

# The Effect of External Temperature on Body Heat Increase

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## ABSTRACT

**Introduction:** The age range of men at their highest point of physicality over the course of the average human life span ranges from early 20's to the late 30's (Cavanaugh and Kail, 1995), leaving a median age of around 34 years. With the average heart rate of a human adult ranging from 60 to 100 beats per minute, controlled breathing is practiced and then obtained based upon self-implicating factors including weight, height, body mass, metabolic rate, etc. (Laskowski, 2015). However, external factors also play a large role in activity and breathing in fully developed human beings. **Purpose:** To find the effects of external temperature on the increase of (male) body temperature during exercise. **Methods:** This study involves 15 male participants ages 18-23 at a military college. Each participant uses an *Ergomedic* brand stationary bicycle model 828 E for a total of 20 minutes each while their body temperature is recorded using a digital temperature probe. A temperature probe simply measures something's current temperature, similar to a thermometer except with a little better precision. The temperature probe model we use for our experiment is the *Raytek* brand *MiniTEMP MT6* model. Statistical methods include charting every participant's (trial) temperature before, midway through and after exercising in order to find out which external temperature setting provokes the greatest increase of body temperature in males within the age range. **Results:** The control group had the highest increase. **Conclusions:** Average external temperatures of and around 70 degrees Fahrenheit will generate the maximum increase in internal body temperature while exercising.

