

Evidence of Homeostasis in Blood Pressure

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Abstract

Objective: The objective of this study was to see how the human body maintains homeostasis during a change in blood pressure.

Design: Subjects were placed in different levels of stressful environments.

Subjects: The subjects consisted of 3 adolescent males enrolled in high school.

Variables Measured: The variables measured were the blood pressures of the subjects in different environments.

Analysis/Results: Subjects' blood pressure increased as they were put in different environments. The subjects' blood pressure rose and then went back down to around the initial reading, showing how the body uses homeostasis to maintain stability.

Implications: These findings suggest that stress has an effect on blood pressure.

Introduction

Homeostasis is the equilibrium (natural state) between elements in the human body (e.g. Glucose levels, heart rate, water levels, etc) especially as maintained by physiological processes. The element we are observing is blood pressure, the pressure of the blood in the circulatory system, caused by rate and force of blood flow, and the extension of arteries as a result to the force of blood flow. High blood pressure, also called hypertension, is dangerous because it makes the heart work harder to pump blood out to the body and contributes to hardening of the arteries, or atherosclerosis, to stroke, kidney disease, and to the development of heart failure.

Hypothesis

If the stress level of a human subject increases, then the blood pressure of that subject will also increase.

Procedure and Materials

Materials:

- 2 blood pressure monitors
- 3 test subjects
- Timer
- Charles Dickens' *Pickwick Papers*
- "Alien Isolation" and device to play it on
- Silent enclosed area with couch
- Classroom environment (background noise)

Procedure:

1. Low Stress
 - a. Take the initial blood pressure of the two subjects.
 - b. Subject one enters the solar studio and rests on a couch for 10 minutes.
 - c. Subject two sits in a classroom environment and reads from *Pickwick Papers*.
 - d. At the end of 10 minutes, the blood pressure of both subjects is taken.
 - e. After waiting 10 minutes in a classroom setting, the blood pressure is taken again of both subjects, neither subjects actively completing a task.
2. Medium Stress
 - a. Blood pressure is taken of two subjects in a stabilized condition.
 - b. Subjects one and two will sit in a classroom environment and reads from *Pickwick Papers*.
 - c. Subject two will take the skin tone IATs found in the works cited.
 - i. The subject will be observed and timed.
 - d. Subject one will sit in the environment and read for the duration of subject two's tests
 - e. The blood pressure will be taken of the two subjects after subject two finishes the test.
 - f. The blood pressure will be taken after 10 minutes in a classroom environment, neither subjects active.
3. High Stress
 - a. Blood pressure is taken of two subjects in a stabilized condition.
 - b. Subjects one and three will sit in a classroom environment and read from *Pickwick Papers*.
 - c. Subject three will play an intensive video game ("Alien Isolation") for 10 minutes.
 - i. The subject will be observed and timed.

- d. Subject two will sit in the environment for the duration of subject one's tests.
- e. The blood pressure will be taken of the two subjects.
- f. The blood pressure will be taken after 10 minutes in a classroom environment, neither subjects active.

