Vitamin Status of Obese Tunisian adults before and after Sleeve Gastrectomy

Statut vitaminique des obèses avant et après Sleeve Gastrectomie

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Abstract

Introduction: The worldwide obesity epidemic continues unabated. Obesity and its associated health risks are considered as the major causes of morbidity and mortality. Currently, bariatric surgery is the most effective treatment for people with severe obesity resulting in sustainable weight loss and a reduced risk for co-morbidities. Sleeve gastrectomy is the most common bariatric procedure undertaken in Tunisia.
Aim: we aim to evaluate the vitamin status of the obese patients before and after sleeve gastrectomy.
Methods: Thirty obese patients undergoing sleeve gastrectomy, were recruited from Obesity unit. In this study. A biological assessment was performed pre-operatively and controlled 6 months following the sleeve gastrectomy including: calcemia, parathyroid hormone (PTH), albuminemia and dosage of vitamin D, vitamin B9 and vitamin B12.
Results: Six months post sleeve gastrectomy, vitamin deficiencies were more prevalent: the mean level of vitamin B9, vitamin B12 and vitamin D respectively, has decreased from 5.03±3.28 ng / ml to 2.71±1.52 ng / ml, from 348.06±158.92 pg/ml to 264.62±119.77 pg/ml and from 17.18±11.45 ng/ml to 11.69±8.22 ng/ml, with a statistically significant difference (p=0.008, p=0.01 and p=0.012). Sleeve gastrectomy has proven to be an effective weight loss treatment. However, nutritional deficiencies have worsened during postoperative period.
Conclusion: This study highlights the importance of early identification, appropriate treatment and prophylactic micronutrient supplementation.

Key words: Obesity, Sleeve gastrectomy, Vitamin D, Vitamin B9, Vitamin B12, Nutritional deficiencies.

Résumé

Introduction: L'épidémie mondiale de l'obésité est en nette expansion depuis des décennies. L'obésité représente un tremplin aux complications métaboliques et cardiovasculaires augmentant le risque de mortalité. La chirurgie bariatrique est le traitement le plus efficace pour les patients présentant une obésité sévère, entrainant une perte de poids durable et un risque réduit de comorbidités. La sleeve gastrectomie est l'intervention bariatrique la plus pratiquée en Tunisie.
Objectif: Évaluer le statut vitaminique des patients obèses avant et après sleeve gastrectomie.
Méthodes: Trente patients obèses ayant bénéficié d'une sleeve gastrectomie ont été recrutés à l'unité d'obésité. Un bilan biologique a été réalisé en préopératoire et contrôlé 6 mois après la chirurgie comprenant : calcémie, hormone parathyroïdienne (PTH), albuminémie, dosage de la vitamine D, vitamine B9 et vitamine B12.
Résultats: Six mois après la sleeve gastrectomie, une aggravation des carences vitaminiques a été observée: le taux moyen de vitamine B9, vitamine B12 et vitamine D respectivement, est passé de 5.03±3.28 ng / ml à 2.71±1.52 ng / ml, de 348.06±158.92 pg/ml à 264.62±119.77 pg/ml et de 17.18±11.45 ng/ml à 11.69±8.22 ng/ml, avec une différence statistiquement significative (p=0.008, p=0.01 et p=0.012). La sleeve gastrectomie s'est avérée être un traitement efficace pour perdre du poids. Cependant, les carences nutritionnelles se sont aggravées en postopératoire.
Conclusion: Cette étude souligne l'importance d'un dépistage précoce des carences vitaminiques, d'un traitement approprié et d'une supplémentation prophylactique systématique en micronutriments.

Mots clés: Obésité, Sleeve gastrectomie, Vitamine D, Vitamine B9, Vitamine B12, Carences nutritionnelles.

