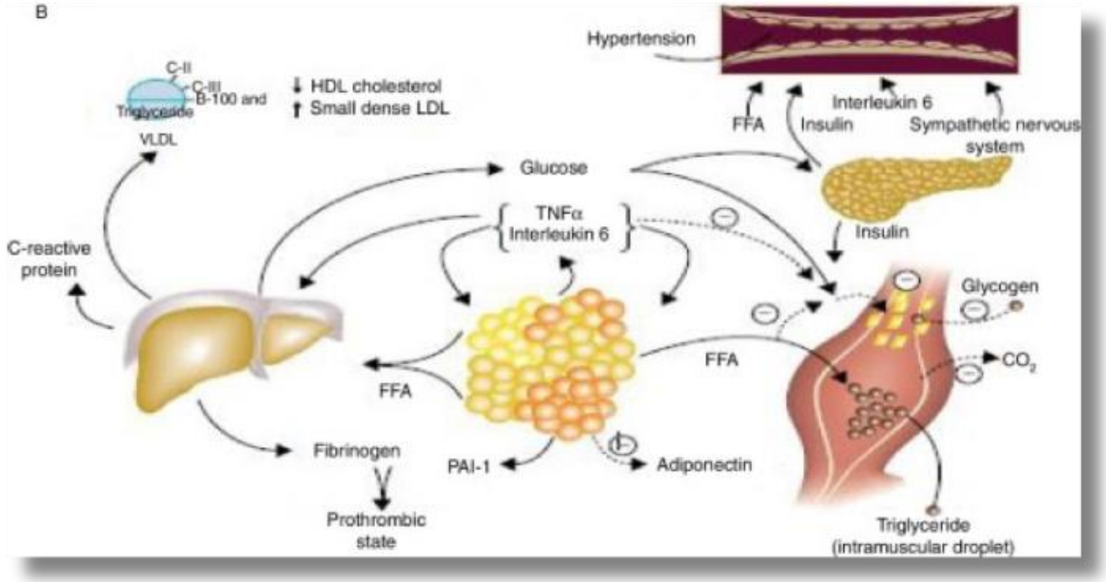

# Early Metabolic Rehabilitation: The body is designed to move

**Klga.MSc. Johanna Pino Z**

Kinetemueve
Centro BIO
Clínica Las Condes

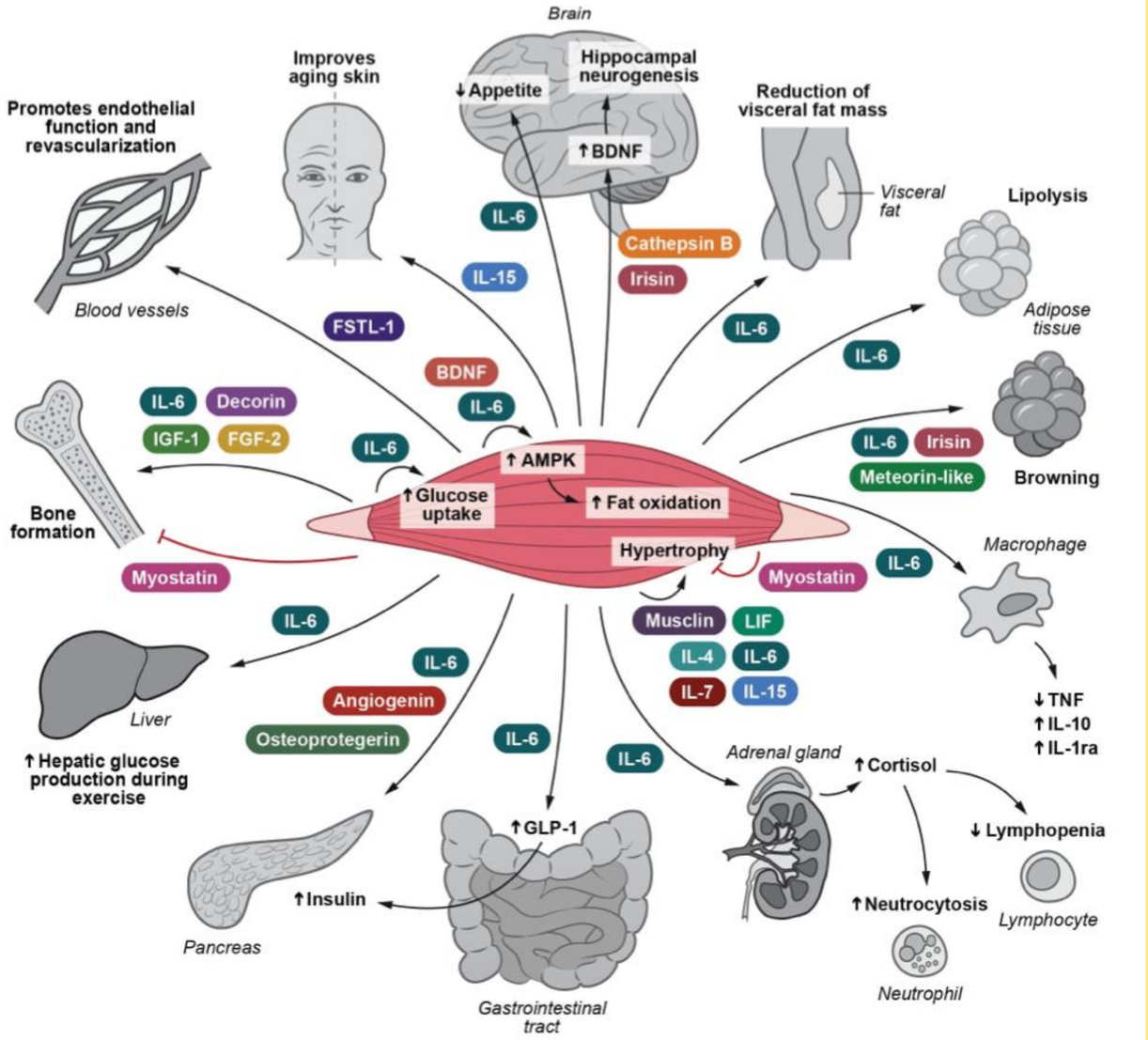
# Understanding Metabolic Rehabilitation

