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Weight loss behaviour in obese patients

1. Preface

In the end of the 5. year in the medical study by The Arctic University of Norway, every student is supposed to write a master thesis. The subject of the master thesis is optional. The work starts in the autumn/spring of the 4. year with the planning of the study, and span out in the 5 year where you finish the study and write the master thesis.

The start of my master thesis period began with a lecture on obesity by Maria Larsen, that later actually became my supervisor. I was really inspired and I wanted to know more about this topic. I contacted the "Gastroenterology and Nutrition Research Group" and got in contact with Jon Florholmen, that later became my second supervisor, and Maria Larsen. Maria was already working on a study concerning obese patients and a Weight Loss Behaviour Scale (WLBS) questionnaire and the use of this questionnaire in clinical practice. She suggested I did a cross-sectional study using this questionnaire on obese patients at the Centre of Obesity at Department of Gastroenterology and Nutrition at the University hospital of Northern Norway.

The involvement of my supervisors has been invaluable, so I would like to offer my sincere gratitude to:

> **Maria Larsen**, M.D. PhD fellow University of Tromsø,
> Research Group of Gastroenterology and Nutrition, Institute of Clinical Medicine, University of Tromsø – The Arctic University of Norway
> **Jon Florholmen**, MD PhD, head, Gastroenterology and Nutrition Research Group, Institute of Clinical Medicine, University of Tromsø – The Arctic University of Norway

I would also like to offer my gratitude to Torunn Dreyer, nurse at the Centre of Obesity at the University Hospital of North Norway, which has collected much of the data used in this study.
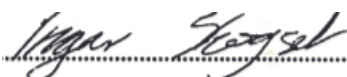
Date: 07.06.17   **Signature**:

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2. Summary

Background: Obesity is increasing worldwide, and especially amongst the younger population. Many obese people are trying to lose weight without long-term success. There are certain things that they struggle with, and it can vary from patient to patient, but knowing this they can better be helped by professionals. There are many questionnaires for this purpose, most of them with many questions.

Aim of study: To analyse the weight-loss behaviour in patients with obesity (BMI > 30) at baseline of treatment using the Weight Loss Behaviour Scale (WLBS). To find patterns and for behavioural differences in regards to gender, relationship status and BMI.

Material and methods: Out of a total of 1150 obese patients (BMI >30) at the Centre of Obesity at Department of Gastroenterology and Nutrition at the University hospital of Northern Norway (UNN) 258 had filled out the WLBS at baseline, as part of the treatment and were included in the study. Data collection span from 2009-2017. Statistical methods: tested for normal distribution, and according to the result either parametric or non-parametric tests and correlations to compare the groups.

Results: Females scored significantly higher on the total score of the WLBS questionnaire, and also in the subcategories A; "Approach to weightloss" and C; "Emotional eating". There were not any significant results concerning relationships status compared with emotional eating and physical activity that this study aimed to find out. There was a positive correlation between BMI and some of the questions; A5, B1, B3, B6, subcategory B and D, including in the total WLBS score.

Conclusion   There is a difference in weight loss behaviour in gender. The obese female patients report a higher score of emotional eating and attitude towards own body weight and dieting compared to males. Being in a relationship has a positive effect on preparing and cooking food. Patients with a higher BMI seem to have more overeating and worse attitude towards physical activity. These results show that there are differences in a obese population, that is why it is important to use the WLBS. By using it, you can point out what the different patients are struggling with and tailor the treatment and increase the chance of long-term weight loss.

Abbreviations

BMI: Body Mass Index, kg/m^2
WLBS: Weight Loss Behaviour Scale
UNN: University hospital of Northern Norway

3. Background

There has been and still is an increase of both bodyweight and BMI in the society today, and therefore more people being categorized as overweight and obese. According to WHO the obese category has doubled worldwide since 1980(1, 2). Several studies in Norway implies that there is an increase in BMI and obesity among young adults (aged 25-35)(3), and according to a survey on living conditions done by "Statistics Norway" the percentage of overweight and obesity in Norway has increased by 4 % the last 10 years(4). There are several campaigns that try to motivate people to be more healthy and active. People seek advice from health professionals, or they try to lose weight themselves, without great success and even gaining weight afterwards(5). The different reasons causing them to fail and gain weight are many and differ from person to person, but repeated failure can be hard to handle. Therefore it's important to find out the challenges for each and one of them and give the best advice and treatment for those in need(6, 7).

One challenge can be to cope with emotions and impulsiveness. Emotional eating is defined as eating as a reaction to cope your own emotion and thoughts(8) . A study from 2006 implies that women with or without eating disorders use emotional eating as a way to deal with emotions and to distract themselves(9). Still, there are some conflicting results concerning emotional eating and gender. Both males and females can react on emotions by eating, but they react on different emotions. Females react more on anger and anxiety, while men react on anger and depression(10). Though both gender react on emotions, maybe women react on the emotions that are more impulsive and that cause them to eat. This is important to know in a clinical setting.

There are several studies that have documented an association between binge eating and obesity(11-13). Both genders are represented when it comes to binge eating. In a study of college students from 2012 where as many 29 % reported binge eating, found out that it was more likely that women had binge eating(14).

