

Meat Consumption, Sleep, and Heart Rate



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Question



Is there a correlation between meat consumption and sleep, is there a correlation between meat consumption and resting heart rate, and is there a correlation between sleep and resting heart rate?

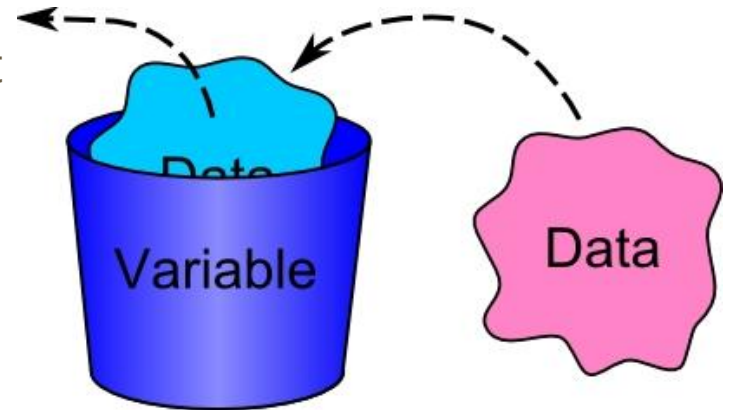
Based on these, how do the independent factors (meat consumption and sleep) affect the dependent factor (heart rate).

Variables

Meat Consumption: 0 meals a week, 1-4 meals a week, 5-9 meals a week, 10-14 meals a week, 15+ meals a week

Hours of sleep: On average for a school night

Heart Rate: Resting BPM, at that moment



Data Collection

Population: Students at Washburn

Method: Stratified random sample. Used random digits

Table

1. On an average school night how many hours of sleep do you get a night?

2. On average how many times a week do you have meat in your meals?

- A) 0 meals
- B) 1-4 meals
- C) 5-9 meals
- D) 10-14 meals
- E) 15+ meals

3. Take your average heart rate at this time and write it down please. (Place your two fingers on your wrist or neck. count the number of beats for 15 seconds. Take this number and multiply it by 4. Record the number below.)

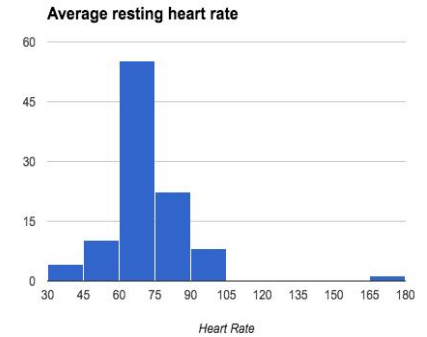
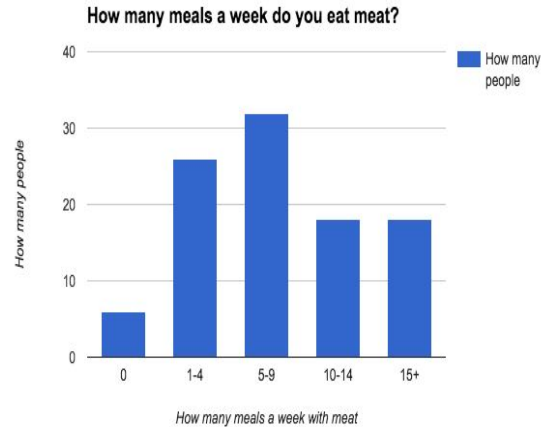
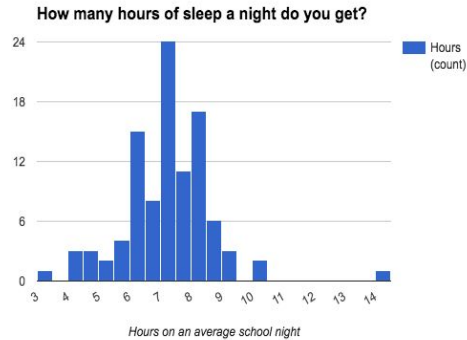
Exploratory

Data

Analysis



Frequency charts of raw data



Inferential Analysis

Significance Test: sleep and meat

Parameters: We are interested in if there is an association between hours of sleep someone gets on an average school night and how many meals a week with meat they have.