**Metabolic rehabilitation** refers to a structured and progressive process aimed at restoring and optimizing the metabolic health of individuals affected by conditions such as obesity, insulin resistance, metabolic syndrome, and type 2 diabetes, Conditions in which excessive fat accumulation causes a disruption in energy metabolism, altering insulin levels, blood glucose, and other related parameters.




**Excessive fat accumulation:**

- Altered carbohydrate metabolism
- Altered fat metabolism
- Insulin resistance
- Type 2 Diabetes
- Sarcopenia
- Dyslipidemia




# Why is muscle so important?

Skeletal muscle is not only essential for movement, posture, and physical strength it is also a highly active metabolic and endocrine organ.

**Myokines**, which are cytokines and peptides secreted by muscle fibers during contraction. These molecules act as **messengers**, communicating with other organs such as the liver, adipose tissue, pancreas, bones, and even the brain


# The challenge of the Bariatric Patient

**Caloric Restriction + Low Protein Intake + Increased Catabolism**

**Muscle Mass Loss**

**Attenuate muscle mass loss with exercise**

ELSEVIER

Surgery for Obesity and Related Diseases 15 (2019) 1965–1973

SURGERY FOR OBESITY AND RELATED DISEASES

Original article

# Acute and longer-term body composition changes after bariatric surgery

Laurent Maïmoun, Ph.D.[a,b,*], Patrick Lefebvre, M.D., Ph.D.[c], Safa Aouinti, Ph.D.[d], Marie-Christine Picot, M.D., Ph.D.[d], Denis Mariano-Goulart, M.D., Ph.D.[a,b], David Nocca, M.D., Ph.D.[e]; for the Montpellier Study Group of Bariatric Surgery

This study shows that during the first month following bariatric surgery, the amount of muscle mass lost is equivalent to that lost over the subsequent 11 months. The loss of muscle mass is directly associated with caloric restriction and the rate of weight loss.

Table 2
Body composition of the patients at baseline and 1 and 12 months after sleeve gastrectomy

| | Baseline | 1 mo | 12 mo | % Change (Δ 1 mo − baseline/baseline) | % Change (Δ 12 − 1 mo/1 mo) | % Change (Δ 12 mo − baseline/baseline) |
|---|---|---|---|---|---|---|
| LTM, kg | | | | | | |
| Upper limbs | 3 ± .8 | 2.7 ± .7 | 2.5 ± .6 | −9.8 ± 4.6† | −8.0 ± 6.2† | −16.5 ± 7.7† |
| Trunk | 30.1 ± 4.2 | 27.3 ± 3.9 | 25 ± 3.3 | −9.5 ± 5.4† | −8.2 ± 6.5† | −16.8 ± 5.7† |
| Lower limbs | 10 ± 1.7 | 9 ± 1.6 | 8.1 ± 1.4 | −10.4 ± 4.2† | −9.9 ± 6.7† | −19.2 ± 4.9† |
| Whole body | 59.8 ± 8.9 | 54.1 ± 7.9 | 49.3 ± 6.9 | −9.7 ± 3.3† | −8.7 ± 4.7† | −17.4 ± 4.4† |

