Academia Open
Vol 9 No 1 (2024): June
DOI: 10.21070/acopen.9.2024.10368 . Article type: (Clinical Research)

Table Of Content

ISSN 2714-7444 (online), https://acopen.umsida.ac.id, published by Universitas Muhammadiyah Sidoarjo

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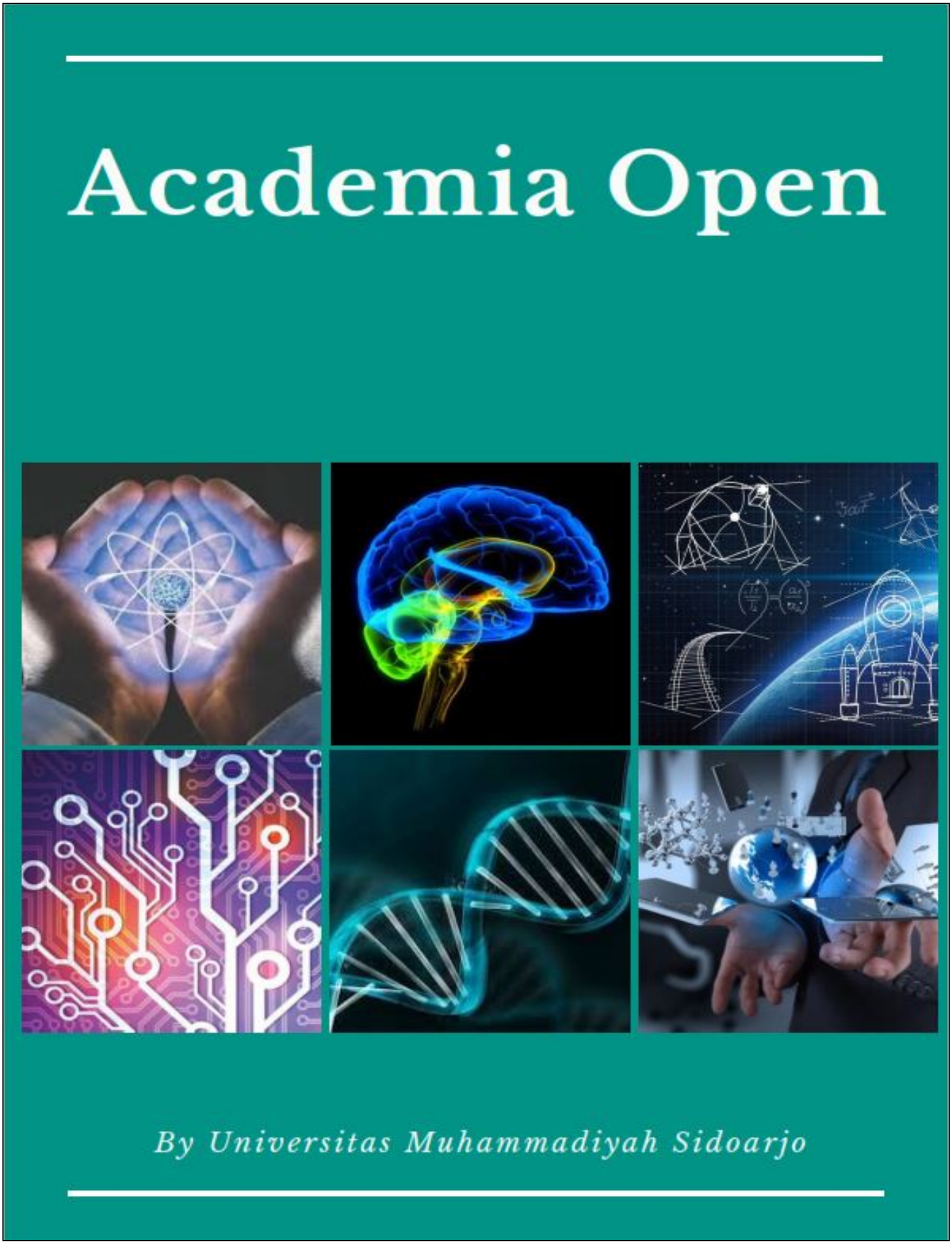

