

# Research Paper:

## The Effects of Essential Amino Acids, Zinc, and Iron Supplementation on the Prevention of Early Hair Loss After Sleeve Gastrectomy



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## ABSTRACT

**Background:** The available micronutrients and proteins are reduced to the body after laparoscopic sleeve gastrectomy (LSG). Thus, we evaluated the effects of various supplements and the rate of hair loss in the postoperative period.

**Methods and Materials:** In this interventional study, we examined female candidates of LSG. The candidates were randomly divided into three groups. Group 1 received routine multivitamin-mineral supplements. Group 2 took zinc, iron, and vitamin B supplements plus routine multivitamin-mineral until the end of the third month after surgery. Group 3 took supplements containing wheat and sesame proteins and methionine and cysteine in addition to zinc, iron, vitamins B supplements, and routine multivitamin-mineral supplements. The number of hairs in the frontal area was counted using trichoscopy before and 3 months after the operation.

**Results:** The mean number of hairs in the frontal area before and after operations respectively were 143 and 100 hairs per cm<sup>2</sup> in group 1, 142 and 116 in group 2, and 137 and 177 in group 3. The mean number of trichoscopy hairs in the frontal area was significantly higher in group 3 than in other groups (P<0.001).

**Conclusion:** The present study clearly showed that the use of protein supplements added to micronutrients more and better reduces the rate of hair loss after LSG. This finding can be considered and evaluated for future surgeries.

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## 1. Introduction

**M**etabolic surgery has been transpired as a helpful treatment for morbid obesity resulting in improvement or even resolution of associated comorbidities [1-3]. On the other hand, patients with morbid obesity develop nutritional problems before and after surgery. Several risk factors have been identified as preoperative nutritional problems in these patients. These problems include unscientific diets and micronutrients malnutrition [4]. Micronutrients consist of fat-soluble vitamins, folic acid, and zinc. Their deficiencies are prevalent in patients with morbid obesity and may worsen after surgery.

Hair loss is a usual complaint of patients after bariatric surgery. It is caused by many things, such as rapid weight loss or zinc, iron, and other micronutrient deficiencies [5, 6].

To our research, data concerning the relationship between postoperative hair loss and micronutrient deficiencies and its treatment are scarce and contradicting.

This study aimed to investigate and find the main causes of hair loss after laparoscopic sleeve gastrectomy (LSG) and prevent and treat hair loss.

## 2. Materials and Methods

This study is a randomized, double-blind, placebo-controlled, clinical trial on patients with morbid obesity. The patients were referred to our tertiary center (Shahid Modarres Hospital, Tehran, Iran) from May to July 2020. In this study, female patients aged between 18 and 50 years with a clinical diagnosis of morbid obesity (BMI  $\geq 40$  kg/m<sup>2</sup>) were included.

After obtaining informed consent, the patients were randomly divided into three groups of 30:

1. Group 1 or the control group or received routine multivitamin-mineral supplements.
2. Group 2 received zinc, iron, vitamin B supplements plus routine multivitamin-mineral.
3. Group 3 received supplements containing wheat, sesame proteins, methionine, and cysteine in addition to zinc, iron, vitamin B supplements, and routine multivitamin-mineral supplements.

The patients were randomly divided into 3 groups using the Block method (with blocks 3, 6, 12). The patients' ages, weights, comorbidities (diabetes, hypothyroidism, and hypertension), and medications were matched between 3 groups (Table 1). Before and 3 months after LSG operation, blood tests were taken from the patients, and their serum zinc, albumin, and iron were measured. All patients were sent to count the number of their hairs in a specific location of the head (frontal part of the head of 1 cm<sup>2</sup>) by a trichoscopy before LSG. The number of each patient's hair was counted and recorded. After LSG, the patients were given the mentioned supplements (with identical shape and packing) according to which group they belonged. The patients were contacted every week after taking the drug to check their medication compliance and possible side effects. Three months after the surgery, the patients were again sent for trichoscopy evaluation in the same area to measure the number of hairs. To analyze the data, number and percentage indices were employed for qualitative variables and mean, standard deviation, and minimum-maximum value indices for quantitative variables. All descriptive tables and statistical tests such as the Chi-square test were prepared and performed in SPSS software version 22, and the statistical significance level was considered less than 0.05.

## Ethical Issues

The research followed the principles of the Declaration of Helsinki. The Ethics Committee of the Shahid Beheshti University of Medical Sciences approved the study protocol (Code: IR.SBMU.RETECH.REC.1398.100).

## 3. Results

Ninety patients were included in the study. The patients were divided into 3 groups of 30 patients each. About 94.4 % of the subjects had a compliance rate of 80% and higher. Two patients in group 1, one patient in group 2, and two patients in group 3 had less than 70% compliance and were excluded from the study (Table 1). The Mean $\pm$ SD age of the patients was 39.56 $\pm$ 11.04 years, and their Mean $\pm$ SD BMI was 46.23 $\pm$ 4.41 kg/m<sup>2</sup>. Analysis of blood marker changes (zinc, albumin, and iron) before and after the operation failed to show significant differences (P-value >0.001).