We know that there are many factors that are correlated to bodyweight and BMI. Relationship status is one of them, and is correlated to a person's BMI, obesity and the degree of it(15-17). On the other hand, there is many questions unanswered on how, and to what extent behaviour correlates to obesity. However, a study done in Tromsø on normalweight and healthy subjects

implied that being in a relationship protects against emotional eating, but at the same time worsens the attitude against physical activity(18).

A study on obese patients seeking therapy, found that there was a significantly difference in binge eating between the group of patients that got bariatric treatment and those who got non-surgical treatment. They were significantly different when it came to BMI, and the bariatric groups had the highest BMI and also significantly more binge eating(19). That might imply that the higher BMI you have, the more you binge eat. A different study on patients with BMI > 40 showed that BMI did not have an association with binge eating, and suggesting that there may be other causes than binge eating that cause the heaviest patients to be this heavy(20).

There are different types of questionnaires that address to find out the behaviour of people who want to diet or loose weight. One of them is "Weight control strategy scale" (WCSC)(21) that address direct behaviour without categorizing the questions and have as many as 30 questions. This result in a total score you can use to measure the treatment by it increasing or decreasing. Another one, the modified "Weight loss behaviour scale" (WLBS)(Figure 1)(22), address different attitudes towards weight loss, and the original version consists of a total of 35 questions(23). The modified version consists of 21 questions and categorizes them in different attitudes. When you categorize them like this, you can differentiate between different challenges the patients are struggling with, and you can observe the evolvement in the different categories.

The parameters in the modified WLBS monitors both positive change of behaviour during the treatment, and can potential imply what sort of treatment that fits the different patients.

Even though obese patients have different weight loss behaviour, many of the obese patients get the similar treatment. To obtain long-term weight loss, and to better tailor the treatment for the obese patient it is important to have good parameters and clinical tools, and also know more about weight loss behaviour in the obese patients.

4. Aim of study

The aim of this study is to analyse the weight-loss behaviour in patients with obesity (BMI > 30) at baseline of treatment. By using the WLBS in the clinical setting, we can evaluate what type of behaviour challenges the obese patient have, tailor the treatment after the result of the WLBS, monitor responsiveness to treatment, and monitor positive or negative change. Research questions:

1. Are there any differences between males and females concerning weight-loss behaviour? *Hypothesis: Females have a higher degree of emotional eating and overeating compared to males.*

2. Does relationship status affect the weight-loss behaviour? *Hypothesis: Subjects who are single will have a higher degree of emotional eating. Subjects who are in a relationship will have a lesser degree of physical activity.*

3. Does the size of the BMI affect the weight-loss behaviour? *Hypothesis: The subjects with the higher BMI will be less active and overeat more.*

5. Material and methods

Population of the study

The subjects in this study are patients at the Centre of Obesity at Department of Gastroenterology and Nutrition at the University hospital of Northern Norway. The data were collected at baseline of the treatment and the examiner of the patients has since 2009 registered anthropometric data in addition to the WLBS-score in a dataset. The last patient data is from 2017.

The inclusion criteria were being obese, hence a BMI > 30. The examiner calculated the BMI after measuring height and weight during the first consultation.

The examiner also collected anthropometric data such as gender, systolic and diastolic blood pressure, cholesterol, triglycerides, serum glucose, c-peptide, basal metabolic rate, neck measure, CRP, and if the patients had diabetes or ever had DVT.

For this study additional information about relationship status and age at baseline were collected retrospective. This data was collected by going through patient journal in DIPS. When collecting the data about relationship status, there was originally differentiated between those who were single, cohabitant, married, widow or widower, but the sample size was to

small, resulting in dividing in only two categories; in a relationship and not.

WLBS – Weight Loss Behaviour Scale

The modified Weight loss behaviour scale is a questionnaire consisting of 21 questions. It is used to evaluate behavioural changes during a treatment at Centre of Obesity at Department of Gastroenterology and Nutrition at the University hospital of Northern Norway. You can divide the questionnaire into 4 subcategories: A. "Approach to weight loss and dieting", B. "Approach to physical activity", C. "Approach to emotional eating" and D. "Approach to overeating". Every question has 5 alternatives rating from 1-5, and 1 is "almost never" and 5 "very often". This results in a score in each subcategory, and a total score for all categories as well. If the patient has a positive impact of the treatment, it can result in a lower score.

Statistical analysis

SPSS 24 for Mac was used to perform the statistical analysis. Normal distribution was detected by determination of skewness and histograms. Parametric statistics were performed when the data were normally distributed, either raw or transformed data resembled normal distribution; otherwise non-parametric tests were used. Tests for independent samples were used as appropriate. Corrections for deviation from the assumption of sphericity were used as appropriate. Effect size was calculated to illustrate the strength of the association when the result was statistical significant.

WLBS score

Each subcategory in the WLBS was summed up by using SPSS. Question B1, B2, B5, D1 and D3 were reversed scored; a high score indicated a positive behaviour, unlike the others that indicated the opposite.

BMI was plotted in the dataset on a continuous scale, but also divided into groups of ten starting from 30.

