obesity and obstructive sleep apnoea. *Sleep Med Rev.* 2013; **17**(2): 123-31.
50. Gasa M, Salord N, Fortuna AM, et al. Obstructive sleep apnoea and metabolic impairment in severe obesity. *Eur Respir J.* 2011; **38**(5): 1089-97.
51. Young T, Palta M, Dempsey J, et al. The occurrence of sleep-disordered breathing among middle-aged adults. *N Engl J Med.* 1993; **328**(17): 1230-5.
52. Pontiroli AE, Morabito A. Long-term prevention of mortality in morbid obesity through bariatric surgery. a systematic review and meta-analysis of trials performed with gastric banding and gastric bypass. *Ann Surg.* 2011; **253**(3): 484-7.
53. Sjostrom L, Lindroos AK, Peltonen M, et al. Lifestyle, diabetes, and cardiovascular risk factors 10 years after bariatric surgery. *N Engl J Med.* 2004; **351**(26): 2683-93.

54. Sjostrom L, Narbro K, Sjostrom CD, et al. Effects of bariatric surgery on mortality in Swedish obese subjects. *N Engl J Med*. 2007; **357**(8): 741-52.
55. Plecka Ostlund M, Marsk R, Rasmussen F, et al. Morbidity and mortality before and after bariatric surgery for morbid obesity compared with the general population. *Br J Surg*. 2011; **98**(6): 811-6.
56. Thaler JP, Cummings DE. Minireview: Hormonal and metabolic mechanisms of diabetes remission after gastrointestinal surgery. *Endocrinology*. 2009; **150**(6): 2518-25.
57. Atlantis E, Ball K. Association between weight perception and psychological distress. *Int J Obes (Lond)*. 2008; **32**(4): 715-21.
58. Derenne JL, Beresin EV. Body image, media, and eating disorders. *Acad Psychiatry*. 2006; **30**(3): 257-61.
59. Luppino FS, de Wit LM, Bouvy PF, et al. Overweight, obesity, and depression: a systematic review and meta-analysis of longitudinal studies. *Arch Gen Psychiatry*. 2010; **67**(3): 220-9.
60. Kessler RC, Wang PS. The descriptive epidemiology of commonly occurring mental disorders in the United States. *Annu Rev Public Health*. 2008; **29**: 115-29.
61. Alloway R, Bebbington P. The buffer theory of social support--a review of the literature. *Psychol Med*. 1987; **17**(1): 91-108.
62. Cairney J, Corna LM, Veldhuizen S, et al. The social epidemiology of affective and anxiety disorders in later life in Canada. *Can J Psychiatry*. 2008; **53**(2): 104-11.
63. Sareen J, Cox BJ, Clara I, et al. The relationship between anxiety disorders and physical disorders in the U.S. National Comorbidity Survey. *Depress Anxiety*. 2005; **21**(4): 193-202.
64. Sareen J, Jacobi F, Cox BJ, et al. Disability and poor quality of life associated with comorbid anxiety disorders and physical conditions. *Arch Intern Med*. 2006; **166**(19): 2109-16.
65. Vink D, Aartsen MJ, Schoevers RA. Risk factors for anxiety and depression in the elderly: a review. *J Affect Disord*. 2008; **106**(1-2): 29-44.
66. Garipey G, Nitka D, Schmitz N. The association between obesity and anxiety disorders in the population: a systematic review and meta-analysis. *Int J Obes (Lond)*. 2010; **34**(3): 407-19.
67. Puhl RM, Heure CA. The Stigma of Obesity: A Review and Update. *Obesity*. 2009; (5): 941-64.
68. Puhl R, Brownell KD. Bias, discrimination, and obesity. *Obes Res*. 2001; **9**(12): 788-805.
69. Puhl R, Brownell KD. Ways of coping with obesity stigma: review and conceptual analysis. *Eat Behav*. 2003; **4**(1): 53-78.
70. Teachman BA, Gapinski KD, Brownell KD, et al. Demonstrations of implicit anti-fat bias: the impact of providing causal information and evoking empathy. *Health Psychol*. 2003; **22**(1): 68-78.
71. Roehling MV. Weight-based discrimination in employment: psychological and legal aspects. *Personnel Psychology*. 1999; **52**(4): 969-1016.

72. Byers T, Sedjo RL. Public health response to the obesity epidemic: too soon or too late? *J Nutr.* 2007; **137**(2): 488-92.
73. US Preventive Service Task Force. Screening for obesity in adults: recommendations and rationale. *Ann Intern Med.* 2003; **139**(11): 930-2.
74. U.S. Department of Health and Human Services. Dietary guideline for Americans, 2010. 2010 [cited 16.01.2013]; Available from: <http://www.cnpp.usda.gov/dietaryguidelines.htm>
75. Kushi LH, Doyle C, McCullough M, et al. American Cancer Society Guidelines on nutrition and physical activity for cancer prevention: reducing the risk of cancer with healthy food choices and physical activity. *CA Cancer J Clin.* 2012; **62**(1): 30-67.
76. Lauber RP, Sheard NF. The American Heart Association Dietary Guidelines for 2000: a summary report. *Nutr Rev.* 2001; **59**(9): 298-306.
77. Klein S, Sheard NF, Pi-Sunyer X, et al. Weight management through lifestyle modification for the prevention and management of type 2 diabetes: rationale and strategies: a statement of the American Diabetes Association, the North American Association for the Study of Obesity, and the American Society for Clinical Nutrition. *Diabetes Care.* 2004; **27**(8): 2067-73.
78. Nicklas TA, Hayes D. Position of the American Dietetic Association: nutrition guidance for healthy children ages 2 to 11 years. *J Am Diet Assoc.* 2008; **108**(6): 1038-44, 46-7.
79. Krebs NF, Jacobson MS. Prevention of pediatric overweight and obesity. *Pediatrics.* 2003; **112**(2): 424-30.
80. Institute of Medicine. Preventing Childhood Obesity: Health in the Balance: The National Academies Press; 2005.
81. World Health Organization. Global strategy on diet, physical activity, and health. 2004 [cited 16.01.2013]; Available from: http://www.who.int/dietphysicalactivity/strategy/eb11344/strategy_english_web.pdf
82. Katz DL, O'Connell M, Yeh MC, et al. Public health strategies for preventing and controlling overweight and obesity in school and worksite settings: a report on recommendations of the Task Force on Community Preventive Services. *MMWR Recomm Rep.* 2005; **54**(RR-10): 1-12.
83. Macdonald IA, Atkinson R. Public health initiatives in obesity prevention: the need for evidence-based policy. *Int J Obes (Lond).* 2011; **35**(4): 463.
84. van Hout GC, Jakimowicz JJ, Fortuin FA, et al. Weight loss and eating behavior following vertical banded gastroplasty. *Obes Surg.* 2007; **17**(9): 1226-34.
85. Dixon JB, le Roux CW, Rubino F, et al. Bariatric surgery for type 2 diabetes. *Lancet.* 2012; **379**(9833): 2300-11.
86. Department of Surgery UoF. Bariatrics Program - Roux-en-Y Gastric Bypass. 13.02.2008 [cited 04.02.2013]; Available from: <http://159.178.78.102/Bariatrics/rouxenY.asp>
87. Buchwald H, Estok R, Fahrenbach K, et al. Trends in mortality in bariatric surgery: a systematic review and meta-analysis. *Surgery.* 2007; **142**(4): 621-32; discussion 32-5.
88. Flum DR, Belle SH, King WC, et al. Perioperative safety in the longitudinal assessment of bariatric surgery. *N Engl J Med.* 2009; **361**(5): 445-54.

89. Karlsson J, Taft C, Rydén A, et al. Ten-year trends in health-related quality of life after surgical and conventional treatment for severe obesity: the SOS intervention study. *International Journal of Obesity*. 2007; **31**: 1248-61.
90. Norris SL, Zhang X, Avenell A, et al. Efficacy of pharmacotherapy for weight loss in adults with type 2 diabetes mellitus: a meta-analysis. *Arch Intern Med*. 2004; **164**(13): 1395-404.
91. Yoong SL, Carey M, Sanson-Fisher R, et al. A systematic review of behavioural weight-loss interventions involving primary-care physicians in overweight and obese primary-care patients (1999-2011). *Public Health Nutr*. 2012: 1-17.
92. Norris SL, Zhang X, Avenell A, et al. Long-term non-pharmacological weight loss interventions for adults with prediabetes. *Cochrane Database Syst Rev*. 2005; (2): CD005270.
93. Kaukua J, Pekkarinen T, Sane T, et al. Health-related quality of life in obese outpatients losing weight with very-low-energy diet and behaviour modification--a 2-y follow-up study. *Int J Obes Relat Metab Disord*. 2003; **27**(10): 1233-41.
94. Buddeberg-Fischer B, Klaghofer R, Krug L, et al. Physical and psychosocial outcome in morbidly obese patients with and without bariatric surgery: a 4 1/2-year follow-up. *Obes Surg*. 2006; **16**(3): 321-30.
95. Mathus-Vliegen EM. Long-term health and psychosocial outcomes from surgically induced weight loss: results obtained in patients not attending protocolled follow-up visits. *Int J Obes (Lond)*. 2007; **31**(2): 299-307.
96. van Hout GC, Boekestein P, Fortuin FA, et al. Psychosocial functioning following bariatric surgery. *Obes Surg*. 2006; **16**(6): 787-94.
97. Sarwer DB, Wadden TA, Fabricatore AN. Psychosocial and behavioral aspects of bariatric surgery. *Obes Res*. 2005; **13**(4): 639-48.
98. Andersen JR, Aasprang A, Bergsholm P, et al. Anxiety and depression in association with morbid obesity: changes with improved physical health after duodenal switch. *Health Qual Life Outcomes*. 2010; **8**: 52.
99. Legenbauer T, De Zwaan M, Benecke A, et al. Depression and anxiety: their predictive function for weight loss in obese individuals. *Obes Facts*. 2009; **2**(4): 227-34.
100. Karlsson J, Taft C, Sjostrom L, et al. Psychosocial functioning in the obese before and after weight reduction: construct validity and responsiveness of the Obesity-related Problems scale. *Int J Obes Relat Metab Disord*. 2003; **27**(5): 617-30.
101. Beck AT, Ward CH, Mendelson M, et al. An inventory for measuring depression. *Arch Gen Psychiatry*. 1961; **4**: 561-71.
102. Beck AT, Steer RA, Brown GK. BDI-II, Beck depression inventory : manual. San Antonio, Tex.; Boston: Psychological Corp. ; Harcourt Brace; 1996.
103. Beck AT, Epstein N, Brown G, et al. An inventory for measuring clinical anxiety: psychometric properties. *J Consult Clin Psychol*. 1988; **56**(6): 893-7.
104. Krukowski RA, Friedman KE, Applegate KL. The utility of the Beck Depression Inventory in a bariatric surgery population. *Obes Surg*. 2010; **20**(4): 426-31.

