The Impact of Femur Length, Tibia Length, Height of Hip and Knee Joint Angles at 90-90 Degrees on Exercise Intensity Using CPX VO2max in 20s Male: Correlation and Linear Regression Analysis.

Jong-Seon Oh, Jin-Seop Kim, Seong-Gil Kim
Dept. of Physical Therapy, College of Health Science, SunMoon University
e-mail: skylove3373@sunmoon.ac.kr

Femur length, Tibia length, 키 사이, hip& knee 관절각도 90-90높이가 20대 남성의 CPX VO2max를 이용한 운동강도에 미치는 영향 :상관관계 및 선형 회귀분석

오종선, 김진섭, 김성길
선문대학교 물리치료학과

Abstract

Purpose: The purpose of this study is to conduct a correlation and linear regression analysis of the relationship between exercise intensity changes based on femur length, tibia length, height, pelvis and knee joint 90-90 degree angles using CPX VO2max.
Methods: To analyze the relationship between physical characteristics such as height, weight, femur length, tibia length, pelvis, knee joint angles, and maximum oxygen uptake (VO2max) with exercise intensity, the data was collected and analyzed using CPX VO2max. The correlation between these physical characteristics and exercise intensity was examined through linear regression analysis. SPSS version 22.0 for Windows was used to analyze the data, and the correlation of each measured value was calculated based on the mean value.
Results: There was a significant negative correlation only between CPX VO2max and tibia length ($r = -0.595$, $P<0.05$), while no significant correlation was found with the other variables ($P>0.05$) Tibia length had a explanatory power of 35.4% and significantly affected exercise intensity using CPX VO2max ($P<0.05$).
Conclusions: Considering joint angles among an individual's physical characteristics is important in determining the appropriate exercise intensity.

1. Introduction

Exercise performance varies depending on the individual, and it is greatly influenced by body type. Previous studies have shown that Femur length and Tibia length have an impact on VO2max, and that joint angles also affect exercise intensity. [1] In particular, it has been proven that the pelvis-knee joint angle is related to exercise intensity. [2,3] Additionally, joint angles related to muscle length, flexibility, posture, and balance are associated with exercise intensity, making them important factors. [3, 4]

Proper exercise, which is very important for maintaining a healthy life, is recommended by many health professionals. As mentioned earlier, exercise intensity varies depending on an individual's physical characteristics, so physical characteristics such as Femur length, Tibia length, height, pelvis and knee joint angles, etc. affect exercise intensity. Therefore, in this study, we aimed to investigate the correlation and linear regression analysis between exercise intensity changes based on Femur length, Tibia length, height, pelvis and knee joint 90-90-degree angles, and CPX VO2max using 20s male subjects.

2. Subjerct and methods

2.1 Subject

This study was performed with 18 (M) college students attending S University in Chungcheongnam-do. The age was 22.17 ± 2.66 years, height was 173.89 ± 5.41 cm and body weight was 69.59 ± 5.80㎏.

2.2 Study procedure

Before conducting the experiment, the subjects were provided with a detailed explanation of the experimental methods and procedures to ensure their understanding, and the researcher demonstrated the procedure before conducting the experiment. The measurement date was adjusted through consultation with the subjects.

To accurately measure the length of the subjects' legs, the researcher used a tape measure from the Anterior superior iliac spine to the medial malleoli.

To measure the height of the subjects, they stood facing the wall and their height from head to toe was measured using a measuring instrument.

To measure the hip and knee joint angle 90-90 height, the hip and knee joint angle was maintained at 90 degrees and the height was measured.

The subjects wore 12-lead electrocardiogram and blood pressure monitor, and were instructed to perform running exercise on a treadmill at a constant speed. This allowed for the measurement of maximum oxygen uptake (VO2max) and analysis of its relationship with exercise intensity. The subjects were instructed to continue running at incremental speeds until they were completely exhausted. The gas exchange analysis data from the last 40 seconds was used to determine the measured maximum VO2.

2.3 Statistical analysis

SPSS for Windows (version 22.0) was used to analyze the data in this study. The Pearson correlation coefficient was used to investigate the relationship between exercise intensity using CPX VO2max and factors such as femur length, tibia length, height, and the 90-90 joint angle. In addition, a simple regression analysis was conducted to examine the linear regression analysis results of tibia length for exercise intensity using CPX VO2max. Statistical significance was indicated by a = 0.05.

3. Results

There was a significant negative correlation only between CPX VO2max and tibia length (r = -0.595, P<0.05), while no significant correlation was found with the other variables (P>0.05) [Table 2]. After confirming the significant correlation, a simple linear regression analysis was performed. Tibia length had a explanatory power of 35.4% and significantly affected exercise intensity using CPX VO2max (P<0.05). The regression equation was Y= -0.935 X + 84.88, indicating that as tibia length increased, exercise intensity using CPX VO2max decreased [Table 3][fig 1].

[Table 1] General characteristics of subjects

Variable	N=18
Age(year)	22.17±2.66a
Height(㎝)	173.89±5.41
Weight(㎏)	69.59±5.80

Mean±SDa

[Table 2] The correlation between exercise intensity using CPX VO2max and factors such as femur length, tibia length, height, and the 90-90 joint angle

	키	femur length	tibia length	관절각도 90-90높이
	173.47±5.41	38.28±3.32	40.22±3.20	42.25±3.26
CPX VO2max	- 0.376	- 0.060	-0.595**	- 0.317
유의수준 (p)	0.124	0.814	0.009	0.200
Mean±SDa,*p<.05,**p<.01				

[Table 3] Linear regression analysis results for Tibia length on exercise intensity using CPX VO2max.

	CPX VO2max		
	R2	B	Significance (p)
Constant	0.354	84.88	0.000**
Tibia length		-0.935	0.009**
regression equation	Y= -0.935 X + 84.88		
Mean±SDa,*p<0.05,**p<0.01			

4. Conclusion

Overall, there was a significant positive correlation between the prediction equations using various measurement tools and CPX VO2max. Moreover, it was found that the correlation coefficients ranged from 0.652 to 0.770, indicating a moderate to strong correlation. These results can be used as fundamental data for estimating VO2max using various measurement tools.

In conclusion, the anatomical leg length difference was correlated with body asymmetry scale (ADAM's FBT, functional leg length difference, Acromion to ASIS) and anterior pelvic asymmetry.

In addition, it was found that there is a correlation with FEV1/FVC, which is one of the lung functions. The results of this study can be used as basic data for improving body alignment and lung function.

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