Hypothesis:

Ho: There is no association between hours of sleep and meat eaten.

Ha: There is an association between hours of sleep and meat eaten.

Significance Test: sleep and meat

Assumptions:

Random: We took a stratified random sample.

Independent: There are over 1,000 students at Washburn.

Normal: All expected counts are at least 5.

Name: Chi-Square Test of Association

Observed vs. Expected Counts

29	9	0
18	13	0
12	6	1
13	5	0
25.8	11.8	0.35
21	9.6	0.29
12.9	5.9	0.17
12.2	5.6	0.16

Significance Test: sleep and meat

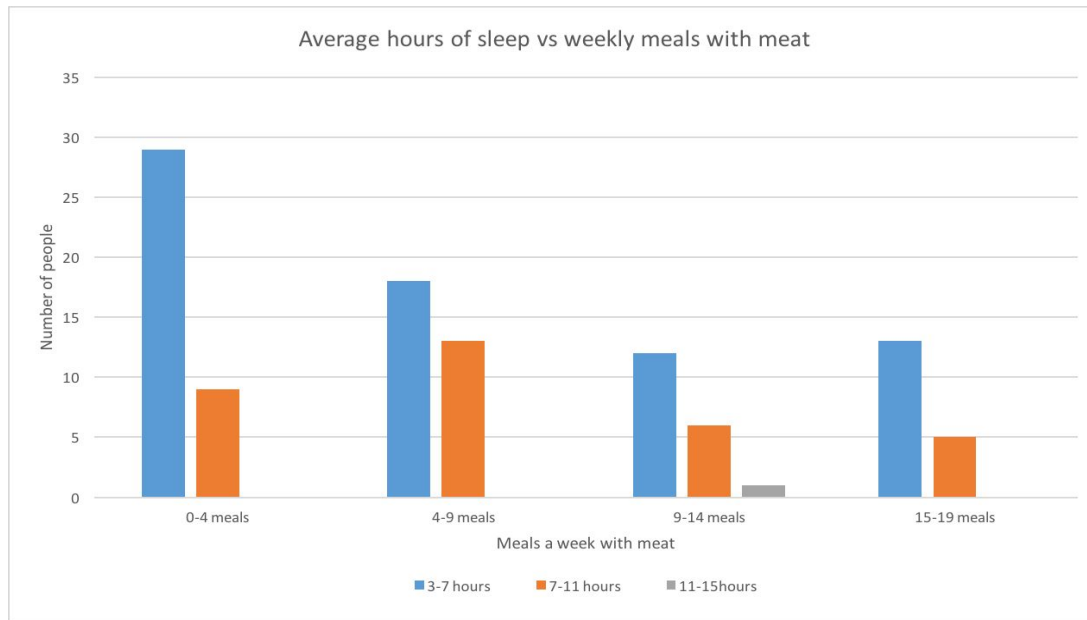
Test statistic:

$$7.43 = \frac{(29 - 25.8)^2}{25.8} + \frac{(9 - 11.8)^2}{11.8} + \dots + \frac{(0 - .16)^2}{.16}$$

$$\chi^2 = \sum \frac{(O - E)^2}{E}$$

Obtain P-Value:

The P-value is **.2825**



Conclusion: sleep and meat

Make decisions: Because the P-value is not significant at the .05 alpha level, we fail to reject the null hypothesis.

State conclusion in context: There is not significant evidence that there is an association between the average hours of sleep one gets a night and the weekly amount of meals consumed that contain meat.

Significance Test: heart rate and meat

Parameters: we are interested in if there is an association between the average resting heart rate and how many meals a week with meat they have.

Hypothesis:

Ho: There is no association between average heart rate and meat eaten

Ha: There is an association between average heart rate and meat eaten.