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INTRODUCTION

Obesity represents a major health problem in Tunisia. In fact, the prevalence of obesity has shown an increasing trend since 2001, escalating from 14.2% to 25.4% in 2012 (1, 2). Moreover, morbid obesity was doubled from 0.8 to 1.5% (1, 2). In 2016, according to the Tunisian Health Examination Survey, subjects older than 15 years old, showed 26.2% prevalence of obesity (3).

The prevalence of obesity in Tunisia continues to rise at an alarming rate. Otherwise, the obesity is associated with several co-morbidities increasing morbidity and mortality. Bariatric surgery has emerged as a therapy of choice in the management of severe and complicated obesity (4). Sleeve gastrectomy is the most common bariatric procedure undertaken in Tunisia (5).

Beyond its undeniable effectiveness on weight loss, quality of life and co-morbidities, bariatric surgery is not devoided of risks and can expose to nutritional deficiencies (6). Patients who undergo restrictive surgeries such as sleeve gastrectomy are generally considered at less risk for micro nutritional deficiencies compared to malabsorptive surgeries. Regular metabolic and nutritional monitoring is recommended after any bariatric surgery. However, vitamin and mineral prophylactic supplementation remains controversial especially for sleeve gastrectomy (7, 8). The French recommendations from the High Authority of Health in 2009 stipulate vitamin supplementation after sleeve gastrectomy only in case of proven deficiency (7). Whereas the American societies recommend systematic vitamin supplementation after sleeve gastrectomy but the duration remains poorly codified (8). Currently, there is no Tunisian studies that have examined the vitamin deficiencies in patients undergoing sleeve gastrectomy. In this context, we conducted this study which evaluated the vitamin status of obese patients before and 6 months after sleeve gastrectomy.

METHODS

Patients:

This was a prospective longitudinal and interventional study, in which 30 obese patients undergoing sleeve gastrectomy were recruited at the Research Obesity Unit of the National Institute of Nutrition and Food Technology of Tunis.

We included in this study patients who met all of the following criteria:

- Age ranged between 18 and 65 years old,
- Body mass index (BMI) ≥ 40 kg/m² or a BMI ≥ 35 kg/m² associated with at least one comorbidity factor that could be improved after surgery (including high blood pressure, sleep apnea syndrome) and other severe respiratory disorders, severe metabolic disorders, particularly type 2 diabetes, disabling osteoarticular diseases, nonalcoholic steatohepatitis.
- Patients who had benefited from well-managed dietary measures for 6 to 12 months with no loss of weight or failure to maintain weight loss.
- Patients well informed of the operative risk and possible complications that have been evaluated and managed in a pre-operative multidisciplinary setting.
- Patients who understood the need and agreed to long-term multidisciplinary follow-up.

We did not include patients who presented at least one of the following criteria: Severe cognitive or mental disorders, severe and unstable eating disorders, inability to participate in prolonged medical follow-up, dependence on alcohol or psychoactive substances, patients who have not received prior nutritional and medical care, medium-term life-threatening diseases, contraindications to general anesthesia and chronic disease or taking drugs that may interfere with the metabolism of vitamin D.

Methods:

Population general characteristics:

Sociodemographic data: Age, gender and socio-economic level were recorded.

Anthropometric measures:

- Measurements of height, weight and body composition using professional TANITA bioimpedance were included.
- BMI and severity obesity were determined (9).
- The percentage of weight loss was calculated using the following formula: **[(P1- P2)/P1]X100**
- The percentage of excess weight loss was calculated using the following formula: **[(P1- P2)/(P1-Pi)]X100**

P1= preoperative weight. P2= postoperative weight

Pi= upper limit of the ideal weight for height = the square of the size multiplied by 25.

