EFFECT OF AEROBIC EXERCISES ON WEIGHT GAIN POST THYROIDECTOMY

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Abstract

Objectives: To evaluate the effect of aerobic exercises on controlling and decreasing weight gain post-thyroidectomy.
Design: A double-blinded randomized, controlled study.
Setting: Outpatient setting.
Subjects: The study included fifty - six female thyroidectomy patients. They were between the ages of 30 and 45 years. After 9-12 months had passed since the total thyroidectomy, the patient began treatment. They were divided into two groups of equal numbers and chosen from the outpatient clinic at Cairo University's Department of Physical Therapy (28 patients for each group). Group (A) received aerobic exercises (Treadmill and Rope-skipping exercise) as well as medical treatment. Group (B) received their medical treatment only.
Intervention: 8 weeks with 5 weekly sessions, the treadmill time is for 45 minutes and the rope skipping exercise for 30 minutes.
Outcome measures: the body mass index (BMI) and the waist-to-hip ratio (W HR) were measured before and after eight weeks of interventions.
Results: When comparing the study group to the control group, there were statistically significant differences in the groups' mean body weight, body mass index, and weight-to-height ratio ($p < 0.001$). After eight weeks of intervention, the mean (SD) for weight, BMI, and W/H ratio was 68.42 ± 3.32 kg, 25.26 ± 0.45 kg/m^2, and 0.83 ± 0.02 in the study group, and 71.66 ± 3.02 kg, 26.64 ± 0.5 kg /m^2, and 0.86 ± 0.03 in the control group, respectively.
Conclusion: Adding Aerobic exercises to the medical treatment might be more effective in decreasing and controlling weight, BMI, and waist-to-hip ratio post-thyroidectomy.

Keywords: Thyroidectomy, weight gain, Aerobic exercises

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1. INTRODUCTION

One of the most common surgeries in iodine-deficient areas is thyroid removal. Thyroidectomy has been associated with a more serious risk of complications and death throughout the first few decades of the twentieth century. Modern advances in anaesthetics, antisepsis, surgical instrumentation, and surgical technique have made thyroidectomy a viable treatment option with minimal risk of complications [1].

Post-thyroidectomy weight gain is a common complaint from patients, even when the therapeutic benefit of thyroid hormone replacement therapy has been achieved. Furthermore, Patients with hypothyroidism, regardless of the underlying cause, often report that their illness has worsened as a result of their weight gain. Weight gain was reported as the most common symptom of hypothyroidism in a cross-sectional study of 244 patients having hypothyroidism (57 percent of the population). Therefore, it is important to provide patient-specific estimates of weight gain following thyroidectomy that are supported by clinical evidence [2].

The butterfly-shaped thyroid gland in the lower neck is a crucial endocrine gland. It can be seen in the trachea's anterior and lateral walls, below the larynx. Not only does it stimulate somatic and mental growth, but it also plays a crucial function in calcium

metabolism and regulates the body's basal metabolic rate (BMR) [3].

Diabetes mellitus, insulin resistance, dyslipidaemia, inflammation, thrombosis, hypertension, the metabolic syndrome, as well as obstructive sleep apnea are just a few of the secondary diseases that are exacerbated by obesity and contribute to an increased risk of cardiovascular disease. In addition to these confounding factors, obesity may act as a regulator of cardiac risk in its own right. The rates of both obesity and heart disease are increasing at alarmingly high rates. The public health benefits of treating and preventing obesity are substantial since obesity has become one of the modifiable factors of cardiovascular morbidity also mortality [4].

Cardiovascular exercise, often known as aerobic exercise, is any physical activity of moderate to high intensity that primarily utilize the aerobic energy-generation process. Aerobic metabolism is able to provide sufficient support for light to moderate intensity activities, allowing them to be performed for lengthy periods of time. Keep your heart rate between 60 and 85% of your maximal [5].

