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Focus on Pulse Pressure---- Statistical Findings and Analysis

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ABSTRACT: We have, on survey, observed that in these days there is a class of people who have become a bit more conscious about blood pressure and its maintenance of its standard brackets as advised by medical practioners. It is highly recommended that one must be careful about pulse pressure which is also an important factor.

KEYWORDS: Systolic B.P., Diastolic B.P., Pulse Pressure, Heart Beats,

ABBREVIATIONS: B.P. (Blood Pressure), P.P. (Pulse Pressure), B.P.M. (Beats per Minute),
AHA (American Heart Association)

I. INTRODUCTION

In this article we have some specific objectives to aim at; these are

- (1) A step towards Awareness
- (2) To describe some facts about pulse pressure
- (3) To concisely express some medical findings
- (4) To statistically justify derivations obtained from primary records

A. A STEP TOWARDS AWARENESS:

Just being highly engrossed in preserving, maintaining, and enhancing self identity and that too in throat cutting competition time zone, it is, we think, that highly necessary to be alert on the functions of extra ordinary load on different systems of body all of which wants to operate on harmonious coordination. We believe and expect that all would agree with, that each system have an upper limit of performance and over dragging or over loading for a longer period of time leads to mal functioning or failure of the system paralyzing other systems too. Mental stress, improper supplements and to some extent traits of family lineage are found responsible for impairing general performance of the system. There are other causes too but their effects or reactions on behavior of the system, in some cases, are within a normal range of sustenance. We believe that a sound capacitated mind lies in a sound body. All these factors considered together help us reconcile the system and its general performance in an efficient way. This leads us to the fact that it is utmost essential to understand some medical terminology in a simpler mode.

B. SOME FACTS RELATED TO PULSE PRESSURE:

It is a felt need to know about some associated terms which help better understand the dominant notion of this unit—Pulse Pressure. We have some elementary description pertaining to big jargons of medical world.

(a) SYSTOLIC B.P.

To execute all functions of the physical system it is highly necessary that heart works properly and pumps oxygenated blood through the arteries. Pumping process works on sufficiently given external force generated by the system which, if all fine, allows perfect contraction resulting in a pressured flow of oxygenated blood supply in to the arteries.

The blood pressure is the pressure exerted by the system to pump oxygenated blood within the arteries. It is produced primarily at the time when heart muscles experience maximum contraction. This is known as 'Systolic Pressure'. It is measured by the height of the mercury column in sphygmomanometer at the point of time when external pressure,



temporarily produced by the air bulb, counteracting the flow of the blood makes it stationary. It is measured in units of mmHg.

(b) DIASTOLIC B.P.

Once the phenomenon of thrusting the blood into arteries is completely executed, the counter action is to release the contracted heart muscles to normal or to the previous state. The pressure at the point of time, just before the second contraction process takes place, is minimum. This pressure is called 'Diastolic Pressure'. The phenomenon in sphygmomanometer is reflected in descending mercury column when it attains a state of no sound being heard in binaural. It is, as is in the case of systolic pressure, measured in terms of mmHg.

(c) PULSE PRESSURE:

Pulse pressure is the difference between the systolic blood pressure and the diastolic blood pressure. It represents the amount of pressure exerted on the blood vessels when the ventricle of the heart contracts (systole). It being the difference is also measured in units of mmHg. It represents the force that the heart generates each time it contracts. For example, if resting blood pressure is 120/80 mmHg, then the pulse pressure is 40 mmHg. This means that heart, at this very point of time generate force that is equivalent to make a rise of 40 units to reach, in this case, a systolic pressure 120 mmHg. This is a very important factor which indicates many features regarding status of arteries and its operation.

(d) PULSE / HEART RATE:

The number of times heart beats per minute is called pulse or heart rate. In general it may be known as 'beats per minute. If all in control, then heart rate indicates the number of times the heart completes total number of cycles per minute.

Your pulse is lower when you are at rest both physically and mentally also. It increases when you exercise or deeply focus on some emotional aspect. The earlier needs more oxygen-rich blood is needed by the body when you exercise the latter one needs high intellectual involvement though remaining mentally and physically attentive to surrounding situations also.