- The percentage of BMI loss was calculated using the following formula: **[(BMI1- BMI2)/BMI1]X100**
- The percentage of excess BMI loss was calculated using the following formula: **[(BMI1- BMI2)/(BMI1-25)]X100**

BMI1= preoperative BMI. BMI2= postoperative BMI

Nutritional survey

Dietary intake of the patients was obtained using dietary history questionnaires performed by a trained nutritionist. The amounts of each food consumed estimated in reference to common size contains (bowls, cups and glasses). Standard measuring cups and spoons in a diary were taught to each patient. Nutritionist Pro software was used to analyze the nutrient intake of the patients (Nutrisoft Version 2.01, 1988).

Biological parameters

A biological assessment was performed preoperatively and controlled 6 months after sleeve gastrectomy including:

- Calcemia and albuminemia with calculation of corrected calcemia. Calcium was assayed by an indirect potentiometric method using a selective calcium electrode. The albumin assay was performed by end-point colorimetric method with bromcresol purple. The corrected Ca was calculated according to the following formula:

Corrected Ca (mmol / l) = Ca measured (mmol / l) + 0.02 (40-albuminemia in g / l) (10)

- A determination of PTH performed by an immunoassay by electro chemiluminescence on Cobas system. This test uses a sandwich method (11).
- The 25 (OH) vitamin D concentration (D2 and D3) was determined by the tandem mass spectrometry method after liquid chromatography. Vitamin D status was classified according to plasma levels referring to the recommendations of GRIO (12). Vitamin D levels were considered normal for a value between 30 and 70 ng/mL.
- The vitamin B9 levels were measured by a binding assay for in vitro quantitative determination of folic acid in human serum and plasma (13).
- Vitamin B9 levels were considered normal for a value between 3.89 and 26.8 ng/mL.
- The assay of vitamin B12 was performed with an immunoassay by electro chemiluminescence on Cobas system (13).
- Vitamin B12 levels were considered normal for a value

between 197 and 771 pg/mL.
Patients didn't receive any vitamin or mineral supplementation during the period of the study.

Statistical Analysis

Descriptive study

We calculated absolute frequencies and relative frequencies percentage for the qualitative variables. We also calculated means, medians and standard deviation and determined the extreme values for the quantitative variables.

Analytical study

Student's T-test for paired series was performed to compare 2 means. The comparison of 2 percentages was carried by Chi-2 Mac Nemar Test. When the use of the Spearman rank correlation was not possible, the linking between 2 quantitative variables was proceeded with the Pearson linear regression test. P was considered significant when <0.05.

Ethics approval and consent to participate

The survey protocol was reviewed and approved by the Ethical Committee of the National Institute of Nutrition and Food Technology of Tunis. Once participants were informed about the objectives of the study and the data collection process, they signed a letter of informed consent in compliance with the guidelines of the declaration of Helsinki.

RESULTS

The general characteristics of our population were represented in table 1.

Table1. General characteristics of the population

Parameters	N=30
Age	36.8±7.8 years
Gender	
Men	20%
Women	80%
Socio-economic level	
High	83%
Middle	17%
Duration of Obesity	19±7 years
Severity of obesity	
Obesity class 2	7%
Obesity class 3	93%
Average BMI	50.4 Kg / m^2
Average waist circumference	
Men	152±15.5 cm
Women	134.6±12.83 cm

Obesity class II, BMI=35-39.9, M: Men, W: Women, Obesity class III, BMI ≥40

The average percentage of weight loss six months after SG was 23.3±9.2 % (table 2).

Table 2. Postoperative weight loss evolution

	Post-operative			
	15 days (n=7)	**1 month (n=11)**	**3 months (n=10)**	**6 months (n=30)**
Mean Percentage of weight loss (%)	6 ±2.9	7.8 ±3.6	15 ±6.5	23.3±9.2
Mean Percentage of excess weight loss (%)	14.4±7.2	16.9±8.6	34.6±18	49.8±23.4
Mean Percentage of BMI loss (%)	6±3	7.9±3.5	15.6±6.1	23.6±9.3
Mean Percentage of excess BMI loss (%)	14.3±7.2	17±8.4	35.6±17.2	50.4±23.8

BMI: Body mass index

Dietary intake before and six months after SG is summarized in table 3.