Significance Test: heart rate and meat

Assumptions:

Random: we took a stratified random sample.

Independent: there are over 1,000 students at Washburn.

Normal: all expected counts are at least 5.

Name: Chi-Square Test of Association

Observed vs. Expected Counts

11	13	7	0
6	22	4	0
3	10	4	1
0	5	4	0
6.8	17.2	6.5	0.34
7.1	17.7	6.7	0.35
4	10	3.8	0.2
2	5	1.9	0.1

Significance Test: heart rate and meat

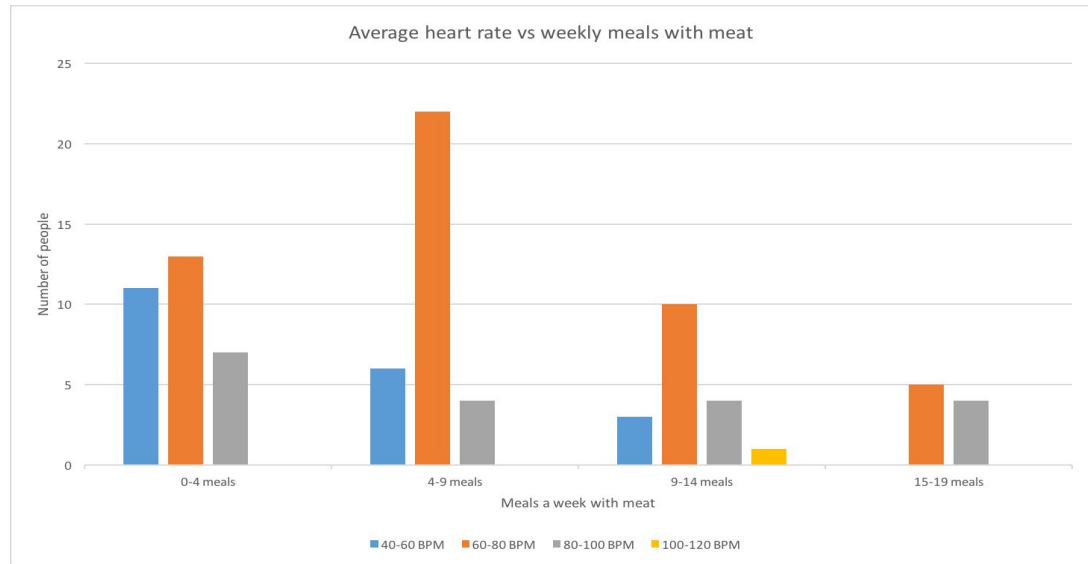
Test statistic:

$$\chi^2 = \sum \frac{(O-E)^2}{E}$$

$$14.4 = \frac{(211 - 6.8)^2}{6.8} + \frac{(13 - 17.2)^2}{17.2} + \dots + \frac{(0 - .1)^2}{.1}$$

Obtain P-value:

The P-Value is **.1087**



Conclusion: Heart Rate and Meat

Make decisions: Because the P-value is significant at the .05 alpha level, we reject the null hypothesis.

State conclusion in context: There is strong evidence that there is an association between heart rate and weekly amount of meals consumed that contain meat.

Significance Test: Sleep and Heart Rate

Parameters: We are interested in if there is an association between hours of sleep someone gets on an average school night and average resting heart rate.

Hypothesis:

Ho: There is no association between hours of sleep and average heart rate

Ha: There is an association between hours of sleep and average heart rate

Significance Test: Sleep and Heart Rate

Assumptions:

Random: we took a stratified random sample.

Independent: there are over 1,000 students at Washburn.

Normal: all expected counts are at least 5.

