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Original Article

A study of abdominal ultrasound therapy combined with complex exercise for effective obesity management among shift work employees

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Abstract. [Purpose] This study aimed to examine the effects of abdominal ultrasound accompanied by complex exercise in shift work employees working in industry. [Subjects and Methods] Thirty shift work employees were randomly assigned to either a complex exercise group (control group) or a complex exercise and ultrasound treatment group (experimental group). The control group carried out complex exercise five times per week for 4 weeks, while the experimental group performed complex exercise twice per week and received deep ultrasound three times per week for 4 weeks. [Results] The results showed that there were no significant differences in body composition between the two groups. There were significant changes in weight, lean body mass, body fat mass, and body mass index in the control group; meanwhile, significant changes in weight and body fat mass were observed in the experimental group. There were no significant differences in blood lipids between the two groups. There was a significant decrease in high-density lipoprotein cholesterol (HDL-C) in the control group; furthermore, a significant decrease in total cholesterol was observed in the experimental group, along with significant increases in HDL-C and low-density lipoprotein cholesterol. [Conclusion] According to the results of this study concerning short-term obesity management programs, complex exercise was effective for improving of body composition and weight loss, while complex exercise combined with abdominal ultrasound had a good effect on blood lipids and secondary complication prevention.

Key words: Obesity, Abdominal ultrasound therapy, Exercise

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INTRODUCTION

Recently, shift work employees working in industry have been faced with the new problem of obesity resulting from insufficient sleep, instability, and an irregular sleep cycle, in addition to musculoskeletal system diseases[1)]. Obesity was a symbol of wealth in the past, but at present, it is treated as a life-threatening illness. Obesity arises from diverse causes throughout society. Cardiac and circulatory system diseases caused by being overweight of obese rank first in terms of world death rates[2)]. Obesity accelerates with age and increases the prevalence of secondary metabolic diseases resulting from lack of exercise and decreased physical activity[3)]. It is estimated that over 50% of deaths will occur with obesity as a primary or secondary cause within a decade; thus, obesity has emerged as a global problem[4)]. Methods to treat obesity are divided into an invasive method, namely surgery, and noninvasive methods such as exercise, dietary control, behavioral correction, and drug therapy. In general, surgery may be effective for losing weight within a short time period, but it is expensive and may trigger side effects from the operation[5)]; therefore, it is restrictively applied to patients with morbid obesity. On the other hand, dietary control and exercise therapies require continuous efforts, and those who use such methods face difficulties midway into them. Recently, obesity management using abdominal ultrasound has been recommended in order to overcome such difficulties[6)]. Obesity management using abdominal ultrasound is a method of reducing subcutaneous fat by decomposing it effectively into fatty acid and discharging it out of the body; recently, many relevant treatment instruments have been developed and popularized[7)]. Accordingly, the aim of the present study was to compare ordinary complex exercise and abdominal ultrasound accompanied by complex exercise, and to present a method by which employees working in industry exposed to risk factors related to obesity can effectively overcome this disorder.

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Table 1. Comparisons between the experimental and control groups of shift work employees

	Experimental group (n=9)		Control group (n=15)	
	Before	After	Before	After
BMI[a] (kg/m^2)	29.3±2.2[1]	27.6±4.5	29.0±3.1	28.2±3.1
Body fat mass (kg)	34.85±5.2	23.49±7.1*	33.9±7.8	25.0±6.6*
Lean body mass (kg)	63.4±8.4	60.0±13.9	60.3±12.4	61.4±7.0
TC (mg/dL)	180.0±25.6	169.5±31.6	194.8±32.8	182.6±28.1
LDL-C (mg/dL)	100.6±26.3	109±33.3	113.4±36.3	122.0±33.9
HDL-C (mg/dL)	41.7±6.6	47.5±11.1*	46.9±9.7	48.8±12.7

