e-ISSN: 2237-3756

# IMPACT OF WEIGHT LOSS ON INFLAMMATORY PROFILE OF PATIENTS WITH SEVERE OBESITY

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## ABSTRACT

**Objective:** To evaluate changes in the inflammatory profile of adults with severe obesity (grades II and III) undergoing treatment with a hypocaloric diet during hospital admission.

**Method:** A retrospective cohort study with a descriptive approach, using electronic medical records of patients with grade II and III obesity admitted between 2016 and 2022 in a hospital specialized in obesity treatment.

**Results:** There was a predominance of female patients, and most patients displayed sedentary behavior. The comparison between admission and discharge after 3 or 6 months revealed that CRP, ferritin, weight, and body fat percentage showed significant reductions following hospitalization ($p<0.05$).

**Conclusions:** Patients hospitalized for multidisciplinary obesity treatment showed significant reductions in inflammatory markers, body weight, and adiposity. CRP and ferritin levels decreased similarly in patients hospitalized for 3 or 6 months; however, a 6-month hospitalization period was more effective in reducing body weight and adiposity.

**Keywords:** Weight loss. Hospital admission. Inflammation. Obesity.

**Received:** 22/09/2024
**Approved:** 07/11/2024
DOI: https://doi.org/10.19141/2237-3756.lifestyle.v11.n00.pe1613

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PIMENTA, Ana; BRAGA, Sérgio Q.; RIOS, Domingos L. S.; ALMEIDA, Marcia. Impact of weight loss on inflammatory profile of patients with severe obesity. **Lifestyle Journal**, *[S. l.]*, v. 11, n. 00, p. e1613, 2024. DOI: https://doi.org/10.19141/2237-3756.lifestyle.v11.n00.pe1613

# IMPACTO DA PERDA PONDERAL NO PERFIL INFLAMATÓRIO DE PACIENTES COM OBESIDADE GRAVE


## RESUMO

**Objetivo:** Avaliar mudanças do perfil inflamatório de adultos com obesidade grave (graus II e III) submetidos a tratamento com dieta hipocalórica via internação hospitalar.

**Método:** Estudo de coorte retrospectivo de natureza descritiva com dados de prontuários eletrônicos de pacientes com obesidade graus 2 e 3 internados entre 2016 e 2022 em um hospital especializado no tratamento da obesidade.

**Resultados:** Houve predominância de pacientes do sexo feminino, a maioria dos pacientes tinha comportamento sedentário. A comparação entre admissão e alta após 3 ou 6 meses revelou que os valores de PCR, ferritina, peso e percentual de gordura corporal apresentaram reduções significantes após a internação ($p<0.05$).

**Conclusões:** Pacientes internados para tratamento multidisciplinar da obesidade apresentaram reduções significantes nos marcadores inflamatórios, no peso corporal e na adiposidade. Os níveis de PCR e de ferritina foram reduzidos de forma similar entre os pacientes internados por 3 ou 6 meses, entretanto, o período de internação de 6 meses foi mais eficaz para a redução de peso corporal e adiposidade.


**Palavras-chave:** Perda de peso. Internamento hospitalar. Inflamação. Obesidade.

# IMPACTO DE LA PÉRDIDA DE PESO EN EL PERFIL INFLAMATORIO DE PACIENTES CON OBESIDAD GRAVE


## RESUMEN

**Objetivo:** Evaluar los cambios en el perfil inflamatorio de adultos con obesidad grave (grados II y III) sometidos a tratamiento con una dieta hipocalórica durante la hospitalización.

**Método:** Estudio de cohorte retrospectivo de naturaleza descriptiva basado en datos de historias clínicas electrónicas de pacientes con obesidad de grados II y III hospitalizados entre 2016 y 2022 en un hospital especializado en el tratamiento de la obesidad.

**Resultados:** Se observó un predominio de pacientes del sexo femenino, y la mayoría presentaba un comportamiento sedentario. La comparación entre los datos al ingreso y al alta, después de 3 o 6 meses de hospitalización, mostró reducciones significativas en los niveles de proteína C reactiva (PCR), ferritina, peso corporal y porcentaje de grasa corporal ($p<0.05$).

**Conclusiones:** Los pacientes hospitalizados para un tratamiento multidisciplinario de la obesidad mostraron reducciones significativas en los marcadores inflamatorios, el peso corporal y la adiposidad. Aunque los niveles de PCR y ferritina disminuyeron de manera similar en los pacientes hospitalizados durante 3 o 6 meses, el período de hospitalización de 6 meses fue más efectivo para reducir el peso corporal y la adiposidad.