# Keys to long-term weight maintenance

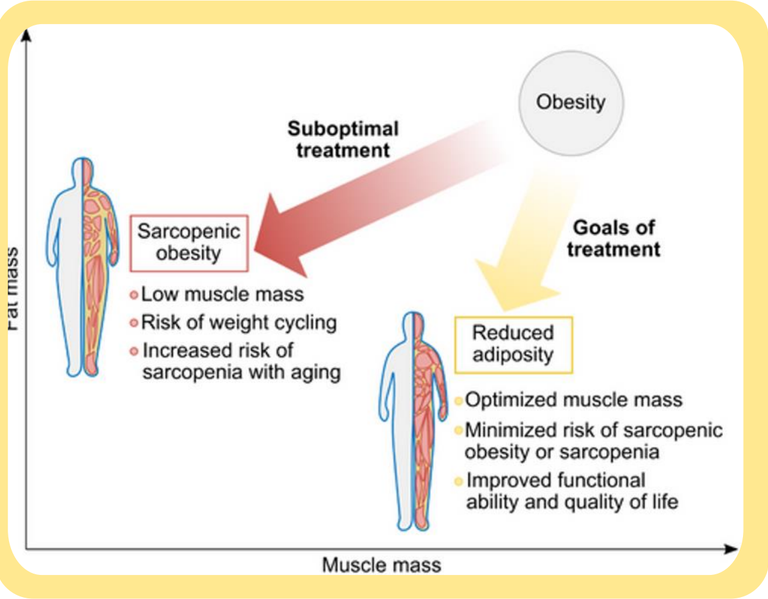
- Systematic review and meta-analysis on bariatric surgery patients, reported that skeletal muscle mass (SMM), fat-free mass (FFM) and lean body mass (LBM) **decline most sharply during the first 3 months post-surgery**, accounting for more than 55% of total 12-month loss, with over 8 kg lost by one year.
- Critically, this muscle loss correlates with decreased **basal metabolic rate** and a higher risk of **weight regain**, as muscle influences metabolic regulation and appetite signals .

What matters: Preserving muscle mass, Improving physical condition, Maintaining long-term healthy habits

Nuijten MAH, Eijsvogels TMH, Monpellier VM, Janssen IMC, Hazebroek EJ, Hopman MTE. The magnitude and progress of lean body mass, fat-free mass, and skeletal muscle mass loss following bariatric surgery: A systematic review and meta-analysis. Obes Rev. 2022 Jan;23(1)

# During caloric restriction for weight loss, the body uses not only fat stores but also muscle tissue as an energy source.

Studies indicate that muscle mass loss can represent between 25% and 39% of total weight lost over periods of 36 to 72 weeks.




**Sarcopenic obesity**

**Postural alterations**

**Decrease strength**

Bellicha et al., 2021

# How early?

What do you think, when I say EXERCISE!!! The surgeon thinks: how is the patient going to exercise so soon? Let’s better make sure and wait until a month. The kinesiologist thinks: exercise is adaptable to each condition; it is the tool we can introduce if it is guided by a specialist in this area

The group that exercised had greater weight and fat loss.

SUPPLEMENT ARTICLE

OBESITY Reviews WILEY

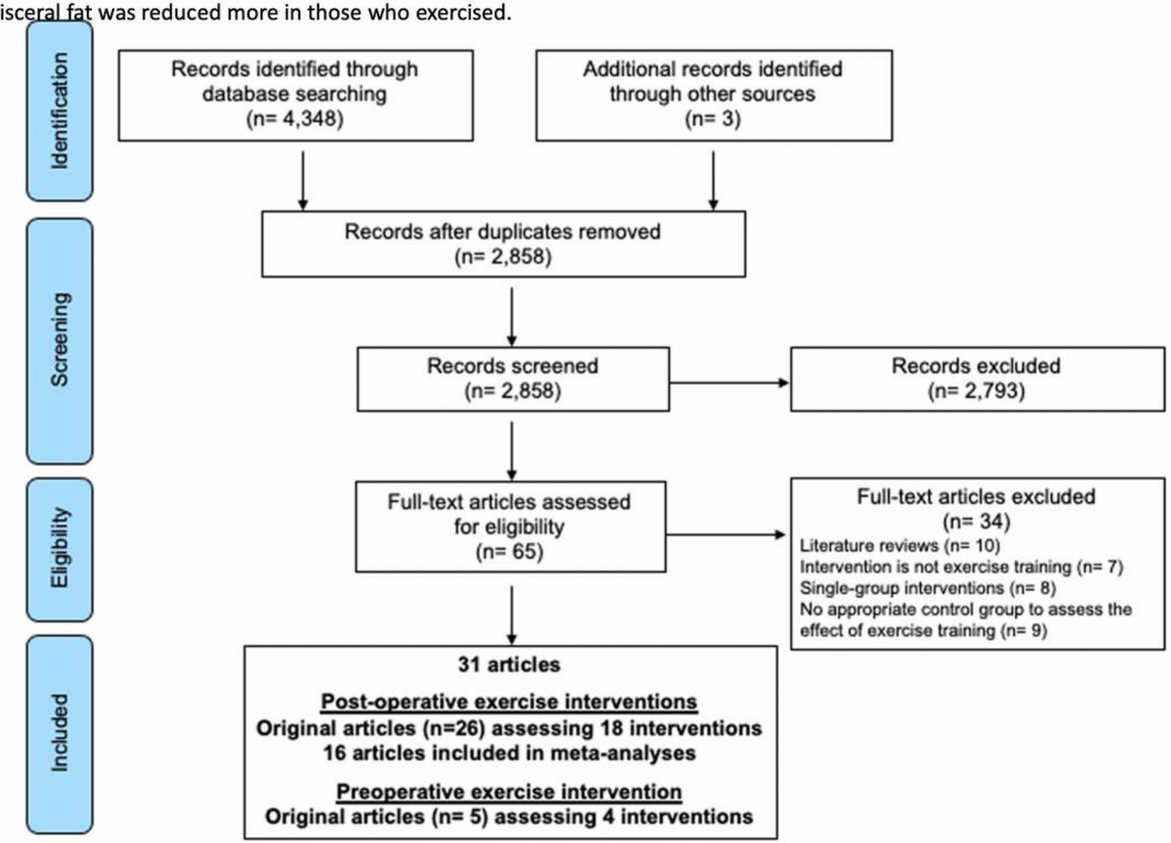
# Effect of exercise training before and after bariatric surgery: A systematic review and meta-analysis