6. Results

The total dataset consisted of 1150 patients that met the inclusioncriteria, but only 258 had responded to the WLBS at baseline. Out of the 258 patients, 24 had one or more missing question. One person was pregnant during the first examination so she was excluded from the analyses concerning BMI. There were 176 females and 82 males in the final dataset. The median BMI was 42.00 (Min-max: 31.75-67.8) for the females and 44.00 (Min-max: 32.5-65) for the males, and it was a significant difference between the two groups. There was no significant difference between the mean age between males and females. Most of the patients were in a relationship (Md=1), which applies to both men and women.

Gender

Females scored significantly higher on the total score of the WLBS, and also in the subcategories A; "Approach to weightloss" and C; "Approach to emotional eating". Every question in these categories was significantly higher in the females, except from question C5 in subcategory C (table 2). There is a tendency in subcategory B; "Approach to physical activity", where question B1, B2 and B6 show significant difference, even though the total for the subcategory was not significantly different between the genders. Question D4 also showed a significant difference.

Effect size

The formula beneath is showing calculations using Eta-squared to calculate the effect size.
WLBS total
$$\frac{t^2}{t^2 + (N1 + N2 - 2)} = \frac{2,598^2}{2,598^2 + (159 + 75 - 2)} = 0,02827 = 2,8\ \%$$

WLBS A
$$\frac{t^2}{t^2 + (N1 + N2 - 2)} = \frac{3,625^2}{23,625^2 + (176 + 80 - 2)} = 0,04918 = 4,9\ \%$$

The effect size of 2,8 % for WLBS total and 4,9 % for WLBS A is indicating how big proportion of the variance that is caused by the independent variable gender.

There was a significant correlation between the total score for the WLBS, subcategories A; "Approach to weightloss" and C; "Approach to emotional eating" (Table 3). Subcategory B; "Approach to physical activity" did not have a significant correlation, but there was a tendency for question B1, B2 and B6. The size of the correlation is small (r=0.168-0.253). This indicates that females are associated with high scores in these subcategories and questions.

Relationship status

The only question in the WLBS that showed a significant difference in scoring between being in a relationship (Md=2, min-max=1-5) and not being in a relationship (Md= 2, min-max=1-5) was A4. "I feel that it is mentally stressful to prepare and cook food" (p=0.04). The same question had significant negative correlation (p=0.04, r=-0.128), meaning that those in a relationship report less mental stress when preparing and cooking food.

There were no significant results concerning emotional eating and physical activity that this study aimed to find out.

BMI

There was no significant difference in total score or any of the questions when dividing BMI into intervals 30-40, 40-50, and so on. There was a positive correlation between BMI and some of the questions; A5, B1, B3, B6, subcategory B; "Approach to physical activity" and D; "Approach to overeating", including in the total WLBS score (table 4). The higher the BMI the patients had, the higher they scored in total WLBS score, subcategory B "Approach to physical activity" and subcategory D " Approach to overeating".

7. Discussion

In this study we wanted to find out if there were any weight loss behaviour differences concerning gender, relationship status and BMI in obese patients, to better be able to tailor the weight loss treatment for obese patients. When we looked on the population based on gender we found that women reported significantly higher WLBS total score compared with men. There were also significant results of women having more concerns about their weight and weight gain in relation to go grocery shopping and eating. This was also found in the study on normal weighted subjects(18). That implies that this behaviour occur in both normal weight and obese females.

We also found that women reported more emotional eating compared to men, with significant results for the total score of emotional eating and for 4 out of 5 questions in the subcategory. The fact that women have concerns and eat more according to their emotions is also supported by a study where they compare women with and without eating disorders(9). This result says that females likely will have a general worse attitude against weight loss and report more emotional eating and that information can be used in clinical practice. Recent studies show that improving body image might promote weight loss and a positive eating behaviour in females (24, 25)

Relationship status was found in this study to only have an association with one question in the WLBS, question A4. "I feel that it is mentally stressful to prepare and cook food". This implies that being in a relationship is a protecting factor when it comes to prepare and cook food, which is an important part when it comes to lifestyle change and weight loss. This can imply that single obese individuals are more prone to eat fast food, because they think that it is mentally stressful to prepare it by themselves and eat it alone. We didn't get any significant results when it came to relationship status and physical activity or emotional eating, but in the study on normal weighted subjects they suggested that being in a relationship made the attitude towards physical activity and emotional eating worse. It is possible that these results can help to describe the obese population and that being in a relationship doesn't give any risk factors.

The results concerning BMI implied that the higher BMI the patients had, the higher they would score on the subcategory concerning physical activity, meaning they have a worse

attitude towards physical activity. Three questions in this subcategory showed significant difference as well, but none of them was the question concerning how physically activity they are during a week. But those questions tells us that the heaviest patients are feeling mentally and physically wellness during physical activity, they dread before physical activity and they are ashamed of their own body in physical situations. These findings don't necessarily tell us that the most obese patients are less physical active, but it can imply that fact. A Norwegian study on normal weight subjects says that normal weighted are 10% more physically active than overweight subjects, and 28% more active than obese subjects in general(26). This kind of supports the findings in this study because the more the psychical activity decreases, the bigger you get, but we can´t fully compare the results because the population are somewhat different. An interesting thing to look further into is if these differences in attitudes can be one of the causes of attitudes towards physical activity in the heaviest patients, or if they enjoy physical activity less because of the heavy weight and what challenges that can cause.