105. Hannesdottir SH, Gudmundsson LA, Johannsson E. [Health-related quality of life during a clinical behavior weight loss intervention therapy]. *Laeknabladid*. 2011; **97**(11): 597-602.
106. Njalsdottir A. [Results of obesity treatment in Reykjalundur with or without gastric bypass surgeries, 2-year follow-up] [Cand.Psych]. Reykjavik: University of Iceland; 2011.
107. Fridfinnsdottir ER, Palsdottir S. Mental health of individuals in obesity treatment at Reykjalundur and after gastric bypass surgery. Reykjavik: University of Iceland; 2008.
108. Offitu- og næringarsvið. [cited 17.01.2013]; Available from: <http://reykjalundur.is/sjuklingar-og-adstandendur/offitu--og-naeringarsvid/>
109. Gudmundsson LA. Reykjalundur Modellen. Landspítali & Reykjalundur; 2010.

Article

To be submitted to BMJ

The effects of intensive behavioural obesity treatment with or without surgical intervention on weight loss and mental health

3 – 4 year follow up

Marianna Þórðardóttir,¹ Unnur Valdimarsdóttir,^{1,2} Arna Hauksdóttir,¹ Thor Aspelund,¹ Ludvig Guðmundsson³

¹ Centre of Public Health Sciences, University of Iceland

² Department of Epidemiology, Harvard School of Public Health, Boston, MA, USA

³ Reykjalundur rehabilitation centre

Correspondence: Marianna Þórðardóttir, Centre of Public Health Sciences, University of Iceland, Stapi v/Hringbraut, 101 Reykjavik, Iceland
mth5@hi.is

Abstract

Objective: To study the effect of intensive behavioural obesity treatment with or without Roux en Y gastric bypass surgery on depression, anxiety, obesity-related psychosocial problems and weight at 3-4 year follow-up.

Design: Prospective, non-randomized intervention study.

Setting: The obesity department at Reykjalundur rehabilitation centre, Iceland.

Participants: 120 patients completed a five week inpatient treatment from September 2007 to December 2008. At 3-4 year follow-up, 90 (75%) consented to participate.

Main outcome measures: Depression, anxiety, obesity-related psychosocial problems and weight.

Results: Three to four years post treatment we observed a reduction both in surgically and non-surgically treated patients' depression ($p<0.0001$), anxiety ($p<0.0001$), obesity-related psychosocial problems ($p<0.0001$) and weight ($p<0.0001$), compared to pre-intervention baseline data. Compared to non-surgically treated, surgically treated patients lost more weight ($p<0.0001$) and showed more improvements with respect to obesity-related psychosocial problems ($p<0.0001$). The magnitude of weight loss seemed to affect obesity-related psychosocial problems ($p<0.0001$), no such effects were observed for depression ($p=0.6059$) and anxiety ($p=0.7568$).

Conclusion: The findings of this study indicate that multidisciplinary intensive behavioural obesity treatment may have lasting positive impact on mental health and weight in morbidly obese individuals, irrespectively of whether they are surgically or non-surgically treated. Obesity is one of the most serious health crises of our time. Future studies should focus on long-term potential benefit of intense lifestyle interventions, in terms of individual health and societal benefits.

Introduction

Obesity is one of the most serious public health crises of our times. Due to increasing prevalence and health impact during the last decades, the World Health Organization officially declared obesity as a disease in 1998.¹ Overweight and obesity are today the fifth leading risks for global deaths and are linked to more deaths worldwide than underweight.² High BMI has indeed been found to be a risk factor for several causes of death including from ischemic heart diseases,³ stroke,⁴ and several types of cancer.^{5, 6} Obesity is furthermore strongly associated with several kinds of co-morbidity⁷ both physical, such as hypertension,⁸ arthritis,^{9, 10} sleep apnoea,¹¹ polycystic ovary syndrome,¹² and mental health problems^{13, 14} such as depression,¹⁵ anxiety disorders¹⁶ and psychosocial dysfunction.¹⁷ Unfortunately, interventions for obesity have yielded mixed results regarding weight loss and mental health improvements. Until now, surgical treatment along with behavioural treatment for obesity has been shown to be the most effective intervention for long-term beneficial results.¹⁸⁻²¹

The prevalence of obesity around the world has been increasing rapidly the past decades; the average prevalence in 2009 or nearest year for OECD countries was 17.2% for women and 16.7% for men.²² The prevalence of obesity in Iceland was in 2007 23% for men and 21% for women.²³ Using prospectively collected data from Reykjalundur - rehabilitation centre in Iceland, the aim of this study was firstly to investigate whether intensive behavioural treatment for obesity affects levels of depression, anxiety, obesity-related psychosocial problems and weight three to four years post treatment. Secondly, the aim was to determine if there is a difference between surgically treated subjects and non-surgically treated subjects.

Materials and methods

The treatment

At Reykjalundur - rehabilitation centre an interdisciplinary team of professionals has been treating patients for obesity since 2001, with approximately 100 patients completing treatment every year. The centre practices multi-disciplinary treatment for its patients. The treatment comprises of an intensive behavioural obesity treatment for severely obese individuals (BMI ≥ 35 kg/m²) and includes education on nutrition, exercise and other factors related to obesity. Physical education is a big part of the treatment, as well as focus on self-image, relaxation and planning on daily life schedule with the aim of improving quality of life. Despite the fact that

this is a group treatment it is also individually based and the patients have access to support from a psychologist, nutritionist, physical therapist and other support when needed.

Certain criteria need to be met before starting treatment at Reykjalundur, including: Suffer from severe obesity ($\text{BMI} \geq 35 \text{ kg/m}^2$), having referral from a doctor, be able to follow the treatment program and to show intention to work with lifestyle changes. Lastly, smokers are required to quit smoking and alcohol or drug abusers are required to be abstinent.

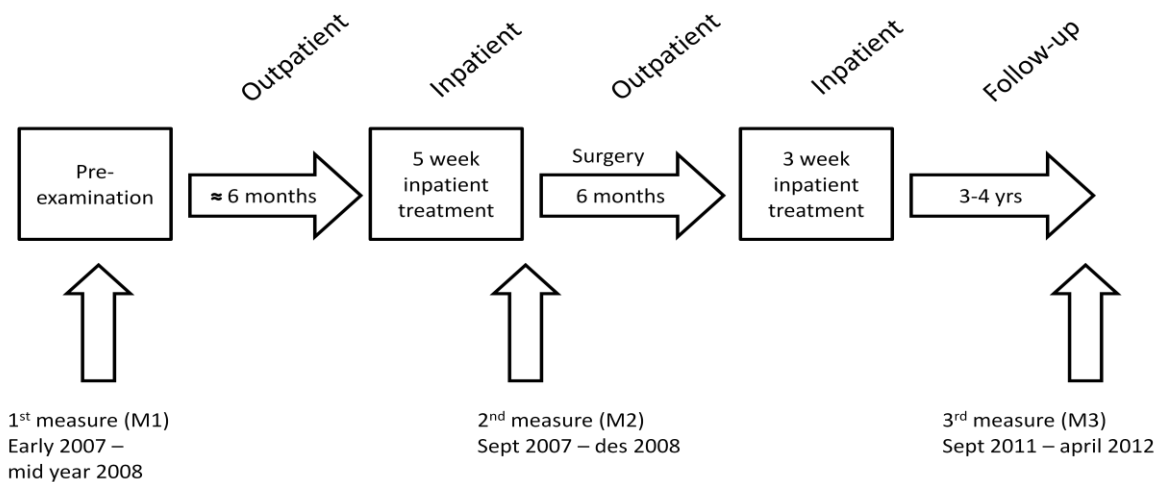


Figure 1: Timeframe of the study. Routine measures, not used in this study, are additionally performed at beginning of 5 week inpatient treatment, at the end of the 3 week inpatient treatment and at 1 and 2 year follow-up

The treatment starts with pre-examination followed by an outpatient treatment where the patient is required to lose 6-8% of his initial body weight to get further on in the treatment. During the outpatient treatment the patient is invited to get support from professionals every two or three weeks. The inpatient treatment is initiated when the patient has reached the required weight loss minimum. The inpatient treatment is divided into two periods. The first period is five weeks and the second is three weeks, with approximately six months in between. During that period the patients come in for one visit in groups, and they can get additional private support from members of the obesity treatment team if needed. The patient is then invited for a follow-up every six months for two years. Mental evaluation using various assessment scales and physical measures are performed six times throughout the treatment and follow-up period, starting at the pre-examination. Timeframe of the treatment including information regarding time of measures for this study are presented in figure 1.

Study design and participants

This study was a prospective non randomized intervention study. Measures on depression, anxiety, obesity-related psychosocial problems and weight were collected at three time points and additional background information was collected at the 3-4 year follow up (see figure 1).

The study population was defined by the time they finished the 5 week inpatient treatment. Patients finishing from September 2007 through December 2008 were invited to participate (N=127). Seven were excluded prior to the 3-4 year follow-up; two due to death, four were living abroad and one could not be found. At the 3-4 year follow up, 120 individuals were invited for assessment, of them, 90 individuals (75%) agreed to participate. 47 (52,2%) of them had underwent Roux en Y gastric bypass surgery at Landspítali – University Hospital of Iceland (LSH), during the treatment at Reykjalundur. A flowchart of the participants can be seen in figure 2.