Name: Chi-Square Test of Association

Observed vs. Expected Counts

17	30	12	1
11	19	8	0
0	1	0	0
16.9	30.3	12.1	0.6
10.7	19.1	7.6	0.38
0.28	0.5	0.2	0.01

Significance Test: Sleep and Heart Rate

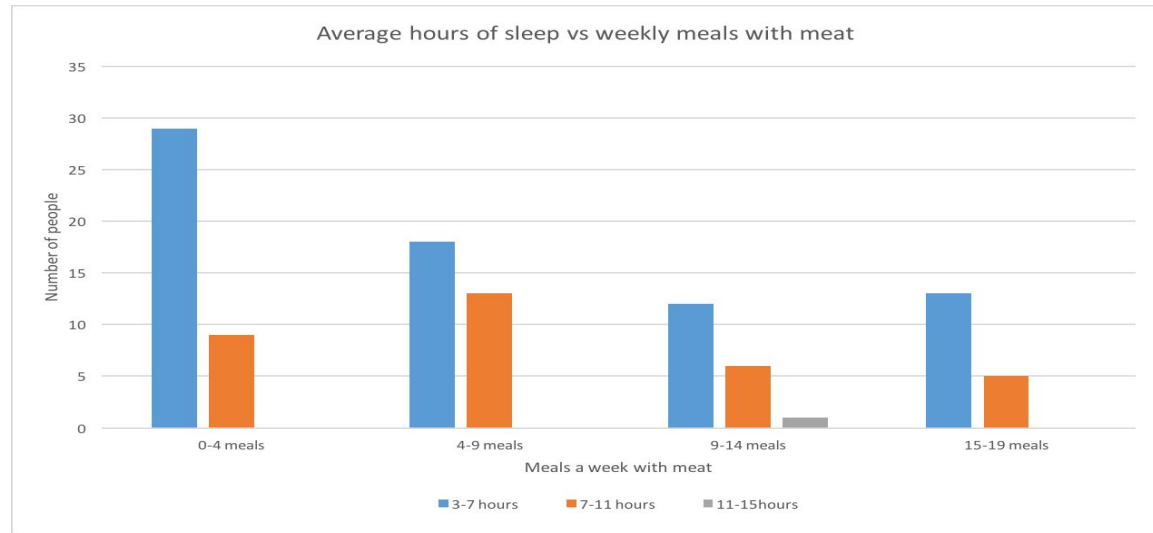
Test Statistic:

$$\chi^2 = \sum \frac{(O-E)^2}{E}$$

$$1.645 = \frac{(17 - 16.9)^2}{16.9} + \frac{(30 - 30.3)^2}{30.3} + \dots + \frac{(0 - .01)^2}{.01}$$

Obtain P-value:

P-Value is .945.



Conclusion: Sleep and Heart Rate

Make decisions: Because the P-value is significant at the .05 alpha level, we reject the null hypothesis.

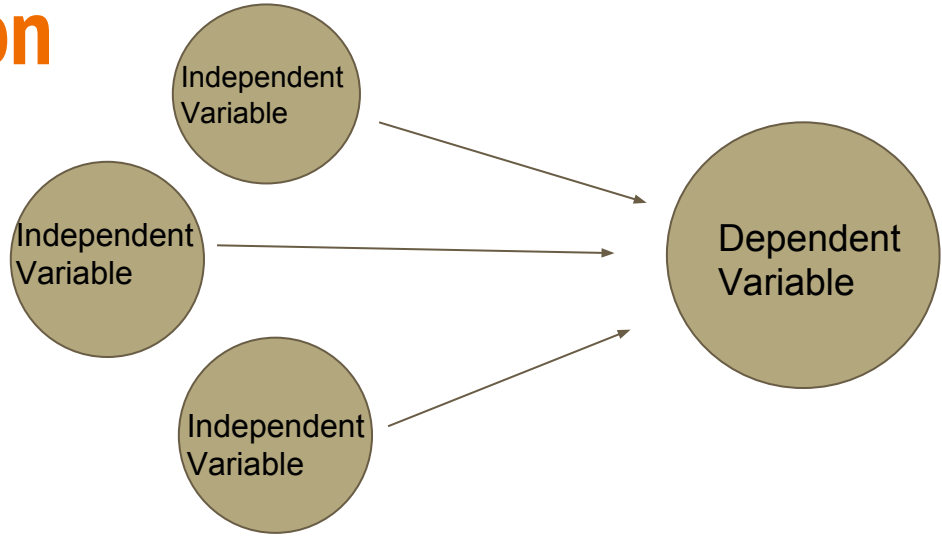
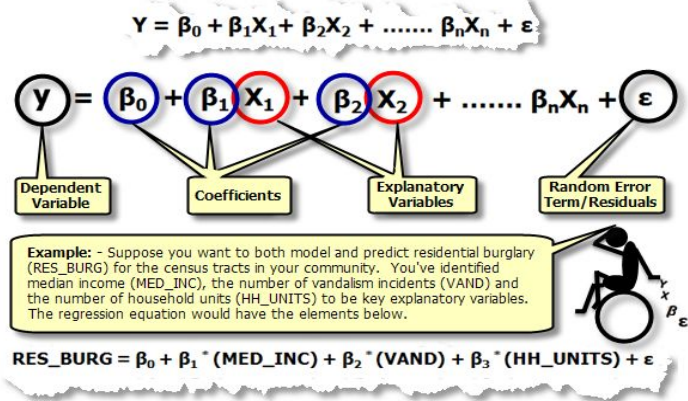
State conclusion in context: There is strong evidence that there is an association between the average amount of sleep a night and resting heart rate.

