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STAT 5023 Data Analysis Project

1. Abstract

The purpose of this study is to examine whether stretching and wearing ankle weights would provide exercise benefits before using treadmill based on the energy consumption in number of calories. Different set of subjects were considered to examine this case study with same level of physical fitness and are categorized accordingly into four groups based on with or without a stretching period, with or without ankle weights. The number of calories burned called as the energy is considered as the response variable which helps in knowing the significant effects of exercise. On performing the analysis on these subjects, we found significant and enough evidence for claiming that stretching and wearing ankle weights have effects on exercise benefits and also helps in burning higher number of calories (energy).

2. Introduction

The Treadmill is an exercise machine used generally for performing physical exercises. There are many health benefits of treadmill exercise which includes weight loss, diagnosis of heart disease, cardiac issues and diagnosing artery blockages. Before using the treadmill at the gym, it is vital that stretches are performed before workout which helps in reducing injury, provide flexibility, coordination and posture. In addition, using ankle weights forces the lower body muscles to work harder while exercising.

The study that is carried out in the project is about examining whether stretching and wearing ankle weights would help in affecting the value of exercise on treadmills. This is measured by considering subjects of same physical fitness and measure the data randomly based whether the subjects use ankle weights or not, and do the subjects perform stretching before the exercise.

There are many previous researchers who have performed different experiments using a treadmill and identified their effects. The experiments include evaluating the effect of 12-week treadmill based and track-based walking program on consuming maximum oxygen, muscular strength and endurance and ankle range of motion (ROM) in ankle sprain experienced young people. [1] There were different tests performed in this experiment such as incremental treadmill testing, 20-m shuttle run test, 2km walking test procedure, jumping test, Ankle ROM and statistical analysis on both the walking programs which helps in studying the results of performing physical exercises. [1] On observing the results obtained in the experiment it was observed that track-based walking program induces positive effect on muscle strength in lower extremities and ankle ROM than treadmill-based training in ankle sprain experienced young people.

The other case studies which are carried out were based on association of cardiorespiratory fitness with long term mortality among adults undergoing exercise treadmill testing which focus on how to maintain high levels of fitness. There are different methods involved in this research were studying design and patient population, Performance

Stratification, Mortality Surveillance and Statistical Analysis. [2] The conclusions that were obtained on performing this analysis is that the cardiorespiratory fitness is inversely associated with long-term mortality with no observed upper limit of benefit. [2] In addition to perform high aerobic fitness was associated with the greatest survival and was associated with older patients and those with hypertension.

The research questions that are necessary to be found are to show if there exists any significance effect of stretching and wearing ankle weights which provide exercise benefits before performing treadmill exercise. The next research question to be focused on whether there exists any significant interaction effect of both the fixed factors which helps in plotting the independent variable 'energy'.

3. Methodology and Study Area

The nature of the study area for performing this statistical analysis is considered under health and fitness. It precisely focuses on how stretching and wearing ankle weights affects exercise on treadmills. Considering this problem area, we can define the test statistics which helps in identifying whether there is sufficient evidence to claim that stretching and wearing ankle weights both have significant effects on exercise benefit or not.

Methodological Design

The methodological design used for this project is Two-Way Analysis of Variance (ANOVA). This statistical test is used to determine the effect of two nominal predictor variables on a continuous outcome variable. This test is also used to identify the differences in the effects of independent variable on a dependent variable along with their relationships to the outcome. The assumptions that are considered for Two-Way ANOVA are the samples must be normally distributed, the samples must be independent, variances of the populations must be equal and the groups must have the same sample size.

The source of data is collected from SAS Institute Inc and the data set constructed consists of 80 subjects who have roughly the same physical fitness. The variables that are present in the data set are Pre-Stretch, Ankle Weights, Energy in terms of calories burned, Average Speed, Oxygen consumed in litres. The Stretching has two groups stretch and no stretch, the ankle weights are divided into two groups weights and no weights. The analysis of this input data is performed based on the dependent variable 'energy' and the independent variables 'Pre-Stretch' and 'Ankle Weights'.

4. Results

We are performing a two-way analysis test for the treadmill exercise data set (Treadmill Exercise.xls).

Test Statistic:

H_0: Stretching and wearing ankle weights both have significant effects on exercise benefit
H_a: Stretching and wearing ankle weights do not have significant effects on exercise benefit

SAS Code: (Here value of $\alpha = 0.05$)

```
data treadmillexercise;
input prestretch$ ankleweight$ energy speed oxygen @@;
```

```
datalines;
Nostretch  Noweights  106.9  87.8  34.3
Nostretch  Noweights  84  92.9  25.4
/////
;
Proc glm data = treadmillexercise;
Class prestretch ankleweight speed oxygen;
Model energy = prestretch | ankleweight;
Run;
```

The SAS System

The GLM Procedure

Dependent Variable: energy

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	3	279.595662	93.198554	1.44	0.2369
Error	77	4974.020881	64.597674		
Corrected Total	80	5253.616543			

R-Square	Coeff Var	Root MSE	energy Mean
0.053220	8.475261	8.037268	94.83210

Source	DF	Type I SS	Mean Square	F Value	Pr > F
prestretch	1	155.3525432	155.3525432	2.40	0.1251
ankleweight	1	80.6247711	80.6247711	1.25	0.2674
prestretc*ankleweigh	1	43.6183480	43.6183480	0.68	0.4138