The heavier the patients are, the higher they score on the over eating subcategory. None of the separate questions in the subcategory was significant associated with increasing BMI so the only thing we can assume is that the heavier they get the worse behavior and attitude they have towards over eating. There are results from studies that show more over eating in the heaviest patients within the obese category(19), but there also studies that claim there is no association between BMI and over eating, and therefore suggesting over eating is not as important factor to why the heaviest patients get so heavy(20).

These results describe different associations concerning gender, weight and relationship status. They are important because they describe the obese population. It can further on be used to make the treatment of obese people better and more tailor-made for each patient. Future studies should include an even larger sample of obese patients, and "Tromsøundersøkelsen" could be appropriate for this. Also it is of importance to compare the WLBS before and after the treatment, and this study is ongoing.

8. Conclusion

This study shows that there is a difference in weight loss behaviour between females and males. The obese female patients report a higher score of emotional eating and attitude towards own weight and dieting compared to males. Being in a relationship has a positive effect on preparing and cooking food. Patients with a higher BMI seem to have more overeating and worse attitude towards physical activity. These results show that there are differences in an obese population, which is why it is important to use the WLBS. By using it, you can point out what the different patients are struggling with and tailor the treatment and increase the chance of long-term weight loss.

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Tables and figures

Table 1, demographics.

Group	Total (N=258)	Female (N=176)	Male (N=82)	Difference P
BMI	42.5 (31.5-67.8)	42.00 (31.5-67.8)	44.00 (32.5-65)	0.017[1]
Age	43.35 (41.81-44.9)	43.5 (41.65-45.33)	43.06 (40.21-45.91)	0.799[2]

[1] Mann Whitney U-test.
[2] Independent samples t-test

Table 2, Results of the WLBS, measuring the difference in mean/median between gender.

*P=<0.05, **P=<0.01

Scale item	Both gender N=258	Female N=176	Male N=82	Difference	Difference P
WLBS total score	60.09 (58.38-61.80)	61.62 (59.41-63.82)	56.85 (54.39-59.32)	4.77	0.010*[3]
A "Approach to weight loss and dieting"	14.35 (13.80-14.90)	15.01 (14.35-15.68)	12.89 (11.99-13.79)	2.12	0.000**[3]
A1. I worry about my bodyweight while I am eating	4 (1-5)	4 (1-5)	3 (1-5)	1	0.002**[4]
A2. I am concerned about weight gain while I am eating	4 (1-5)	4 (1-5)	3 (1-5)	1	0.004**[4]
A3. I feel that it is mentally stressful to go grocery shopping	2 (1-5)	2 (1-5)	2 (1-5)	0	0.037*[4]
A4. I feel that it is mentally stressful to prepare and cook food	2 (1-5)	2 (1-5)	1 (1-5)	1	0.010*[4]
A5. I feel ashamed in social situations where food is involved	3 (1-5)	3 (1-5)	2 (1-5)	1	0.002**[4]
B. "Approach to physical activity"	17 (6-30)	17 (6-28)	17 (9-30)	0	0.991[4]
B1. I feel mental and physical wellness while I am doing physically activity	2 (1-5)	2 (1-5)	3 (1-5)	1	0.021*[4]
B2. I feel mental and physical wellness after being physically active	2 (1-5)	2 (1-5)	2 (1-5)	0	0.003**[4]
B3. I dread before physical activity	3 (1-5)	3 (1-5)	3 (1-5)	0	0.449[4]
B4. I find excuses for not being physically active	3 (1-5)	3 (1-5)	3 (1-5)	0	0.112[4]
B5. I am physically active 30 minutes more than 3 times a week	3 (1-5)	3 (1-5)	3 (1-5)	0	0.140[4]
B6. I feel ashamed over my own body in social situations where physical activity is involved	4 (1-5)	4.5 (1-5)	4 (1-5)	0.5	0.000**[4]
C "Approach to emotional eating"	15 (5-25)	16 (5-25)	12 (5-25)	4	0.000**[4]
C1. I eat more when I feel stressed and frustrated	3 (1-5)	3 (1-5)	2.5 (1-5)	0.5	0.001**[4]
C2. I eat more when I feel sad	3 (1-5)	3 (1-5)	2 (1-5)	1	0.000**[4]
C3. I eat more when I feel worried and concerned	3 (1-5)	3 (1-5)	2 (1-5)	1	0.002**[4]
C4. I eat more when I am in conflict with my partner/family/ friends/colleagues	2 (1-5)	3 (1-5)	2 (1-5)	1	0.002**[4]
C5. I eat more when I am bored	3 (1-5)	4 (1-5)	3 (1-5)	1	0.050[4]
D "Approach to overeating"	13 (5-23)	13 (5-22)	13 (6-23)	0	0.640[4]
D1. I eat regularly 4-6 times a day	3 (1-5)	2 (1-5)	3 (1-5)	1	0.067[4]
D2. I overeat and feel uncomfortably full 1 or more times a day	2 (1-5)	3 (1-5)	2 (1-5)	1	0.547[4]
D3. I stop to eat when I feel full	2 (1-5)	2 (1-5)	3 (1-5)	1	0.033*[4]
D4. I can not stop eating although I feel full	2 (1-5)	2 (1-5)	2 (1-5)	0	0.907[4]
D5. I eat less when I eat in company with other people than when I eat by myself	3 (1-5)	3 (1-5)	3 (1-5)	0	0.246[4]

[3] Independent samples t-test
[4] Mann Whitney U-test

Table 3 –Correlation analysis between questions and genders, only significant (p<0.05) show.