Table 3. Dietary intake before and six months after sleeve gastrectomy

	Pre-operative values	Post-operative values
Caloric intake (kcal/d)	3944.53±1683.41	689.5±300.91
Folate intake (ug/d)	187.87± 51.07	57.43±28.81
Calcium (mg/d)	637.7±297.8	449.33±248.68
Phosphorus (mg/d)	1431.3±528.9	543.63±218.94
Iron (mg/d)	13.66±4.18	3.3±1.51
Magnesium (mg/d)	403.33±156.14	105.83±37.74
Vitamine C (mg/d)	85.1±65.11	45.06±34.34
Vitamine B1 (mg/d)	0.68±0.31	0.23±0.11
Fibers (g/d)	27.97±24.95	8.51±7.03

High prevalence of vitamin deficiencies was found in patients with complicated and severe obesity. The major clinical signs in favor of nutritional deficiencies found were hair loss (38%), asthenia (33%) and depressive syndrome (29%). Average levels of vitamins, PTH and calcemia evolution before and six months after SG are represented in table 4.

Table 4. Average levels of Vitamins, PTH and Calcium before and six months after sleeve gastrectomy

	Preoperative Average Rates	Postoperative Average Rates	Change / at Initial Rate (%)	P
Vitamin B9 (ng/mL)	5.03±3.28	2.71±1.62	-36.81%	**0.008***
Vitamin B12 (Pg/mL)	348.06±158.92	264.62±119.77	-17.91%	**0.01***
Vitamin D (ng/mL)	17.18±1145	11.69±8.22	-10.9%	**0.032***
PTH (pg\L)	31.92±21.13	45.82±49.11	101.84%	0.118
Calcium (mmoL/L)	2.32±0.09	2.32±0.12	0%	0.931

* : p < 0.05.

Vitamin levels variation by gender is illustrated in table 5.

Table 5. Average postoperative vitamin levels by gender

Variation	Women	Men	P
Vitamin B9 (ng/mL)	2.88	2.67±1.65	0.743
Vitamin B12 (pg/mL)	261.71±123.47	276.26±113.43	0.631
Vitamin D (ng/mL)	10.24±7.61	17.47±8.71	**0.029**

Before SG, vitamin B9 and B12 deficiencies were respectively observed in 43% and 17% of the cases. Hypovitaminosis D was objectified in 80% of subjects with 30% of deficiency proven cases and 50% of insufficiency cases.

Six months after SG, aggravation of vitamin deficiencies was noted, revealing a postoperative deficiency of vitamin B9 in which its prevalence attained 73% (59% of patients had a pre-existing deficiency while 41% developed it de novo). The mean level of vitamin B9 has decreased from 5.03±3.28 ng / ml to 2.71±1.62 ng / ml with a statistically significant difference (p=0.008). The mean postoperative variation was -2.32 ng/ml with extremes ranging from -12.23 ng/ml to +0.44 ng/ml, and it decreased by 36.81% from baseline vitamin B9. A positive correlation was statistically significant between post-operative dietary folate intake and serum vitamin B9 variation (r = 0.21, p = 0.04) (figure 1). Regarding vitamin B12 levels, the prevalence of postoperative deficiency was 30% (among patients with vitamin B12 deficiency 56% developed it de novo). Comparing vitamin B12 levels preoperatively and 6 months following sleeve gastrectomy, an average variation of -83.44 pg/ml was observed with extremes ranging from -458.7 pg/ml to +192.2 pg/ml. This corresponded to an average decrease of 17.91% in the initial vitamin B12 level. We noted a positive and statistically significant

correlation between postoperative variation in serum vitamin B12 levels and number of postoperative follow-up visits (r=0.517, p=0.03). There was no significant correlation between postoperative variation in serum vitamin B12 levels and postoperative protein intake (r=-0.008, p=0.966).

