# Preoperative markers of post-operative weight changes following bariatric surgery

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## INTRODUCTION

- Bariatric surgery is the most effective therapy for management of obesity[1]
- Laparoscopic roux-en-y gastric bypass (LRYGB) has been established as mainstay therapy for obesity
- Weight recidivism is a significant barrier to patients considering bariatric surgery [1]
- Both inadequate weight loss and weight regain following bariatric surgery are suboptimal outcomes.
- Studies have explored various demographic, socioeconomic & biological factors that may play role in long term weight changes[2,3]

## OBJECTIVES

- Assess the relationship between preoperative patient baseline characteristics and serum profiles to their postoperative outcomes of maximal weight loss (WL) and weight regain (WR).
- We hypothesize that higher baseline BMIs and poor glycemic control will lead to suboptimal postoperative outcomes.
- These patients may have lower maximal weight loss and higher rates of weight regain.

## METHODS

- BWH bariatric surgery database of prospectively collected patient data undergoing bariatric surgery at BWH + affiliated sites
- Pts who have consented to sx + agreed to the preoperative blood work + weight measurements following surgery.
- The database collects: preoperative markers, postoperative data points such as weight changes such as maximal weight loss and weight regain.
- Analysis of 5 years post op weightloss data. Total of 121 patients available for analysis.
- All our study patients underwent laparoscopic Roux-en-Y gastric bypass with 100 cm Roux and 40 cm biliopancreatic limb.
- Primary outcome: maximal weight regain (WR) at 5 years post operatively.
- Weight regain WR will be defined as the percentage of the maximal weight loss (WL) regained at 5 years post operatively.
- 100 x (highest recorded weight within 5 years of surgery - lowest postoperative weight recorded/ preoperative weight)
- Secondary outcome: maximal weight loss (WLmax) within the first three postoperative years.
- WLmax is a percentage of maximal total body weight loss
- Patient's last recorded preoperative weight used to calculate this in addition to the nadir weight within the first two years following surgery.
- Statistical Analysis performed using StataCv16.1

## RESULTS

### Table 1. Participant demographics

| | Overall mean (SD) |
|---|---|
| WLmax (%) | 32.47 (10.40) |
| WR at 5yr (%) | 10.57 (5.43) |
| Age (years) | 43.89 (12.71) |
| Female (%) | 77.69% |
| Race (W%/B%/H%) | 65.29%/15.70%/18.18% |
| Preop BMI (kg/m2) | 45.56 (7.07) |
| Ghrelin (pg/ml) | 54.46 (22.24) |
| Leptin (ng/ml) | 53.87 (30.83) |
| Glucagon (pg/ml) | 65.03 (25.76) |
| HOMAIR | 3.36 (5.17) |
| Insulin ( IU/ml) | 13.22 (18.53) |
| A1C (%) | 5.97 (0.87) |
| Glucose (mg/dl) | 99.77 (25.26) |
| CRP (mg/l) | 6.59 (6.15) |
| Pre-op WL (%) | 4.56 (3.59) |

### Figure 1. WLmax unadjusted values

| Cohort | Serum Marker | Beta-coefficient (+/- SD) | p value |
|---|---|---|---|
| Overall cohort | Ghrelin | 0.039 (0.044) | 0.378 |
| | Leptin | 0.047 (0.032) | 0.144 |
| | HbA1c | -1.82 (1.14) | 0.112 |
| DM cohort | Ghrelin | 0.125 (0.057) | 0.037 |
| | Leptin | -0.00025 (0.051) | 0.996 |
| | HbA1c | -0.27 (1.18) | 0.821 |

### Figure 2. WR at 5 years, unadjusted values

| Cohort | Serum Marker | Beta-coefficient (+/- SD) | p value |
|---|---|---|---|
| Overall cohort | Ghrelin | 0.044 (0.062) | 0.479 |
| | Leptin | 0.045 (0.049) | 0.364 |
| | HbA1c | -1.51 (1.04) | 0.152 |
| DM cohort | Ghrelin | 0.110(0.091) | 0.247 |
| | Leptin | 0.173 (0.113) | 0.153 |
| | HbA1c | -4.38 (1.53) | 0.013 |

### Table 2. WLmax adjusted outcomes

*N=91; F=1.21; R2=0.195;aR2=0.034*

| Predictor | Beta Coeff | P - value | Lower 95%CI | Upper 95%CI |
|---|---|---|---|---|
| Moderate Leptin Category | 2.211 | 0.363 | -2.606 | 7.027 |
| High Leptin Category | 5.638 | 0.071 | -0.484 | 11.760 |
| Moderate Ghrelin Category | 1.098 | 0.671 | -4.034 | 6.229 |
| High Ghrelin Category | 2.551 | 0.386 | -3.281 | 8.384 |
| Sex | 0.993 | 0.709 | -4.291 | 6.277 |
| High CRP Category | -2.406 | 0.399 | -8.058 | 3.246 |
| Preoperative BMI | 0.008 | 0.966 | -0.370 | 0.387 |
| Age | *-0.2550* | *0.012* | *-0.453* | *-0.058* |
| Race, Black | -1.552 | 0.593 | -7.315 | 4.211 |
| Race, Hispanic | -1.738 | 0.493 | -6.770 | 3.292 |
| Moderate Preop Weightloss Cat | *4.583* | *0.051* | *-.016* | *9.182* |
| High Preop Weightloss Cat | -2.482 | 0.553 | -10.779 | 5.814 |
| HbA1c, serum level | -0.018 | 0.992 | -3.541 | 3.505 |
| DM status | 0.028 | 0.994 | -6.821 | 6.876 |
| HOMA-IR | 0.369 | 0.193 | -0.190 | 0.927 |