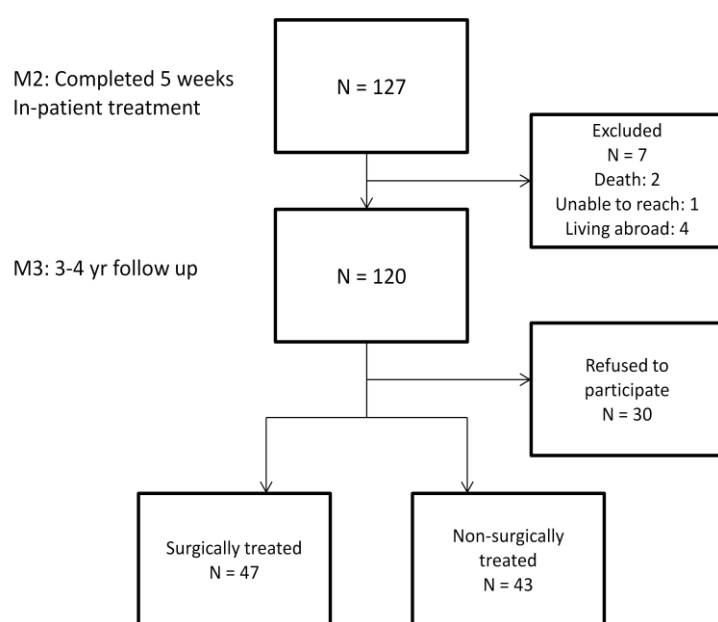


Figure 2: Flowchart of study participants. The study population was defined by the time the 5 week inpatient treatment was finished

Certain criteria need to be met if a patient chooses to undergo Roux en Y gastric bypass surgery at LSH. His BMI needs to be above 40 kg/m², but above 35 kg/m² if obesity-related co-morbidities i.e. type 2 diabetes, sleep apnoea, heart diseases and other diseases are present and are affected by the patient's weight. The patient's age must be between 18 – 65 years and he must have lost approximately 10% of his highest weight measured in the past 2 years. The patient must be mentally stable, be capable of dealing with necessary lifestyle changes needed for a successful procedure outcome, understand the protocol of the procedure

and be able to follow guidelines. Lastly he needs to be a non-smoker and alcohol and drug abusers are required to be abstinent. The professionals at Reykjalundur assess whether a patient is eligible for a surgery based on above mentioned criteria.

Measures

Pre-examination measures (M1) were carried out approximately six months prior to the five week inpatient treatment (M2). The length between M1 and M2 was confined by the time it took the patient to lose 6-8% of his bodyweight. The patients were measured according to their order in line for treatment at Reykjalundur. The M2 measurements were carried out from September 2007 to December 2008. Professionals at Reykjalundur's nutrition and obesity department performed all measures at M1 and M2 which are a part of routine treatment at Reykjalundur and stored in Reykjalundur's database. The study researchers carried out all measures at the 3-4 year follow-up (M3) and collected M1 and M2 measures from Reykjalundur's database. The independent variable (exposure) for this study was the treatment at Reykjalundur with and without surgical intervention. The dependent variables (outcome) were weight, depression, anxiety and obesity-related psychosocial problems. Other measurements used were age, education, residency and marital and employment status measured at follow-up.

Beck's Depression Inventory (BDI II) was used for assessment on depression. BDI II was developed by Aaron T. Beck to measure the intensity, severity and depth of depression in individuals. Scores range from 0-63; 1-10 indicate ups and downs within normal range, 11-16 indicate mild mood disturbance, 17-20 indicate borderline clinical depression, 21-30 indicate moderate depression, 31-40 indicate severe depression and scores from 40 and above indicate extreme depression.²⁴ The scale had previously been translated to Icelandic and its psychometric properties reported.²⁵ For measurement of anxiety, Beck's Anxiety Inventory (BAI) was utilized. BAI is a 21 item self-report inventory for measuring the severity of anxiety. It was developed to address the need for an instrument that would reliably discriminate anxiety from depression while displaying convergent validity. Scores range from 0-63, where higher scores indicate more severe anxiety. A score of 0-7 is interpreted as minimal level of anxiety, 8-15 as mild, 16-25 as moderate and 26-63 as severe.²⁶ The scale had previously been translated to Icelandic and its psychometric properties reported.²⁷ For evaluating the impact of obesity on psychosocial functioning the Obesity-related Problem

Scale (OP-scale) was used. It is an obesity-specific measurement that includes eight questions concerning how bothered individuals are by their obesity in different aspect of their everyday life, such as attending social events, travelling and being part of intimate relations. Each question is scored on a scale from 1-4, considering how bothered individuals are by each social activity. Responses are presented on a scale from 0-100 where higher scores indicate more psychosocial dysfunction. 0-19 points indicate no or very mild limitations in psychosocial functioning, 20-39 mild impacts, 40-59 moderate impacts, 60-79 severe impacts and 80-100 extreme impacts.²⁸ The scale was translated in 2004 and its psychometric properties reported in 2005.²⁹

Statistical analysis

Summary statistics was used to investigate characteristics of the study population. Two sample t-test was performed to investigate difference between surgically treated and non-surgically treated subjects regarding background factors and baseline outcome. To investigate change in frequency in groups McNemar's test was used. Linear regression for repeated measures using a random subject effect (PROC MIXED) was used to investigate the relationship between exposures and outcomes. To investigate whether there was a difference in improvements between groups during treatment an interaction between the two treatment forms was examined. To investigate whether degree of weight loss affected improvements in depression, anxiety and obesity-related psychosocial problems more than lower weight loss an interaction between weight change and treatment was calculated. Adjustment was made for age and education, since these factors were the only background factors that were statistically different between the groups. Adjustment was additionally made for weight change to investigate the effect of the two modes of treatments on depression, anxiety and obesity-related psychosocial problems aside from the effect of weight loss. SAS Enterprise Guide 4.3 was used for statistical analysis.

Ethical considerations

Informed consent from each participant was collected prior to participation. Since this study involved sensitive measures on humans and the use of patients' medical record, permission from the Icelandic National Bioethics Committee (nr. VSNb2011060008/03.7) was applied

for and granted in September 2011. An additional permission from Reykjalundur's medical director was granted in August 2011. The Data Protection Authority was notified of the study.

Results

Of the 120 patients available for participation, a total of 90 individuals (75%) agreed to participated in the study, 81 women and 9 men, which reflects the ordinary gender distribution in obesity treatment at Reykjalundur. Average length between pre-examination measures (M1) and follow-up (M3) was 4.2 years and average length between measure 2 (M2) and M3 was 3.6 years. Average age at follow up was 44 years (range from 23 to 75 years). A total of 86 participants answered BDI II at M1, 83 at M2 and 89 at M3. 86 participants answered BAI at M1, 82 at M2 and 89 at M3. 84 participants answered the OP-scale at M1, 52 at M2 and 89 at M3. Weight was measured for all 90 individuals at all three time points. When contrasting background factors in the group undergoing surgery to the non-surgery group we found the surgery group to be younger ($p=0.0002$) and less likely to have finished higher education ($p=0.02$) (table 1). The two groups were otherwise similar with regard to gender, residence area and marital and employment status.

Change from baseline to follow up

During the study period, from M1 to M3, the participants experienced a decrease in their depression symptoms from a mean of 19.5 to 8.8 points ($p<0.0001$). A similar decrease in anxiety was noted among the participants from 12.5 to 6.5 points ($p<0.0001$), and their obesity-related psychosocial problems from 61.4 to 22 points ($p<0.0001$). At the 3-4 year follow up, depression in surgically treated subjects had decreased from a mean of 17.4 points to 6.7 ($p<0.0001$) and for the non-surgically treated subjects from 21.7 to 11.2 ($p<0.0001$). Anxiety decreased from a mean of 10.6 to 5.6 ($p<0.0001$) in surgically treated subjects and from 14.3 to 7.6 ($p<0.0001$) for the non-surgically treated subjects. Obesity-related psychosocial problems decreased from a mean of 61.5 to 10.5 ($p<0.0001$) in surgically treated subjects while the non-surgically treated subjects decreased from 61.4 to 34.8 ($p<0.0001$). Average weight at baseline was 123.7 kg. During the study period, the participants lost an average of 26.6 kg ($p<0.0001$) or 22% of their initial weight. The surgically treated subjects

lost 44.2 kg ($p<0.0001$) or 34% of their body weight while the non-surgically treated lost 7.4 kg ($p=0.0001$) or 6%. Detailed changes during the study period can be seen in table 2.

A significant improvement in depression was found from M1 to M2 for both surgically ($p<0.0001$) and non-surgically treated subjects ($p<0.0001$). There was a slight statistically significant ($p=0.02$) increase from M2 to M3 in the surgically treated group but not in the non-surgically treated group. Regarding anxiety a statistically significant ($p<0.0001$) improvement from M1 to M2 was found in both groups, but not a statistically significant change from M2 to M3 in neither groups. A significant ($p<0.0001$) improvement from M1 to M2 was found for both groups regarding obesity-related psychosocial problems, a significant improvement ($p<0.0001$) was also found from M2 to M3 in the surgically treated group while there was no change from M2 to M3 in the non-surgically treated group. Weight loss from M1 to M2 was significant ($p<0.0001$) in both groups. The weight loss was also significant ($p<0.0001$) from M2 to M3 in the surgically treated group but not in the non-surgically treated group. Changes in depression, anxiety, obesity-related psychosocial problems and weight from baseline to 3-4 year follow up between the three measurements carried out in the study can be seen in figure 3.

To investigate the effect of the treatments on depression, anxiety and obesity-related psychosocial problems irrespective of weight loss during treatment adjustment was made for weight change. The treatments continued to have a significant effect on these factors after the adjustment ($p<0.0001$). We further investigated whether degree of weight loss affected improvements in depression, anxiety and obesity-related psychosocial problems by examining interaction between weight change and treatment. Interaction between weight change and treatment was found in the model for obesity-related psychosocial problems ($p<0.0001$), but not for depression and anxiety, indicating that greater weight loss resulted in higher improvements in obesity-related psychosocial problems. We further investigated change in frequency of participants with high depression, anxiety and obesity-related psychosocial problems from M1 to M3. A decrease in frequency was noted for all outcomes. Further results can be seen in table 3.