WLBS questions	Spearmans rho	Pearson correlation	P
WLBS total		-0.168**	0.010
WLBS A Approach to weight loss and dieting"		-0.222**	0.000
A1. I worry about my bodyweight while I am eating	-.190**		.002
A2. I am concerned about weight gain while I am eating	-.182**		.003
A3. I feel that it is mentally stressful to go grocery shopping	-.130*		.037
A4. I feel that it is mentally stressful to prepare and cook food	-.160**		.010
A5. I feel ashamed in social situations where food is involved	-.198**		.001
B1. I feel mental and physical wellness while I am doing physically activity	-.146*		.020
B2. I feel mental and physical wellness after being physically active	-.191**		.002
B6. I feel ashamed over my own body in social situations where physical activity is involved	-.253**		.000
C "Approach to emotional eating"	-.224**		.000
C1. I eat more when I feel stressed and frustrated	-.211**		.001
C2. I eat more when I feel sad	-.236**		.000
C3. I eat more when I feel worried and concerned	-.197**		.001
C4. I eat more when I am in conflict with my partner/family/ friends/colleagues	-.198**		.001
D3. I stop to eat when I feel full	-.133*		.033

**Correlation is significant at the 0.01 level (2-tailed).

*Correlation is significant at the 0.05 level (2-tailed).

Table 4 –Correlation analysis between continuous BMI and WLBS question scores, only significant (p<0.05) show.

WLBS questions	Spearmans rho	P
WLBS total score	0.134*	0.041
A5. I feel ashamed in social situations where food is involved	0.136*	0.030
B. "Approach to physical activity"	0.199**	0.002
B1. I feel mental and physical wellness while I am doing physically activity	0.133*	0.036
B3. I dread before physical activity	0.198**	0.002
B6. I feel ashamed over my own body in social situations where physical activity is involved	0.129*	0.040
D "Approach to overeating"	0.136*	0.032

Figure 1 – WLBS

"Weight Loss Behaviour Scale"

Meusurement on lifestyle change

Every question scores from 1-5. Minimum score is 21 and maximum score is 105.

1: almost never   2: rare   3: from time to time   4: quite often   5: almost all the time

A. "Approach to weight loss and dieting"

1. I worry about my bodyweight while I am eating   1   2   3   4   5
2. I am concerned about weight gain while I am eating   1   2   3   4   5
3. I feel that it is mentally stressful to go grocery shopping   1   2   3   4   5
4. I feel that it is mentally stressful to prepare and cook food   1   2   3   4   5
5. I feel ashamed in social situations where food is involved   1   2   3   4   5

B. "Approach to physical activity"

1. I feel mental and physical wellness while I am doing physically activity   1   2   3   4   5
2. I feel mental and physical wellness after being physically active.   1   2   3   4   5
3. I dread before physical activity.   1   2   3   4   5
4. I find excuses for not being physically active   1   2   3   4   5
5. I am physically active 30 minutes more than 3 times a week.   1   2   3   4   5
6. I feel ashamed over my own body in social situations where physical activity is involved.   1   2   3   4   5

C. "Approach to emotional eating"
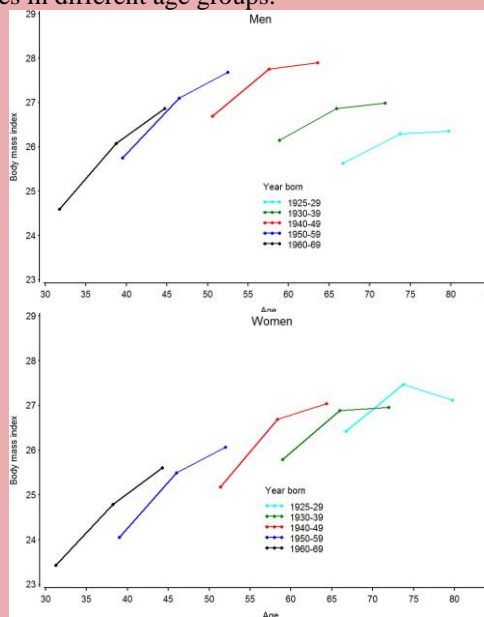
1. I eat more when I feel stressed and frustrated.   1   2   3   4   5
2. I eat more when I feel sad.   1   2   3   4   5
3. I eat more when I feel worried and concerned.   1   2   3   4   5
4. I eat more when I am in conflict with my partner/ family/ friends/colleagues.   1   2   3   4   5
5. I eat more when I am bored.   1   2   3   4   5

D. "Approach to overeating"

1. I eat regularly 4-6 times a day   1   2   3   4   5
2. I overeat and feel uncomfortably full 1 or more times a day   1   2   3   4   5
3. I stop to eat when I feel full   1   2   3   4   5
4. I can not stop eating although I feel full   1   2   3   4   5
5. I eat less when I eat in company with other people than when I eat by myself   1   2   3   4   5

