

INVESTIGATING SOME PARAMETERS IN BLOOD PRESSURE

Mahta moradi ,Farzanegan 2 School , Tehran /Iran , mahtamoradi83@gmail.com

ABSTRACT

This is a problem in International Young Naturalists’ Tournament, IYNT 2018, to study the accuracy of various methods to measure blood pressure. Propose an interesting study involving blood pressure and pulse. What is blood pressure and also different methods to measure it? To find affecting parameters like music , color and eating on blood pressure and pulse is the main aim in this problem.

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Supervisor: Yasamin Masoumi Sefidkhani

Accepted in country selection by Ariaian Young

Innovative Minds Institute , AYIMI

1 Introduction

The pulse is the heart rate, or the number of times the heart beats in one minute. Pulse rates vary from person to person. It is lower when you are at rest and increases when you exercise (more oxygen is needed by the body when you exercise). But what do the numbers of the blood pressure mean?

Every blood pressure reading consists of two numbers or levels. They are shown as one number on top of the other. The first (or top) number is your systolic blood pressure. It is the highest level your blood pressure reaches when your heart beats. The second (or bottom) number is your diastolic blood pressure. It is the lowest level your blood pressure reaches as your heart relaxes between beats. Having high blood pressure (hypertension) is not usually something that you feel or notice. The only way is measuring to know if you have blood pressure or not. Blood pressure is measured in ‘millimeters of mercury’ (mmHg) and is written as two numbers. For example, if your reading is 120/80mmHg, your blood pressure is ‘120 over 80’.

2 Blood pressure in different ages

Using the blood pressure chart (Fig. 1) to find what your blood pressure readings mean, just find your top number (systolic) on the left side and read across, the bottom number (diastolic) . Where the two meet is your blood pressure.

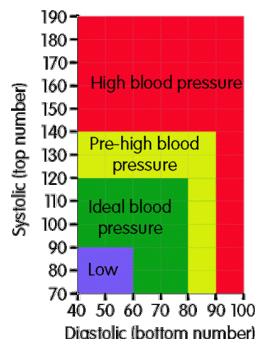


Fig. 1: Blood pressure chart

Normal blood pressure and pulse in several ages are compared in Fig. (2).

	age	Min	Normal	max
Childhood	1 to 12 months	75.50	90.60	100.75
	1 to 5 years	80.55	95.65	110.77
	6 to 13 years	90.60	105.70	115.80
	14 to 19 years	105.73	117.77	120.81
adulthood	20 to 24 years	108.75	120.79	132.83
	25 to 29 years	109.76	121.80	133.84
	30 to 34 years	110.77	122.81	134.85
	35 to 39 years	111.78	123.82	135.86
elderly	40 to 44 years	112.79	125.83	137.87
	45 to 49 years	115.80	127.84	139.88
	50 to 54 years	116.81	129.85	142.89
	55 to 59 years	118.82	131.86	144.90
	60 to 64 years	121.83	134.07	147.91

Fig. 2: Normal blood pressure and pulse in different ages

The following is a table of normal resting heart rates at different ages (Fig. 3). The resting heart rate will increase in response to a variety of changes, including exercise, body temperature, emotional triggers, and body position, such as for a short while after standing up quickly.

Age	Normal heart rate (bpm)
Up to 1 month	70 to 190
From 1 to 11 months	80 to 160
From 1 to 2 years	80 to 130
From 3 to 4 years	80 to 120
From 5 to 6 years	75 to 115
From 7 to 9 years	70 to 110
20 years	100 to 170
30 years	95 to 162
35 years	93 to 157
40 years	90 to 153
45 years	88 to 149
50 years	85 to 145
55 years	83 to 140
60 years	80 to 136
65 years	78 to 132
70 years	75 to 128

Fig. 3: Normal resting heart rates at different ages

3 Different Methods to measure the blood pressure and heart rate or pulse

Methods for measuring the blood pressure are as :

- Auscultatoric measurement devices
- Quicksilver-sphygmomanometer
- Stethoscope

and for heart rate (Fig. 4):

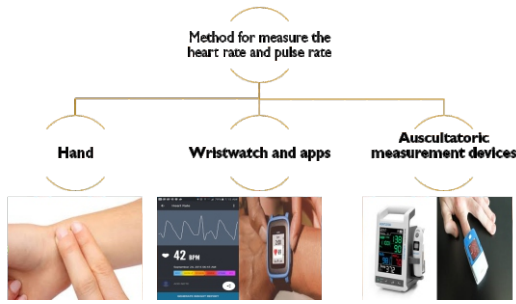


Fig. 4: Heart and pulse rate measuring methods

3-1 Quicksilver-sphygmomanometer

This sort of blood pressure measurement device is called the 'olden standard' of blood pressure measurement because it is highly reliable and accurate. This is why it is predominantly used as a reference system in clinical validation studies and the underlying measurement principle is the same as the one of stethoscopes.