Alice Bellicha[1,2] | Marleen A. van Baak[3] | Francesca Battista[4] | Kristine Beaulieu[5] | John E. Blundell[5] | Luca Busetto[6,7] | Eliana V. Carraça[8] | Dror Dicker[6,9] | Jorge Encantado[10] | Andrea Ermolao[4] | Nathalie Farpour-Lambert[6,11] | Adriyan Pramono[3] | Euan Woodward[6] | Jean-Michel Oppert[12]

Physical exercise has multiple benefits for the bariatric patient; however, there are few studies on early exercise

Only 3 studies (out of 26) began with exercise prior to the month post-surgery

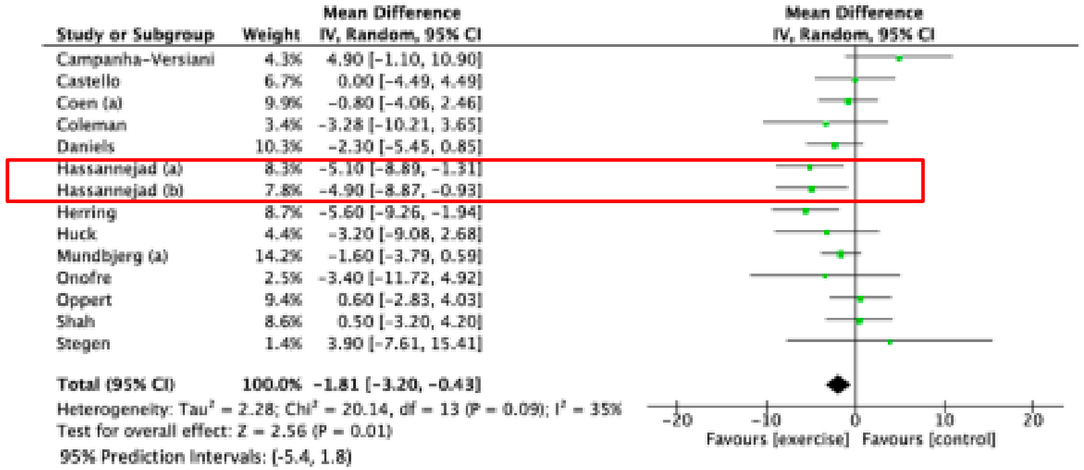
Visceral fat was reduced more in those who exercised.