Source	DF	Type III SS	Mean Square	F Value	Pr > F
prestretch	1	160.0549745	160.0549745	2.48	0.1196
ankleweight	1	79.1905407	79.1905407	1.23	0.2717
prestretc*ankleweigh	1	43.6183480	43.6183480	0.68	0.4138

Table (a) Result table obtained on performing the analysis

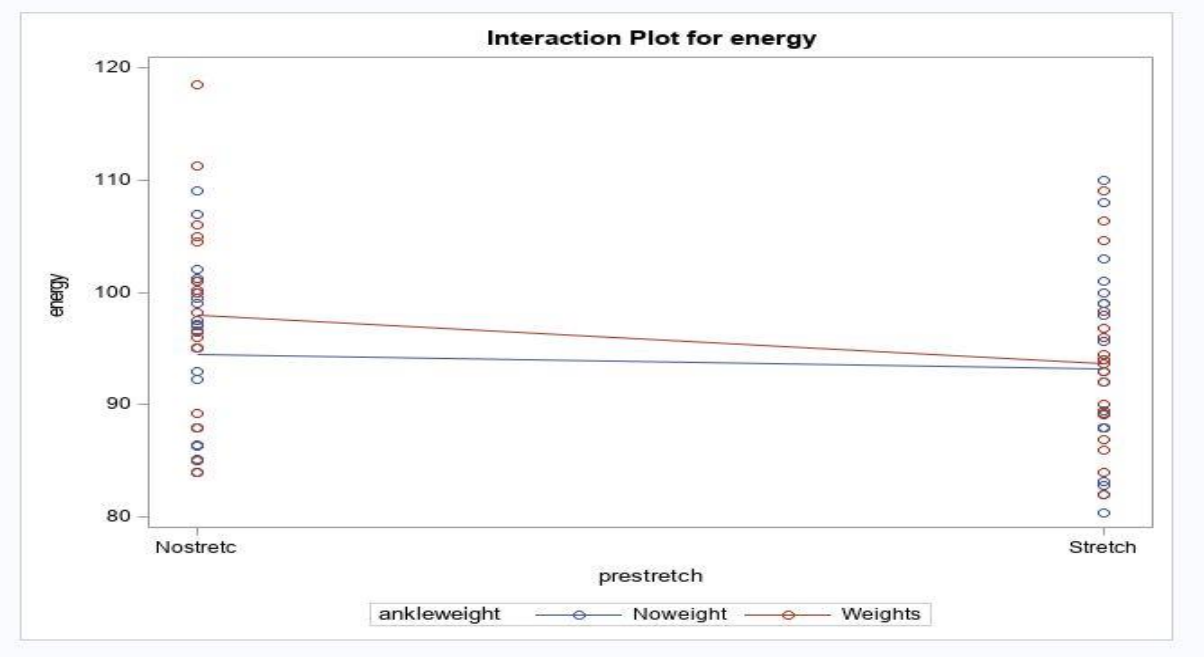

Fig (a) Interaction Plot obtained on the analysis

5. Discussion

Based on the implications of our findings from the given input data and the table (a) we conclude that the two-way model is significant, based on the p-value of 0.2369 which is greater than 'α' value and we fail to reject the null hypothesis. In this analysis the output obtained for type I and type III sums of squares are equivalent in this case. From observing the results, the independent variables with p-values 0.12 and 0.27, from which we can conclude that both stretching and wearing ankle weights have significant effects on exercise benefit.

On observing the interaction plot obtained in figure (a) we can see that there exists a slight interaction effect between both types of ankle weights categorized of 'no weight' and 'weight' when both type of subjects perform stretching, but the graph line for ankle weights of no weights decreases as they perform stretching and the number of calories burnt also decreases. Simultaneously, the subjects using no weights have high impact of burning a greater number of calories while the subjects perform stretching.

The sources of inaccuracies observed from the results are that, subjects who are performing no stretching are able to burn a greater number of calories. But as a contrast in general terms as stretching is part of a physical exercise before using treadmill it must help in burning out still higher number of calories on considering the other independent fixed factor ankle weights. So, as an extension to this problem and considering the future scope of this project we can extend this by increasing the number of subjects and also add new response variables which help in measuring the pulse rate, insulin levels on different subjects. This can help in analysing the necessary factors that can help in ensuring that the subjects stay a healthy and long life.

6. Conclusion

On summarizing the findings of the research questions of the given problem we can conclude that stretching and wearing ankle weights have significant affect of exercise benefits before using a treadmill which helps in finding the number of calories that were burnt for individual subject. This factors also help in improving the health and fitness of the selected number of subjects. Also there exists a slight interaction effect between the subjects when they perform stretching in both the cases while using ankle weights (or) not.

The future scope of this study can be extended on a large platform of medical sciences such as how treadmill exercises create an impact of reducing insulin levels for diabetic patients, the significance of how the treadmill exercises can improve the pulse rate and solve cardiac issues.

7. References

[1] The effect of treadmill-based and track-based walking training on physical fitness in ankle-sprain experienced young people, J. Exerc Rehabil, 2017

[2] Association of Cardiorespiratory fitness with long-term mortality among adults undergoing exercise treadmill testing, Kyle Mandsager, Serge Harb, Paul Cremer, JAMA Network Open, 2018.