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ISSN 2714-7444 (online), https://acopen.umsida.ac.id, published by Universitas Muhammadiyah Sidoarjo

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The Efficacy of a Three-Week Low-Calorie Diet in Decreasing Liver Volume Pre-Laparoscopic Sleeve Surgery: A Randomized Clinical Trial

Efektivitas Diet Rendah Kalori Selama Tiga Minggu dalam Mengurangi Volume Hati Pra-Bedah Lengan Laparoskopi: Uji Klinis Secara Acak

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Abstract

Background: For obese individuals having significant non-bariatric surgery, better preoperative weight loss techniques are required. Objectives: To identify the efficacy of a three-week low-calorie diet in decreasing liver volume pre-laparoscopic sleeve surgery. Methods: Twenty-five morbidly obese individuals who were scheduled for LSG participated in this interventional trial. Every patient was instructed to adhere to a low-calorie, restrictive diet for three weeks, and their liver span was measured by ultrasonography before and after the regimen. The end measurements were the effects of the preoperative diet on liver span and liver enzymes (ALT and AST). Results: Liver span is significantly reduced as a function of diet. Weight and body mass index showed a favorable correlation with changes in liver size. Liver enzyme levels significantly increased. Conclusion: A low-calorie diet successfully decreased liver size for three weeks before bariatric surgery.

Highlights:

1. Evaluate 3-week low-calorie diet's effect on liver size before surgery.
2. 25 obese patients followed low-calorie diet; liver span measured pre/post.
3. Diet reduced liver size, correlated with weight, but increased liver enzymes.

Keywords: Sleeve Surgery, Liver Volume, Three weeks, Efficacy

ISSN 2714-7444 (online), https://acopen.umsida.ac.id, published by Universitas Muhammadiyah Sidoarjo

Academia Open
Vol 9 No 1 (2024): June
DOI: 10.21070/acopen.9.2024.10368 . Article type: (Clinical Research)

Published date: 2024-06-28 00:00:00

Academia Open
Vol 9 No 1 (2024): June
DOI: 10.21070/acopen.9.2024.10368 . Article type: (Clinical Research)

Introduction

Obesity is the accumulation and abnormal distribution of body fat brought on by many factors, including genetics, a diet heavy in calories and fat, and a lack of physical activity [1].

Obesity has been a major public health concern in both developed and developing regions of the world. Over 650 million of the 1.9 billion overweight persons in the world in 2016 were obese, a number that has tripled since the 1970s. According to projections, if the pace keeps increasing, by 2025, over one-third of adults worldwide will be overweight, and over 1 billion will be obese. By 2030, up to 57.8% of the world's adult population, or 3.3 billion people, will be either overweight or obese [2].

Obesity is defined as a person's body mass index (BMI) of 30 kg/m2 or above. This figure is calculated by dividing the square of the height in meters by the body weight in kilos [3].

Coronary artery disease, hyperlipidemia, hypertension, sleep apnea, and non-alcoholic fatty liver disease are all associated with high body mass index [4].

When bariatric surgery is used to treat extreme obesity, it can improve and remit several obesity-related comorbidities, cause long-term weight loss, enhance quality of life, and increase survival [5].

A very low-calorie diet is commonly characterized as consuming 450-800 kcal per day, whereas a low-calorie diet consumes 800- 1500 kcal per day [6,7]. The duration of very low-calorie diets ranges from 2 weeks to 8 weeks, and the consistency ranges from entirely liquid meal replacements in the form of commercially available protein shakes to a combination of liquid meal replacement and food meals [8,9,10].

Methods

The prospective interventional study design has been adopted to evaluate the effectiveness of 3 weeks of a low-calorie diet in a patient awaiting bariatric surgery. The study is conducted at two hospitals: Basrah Teaching Hospital and AL-Sader Teaching Hospital. The study period started from Feb 2023 to the end of June 2023.

