

Impact of Aerobic Exercise and Acupuncture Treatment on Obese Patients; A Retrospective Case-Controlled Study

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Objectives: The purpose of this study is to investigate the effects of aerobic exercise and acupuncture treatment in obese patients.

Methods: The effects of exercise in obese patients receiving acupuncture therapy were investigated in this retrospective, case-controlled study in which subjects complying with exercise were enrolled in the case and non-compliers were enrolled in the control group.

Results: There was a statically significant weight loss in both the study case group (94.39 ± 20.36 ; 88.91 ± 19.00 ; $n = 22$; $p = 0.001$) and the control group (103.18 ± 21.92 ; 99.56 ± 21.92 ; $n = 34$; $p = 0.001$) after 3 months. Weight loss occurred in all 22 patients in the case group. In the control group, while weight loss occurred in 27 of the 34 patients, weight gain occurred in three patients.

Conclusion: In conclusion, the addition of modalities such as acupuncture, exercise and diet may provide effective improvement in weight control.

Keywords: obesity, acupuncture, exercise, diet

INTRODUCTION

Exercise is generally assessed under three separate categories aerobic, strength, and balance and stretching [1]. Activities that provide sufficient tissue oxygenation, such as brisk walking, cycling, swimming, and tennis, are defined as aerobic exercise [2]. In order for an individual's exercise activity to be defined as aerobic, it is first essential to calculate whether or not the subject meets aerobic fitness conditions. Aerobic fitness involves the capacity to transport and use oxygen. The greater amount of O₂ an individual can use in a unit of time, the greater their aerobic capacity (VO₂max). One of the most important parameters for aerobic fitness is intensity of exercise. Exercise tests must be performed to determine intensity of exercise. The exercise test is planned in the light of the individual's symptoms, together with cardiac risk factors (low, moderate or high risk) such as age, family history, smoking status, a sedentary lifestyle, obesity, dyslipidemia, hypertension, and prediabetes. Maximum

heart rate is calculated based on intensity of exercise, and a target heart rate during exercise is determined [3]. It is important for exercise to be performed regularly. Regular exercise must be taken at least five days a week, for at least 30 min a day, for a total of 150 min. Regular exercise is reported to reduce insulin resistance and to play an effective role in obesity treatment by increasing muscle glucose consumption and fat oxidation [4].

Obesity develops with a multifactorial etiology [5]. Two of the most important etiological factors are a sedentary lifestyle and irregular nutrition. Endocrine disorders such as hypothyroidism, adrenal irregularity, and polycystic ovary also increase the disposition to obesity. Equilibrium between appetite and satiation is established by various humoral and neurological controls. Leptin, adiponectin, insulin, ghrelin and peptide YY3-36 are hormones involved in the humoral mechanism [6]. Pro-inflammatory cytokines such as TNF- α , IL-1 β , and leptin increase in obesity, while plasma adiponectin levels decrease [7].

Various incompatible theses have been proposed regard-

ing the effects of exercise on weight loss. In addition to studies reporting very little effect of exercise on weight loss [8], others have reported rapid weight gain following discontinuation of exercise [9]. Exercise, diet, and other therapeutic approaches appear to be insufficient for weight loss in some patients [10]. Because of easy, cheap, and safe, acupuncture has been widely used in clinical practice for obesity treatment [11]. Some studies suggest that auricular acupuncture is effective for weight loss [12].

The purpose of this study is to evaluate the effects of aerobic exercise and acupuncture treatment in obese patients.

MATERIALS AND METHODS

1. Study population

The effects of exercise in obese patients receiving acupuncture therapy were investigated in this retrospective, case-controlled study in which subjects complying with exercise were enrolled in the case and non-compliers were enrolled in the control group. A total of Fifty-six patients were included in the study, 22 in the case group and 34 in the control group. Acupuncture therapy was administered via the ear, in three once-monthly sessions, with the insertion of a permanent needle. Auricular depression, anxiety, hunger, swallowing, stomach, liver, pancreas, and vitamin B12 acupuncture points have frequently been used in treatment. Patients were invited to follow-ups at 14-day intervals and regular exercise was recommended in addition to acupuncture. This regular exercise was defined as walking for at least 30 min a day for at least five days a week and a total weekly time of 150 minutes. The intensity of exercise was set such as not to exceed normal heart rate by more than 50%. In addition, patients were advised to reduce their carbohydrate intake, and particularly sugary foods. Subjects performing activities not regarded as aerobic exercise or exercising non-regularly were enrolled in the control group. No tests were performed to determine patients' aerobic capacities. Initial and three-month data were evaluated in the scope of the study.

