EAT PEPPERS, LIVE LONGER?

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On 9th January 2017, researchers from University of Vermont College of Medicine conducted a cohort study to analyze the association between consumption of hot red chilli peppers and mortality. After controlling for age, sex, smoking, blood pressure, cholesterol, diabetes and other characteristics, the researchers calculated that consumption of hot red chilli peppers was associated with a 13% reduction in the instantaneous hazard of death and concluded that consumption was associated with reduced mortality.

The research used data from 33,199 people, but filtered to only 16,179 respondents. During 273,877 person-years of follow-up, a total of 4,946 deaths were observed. Mortality for those who consumed hot red chili peppers was 21.6% compared to 33.6% for non-consumers. The results add to current literature on chilli and longevity by corroborating a previous study. However, how much of this is true? And can the study be trusted?

QR Framework

Frame

The study measures consumption of chilli peppers against longevity, an observational, cohort study with data retrieved from the probability-sampled National Health and Nutritional Examination Survey III (NHANES) conducted from 1988 to 1994. Respondents were divided based on exposure ("eating chili peppers"), then analysed against mortality data ("longevity") from the National Death Index in 2011. The main variables to determine association in this study are "consumption of chilli peppers" and "longevity".

Comunicate

As the study finds that those who eat hot peppers had a 13% reduced risk for dying early, the researchers are correct in concluding association. Furthermore, they also do not claim any causation, which is accurate in communication. As this is a cohort study, the risk ratio can be calculated and generalised to the population, although, as mentioned earlier, the generalisation is only limited to a subset of the population as defined by their survey criteria (e.g. >18 years old).

Collect

	Alive	Dead	Total
Consumes Chilli Peppers	3,220	887	4,107
Does not consume Chilli Peppers	8012	4,059	12,071
Total	11,232	4,946	16,178

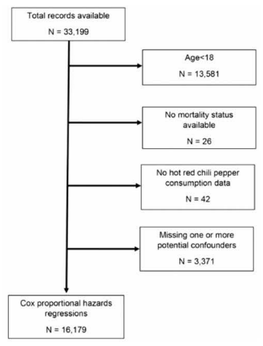
Figure: 2x2 table on consumption vs living status

Data Sources

NHANES — Chilli Pepper Consumption

DEATH INDEX — Living Status

Researchers did not conduct surveys on their own; they used the NHANES survey instead. The NHANES survey is a probability, multistaged sampling study: a stratified selection of 81 states and counties, then a random sampling of households, followed by members in the household. Coupled with a large sample size of 33,199 people, the sample is likely representative of the population.



UNREPRESENTATIVE

Excluded institutionalized and 13,581 people

However, the NHANES survey excludes institutionalized personnel. Hence we cannot generalize results to the entire population.
Furthermore, the researchers only used a subset of the NHANES sample. Critically, they excluded 13,581 people under the age of 18 with no justification. Even though the sample size is still large (16,179 people), since people under 18 have been excluded, the sample is no longer representative of the entire American population. Hence, we cannot generalise results to entire population.

LOW BIAS AND ERROR

Accurate data, unbiased wording

On the other hand, the collected results are likely to be reliable with little bias. The question, "how often did you have red hot chilli peppers" is phrased to induce as little intentional bias as possible. The study also clarifies that the surveyed "should not include consumption of ground red hot chilli peppers", which further removes ambiguity, reducing unintentional bias.
As the question does not involve sensitive topics with an inherent bias, it is unlikely that people would lie about their consumption in a "desire to please". The nature of the measurement method is unlikely to result in false positive or false negative values and thus the results are likely to be accurate and without bias.

Furthermore, the measurement of longevity is also reliable. Assuming that the Death Index on living status is accurate, there is little random error and bias.

Specify

Categorical VS Numerical

Yes, No 1, 2, 3, 4...

Consumption of chilli peppers was inaccurately defined as categorical. By the researchers' definitions, if person A consumed 10 grams of red hot chilli peppers a week, he would be lumped together in the same category as a Person B who consumes 500 grams of red hot chilli peppers a week.
It should be numerical because the amount of chilli peppers consumed would also impact longevity, not just the act of consumption. The binary classification of consuming any or none understates consumption of chilli peppers, as people who consumed a lot are still considered "consumed", indistinguishable from those who only consumed a little. Considering consumption as a numerical value would alows us to study the degree to which the amount of peper consumed affects their longevity.

Longevity VS Mortality

Living Dying

The researchers measured mortality instead of "longevity". Longevity measures an individual's lifespan but mortality rate is the risk of dying, hence using mortality rate is imprecise and off tangent to what the researchers claim to measure. Additionally, utilising mortality rate results in the experiment ignores age as a confounder, because older respondents naturally have a higher risk of dying. Hence it is important to distinguish between increased longevity and "reduced mortality".