3-2 Stethoscope

The stethoscope is an acoustic medical device for auscultation, or listening to the internal sounds of an animal or human body. It typically has a small disc-shaped resonator that is placed against the chest, and two tubes connected to earpieces which is often used to listen to lung and heart sound. It is also used to listen to intestines and blood flow in arteries and veins. (Fig.5).



Fig. 5: stethoscope

3-3 Auscultation devices

Auscultation devices determine blood pressure by monitoring Korotkoff sounds. Then the pressure in the cuff is slowly released. When blood starts to flow into the artery, the turbulent flow creates a pulse synchronous pounding (first Korotkoff sound). The pressure at which this sound is first detected is the systolic blood pressure. The cuff pressure is further released until no more sound can be detected at the diastolic arterial pressure (Fig.6).



Fig. 6: Auscultation device

4 Accuracy of various methods to measure blood pressure

By comparison, it is found that the accuracy of various methods are:

Auscultation measurement devices < Stethoscope < Quicksilver-sphygmomanometer

5 Polygraph

Polygraph is based on measuring the function of the human body. Results of this measuring can show as the people say right or not. Then the pulse, blood pressure, electricity of the body and speed of breathing are measured. We made one polygraph which works on the base of pulse or heart rate (Fig. 7) and asked questions such as: did you pass the red light? or questions they didn't know the answer and we measured their pulse, blood pressure, electricity of their body and speed of breathing. After these measurements we compared the parameters.

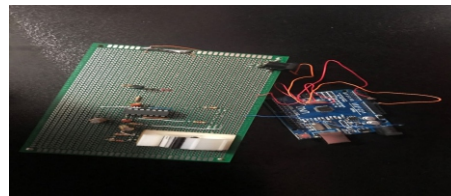


Fig. 7: Polygraph was made in our experiment

6 Experiments

One of the environmental factors which can affect on body of human is color. We used monitors with different colors. Different genders were asked to watch the monitors about 30 minutes. After that their blood pressures and heart rates were measured.

$$\begin{aligned}
 p_i &= \text{initial blood pressure} \\
 p_f &= \text{final blood pressure} \\
 \Delta p &= p_f - p_i \\
 \frac{\Delta p}{p_i} \times 100
 \end{aligned}$$

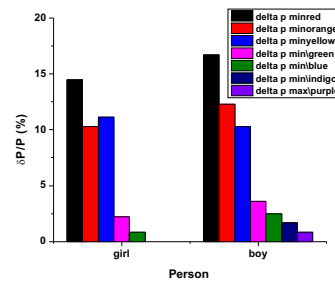


Fig. 8: Investigation of color effect on heart rate in different genders and ages

Different genders were asked to eat salt and sugar. Then their blood pressure and heart rate were measured.

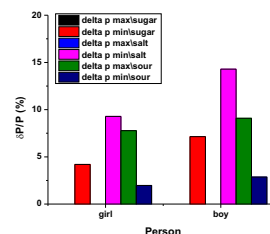


Fig. 9: Investigation of salt and sugar effect in blood Pressure in different genders and ages

The effect of music was investigated too.

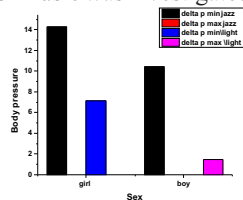


Fig. 10: Investigation of music effect in blood Pressure in different genders and ages

Blood pressure and heart rate in the different time of the day were measured too.

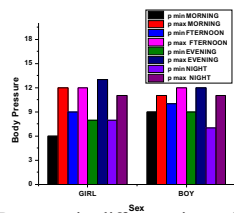


Fig. 11: Blood Pressure in different times during the day (among several genders and ages)

7 Conclusion

To measure the blood pressure we have 3 methods:

- Stethoscope
- Quicksilver-sphygmomanometer
- Auscultatory measurement devices

To measure the heart rate and pulse rate we have 3 methods:

- APP and wristwatch
- Hand
- Auscultatory measurement devices

The average results in our graphs show the change of heart rate and blood pressure of boys are more than girls and in different ages when the age is going to be upper, the blood pressure is going upper too but when the age is going to upper, heart rate is going to be less .

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