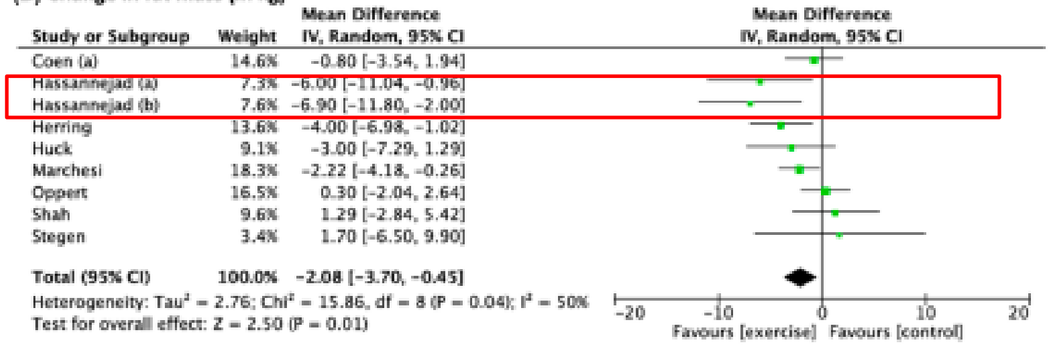
| | | | | | | |
|---|---|---|---|---|---|---|
| Rojhani-Shirazi et al.[46] | RCT<br>SG | Exercise group: $N = 16$<br>Age: 36.1 (6.7) years<br>BMI: 40.5 (5.4) kg/m$^2$<br>Female: 100%<br>Control group: $N = 16$<br>Age: 36.6 (7.8) years<br>BMI: 44.0 (7.2) kg/m$^2$<br>Female: 100% | Postoperative intervention<br>- Program duration: 1 month<br>- Start: 5 days after surgery<br>- Balance training<br>- 4 sessions/week of 30–45 min<br>- Supervision: Not reported | Usual care | - Body weight<br>- Waist circumference<br>- Balance control | Postintervention |
| Hassannejad et al.[17] | RCT<br>RYGB, SG | Exercise (aerobic) group: $N = 20$<br>Age: 33.3 (8.4) years<br>BMI: 47.9 (6.7) kg/m$^2$<br>Female: 75%<br>Exercise (aerobic + resistance) group: $N = 20$<br>Age: 35.4 (8.1) years<br>BMI: 42.9 (3.9) kg/m$^2$<br>Female: 70%<br>Control group: $N = 20$<br>Age: 36.7 (6.2) years<br>BMI: 46.6 (6.0) kg/m$^2$<br>Female: 80% | Postoperative intervention<br>- Program duration: 3 months<br>- Start: immediately (aerobic) and 5-week (aerobic + resistance) after surgery<br>- Aerobic training or aerobic + resistance training<br>- 3–5 sessions/week: 150–200 min of aerobic exercise (12–14 on Borg scale) per week + 20–30 min of resistance exercise (only in the aerobic + resistance group)<br>- Supervision: none | Usual care | - Body weight<br>- Body composition<br>- Skeletal muscle mass<br>- Muscle strength<br>- Walking test | Postintervention |
| Muschitz et al.[50] | RCT<br>RYGB, SG | Exercise group: $N = 110$<br>Age: 41.0 (34;0; 45.0) years<br>BMI: 44.3 (41.1; 47.9) kg/m$^2$<br>Female: 60%<br>Control group: $N = 110$<br>Age: 40.0 (35.0; 45.8) years<br>BMI: 44.2 (40.7; 47.7) kg/m$^2$<br>Female: 56% | Post-operative intervention<br>- Program duration: 24 months<br>Start: 2 weeks after surgery<br>- Aerobic + resistance training + protein, calcium and vit. D supplementation<br>- 5 sessions/week of aerobic training (45 min, intensity not reported) + 2 sessions/week of resistance training (30 min, intensity not reported)<br>- Supervision: none | Usual care | - Body weight<br>- Body composition<br>- Bone mineral density<br>- Quality of life | Postintervention |

Of these 3 studies, 1 started exercise 5 days after surgery, and only 2 reported having performed muscle strength exercises

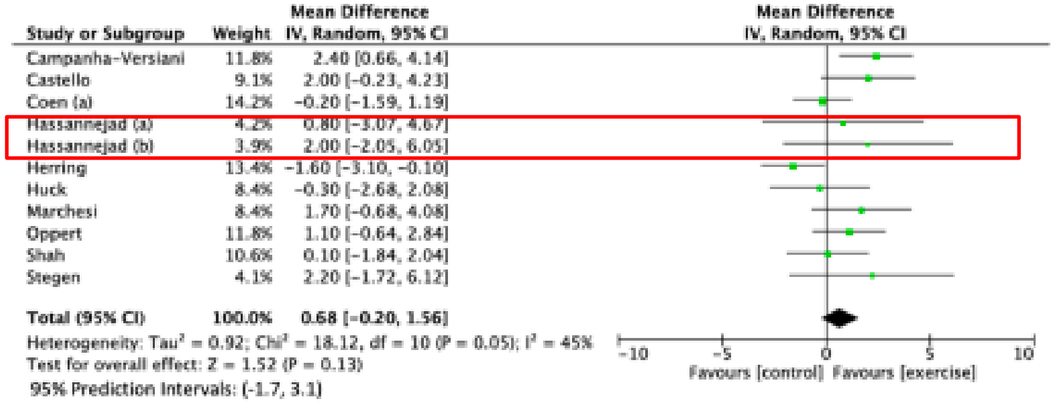
**(A) Change in body weight (in kg)**




**(B) Change in fat mass (in kg)**




**(C) Change in lean body mass (in kg)**




The study found changes in body weight as well in fat mass and muscle mass.