According to the results of the mentioned tests (Table 2), group 3, group 2, and then group 1 had the least hair loss in this order after LSG. Moreover, the differences in hair count before and after LSG were calculated in each group and compared between groups to find any probable residual confounding effects. The analysis was

**Table 1.** The basic characteristics of the study patients

Variable	Mean±SD			P
	Group 1 n = 28	Group 2 n = 29	Group 3 n = 28	
Weight (kg)	131.03±17.43	128.51±19.39	129.03±22.63	>0.05
Body mass index (kg/m <sup>2</sup> )	46.6±4.8	45.8±5.0	46.3±5.8	>0.05
Age (y)	38.46±10.00	37.52±8.94	39.72±8.94	>0.05
Comorbidities				
Diabetes (n)	2	2	2	>0.05
Hypothyroidism (n)	1	1	1	>0.05
Hypertension (n)	3	3	3	>0.05



performed to compare mean hair loss (hair count before surgery- hair count after surgery [ $\Delta$ ]) between 3 groups (Table 3) which showed significant differences between groups 1 and 2, 1 and 3, and 2 and 3. There was no significant difference in  $\Delta$  hair count between group 1 and group 2. This finding means that after LSG, taking zinc, iron, and vitamins B supplements containing wheat and sesame proteins and methionine cysteine plus routine multivitamin-mineral may prevent hair loss after surgery. Also, taking a supplement of zinc, iron, vitamins B plus routine multivitamin-mineral may help to reduce hair loss after LSG compared with routine multivitamin-mineral.

#### 4. Discussion

Hair loss is an unexplained multifactorial problem in patients. This problem may cause emotional distress in patients, especially after bariatric surgery [1]. In 95% of men, hair loss results from androgenetic status. Therefore, we eliminated them from the study and analyzed the relationship between nutrient deficiency and hair loss

only in women. Zinc is the second most abundant element after iron in the human body and plays a key role in the body's metabolism [2-4]. After LSG, many factors contribute to reducing zinc levels, including decreased production of gastric hydrochloric acid, which plays a vital role in bioavailability and zinc absorption [5, 6]. In the postoperative period, solid food intake starts about four weeks after surgery. Red meat (the main source of zinc) is being introduced gradually. However, its place has been omitted from the patient's daily intake because of difficulty in ingestion and digestion. After three months of surgery, patients gradually add red meat to their daily intake. This event can explain the initial and rapid decrease in postoperative zinc levels in some cases [7, 8]. This condition also explains why zinc deficiency indicates primary protein absorption after surgery [9]. There are some guidelines for zinc supplementation, but the optimal dosage and rules for administration after an LSG are still unknown. In our study, a small dose of 12.5 mg per day (125% of the recommended daily allowance) for three months was enough to stop hair loss. We sug-

**Table 2.** Mean Number of Hairs of Patients in Each Group Before and After the LSG

Variable	Before LSG			After LSG		
	N	Mean±SD	SE	N	Mean±SD	SE
Group 1	28	143.03±48.58	8.86	28	100.36±37.70	6.88
Group 2	29	142.13±45.97	8.39	29	116.76±40.15	7.33
Group 3	28	137.96±35.10	6.40	28	177.90±43.81	7.99



N: Number of patients; Mean: The mean number of hairs per square centimeter (cm<sup>2</sup>); SD: Standard Deviation; SE: Standard Error.

**Table 3.** Significance analysis of hair change count between groups

Groups	Sig. (2-tailed)
Group 1 vs Group 2	0.108
Group 1 vs Group 3	0
Group 2 vs Group 3	0



gest using a routine supplement with low doses of zinc after LSG to reduce hair loss after surgery.

After zinc, iron deficiency is also associated with hair loss. Dietary iron is absorbed naturally by hydrochloric acid in the stomach. In patients after LSG, the production of hydrochloric acid is decreased, and nutrients pass through the upper gastrointestinal tract rapidly, making iron absorption more difficult [10-12].

Kastrogaki (2018) mentioned that the most common cause of hair loss in patients who underwent LSG is decreased proteins and micronutrients in the body. This finding was consistent with our study [13]. Manazoni reported that bariatric surgery changes the skin and decreases the number of hairs on the head, which may be secondary to metabolic and nutritional disorders [14]. Ruiz Tavor reported that LSG itself reduces hemoglobin, hematocrit, and protein and minerals in the body, which is one of the main causes of hair loss [15]. In another study, they studied 42 patients undergoing LSG who suffered from hair loss after surgery. Examination showed micronutrient deficiencies in these patients before and after surgery.

As studies have shown, LSG reduces energy intake and the absorption of nutrients, especially fats and proteins, in the body [16-19].

The difference between our study and the studies mentioned above is that none of them have proved the relationship between the rate of hair loss and the lack of the mentioned nutrients quantitatively and accurately, and their research tool was self-reported questionnaires. Our study is the first to accurately measure and prove this association by quantitatively measuring the number of hair follicles with a trichoscope.

We showed that protein deficiency is the most important cause of hair loss after LSG. So the consumption of proteins along with other micronutrients can not only reduce the rate of hair loss in patients but also help in

better hair growth in patients due to inadequate intake of nutrients needed in the past.

## 5. Conclusion

The present study showed that the use of micronutrients along with protein supplements in people who underwent LSG improved their rate of hair loss. Therefore, it is recommended that people who have had an LSG, in addition to micronutrients, consume essential protein supplements.

## Ethical Considerations

### Compliance with ethical guidelines

This study was approved by the Ethics Committee of the Shahid Beheshti University of Medical Sciences (Code: IR.SBMU.RETECH.REC.1398.100).

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### Authors' contributions

All authors equally contributed to preparing this article.

### Conflict of interest

The authors declared no conflict of interest.

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