Difference between groups

Baseline difference between groups in depression, anxiety, obesity-related psychosocial problems and weight can be seen table 2. Surgically treated subjects where on average 5.5

points lower in depression ($p=0.0002$) and 3.8 points lower in anxiety ($p=0.0071$) than non-surgically treated subjects throughout the study period when adjusting for age and education. To investigate whether there was a difference in improvement between groups during treatment an interaction between the two treatment forms was examined. A significant interaction was found for obesity-related psychosocial problems ($p<0.0001$) and weight ($p<0.0001$), reflecting that the surgically treated subjects were improving more in obesity-related psychosocial problems and losing more weight compared to the non-surgically treated subjects during the study period.

Discussion

Our findings suggest that multidisciplinary intensive behavioural obesity treatment has long-term effects on depression, anxiety, obesity-related psychosocial problems and weight, both for surgically and non-surgically treated individuals. The findings furthermore indicate that surgically treated subjects improve their obesity-related psychosocial problems more and loose more weight, compared to non-surgically treated subjects.

Weight

The surgically treated subjects lost 8% of their initial weight from baseline (M1) to second measure (M2) and continued to lose weight until the 3-4 year follow-up (M3), resulting in a total of 34% initial weight loss. The non-surgically treated subjects lost approximately 6% of their initial weight throughout the study period. At M2 all participants had gone through the same treatment form from baseline. The surgically treated subjects had their surgery between M2 and M3, approximately 3 years prior to M3. The difference in weight loss between surgically and non-surgically treated subjects throughout the study period was clear. Indeed gastric bypass surgeries have repeatedly been reported to be effective in weight loss.^{18, 21, 30} Previous studies on weight loss in surgically and non-surgically treated subjects have given mixed results,^{18, 21, 30-32} which can partly be explained by the difference in weight loss methods. However, most of the studies are in line with our findings and conclude that bariatric surgery is the optimal option for long-term weight loss for obese individuals.^{18, 21, 30} Although the weight loss of the surgically treated subjects was much higher, the weight loss

in the non-surgically treated subjects was also significant. Until now, long-term weight loss maintenance in non-surgically treated subjects has not been substantial according to studies on multiple weight loss methods.^{18, 32} In our study the non-surgically treated subjects lost 10% of their initial weight during the first 6 months of treatment, a slight non-significant regain was measured at the 3-4 year follow-up resulting in over 6% initial weight loss. Despite the regain, maintaining a weight loss for 3-4 years is satisfactory when compared to other studies^{18, 32} and is beneficial with regard to obesity related co-morbidities since studies have shown that a small weight loss can have a profound effect on co-morbidities and mortality.^{33, 34}

Mental health

During the treatment, depression improved for both surgically and non-surgically treated subjects. Although the non-surgically treated subjects had on average higher frequency of depressive symptoms compared to the surgically treated subjects throughout the study period the decrease of symptoms was the same in both groups. The surgical intervention, alongside the treatment, did thus not have an additional beneficial effect on depression.

Our findings are in line with previous findings from a two year follow-up on the same treatment,³⁵ but are only partially in line with the findings from the Swedish Obese Subjects intervention study (SOS study)¹⁸ which is a controlled longitudinal trial of the health effects of weight loss in 1276 severely obese individuals. Findings from a 10-year follow-up of the SOS study comparing surgically treated and non-surgically treated subjects indicated that depression improved significantly for both groups and that surgically treated subjects showed significantly better outcome, which was not found in our study. The difference in treatment approach between the two studies, like the intensity of the behavioural aspects of the treatments, can partly explain the difference in improvement and explain the inconsistency to our findings. A follow-up study by Buddeberg-Fischer and co-workers from 2006 on morbidly obese patients with and without bariatric surgery found that depressive symptoms in both surgically treated and non-surgically treated patients had decreased 4.5 years post treatment and that the improvements were the same in both groups.²¹ That is consistent with our findings.

Anxiety improved for both surgically treated and non-surgically treated individuals. Although the non-surgically treated subjects scored on average higher in anxiety than the surgically treated subjects throughout the study period (figure 3) the improvements were the

same in both groups indicating that the surgical intervention along with the support provided alongside the procedure did not have an additional effect on anxiety. Result from other studies on the relationship between obesity and anxiety have been mixed. Our findings are in line with the findings from the SOS study, that anxiety decreases for both surgically and non-surgically treated subjects and that there is no difference between the groups regarding these improvements.¹⁸ However, the results from a two year follow-up study from 2010 found that the obesity intervention did not have an effect on anxiety³⁵ and the same was found in the 2006 follow-up study by Buddeberg-Fischer and co-workers.²¹ The inconsistency could be caused by the difference in treatment or research approach, including differences in follow-up times. A meta-analysis from 2010, including both prospective and cross-sectional studies on the relationship between anxiety and obesity published from 1962 – 2009, found that the relationship was inconsistent and that a causal relationship from obesity to anxiety could not be inferred.¹⁶

Weight loss did not have an effect on improvements in depression nor anxiety. It could therefore be interpreted that other factors such as the therapeutic effect of taking part in a weight loss program, increased contact with health care professionals and increased physical activity promoted by behavioural modification might be an explanatory factor of improved mental health, not only the weight loss as such.

The improvements in obesity-related psychosocial problems were not the same in both intervention groups; the surgically treated subjects improved significantly more than the non-surgically treated subjects indicating that the two treatment forms, behavioural treatment without surgery versus behavioural treatment with surgery, affected the two groups differently. The improvements in obesity-related psychosocial problems between M2 and M3 indicate an additional effect of the surgery (through additional weight loss), which was not found for depression and anxiety. Previous studies on surgically and non-surgically treated subjects have obtained similar results. The two year follow-up study by Njalsdottir and co-workers found that both surgically and non-surgically treated improved their obesity-related psychosocial problems and that the surgically treated improved more than the non-surgically treated.³⁵ The same was found at the 10 year follow-up in the SOS study.¹⁸ A two year follow-up study from 2003³² on obese outpatients losing weight with very-low-energy diet and behaviour modification without surgery found that OP scores dropped from baseline to end of group treatment and that these improvements were maintained at two year follow-up as can be found at the follow-up for the non-surgically treated in our study.

When investigating the effect of weight loss on mental health improvements we found that weight loss affected improvements in obesity-related psychosocial problems. That is coherent with previously mentioned studies.^{18, 32} It can be inferred that in addition to weight loss, that a multidisciplinary group based behavioural treatment does contribute towards improving obesity-related psychosocial problem of morbidly obese treatment seeking patients with and without surgical intervention.

It should be kept in mind that although the participants received the same treatment at Reykjalundur an additional support with weight loss and nutrition is provided by health care professional for the surgically treated at LSH after the surgery. The patients are also able to get support with complications of the surgery, mostly related to nutrition but also because of other discomfort. That could partly explain the difference in improvements in obesity-related psychosocial problems between the two groups, although it did not have an effect on depression nor anxiety.

Strengths and limitations

The main strengths of the study include a clearly defined cohort and high participation rate (75%). Another strength of the study was utilization of established measurement tools: Weight was measured by a health care professional throughout the study period and all mental health assessment scales are widely used and validated in their original language and in Icelandic.

Regarding potential limitations of the study it should be stressed that participants were not randomized in surgery vs. non-surgery groups. The participants decided themselves if they wanted to undergo Roux en Y gastric bypass surgery or not and some participants were unwillingly in the non-surgery group because of not qualifying for a surgery based on procedure criteria. Yet, the two groups (surgically and non-surgically treated) were similar with regards to background factors, and we adjusted our models for factors that were not evenly distributed. Secondly, participants of the study are selected based on previously listed treatment requirements which limits generalization of results and should be kept in mind in all interpretation and comparison. Only 9 out of 90 participants were men, which represents the gender distribution at Reykjalundur, and the results should therefore not be generalized for men. Lastly, in studies on patient's success in weight loss, selective loss to follow-up may

occur in a way that those who are doing well participate and those who have regained weight drop-out.

Conclusion

To conclude, the findings of this study indicate that multidisciplinary intensive behavioural obesity treatment may have long-term effect on mental health outcomes and weight for both surgically and non-surgically treated morbidly obese individuals. Future studies should focus on whether this effect persists for even longer period of time, which may give a clearer picture of the effectiveness of such treatment. Obesity is one of the most serious health crises of our time and causes societies increased costs, decreased quality of life and premature death. Although the value of prevention and public health actions is indisputable, the need for effective treatments is necessary for those already suffering from obesity.

Acknowledgements

We would like to thank Reykjalundur - rehabilitation centre for their support and co-operation during the period of this study and for granting us the access to the valuable data utilized in this study.

Funding

This study was funded through a grant from Reykjalundur - rehabilitation centre. The funding source had no influence on the design, analysis or reporting of this study.

Disclosure of interest

No conflicts of interest are declared.

Contribution to authorship

MP, LG and UV designed the study. MP and LG gathered the data and MP and TA did the statistical analysis. MP wrote the article which was critically revised by all authors, who also approved the final report.

Details of ethical approval

The study was approved by the Icelandic National Bioethics Committee (VSNb2011060008/03.7). The Data Protection Authority was notified of the study.

