

# KRUSKAL WALLIS TESTİ





# TEK YÖNLÜ ANOVANIN (ONE WAY ANOVA) PARAMETİK OLMAYAN ALTERNATİFİ

## KRUSKALL WALLIS TESTİ

$$H = \frac{12}{N(N-1)} \sum_{i=1}^k \frac{R_i^2}{n_i} - 3(N+1)$$

# Özellikleri

- İki ya da daha çok örneklem ortalamasının birbirinden manidar bir farklılık gösterip göstermediğinin test edilmesinde kullanılır.
- Tek yönlü varyans analizinin (ANOVA) parametrik olmayan karşılığıdır.
- Sonucun manidar olması durumunda farkın hangi gruplar arasında olduğunu belirlemek amacıyla alt grupların her bir ikili kombinasyonu arasında Mann Whitney U testi uygulanır.

# Varsayımları

- İki temel varsayımı vardır.
- Bağımlı değişken en az sıralama ölçeği düzeyinde olmalıdır.
- Gruplar birbirinden bağımsız olmalıdır.

$$H = \frac{12}{N(N-1)} \sum_{i=1}^k \frac{R_i^2}{n_i} - 3(N+1)$$

| No Soya                      |            | 1 Soya Meal |            | 4 Soya Meals |            | 7 Soya Meals |            |
|------------------------------|------------|-------------|------------|--------------|------------|--------------|------------|
| (Millions)                   | Rank       | (Millions)  | Rank       | (Millions)   | Rank       | (Millions)   | Rank       |
| 0.35                         | 4          | 0.33        | 3          | 0.40         | 6          | 0.31         | 1          |
| 0.58                         | 9          | 0.36        | 5          | 0.60         | 10         | 0.32         | 2          |
| 0.88                         | 17         | 0.63        | 11         | 0.96         | 19         | 0.56         | 7          |
| 0.92                         | 18         | 0.64        | 12         | 1.20         | 21         | 0.57         | 8          |
| 1.22                         | 22         | 0.77        | 14         | 1.31         | 24         | 0.71         | 13         |
| 1.51                         | 30         | 1.53        | 32         | 1.35         | 27         | 0.81         | 15         |
| 1.52                         | 31         | 1.62        | 34         | 1.68         | 35         | 0.87         | 16         |
| 1.57                         | 33         | 1.71        | 36         | 1.83         | 37         | 1.18         | 20         |
| 2.43                         | 41         | 1.94        | 38         | 2.10         | 40         | 1.25         | 23         |
| 2.79                         | 46         | 2.48        | 42         | 2.93         | 48         | 1.33         | 25         |
| 3.40                         | 55         | 2.71        | 44         | 2.96         | 49         | 1.34         | 26         |
| 4.52                         | 59         | 4.12        | 57         | 3.00         | 50         | 1.49         | 28         |
| 4.72                         | 60         | 5.65        | 61         | 3.09         | 52         | 1.50         | 29         |
| 6.90                         | 65         | 6.76        | 64         | 3.36         | 54         | 2.09         | 39         |
| 7.58                         | 68         | 7.08        | 66         | 4.34         | 58         | 2.70         | 43         |
| 7.78                         | 69         | 7.26        | 67         | 5.81         | 62         | 2.75         | 45         |
| 9.62                         | 72         | 7.92        | 70         | 5.94         | 63         | 2.83         | 47         |
| 10.05                        | 73         | 8.04        | 71         | 10.16        | 74         | 3.07         | 51         |
| 10.32                        | 75         | 12.10       | 77         | 10.98        | 76         | 3.28         | 53         |
| 21.08                        | 80         | 18.47       | 79         | 18.21        | 78         | 4.11         | 56         |
| <b>Total (R<sub>p</sub>)</b> | <b>927</b> |             | <b>883</b> |              | <b>883</b> |              | <b>547</b> |

$$H = \frac{12}{N(N-1)} \sum_{i=1}^k \frac{R_i^2}{n_i} - 3(N+1)$$

$$\begin{aligned} H &= \frac{12}{80(81)} \left( \frac{972^2}{20} + \frac{883^2}{20} + \frac{833^2}{20} + \frac{547^2}{20} \right) - 3(81) \\ &= \frac{12}{6480} (42,966.45 + 38,984.45 + 38,984.45 + 14,960.45) - 243 \\ &= 0.0019(135,895.8) - 243 \\ &= 251.66 - 243 \\ &= 8.659 \end{aligned}$$



|            | Number of Soya Meals  | N  | Mean Rank |
|------------|-----------------------|----|-----------|
| (Millions) | No Soya Meals         | 20 | 46.35     |
|            | 1 Soya Meal Per Week  | 20 | 44.15     |
|            | 4 Soya Meals Per Week | 20 | 44.15     |
|            | 7 Soya Meals Per Week | 20 | 27.35     |
|            | Total                 | 80 |           |