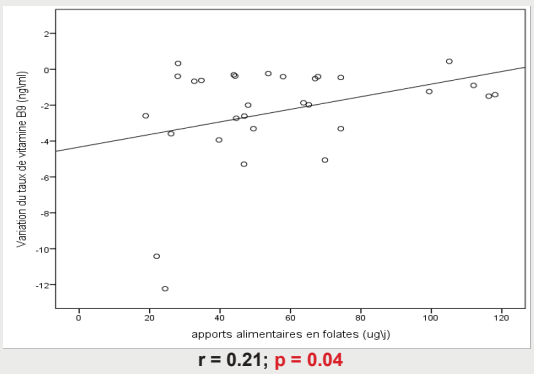

Figure1. Correlation between vitamin B9 levels and folate intake

Hypovitaminosis D prevalence increased from 80% preoperatively to 93% six months after SG. One-fifth of the obese developed the deficiency after the surgery. The mean 25OHvitD variation was -5.49 ng/ml with extremes ranging from -35.96 ng/ml to + 24.04 ng/ml, which corresponded to an average decrease of 10.9% in the initial vitamin D level. Postoperative variation in serum vitamin D levels was negatively and statistically correlated with postoperative variation in serum PTH levels (r=0.77, p=0.038).

DISCUSSION

In this study, we were interested in assessing the vitamin status of obese people before and after sleeve gastrectomy. Vitamin deficiencies were more prevalent in patients with complicated and severe obesity. Six months after SG, aggravation of vitamin deficiencies was observed, revealing a postoperative deficiency of vitamin B9, B12 and vitamin D in which its prevalence attained 73%, 30% and 93% respectively.

We found that among 73% of patients who had vitamin B9 deficiency, 59% had a pre-existing one while 41% developed it de novo.

Moizé et al found in a Spanish study concerning 355 grade 3 obese patients that among 61 patients who underwent sleeve gastrectomy 13.6% of subjects had developed de novo folate deficiency six months postoperatively (14).

Damms-Machado et al. (5) reported in a German study published in 2012, concerning 54 obese patients who underwent a sleeve gastrectomy that 71.4% of subjects had developed de novo deficiency while 28.6% had a pre-existing deficiency one year following sleeve gastrectomy. These subjects did not receive systematic multivitamin supplementation postoperatively.

While the prevalence of folate deficiency remained low postoperatively in a meta-analysis performed by Nie Y et al (15), Van rutte et al. (16) noted a decrease in the prevalence of folic acid deficiency from 23.9% preoperatively to 12.4%, one year after sleeve gastrectomy. In this study, only 6% of subjects developed de novo deficiency. Post-operative multivitamin supplementation would have resolved more than half of the deficiency states initially observed. Indeed, the patients have received a multivitamin supplementation systematically covering 100% to 200% of the recommended daily nutritional intake.

In a Dutch study (17) of 60 obese patients who underwent sleeve gastrectomy, 15% of subjects had folate deficiency one year postoperatively. This low prevalence compared to our results could be explained by the fact that the patients received multivitamin supplementation postoperatively at the rate of 3 tablets per day covering 150% of the recommended nutritional contributions. The risk of vitamin B9 deficiency would be lower after sleeve gastrectomy than after gastric bypass. Nevertheless, the prevalence of folate deficiency observed in our study seems to exceed what other authors had found in the wake of the gastric bypass.

Vitamin B9 is a water-soluble vitamin that is stored in the liver. This vitamin is very sensitive to the level of intake because the storage capacities are low. Absorption is conditioned by the deconjugation capacity of dietary polyglutamates by the intestinal ɣ-glutamyl carboxy peptidase present throughout the intestine but more importantly in the jejunum, the preferred site of its absorption. It undergoes an enterohepatic cycle which allows to considerably increase its absorption (18). These enzymes reach the bolus late in malabsorptive surgery, which may explain an absorption deficiency. However, vitamin B9 deficiency occurring after sleeve gastrectomy may be difficult to attribute to anatomical or physiological changes of the gastrointestinal tract. The main cause of this deficit is attributed to reduced caloric intake due to reduced gastric volume, low diversity in food choices, and low consumption of vitamin-rich sources, such as legumes and green leafy vegetables (19).