Body weight, body mass index, waist and hip circumference, as well as total body fat all decreased significantly after a moderate-to-vigorous exercise intervention, and significant reductions of intra-abdominal fat were suggested with either longer exercise time or higher gains in fitness [11]

Weight increase after thyroidectomy has not been the subject of any scientific investigation. Additional studies are required to find ways to prevent and manage weight gain after thyroid surgery. As a result, we set out to see if aerobic exercise could help reduce the weight gain that can occur after having your thyroidectomy.

2. MATERIALS AND METHODS

Patients and evaluators were both blinded to treatment allocation in this randomised controlled trial. Between August 2022 to March 2023, Participants in the study were chosen from the outpatient clinic at Cairo University's Department of Physical Therapy. Ethical review was performed by the department of physical therapy and was approved (P.T.REC/012/003926). Before participating in this study, participants signed a written consent form after being fully briefed on the study's nature, goals, and anticipated benefits.

Participants:

Fifty - six female thyroidectomy patients. They were between the ages of 30 and 45 years. After 9-12 months had passed since the total thyroidectomy, the patient began treatment. They were divided into two groups of equal number and selected from Cairo University's Physical Therapy Department's outpatient clinic (28 patients for each group).

The following were the inclusion criteria: Female patients only participated in the study, and their age ranged between 30-45 years. Their body mass index was between 25 to 30 kg/ m^2 and had a total thyroidectomy. All patients enrolled to the study took the recommended daily calorie intake. participants were excluded if they had Cardiac diseases, Respiratory disease, Cancer or malignant tumors, Diabetes, Chemotherapy, Corticosteroids and Autoimmune diseases, Progressive, infectious illnesses such as AIDS.

A prior sample size was calculated by G*Power (version 3.1.9.2; Germany,) with effect size equals 0.5. As a result, 56 patients were assumed to be a representative sample.

Randomization

Fifty-six female patients who had undergone thyroidectomy were assigned at random into two groups. Twenty-eight patients in Group A, were given aerobic activities in addition to their medical therapy (treadmill & rope skipping exercise), whereas twenty-eight patients in Group B, were given only their medical treatment.

Intervention

Measurement procedures:

To reduce the potential for inter-tester variability as well as measurement error, all measures were obtained at the beginning and end of the study by the same examiner who was a skilled tester.

- A plastic tape was used to measure the circumference of the waist and hips to figure out ratio of hip circumference to waist circumference. The waist-to-hip ratio (WHR) is the ratio of the waist circumference to the hip circumference.

WHR =Waist(cm)/hip(cm). Using a tape that wouldn't stretch and still held a 100 g tension, we obtained a measurement at the midpoint between the lower border of the last palpable rib and also the top of the iliac crest. The hip measurement is taken with the tape measure parallel to the ground and around the fullest part of the buttocks. Both measurements were taken with the subject standing barefoot with their feet together and their arms at their sides, also wore little clothing. The participant relaxed, and the measurements were obtained at the end of a normal breath. Each measurement was taken twice, and the average was found if the two measurements were within 1 cm of each other. If the differences between these two measurements was more than 1 cm, they were done again [6].

- The therapist used tape measurements to determine the heights of the patients, and weight scales were used to determine their weights. weight and height were measured to calculate BMI of the patients. Weight and height were assessed while the subject was wearing a thin layer of clothing, standing erect on the usual weight scale to compute BMI for both groups. The equation was applied by dividing the

subject's weight by their height squared and is universally represented in units of kg/m^2.BMI (kg/m^2) = weight (kg)/ height (m^2) [7].

Therapeutic Procedures:

For the duration of the intervention period of 8 weeks, participants engaged in aerobic training (Treadmill & rope skipping exercise) five times per week (225 min/week).

- The treadmill workout consisted of three phases: warm-up, training, and cool-down. At the start of the exercise session, participants warmed up for 10 minutes. The warm-up program consisted of a slow treadmill run. Then, the training phase will follow the warm-up phase. Starting with 25 minutes of treadmill running at 60% of their maximum heart rate (MHR) in the first week of training and increasing by 25 minutes per week to 75% MHR by the end of training. 10 minutes of cooling down at the end of the session. Sessions occurred on a weekly basis (three times) for the duration of the three-month treatment plan. Maximum heart rate was calculated using the formula:

(HR_{Max} = Age−220) [8][9].

