Abdominal Exersises Versus Ultrasound Cavitation on Coronary Risk Profile in Obese Women

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Abstract

Objective: This study compared the effect of abdominal exercise versus ultrasound cavitation on coronary risk profile in obese women by 6 week program.

Material and Methods: Forty obese women with abdominal obesity, their age ranged from (30-40) years, their BMI (30-35kg/m$^2$), WHR ranged between (0.81 to 1.0) selected from Ibrahim nada hospital, and divided into two equal groups. Group (A): Received abdominal exercises in addition to diet regimen 1200 Cal for six weeks, two sessions per week. Group (B): Received ultrasound cavitation in addition to the same regimen for six weeks, two sessions per week. Methods of evaluation (BMI, WHR, lipid profile, coronary risk ratio) were measured before and after the study period. The study was conducted at Ibrahim Nada hospital and Alexandria center, from October 2015 to May 2016 in Alexandria.

Results: The results showed statistical significant difference concerning, BMI, WHR, lipid profile and coronary risk ratio in both groups, However the results were in the favor of abdominal exercises group.

Conclusion: It was concluded that both abdominal exercises and ultrasound cavitation were effective in reduction of BMI, WHR, lipid profile and coronary risk ratio, However the abdominal exercises cause much more improvement than ultrasound cavitation.

Key Words: Abdominal obesity – Abdominal exercises – Ultrasound cavitation – Coronary risk profile.

Introduction

OBESITY is a state in which there is a generalized accumulation of excess fat in the body, poor foods with high levels of sugar and saturated fats, combined with reduced physical activity, have led to obesity rates that have risen three-fold or more since 1980 in some areas of North America, the United Kingdom, Eastern Europe, the Middle East, the Pacific Islands, Australasia and Africa [1].

Obesity and overweight result from an energy imbalance. The body needs a certain amount of energy (calories) from food to keep up basic life functions. Body weight tends to remain the same when the number of calories eaten equals the number of calories the body burns. Over time when people eat and drink more calories than they burn, lead to obesity or overweight [2].

Body Mass Index (BMI) is the most commonly tool used to estimate Overweight and obesity in adult and children [3]. Which is defined as the weight in kilograms divided by the square of the height in meters ($kg/m^2$). Body mass index over 25$kg/m^2$ is defined as overweight, and BMI of over 30$kg/m^2$ defined as obese. These markers provide common benchmarks for assessment [4]. Abdominal obesity characterized by high waist circumference (WC) is a stronger predictor than generalized obesity defined by elevated BMI of subsequent development of major coronary events, vascular mortality, diabetes and metabolic syndrome. Men and women who have WC greater than 102cm and 88cm are considered to be at increased risk for cardio metabolic diseases [5].

It has been reported that waist circumference and visceral adiposity decreased in response to exercise, the dose response relationship between exercise and reductions in waist circumference or visceral adipose tissues largely unknown despite much interest in exercise-induced fat loss, the optimal exercise prescription to maximize fat loss remains exclusive [6].

Low frequency ultrasound cavitation is a relatively new procedure offering non-invasive painless reduction of unwanted fat deposits [7]. Energy is released in the form of heat (minor effect) and pressure waves (major effect). The membranes of
fat cells do not have the structural capacity to withstand such vibrations, so the cavitation easily breaks them while sparing vascular, nervous and muscular tissue [8].

**Material and Methods**

This study was conducted on forty women, their age ranged from 30-40 years, BMI in between 30-35kg/m$^2$, WHR from 0.8 to 0.1, and were divided into two groups. The first group (group A) 15 women received abdominal exercises and diet regimen 1200 cal, the second group (group B) 15 women received ultrasound cavitation and diet regimen 1200 cal for six week two session per week to both groups, the assessment tools were applied through measurement abdominal obesity indices (BMI, WHR) and lipid profile (assessment to coronary risk ratio) were measured before and after treatment the end program for both group.

*Training procedure:* Subjects participated in exercises program the duration of session 45 minutes as circuit training program (curls up, Trunk rotation, Lateral trunk flexion exercise, lower abdominal muscle exercise, Lateral Abdominal Plank exercise). 15 repetitions for each exercise in 3 sits cycle and rest in between, started with warm up and ended by cooling down on treadmill for 5 mints to improve basal metabolic rate and avoid muscle spasm during exercises. Two sessions per week for 6 weeks in addition to home program. Giving total number of 12 sessions at the end of program in addition to diet regimen 1200 cal as showed in Fig. (1) [9].

On the other hand Subjects received ultrasound cavitation therapy for 30 minutes-40KHZ 3WATT/cm$^2$ two sessions per week for 6 weeks giving total number of 12 sessions at end program in addition to the Sam diet regimen as showed in Fig. (2) [10].