Results

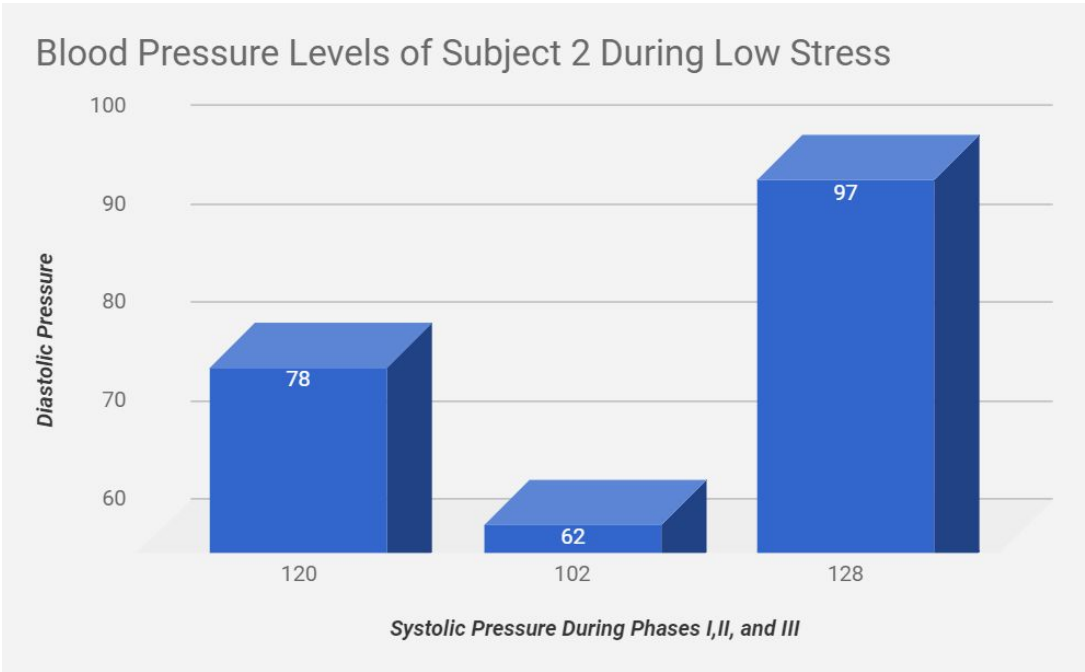
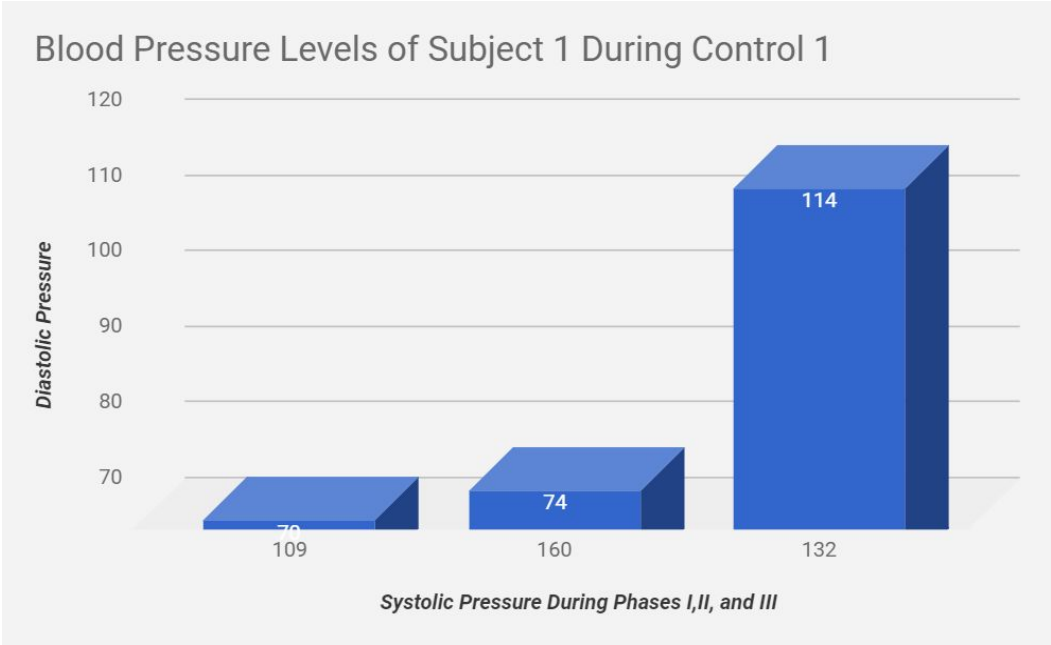
Stress level 1 Low stress	Subject 1 (Control)	Subject 2
Baseline	109/70	120/78
After stimulus	160/74	102/62
After 10 Minutes	132/114	128/87

Stress level 2 Medium stress	Subject 1 (Control)	Subject 2
Baseline	105/60	175/76
After stimulus	102/61	109/76
After 10 Minutes	106/61	137/83