Forty men and women who were morbidly obese and candidates for laparoscopic sleeve gastrectomy bariatric surgery made up the study population. Men and women aged 20–55 who met the following inclusion criteria were eligible: (a) had a body mass index > 35 kg/m2 and were associated with comorbid conditions like type 2 diabetes mellitus, hypertension, dyslipidemia, and sleep apnea; or (b) had a body mass index >40 kg/m2 and had not responded to conservative treatment. The following were the exclusion criteria: (a) BMI less than 35; (b) insulin treatment due to hypoglycemia risk; (c) coagulation issues; and (d) serious organ or systemic disease.

Patients undergoing surgery in the surgical wards of Al-Sader Teaching Hospital and Basrah Teaching Hospital provided the data. The patients underwent a physical examination both before and after the low-calorie diet was implemented, had their weight recorded, had a blood sample taken for a liver function test, and had an upper abdominal ultrasound before and after the diet.

For three weeks, a low-calorie diet consisting of 800-1200 kcal per day is prescribed. The liver is evaluated by abdominal ultrasonography and blood is drawn to measure the liver function tests ALT and AST.

A general surgeon provided dietary guidance and monitoring, and the participants were instructed to maintain the same level of physical activity during the three-week diet, which included 800-1200 kcal [11].

Result and Discussion

Result

When classified by sex, Table 1 indicates that neither the age nor the levels of BMI, liver span, ALT, and AST showed any statistically significant differences.

Sex		Age	BMI before diet	BMI after diet	Liver span before diet	Liver span after diet	ALT before diet	ALT after diet	AST before diet	AST after diet
Male	N	8	8	8	8	8	8	8	8	8
	Mean±SD	37.75±9.25	43.86±4.56	42.55±4.22	15.5±1.19	13.59±1.23	31.5±16.08	32.12±16.02	25.75±14.34	26.54±14.28

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	Median (Min.-Max.)	---------	----------	----------	----------	13 (12-15.7)	28.5 (13-60)	28.8 (14.1-60.5)	22.5 (12-55)	23.1 (13-55.6)
Female	N	17	17	17	17	17	17	17	17	17
	Mean±SD	39.29±9.22	43.73±3.79	42.19±3.48	15.35±1.62	13.79±1.65	26.73±9.62	27.48±9.56	22.88±8.85	23.68±8.86
	Median (Min.-Max.)	----------	----------	----------	----------	13 (11.6-17)	26 (7-50)	27 (8-51)	22 (8-46)	22.1 (9-47)
P-value		0.700	0.939	0.826	0.821	0.929	0.466	0.485	0.930	0.907

Table 1. *Comparison of the levels of the study variables categorized*

** Mann-Whitney U

		BMI before diet	BMI after diet	Liver span before diet	Liver span after diet	ALT before diet	ALT after diet	AST before diet	AST after diet
Age	R	-.143-	-.137-	.184	.351	.084	.090	.153	.147
	Sig.	.496	.514	.378	.085	.691	.669	.466	.482
	N	25	25	25	25	25	25	25	25
BMI before diet	R		.990**	.235	.001	.401*	.403*	.398*	.399*
	Sig.		.000	.258	.998	.047	.046	.049	.048
	N		25	25	25	25	25	25	25
BMI after diet	R			.243	.009	.409*	.410*	.399*	.401*
	Sig.			.242	.968	.043	.042	.048	.047
	N			25	25	25	25	25	25
Liver span before the diet	R				.871**	.246	.250	.297	.298
	Sig.				.000	.235	.228	.150	.148
	N				25	25	25	25	25
Liver span after diet	R					.019	.020	.055	.057
	Sig.					.927	.925	.792	.787
	N					25	25	25	25
ALT before diet	R						.999**	.944**	.942**
	Sig.						.000	.000	.000
	N						25	25	25
ALT after diet	R							.945**	.944**
	Sig.							.000	.000
	N							25	25
AST before diet	R								1.000**
	Sig.								.000
	N								25

Table 2. *Spearman's and Pearson's correlations between the variables under investigation*

A substantial statistical difference between the BMI before and after diet regimens was discovered when the change in BMI was examined for significance. Following the diet, the BMI dramatically dropped.