![Fig. (1): Curl up exercise.](image1)

![Fig. (2): Ultrasound cavitation for abdomin.](image2)

**Results**

Statistical package for social sciences (SPSS) computer program (version 16 windows) was used for data analysis. $p$-value less than or equal to 0.05 was considered and $<0.01$ was considered highly significant. Data are expressed as mean ± standard deviation (SD). Data are normally distributed, so comparison between mean values of different variables in the two studied groups was performed using unpaired $t$-test. Pair wise comparison (pre vs. post) within the same group was performed using paired $t$-test.

The results of the study showed that the abdominal exercises in addition to diet regimen caused significant decrease in BMI, WHR, Lipid profile and Coronary risk. The reduction was 5.44% for (BMI), 4.49% for (WHR), 11.19% for (TG), 10.82% for total cholesterol and 31.69% for coronary risk ratio. In comparison to ultrasound cavitation group which showed that the reduction was 4.39% for BMI, 3.30% for WHR, 6.27% for TG, 4.48% for total cholesterol and 10.71% for coronary risk ratio.

Statistical analysis of anthropometric measurement of subjects in both groups before starting the study showed the following results, as shown in Table (1).

![Table (1): Demographic features of the two studied groups.](table1)

<table>
<thead>
<tr>
<th></th>
<th>Abdominal program</th>
<th>Ultrasound cavitation</th>
<th>$t$-value</th>
<th>$p$-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age (yrs)</td>
<td>34.15±2.85</td>
<td>34.65±2.35</td>
<td>0.606</td>
<td>0.548 (NS)</td>
</tr>
<tr>
<td>Height (cm)</td>
<td>165.35±4.89</td>
<td>164.90±4.87</td>
<td>−0.292</td>
<td>0.772 (NS)</td>
</tr>
<tr>
<td>Weight (kg)</td>
<td>87.35±7.15</td>
<td>85.30±7.09</td>
<td>−0.910</td>
<td>0.368 (NS)</td>
</tr>
</tbody>
</table>

NS: Not significant when $p>0.05$
Table (2): Mean, standard deviation (SD) and statistical comparison of the pre training and post training values for abdominal exercises.

<table>
<thead>
<tr>
<th>Variable</th>
<th>Pre training value</th>
<th>Post training value</th>
<th>Mean difference</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>BMI (Kg/m$^2$)</td>
<td>32.93±1.56</td>
<td>31.14±1.69</td>
<td>1.79</td>
<td>0.001 **</td>
</tr>
<tr>
<td>WHR (cm)</td>
<td>0.89±0.04</td>
<td>0.85±0.04</td>
<td>0.04</td>
<td>0.001 **</td>
</tr>
<tr>
<td>TG (mg/dl)</td>
<td>204.80±13.42</td>
<td>191.95±21.02</td>
<td>23.25</td>
<td>0.001 **</td>
</tr>
<tr>
<td>Cholesterol (mg/dl)</td>
<td>251.45±12.56</td>
<td>224.25±13.40</td>
<td>27.20</td>
<td>0.001 **</td>
</tr>
<tr>
<td>HDL (mg/dl)</td>
<td>51.60±9.50</td>
<td>67.35±10.17</td>
<td>15.75</td>
<td>0.001 **</td>
</tr>
<tr>
<td>LDL (mg/dl)</td>
<td>144.75±12.72</td>
<td>119.30±12.07</td>
<td>25.45</td>
<td></td>
</tr>
<tr>
<td>Total cholesterol (mg/dl)</td>
<td>251.45±12.56</td>
<td>224.25±13.40</td>
<td>27.20</td>
<td>0.001 **</td>
</tr>
<tr>
<td>Coronary risk ratio</td>
<td>4.66±0.89</td>
<td>3.32±0.55</td>
<td>1.54</td>
<td>0.001 **</td>
</tr>
</tbody>
</table>

Table (3): Mean, standard deviation (SD) and statistical comparison of the pre training and post training values for ultrasound cavitation group.

