Differences in cardiovascular change in normal and obese in treadmill

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트레드밀에서 정상인과 비만인의 심혈관계 변화차이

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Abstract

Purpose: The purpose of this study is to examine the difference in cardiovascular changes between obese people and the general public using a treadmill.

Methods: This study was conducted by recruiting 32 adult males who had no experience in hospital visits or treatment due to cardiovascular disease. The subjects were divided into an obese group and a general group based on BMI 25 and performed treadmill exercise for 12 minutes. SBP, DBP, HR, MAP and PP before and after the treadmill were measured to see the difference in cardiovascular system changes. Data analysis was evaluated using an independent t-test.

Results: In the increase rate of systolic blood pressure, t=-3.771, p=0.001, which was statistically significant based on the significance level of 0.05 (p<.05). In the increase rate of mean arterial pressure, t=-3.279, p=0.003, which was statistically significant based on the significance level of 0.05 (p<.05). In the increase rate of pulse pressure, t=-2.696, p=0.014, which was statistically significant based on the significance level of 0.05 (p<.05).

Conclusion: This study compared blood pressure, heart rate, and pulse pressure changes on a treadmill between the general population and obese individuals. The study found differences in the rate of increase in systolic blood pressure, mean arterial pressure, and pulse pressure but no difference in the rate of increase in diastolic blood pressure and heart rate between the two groups.

1. Introduction

The number of obesity in modern society is rapidly increasing. Many factors in the stressful environment of busy modern society promote weight gain, and the deterioration of sleep quality accompanied by obstructive sleep apnea, competition, and leisure greatly influence appetite control [1].

Obesity can also lead to decreased quality of life and an increased risk of chronic diseases. Therefore, regular cardiology check-ups and early diagnosis and treatment of asymptomatic obese patients are important to reduce the risk of cardiovascular disease [2,3].

Cardio respiratory endurance is a key indicator of overall fitness, which refers to the ability of the circulatory and respiratory systems to supply oxygen and nutrients to the muscles during physical activity. It is measured by evaluating heart rate and oxygen intake during exercise, and a clinical expert's measurement is considered the most suitable method, despite the limitations [4,5].

High blood pressure is more likely in the general population, and weight gain causes an increase in blood pressure, and dilatation of the left ventricle occurs frequently due to an increase in filling pressure and blood volume [6].

If we look at these previous studies, we can see that blood pressure is important for obese

Therefore in this study, heart rate (HR), systolic blood pressure (SBP), diastolic blood pressure (DBP), mean arterial pressure (MAP), and pulse pressure (PP) were measured among adult males and obese adults using a treadmill. Based on this, we aim to see the difference in cardiovascular changes between obese people and the general public.

2. Subjerct and methods

2.1 Subject

This study involved 32 adult males aged 20 to 30 who were

enrolled at S University in Asan City and had no history of hospital visits or treatment for cardiovascular disease.

The sample size was determined using a sample size calculation program, and the participants were divided into two groups - an obese group (n=16) and a general population group (n=16). Statistical analysis was performed using a T-test to compare the means difference between the two independent groups.

2.2 Study procedure

Prior to the experiment, subjects were trained on safety and equipment, and were prohibited from smoking the day before. During the exercise stress test, ratings of perceived exertion were checked, and subjects were monitored for any abnormalities in heart rate, blood pressure, ECG waveform, or RPE.

All the general public and obese people participating in the study were assigned to the obese group and the general group according to the BMI measurement. Obesity is based on BMI (Weight/Height + Height), and the average age is in the early to mid-20s, and the number of people with a result value of 25 kg/m2 or more according to world health standards is designated as obese. (World Health Organization, Asia-Pacific region and the Korean Society of Obesity standards BMI >25 kg/m2 or more)

For more accurate experiments, the general public and obese people are tested under the same conditions. The experimenter sits in a chair while wearing the equipment, rests for 5 minutes, and measures systolic blood pressure, diastolic blood pressure, heart rate, mean arterial pressure, and pulse pressure.

After the measurement, the experimenters proceeded with the treadmill exercise according to [table 2] up to 4 steps. Each stage lasts for 3 minutes, and the condition of the subjects is measured before and after exercise.

The study aimed to compare the cardiovascular changes between the two groups by analyzing the average changes in the measured values before and after exercise.

2.3 Statistical analysis

In this study, descriptive statistics were used to analyze the mean and standard deviation (SD) of each variable. SPSS was used for all statistical analyses. Means difference between the two independent means was used to compare the differences in cardiovascular changes between obese people and the general population, and the statistical significance level was set to $\alpha = 0.05$

3. Results

In the increase rate of systolic blood pressure, t=-3.771, p=0.001, which was statistically significant based on the significance level of 0.05 (p<.05).

In the increase rate of diastolic blood pressure, t=-0.890, p=0.385, which was not statistically significant based on the significance level of 0.05. (p>.05).

In the heart rate increase rate, t=-0.155, p=0.878, which was not statistically significant based on the significance level of 0.05. (p>.05).

In the increase rate of mean arterial pressure, t=-3.279, p=0.003, which was statistically significant based on the significance level of 0.05 (p<.05).

In the increase rate of pulse pressure, t=-2.696, p=0.014, which was statistically significant based on the significance level of 0.05 (p<.05).

[Table 1] Information of participants (N=32)

Variable	N=16(Normal)	N=16(Obesity)
Age(year)	20.18±1.75	20.68±1.85
Height(cm)	176.57±4.10	174.06±3.06
Weight(kg)	69.61±6.69	80.51±5.62
BMI	22.55±2.37	26.58±1.76

Mean±SDa

[Table 2] Treadmill in speed and slope

Stage	speed	slope	time	Cumulative time
1	1.7	0	3	3
2	1.7	5	3	6
3	1.7	10	3	9
4	2.5	12	3	12

[Table 3] Comparison of SBP, DBP, HR, MAP, PP growth rate between obesity and normal (n=16)

	Normal	Obesity	T	P
SBP growth rate	.4125(.17706)	.6926(.23860)	3.771	.001
DBP growth rate	.1360(.09602)	.0699(.28140)	.890	.385
HR growth rate	.6000(.16287)	.6121(.26633)	.155	.878
MAP growth rate	.1181(.07972)	.2551(.18706)	2.696	.014
PP growth rate	1.2494(.78944)	2.4505(1.23415)	3.279	.003

*p<0.05, mean ± standard deviation, DBP: diastolic blood pressure, SBP: systolic blood pressure, HR: heart rate, MAP: mean arterial pressure, PP: pulse pressure

$$growth\ rate = \left(\frac{c_{post}}{c_{pre}}\right) - 1$$

$$c_{pre} = pre\ cardiovascular\ value$$

$$c_{post} = post\ cardiovascular\ value$$

[Fig. 1] Formula for calculating growth rate

4. Conclusion

This study was carried out to compare the differences in systolic blood pressure, diastolic blood pressure, heart rate, arterial pressure, and pulse pressure on a treadmill between the general population and obese people. As a result of the study, there was a difference in the rate of increase in systolic blood pressure, mean arterial pressure, and pulse pressure in the general population and obese people. On the other hand, there was no difference in the rate of increase in diastolic blood pressure and heart rate between the general population and the obsess

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