**Palabras clave:** Pérdida de peso. Hospitalización. Inflamación. Obesidad.

## INTRODUÇÃO

The World Health Organization (WHO, 2024) released alarming data on overweight and obesity among the adult population in 2022, revealing that 43% of adults were overweight, and 16% were classified as obese. This equates to approximately 890 million people living with obesity that year. These figures underscore the high prevalence of this clinical condition, which represents a severe public health challenge, as it is associated with the development of various non-communicable chronic diseases (NCDs) and certain types of cancer, increasing morbidity and mortality rates and affecting the quality of life of this population (ION et al., 2023).

Obesity is a multifactorial condition related to genetic, environmental, biological, and behavioral factors, characterized by an increase in body mass index (BMI) due to excessive fat accumulation (KWAIFA et al., 2020). Its classification is determined by calculating the division of weight (kg) by the square of height ($m^2$), resulting in three degrees of obesity: Obesity Grade I = 30 to 34.9 $kg/m^2$; Obesity Grade II = 35 to 39.9 $kg/m^2$; and Obesity Grade III = > 40 $kg/m^2$ (WHO, 2000).

Excess body fat leads to chronic low-grade inflammation, as adipose tissue plays a crucial role in inflammatory cascades, and obesity can trigger disruptions in these mechanisms, such as hyperactivation of the immune system and, consequently, an increased inflammatory response (TAYLOR, 2021). Inflammatory markers like C-reactive protein (CRP) and ferritin are important indicators of this condition (RYAN et al., 2018; IZAOLA et al., 2015). This inflammatory process leads to a series of pathophysiological events that can promote oxidative stress in various tissues (MACEDO, 2020).

Non-surgical hospital treatments, hypocaloric diets, and a structured holistic approach with a multidisciplinary team have been studied as viable strategies for Grades 2 and 3 obesity, as they exhibit several characteristics that can directly influence outcomes related to lifestyle changes, weight loss, and improved quality of life for this group (REES et al., 2021).

## OBJECTIVE

The aim of this study was to evaluate changes in the inflammatory profile of adults with severe obesity (grades II and III) undergoing treatment with a hypocaloric diet during hospital admission.

## METHOD

This is a retrospective cohort study of descriptive nature. Data were collected from the electronic medical records of patients with grade 2 and 3 obesity admitted between 2016 and 2022 at a hospital specializing in obesity treatment, with a multidisciplinary team providing 24-hour care. The study included individuals with severe obesity who were hospitalized for periods of 3 or 6 months. Inclusion criteria were as follows: grade II or III obesity upon admission; age over 12 years; treatment with a hypocaloric diet. Patients lacking laboratory data upon admission were excluded. A total of 1,179 patients met these criteria, with n = 777 admitted for 3 months and n = 402 admitted for 6 months.

Patients were followed by a multidisciplinary team consisting of physicians, nutritionists, psychologists, physical therapists, exercise instructors, and occupational therapists, who employed a transdisciplinary approach focused on weight loss and lifestyle changes. The main components included low-calorie diets (LCD) and very low-calorie diets (VLCD), physical activity, individual cognitive behavioral therapy, participation in educational groups, and individual clinical support. The restrictive diets, along with supplementation of vitamins, minerals, electrolytes, and essential fatty acids, were based on Brazilian guidelines for the treatment and management of obesity (ABESO, 2022) to ensure adequate nutrition for the patients.

All patients had their weight and height measured and underwent bioimpedance analysis upon admission and after three or six months of hospitalization. Body composition was evaluated using a tetrapolar bioimpedance device (with 8 tactile electrodes, InBody 570, Seoul, Korea), and blood samples were collected for biochemical analysis at admission and discharge. Laboratory tests were performed to measure C-reactive protein (by immunoturbidimetry) and ferritin (by electrochemiluminescence) using an automated device.

Obesity severity was assessed using body mass index (BMI). Grade I obesity was classified as a BMI of 30 to 34.9 kg/m², grade II as 35 to 39.9 kg/m², and grade III as ≥40 kg/m².

Comparisons between variables at admission and after the hospitalization period were conducted using the Wilcoxon test, with a significance level of 5%. Statistical analyses were performed using SPSS v.29.

This research adhered to bioethical principles according to Resolution 466/2012 (CONEP). The study was approved by the UNEB Ethics Committee (CAEE: 65578822.1.0000.0057).

## RESULTS

The epidemiological data of the patients who participated in this study (Table 1) represent demographic and health-related characteristics of the patients who remained hospitalized for 3 (n=777) and 6 (n=402) months. There was a predominance of female patients, most of the patients had a sedentary lifestyle, and more than half were diagnosed with systemic arterial hypertension (Table 1).