<table>
<thead>
<tr>
<th>Variable</th>
<th>Pre training value</th>
<th>Post training value</th>
<th>Mean difference</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>BMI (Kg/m$^2$)</td>
<td>32.81±1.55</td>
<td>31.37±1.75</td>
<td>1.44</td>
<td>0.001 **</td>
</tr>
<tr>
<td>WHR (cm)</td>
<td>0.91±0.03</td>
<td>0.88±0.04</td>
<td>0.03</td>
<td>0.001 **</td>
</tr>
<tr>
<td>TG (mg/dl)</td>
<td>207.80±16.88</td>
<td>184.55±15.01</td>
<td>12.85</td>
<td>0.014*</td>
</tr>
<tr>
<td>Cholesterol (mg/dl)</td>
<td>257.00±9.72</td>
<td>244.55±9.72</td>
<td>12.45</td>
<td>0.001 **</td>
</tr>
<tr>
<td>HDL (mg/dl)</td>
<td>55.10±9.72</td>
<td>59.00±9.72</td>
<td>3.90</td>
<td>0.001 **</td>
</tr>
<tr>
<td>LDL (mg/dl)</td>
<td>138.60±8.89</td>
<td>129.60±10.88</td>
<td>9.0</td>
<td>0.001 **</td>
</tr>
<tr>
<td>Total cholesterol (mg/dl)</td>
<td>257.00±9.32</td>
<td>244.55±9.90</td>
<td>12.45</td>
<td>0.001 **</td>
</tr>
<tr>
<td>Coronary risk ratio</td>
<td>4.76±0.84</td>
<td>4.25±0.70</td>
<td>0.51</td>
<td>0.001 **</td>
</tr>
</tbody>
</table>

Table (4): Comparison between mean, standard deviation (SD) and statistical comparison of the pre-treatment and post treatment values for both group.

<table>
<thead>
<tr>
<th>Variable</th>
<th>Treatment time</th>
<th>Abdominal exercise</th>
<th>Cavitation therapy</th>
<th>t-value</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>BMI (Kg/m$^2$)</td>
<td>Pre treatment</td>
<td>32.93±1.56</td>
<td>32.81±1.55</td>
<td>-0.235</td>
<td>0.816 (NS)</td>
</tr>
<tr>
<td></td>
<td>Post treatment</td>
<td>31.14±1.69</td>
<td>31.37±1.75</td>
<td>0.429</td>
<td>0.671 (NS)</td>
</tr>
<tr>
<td>WHR (cm)</td>
<td>Pre treatment</td>
<td>0.89±0.04</td>
<td>0.91±0.03</td>
<td>1.224</td>
<td>0.229 (NS)</td>
</tr>
<tr>
<td></td>
<td>Post treatment</td>
<td>0.85±0.04</td>
<td>0.88±0.04</td>
<td>2.333</td>
<td>0.025*</td>
</tr>
<tr>
<td>Triglyceride (mg/dl)</td>
<td>Pre treatment</td>
<td>204.80±13.42</td>
<td>204.80±13.42</td>
<td>-0.622</td>
<td>0.538 (NS)</td>
</tr>
<tr>
<td></td>
<td>Post treatment</td>
<td>191.95±21.02</td>
<td>184.55±15.01</td>
<td>1.281</td>
<td>0.208 (NS)</td>
</tr>
<tr>
<td>Cholesterol (mg/dl)</td>
<td>Pre treatment</td>
<td>251.45±12.56</td>
<td>251.45±12.56</td>
<td>0.541</td>
<td>0.012*</td>
</tr>
<tr>
<td></td>
<td>Post treatment</td>
<td>224.25±13.40</td>
<td>244.55±9.90</td>
<td>5.451</td>
<td>0.001**</td>
</tr>
<tr>
<td>HDL (mg/dl)</td>
<td>Pre treatment</td>
<td>51.60±9.50</td>
<td>55.10±9.72</td>
<td>1.152</td>
<td>0.256 (NS)</td>
</tr>
<tr>
<td></td>
<td>Post treatment</td>
<td>67.35±10.17</td>
<td>59.00±9.76</td>
<td>-2.649</td>
<td>0.012*</td>
</tr>
<tr>
<td>LDL (mg/dl)</td>
<td>Pre treatment</td>
<td>144.75±12.72</td>
<td>138.60±8.89</td>
<td>-1.773</td>
<td>0.084 (NS)</td>
</tr>
<tr>
<td></td>
<td>Post treatment</td>
<td>119.30±12.07</td>
<td>129.60±10.88</td>
<td>2.835</td>
<td>0.007**</td>
</tr>
<tr>
<td>Total cholesterol (mg/dl)</td>
<td>Pre treatment</td>
<td>251.45±12.56</td>
<td>251.45±12.56</td>
<td>0.541</td>
<td>0.001**</td>
</tr>
<tr>
<td></td>
<td>Post treatment</td>
<td>224.25±13.40</td>
<td>244.55±9.90</td>
<td>5.451</td>
<td>0.001**</td>
</tr>
<tr>
<td>Coronary risk ratio</td>
<td>Pre treatment</td>
<td>4.86±0.89</td>
<td>4.76±0.84</td>
<td>-0.374</td>
<td>0.710 (NS)</td>
</tr>
<tr>
<td></td>
<td>Post treatment</td>
<td>3.32±0.55</td>
<td>4.25±0.70</td>
<td>4.647</td>
<td>0.001**</td>
</tr>
</tbody>
</table>
Abdominal Exercises Versus Ultrasound Cavitation on Coronary Risk Profile

Discussion

Obesity is a complex disorder involving an excessive amount of body fat. People who are overweight or obesity run an increased risk for cardiovascular disease, cancer, diabetes, osteoarthritis, and chronic kidney disease, with most deaths due to cardiovascular problems, including heart attack and stroke, obesity occurs when eaten more calories than you burn through exercise or normal daily activities. The body stores these excess calories as fat in different areas most dangerous risk abdominal obesity [11].

