

Climbing Stairs without Making Your Heart Rate Climb

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Abstract

Our purpose is to help people incorporate exercise into their daily lives by studying ways to climb stairs easily. Therefore, we conducted two experiments. Our first experiment tests how one carries their bag affects their heart rate when climbing, and in our second one

1.Introduction

Developed countries are trying to extend their life expectancy. Exercise is one of the main factors to help this. However, many people are reluctant to exercise. Therefore, we are researching and conducting experiments on the easiest way to climb stairs so that we can make people willing to use stairs instead of elevators or escalators as a form of exercise. What posture we take to climb stairs is important, and the center of gravity depends on the posture, so we focused on the position of the center of gravity. We have two hypotheses. Our first hypothesis is if the center of gravity is low, we can stabilize our body, and if it is forward, it will help us push our bodies forward, thus it will keep our heart rates low

Also we focused on the tiredness of the brain as a factor that makes stair climbing difficult. We get 90 percent of the information around us from our sight, so if the view is moving, we get a lot of information and it makes our brains tired, so our second hypothesis is that if our brains are less tired, we can climb stairs with less energy. To confirm these hypotheses, we changed the way we sway our arms and the posture of subjects' bags. How long we can stand one leg depends on the tiredness of our brains, so we compared it, too. We hope by understanding the most efficient ways to climb stairs we can encourage move people to incorporate exercise into their daily life.

2.Method

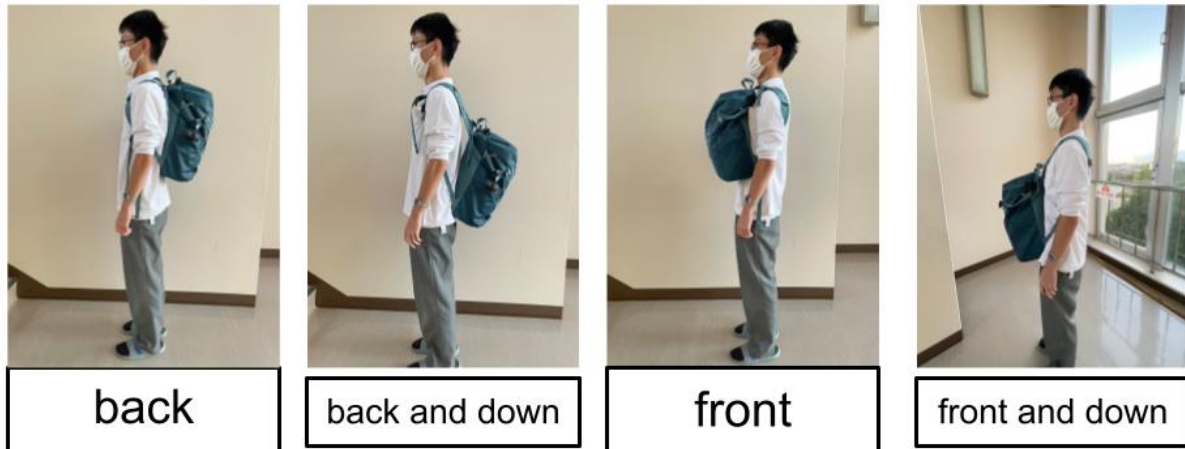
We conducted two experiments. We compared the method of swinging arms. We will explain how to conduct the experiment. We measured the heart rate to see which was the lowest. Fatigue is defined as the time it takes for the heart rate to reach a defined value.

1) First, we measured our heart rate before climbing the stairs, and recorded it. The average was 80 bpm. Then, we climbed the stairs until our heart rate increased by 40 bpm. By 120 bpm, our five high school participants exhibited signs of tiredness. For example, we felt stressed. We set a specific tempo of 100 bpm with a metronome so that participants would climb at the same pace. We swung our arms in the following three ways. First, we climbed stairs without swinging. Second we climbed, matching our arms swinging with our steps. Third, we moved our arms and legs alternately.

2) Next we compared methods of carrying our backpack. First, we measured our heart rate before climbing the stairs, and recorded it. The average was 80 bpm. Then, we climbed the stairs until our heart rate increased by 50 bpm. We set a specific tempo of 100 bpm with a metronome so that participants would climb at the same pace. We carried it in the following four ways. We carried it in front with shortened shoulder straps, in front with slack shoulder straps, on back with shortened shoulder straps and on back with slack shoulder straps.