## INTRODUCTION

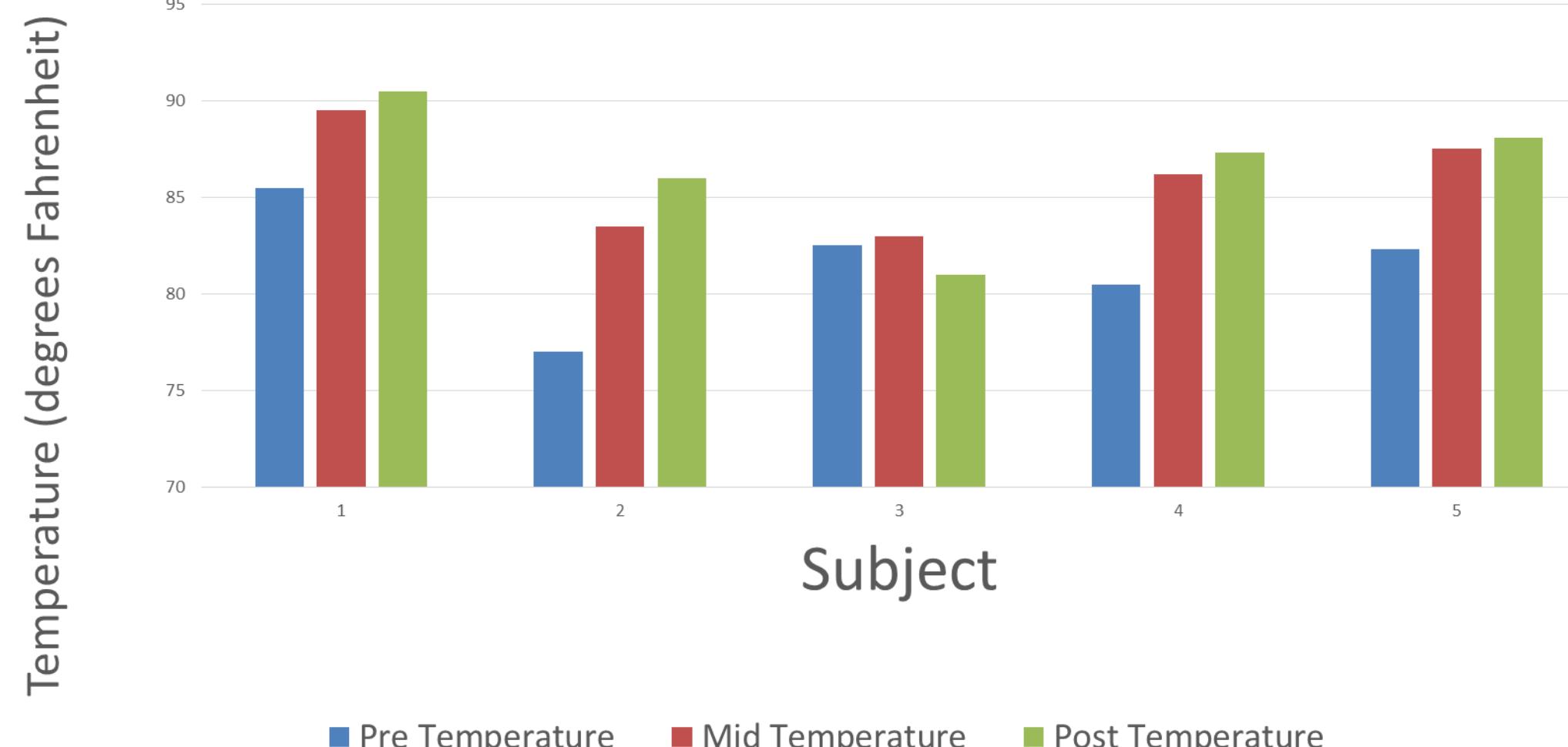
The age range of men at their highest point of physicality over the course of the average human life span ranges from early 20's to the late 30's (Cavanaugh and Kail, 1995), leaving a median age of around 34 years. With the average heart rate of a human adult ranging from 60 to 100 beats per minute, controlled breathing is practiced and then obtained based upon self-implicating factors including weight, height, body mass, metabolic rate, etc. (Laskowski, 2015). However, external factors also play a large role in activity and breathing in fully developed human beings. These factors can include climate (or simply temperature), different types of environment and even the closer-knit external factors such as clothing. Recent studies have shown that it is best for human beings to regularly exercise in an external environment at around 70 degrees Fahrenheit (George, 2014). Doing this could help to avoid climate atrocities such as heat stroke, dehydration, or even sub-temperature symptoms such as hypothermia (George, 2014). During this study, students at a military college (males age 18-23) will exercise and be recorded at temperatures above, below, and at 70 degrees Fahrenheit using temperature probes to record the effects it has on their own body temperature. We predict that the greatest internal body temperature increase will be in the 60 degree Fahrenheit group.