2. Statistical analysis

All statistical analyses were performed with IBM SPSS Statistics (V25). P less than 0.05 was considered statistically significant. Categorical data were expressed as numbers and percentages. The chi-square test was used to compare categori-

cal groups. Numerical data were expressed as mean values and were analyzed using the Mann-Whitney U test in independent groups and with the Wilcoxon signed ranks test in dependent groups. In repeated measures were used generally linear model. Compatibility with normal distribution was assessed using skewness analysis.

3. Ethical statement

Due to the retrospective nature of the study design, no ethical committee approval was required. However, patients signed informed consent forms expressing their agreement to participate in the study. All procedures performed in this study were in accordance with the ethical standards of the institutional and/or national research committee and with the 1964 Helsinki declaration and its later amendments or comparable ethical standards.

The authors declare that they are responsible for the article's scientific content including study design, data collection, analysis and interpretation, writing, some of the mainline, or all the preparation and scientific review of the contents and approval of the final version of the article.

RESULTS

Women comprised 94.6% (n = 53) of the patients in the study and men 5.4% (n = 3). Patients' ages ranged between 15 and 66 years, with a mean age of 35.29 years.

No significant differences were observed between the case and control groups in terms of mean age or body mass index (BMI). No significant difference was observed between the case and control groups in terms of sex distribution. The rate of compliance with dietary advice was significantly higher in the case group compared to the control group. Prevalence of chronic disease was significantly lower in the case group than in the control group (Table 1).

Statistically significant weight loss occurred after three-month acupuncture therapy in both the case group (94.39 ± 20.36 ; 88.91 ± 19.00 ; n = 22; p = 0.001) and the control group (103.18 ± 21.92 ; 99.56 ± 21.92 ; n = 34; p = 0.001) (Fig. 1). Weight loss occurred in all 22 patients of the case group. In the control group, while weight loss occurred in 27 of the 34 patients, weight gain occurred in three patients. In addition, no weight change occurred in four patients of the control group.

In the case group, weight loss occurred at the end of three-

Table 1. Comparison of the case and control groups in terms of age, BMI, compliance with dietary advice and presence of chronic disease

Characteristics of participants		Case (n = 22)	Control (n = 34)
Age (Mean ± SD)		31.55 ± 10.30	37.71 ± 11.95
BMI (Mean ± SD)		35.25 ± 6.08	38.23 ± 7.32
Gender (n; %)	Female	21; 95.5	32; 94.1
	Male	1; 4.5	2; 5.9
Diet (n; %)*	Compliant	16; 72.7	12; 35.3
	Non-compliant	6; 27.3	22; 64.7
Chronic disease (n; %)*	Yes	6; 27.3	24; 70.6
	No	16; 72.7	10; 29.4

SD, Standard Deviation; *The statistical significant different was accepted as $p < 0.05$.

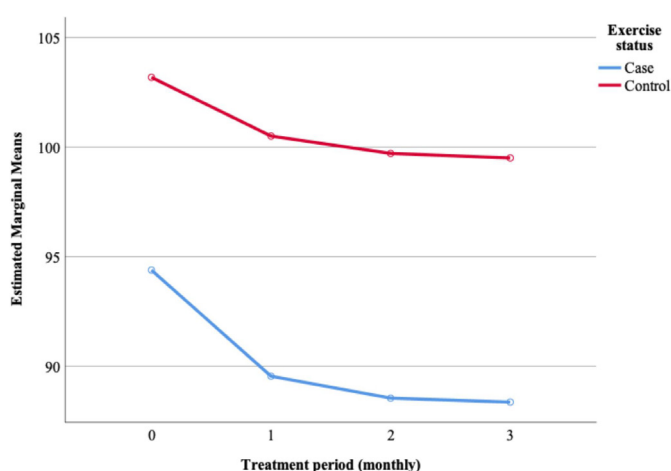


Figure 1. Comparison of the case and control groups in terms of three-month therapy according to weight changes.