Final Conclusions

We found that there IS an association between resting heart rate and hours of sleep and there is an association between heart rate and meat eaten for Washburn students. There is NOT an association between hours of sleep and meat eaten for Washburn students.



Multiple Linear Regression



- ❖ As a predictive analysis, the multiple linear regression is used to explain the relationship between one continuous dependent variable and two or more independent variables.
- ❖ Used to determine which independent variable has the greatest impact on the variance of the dependent variable. Once a variable is identified as having impact, the other variables are examined in decreasing order.
- ❖ The goal is to explain as much of the variance as is meaningful. It is not possible to explain 100%.

Multiple Linear Regression

Diagnostic Tools for Data Transformation Decisions

R-Square	0.047107818	F-Statistic	0.321338372
Mean	-1.288	Variance	110.8732492
Mean: The first half	-4.7014286	Mean: The second half	1.69875
Variance: The first-half	166.9280171	Variance: The second half	75.6310479
First order serial- correlation	0.0107603	Second order serial-correlation	0.2351425
Durbin-Watson statistic	1.88391	Mean absolute errors	8.7475
Normality Condition:			
Evidence against normality			
i^{th} Residual:			
(1)-13.56 (2)10.34 (3)3.29 (4)-14.72 (5)1.02 (6)-21.56 (7)2.28 (8)-4.66 (9)6.4 (10)9.86 (11)13.34 (12)4.13 (13)-0.66 (14)-4.99			

	X1	X2	X3	X4	Y	Predicted Y values
1	8	6.5			60	73.56
2	7	11.5			83	72.66
3	5	17			76	72.71
4	7	6.5			60	74.72
5	6.5	17			72	70.98
6	6	17			50	71.56
7	6	2			80	77.72
8	7	11.5			68	72.66
9	4.5	6.5			84	77.6
10	7.5	6.5			84	74.14
11	7	11.5			86	72.66
12	6	6.5			80	75.87
13	7	11.5			72	72.66
14	8.5	6.5			68	72.99
15	7.5	17			60	69.83
16	8.5	17			88	68.68

Multiple Linear Regression

$$\hat{Y}=85.45+(-1.152)X_1+(-0.4105)X_2$$

R Squared: 0.047107

Conclusion: Based on the small R Squared value given by the multiple linear regression equation, we can conclude that there is very little, if any, correlation between meat consumption, sleep patterns, and heart rate in our sample.

Further Research

Future studies could include a larger sample size. There are also other factors that could be explored, like blood pressure, physical activity, and type of food eaten.

- Ex: Confounding Variables. Athletic students at Washburn may eat more meat because they think they need it for protein. They may have lower heart rates not because they eat more meat, but because they are involved in athletics.