# Physical training in bariatric patients is essential to preserve muscle mass and enhance fat los? Our experience...

Obesity Surgery
https://doi.org/10.1007/s11695-025-07685-z

RESEARCH

## Adherence to an Early Exercise Plan Promotes Visceral Fat Loss in the First Month Following Bariatric Surgery

Johanna Pino-Zuñiga[1] · Paloma Lillo-Urzua[2] · Mariela Olivares-Galvez[1] · Ana Palacio-Aguero[1,3] · Juan Camilo Duque[1] · Rafael Luengas[1] · Jorge Cancino-Lopez[4,5]

Received: 9 September 2024 / Revised: 6 January 2025 / Accepted: 11 January 2025


Obesity Surgery
https://doi.org/10.1007/s11695-024-07451-7

RESEARCH

## Creatine Supplementation Prior to Strength Exercise Training Is Not Superior in Preventing Muscle Mass Loss Compared with Standard Nutritional Recommendations in Females After Bariatric Surgery: A Pilot Study

Marcelo Diaz-Pizarro[1] · Johanna Pino-Zúñiga[1,2] · Mariela Olivares Gálvez[2] · Carolina Rendon Vesga[2] · Rafael Luengas Tello[2] · Juan Camilo Duque Seguro[2] · Jorge Cancino-Lopez[1]

Received: 25 July 2024 / Revised: 5 August 2024 / Accepted: 8 August 2024


It can be started early without complications but with precautions for common symptoms: dizziness, nausea, abdominal pain.

Obesity Surgery
https://doi.org/10.1007/s11695-024-07185-6

ORIGINAL CONTRIBUTIONS

## Early Exercise Through Telerehabilitation After Bariatric Surgery: Is It Feasible?

Johanna Pino-Zúñiga[1,2] · Mariela Olivares[1,2] · Giselle Muñoz[3] · Camilo Boza[4] · Camilo Duque[1] · Jorge Cancino-López[2]

Here I present our experience, which has been published in *Obesity Surgery*, where our intervention started 5 days after surgery."

Obesity Surgery
https://doi.org/10.1007/s11695-024-07451-7

IFSO

RESEARCH

# Creatine Supplementation Prior to Strength Exercise Training Is Not Superior in Preventing Muscle Mass Loss Compared with Standard Nutritional Recommendations in Females After Bariatric Surgery: A Pilot Study

Marcelo Diaz-Pizarro[1] · Johanna Pino-Zúñiga[1,2] · Mariela Olivares Gálvez[2] · Carolina Rendon Vesga[2] · Rafael Luengas Tello[2] · Juan Camilo Duque Seguro[2] · Jorge Cancino-Lopez[1]

Received: 25 July 2024 / Revised: 5 August 2024 / Accepted: 8 August 2024


| Variable | Creatine Group | Placebo Group | Total |
|---|---|---|---|
| **Number of Participants** | 5 | 8 | 13 |
| **Mean Age (years)** | 40.4 | 37.4 | 38.6 |
| **Height (m)** | 1.60 | 1.63 | 1.62 |
| **BMI (kg/m²)** | 40.4 ± 4.8 | 38.7 ± 6.6 | 39.4 ± 5.8 |
| **Type of Surgery** | | | |
| Gastric Bypass | 3 | 4 | 7 |
| Sleeve Gastrectomy | 2 | 4 | 6 |

In this pilot study on the use of creatine, we first wanted to assess the tolerance to a supplement just a few days after surgery. It was a double-blind study in which the experimental group received 8 grams of creatine before training, while the placebo group received cornstarch. The training was strength-based and started between 7–15 days post-op. As you can see, there was no difference between the two groups; however, both groups that trained lost less than 10% of skeletal muscle mass from the total weight lost.

## CREATINE SUPPLEMENTATION PRIOR TO STRENGTH TRAINING AFTER BARIATRIC SURGERY: A PILOT STUDY

### STUDY TITLE

- 20 women
- 18–60 years, ≤ 2 weeks post-surgery
- No renal disease or high CVR

### INTERVENTION

- Randomized into creatine group (n=10, placebo n=10)
- 8 weeks
- Strength training 3 Times/week

### INTERVENTION

8 weeks intervention placebo or creatine

| Outcome | Creatine | Placebo Δ | Between-group |
|---|---|---|---|
| Body weight | 9,8 | 9,4 | NS |
| Fat mass | 8,8 | 8,9 | NS |
| Lean (muscle) mass | 0,9 | 0,6 | NS |

