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ORIGINAL ARTICLE

# The Effect of Laparoscopic Sleeve Gastrectomy on Serum Iron Level

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ABSTRACT

**Background:** Sleeve gastrectomy surgery is effective in limiting food intake and sometimes unknown and hormonal causes in weight loss. After the bariatric surgery, patients may be exposed to nutritional deficiencies, especially iron deficiency. Regarding the importance of iron in body metabolism, this study aimed to investigate the effect of Sleeve Gastrectomy surgery on the level of serum iron deficiency anemia.

**Methods:** This cross-sectional study of 218 patients who underwent sleeve gastrectomy surgery for obesity from April 2017 to July 2018 in Shiraz Ghadir Mother & Child Hospital, which were studied in a quarterly period. The indications of the surgery were having BMI> 40 or between 35 and 39.9, which were associated with an co morbid disease. Serum levels of hemoglobin, iron, and ferritin before and three months after the surgery were evaluated.

**Results:** The mean±SD of serum iron level in women ranged from 68.8±1.91 to 65.9±2.7 and in mean±SD from 74.6±5.32 to 71.7±2.8, and the mean serum ferritin level in women was from 56.1±5.5 to 43.2±6.1, and in males, from 61.9±9.7 to 47.3±8.2, and the mean±SD of serum hemoglobin level in both women and men was from 11.8±0.13 to 12.7±0.09 to 10.7±0.12 to 11.7±0.08 and from 12.7±0.09 to 11.8±0.13 to 11.7±0.08 to 10.7±0.12, respectively.

**Conclusion:** The results of this study indicate that due to the reduction of the level of iron, after the sleeve gastrectomy surgery, the iron level of the patients should be regularly checked in order to be able to administer adequate supplements and to adjust the diet which is rich in iron to prevent anemia and its effects.

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## Introduction

The prevalence of obesity in developed and developing countries is increasing and is associated with important complications such as diabetes and cardiovascular diseases (1-5). There are various criteria for defining excessive obesity; perhaps the most accepted one is having 100 pounds (45 kg) of extra weight on the body's optimal weight (1). They also define obesity based on the BMI definitions. Its complications include: coronary artery disease, hypertension, sleep apnea, increased blood coagulation, gallstones, gastric reflux, decreased self-esteem and depression (1, 6-8).

Every year, 2.8 million people die in the world, due to the obesity or overweight (9). The ways to treat obesity include diet, increased physical

activity, and sometimes the use of medications (2). One of the methods of treating obesity in patients who do not respond appropriately to the other weight loss methods is bariatric surgery, which is, of course, limited to those with morbid obesity, or severe obesity with its complications (2). Sleeve gastrectomy surgery is the most commonly used surgical methods in bariatric surgery, in which 60-80 percent of the stomach volume is removed and the rest of the stomach resembles banana or sleeve. In this way it limits the food intake and results in weight loss. These patients may be subject to various nutritional deficiencies (3, 10).

In these surgeries, failure to monitor the vital factors in the metabolism of the body may result in malnutrition and risk to the health of the patient (11). Various studies have been conducted on the effects of sleeve gastrectomy surgery on malnutrition, although comparing its results with other methods of Bariatric surgery regarding malnutrition is more acceptable (12). Previous studies have indicated the effect of sleeve gastrectomy surgery on the malnutrition of micronutrients (13). Symptoms of iron deficiency anemia include spoon nails, food swallowing problems, weakness and sleepiness, and anorexia and decreased learning power (14-16).

According to a study conducted in Sao Paulo in 2015, patients after surgery cannot tolerate red meat, which is a rich source of iron, and should provide iron from other sources of food; so, the patients won't have iron deficiency anemia (14). Considering the existence of all the mentioned cases and possible cases that may be caused to the patients; such as inadequate intake or intolerance to some iron sources (12, 17), this study was conducted to investigate the serum level of iron deficiency anemia in post-operative sleeve gastrectomy surgery patients.

## Materials and Methods

This cross-sectional study was performed without control group and consisted of 218 patients who underwent sleeve gastrectomy surgery for obesity by a surgical team in Shiraz Ghadir Mother and Child Hospital. The indication of the surgery was having morbid obesity. Before and three months after the surgery, blood samples were taken in order to evaluate the serum levels of iron and ferritin. The blood samples were placed in the Selectra machine and centrifuged in order to separate their serum. For the measurement of iron, the Pars test kit and the Ferem method was used and in order to evaluate the ferritin level, the Archem kits were used. In this study, 218 patients underwent sleeve surgery. 170 patients were female and 48 were male. The mean age of the patients was 35±9 years and the mean weight of the patients was 19.33±19.33 kg. (Male: 143.14±17.92 kg, and female: 125.43±17.78). The BMI mean was 45.53±10.15 (male: 40.89±15.25and female: 47.52±6.52). The follow- up duration was 3 months.

All the Patients received multivitamins with the following specifications, except in the test range. At each visit, the weight of the patients was evaluated. All the patients' information was analyzed by using the SPSS software. The Independent-samples t-test was used to determine the differences between the groups. A p value less than 0.05 was considered statistically significant.

## Results

The results of this study show the changes in the level of iron deficiency anemia associated with iron depletion. In this study, the results indicated that the mean of serum iron level in women ranged from 68.8±1.91 to 65.9±2.7 and in males from 74.6±5.32 to 71.7±2.8, and the ferritin serum levels mean±SD in women ranged from 56.1±5.5 to43.2±6.1, and in males from 61.9±9.7 to 47.3±8.2, and the mean±SD of serum hemoglobin level in both females and males was changed from 11.7±0.08 to 10.7±0.12 and from 12.7±0.09 to 11.8±0.13, respectively (Table 1).

