To determine if there is an association between exposure to a high cholesterol diet and heart disease, we can perform a chi-square test of independence. Here’s the step-by-step analysis:

### Observed Frequencies (O):

- High Cholesterol Diet, Heart Disease (Yes): 11

- High Cholesterol Diet, Heart Disease (No): 4

- Low Cholesterol Diet, Heart Disease (Yes): 2

- Low Cholesterol Diet, Heart Disease (No): 6

### Expected Frequencies (E):

The expected frequency for each cell is calculated using the formula:

\[ E\_{ij} = \frac{(Row \, Total \, of \, i) \times (Column \, Total \, of \, j)}{Grand \, Total} \]

- Total for High Cholesterol Diet: 15

- Total for Low Cholesterol Diet: 8

- Total for Heart Disease (Yes): 13

- Total for Heart Disease (No): 10

- Grand Total: 23

Calculating each expected frequency:

1. \( E\_{11} = \frac{15 \times 13}{23} = \frac{195}{23} \approx 8.48 \)

2. \( E\_{12} = \frac{15 \times 10}{23} = \frac{150}{23} \approx 6.52 \)

3. \( E\_{21} = \frac{8 \times 13}{23} = \frac{104}{23} \approx 4.52 \)

4. \( E\_{22} = \frac{8 \times 10}{23} = \frac{80}{23} \approx 3.48 \)

### Chi-Square Test Statistic:

\[ \chi^2 = \sum \frac{(O\_{ij} - E\_{ij})^2}{E\_{ij}} \]

Calculating each term:

1. \( \frac{(11 - 8.48)^2}{8.48} \approx \frac{(2.52)^2}{8.48} \approx \frac{6.35}{8.48} \approx 0.75 \)

2. \( \frac{(4 - 6.52)^2}{6.52} \approx \frac{(-2.52)^2}{6.52} \approx \frac{6.35}{6.52} \approx 0.97 \)

3. \( \frac{(2 - 4.52)^2}{4.52} \approx \frac{(-2.52)^2}{4.52} \approx \frac{6.35}{4.52} \approx 1.41 \)

4. \( \frac{(6 - 3.48)^2}{3.48} \approx \frac{(2.52)^2}{3.48} \approx \frac{6.35}{3.48} \approx 1.83 \)

Summing these values:

\[ \chi^2 = 0.75 + 0.97 + 1.41 + 1.83 = 4.96 \]

### Degrees of Freedom (df):

\[ df = (rows - 1) \times (columns - 1) = (2 - 1) \times (2 - 1) = 1 \]

### Critical Value:

For a typical significance level of \(\alpha = 0.05\), the critical value from the chi-square distribution table with 1 degree of freedom is approximately 3.841.

### Conclusion:

Since our calculated chi-square statistic (4.96) is greater than the critical value (3.841), we reject the null hypothesis that there is no association between exposure to a high cholesterol diet and heart disease.

\*\*Conclusion:\*\* There is a statistically significant association between exposure to a high cholesterol diet and heart disease (χ²(1) = 4.96, p < 0.05). Specifically, individuals on a high cholesterol diet are more likely to have heart disease compared to those on a low cholesterol diet.