# Association Between High Cholesterol Diet and Heart Disease

## Data Analysis

The table presents a 2×2 contingency table examining the association between exposure to high cholesterol diet and heart disease. To properly analyze this relationship, I will perform a chi-square test of independence and calculate the odds ratio.

### Data Summary:

- High cholesterol diet: 11 with heart disease, 4 without heart disease

- Low cholesterol diet: 2 with heart disease, 6 without heart disease

- Total sample size: 23 subjects

## Chi-Square Test of Independence

First, I'll calculate the chi-square statistic to test the null hypothesis that there is no association between diet type and heart disease.

χ² = Σ [(Observed - Expected)²/Expected]

Expected values:

- High cholesterol with heart disease: 15 × 13/23 = 8.48

- High cholesterol without heart disease: 15 × 10/23 = 6.52

- Low cholesterol with heart disease: 8 × 13/23 = 4.52

- Low cholesterol without heart disease: 8 × 10/23 = 3.48

χ² = (11-8.48)²/8.48 + (4-6.52)²/6.52 + (2-4.52)²/4.52 + (6-3.48)²/3.48

χ² = 4.61

With 1 degree of freedom, this chi-square value yields p ≈ 0.032

## Odds Ratio Calculation

Odds ratio = (11×6)/(4×2) = 66/8 = 8.25

This indicates that the odds of heart disease are 8.25 times higher among those with high cholesterol diets compared to those with low cholesterol diets.

## 95% Confidence Interval for Odds Ratio

The 95% CI for the odds ratio can be calculated as:

ln(OR) ± 1.96 × √(1/11 + 1/4 + 1/2 + 1/6)

ln(8.25) ± 1.96 × √(0.091 + 0.25 + 0.5 + 0.167)

2.11 ± 1.96 × 1.01

2.11 ± 1.98

Therefore, 95% CI for OR = (exp(0.13), exp(4.09)) = (1.14, 59.75)

## Fisher's Exact Test

Given the small sample size with expected cell counts less than 5, Fisher's exact test is also appropriate:

p-value = 0.035 (one-tailed)

p-value = 0.049 (two-tailed)

## Conclusion

Based on the chi-square test (p = 0.032) and Fisher's exact test (p = 0.049), there is a statistically significant association between high cholesterol diet and heart disease at the α = 0.05 level. The odds ratio of 8.25 (95% CI: 1.14-59.75) suggests that exposure to a high cholesterol diet is associated with substantially increased odds of heart disease. The confidence interval is quite wide due to the small sample size, but it does not include 1, confirming the statistical significance of this finding.