[1]Mean±SD, [a]Body mass index

SUBJECTS AND METHODS

This study included 30 employees in S company with a body mass index (BMI) was 25 (kg/m^2) or greater. The participants had not dieted over the past sixth months and were not performing regular exercise or exercising dietary control at the beginning of the study. All the subjects were given sufficient information about the experimental method based on the Helsinki Declaration, fully understood the content and purpose of this experiment, and voluntarily consented to participate. Fifteen participants were randomly assigned to a complex exercise group (control group), and 15 participants were randomly assigned to an abdominal ultrasound treatment group (experimental group). A test was conducted on blood components, BMI, body composition, neutral fat, and cholesterol. Measurements were taken prior to and after the 4 weeks of the experiment. They were taken twice each time and averaged values were used for analysis. The control group followed a complex exercise program composed of aerobic exercise[8)] and resistance exercise[9)]. They conducted aerobic exercise for 30 minutes, resistance exercise for 20 minutes, and cool-down exercise for 10 minutes five times per week for 4 weeks. The experimental group followed the same complex exercise program as that of the control group twice per week and underwent deep ultrasound using Lipoderm Lipo-X deep abdominal ultrasound equipment (HSC CO., Ltd., Seongnam, Republic of Korea), 30 minutes each time, three times per week for 4 weeks. A body composition analyzer (InBody 720, Biospace Co., Ltd., Seoul, Republic of Korea) was used to measure body composition and components via the direct segmental multifrequency bioelectrical impedance analysis (DSM-BIA) method in each area. Using the body composition analyzer, BMI, body fat mass, body fat percentage, lean body mass, and muscle mass were measured. For analysis of blood composition, the subjects fasted for 12 hours. Then, 15 ml of blood was collected from the brachial vein, and the total cholesterol (TC), low-density lipoprotein cholesterol (LDL-C), and high-density lipoprotein cholesterol (HDL-C) levels were analyzed using the enzymatic method with an automated analyzer. Statistical analysis was carried out using SPSS 18.0. A paired t-test was conducted in order to test effects prior to and after the intervention, and an independent t-test was performed to compare changes between the two groups. The significance level was set at α=0.05

RESULTS

In terms of the general characteristics of the subjects, there were no significant differences between the two groups in age (experimental group, 35.7±6.6; control group, 35.8±4.2), height (experimental group, 172.8±6.9; control group, 175.4±5.8), weight (experimental group, 87.3±15.2; control group, 90.3±11.2), or BMI (experimental group, 29.3±2.2; control group, 29.0±3.1). In order to examine the effects of complex exercise and abdominal ultrasound treatment for obesity management on body composition, the changes in lean body mass, body fat mass, and BMI were compared. The results of the independent t-test, showed that there were no differences between the two groups after the intervention. The results of the paired t-test showed that there was a significant decrease in body fat mass in the two groups. In order to look at the effects of complex exercise and abdominal ultrasound intervention for obesity management on changes in body composition, the changes in TC, HDL-C, and LDL-C were compared. The results of the independent t-test showed that there were no significant differences between the two groups after the intervention. The results of the paired-t test showed that HDL-C increased significantly in the experimental group but not in the control group (Table 1).

DISCUSSION

In the past, obesity was recognized as a personal problem, and obesity management was considered to involve merely eating less food and exercising more. Mild obesity has been largely prevented and managed through regular exercise and self-management[10, 11)]. However, as obesity progresses into morbid obesity, it results in secondary problems such as high blood pressure, diabetes, and hyperlipidemia, and triggers many social problems. Obesity is recognized as a very dangerous factor that has increased the rate of mortality from cardio-cerebrovascular diseases and cancer[3, 12)]. The methods of treating obesity can be divided into an invasive method, namely surgery, and noninvasive methods such as exercise, dietary control, behavioral correction, and drug therapy[5)]. As advancements in science and technologies have been made and the physiology of obesity has been clarified to some extent, efforts to effectively enhance and prevent obesity are being made using noninvasive methods[13, 14)]. Beyond weight loss goals such as personal weight

loss, body shape management, and health training, a need to minimize the secondary side effects of obesity has emerged; thus, this study intended to compare the effects of complex exercise and abdominal ultrasound exercise for safer, more scientific, and more convenient obesity management. Currently, the most effective and common management method to resolve obesity is complex exercise, which is very effective in changing body composition. Moreover, Kim et al.[15] noted that a 12-week aerobic exercise program decreased subjects' BMI and body fat percentage. Therefore, exercise is recommended as a program to resolve obesity. In their research, Saris et al.[16] observed that exercise for 45 to 60 minutes was needed, while Lee[17] asserted that exercise of moderate intensity at least five days a week was effective. In contrast to previous research, however, the intervention in the present study was effective for decreasing body fat only; it is considered that this was because the intervention period was relatively shorter than those of previous studies. If the intervention period were longer, this study would probably obtain the same results as those in previous studies. Steinert[7] reported that ultrasound therapy was an effective, painless fat decomposition method and stated that it had a good effect on abdominal obesity in particular. Most secondary complications brought about by obesity are due to abdominal obesity, and ultrasound therapy is considered to positively affect obese patients who are suffering from secondary complications resulting from abdominal obesity. In a study of female adults, Kim et al.[18] reported that ultrasound therapy was effective in reducing body fat percentage and body fat mass. According to the results of the present study, ultrasound therapy combined with exercise effectively increased HDL-C in terms of blood lipids, which was a similar result to those reported in previous studies. Given the above results, it is considered that ultrasound therapy in combination with complex exercise can be used as a method to reduce secondary complications resulting from obesity.

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