Obesity Surgery
https://doi.org/10.1007/s11695-025-07685-z

RESEARCH

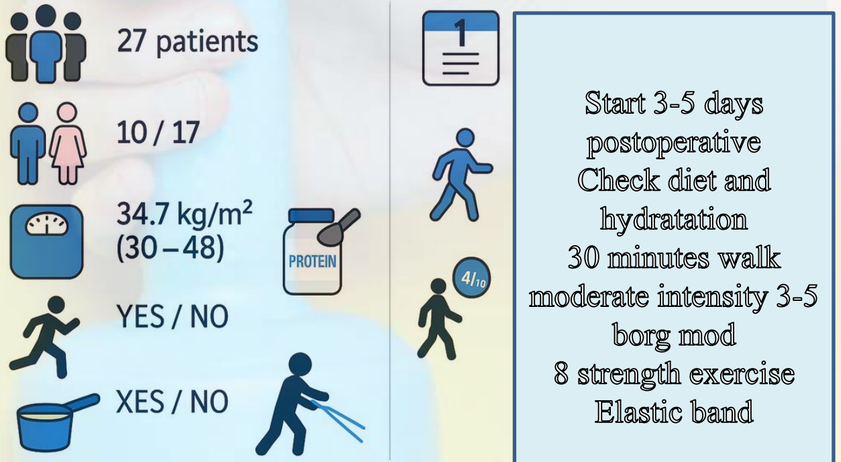
# Adherence to an Early Exercise Plan Promotes Visceral Fat Loss in the First Month Following Bariatric Surgery

Johanna Pino-Zuñiga[1] · Paloma Lillo-Urzua[2] · Mariela Olivares-Galvez[1] · Ana Palacio-Aguero[1,3] · Juan Camilo Duque[1] · Rafael Luengas[1] · Jorge Cancino-Lopez[4,5]

Received: 9 September 2024 / Revised: 6 January 2025 / Accepted: 11 January 2025


In this other study, we aimed to start exercise even earlier, but with exercise instructions rather than supervised sessions as in the previous study. Upon hospital discharge, patients were given a medium-resistance elastic band and a video with 8 strength exercises to be performed 3 times per week, with 3 sets of 15 repetitions each. In addition, they were instructed to complete 30 minutes of walking at moderate intensity, evaluated using the Borg scale (3–5). They were also advised to avoid the Valsalva maneuver, and it was ensured that their protein intake was at least 60 grams per day during the first month. The results showed that: (1) patients who achieved a protein intake ≥60 g/day lost higher weight and fat (2) patients who adhered to the exercise program increased both total fat loss and visceral fat loss."

## Materials & Methods Exercise Plan



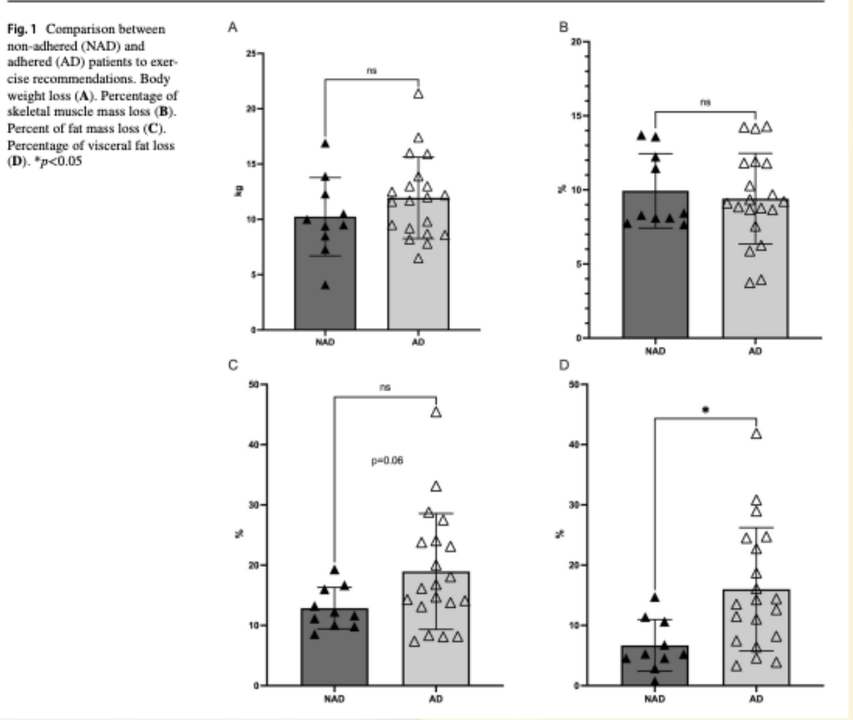




**Fig. 1** Comparison between non-adhered (NAD) and adhered (AD) patients to exercise recommendations. Body weight loss (**A**). Percentage of skeletal muscle mass loss (**B**). Percent of fat mass loss (**C**). Percentage of visceral fat loss (**D**). *$p<0.05$