month acupuncture therapy in all six patients with chronic disease and in all 16 patients without chronic disease. In the control group, while weight loss occurred in 18 of the 24 patients with chronic disease, weight gain occurred in three patients. In addition, no weight change occurred in three patients. Weight loss occurred in nine of the 10 patients without chronic disease in the control group, while no weight change occurred in one patient (Table 2).

In the case group, statistically significant weight loss occurred after three-month acupuncture therapy in both the patients with diet compliant (99.28 ± 20.72 ; 93.69 ± 19.29 ; $n = 16$; $p = 0.001$) and the patients with diet non-compliant (81.33 ± 13.11 ; 76.17 ± 11.47 ; $n = 6$; $p = 0.026$) (Fig. 2). In the case group, weight loss occurred in all 16 patients who complied with dietary advice at the end of three-month acupuncture therapy. Weight loss also occurred in all six patients who did not comply

with dietary advice.

In the control group, statistically significant weight loss occurred after three-month acupuncture therapy in both the patients with diet compliant (107.17 ± 24.68 ; 101.75 ± 25.60 ; $n = 12$; $p = 0.003$) and the patients with diet non-compliant (101.00 ± 20.54 ; 98.36 ± 20.17 ; $n = 22$; $p = 0.001$) (Fig. 3). In the control group, weight loss occurred in 11 of the 12 patients who complied with dietary advice, while weight gain occurred in one patient. Weight loss occurred in 16 of the 22 patients who did not comply with dietary advice, while weight gain occurred in two patients. In addition, no weight change occurred in four patients.

DISCUSSION

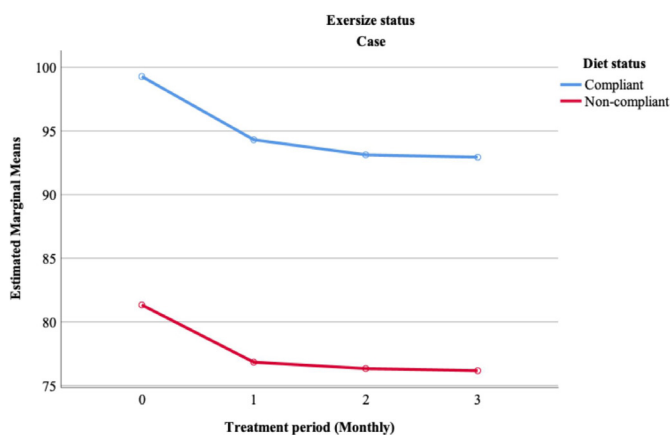
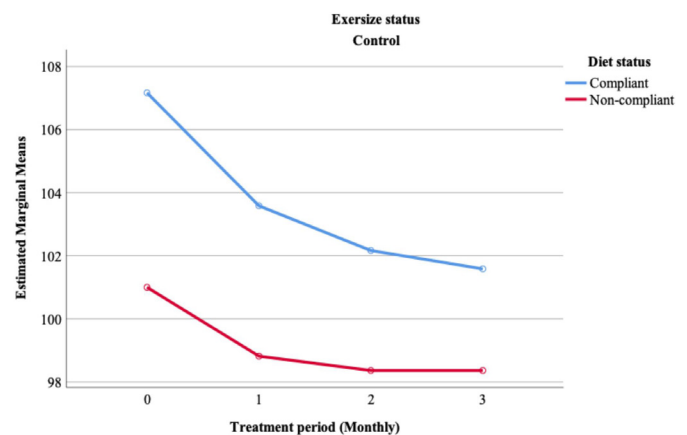
The absence of any difference between the case and control groups in terms of demographic parameters such as age, sex, and BMI had a positive effect on randomization between the two groups. However, the higher rate of compliance with dietary advice in the case group, and the lower rate of chronic disease, adversely affected randomization between the two groups.