**Table 1**. Clinical and demographic data.

| | 3 months (n=777) | 6 months (n=402) |
|---|---|---|
| Age | 45.4 ± 16,4 | 47.1 ± 17,1 |
| Female sex | 546 (70,3%) | 284 (70,6%) |
| Sedentary lifestyle | 641 (82,5%) | 344 (85,6%) |
| Grade II obesity | 288 (37,1%) | 97 (24,1%) |
| Grade III obesity | 489 (62,9%) | 305 (75,9) |

Data expressed as n (%) or mean ± standard deviation.

The comparison between admission and discharge after 3 or 6 months revealed that CRP, ferritin, weight, and body fat percentage showed significant reductions following hospitalization (Table 2).

**Table 2**. Comparison of variables between admission and discharge.

| | Admission | 3 months (n=777) | Admission | 6 months (n=402) |
|---|---|---|---|---|
| PCR | 8.2 (4.2-13.8) | 5.2 (2.6-10.5)* | 8.0 (4.5-13.7) | 6.5 (3.0-8.7)* |
| Ferritine | 165.0 (82.5-286.0) | 137.0 (67.5-259.0)* | 165.0 (80.8-285.2) | 139.0 (68.0-257.0)* |
| Weight (kg) | 112.7 (100.9-126.3) | 100.2 (89.7-111.7)* | 116.4 (103.7-130.2) | 91.6 (83.8-101.9)* |
| % G | 51.3 (48.6-53.3) | 47.8 (43.0-51.3)* | 52.0 (50.0-53.7) | 43.2(37.6-48.0)* |

Data expressed as medians (interquartile ranges).
CRP: C-reactive protein; %BF: body fat percentage.
Statistically significant differences ($p<0.05$) between the time points before and after the hospitalization period.

## DISCUSSION

The aim of this study was to evaluate changes in the inflammatory profile of adults with severe obesity undergoing hypocaloric diet treatment through hospitalization. The results indicate that even the shorter hospitalization period (3 months) was sufficient for patients to show statistically significant reductions in inflammatory markers (CRP and ferritin), body weight, and adiposity. CRP and ferritin levels were similarly reduced in patients hospitalized for 3 or 6 months; however, the 6-month hospitalization period was more effective in reducing body weight and adiposity compared to 3 months.

Several studies have evaluated the effect of hypocaloric diets and weight loss on CRP levels (CAMHI et al., 2010; UUSITUPA, 2013; STECKHAN et al., 2016). However, results in the literature remain conflicting. While some studies, such as a systematic review of randomized clinical trials (BIANCHI, 2018), suggest that calorie restriction and the consequent reduction in weight and fat percentage lead to decreased inflammatory markers, other authors, like Buchowski et al. (2012), did not observe significant changes in CRP levels in overweight and obese women followed for 119 days despite a hypocaloric diet.

Nevertheless, a recent systematic review (RAHIMI et al., 2022) concluded that lifestyle changes, including calorie restriction and regular physical exercise, can produce changes in some inflammatory markers. Regarding CRP, the authors report an average reduction of 0.52 in the reviewed studies, which is considerably lower than the reduction observed in this study (-3), demonstrating the effectiveness of the proposed intervention.

CRP, being an acute-phase protein regulated by cytokines IL-6, TNF-alpha, and IL-1, is often measured in obese patients, as pro-inflammatory contexts are directly associated with higher values of this marker (KEMALASARI et al., 2022). CRP levels can be influenced by several factors beyond weight and fat percentage, such as age, sex, physical activity levels, smoking, alcohol consumption, and the presence of comorbidities like diabetes and hypertension (NAZMI et al., 2008). Therefore, a comprehensive program with lifestyle changes is desirable for treating obese patients. It should also be noted that obesity is an important cardiovascular risk factor, making its management through such interventions highly recommended (WILLIAMS et al., 2019; HO et al., 2016).

The literature suggests that elevated ferritin levels may be influenced by factors such as body mass index (BMI) and obesity, as shown in a systematic review with meta-analysis by Suárez-Ortegón et al. (2018). Elevated ferritin levels have also been associated with increased

metabolic risk (YOO et al., 2012), thus being considered inflammatory markers rather than indicators of iron status in obese patients (KHAN et al., 2016).

The intervention proposed here was effective in significantly reducing ferritin levels among patients hospitalized for 3 or 6 months, corroborating data from a meta-analysis conducted by Teng et al. (2020). The authors found that body weight reduction helps restore iron homeostasis in obese individuals, with this benefit linked to the extent of weight reduction and the duration of the intervention.

## CONCLUSION

Patients hospitalized for multidisciplinary obesity treatment showed significant reductions in inflammatory markers, body weight, and adiposity. CRP and ferritin levels were similarly reduced among patients hospitalized for 3 or 6 months; however, a 6-month hospitalization period was more effective for reducing body weight and adiposity.

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