GRADE evaluations

	GRADE	
Reference: Jacobsen BK, Aars NA. Changes in body mass index and the prevalence of obesity during 1994-2008: repeated cross-sectional surveys and longitudinal analyses. The Tromso Study. BMJ Open. 2015;5(6):1-9..	Documentation	III
	Recommendation	C

Aim of study	Material and methods	Results	Discussion
To determine the mean body mass index (BMI, kg/m2) and prevalence of low weight (BMI<20) and obesity (BMI≥30) in 3 population-based surveys, and to describe the longitudinal changes during 1994– 2008 in mean BMI, and the prevalence of low weight and obesity.	**Studydesign** Longitudinal cross-sectional **Recruitment of participants** Volunteers in The Tromsø Study **Inclusion-/Exclutioncriteria.** Must have participated in all three surveys. **Data/population** The Tromsø Study, surveys 1994-1995, 2001-2002 and 2007-2008.	**Main findings** The age-adjusted (ages 30–84) prevalence of obesity increased from 9.8% and 11.8% in men and women, respectively, in 1994–1995 to 20.9% and 18.5%, respectively, in 2007–2008. The increase in mean age-adjusted BMI was stronger from 1994–1995 to 2001–2002 than from 2001–2002 to 2007–2008. Longitudinal results confirmed that the change in BMI from 1994–1995 to 2001–2002 was larger (0.9 kg/m2 (95% CI 0.8 to 1.0) in men and 1.3 kg/m2 (95% CI 1.2 to 1.4) in women) than from 2001–2002 to 2007–2008 (0.2 kg/m2 (95% CI 0.1 to 0.3) in men and women).	**Strengths** Height and weight were measured using standardised procedures, not self-reported. Although the rate of participa- tion has decreased somewhat (from 72% in the 1994–1995 survey to 66% in the survey conducted in 2007–2008), the survey still enjoys a high response rate compared to similar studies in Norway conducted in the same period
Conclusion		**Secondary findings** The most recently born had the largest increase (p<0.001). The figures are showing the development of BMI in men and females in different age groups.	**Weaknesses** Selective attrition may have taken place, particu- larly in the older participants. BMI is not a perfect measure of the proportion of body fat.
The mean BMI and the prevalence of obesity are still increasing in Tromsø, and the increase is strongest in the youngest age groups. However, the increase in BMI was less marked in the last period (from 2001–2002 to 2007–2008) than in the first period (1994–1995 to 2001–2002).	**Important confounding factors** No. **Statistical methods** All statistical analyses were performed using SAS V.9.4.22 They included simple descriptive analyses, χ2 tests, independent sample t test and linear regression. Age adjustment of mean BMI in the three surveys was carried out by the direct method, with the population of Tromsø 4 serving as the reference population. A p value of <0.05 was considered statistically significant. The Tromsø Study was approved by the Regional Committee for Research Ethics.		**What did the authors discuss?** The results, compared to other studies, strengths and limitations with the study. **Other literature that support the finding?** Yes. Checklist **Were the population the sample gathered from clearly defined?** Yes. **Was the sample representative for the population?** Yes. **Is it clearly been evaluated (and how) the respondants separates from the ones that didn't answer/respond?** Yes **Was the respond/answer-rate high enough?** Yes. **Was the datacollection standardised?** Is not mentioned in the study. **Are objective criterias used for evalution of the output/exposure?** Yes. **Is it used adequate methods in the datanalysis?** Yes.
Country			
Norway			
Year of data collection			
1994-2008			

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GRADE	
Documentation	III
Recommendation	C

Aim of study	Material and methods	Results	Discussion

Aim of study

The purpose of the study was to investigate gender differences in binge eating and associated behavioral correlates in college students.

Conclusion

Results generated from this study suggest that gender-disparate behaviors are potential targets for future tailored interventions.

Country

USA

Year of data collection

Prior to 2012, other isn't specified

Material and methods

Studydesign
Descriptive, cross-sectional study

Recruitment of participants
College students.
Institutional Review Board approval

Inclusion-/Exclutioncriteria.
None.

Data/population
Undergraduate college students, N=2073.

Exposure-variables (validated/not validated)
None.

Statistical methods
Parametric test- ing occurred for variables meeting normality assumptions. Significance was set at α≤0.05. Results are presented as mean±standard deviation (SD). Multiple logistic regression was used to calculate odds ratios and 95% confidence intervals for the factors associated with binge eating

Results

Main findings
Twenty-nine percent of students reported recent bingeing. Factors associated with binge eating included being female, having a higher body mass index, current tobacco use, and exercising to lose weight. Women were more likely to binge eat (73.8%; $\chi2 =32.3$; $p≤0.001$), report loss of control (45%; $\chi2=16.3$; $p≤0.001$), self-induced vomiting (20.7%; $\chi2=15.9$; $p≤0.001$), and laxative use (6.7%; $\chi2=8.93$; $p≤0.001$).
The table are showing gender difference behaviour among binge eating individuals.

TABLE 2
Gender differences in behavioral correlates among individuals reporting binge eating.