### Table 3. WR adjusted outcomes

*N=56; F=1.78; R2=0.400;aR2=0.176*

| Predictor | Beta Coeff | P - value | Lower 95%CI | Upper 95%CI |
|---|---|---|---|---|
| Moderate Leptin Category | 4.278 | 0.118 | -1.138 | 9.693 |
| High Leptin Category | *10.054* | *0.015* | *2.091* | *18.018* |
| Moderate Ghrelin Category | 3.951 | 0.172 | -1.786 | 9.688 |
| High Ghrelin Category | 0.279 | 0.933 | -6.370 | 6.928 |
| Sex | 0.993 | 0.075 | -0.542 | 10.804 |
| High CRP Category | *-8.175* | *0.029* | *-15.465* | *-0.885* |
| Preoperative BMI | -0.147 | 0.557 | -0.646 | 0.353 |
| Age | 0.086 | 0.410 | -0.123 | 0.296 |
| Race, Black | 1.308 | 0.709 | -5.723 | 8.339 |
| Race, Hispanic | -0.220 | 0.938 | -5.955 | 5.514 |
| Moderate Preop Weightloss Cat | 0.120 | 0.962 | -4.898 | 5.137 |
| High Preop Weightloss Cat | 9.013 | 0.110 | -2.142 | 20.169 |
| HbA1c, serum level | *-5.487* | *0.009* | *-9.511* | *-1.463* |
| DM status | *12.371* | *0.004* | *4.274* | *20.469* |
| HOMA-IR | -0.124 | 0.697 | -0.762 | 0.515 |

## RESULTS

- Table 1 demonstrates overall means with standard deviations of our variables in the whole cohort along with Chi-square analysis of our predictor variables
- Figures 1 and 2 show selected results of crude analyses for WLmax and WR at 5 years stratified by diabetic status
- Only 31 (25.6%) diabetic patients in our entire cohort. Our adjusted analysis showed significant positive association between preoperative fasting high leptin category and WR at 5 years
- Increase in WR of 10% compared to low leptin category
- High CRP category found to have significant inverse association with WR at 5 years
- 5.5% decrease in WR per 1% increase in HbA1c
- Increase in WR of 12.4% among diabetics compared to non-diabetics
- In adjusted analysis age was found to have significant inverse correlation (0.25%/yr) with WL & no significant association with WR

## CONCLUSIONS

- Previous studies have found age positively correlated with WL[1,3]
- Interestingly we found no correlation between preoperative fasting ghrelin and WL as had been found in previous studies [1,2]
- May have been due to a smaller sample size or differences in f/u interval
- Initial hypothesis that higher baseline BMIs and poor glycemic control will lead to suboptimal postoperative outcomes.
- We did not identify significant association between high baseline BMI and WL/WR
- Increasing HbA1c inversely correlated to WR in our cohort
- DM status positively correlated to WR in our cohort
- We identified preoperative fasting high leptin category to be positively correlated with WR at 5 years
- Previous studies have demonstrated some statistically significant predictors for WL such as ghrelin that we did not identify
- Difficult to identify baseline variables that will predict behavior as long as five years out

## CITATIONS

1. *Policy Sci* 53, 225–241 (2020). Aliakbarian, H., Bhutta, H.Y., Heshmati, K., Kunju S.U., SHEU E.G., & Tavakkoli A. Pre-operative Predictors of Weight Loss and Weight Regain Following Roux-en-Y Gastric Bypass Surgery: a Prospective Human Study. OBES SURG 30, 4852–4859 (2020). https://doi.org/10.1007/s11695-020-04877-7
2. Nicoletti CF, de Oliveira AP, Brochado MJ, Pinhel MA, de Oliveira BA, Marchini JS, et al. The Ala55Val and -866G>A polymorphisms of the UCP2 gene could be biomarkers for weight loss in patients who had Roux-en-Y gastric bypass. Nutrition. 2016/10/17. 2017;33:326–30. Available from http://www.ncbi.nlm.nih.gov/entrez/query.fcgi?cmd=Retrieve&db=PubMed&dopt=Citation&list_uids=27743836
3. Novais PF, Weber TK, Lemke N, Verlengia R, Crisp AH, Rasera-Junior I, et al. Gene polymorphisms as a predictor of body weightloss after Roux-en-Y gastric bypass surgery among obese women. Obes Res Clin Pr. 2016/08/25. 2016;10:724–7.