In this study, the level of hemoglobin in 23% of women before the surgery was less than the normal level and 16% of women had iron deficiency before surgery. And also the level of these factors for men was 16% and 8%, respectively. The percentage of reduction in iron before and after the surgery was 3.3% for men and 14.4% for females, and the ferritin in both men and women was 31% and 30%, respectively, and the hemoglobin was 8% for men and 15.8% for females, respectively (*P* value=0.04).

**Table 1:** The data on changes in the serum levels of blood factors in the participants of the study

| Gender | Iron | | | Hemoglobin | | | Ferritin | | |
|---|---|---|---|---|---|---|---|---|---|
| | Pre-operation mean±SD | Post-operation mean±SD | P value | Pre-operation mean±SD | Post-operation mean±SD | P value | Pre-operation mean±SD | Post-operation mean±SD | P value |
| Male | 74.6±5.32 | 71.7±2.8 | 0.6 | 12.7±0.09 | 11.8±0.13 | 0.05 | 61.9±9.7 | 47.3±8.2 | 0.3 |
| Female | 68.8±1.91 | 65.9±2.7 | 0.5 | 11.7±0.08 | 10.7±0.12 | 0.6 | 56.1±5.5 | 43.2±6.1 | 0.01 |

Fe serum unit: mcg/dl, Hb unit: g/l, Ferritin unit: ng/ml

## Discussion

Iron deficiency anemia is one of the most common anemias in the whole world.(2) There are many causes for iron deficiency, including the decrease in iron intake, inadequate iron absorption, an increased need for iron to increase blood volume in the infancy, adolescence, Pregnancy, breast feeding and high bleeding in women during menstruation (3). Food sources of Iron include: liver, kidney, red meat, fish, yolks, dark green vegetables, such as parsley; spinach; legumes like lentils; beans; dry fruits especially dried apricot, and oily seeds (3).

There are many reasons for iron deficiency, the first one related to inadequate iron intake due to inappropriate diets before having the surgery, most of which unfortunately are unconscious and vegetarian diets (5). The second one refers to inadequate iron absorption due to diarrhea, reduction in gastric juice secretion and gastrointestinal problems, or using drugs such as cimetidine or ranitidine, pancreatin and Inhibitors proton pumps, all of which are effective in absorbing iron. However, it seems that long-term use of these drugs can be more effective in reducing the iron absorption under conditions when the iron intake is at its lowest level (6).

The third reason is Surgical-related bleeding and complications related to it. Most of the iron absorption occurs in the duodenum and the upper part of the jejunum, which is facilitated by some factors, such as ascorbic acid, citric acid and gastric acid, and some factors such as phytate and tannin inhibits its absorption. Iron balance is controlled by controlling the amount of iron absorbed. At maximum, about 20 percent of the consumed iron in a diet containing meat is absorbed and less than this amount is absorbed by having a vegetarian diet. Normally, the body's total iron content is a constant amount throughout life (10).

Several physiologic factors affect the daily iron requirement, including menstruation in women, pregnancy, growth, etc., for example, in a woman with a hemoglobin of 14 grew in Deciliters and natural monthly bleeding 40-60 milliliters of blood is discharged, containing 20-23 milligrams of iron. There are several causes for iron deficiency anemia in post-Bariatric surgery patients, including intraoperative bleeding, the use of proton pump inhibitors, decreased post-operative food intake, or intolerance to some iron-rich foods such as red meat (11).

The use of proton pump inhibitor and h2blocker drugs in sleeve gastrectomy surgery is due to the presence of marginal sores and only due to the presence of reflux (3). These drugs are prescribed for 3 months. Food intake in patients undergoing sleeve gastrectomy surgery is more than other treatments (13). Also, because the digestive system is not manipulated, the absorption of iron in the digestive tract does not change (14).

Therefore, it seems that sleeve gastrectomy surgery causes the least hazardous to iron absorption. In women undergoing sleeve gastrectomy surgery, the anemia can be due to menstruation, and after surgery, since the causes of iron deficiency is intensified, due to menstrual periods and a decrease in the food intake and food containing iron in daily intake, it seems necessary to begin the intake of supplements before the surgery (15). In one study, it was shown that anemia had occurred after bypaas surgery and serum iron changes were less than our findings (18). Differntly in other studies in bariatric surgery patients, no anemia was noted, while we observed the anemia after 3 months (19-24). The differences may be due to cultural variation in our country for nutritional behavior.

## Conclusion

The results of this study indicate that the level of iron deficiency anemia after the sleeve gastrectomy surgery is decreasing, which the authors recommend that the iron level of the patients should be regularly checked in order to be able to administer adequate supplements and to adjust the diet rich in iron to prevent anemia and its effects. It is also suggested that, given the prevalence of iron deficiency anemia, especially in women, the treatment for this problem begins before bariatric surgery. Although the duration of the study was short, the continuation of this study is ongoing in longer periods. Regarding the nutritional life style in different communities, it shows that the nutritional behavior in drinking tea after food, less consumption of vitamin C-rich foods and intake of foods rich in iron has a significant role in iron deficiency anemiain patients undergoing sleeve gastrectomy.

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## Conflict of Interest

None declared.

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