## METHODS

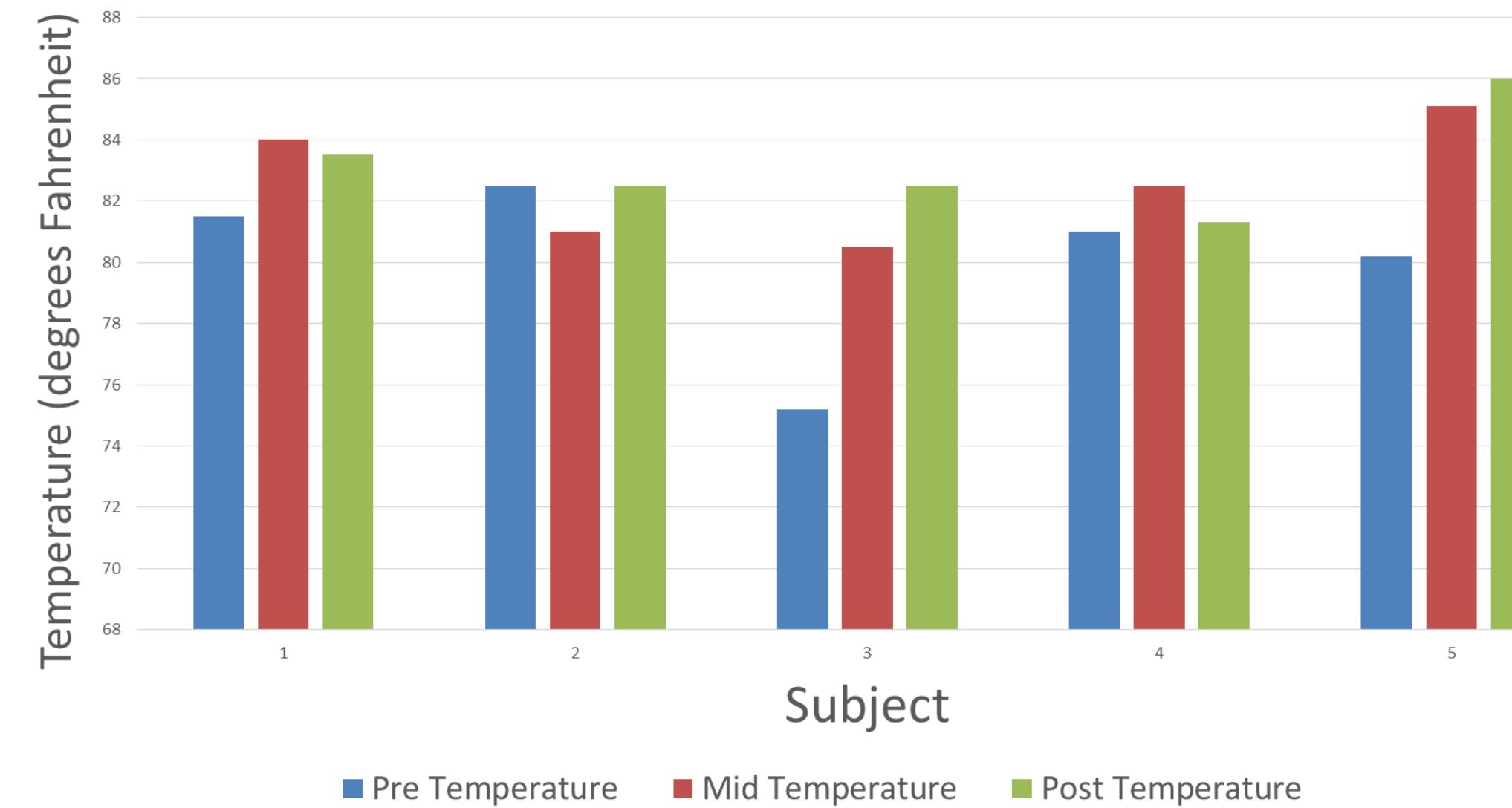
This study involves male participants ages 18-23 at a military college. The total number of participants is 15 and they are split into three groups (each with five participants). Each participant uses the *Ergomedic* brand stationary bicycle model 828 E for a total of 20 minutes each while their body temperature is recorded using a digital temperature probe. The temperature probe model we will be using for our experiment is the *Raytek* brand *MiniTEMP MT6* model. The first group is the control group, which is tested at a room temperature of 70 degrees Fahrenheit. According to our research, this is the best temperature for constant to hardcore exercise. These trials will take place on Tuesday, February 23, 2016 at 3:00 pm at Deas Hall. The next group will be tested in a room at 75 degrees Fahrenheit. This set of trials will take place on Thursday, February 25, 2016 at 3:00 pm, also at Deas Hall. The final group will be tested while exercising in a room held at 60 degrees Fahrenheit. They are tested the following Monday, February 28, 2016 at 2:30 pm at Deas Hall. The participants will have consumed no more than two standard meals each day, and will have already completed regular physical training exercises all three days they are tested before the trials take place. Statistical methods include charting every participant's (trial) temperature before and after exercising as well as 10 minutes (halfway) into the trial in order to find out which external temperature setting provokes the greatest increase of body temperature in males within the age range.