The more pronounced weight loss in the case group compared to the control group shows that regular and aerobic exercise plays an effective role in weight loss. The results of studies in the previous literature support our study. One analysis of research in the literature concluded that aerobic exercise is particularly effective in preventing visceral fat deposition [13]. Aerobic exercise has also been shown to increase adiponectin and to reduce IL-6, CRP, leptin, and TNF alpha levels [14]. It has also been suggested that aerobic exercise reduces TNF alpha levels, but that resistance exercises have no effect on these [15]. It has also been proposed that regular exercise lowers TNF

Table 2. Comparison of weight changes before and after treatment depending on presence of chronic disease in the case and control groups

	Chronic disease	Treatment	N	Mean \pm SD*	↓	↑	→	p value
Case	Yes	Before	6	102.83 \pm 24.71	6	0	0	0.027
		After	6	96.33 \pm 23.82				
	No	Before	16	91.22 \pm 18.378	16	0	0	0.001
		After	16	86.12 \pm 16.915				
Control	Yes	Before	24	108.12 \pm 22.146	18	3	3	0.001
		After	24	104.96 \pm 21.946				
	No	Before	10	91.30 \pm 16.932	9	0	1	0.008
		After	10	86.60 \pm 16.304				

*SD, Standard Deviation; The statistical significant different was accepted as $p < 0.05$; ↓, Negative Ranks; ↑, Positive Ranks; →, Ties.

**Figure 2.** Comparison of weight changes according to diet status in the case group.**Figure 3.** Comparison of weight changes according to diet status in the control group.

alpha levels [16].

The more pronounced weight loss in patients with chronic disease in the case group compared to the control group shows the importance of the effects of regular and aerobic exercise in the monitoring and treatment of chronic diseases. Some previous studies support our findings. Regular exercise is reported to cause a decrease in TNF alpha levels and insulin resistance, and therefore to be potentially effective in protecting against chronic diseases [17]. It has been suggested that both aerobic and resistance exercises reduce body fat levels, and that aerobic exercise lowers inflammatory cytokines and blood pressure, responsible for severe problems in the elderly [18].

The fact that weight loss was observed in all patients in the case group, both those complying with dietary advice and those not complying, suggests that aerobic exercise has a diet-independent effect on weight loss. Studies have reported that combined diet and exercise play a more effective role in weight

control [19]. It has also been that exercise alone provides more effective weight control than diet alone [20].

Weight loss occurred in 16 of the 22 patients who did not comply with both exercise and diet advice in our study. This shows that auricular acupuncture therapy plays an effective role in weight loss. Our results agree with other studies in the literature. A protocol involving acupuncture, diet, and aerobic exercise has been reported to provide better weight control than a diet and aerobic exercise protocol, and also to reduce serum leptin levels [21]. Another systematic analysis concluded that acupuncture techniques are effective in weight loss, with no side-effects [22].

CONCLUSION

In conclusion, the addition of other modalities such as acupuncture, exercise and diet may provide more effective

improvement in weight control. In addition, regular aerobic exercise obese patients receiving acupuncture treatment also provides a more marked improvement in weight control. We recommend primary application of aerobic exercises for the organism to be able to perform energy consumption via fat oxidation and carbohydrate metabolism.

CONFLICT OF INTEREST

The author declares no conflict of interest.