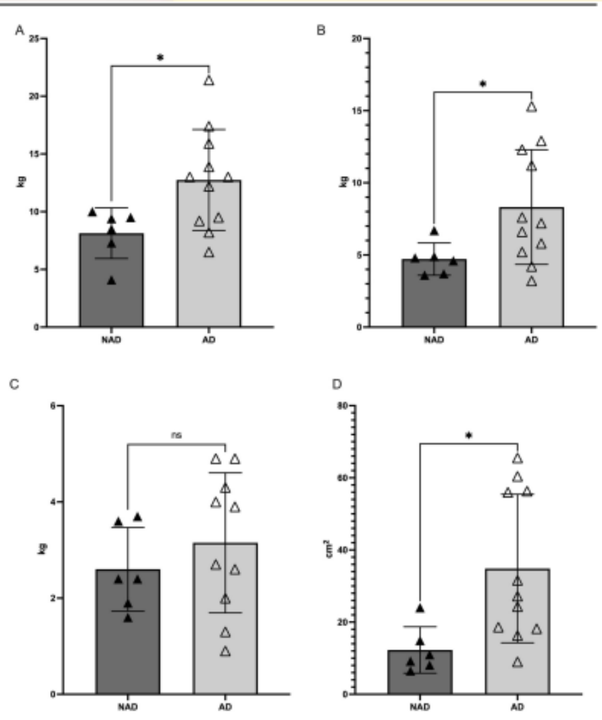



**Fig. 2** Comparison between non-adhered (NAD) and adhered (AD) patients to exercise and daily protein intake recommendations. Body weight loss (**A**). Fat mass loss (**B**). Skeletal muscle mass loss (**C**). Visceral fat loss (**D**). *$p<0.05$

Obesity Surgery
https://doi.org/10.1007/s11695-024-07185-6

IFSO

ORIGINAL CONTRIBUTIONS

Check for updates

# Early Exercise Through Telerehabilitation After Bariatric Surgery: Is It Feasible?

Johanna Pino-Zúñiga[1,2] · Mariela Olivares[1,2] · Giselle Muñoz[3] · Camilo Boza[4] · Camilo Duque[1] · Jorge Cancino-López[2]

## METHOD

67 patients enrolled in a telerehabilitation program following bariatric surgery, completed a survey assessing their perception of the intensity, discomfort, and safety during exercise sessions.

## RESULTS

Ninety-eight percent of patients felt safe during online exercise sessions
Less discomfort reported in the group that started after 15 days
Most participants perceived the intensity of the sessions as moderate
The most frequently mentioned benefits of exercise were increased energy, mood and feeling more active

40% began exercising between 5-10 days after surgery

70% did not experience discomfort during the first month of exercise


## CONCLUSION

Telerehabilitation conducted during the first month after bariatric surgery:

- Was feasible and well-tolerated by patients.
- Online supervised exercise providing a safe Alternative for those patients who face difficulties with in-person interventions

Safe and well Tolerated

Since technology is here to stay, during the pandemic we implemented online group training, which to this day has given us great results by reducing barriers of time and, in many cases, the feeling of exposure that our patients experience when attending a conventional gym. We therefore wanted to evaluate the feasibility, tolerance, and adverse effects in a group of 67 patients who started exercise via Zoom between 5–15 days after surgery. The sessions lasted 50 minutes: 10 minutes of general mobility and warm-up; 35 minutes of full-body strength exercises using equipment such as elastic bands, dumbbells, and body weight, performed in 3 sets of 12–15 repetitions with rest as tolerated, adjusting session intensity using the Borg scale; and the final 10 minutes dedicated to cool-down and stretching. The results show that only a very small percentage reported discomfort, the most frequent being dizziness. This can be associated with episodes of orthostatic hypotension, which can be prevented by adjusting position changes and making slower transitions between exercises

# Final Reflections

- Physical training in bariatric patients is essential to preserve muscle mass and enhance fat loss.
- It can be safely initiated early, without complications, although some precautions are needed due to more frequent symptoms such as dizziness, nausea, and abdominal pain. Preoperative physiotherapy evaluation is indispensable for early initiation
- By adjusting the exercise session, training can be performed at a moderate intensity, which is the goal during this postoperative phase.
- Patient motivation and support are key for them to feel safe while exercising.
- Exercise also provides additional benefits that are perceived and valued by patients during this lifestyle change.

# Take-Home Message

Teamwork and trust are essential to generate new knowledge and improve the quality of care for our patients, building on experience but always science based




**Johanna Pino**
@kinetemueve
www.kinetemueve.cl