## RESULTS

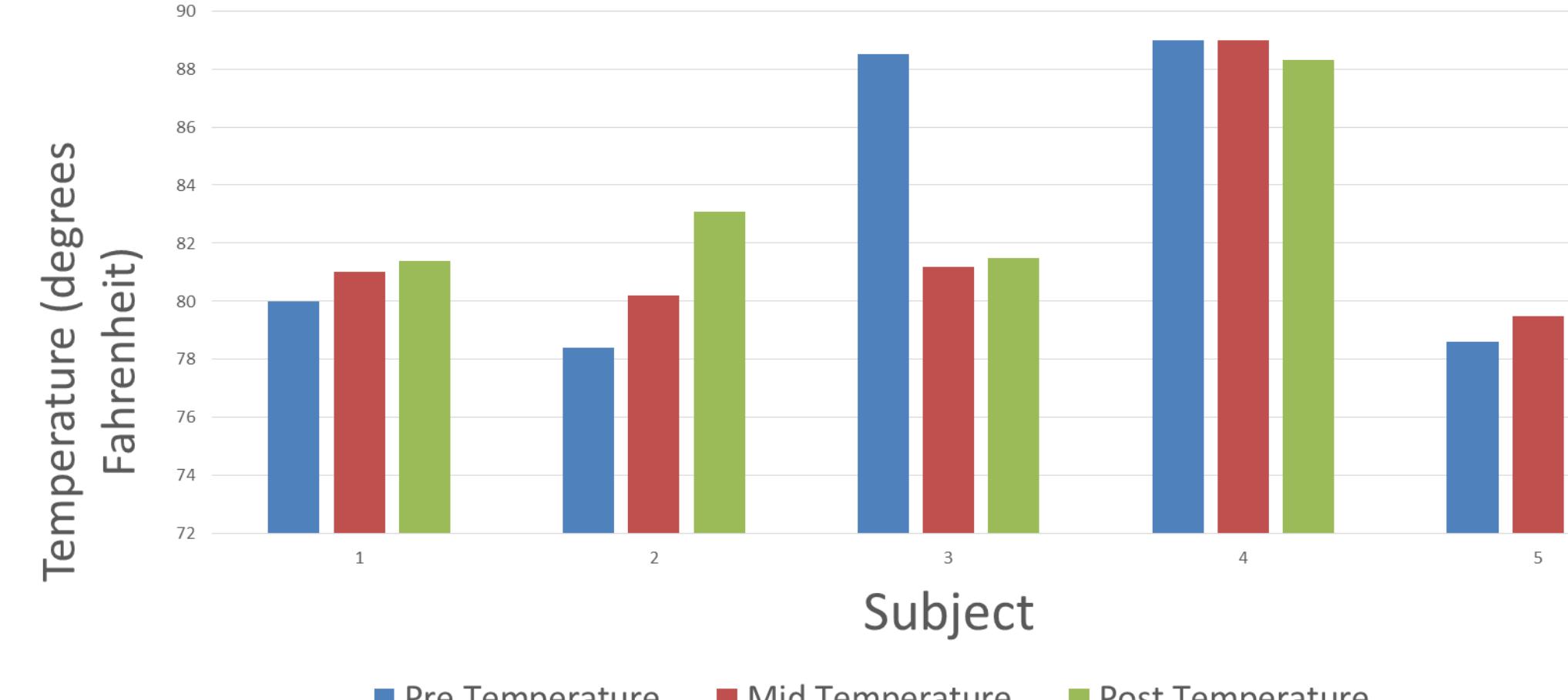
### 70 Degrees Fahrenheit (Group 1)



### 75 Degrees Fahrenheit (Group 2)



### 60 Degrees Fahrenheit (Group 3)



Pre Temperature p= .545

Mid Temperature p= .131

Post Temperature p= .152

## RESULTS

There was no significant effect of external body heat on internal body heat during exercise at the p<.05 level for the pre-exercise period [ $F(2,12)=.638$ ,  $p=.545$ ], mid-exercise period [ $F(2,12)=2.416$ ,  $p=.131$ ] nor post-exercise period [ $F(2,12)=2.215$ ,  $p=.152$ ]. The mean values for the first group during the pre-exercise period are group 1=81.560 degrees with a standard deviation of 3.1174; group 2=80.080 degrees with a standard deviation of 2.8525; group 3=82.900 degrees with a standard deviation of 5.3787. The total pre-exercise mean temperature was 81.513 degrees with a standard deviation of 3.8456. The mean values for the second group during the mid-exercise period are group 1=85.940 degrees with a standard deviation of 2.7282; group 2=82.620 degrees with a standard deviation of 1.9486; group 3=82.180 degrees with a standard deviation of 3.8720. The total mid-exercise mean temperature was 83.580 degrees with a standard deviation of 3.2424. The mean values for the third group during the post-exercise period are group 1=86.580 degrees with a standard deviation of 3.5238; group 2=83.160 degrees with a standard deviation of 1.7686; group 3=83.600 degrees with a standard deviation of 2.8107. The total post-exercise mean temperature was 84.447 degrees with a standard deviation of 3.0284.

## CONCLUSION

The outcome of this study show that the body generates the largest temperature increase in temperatures around and of 70 degrees Fahrenheit. This disproves our hypothesis as we believed the largest increase would be found in the cooler temperature setting, forcing the body to generate more internal heat than usual. Our data found that there was no significant effect from external body on internal body heat during exercise, however, potential flaws in the study include the fact(s) that the levels of intensity between trials were random/at will, a greater amount of time for the trials would have produced more significant results as well as the fact that all the subjects' body compositions and age were random (within a specific range).

## ACKNOWLEDGEMENTS

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