C. TO CONCISELY EXPRESS SOME MEDICAL FINDINGS:

(a) A LITTLE MORE ABOUT PULSE PRESSURE:

*In connection to the unit 1.2(c) above, we would like to share some views –referenced and/or logical. As per technical findings the acceptable and safe interval for pulse pressure is **40 to 60 mmHg**. This is the desirable bracket for soundness and a feeling of well-being. Of course, it is necessary to think of this interval keeping in view the recommended intervals of systolic and diastolic blood pressure.

* In general a subject with pulse pressure lower than the above suggested recommended range (40 60) falls within a class 'low / narrow pulse pressure. If it gets lower than 25% of the systolic B.P. on a given time slot it is an indication of drop in left ventricular stroke volume. If the pulse pressure is extremely low, i.e. 25 mmHg or less indicates low stroke volume which parallels to the case, as observed, in **Congestive Heart Failure** and/or **cardiogenic shock**. A narrow pulse pressure is also caused by aortic valve stenosis and cardiac tamponade.

On the other end, a comparatively high value in the pulse pressure indicates the relatively higher stroke pressure developed by the heart muscle. It is a consequence that the system develops in accordance with requirement of oxygen rich blood amount. During the time slot of exercise the pulse pressure increase which is proportionate to stroke volume. It is estimated that it will typically return to normalcy within 10 to 11 minutes. Individuals with larger BMIs due to increased muscle mass have relatively more pulse pressure and lower diastolic pressure.



A high resting pulse pressure is harmful and tends to accelerate the normal aging of vital body organs like heart, the brain and kidneys. A high pulse pressure combined with bradycardia and an irregular breathing pattern is associated with increased intracranial pressure..

Some of the major causes responsible for a relatively high pulse pressure are as follows.

[This can never ever be an exhaustive list but some of them , one may, directly relate with one of the end result.]

- **Valve regurgitation.** In this, blood flows backward through your heart's valves. This reduces the amount of blood pumping through your heart, making your heart work harder to pump enough blood.
- **Aortic stiffening.** The aorta is the major artery that distributes oxygenated blood throughout your body. Damage to your aorta, often due to high blood pressure or fatty deposits, can cause wide pulse pressure.
- **Severe iron deficiency anemia.** In this condition, there aren't enough hemoglobin cells in your blood due to lack of iron.
- **Hyperthyroidism.** Your thyroid produces too much of a hormone called thyroxine, which affects many of your body's processes, including the beating of your heart.

II. STATISTICAL ANALYSIS AND GRAPHICAL JUSTIFICATION:

All that has been narrated above, to some extent, are generalizations of the statistical parameters derived from large samples statistics. Many samples taken in different situations, different geographic conditions, and related on subjects of broader age group, in concurrence with medical facts, have conceptually strengthened both statistical researchers and medical authoritarians to synergize with common objectives.

In this situation to convey something more in the related direction we are equipped with the primary data from different authenticable sources and a total of ninety observations have been grouped in six different samples each with 15 subjects. The following data is for a sample of 15 subjects. We have variable x1 showing systolic pressure, variable x2 showing diastolic pressure and their difference; what we call pulse pressure.

Sr. No.	X1= systolic	X2= diastolic	X1-x2 = P.Pressure	Sr. No.	X1= systolic	X2= diastolic	X1-x2= P.Pressure
1	119	72	47	9	124	78	46
2	126	83	43	10	128	82	46
3	119	73	46	11	118	74	44
4	134	68	46	12	130	82	48
5	105	70	35	13	132	84	48
6	140	90	50	14	126	80	46
7	134	86	48	15	128	78	50
8	132	90	42				

From this we have average pulse pressure = 45.7 mmHg.

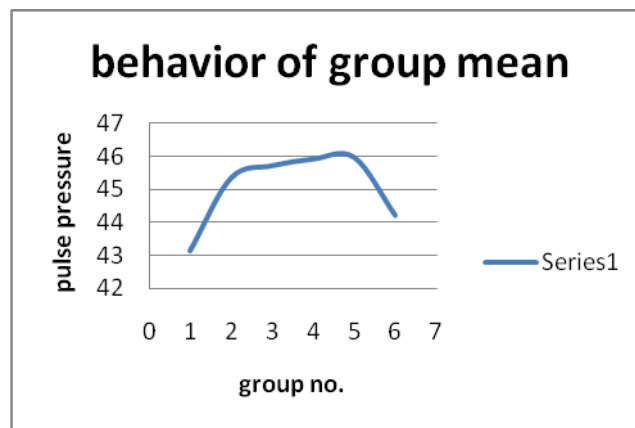
Following on the same track we have six samples each of 15 subjects. We have calculated mean pulse pressure for each group. It is shown below.