References

1. WHO. Obesity: Preventing and managing the global epidemic. Geneva: WHO Technical Report Series, No. 894; 2000.
2. WHO. Obesity and overweight: Fact sheet N°311. World Health Organization; 2011.
3. Manson JE, Colditz GA, Stampfer MJ, et al. A prospective study of obesity and risk of coronary heart disease in women. *N Engl J Med*. 1990; 322(13): 882-9.
4. Song YM, Sung J, Davey Smith G, et al. Body mass index and ischemic and hemorrhagic stroke: a prospective study in Korean men. *Stroke*. 2004; 35(4): 831-6.
5. Calle EE, Rodriguez C, Walker-Thurmond K, et al. Overweight, obesity, and mortality from cancer in a prospectively studied cohort of U.S. adults. *N Engl J Med*. 2003; 348(17): 1625-38.
6. Reeves GK, Pirie K, Beral V, et al. Cancer incidence and mortality in relation to body mass index in the Million Women Study: cohort study. *BMJ*. 2007; 335(7630): 1134.
7. Whitlock G, Lewington S, Sherliker P, et al. Body-mass index and cause-specific mortality in 900 000 adults: collaborative analyses of 57 prospective studies. *Lancet*. 2009; 373(9669): 1083-96.
8. Plecka Ostlund M, Marsk R, Rasmussen F, et al. Morbidity and mortality before and after bariatric surgery for morbid obesity compared with the general population. *Br J Surg*. 2011; 98(6): 811-6.
9. Busija L, Buchbinder R, Osborne RH. Quantifying the impact of transient joint symptoms, chronic joint symptoms, and arthritis: a population-based approach. *Arthritis Rheum*. 2009; 61(10): 1312-21.
10. Toivanen AT, Heliovaara M, Impivaara O, et al. Obesity, physically demanding work and traumatic knee injury are major risk factors for knee osteoarthritis--a population-based study with a follow-up of 22 years. *Rheumatology (Oxford)*. 2010; 49(2): 308-14.
11. Ong CW, O'Driscoll DM, Truby H, et al. The reciprocal interaction between obesity and obstructive sleep apnoea. *Sleep Med Rev*. 2013; 17(2): 123-31.
12. Salehi M, Bravo-Vera R, Sheikh A, et al. Pathogenesis of polycystic ovary syndrome: what is the role of obesity? *Metabolism*. 2004; 53(3): 358-76.
13. Atlantis E, Ball K. Association between weight perception and psychological distress. *Int J Obes (Lond)*. 2008; 32(4): 715-21.
14. Derenne JL, Beresin EV. Body image, media, and eating disorders. *Acad Psychiatry*. 2006; 30(3): 257-61.
15. Luppino FS, de Wit LM, Bouvy PF, et al. Overweight, obesity, and depression: a systematic review and meta-analysis of longitudinal studies. *Arch Gen Psychiatry*. 2010; 67(3): 220-9.
16. Garipey G, Nitka D, Schmitz N. The association between obesity and anxiety disorders in the population: a systematic review and meta-analysis. *Int J Obes (Lond)*. 2010; 34(3): 407-19.
17. Puhl RM, Heure CA. The Stigma of Obesity: A Review and Update. *Obesity*. 2009; (5): 941-64.

18. Karlsson J, Taft C, Rydén A, et al. Ten-year trends in health-related quality of life after surgical and conventional treatment for severe obesity: the SOS intervention study. *International Journal of Obesity*. 2007; 31: 1248-61.
19. van Hout GC, Boekestein P, Fortuin FA, et al. Psychosocial functioning following bariatric surgery. *Obes Surg*. 2006; 16(6): 787-94.
20. Sarwer DB, Wadden TA, Fabricatore AN. Psychosocial and behavioral aspects of bariatric surgery. *Obes Res*. 2005; 13(4): 639-48.
21. Buddeberg-Fischer B, Klaghofer R, Krug L, et al. Physical and psychosocial outcome in morbidly obese patients with and without bariatric surgery: a 4 1/2-year follow-up. *Obes Surg*. 2006; 16(3): 321-30.
22. OECD. Obesity Update 2012. Paris: Organisation for Economic Co-operation and Development (OECD) 2012.
23. Thorsson B, Aspelund T, Harris TB, et al. [Trends in body weight and diabetes in forty years in Iceland]. *Laeknabladid*. 2009; 95(4): 259-66.
24. Beck AT, Ward CH, Mendelson M, et al. An inventory for measuring depression. *Arch Gen Psychiatry*. 1961; 4: 561-71.
25. Arnarson TO, Olason DT, Smari J, et al. The Beck Depression Inventory Second Edition (BDI-II): psychometric properties in Icelandic student and patient populations. *Nord J Psychiatry*. 2008; 62(5): 360-5.
26. Beck AT, Epstein N, Brown G, et al. An inventory for measuring clinical anxiety: psychometric properties. *J Consult Clin Psychol*. 1988; 56(6): 893-7.
27. Saemundsson B. [Psychometric properties of the Icelandic version of Beck's Anxiety Inventory] Reykjavik: University of Iceland; 2009.
28. Karlsson J, Taft C, Sjostrom L, et al. Psychosocial functioning in the obese before and after weight reduction: construct validity and responsiveness of the Obesity-related Problems scale. *Int J Obes Relat Metab Disord*. 2003; 27(5): 617-30.
29. Kristjansson K, Gudmundsson LA. [Translation and testing of a quality of life scale that deals with problems related to obesity, Obesity-related Problem Scale (OP)] Víðindagur Reykjalundar; 2005 18.11.2005; Mosfellsbær: Reykjalundur; 2005.
30. Mathus-Vliegen EM. Long-term health and psychosocial outcomes from surgically induced weight loss: results obtained in patients not attending protocolled follow-up visits. *Int J Obes (Lond)*. 2007; 31(2): 299-307.
31. Yoong SL, Carey M, Sanson-Fisher R, et al. A systematic review of behavioural weight-loss interventions involving primary-care physicians in overweight and obese primary-care patients (1999-2011). *Public Health Nutr*. 2012: 1-17.
32. Kaukua J, Pekkarinen T, Sane T, et al. Health-related quality of life in obese outpatients losing weight with very-low-energy diet and behaviour modification--a 2-y follow-up study. *Int J Obes Relat Metab Disord*. 2003; 27(10): 1233-41.
33. Birks S, Peeters A, Backholer K, et al. A systematic review of the impact of weight loss on cancer incidence and mortality. *Obes Rev*. 2012; 13(10): 868-91.
34. Larsson UE. Influence of weight loss on pain, perceived disability and observed functional limitations in obese women. *Int J Obes Relat Metab Disord*. 2004; 28(2): 269-77.

35. Njalsdottir A. [Results of obesity treatment in Reykjalundur with or without gastric bypass surgeries, 2-year follow-up] [Cand.Psych]. Reykjavik: University of Iceland; 2011.

Table 1: Characteristics of the surgically and non-surgically treated subjects at Reykjalundur - rehabilitation centre. Collected at the 3-4 year follow-up.

	<i>Treatment with surgery (n = 47)</i>	<i>Treatment without surgery (n = 43)</i>	<i>Difference between groups P-value*</i>
<i>Age (mean years)</i>	41.9	47.0	0.0002
<i>Gender n (%)</i>			NS
Male	4 (8.51%)	5 (11.63%)	
Female	43 (91.49%)	38 (88.37%)	
<i>Residence n (%)</i>			NS
Capital area	35 (74.47%)	29 (67.44%)	
Rural area	12 (25.53%)	13 (30.23%)	
Abroad	0 (0.00%)	1 (2.33%)	
<i>Education n (%)</i>			0.02
Primary education	17 (36.17%)	10 (23.81%)	
Secondary education	17 (36.17%)	16 (38.10%)	
Higher education	13 (27.66%)	16 (38.10%)	
<i>Marital status n (%)</i>			NS
Married	23 (48.94%)	17 (40.48%)	
Unmarried/divorced/widow	12 (25.53%)	17 (40.48%)	
Cohabiting	12 (25.53%)	8 (19.05%)	
<i>Employment n (%)</i>			NS
Fully employed	25 (53.19%)	18 (42.86%)	
Partly employed	6 (12.77%)	7 (16.67%)	
Unemployed	0 (0.00%)	1 (2.38%)	
Disabled	10 (21.28%)	11 (26.19%)	
Student	6 (12.77%)	5 (11.90%)	

*P-value is based on two sample t-test. Differences in denominator is due to missing internal.

Table 2: Depression, anxiety, obesity-related psychosocial problems and weight before treatment and at 3-4 year follow-up at Reykjalundur - rehabilitation centre

	Treatment with surgery n = 47 Mean (s.d)	Treatment without surgery n = 43 Mean (s.d)	P-value [¥]	P-value [‡]
Depression				
Before intervention (M1)	17.4 (10.5)	21.7 (12.1)	NS	NS
3-4 year follow-up (M3)	6.7 (8.5)*	11.2 (10.4)*		
3-4 year change	10.7	10.5		
Anxiety				
Before intervention (M1)	10.6 (8.2)	14.3 (11.7)	NS	NS
3-4 year follow-up (M3)	5.6 (7.7)*	7.6 (7.9)*		
3-4 year change	5.0	6.7		
Obesity-related problems				
Before intervention (M1)	61.5 (21.2)	61.4 (21.9)	NS	<0.0001
3-4 year follow-up (M3)	10.5 (18.1)*	34.8 (29.0)*		
3-4 year change	51.0	26.6		
Body weight (kg)				
Before intervention (M1)	129.5 (19.3)	117.4 (18.6)	0.003	<0.0001
3-4 year follow-up (M3)	85.3 (15.4)*	110.0 (18.7)*		
3-4 year change	44.2	7.4		

¥ Baseline difference between groups. P-value is based on two sample t-test. *Change from baseline to follow up within groups adjusted for age and education significant at $p < 0.05$ using Proc Mixed

‡ Difference in improvement between groups adjusted for age and education using Proc Mixed.

Table 3: Frequency of patients with high depression, anxiety and obesity-related psychosocial problems before treatment (M1), during 5 week inpatient treatment (M2) and at 3-4 year follow-up (M3) at Reykjalundur - rehabilitation centre

	M1 n (%)	M2 n (%)	M3 n (%)	P-value*
Depression				
All	46 (54.1%)	3 (3.6%)	15 (17.7%)	<0.0001
Surgery	22 (50.0%)	0 (0.0%)	3 (6.8%)	<0.0001
Non-surgery	24 (60.0%)	3 (7.3%)	12 (30.0%)	0.0027
Anxiety				
All	28 (32.9%)	5 (6.1%)	12 (14.1%)	0.0025
Surgery	12 (27.3%)	0 (0.0%)	4 (9.1%)	0.0325
Non-surgery	16 (40.0%)	5 (12.5%)	8 (20.0%)	0.0325
Obesity-related problems				
All	70 (84.3%)	28 (53.9%)	16 (19.3%)	<0.0001
Surgery	37 (84.1%)	14 (48.3%)	3 (7.0%)	<0.0001
Non-surgery	33 (84.6%)	14 (60.9%)	13 (33.3%)	<0.0001

*Mcneamars test was used to test difference in frequency of participants with high depression, anxiety and obesity-related psychosocial problems between M1 and M3. Cut off for high depression was chosen at 17; borderline clinical depression. Cut off for high anxiety was chosen at 16; moderate anxiety. Cut off for high obesity-related psychosocial problems was chosen at 40; moderate impact on psychosocial functioning.