Analyse

CONFOUNDERS

Accounted through regression

It was good that demographics like ethnic groups, education, gender and income level were taken into consideration as they are potential confounders. The confounders were sliced and individual variables within were compared. This is significant as mortality rate and chilli consumption can differ significantly within a confounder group.

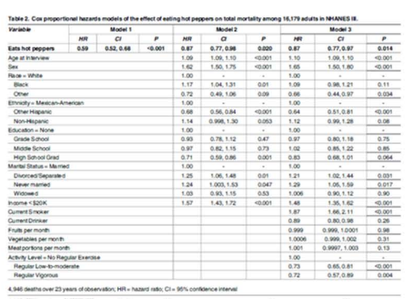


Table 2. Cox proportional hazards models of the effect of eating hot peppers on total mortality among 16,179 adults in NHANES III.

Variable	Model 1			Model 2			Model 3		
	HR	CI	P	HR	CI	P	HR	CI	P
Eats hot peppers	0.59	0.52, 0.68	<0.001	0.87	0.77, 0.98	0.020	0.87	0.77, 0.97	0.014
Age at Interview				1.09	1.09, 1.10	<0.001	1.10	1.09, 1.10	<0.001
Sex				1.62	1.50, 1.75	<0.001	1.65	1.50, 1.80	<0.001
Race = White				1.00	-	-	1.00	-	-
Black				1.17	1.04, 1.31	0.01	1.09	0.98, 1.21	0.11
Other				0.72	0.49, 1.06	0.09	0.66	0.44, 0.97	0.034
Ethnicity = Mexican-American				1.00	-	-	1.00	-	-
Other Hispanic				0.68	0.56, 0.84	<0.001	0.64	0.51, 0.81	<0.001
Non-Hispanic				1.14	0.998, 1.30	0.053	1.12	0.99, 1.28	0.08
Education = None				1.00	-	-	1.00	-	-
Grade School				0.93	0.78, 1.12	0.47	0.97	0.80, 1.18	0.75
Middle School				0.97	0.82, 1.15	0.73	1.02	0.85, 1.22	0.85
High School Grad				0.71	0.59, 0.86	0.001	0.83	0.68, 1.01	0.064
Marital Status = Married				1.00	-	-	1.00	-	-
Divorced/Separated				1.25	1.06, 1.48	0.01	1.21	1.02, 1.44	0.031
Never married				1.24	1.003, 1.53	0.047	1.29	1.05, 1.59	0.017
Widowed				1.03	0.93, 1.15	0.53	1.006	0.90, 1.12	0.90
Income < $20K				1.57	1.43, 1.72	<0.001	1.46	1.35, 1.62	<0.001
Current Smoker							1.87	1.66, 2.11	<0.001
Current Drinker							0.89	0.80, 0.98	0.26
Fruits per month							0.999	0.999, 1.0001	0.98
Vegetables per month							1.0006	0.999, 1.002	0.31
Meat portions per month							1.001	0.9997, 1.003	0.13
Activity Level = No Regular Exercise							1.00	-	-
Regular Low-to-moderate							0.73	0.65, 0.81	<0.001
Regular Vigorous							0.72	0.57, 0.89	0.004

4,946 deaths over 23 years of observation; HR = hazard ratio; CI = 95% confidence interval

Figure: Sliced comparison of consumption vs mortality.

For example, black people made up 32.2% of people who do not consume chilli pepper compared to 18.9% of those that do. Black people who don't consumed chilli pepper have a higher mortality rate than those that do, contrary to overall findings! Slicing allows us to recognise how each confounder affects the 2 variables, while also allowing us to check for presence of Simpson's Paradox within one variable.
It is important to recognise and account for confounders so as to arrive at an accurate conclusion. In this study, the demographic confounders were also well accounted and controlled for through the use of regression.

Additionally, the study aptly identifies its limitations. It states that although the narrow confidence intervals and small P-values argue against random error, the apparent association could be caused by some factor not controlled for in the analysis.
This is correct. Variables like location could be a confounder. Certain areas in the US could consume more chilli peppers and have better healthcare services in that area, reducing mortality.
Additionally, the study aptly identifies diet as a confounder. Hot red chilli peppers are usually consumed in conjunction with other spices or food that could affect longevity. For example, if they are used in fried chicken chicken, then As such, presence of other food or spices could be a potential confounder which could account for the apparent association.

CONFOUNDERS

That researchers left out ⚠

However, the study did not consider time as a confounder. The study follows the sample units for a period of 22 years, after which they obtained the results of mortality. However, over this long time period, the respondents' diets may change. Those who stated that they do not consume chilli pepper could start consuming pepper, and vice versa, due to reasons like becoming more health-conscious. Hence, this could affect the number of people who actually consume chilli pepper at the end of the study when mortality rate was calculated, hence affecting the conclusion.