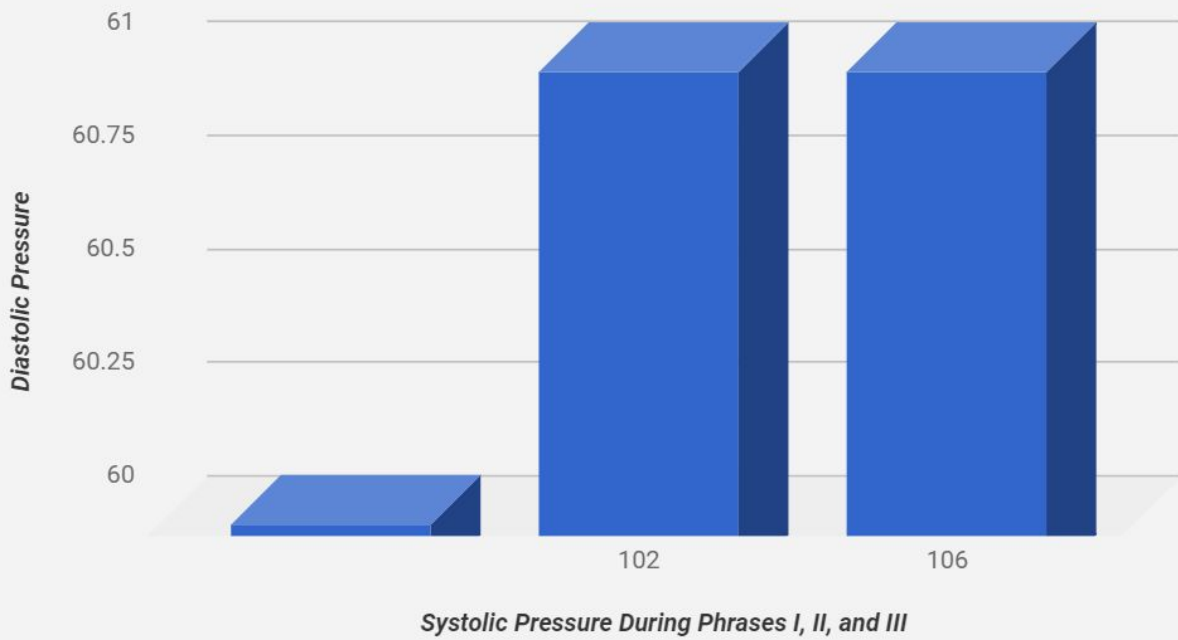
Stress level 3 High Stress	Subject 1 (Control)	Subject 3
Baseline	148/132	148/67
After stimulus	115/70	185/142

After 10 Minutes	168/93	157/89
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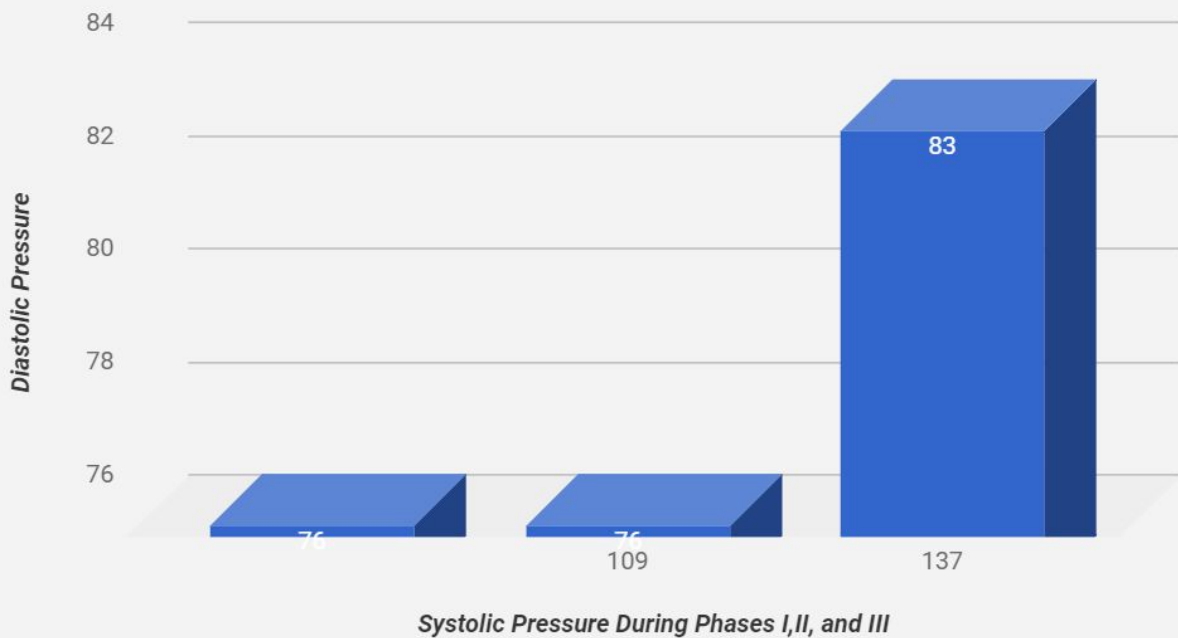
Discussion