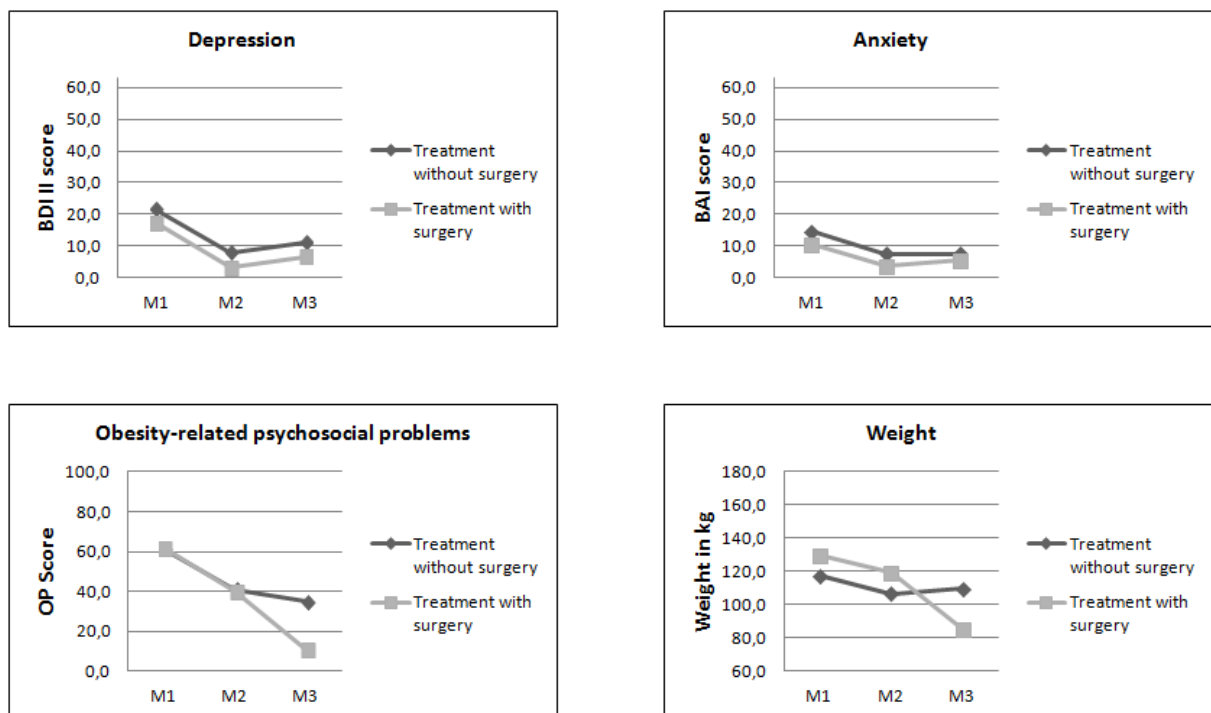


Figure 3: Trend in depression, anxiety, obesity-related psychosocial problems and weight in surgically and non-surgically treated patients at Reykjalundur-rehabilitation centre during the study period.

Appendix 1: Beck's Depression Inventory II

BDI®-II

Dagsetning:

Nafn: _____ Hjúskaparstaða: _____ Aldur: _____ Kyn: _____

Starf: _____ Menntun: _____

Leiðbeiningar: Spurningalisti þessi samanstendur af 21 flokki fullyrðinga. Vinsamlegast lestu hvern flokk vandlega og velð svo eina fullyrðingu í hverjum flokki sem lýsir best hvernig þér hefur liðið undanfarnar tvær vikur, að meðtöldum deginum í dag. Dragðu hring utan um númerið fyrir framan fullyrðinguna sem þú velur. Ef nokkrar fullyrðingar í hverjum flokki virðist eiga jafn vel við þig skaltu draga hring utan um hæstu töluna sem passar. Gættu þess að velja aðeins eina fullyrðingu innan hvers flokks að meðtöldum flokkum 16 (breyting á svefnmynstri) og 18 (breyting á mataræði).

<p>1. Depurð</p> <ul style="list-style-type: none"> 0 Mér finnst ég ekki vera döpur/dapur. 1 Mér finnst ég oft vera döpur/dapur. 2 Ég er alltaf döpur/dapur. 3 Ég er svo döpur/dapur og óhamingjusöm/óhamingjusamur að ég held það ekki út. <p>2. Svartsýni</p> <ul style="list-style-type: none"> 0 Ég er ekki vanmáttug/ur varðandi framtíðina. 1 Mér finnst ég vera vanmáttugri varðandi framtíðina en ég var áður. 2 Ég á ekki von á að hlutirnir gangi upp hjá mér. 3 Mér finnst framtíð mín vera vonlaus og hún muni einungis versna. <p>3. Fyrri mistök</p> <ul style="list-style-type: none"> 0 Ég upplifi mig ekki sem mistök. 1 Mér hefur mistekist meira en ég hefði átt að gera. 2 Þegar ég lít yfir farinn veg sé ég mörg mistök. 3 Mér finnst mér hafa mistekist algerlega sem manneskju. <p>4. Ánægjumissir</p> <ul style="list-style-type: none"> 0 Ég fæ jafn mikla ánægju og áður út úr hlutum sem ég hef gaman af. 1 Ég nýt ekki hlutanna eins mikið og ég gerði áður. 2 Ég fæ mjög litla ánægju út úr hlutum sem ég hafði áður gaman af. 3 Ég fæ enga ánægju út úr hlutum sem ég hafði áður gaman af. <p>5. Sektarkennd</p> <ul style="list-style-type: none"> 0 Ég finn enga sérstaka sektarkennd. 1 Ég finn til sektarkenndar yfir mörgum hlutum sem ég hef gert eða hefði átt að gera. 2 Ég finn oft fyrir sektarkennd. 3 Ég finn stöðugt fyrir sektarkennd. 	<p>6. Refsing</p> <ul style="list-style-type: none"> 0 Mér líður ekki eins og verið sé að refsá mér. 1 Mér líður eins og mér verði kannski refsáð. 2 Ég á von á því að mér verði refsáð. 3 Mér líður eins og verið sé að refsá mér. <p>7. Sjálfsfyrirlitning</p> <ul style="list-style-type: none"> 0 Ég sé sjálfa/n mig í sama ljósi og áður. 1 Ég hef misst sjálfstraust mitt. 2 Ég er vonsvikin/n með sjálfa/n mig. 3 Mig líkar ekki við sjálfa/n mig. <p>8. Sjálfsgagnrýni</p> <ul style="list-style-type: none"> 0 Ég gagnrýni ekki sjálfa/n mig né kenni sjálfri/sjálfum mér um meira en venjulega. 1 Ég er gagnrýnni á sjálfa/n mig en ég var. 2 Ég gagnrýni sjálfa/n mig fyrir alla galla mína. 3 Ég kenni sjálfri/sjálfum mér um allt slæmt sem gerist. <p>9. Sjálfsmorðshugsanir eða óskir</p> <ul style="list-style-type: none"> 0 Ég hugsa ekki um að fyrirfara mér. 1 Ég hugsa um að fyrirfara mér en ég myndi ekki framkvæma það. 2 Mig langar til að fyrirfara mér. 3 Ég myndi fyrirfara mér ef ég hefði tækifæri til þess. <p>10. Grátur</p> <ul style="list-style-type: none"> 0 Ég græt ekki meira en ég gerði áður. 1 Ég græt meira nú en áður. 2 Ég græt út af hverju sem er. 3 Mig langar til að gráta en ég get það ekki.
--	--

Heildarstig af síðu 1

Framhald á baksíðu

Beck Depression Inventory: Second Edition. Copyright © 1996 by Aaron T. Beck. Translated and reproduced by permission of the publisher, The Psychological Corporation, a Harcourt Assessment Company. All rights reserved.

Beck Depression Inventory: Second Edition. © Aaron T. Beck, 1996. Þýtt og endurgert með leyfi útgefanda, The Psychological Corporation, a Harcourt Assessment Company. Öll réttindi áskilin.

"Beck Depression Inventory" and "BDI" are U.S. registered trademarks of The Psychological Corporation.

"Beck Depression Inventory" og "BDI" eru skrásett vörumerki The Psychological Corporation í Bandaríkjunum.