	Female (N=450) %	Male (N=160) %	Statistical significance
Loss of control (N=246)	45.1	26.88	$\chi^2=16.31$; $p≤0.001$
Self induced vomiting (N=104)	20.7	6.88	$\chi^2=15.87$; $p≤0.001$
Laxative use (N=30)	6.7	0.63	$\chi^2=8.93$; $p≤0.003$
Diuretic use (N=6)	0.9	1.25	$\chi^2=0.158$; $p≤0.691$

Discussion

Strengths
The first large-scale study to recently examine gender differences and behavioral correlates among college students who report BE.

Weaknesses
Due to the cross-sectional nature of the data, it is not possible to assume any causal relationship between the behaviors under investigation
Sample from only one private university, thereby limiting the generalizability of the results.

What did the authors discuss?
Comparisons to earlier study and their results.

Other literature that support the finding?
Yes.

Checklist
Were the population the sample gathered from clearly defined?
Yes.

Was the sample representative for the population?
For college student population, yes.

Is it clearly been evaluated (and how) the respondants separates from the ones that didn't answer/respond?
Yes

Was the respond/answer-rate high enough?
Not mentioned.

Was the datacollection standardised? Yes.
Are objective criterias used for evalution of the output/exposure? Yes.
Is it used adequate methods in the datanalysis? Yes.

Reference:			GRADE	
Darby A, Hay P, Mond J, Quirk F, Buttner P, Kennedy L. The rising prevalence of comorbid obesity and eating disorder behaviors from 1995 to 2005. Int J Eat Disord. 2009;42(2):104-8..			Documentation	III
			Recommendation	C

Aim of study	Material and methods	Results	Discussion
To measure the cooccurrence of obesity and eating disorder (ED) behaviors in the South Australian popu- lation and assess the change in level from 1995 to 2005.	**Studydesign** Descriptive, cross-sectional study on two cross-sectional single stage interview based surveys who were conducted a decade apart **Recruitment of participants** Two samples: -Metropolitan: districts selected from those used by the Australian Bureau of Statistics in the 1991 and 2001 census, respectively. -Rural: towns over 10 000 in population were surveyed **Inclusion-/Exclutioncriteria.** One survey per household, they must have at least one person over 15. The respondent was the person whose birthday was last. Five percent in 1995 and 10% in 2005 of each interviewer's work was selected at random, and the respondents recontacted and a number of questions were asked of them, to ensure they had been interviewed as reported **Data/population** Undergraduate college students, N=2073. **Exposure-variables (validated/not validated)** None. **Statistical methods** Multinominal (polytomous) logistic regression analysis was used to assess changes in prevalence of obesity, ED behaviors, and comorbidity between 1995 and 2005 adjusted for sociodemographic characteristics. Results were presented as prevalence odds ratios (POR) and 95% confidence intervals (95% CI). Data analysis was conducted using SPSS version 14, for Windows and STATA, release 8. To correct for multiple tests, the significance level was lowered to p \ .01.	**Main findings** From 1995 to 2005 the population prevalence of comorbid obesity and eating disorder behaviors (ED) increased from 1 to 3.5%. Comorbid obesity and ED behaviors increased more (prevalence odds ratio (POR) 5 4.5; 95% confidence interval (CI) 5 95% CI 5 [2.8, 7.4]; p < .001) than either obesity (POR 5 1.6; 95% CI 5 [1.3, 2.0]; p < .001) or ED behaviors (POR 5 3.1; 95% CI 5 [2.3, 4.1]; p < .001) alone.	**Strengths** The final selection was randomly selected of the total of each interviewers work. The findings in the study have clear implications for both public health and clinical practice. **Weaknesses** Not the same participants for both surveys. There could be information bias between the two time points. In that participants in 2005 may have been more prepared to disclose their ED behaviours than in 1995 Height and weight was not objectively measured. **What did the authors discuss?** The large increase of obese people with ED behaviours. The use of the study results in clinical practice. **Other literature that support the finding?** Uncertain, not the cause of the big increase of obese people with ED behaviours. Checklist **Were the population the sample gathered from clearly defined**? Yes. **Was the sample representative for the population?** Yes. **Is it clearly been evaluated (and how) the respondants separates from the ones that didn't answer/respond?** No. **Was the respond/answer-rate high enough?** Not mentioned. **Was the datacollection standardised?** Yes. **Are objective criterias used for evalution of the output/exposure?** Yes. **Is it used adequate methods in the datanalysis?** Yes.

Conclusion
The number of people with comorbid ED and obesity has grown at a much faster rate than those with ED alone of obesity alone. Professionals involved in obesity and ED prevention, treatment or research, must further consider this comorbidity and develop strategies to overcome this problem.

Country
Australia

Year of data collection
1995 and 2005.