The result of this study showed that the abdominal exercises in addition to diet regimen caused significant decrease in BMI, WHR, lipid profile and coronary risk. The reduction was 5.44% for (BMI), 4.49% for (WHR), 10.19% for (TG), 10.82% for (total cholesterol), and 31.69% for (coronary risk ratio). In comparison to ultrasound cavitation group which showed that the reduction was 4.39% for (BMI), 3.30% for (WHR), 6.27% for (TG), 4.84% for (total cholesterol) and 10.71% for (coronary risk ratio).

Many studies demonstrated that abdominal exercises are associated with reduced serum levels of LDL-C, due to the effects of these exercises on fat throw, fat is used as a source of energy by fat oxidation. Also, a activities increase lipoprotein lipase (LPL) and Lecithin Cholesterol acyltransferase (LCAT) enzymatic activities. These two enzymes decrease triglyceride, LDL-C, and cholesterol while increase HDL-C [12].

Another possible reason for the increase in HDL may be due to increased HDL production by the liver followed by a change in (LPL) enzymatic activity and decrease in hepatic lipase followed by physical activity or exercises [13].

Also, the weight loss lead to decrease in BMI and lipid profile after low caloric diet may attributed to several mechanisms including, the diuresis and depletion in stored glycogen and reduction in fat mass. The depletion of fat depot caused by hydrolysis and clearance of triglyceride stored in adipose tissue into glycerol and free fatty acid (FFA) by the action of lipoprotein lipase (LPL) [14].

Parvin et al., were reported that resistance training has a favorable effect on total cholesterol, body fat percentage, waist and abdomen circumferences. This study was done on forty women who received abdominal exercises in a supervised 45- to 50-minute training sessions, 3 times per week on nonconsecutive days for 10 weeks without any diet restriction. In the current study subjects were received diet regimen, so they showed highly improvement in decreased lipid profile and abdominal obesity indices [15].
The reduction of total blood cholesterol has been clearly related to a reduction in the risk of stroke, coronary disease and overall cardiovascular death. Risk ratio was calculated by the LDL-Cholesterol/HDL-Cholesterol ratio or the Total-Cholesterol/HDL-Cholesterol ratio, which have the easy way to use in clinical practice [16]. In the current study abdominal exercises showed more improvement in coronary risk ratio which help to protect subjects in future from cardiovascular problems.

On the other hand ultrasound cavitation effect on lipids, as membranes of fat cells do not have the structural capacity to withstand such vibrations, the effect of cavitation easily breaks them while sparing vascular, nervous and muscular tissue [17].

The cavitations used in the field of aesthetic medicine is an non invasive technique for a non-surgical reduction of the localized fat and cellulite, Ultrasonic vibrations spread in the form of a wave in medium such as a liquid or a solid. When the particles of an elastic medium are under ultrasonic vibration, they act continuously in only one direction this phenomenon called cavitation [18].

The fat cell membrane cannot withstand this pressure; it will explode into the liquid content. After disruption of adipose cells (fat cells), the broken fat in the form of triglycerides is released into the interstitial fluid between the cells, where they are enzymatically metabolized to glycerol and free fatty acids. Water soluble glycerol is absorbed by the circulatory system and used as the energy source, whereas the insoluble free fatty acids are transported to the liver and processed as fatty acids from food [19,20].

The lipolysis range of ultrasounds is 30-70 KHz, and the best effects are obtained in a range between 30-35 KHz. The depth of the treatment in the tissues is generally 2-3 cm, to avoid muscles involvement [21].

The results of the study agreed with that of [22], in which 60 years old females, were received ultrasound cavitation for 4 weeks, with one session per week, 40 minutes. The results showed significant improvement in decreased in weight, BMI, SFT, WC and lipid profile and more dramatic response if combination between UC, electro lipolysis and diet regimen.

Finally, according to pervious discussion and results of the present study, application of abdominal exercise connected with diet regimen is highly significant method for treating abdominal obesity and reduction all abdominal indices measurement, harmful lipid, coronary risk ratio more than ultrasound cavitation connected with diet regimen.

References