- **Table 1** displays the eight-week rope-skipping exercise program. Five minutes were used to warm up and stretch, and five minutes were used to cool down. Each session of exercise lasted 30 minutes. Each week, the length of the sets got longer, and in the fourth, seventh, and eighth weeks, the number of jumps also got longer. Fatigue served as a warning sign to end the training at all times. Times and distances jumped were recorded while progressive training was carried out. Regular exercise was performed five times a week for thirty minutes at a time, with thirty seconds of rest in between sessions [16].

Table (1). An Eight-Week Program of Rope Training

Week	The Time of Jump in Each Set, min	Number of Jumps per Minute
1	1	60
2	1.5	60
3	2	60
4	2.5	90
5	3	90
6	3.5	90
7	4	110
8	4.5	120

Table (2): Mean weight, BMI, and W/H ratio pre and post-treatment of study and control groups

	Study group	Control group	MD	t- value	p value
	Mean ± SD	Mean ± SD			
Weight (kg)					
Pre-treatment	70.46 ± 3.23	70 ± 2.86	0.46	0.56	0.57
Post-treatment	68.42 ± 3.32	71.66 ± 3.02	-3.24	-3.81	0.001
MD	2.04	-1.66			
% of change	2.9	2.37			
t- value	17.3	-11.77			
p value	***p = 0.001***	***p = 0.001***			
BMI (kg/m^2)					
Pre-treatment	26.01 ± 0.4	26.03 ± 0.37	-0.02	-0.14	0.88
Post-treatment	25.26 ± 0.45	26.64 ± 0.5	-1.38	-10.84	0.001
MD	0.75	-0.61			
% of change	2.88	2.34			
t- value	16.95	-11.68			
p value	***p = 0.001***	***p = 0.001***			
W/H ratio					
Pre-treatment	0.85 ± 0.02	0.84 ± 0.03	0.01	0.39	0.69
Post-treatment	0.83 ± 0.02	0.86 ± 0.03	-0.03	-3.78	0.001
MD	0.02	-0.02			
% of change	2.35	2.38			
t- value	8.36	-10.33			
p value	***p = 0.001***	***p = 0.001***			

SD, standard deviation; **MD,** mean difference; **p-value,** probability value

STATISTICAL ANALYSIS:

Unpaired t-test was conducted for comparison of age between groups. The Shapiro-Wilk test was used to ensure that the data followed a normal distribution. The homogeneity of the groups was examined using Levene's test for homogeneity of variances. The pre- and post-treatment weight, BMI, and WHR of each group were compared using the unpaired t-test, and between groups using the paired t-test. The level of significance for all statistical tests was set at $p < 0.05$. All statistical analysis was conducted through the statistical package for social studies (SPSS) version 25 for windows (IBM SPSS, Chicago, IL, USA).

Fifty-six women who had gained weight after having their thyroidectomy took part in the study. The mean ± SD age of the study group was 39.53 ± 3.35 years and that of control group was 38.03 ± 3.87 years, with maximum value of 45 years and minimum value of 31 years. There was no significance difference between groups in mean age values ($p = 0.12$).