Our results support these claims. In fact, total caloric intake decreased from 3944.53±1683.41 Kcal / day to 689.5±300.91 kcal / day respectively in pre- and post-operative periods.

Similarly, dietary folate intake decreased significantly from preoperative 187.87±102.01 to 57.43±28.81 µg / d, 6 months after sleeve gastrectomy. Thus, all obese had insufficient folate intake at 6 months postoperatively.

In addition, postoperative serum vitamin B9 variation was positively and significantly correlated with postoperative folate dietary intakes (r = 0.21, p = 0.04). However, we did not observe a significant correlation between the percentage of excess weight loss and the post-operative variation in serum vitamin B9 levels.

Thus, the American Society for Metabolic and Bariatric Surgery recommends folate supplementation in the order of 400 µg / day for multivitamin supplementation (8).

In our study, the prevalence of vitamin B12 deficiency has increased from 17% to 30% and we noted that 56% developed it de novo.

Moizé et al reported low plasma levels of vitamin B-12 in only 3.7% of patients six months after sleeve gastrectomy (14).

One year postoperatively, Aarts et al. (17) reported vitamin B12 deficiency in 9% of obese patients, while Hakeam et al. (20) showed a deficiency in 19.6% of patients. Kehagias et al. found a prevalence of vitamin B12 deficiency in the order of 11.7%, one year postoperatively (21). In the study of Mulita et al (22) it was shown that one year after SG, 15% of the study population had vitamin B12 deficiency. Similary, Rachnoo F et al (23) found in his prospective study performed in Tehran, that the mean serum level of vitamins B12 has decreased from 413.7±247.3 (pg/ml) before surgery to 405.1±4.236 (pg/ml) one year after SG.

The prevalence of postoperative vitamin B12 deficiency in our study is significantly higher than that found in the literature and this is due to the high prevalence of preoperative deficiencies as well as the lack of post-operative multivitamin supplementation in contrast to other studies.

Vitamin B12 is absorbed in the terminal ileum when it is linked to the factors considerable reduction in the number of parietal cells occurs, and less intrinsic factor will be produced (18).

The decrease in the secretion of hydrochloric acid in the gastric sac is responsible for a «syndrome of non-dissociation of vitamin B12» leading to a lack of cleavage between vitamin B12 and its carrier protein. In addition, treatments with proton pump inhibitors accentuate this decrease in the bioavailability of B12 by decreasing its capacity. Vitamin B12 deficiency is a source of hematological disorders in this case megaloblastic anemia and neurological symptoms including a combined sclerosis of the marrow manifested primarily by polyneuritis, ataxia and a sign of Babinski (24).

The recommendations of the American Society of Endocrinology in association with the American Society of Metabolic and Bariatric Surgery stipulate routine vitamin B12 supplementation post-operatively to overcome the risk of deficiencies (8).

Our results shows that the prevalence of hypovitaminosis D increased from 80% preoperatively to 93%, 6 months after sleeve gastrectomy. One-fifth of the obese developed de novo deficit postoperatively.

Similarly, Van Rutte et al. found de novo deficit of vitamin D during the first postoperative year in about a fifth of obese operated for sleeve gastrectomy (16). In this study, patients received a post-operative multivitamin supplement covering 100% to 200% of the recommended dietary intakes including vitamin D. Machado et al. (5) showed that among patients with vitamin D deficiency, 6 months after sleeve gastrectomy, 28.6% of them were already preoperatively deficient, while 57.1% newly developed it. Postoperatively, patients did not receive systematic multivitamin supplementation. Moizé et al found vitamin D levels less than 30 ng/mL at baseline in 93% of the SG cohorts. Despite universal supplementation, the proportion of patients with vitamin D levels less than normal ranged between 60% and 90% throughout the study. Vitamin D deficiency was found in 77.2% of patients six months after sleeve gastrectomy (14).