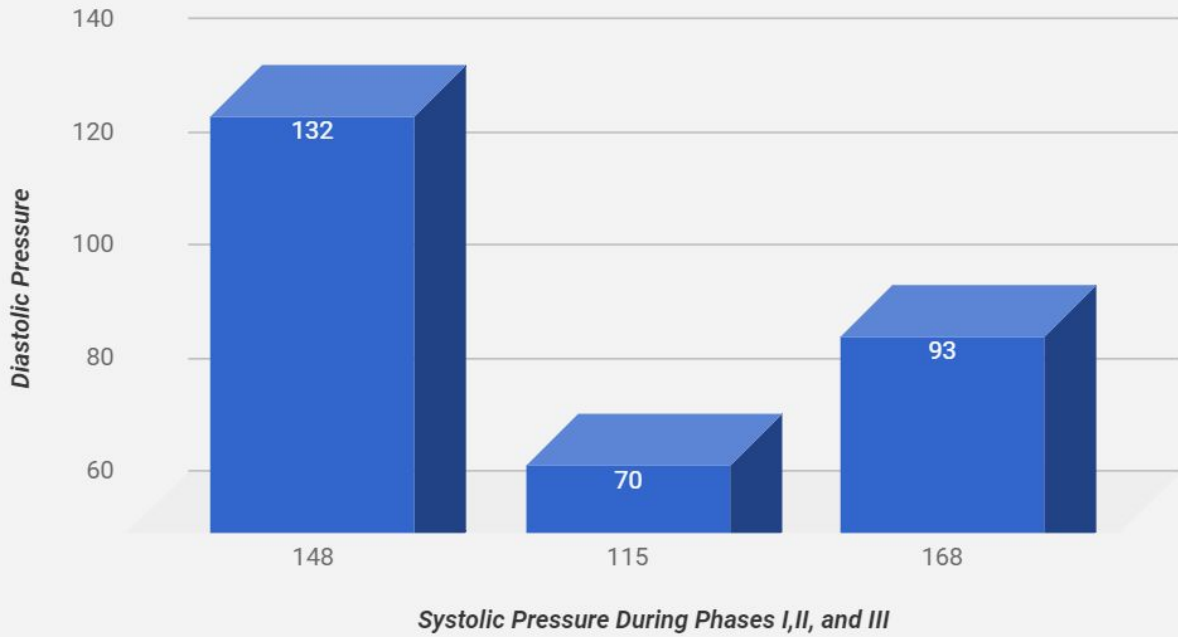
Blood Pressure Levels of Subject 1 During Control 2