0154018392

<p>11. Óróleiki</p> <p>0 Ég er ekki eirðarlausari eða uppspenntari en venjulega.</p> <p>1 Mér finnst ég vera eirðarlausari eða uppspenntari en venjulega.</p> <p>2 Ég er svo eirðarlaus eða pirruð/pirraður að það er erfitt að vera kyrr.</p> <p>3 Ég er svo eirðarlaus eða pirruð/pirraður að ég verð að vera á hreyfingu eða að gera eitthvað.</p> <p>12. Áhugaleysi</p> <p>0 Ég hef ekki misst áhuga á öðru fólki eða athöfnum.</p> <p>1 Ég hef minni áhuga á öðru fólki og athöfnum en áður.</p> <p>2 Ég hef misst mest allan áhuga á öðru fólki og athöfnum.</p> <p>3 Ég á erfitt með að fá áhuga á einhverju.</p> <p>13. Óákveðni</p> <p>0 Mér tekst jafn vel og áður að taka ákvarðanir.</p> <p>1 Mér finnst erfiðara að taka ákvarðanir en venjulega.</p> <p>2 Ég á mun erfiðara með að taka ákvarðanir en áður.</p> <p>3 Ég á erfitt með að taka allar ákvarðanir.</p> <p>14. Einskis virði</p> <p>0 Mér finnst ég ekki vera einskis virði.</p> <p>1 Mér finnst ég ekki vera jafn mikils virði og gagnleg/gagnlegur og áður fyrr.</p> <p>2 Mér finnst ég vera minna virði í samanburði við aðra.</p> <p>3 Mér finnst ég vera algjörlega einskis virði.</p> <p>15. Orkuleysi</p> <p>0 Ég hef jafn mikla orku og áður.</p> <p>1 Ég hef minni orku en ég hafði áður.</p> <p>2 Ég hef ekki næga orku til að gera mjög mikið.</p> <p>3 Ég hef ekki næga orku til að gera neitt.</p> <p>16. Breytingar á svefnmynstri</p> <p>0 Ég hef ekki upplifað neina breytingu á svefnmynstri mínu.</p> <p>1a Ég sef aðeins meira en venjulega.</p> <p>1b Ég sef aðeins minna en venjulega.</p> <p>2a Ég sef mikiu meira en venjulega.</p> <p>2b Ég sef miklu minna en venjulega.</p> <p>3a Ég sef mest allan daginn.</p> <p>3b Ég vakna 1-2 tímum fyrr en venjulega og get ekki sofnað aftur.</p>	<p>17. Pirringur</p> <p>0 Ég er ekki pirraðri en venjulega.</p> <p>1 Ég er pirraðri en venjulega.</p> <p>2 Ég er miklu pirraðri en venjulega.</p> <p>3 Ég er alltaf pirruð/pirraður.</p> <p>18. Breytingar á matarlýst</p> <p>0 Ég hef ekki upplifað neina breytingu á matarlýst minni.</p> <p>1a Matarlýst mín er svolítið minni en venjulega.</p> <p>1b Matarlýst mín er svolítið meiri en venjulega.</p> <p>2a Matarlýst mín er miklu minni en venjulega.</p> <p>2b Matarlýst mín er miklu meiri en venjulega.</p> <p>3a Ég hef alls enga matarlýst.</p> <p>3b Mig langar stöðugt í mat.</p> <p>19. Einbeitingarferðileikar</p> <p>0 Ég get einbeitt mér eins vel og áður.</p> <p>1 Ég get ekki einbeitt mér eins vel og venjulega.</p> <p>2 Ég á erfitt með að halda huganum við eitthvað í langan tíma.</p> <p>3 Ég finn að ég get ekki einbeitt mér við neitt.</p> <p>20. Preyta eða þrekleysi</p> <p>0 Ég er ekki þreyttari eða uppgefnari en áður.</p> <p>1 Ég verð fyrr þreyttari eða uppgefnari en áður.</p> <p>2 Ég er of þreytt/preyttur eða uppgefn/n til að gera marga hluti sem ég gerði áður fyrr.</p> <p>3 Ég er of þreytt/preyttur eða uppgefn/n til að gera flesta hluti sem ég gerði áður fyrr.</p> <p>21. Áhugaleysi á kynlífi</p> <p>0 Ég hef ekki tekið eftir neinni breytingu nýlega á áhuga mínum á kynlífi.</p> <p>1 Ég hef minni áhuga á kynlífi en áður.</p> <p>2 Ég hef miklu minni áhuga á kynlífi en áður.</p> <p>3 Ég hef misst allan áhuga á kynlífi.</p>
---	---

_____ Heildarstig af síðu 2

_____ Heildarstig af síðu 1

_____ Heildarstig samtals

789101112 ABC

Appendix 2: Beck's Anxiety Inventory

MÆLIKVARÐI BECKS Á KVÍÐA

Nafn _____ Dags. _____

Á eftirfarandi lista eru talin upp ýmis algeng einkenni kvíða. Viltu vinsamlega lesa hverja spurningu gaumgæfilega. Gefðu til kynna hve mikið hvert einkenni hefur angrað þig UNÐANFARNA VIKU, AÐ DEGINUM Í DAG MEÐTÖLDUM, með því að merkja (X) í viðeigandi dálk fyrir hvert einkenni.

		Alls ekki	Dálitið	Þó nokkuð	Mjög mikið
			það olli mér ekki áhyggjum	Óþægilegt en ég gat afborið það	Ég gat varla afborið það
1.	Dofi eða fiðringur	0	1	2	3
2.	Hitatilfinning	0	1	2	3
3.	Óstöðug(ur) á fótum	0	1	2	3
4.	Get ekki slakað á	0	1	2	3
5.	Óttast að hið versta geti hent	0	1	2	3
6.	Vönkuð/vankaður	0	1	2	3
7.	Þungur eða hraður hjartsláttur	0	1	2	3
8.	Reikull í spori	0	1	2	3
9.	Skelfingu lostin(n)	0	1	2	3
10.	Kvíðin(n)	0	1	2	3
11.	Köfnunartilfinning	0	1	2	3
12.	Skjálfti í höndum	0	1	2	3
13.	Titrandi	0	1	2	3
14.	Ótti við að missa stjórnina	0	1	2	3
15.	Erfiðleikar við öndun	0	1	2	3
16.	Ótti við að deyja	0	1	2	3
17.	Hræðsla	0	1	2	3
18.	Meltingartruflanir eða óþægindi í kviðarholi	0	1	2	3
19.	Yfirliðstilfinning	0	1	2	3
20.	Roði í andliti	0	1	2	3
21.	Að svitna (ekki vegna hita)	0	1	2	3

Heildareinkunn:

Appendix 3: Obesity-related Problem Scale

Veldur offitan þér óþægindum við eftirtaldar athafnir ?

Krossaðu í reitinn undir því svari sem á best við í þínu tilfelli.

	Miklum óþægindum	Nokkrum óþægindum	Engum teljandi óþægindum	Alls engum óþægindum
1. Að halda boð/samkvæmi á heimili mínu	1 <input type="checkbox"/>	2 <input type="checkbox"/>	3 <input type="checkbox"/>	4 <input type="checkbox"/>
2. Fara í boð/samkvæmi hjá vini eða ættingja	1 <input type="checkbox"/>	2 <input type="checkbox"/>	3 <input type="checkbox"/>	4 <input type="checkbox"/>
3. Fara út á veitingahús	1 <input type="checkbox"/>	2 <input type="checkbox"/>	3 <input type="checkbox"/>	4 <input type="checkbox"/>
4. Taka þátt í félagslífi, námskeiðum eða þvítíku	1 <input type="checkbox"/>	2 <input type="checkbox"/>	3 <input type="checkbox"/>	4 <input type="checkbox"/>
5. Ferðast í fríum	1 <input type="checkbox"/>	2 <input type="checkbox"/>	3 <input type="checkbox"/>	4 <input type="checkbox"/>
6. Máta og kaupa fót	1 <input type="checkbox"/>	2 <input type="checkbox"/>	3 <input type="checkbox"/>	4 <input type="checkbox"/>
7. Fara á almenna sundstaði (sundlaug, baðströnd o.s.frv)	1 <input type="checkbox"/>	2 <input type="checkbox"/>	3 <input type="checkbox"/>	4 <input type="checkbox"/>
8. Að stunda kynlíf með maka mínum	1 <input type="checkbox"/>	2 <input type="checkbox"/>	3 <input type="checkbox"/>	4 <input type="checkbox"/>
(Krossaðu hér ef þú ert ekki í sambúð)	1 <input type="checkbox"/>			

Appendix 4: Almennar spurningar (General questions)

Í spurningum 1-3 má merkja við fleiri en einn valmöguleika ef þörf er á.

1. Hver er menntun þín?

- ☐ Grunnskólamenntun
- ☐ Framhaldsskólamenntun/stúdentspróf
- ☐ Iðnnám
- ☐ Háskólamenntun

2. Hver er hjúskaparstaða þín í dag?

- ☐ Gift(ur)
- ☐ Ógift(ur)/ekki í sambúð
- ☐ Í sambúð
- ☐ Fráskilin(n)
- ☐ Ekkja/ekkill

3. Hver er staða þín á atvinnumarkaðnum?

- ☐ Í vinnu _____%
- ☐ Atvinnulaus
- ☐ Öryrki
- ☐ Í námi

Svaraðu eftirfarandi spurningum með því að merkja við einn svarmöguleika í hverri spurningu.

4. Fórst þú í magahjáveituaðgerð?

- ☐ Já Hvenær? Mánuður_____ ár_____
- ☐ Nei, óskaði ekki eftir því
- ☐ Nei, ég vildi fara en uppfyllti ekki skilyrði til að fara

5. Hafir þú farið í magahjáveituaðgerð, ertu ánægð(ur) með þá ákvörðun?

- ☐ Já
- ☐ Nei

6. Reyktir þú áður en þú byrjaðir í offitumeðferðinni á Reykjalundi?

- ☐ Já
- ☐ Nei

7. Ef já, hættir þú að reykja eftir að meðferð hófst á Reykjalundi?

- ☐ Já
- ☐ Nei

8. Reykir þú í dag?

- ☐ Já
- ☐ Nei

9. Stundaðir þú hreyfingu/líkamsþjálfun áður en meðferð hófst á Reykjalundi?

- ☐ Aldrei
- ☐ Sjaldan og óreglulega
- ☐ Einu sinni í viku
- ☐ 2-3 svar í viku
- ☐ 4-5 sinnum í viku
- ☐ 6-7 sinnum í viku

10. Stundar þú hreyfingu/líkamsrækt núna?

- ☐ Aldrei
- ☐ Sjaldan og óreglulega
- ☐ Einu sinni í viku
- ☐ 2-3 svar í viku
- ☐ 4-5 sinnum í viku
- ☐ 6-7 sinnum í viku

11. Ef þú stundar hreyfingu/líkamsrækt núna, hversu lengi varir hún í hvert skipti?

- ☐ 15-30 mínútur
- ☐ 31-45 mínútur
- ☐ 46-60 mínútur
- ☐ 61 mínútu eða meira

12. Ertu sátt(ur) við þann árangur hvað varðar þyngdartap sem þú náðir í meðferðinni á Reykjalundi?

- ☐ Mjög sátt(ur)
- ☐ Frekar sátt(ur)
- ☐ Hlutlaus
- ☐ Frekar ósátt(ur)
- ☐ Mjög ósátt(ur)

13. Ertu sátt(ur) við árangur (annan en þyngdartap) sem þú náðir í meðferðinni á Reykjalundi? (líkamleg, andleg líðan o.fl.)