EXPERIMENT2

Change the way of wearing backpack

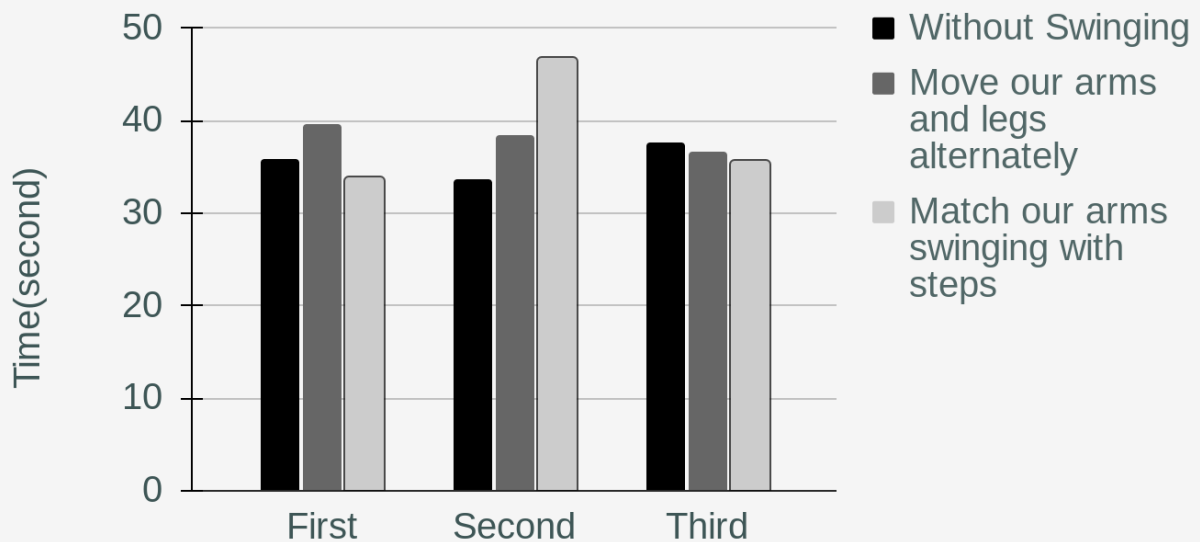


Time to the heart rate increasing by 50 bpm

3.Results

1)No relationship can be found between the differences in heart rate in the three ways of arm swings.

The differences between the ways of swinging



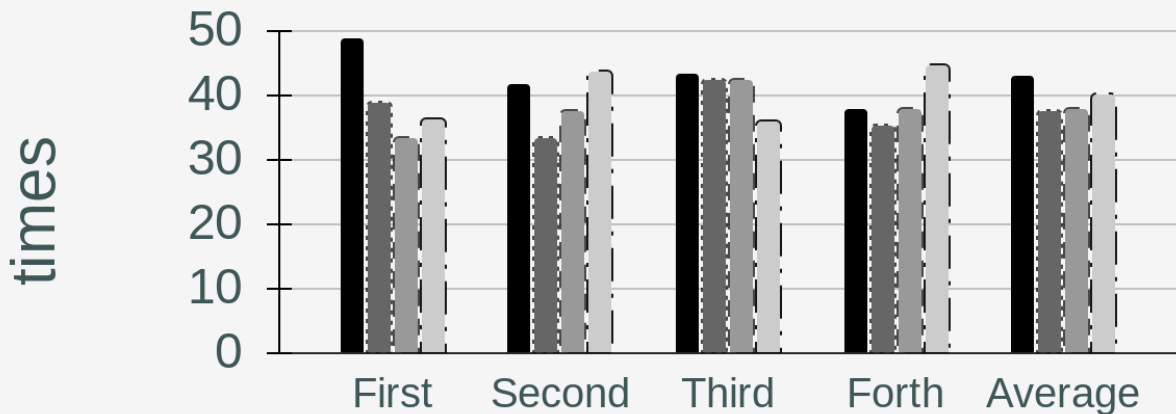
2)Comparing two conditions of carrying bags on the back with shortened shoulder straps and on the back with slack shoulder straps, fatigue level was small with shortened ones.

Comparing two conditions of carrying bags in front with shortened shoulder straps and in front with slack shoulder straps, fatigue level was small with slack shoulder ones.

Focusing on the average, fatigue level was the smallest with shortened straps on back.

Differences in fatigue levels depending on the way the baggage is carried

■ back ■ back and down ■ front ■ front and down



4. Discussion

1) On the contrary to our hypothesis, when we carry a bag on “back”, we will get less tired than on “front and down”. We suppose that this is because of the shape of the spine. It has a slight curve and thanks to this, we can lessen the pressure from our head.

When we carry the bag on “front and down”, we lean back to keep a balance and the spine will stand up straight. However when we carry the bag on “back”, we lean in front and the spine will shape a curve.

2) There is no relationship between the gaze direction and heart rate. However, there is a possibility that heart rate is related to brain fatigue. Therefore, we have to conduct the same experience more to improve accuracy.

5. Reference

・松枝千尋、宮川健、早田剛、阿部竜士、山口英峰、小野寺昇(2001)「背荷物が階段歩行中の下肢生体内力に及ぼす影響」

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・多くの人が誤解している「正しい立ち方」。100歳まで元気に歩くため今できることを教わった。

<https://kaigo.homes.co.jp/tayorini/report/experience005/>

6. Key words

stairs, fatigue level