

AGAINST ALL ODDS
EPISODE 5 – “BOXPLOTS”
TRANSCRIPT

FUNDER CREDITS

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INTRO

Pardis Sabeti

Hello, I'm Pardis Sabeti and this is *Against All Odds*, where we make statistics count.

Hot diggity hot dog! They're an American icon – and we eat billions of them every year. Not all hot dogs are created equal though. It seems like there's a hot dog to fit just about every taste out there... all beef, some pork, turkey, skinless, even tofu for that vegetarian hot dog lover! How do they all stack up nutritionally?

For the cold facts on hot dogs, we turn to Vallid Labs and their calorie counting techniques. The first step is transforming a pound of hotdogs into a uniform consistency for testing.

Jenna McLoughlin

You grind it for about two minutes or until you can't tell there are any pieces left of the product. So this would be called homogenous, which basically means you can't tell which part of the hot dog is the skin versus the interior versus the end piece... You just want it to all be the same, almost like a mush.

Pardis Sabeti

After a series of treatments with acids and bases, distillations and titrations, Jenna can figure out the percent of nitrogen in the sample.

Jenna McLoughlin

When this heats it will release ammonium gas which will come over here to collect/ which comes down into the catch and from the catch we measure the amount of nitrogen out of the ammonium.

Pardis Sabeti

The amount of nitrogen is a proxy for how much protein is in the hotdog mush.

To figure out how much fat is in the sample, it's mixed up with some sand to increase the surface area and baked, to dry it out. Then Jenna runs petroleum ether through it for several hours.

Jenna McLoughlin

As the ether drips down it will kinda intermingle with the sample and grab any extra fat and oil and bring it down into the flask.

Pardis Sabeti

By the end of the process, the flask contains just the oily fat, which she weighs.

Another couple baking steps allow Jenna to determine water and ash content for the hot dogs. Water, of course, is calorie free. Everything else in the franks that's not protein, fat, moisture, ash or fiber is chalked up as carbs.

At the end of the whole process, Jenna can calculate calorie contents from her results. Each gram of fat is 9 calories toward the hotdog's total. Each gram of protein or carbohydrates contributes 4 calories to the hotdog's bottom line.

Add it all up, and you have the complete calorie info for this hotdog brand. Despite similar appearances, hotdogs vary widely in nutritional content. Maybe you pay more attention to what's on your hotdog than what's in it... but for the calorie conscious among us, statistics can help suggest the healthiest choice.

Here are the calorie results for 20 different brands of all-beef hotdogs. If we line them all up in order, you can see that they range from 110 calories in the lowest brand to 230 in the highest. One way we can describe this distribution numerically is with the median – the number of calories in a typical beef hotdog. Since we have 20 brands, the location of the median is 20 plus 1, divided by 2 which equals 10.5. That's halfway between the tenth and eleventh hotdog in the ordered list... the median is the average of these two values – 172.5 calories.

So your typical beef dog has 172.5 calories. We can add some more numbers to our analysis of the spread of the data, which in this case is the variability of the calorie counts. We know the minimum and maximum values already, but they don't tell us anything about all the values in between. For that, we can figure out the quartiles. They're the values one quarter and three quarters up the list.

The first quartile – also know as Q_1 – has 25% of the observations below it. It's the center point between the lowest value and the median. So in this case, we have ten calorie values below the median. The median of this 10 number subset is between the 5th and 6th value, so 145. That's our Q_1 .

The third quartile is three quarters up the list, with 75% of the observations below it. Just as Q_1 is the median of the lower half of the values, Q_3 is the median of the upper half. Calculate it the same way: the median of these 10 upper numbers is between the 5th and 6th values, so 190.

With our minimum, first quartile, Median, third quartile, and maximum, we have what's called the Five Number Summary. It's a nice snapshot of both center and spread. The median marks the center. The quartiles contain between them the middle half of the data. The two extremes show how far out the data extends.

In statistics, the best description of data often combines the precision of numbers with the clarity of pictures. The five number summary can generate a helpful illustration of data called a boxplot. Here's the boxplot of our calorie data distribution for the beef hot dogs.

The scale is here, marked off in calories. We add a box that ends at the first and third quartiles. Add a line within the box for the median. Then extend whiskers up to the largest and down to the smallest observations. It's our five-number summary visualized!

The distance from the maximum to the minimum value is called the range. The box spans the central half of the observations, from the first quartile to the third quartile. That distance is called the interquartile range.

The boxplot doesn't give a lot of detail in comparison to a stemplot or a histogram, but it can be a great way to make a quick side-by-side comparison of a few distributions. Let's line up boxplots for calories in beef and poultry hot dogs.

Right away, it's easy for a hot dog consumer to spot that the poultry franks, as a group, are lower in calories than the beef varieties. The median of the poultry dogs lies below the minimum value for beef dogs... meaning the typical turkey dog has fewer calories than any beef brand. Now check out the boxplot for the vegetarian version... overall they look comparatively low cal. But take a look at the whiskers – at least one veggie brand has more calories than three quarters of the beef dogs! A hot dog lover would have to read the label to be sure how many calories are about to be consumed.

So here with boxplots we have another great way to graphically represent data – and this method allows for easy comparisons between groups. Groups like beef dogs versus veggie dogs, for instance! Bon appetit, hot dog lovers!

I'm Pardis Sabeti for *Against All Odds*. See you next time!

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