Aim of study	Material and methods	Results	Discussion
The aim of the study was to examine the longitudinal association of frequency of dieting for weight loss with (a) obesity status and (b) body mass index (BMI) change.	**Studydesign** Prospective study with cross-sectional data. **Recruitment of participants** From HILDA survey. **Inclusion-/Exclutioncriteria.** Subsample of respondents who were interviewed, filled out the self-completion questionnaire in Waves 9 and 10, and had complete data for all of the variables used in the analyses (n = 8824).	**Main findings** Compared to those who were never on a diet in the previous year, the odds of obesity were 1.9, 2.9, and 3.2 times higher among those who were on a diet once, more than once, and always, respectively. Similarly, the odds of BMI gain versus BMI maintenance and also versus BMI loss were higher among those who dieted than those who did not.	**Strengths** The use of a large nationally representative sample with a relatively high response rate, the prospective nature of the study design with low attrition rates, and data collection based on in-person home interviews **Weaknesses** The measurement of obesity was based on self-reported weight and height. **What did the authors discuss?** Reasons for the association between dieting and weight gain. **Other literature that support the finding?** Checklist **Were the population the sample gathered from clearly defined**? Yes.
Conclusion			
Dieting to lose weight can contribute to the risk of future obesity and weight gain. Losing weight requires a commitment to change one's lifestyle and a sustained effort to maintain a healthy diet and engage in physical activity.	**Data/population** Data from Waves 9 (2009) and 10 (2010) of the Household Income and Labour Dynamics in Australia (HILDA) survey, which is a national longitudinal study based on a multistage area sample of households. HILDA includes a face-to-face interview and a self-completion questionnaire. **Exposure-variables (validated/not validated)** None.		**Was the sample representative for the population?** Yes. **Is it clearly been evaluated (and how) the respondants separates from the ones that didn't answer/respond?** Yes.
Country	**Statistical methods** Binominal logistic regression estimated the association of frequency of dieting in 2009 on probability of obesity in 2010. Multinomial logistic regression estimated the association of frequency of dieting in 2009 on the probability of BMI gain versus BMI maintenance and BMI loss between 2009 and 2010. The analysis sample size was 8824.		**Was the respond/answer-rate high enough?** Yes.
Australia			
Year of data collection			**Was the datacollection standardised?** Yes.
2009 and 2010	Because of use of secondary data, they did not deem it necessary to seek approval from the Institutional Review Board.		**Are objective criterias used for evaluation of the output/exposure?** Yes. **Is it used adequate methods in the datanalysis?** Yes.

Reference: Tzotzas T, Vlahavas G, Papadopoulou SK, Kapantais E, Kaklamanou D, Hassapidou M. Marital status and educational level associated to obesity in Greek adults: data from the National Epidemiological Survey. BMC Public Health. 2010;10:732.		GRADE	
		Documentation	III
		Recommendation	C

Aim of study	Material and methods	Results	Discussion
The aim of the present study was to determine associations of overweight (OW), obesity (OB) and abdominal obesity (AO) with marital status and educational level in Greek adults of both genders based on data from the National Epidemiological Survey on the prevalence of obesity.	**Studydesign** Cross-sectional study. **Recruitment of participants** The selection was conducted by stratified sampling through household family members of Greek children attending school during 2003. **Inclusion-/Exclutioncriteria.** None. **Data/population** 17,341 Greek men and women aged from 20 to 70 years participated in the survey.	**Main findings** The overall prevalence of OB was 22.3% (25.8% in men, 18.4% in women), that of OW 35.2% (41.0% in men, 29.8% in women) and that of AO 26.4% in men and 35.9% in women. Ahigher risk of OB was found in married men (OR: 2.28; 95% CI: 1.85-2.81) and married women (OR: 2.31; 95% CI: 1.73-3.10) than in the respective unmarried ones. Also, a higher risk of AO was found in married men (OR: 3.40; 95% CI: 2.86-4.03) and in married women (OR: 2.40; 95% CI 2.00-2.88) compared to unmarried ones. The risk for being obese was lower among educated women (primary school, OR: 0.76; 95% CI: 0.60-0.96, high school, OR: 0.58; 95% CI: 0.46-0.74 and University, OR: 0.64; 95% CI: 0.49-0.81) than among illiterates. No significant differences were found among men.	**Strengths** The first study that reports on marital status and educational level associated to overweight, obesity and abdominal obesity in the adult Greek population. Large number of participants and the relatively high response rate. **Weaknesses** They study used only educational level as a proxy for socioeco- nomic position, which, although a reliable indicator in such conditions, it does not always reflect the financial situation of a subject. Another limitation is that anthro- pometric measurements in their population were performed by adolescents 13-19 y who were trained by school instructors at school. **What did the authors discuss?** Comparing to earlier studies done in other countrie and their results compared to the study results. **Other literature that support the finding?** No.
Conclusion			Checklist
In Greek adults, marital status was significantly associated with obesity and abdominal obesity status in both genders while educational level was inversely associated with obesity status only in women.	**Exposure-variables (validated/not validated)** None. **Statistical methods** Multinomial logistic regression analyses were performed to determine the association of gender, age, marital status and education level to overweight, obesity and abdominal obesity. Statistical analyses were per- formed using Minitab v15. Odd ratios were calculated using a confidence level of 95% and values of p < 0.05 were considered to be statistically significant.		**Were the population the sample gathered from clearly defined**? Yes. **Was the sample representative for the population?** No. **Is it clearly been evaluated (and how) the respondants separates from the ones that didn't answer/respond? No.** **Was the respond/answer-rate high enough?** Yes, participation rate 78.3% **Was the datacollection standardised?** Yes. **Are objective criterias used for evaluation of the output/exposure?** Yes. **Is it used adequate methods in the datanalysis?** Yes
Country			
Greece	The survey has been approved from the ethical committee of the Technologi- cal Educational Institute of Thessaloniki		
Year of data collection			
2003			