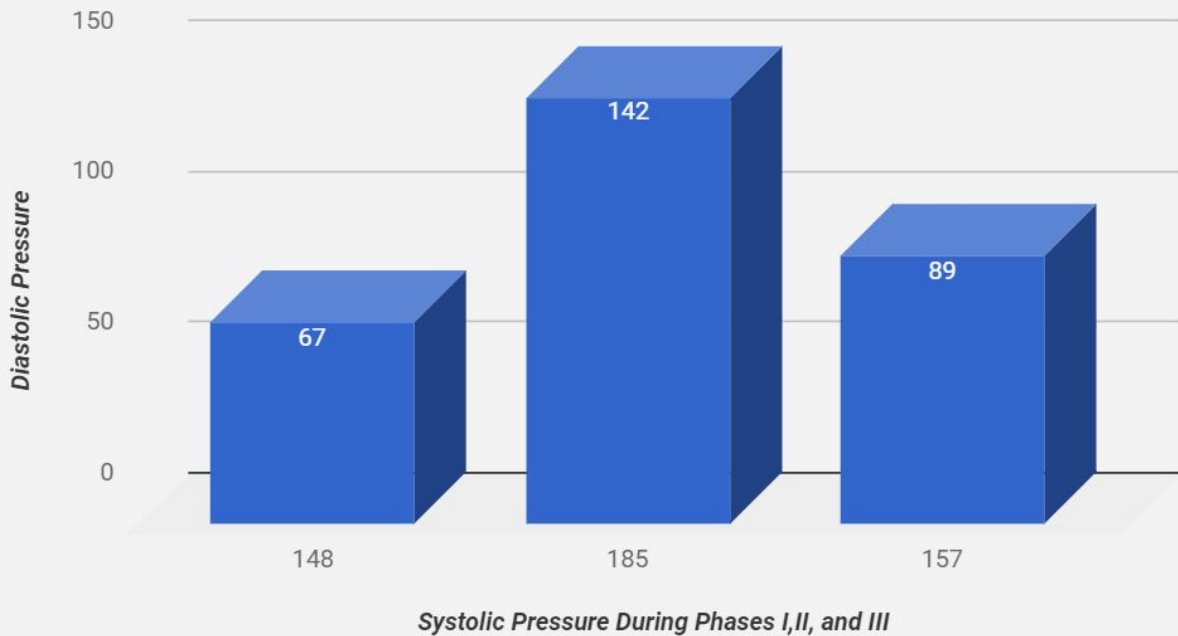
Blood Pressure Levels of Subject 2 During Medium Stress



Blood Pressure Levels of Subject 1 During Control 3



Blood Pressure Levels of Subject 3 During High Stress



This data shows the differences in the blood pressure of the participants when subjected to different situations. In the first (low stress) test, subject 1 (control) was put in a classroom environment. Subject 2 was put in a low-stress environment (a silent room with a couch). The results of this test indicate that the blood pressure of Subject 2 decreased for the period of rest. In the second test, Subject 1 was kept in that same classroom environment for the same period of time. Subject 2 was put in a medium stress environment - a classroom setting while taking an online test. The data from this test point to an increase in stress during Phase III of the test. This result could be due to the delayed increase of stress that is a result of the online stressor. In the third test, Subject 1 was kept in the same environment for the same time period. Subject 2 was put in a classroom environment and played an “intense” video game, making this the high-stress environment. This data greatly displays a considerable increase of blood pressure during Phase II of the test, and a proportional decrease of blood pressure during Phase III of the test.

There were several discoveries made as a result of these experiments. From this data, it is possible to conclude that stress has a direct relationship on the blood levels of most subjects. This conclusion can be drawn most easily from Subject 3’s high stress test (Figure 6). During Phase II, the blood pressure of the subject increased dramatically, then as stress is relieved, (Phase III) the blood pressure declined. This trend can also be observed in Subject 2’s low stress test (Figure 2). The blood pressure of the subject declines as stress is relieved, then increases as the subject is immersed in a more stressful environment.

Several items in the procedure did not work out as planned. This may have lead to possible errors. One case of such an occurrence is found in the medium stress test. In that test, Subject 2 took an online test that increased their blood pressure. However, the online test ended before the requisite time elapsed (8 minutes vs. the prescribed 10 minutes). While there was still an uptick in the subject’s blood pressure, the degree to which that might have been recorded can be questioned.

Another case in which an error may have occurred is the use of an outside subject for the high stress level. Due to the absence of any usable “in-group” subject that were able to have access to the requisite materials (video game), a third subject with different baselines. With this, there were other unseen variables, such as a highly fluctuating blood pressure and heart rate, that may have affected results.

In order to improve the lab, several amendments and changes could be made. The first and probably most effective change would be to expand the base of testing, to provide more data points and reduce the risk of an outlier greatly affecting the outlier. An increased sample size also could lead to new analysis.

A secondary improvement would be to standardize the testing of the medium stress blood pressure test. The differences of time that subjects took to complete the test may have been affected the peaks of their blood pressure. A possible remedy would be to find another test that would provide a stress level lower than an intensive video game, but higher than the tested low stress environment.

As a further point of investigation, there are several avenues open. The first of which is to explore other options that affect the human body's blood pressure, and example being food. By doing this, it would test another angle to blood pressure that is less cognitive. With more resources, it would be possible to analyze what types of stress or other factor affect blood pressure in different ways.

Works Cited

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