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REFERENCES

- Howley ET. Type of activity: resistance, aerobic and leisure versus occupational physical activity. *Med Sci Sports Exerc.* 2001; 33(6 Suppl):S364-9; discussion S419-20.
- Ashe MC, Khan KM. Exercise prescription. *J Am Acad Orthop Surg.* 2004;12(1):21-7.
- Yıldız SA. What is the Meaning of aerobic and anaerobic capacity? *Eurasian J Pulmonol.* 2012;14(1):1-8.
- Aydin C, Gökdemir K, Cicioğlu İ. Assessment of insulin and blood glucose level after aerobic and anaerobic exercise. *Hacet J Sport Sci.* 2000;11(1):47-55.
- González-Muniesa P, Martínez-González MA, Hu FB, Després JP, Matsuzawa Y, Loos RJE, et al. Obesity. *Nat Rev Dis Primers.* 2017;3:17034.
- Makki K, Froguel P, Wolowczuk I. Adipose tissue in obesity-related inflammation and insulin resistance: cells, cytokines, and chemokines. *ISRN Inflamm.* 2013;2013:139239.
- El-Wakkad A, Hassan Nel-M, Sibaii H, El-Zayat SR. Proinflammatory, anti-inflammatory cytokines and adipokines in students with central obesity. *Cytokine.* 2013;61(2):682-7.
- Aadland E, Anderssen SA. [The effect of physical activity on weight loss]. *Tidsskr Nor Laegeforen.* 2013;133(1):37-40. Norwegian.
- Loveman E, Frampton GK, Shepherd J, Picot J, Cooper K, Bryant J, et al. The clinical effectiveness and cost-effectiveness of long-term weight management schemes for adults: a systematic review. *Health Technol Assess.* 2011;15(2):1-182.
- Mastellos N, Gunn LH, Felix LM, Car J, Majeed A. Transtheoretical model stages of change for dietary and physical exercise modification in weight loss management for overweight and obese adults. *Cochrane Database Syst Rev.* 2014;(2):CD008066.
- Zhang K, Zhou S, Wang C, Xu H, Zhang L. Acupuncture on obesity: clinical evidence and possible neuroendocrine mechanisms. *Evid Based Complement Alternat Med.* 2018;2018:6409389.
- Huang CF, Guo SE, Chou FH. Auricular acupressure for overweight and obese individuals: a systematic review and meta-analysis. *Medicine (Baltimore).* 2019;98(26):e16144.
- Ohkawara K, Tanaka S, Miyachi M, Ishikawa-Takata K, Tabata I. A dose-response relation between aerobic exercise and visceral fat reduction: systematic review of clinical trials. *Int J Obes (Lond).* 2007;31(12):1786-97.
- Akbarpour M. The effect of aerobic training on serum adiponectin and leptin levels and inflammatory markers of coronary heart disease in obese men. *Biol Sport.* 2013;30(1):21-7.
- Landers-Ramos RQ, Jenkins NT, Spangenburg EE, Hagberg JM, Prior SJ. Circulating angiogenic and inflammatory cytokine responses to acute aerobic exercise in trained and sedentary young men. *Eur J Appl Physiol.* 2014;114(7):1377-84.
- Moon MK, Cho BJ, Lee YJ, Choi SH, Lim S, Park KS, et al. The effects of chronic exercise on the inflammatory cytokines interleukin-6 and tumor necrosis factor- α are different with age. *Appl Physiol Nutr Metab.* 2012;37(4):631-6.
- Petersen AM, Pedersen BK. The anti-inflammatory effect of exercise. *J Appl Physiol (1985).* 2005;98(4):1154-62.
- Wanderley FA, Moreira A, Sokhatska O, Palmares C, Moreira P, Sandercock G, et al. Differential responses of adiposity, inflammation and autonomic function to aerobic versus resistance training in older adults. *Exp Gerontol.* 2013;48(3):326-33.
- Johns DJ, Hartmann-Boyce J, Jebb SA, Aveyard P; Behavioural Weight Management Review Group. Diet or exercise interventions vs combined behavioral weight management programs: a systematic review and meta-analysis of direct comparisons. *J Acad Nutr Diet.* 2014;114(10):1557-68.
- Ghroubi S, Elleuch H, Kaffel N, Echikh T, Abid M, Elleuch MH. [Contribution of exercise and diet in the management of knee osteoarthritis in the obese]. *Ann Readapt Med Phys.* 2008;51(8):663-70. French.
- Yang JJ, Xing HJ, Xiao HL, Li Q, Li M, Wang SJ. [Effects of acupuncture combined with diet adjustment and aerobic exercise on weight and waist-hip ratio in simple obesity patients]. *Zhongguo Zhen Jiu.* 2010;30(7):555-8. Chinese.
- Zhang X. A clinical survey of acupuncture slimming. *J Tradit Chin Med.* 2008;28(2):139-47.