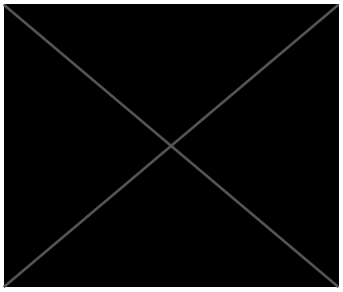
“Pump It Up”: How ball air pressure affects the distance a volleyball is served



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In my science fair project, I was curious to see how air pressure affects volleyball distance when served. Volleyball players, before games are sometimes offered hard versus softer balls. Having the knowledge of what ball to choose to hit could be an advantage. My hypothesis is that as air pressure increases in the ball, the ball will travel farther.. This science fair project has the potential to help other volleyball teams to determine what air pressure they prefer when they play their games.

Method

The following explains how the experiment was organized, including the materials and step by step procedures. My question in this experiment was, “Does the air pressure in a volleyball affect the distance it travels?”. The hypothesis is that as air pressure increases in the ball, the ball will travel farther when served.

All materials required for conducting the study are described below to allow for full replication of the procedures. The materials used were 1 official sized volleyball, an air pump, a pressure gauge, a tape measure, a paper, a pencil, and a volleyball net. First the volleyball was inspected, making sure that it was intact and without defects. The second item used was an air pump with a digital pressure gauge. This device was used to incrementally adjust the air pressure in the volleyball. According to API Tech, digital pressure gauges are more accurate than analog gauges. Next, a tape measure was used to measure the distance the ball traveled. The distance was measured perpendicularly from the net to the point the ball impacted the ground. The next two things are really simple. A paper and a pencil. These two materials were used to help me to record the measurements of how far the ball travelled. Finally, the last

material used was a volleyball net. It is important because it is the starting point of the measurement on how far the ball travels.

This section outlines the specific procedures used to carry out the experiment and gather reliable results. The procedures used in this experiment are basically repeated. First I grabbed my ball and pumped it to the lowest PSI, 3.4. I then served the volleyball overhand over the net 5 times. Following each serve, my dad marked where the ball landed and then the tape measure was used to measure the distance (in feet) perpendicularly from the net to the spot the ball landed. The distance was then recorded by pencil to paper in an organized way, keeping the distance noted to its correct ball pressure. These steps were repeated again and again, collecting data on the different pressures. I used 3.4 PSI, 4.2 PSI, 4.6 PSI, and 5.4 PSI. After collecting all of the information on the serves, the average distance was calculated for each PSI. Then, I went to see if my hypothesis was correct or not. Overall, the results of this experiment showed a clear pattern that helps answer the original research question.

Results

This section presents the results of the experiment, including measurements and observations recorded during each trial. The hypothesis of this experiment was that as air pressure in the volleyball is increased, then it will travel farther when served. My data does not support this hypothesis.

Data: 3.4 PSI - 45 ft., 50 ft., 44 ft., 57 ft., 59 ft. Average: 51ft.

4.2 PSI - 46 ft., 51 ft., 57 ft., 59 ft., 54 ft. Average: 54ft.

4.6 PSI - 64 ft., 55 ft., 55 ft., 51 ft., 56 ft. Average: 56ft.

5.4 PSI - 51 ft., 49 ft., 54 ft., 47 ft., 54 ft. Average: 51ft.

Discussion

The purpose of this discussion is to compare the results of this experiment with findings from similar scientific studies and to explain what the results suggest about the relationship between the independent and dependent variables. When I thought of this experiment, the question to answer was what air pressure in a volleyball will allow it to travel farther when served. According to the Federation Internationale de Volleyball, the standard ball pressure for a competitive volleyball is 4.2-4.6 PSI. So I tried using 4 different air pressures in a volleyball, inside and outside of the recommended range, to find each distance they traveled. The pressures used in this experiment were 3.4 PSI, 4.2 PSI, 4.6 PSI, and 5.6 PSI.

I elected to use an overhand serve rather than an underhand serve. According to Volleyball Dynamics, the overhand method provides the greatest distance when you hit the ball. I served the ball at my local playground, which has a volleyball net. And of course, I needed my dad's help for measuring the distance the ball traveled. Everything was going well! For each time I changed the air pressure, I would then serve the ball 5 times. And each time I would serve, I would write down how far the ball traveled in feet.

The question that I was trying to answer was what ball air pressure will cause the ball to travel farther? So, before I got my answer, I had to find the average distance for each air pressure. I started off with the lowest pressure and incrementally increased to the highest air pressure. This process took a while because there were a lot of numbers to add and divide. But after calculating, I finally got my answer, which showed that 4.6 PSI was associated with the longest average distance of 56 feet! So yes, I did accomplish the question, and I was happy with my results.

This experiment had problems that I did not expect and may have influenced my results. As the testing continued, my serving arm became a little fatigued. This may have influenced the distance on the higher pressured balls because those balls were hit later in the study. Also, I noticed that accuracy was an issue with lower and higher pressured balls. This may have affected distance as well because we measured directly perpendicular to the net, not the actual flight path of the ball. Still, I believe the data was accurate enough to see that there was certainly a bell curve average to the distance of the balls when compared to air pressure.

If this data is true, volleyball players should select balls that are pressurized to the recommended pressures by the Federation Internationale de Volleyball (4.2-4.6 PSI). Underinflated and overinflated balls lose accuracy and distance.

References

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