Aaseth JO (25) found in a review published on March 2023, summarizing some of the micronutrient deficiencies following sleeve gastrectomy that can lead to bone loss, that at least 20% of operated individuals suffered from vitamin D deficiency after 2 years, and the incidence could be significantly higher after 5 years, despite the recommended supplementation with about 15 µg vitamin D3 daily. Aarts et al. (17) also showed a prevalence of hypovitaminosis D of 39%, one year after sleeve gastrectomy despite multivitamin and specific vitamin D supplementation in the order of 880 IU. This could be attributed to low adherence to multivitamin and mineral supplementation. However, other mechanisms may play a role after SG. The latter has been associated with rapid gastric emptying (26). Furthermore, lower sunlight exposure (compared with the nonobese population) due to psychological or environmental factors could be a contributing mechanism for vitamin D deficiency after SG (27, 28).

Hypovitaminosis D would promote the development of autoimmune diseases and certain cancers. It is also associated with an increased risk of developing type 2 diabetes and certain cardiovascular diseases (29). Both American and European guidelines recommend systematic vitamin D supplementation after sleeve gastrectomy (8).

A systematic review and meta-analysis published on September 2023 by Giustina A et al (30), aimed to analyse systematically the published experience on 25(OH)D status and vitamin D supplementation, pre- and post-surgery, and to propose, on this basis, recommendations for management. Giustina A et al found that preoperatively, the prevalence of vitamin D insufficiency as defined by 25(OH)D < 30 ng/mL (75 nmol/L) was 85%, whereas when defined by 25(OH)D < 20 ng/mL (50 nmol/L) was 57%. The median preoperative 25(OH)D level was 19.75 ng/mL. After surgery, 39 studies including 5296 patients were analysed and among those undergoing restrictive procedures, a lower rate of vitamin D insufficiency and higher 25(OH)D levels postoperatively were observed in patients treated with high-dose oral vitamin D supplementation, defined as ≥ 2,000 IU/daily (mostly D3-formulation), compared with low-doses (< 2,000 IU/daily). Guidelines based on this systematic review and meta-analysis recommended high-dose supplementation in patients after bariatric surgery (30).

Study limitation:

The sample sizes were limited. During this study, pre-operative vitamin deficiencies were not supplemented due to the fact that vitamin dosages are not common practice at the National Institute of Nutrition and Food Technology in Tunis. Moreover, we could not assess the vitamin B1 status of obese people since this dosage is not performed in Tunisia. In addition, there are few studies published assessing short-term vitamin status after sleeve gastrectomy.

CONCLUSIONS

Dietary measures and physical activity remain the mainstay of obesity management. However, in certain situations where obesity is severe and complicated or morbid, we are confronted with therapeutic failures such as relapses and weight recoveries exceeding the lost weight.

Despite its undeniable effectiveness in weight reduction, quality of life and comorbidities improvement, sleeve gastrectomy is associated with a significant risk of nutritional deficiencies including vitamins.

The interest of our study is to demonstrate the importance of vitamin preoperatively deficiencies in a population of obese Tunisian adults and the risk of aggravation of these deficiencies after sleeve gastrectomy. Some of these deficiencies could show sometimes severe clinical impact. Our results highlight the need for pre- and post-operative nutritional management for life, to prevent, detect and treat nutritional deficiencies prematurely. Treatment of preoperative nutritional deficiencies is imperative. Similarly, vitamin and mineral supplementation should be systematic after the surgery with adjustments according to vitamin dosages.

Abbreviations list

BMI: Body Mass Index
SG: Sleeve Gastrectomy
GRIO: Osteoporosis Research and Information Group

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