- ☐ Mjög sátt(ur)
- ☐ Frekar sátt(ur)
- ☐ Hlutlaus
- ☐ Frekar ósátt(ur)
- ☐ Mjög ósátt(ur)

14. Myndir þú mæla með meðferðinni við aðra?

- ☐ Já
- ☐ Nei

15. Ef við á, hver er ástæða þess að þú komst ekki í boðaðan tíma í lokaendurkomu (2 ára endurkomu)?

- ☐ Komst ekki vegna vinnu/skóla
- ☐ Vegna fjarlægðar frá Reykjalundi (bý á landsbyggðinni, var erlendis)
- ☐ Vegna peningaleysis
- ☐ Vegna veikinda
- ☐ Fannst ég ekki þurfa þess, hefur gengið það vel
- ☐ Fannst ég ekki hafa verið nógu dugleg(ur) í lífsstílsbreytingu / hef þyngst
- ☐ Finnst endurkomurnar ekki hafa nýst mér
- ☐ Ég var ekki boðuð/boðaður í endurkomu
- ☐ Ég mætti í boðaða endurkomu
- ☐ Annað? Hvað: _____

16. Hvað telur þú að mætti betur fara í offitumeðferðinni á Reykjalundi? (Hér er átt við alla meðferðina, frá forskoðun að eftirfylgd)

17. Er eitthvað sem þér finnst vanta í meðferðina? Ef já, hvað?

18. Hvað í meðferðinni finnst þér hafa gagnast/nýst þér best? (Hér má forgangsraða ef um marga þætti er að ræða)

19. Er eitthvað annað sem þú vilt taka fram? Allar ábendingar vel þegnar.

Appendix 5: Kynningarbréf (Introductory letter)

Kynningarbréf

Apríl 2012

Kæri viðtakandi

Um þessar mundir stendur yfir rannsókn á heilsufarslegum breytingum sjúklinga sem kláruðu 5 vikna dagdeildarprógramm á tímabilinu frá sept. 2007 til des. 2008 og er þátttöku þinnar óskað.

Ábyrgðarmaður rannsóknar er Ludvig Á. Guðmundsson, yfirlæknir offitu- og næringarsviðs Reykjalundar. Leiðsögukenningar rannsóknar eru Unnur Anna Valdimarsdóttir, dósent við Háskóla Íslands, Marta Guðjónsdóttir, lektor við Háskóla Íslands, Arna Hauksdóttir, lektor við Háskóla Íslands og Sigrún Vala Björnsdóttir, lektor við Háskóla Íslands.

Mikilvægt er að taka á hvers konar heilbrigðisvandamálum sem upp koma. Þörf er á rannsóknum á meðferðum gegn offitu og mikilvægt er að endurskoða og meta í sífellu meðferðir og úrræði, til að einstaklingar nái sem bestum árangri. Hér á landi er skortur á rannsóknum um árangur í þeim meðferðum sem eru viðhafðar. Rannsóknin er liður í því að skoða árangur meðferðar gegn offitu, þannig að hægt sé að meta meðferðina, þann árangur sem orðið hefur og breytingar á lífsgæðum einstaklinganna. Þetta kemur ekki einungis þeim meðferðaraðilum og skjólstæðingum til góða sem tengjast Reykjalundi heldur einnig öðrum sem fást við offitumeðferð.

Markmið þessarar rannsóknar er að kanna áhrif offitumeðferðar á Reykjalundi á holdafar, þol, púls- og blóðþrýstingssvörum á þolprófi, heilsutengd lífsgæði, félagslega líðan, þunglyndi og kvíða 3-4 árum eftir að 5 vikna dagdeildartímabili líkur.

Aðferðir:

Unnið verður með mælingar úr sjúkraskrá frá forskoðun og við lok 5 vikna dagdeildarprógramms og þær bornar saman við niðurstöður mælinga frá 3-4 ára eftirfylgd.

Í rannsókninni verður notast við mælingar á holdafari þ.e. hæð, þyngd, mittismál og fitumæling ásamt mælingum úr hámarksþolprófi á hjóli. Auk þess verður notast við niðurstöður úr spurningalistum um heilsutengd lífsgæði, félagslega líðan, þunglyndi og kvíða, sem hafa verið lagðir fyrir fyrir í meðferðinni. Gera þarf ráð fyrir að hvert þolpróf og aðrar mælingar taki um 35 mín. og útfylling við spurningalista um það bil 20-25 mín. Mælingar verða gerðar á Reykjalundi. Úrtakið verður 120 einstaklingar sem lokið hafa 5 vikna dagdeildarprógrammi á Reykjalundi frá sept. 2007 til des. 2008.

Persónuöryggi:

Við vörslu persónuupplýsinga verður ítrustu öryggisráðstafana gætt og kemur nafn þátttakenda hvergi fram við úrvinnslu eða birtingu rannsóknar. Farið verður með allar upplýsingar sem trúnaðarmál. Þannig fær hver þátttakandi sérstakt kóðanúmer sem rannsóknargögnin verða merkt með. Lykillinn að kóðanum verður í læstri geymslu ábyrgðarmanns rannsóknarinnar. Þáttakandi getur á hvaða stigi rannsóknarinnar sem er hætt við þátttöku, líka eftir að öllum gögnum hefur verið safnað. Gögnum viðkomandi verður þá samstundis eytt.

Áhætta:

Líkamleg áhætta sem fylgir rannsókninni er óveruleg eða engin. Þátttakendur munu hins vegar fá auknar upplýsingar um stöðu á eigin líkamspreki um miðbik meðferðar sem vonandi verður til hvatningar. Læknir mun vera við framkvæmd á hámarksþolprófum á hjóli. Í rannsókninni eru þátttakendur að endurtaka þolpróf sem þeir gerðu í forskoðun og þekkja því hvernig prófið fer fram. Eins og áður hefur verið tilgreint verður farið með allar upplýsingar sem trúnaðarmál og munu niðurstöður verða birtar sem töflur og/eða línurit og verða því ekki persónugreinanlegar.

Mikilvægi þessarar rannsóknar er ótvírætt til að meta árangur offitumeðferðarinnar. Með henni safnast dýrmætar upplýsingar sem gagnast við endurnat á meðferðinni.

Rannsóknin er meistaraverkefni Guðlaugs Birgissonar og Maríönnu Þórðardóttur í Lýðheilsuvísindum við Háskóla Íslands og er rannsóknin unnin í samstarfi við offitu- og næringarsvið Reykjalundar. Vinsamlegast staðfestið þátttöku í tölvupósti til Maríönnu

(mth5@hi.is) eða Guðlaugs (gullib@reykjalundur.is). Ef ekki berst svar innan tveggja vikna verður haft samband símleiðis.

Hafir þú spurningar um rétt þinn sem þátttakandi í vísindarannsókn eða vilt hætta þátttöku í rannsókninni getur þú snúið þér til Vísindasiðanefndar í Hafnarhúsinu, Tryggvagötu 17, 101 Reykjavík. Sími: 551-7100, fax: 551-1444.

Með þökk og kærri kveðju,

Ludvig Á. Guðmundsson, yfirlæknir offitu- og næringarsviðs RL
Sími: 585 2000. Netfang: ludvigg@reykjalundur

Guðlaugur Birgisson, meistaranemi við HÍ
Sími: 693-9060. Netfang: gullib@reykjalundur.is

Marianna Þórðardóttir, meistaranemi við HÍ
Sími: 867 1820. Netfang: mth5@hi.is

Appendix 6: Upplýst samþykki (Informed consent)

Yfirlýsing um upplýst samþykki

Ég hef lesið kynningu á rannsókninni og samþykki þátttöku mína í öllum þáttum rannsóknarinnar, auk notkun tilgreindra gagna um mig úr forskoðun offitumeðferðar og við lok 5 vikna dagdeildartímabils í sjúkraskrá.

Ávinningur og/eða áhætta samfara rannsókninni hefur verið útskýrð fyrir mér. Mér er ljóst að ég get hvenær sem er dregið þátttöku mína í rannsókninni til baka án allra eftirmála af hálfu rannsakenda. Farið verður með allar upplýsingar sem trúnaðarmál og þær verða ekki persónugreinanlegar í neinum niðurstöðum.

Rannsóknin er gerð með leyfi Vísindasiðanefndar og Persónuverndar.

Staður og dagsetning: _____

Nafn þátttakanda: _____ Kennitala: _____

Leiðsögukenningar:

Unnur Anna Valdimarsdóttir, dósent við Háskóla Íslands.

Sími: 525 5898. Netfang: unnurav@hi.is

Marta Guðjónsdóttir, lektor við Háskóla Íslands

Sími: 867 9890. Netfang: martagud@hi.is

Framkvæmdaaðilar

Guðlaugur Birgisson, meistaranemi við Háskóla Íslands og sjúkrahjálfari á RL

Sími: 693 9060. Netfang: gullib@reykjalundur.is

Marianna Þórðardóttir, meistaranemi við Háskóla Íslands

Sími: 867 1820. Netfang: mth5@hi.is

Appendix 7: Leyfi (Ethical approval)



VÍSINDASIÐANEFND

Ludvig Guðmundsson, læknir og ábyrgðarmaður
Dalapíngi 14
203 Kópavogur

Hafnarhúsið, Tryggvagata 17
101 Reykjavík,
Sími: 551 7100, Bréfsími: 551 1444
netfang: visindasidanefnd@vsn.stjr.is

Reykjavík 30. ágúst 2011
Tilv.: VSNb2011060008/03.7

Efni: Varðar: 11-097-S1 Atferlismeðferð með eða án magahjáveituaðgerðar hjá alvarlega offeittum (BMI>35), 3. til 4. ára eftirfylgd.

Vísindasiðanefnd þakkar svarbréf þitt, dags. 24.08.2011 vegna áðursendra athugasemda við ofangreinda rannsóknaráætlun sbr. bréf nefndarinnar dags. 28.06.2011. Í bréfinu koma fram svör og skýringar til samræmis við athugasemdir Vísindasiðanefndar.

Fjallað var um svarbréf þitt og önnur innsend gögn á fundi Vísindasiðanefndar 30.08.2011 og voru þau talin fullnægjandi.

Rannsóknaráætlunin er endanlega samþykkt af Vísindasiðanefnd.

Vísindasiðanefnd bendir rannsakendum vinsamlegast á að birta VSN tilvísunarnúmer rannsóknarinnar þar sem vitnað er í leyfi nefndarinnar í birtum greinum um rannsóknina. Jafnframt fer Vísindasiðanefnd fram á að fá send afrit af, eða tilvísun í, birtar greinar um rannsóknina. Rannsakendur eru minntir á að tilkynna rannsóknarlök til nefndarinnar.

Með kveðju,
f.h. Vísindasiðanefndar,

dr. med., Björn Rúnar Láðvíksson, læknir, formaður