	Mean±SD	N	Paired Mean±SD	P-value
BMI before diet	43.77±3.96	25	1.46±0.61	0.0001
BMI after diet	42.31±3.65	25		

Table 3. *Tests of paired BMI to determine the change post the dietary regimen*

	Liver span before the diet	Liver span after diet	ALT before diet	ALT after diet	AST before diet	AST after diet
N	25	25	25	25	25	25

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Mean±SD	15.4±1.47	13.72±1.51	28.26±11.93	28.97±11.86	23.8±10.68	24.59±10.66
Median (Min.-Max.)	16 (13-18)	13 (11.6-17)	27 (7-60)	27 (8-60.5)	22 (8-55)	22.1 (9-55.6)

Table 4. *The study variables' mean and median values*

		N	Mean Rank	P-value
Liver span after diet - Liver span before diet	Negative Ranks	25a	13.00	0.0001
	Positive Ranks	0b	0.00	
	Ties	0c		
	Total	25		
ALT after diet - ALT before diet	Negative Ranks	1d	2.50	0.0001
	Positive Ranks	24e	13.44	
	Ties	0f		
	Total	25		
AST after diet - AST before diet	Negative Ranks	0g	0.00	0.0001
	Positive Ranks	25h	13.00	
	Ties	0i		
	Total	25		

Table 5. *shows the changes in paired liver span, ALT, and AST tests following the food course.*

* Wilcoxon Signed Ranks Test

a. Liver span after diet < Liver span before diet

b. Liver span after diet > Liver span before diet

c. Liver span after diet = Liver span before diet

d. ALT after diet < ALT before diet

e. ALT after diet > ALT before diet

f. ALT after diet = ALT before diet

g. AST after diet < AST before diet

h. AST after diet > AST before diet

i. AST after diet = AST before die

Discussion

Regarding the results of the study, most of the study sample ages were between 30 to 39 years old. The results of the present study agree with other studies [12-16] which reveal that most of the study ages were between 30 to 39 years old.

Regarding the results of the study, most of the study sample were female. The results of the current study agree with other studies [17-23] which reveal that most of the study sample were female.

According to the study, liver size was significantly reduced (11%) by following a low-calorie diet for three weeks before laparoscopic sleeve gastrectomy, similar to many studies [24-28].

Both the starting BMI and liver size, as well as the weight and BMI after the diet, were positively connected with the reduction in liver size. These results agreed with many studies [29-35].

The BMI decreased by 1 to 1.5 kg/m2 Preoperative weight loss is recommended by various studies to lower the risk of postoperative complications. The results of this study agreed with a study [36] which revealed the majority of patients showed a considerable rise in their liver enzymes (ALT and AST). The degree of cytolysis in those following an LCD diet may help to explain this.

According to the study by [37], this rise is temporary during the first few weeks on LCD, and related metrics did not alter significantly after 30 weeks. Since ultrasound is a quick, simple, and affordable method that works well in underdeveloped nations, we decided to use it to test the liver span. It has been demonstrated that liver size and

ISSN 2714-7444 (online), https://acopen.umsida.ac.id, published by Universitas Muhammadiyah Sidoarjo

texture can be assessed using ultrasonography [38].

The target population of our study was extremely uniform in terms of the level of obesity and dietary composition, which is one of its strengths. It may be questioned in the future if a universal LCD will be advantageous for all patients. Depending on the objectives being set by a multidisciplinary team, customized preoperative diets might be preferable. Patients with varying BMIs or comorbidities may have varied objectives, such as stabilizing glucose levels or reducing liver volume. New research examining the impact of LCDs in various study populations is justified.

Conclusion

This study shows that an LCD can effectively lower the weight and volume of the liver. It is advised that an LCD lasts for three weeks and delivers 800-1500 kcal per day. According to earlier research using a VLCD, an LCD may even be useful for reducing liver volume. An LCD should therefore be used since it can prevent needless, severe dietary restriction and its aftereffects (such as adverse effects).

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ISSN 2714-7444 (online), https://acopen.umsida.ac.id, published by Universitas Muhammadiyah Sidoarjo