Sample:	1	2	3	4	5	6
Mean P.P	43.13	45.33	45.7	45.9	45.95	44.2

[These are the figure obtained on finding average and standard deviation; they need rounding off.]

Mean \bar{x} 45.035 \approx 45 mmHg	=	Median = m 45.8 \approx 46 mmHg	Std. Dev = σ 1.135 \approx 1mmHg
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The above facts can be represented graphically. The grand mean 45mmHg. and the standard deviation of mean of means which is approximately 1.0 mmHg conveys many suggestion including how one, in general, requires to be attentive to the notion of pulse pressure.



Graph-1

APPLICATION: On using the above records, we conclude that the data approximates normality with a mean 45 mmHg. and standard deviation closer to 1 mmHg. This may be used as an indicative tool for portraying control limits.

The broader limit scales can be regarded as $[\bar{x} - 3\sigma \quad \bar{x} + 3\sigma] = [45 - 3(1) \quad 45 + 3(1)] = [42 \quad 48]$

On the same lines we have a set of 15 new observations/ primary data. We would like to analyze the same in the above context.

Table-2

Sr. No	X1= Systolic	X2= Diastolic	X1-x2 = P.P.	Sr. No.	X1= Systolic	X2= Diastolic	X1-x2 = P.P.
1	125	85	40	9	120	80	40
2	130	90	40	10	119	90	29**
3	120	77	53	11	140	95	45
4	142	88	54	12	115	80	35*
5	189	105	84++	13	125	95	30*



6	150	80	70+	14	75	55	20**
7	110	75	35*	15	137	87	50
8	100	65	35*	----	-----	-----	---

SYMBOLS:

We have employed certain symbols for indicating measures of pulse pressure which crosses the approximate normal limits as recommended by ‘AHA’--- [40, 60]

Category P.P.

symbol Conveys

I (a)	$30 \leq 40$	*	Needs attention
I (b)	≤ 30	**	Possibly Immediate Attention
II(a)	$60+ \text{ and } \leq 70$	+	Needs attention
II(a)	$70+ \text{ and } \leq 80$	++	Possibly Immediate Attention
II(c)	$80+$	+++	Inform Physician

With context to above symbols

Subjects 7, 8, and 12 falls in category **I(a)**,

Subjects 10 and 14 falls in category **I(b)**

Subjects 5 falls in category **II(c)**

Subject 6 falls in category **II(a)**

These are the probable guide lines that strictly may be accepted as per advise of experienced physician.

III. CONCLUSION

Primary data with appropriate analysis is, to our opinion, is very suggestive and conveys many important points. In addition to both the measures of blood pressure what important factor plays vital role should be brought forward for general awareness.

REFERENCES

- (1) Anthony M Dart and Bronwyn A Kingwell. Pulse pressure—a review of mechanisms and clinical relevance. *Journal of the American College of Cardiology*. Volume 37, Issue 4, 975-984
- (2) Diego Giuliano Christopharto, Juliano Casonatto, Luiz Carlos Marks Relationship between Resting Heart Rate, Blood Pressure and Pulse Pressure in Adolescents. *ABC Cardiol*. 2017 May; 108(5): 405–410.
- (3) K Kristjansson, JA Sigurdsson, L Lissner, V Sundh and C Bengtsson. Blood pressure and pulse pressure development in a population sample of women with special reference to basal body mass and distribution of body fat and their changes during 24 years. *International Journal of Obesity* (2003) 27, 128–133
- (4) Kwok SY, So HK, Choi KC, Lo AF, Li AM, Sung RY, et al. Resting heart rate in children and adolescents: association with blood pressure, exercise and obesity. *Arch Dis Child*. 2013; 98(4):287-91.
- (5) Rabbia F, Grosso T, Cat Genova G, Conterno A, De Vito B, Mulatero P, et al. Assessing resting heart rate in adolescents: determinants and correlates. *J Hum Hypertens*. 2002;16(5):327-32