Effect of treatment on weight, BMI, and W/H ratio:

- *Within group comparison:* There was a substantial decline in body weight, BMI, also WHR of the study group post-treatment in contrast to the pre-treatment ($p > 0.001$). The percent of change in body weight, BMI, also WHR in the study group was 2.9, 2.88, and 2.35% respectively. There was a substantial increase in body weight, BMI, also WHR of the control group post-treatment in contrast to the pre-treatment ($p > 0.001$). The percent of change in body weight, BMI, also WHR in the control group was 2.37, 2.34 and 2.38% respectively. **(Table 2).**
- *Between groups comparison:* There was no substantial difference between groups pre-treatment ($p > 0.05$). Comparison between groups post-treatment showed a substantial decline in body weight, BMI, also WHR of the study group in contrast to the control group ($p < 0.001$). **(Table 2).**

3. DISCUSSION

Specifically, this study aimed to determine if aerobic exercise can prevent the weight gain that commonly follows a thyroidectomy. Results showed that compared to the control group, those who participated in the aerobic exercise intervention experienced significant reductions in weight, BMI, but also WHR ($p < 0.05$).

Hormones released by the thyroid gland are crucial for controlling metabolism and a number of fundamental aspects of development. Thyroid problems and procedures can cause dramatic shifts in both weight and s well as body composition. The projected increase in body weight and fat mass following total thyroidectomy can be mitigated with regular exercise [15].

Globally, there is an epidemic of obesity, which has been linked to two key factors: excessive calorie consumption and insufficient energy expenditure [17], The ability of the body to use fat as a substrate as well as the amount of fat burned during exercise are both improved by endurance training [18], which supported our primary finding that the WHR of the study subjects was lower than that of the control subjects.

This study's findings are in line with those of others [10] [11] [12] that reported reductions in the body weight, BMI, waist circumference and hip circumference, as well as total body fat were all achieved through aerobic exercise intervention. Similar improvements in abdominal adiposity were seen with both low and high levels of exercise intensity. The individuals' health profiles may have been improved, as seen by the overall % reduction in BMI but also weight.

Body composition in overweight and obese people can improve slightly after only a few weeks of moderate to high-intensity exercise training, but this improvement does not necessarily translate into a reduction in weight [19]. Likewise, a meta-analysis of 29 aerobic exercise training trials found that compared to control groups, those who participated in aerobic exercise had significantly lesser visceral fat (effect size = 0.33) [20].

Our results confirm the growing consensus that weight management protocol for those who are overweight or obese must be expanded to incorporate accurate measurements of body fat levels (or, the indirect measurement of waist circumference, at the very least) to give a much more complete picture of how the person's overall risk level has changed.[21]. Visceral fat buildup is independently linked to health problems including hypertension and insulin resistance [22] [23].

Also, this previous research [14] demonstrated that a healthy diet is necessary for weight loss in many individuals, even when exercise energy expenditure is high. In contrast, this study [13] implies that a moderate quantity of exercise can prevent weight increase in the absence of dietary modifications, and that greater activity may result in significant weight loss in initially overweight subjects.

On the other hand, a new meta-analysis comprising 117 studies (N = 4,815) compared exercise to calorie restriction and found that exercise was more successful in lowering visceral fat reserves, and that this effect persists even in the absence of weight loss following exercise training (by a factor of 6%) [24].

The findings of this study can serve as a jumping off point for future studies investigating the effects of weight increase after thyroidectomy, with a focus on the benefits of resistive exercise, Previous studies [17] have shown that AE as well as RE training can have beneficial metabolic effects on women who are very overweight and who suffer from severe eating problems. Exercise was found to favourably affect the intermediate outcomes that are typically related with cardiovascular disease, but no long-term benefits were found in this review.

To the authors' knowledge, this is the first study to investigate the treatment of weight gain following thyroidectomy. As a step toward preventing obesity, more research could be done to see how aerobic exercises affect weight gain after a thyroidectomy. In our opinion, to investigate the effectiveness of exercise in the absence of diet (as a deprivation), further long-term follow-up studies should be carried out.

In summary, we concluded that aerobic exercises are effective in decreasing and controlling weight gain post thyroidectomy with a significant decrease in body mass index (BMI) and waist-hip ratio (WHR).

4. CLINICAL MESSAGE:

In this study, adding aerobic exercises (treadmill and rope skipping) to the medical treatment to the patients with total thyroidectomy had an effect to maintain and reduce the weight gained post-thyroidectomy.

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Declaration of Conflicting Interests

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