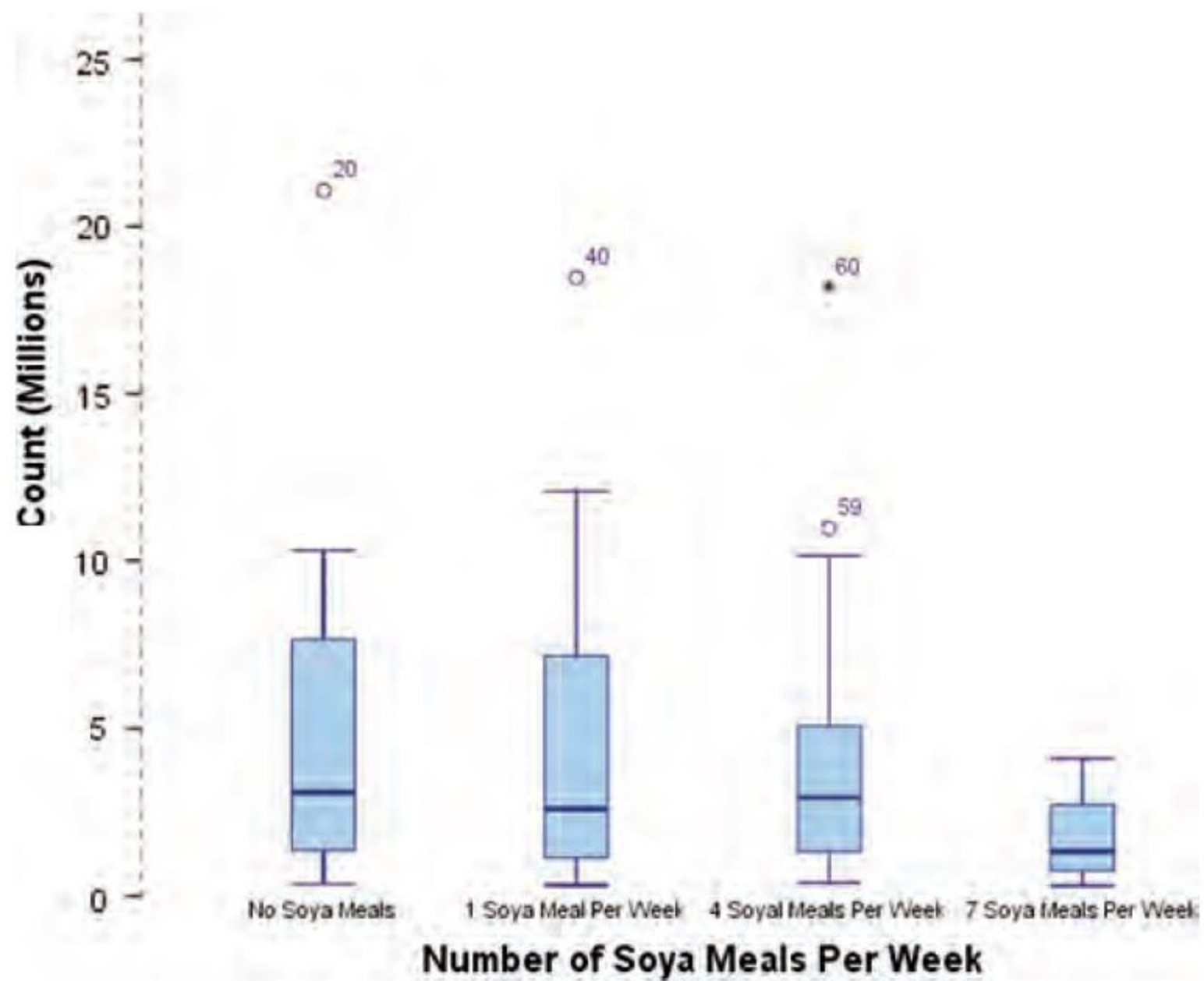
Test Statistics<sup>b,c</sup>

|                  |                         |             | Sperm Count<br>(Millions) |
|------------------|-------------------------|-------------|---------------------------|
| Chi-Square       |                         |             | 8.659                     |
| df               |                         |             | 3                         |
| Asymp. Sig.      |                         |             | .034                      |
| Monte Carlo Sig. | Sig.                    |             | .031 <sup>a</sup>         |
|                  | 99% Confidence Interval | Lower Bound | .027                      |
|                  |                         | Upper Bound | .036                      |

a. Based on 10000 sampled tables with starting seed 2000000.

b. Kruskal Wallis Test

c. Grouping Variable: Number of Soya Meals Per Week



- Test 1: one soya meal per week compared to no soya meals
- Test 2: four soya meals per week compared to no soya meals
- Test 3: seven soya meals per week compared to no soya meals

No Soya vs. 1 Meal per week:

**Test Statistics<sup>b</sup>**

|                                | Sperm Count<br>(Millions) |
|--------------------------------|---------------------------|
| Mann-Whitney U                 | 191.000                   |
| Wilcoxon W                     | 401.000                   |
| Z                              | -.243                     |
| Asymp. Sig. (2-tailed)         | .808                      |
| Exact Sig. [2*(1-tailed Sig.)] | .820 <sup>a</sup>         |

a. Not corrected for ties.

b. Grouping Variable: Number of Soya Meals Per Week

No Soya vs. 4 Meals per week:

**Test Statistics<sup>b</sup>**

|                                | Sperm Count<br>(Millions) |
|--------------------------------|---------------------------|
| Mann-Whitney U                 | 188.000                   |
| Wilcoxon W                     | 398.000                   |
| Z                              | -.325                     |
| Asymp. Sig. (2-tailed)         | .745                      |
| Exact Sig. [2*(1-tailed Sig.)] | .758 <sup>a</sup>         |

a. Not corrected for ties.

b. Grouping Variable: Number of Soya Meals Per Week

No Soya vs. 7 Meals per week:

**Test Statistics<sup>b</sup>**

|                                | Sperm Count<br>(Millions) |
|--------------------------------|---------------------------|
| Mann-Whitney U                 | 104.000                   |
| Wilcoxon W                     | 314.000                   |
| Z                              | -2.597                    |
| Asymp. Sig. (2-tailed)         | .009                      |
| Exact Sig. [2*(1-tailed Sig.)] | .009 <sup>a</sup>         |

a. Not corrected for ties.

b. Grouping Variable: Number of Soya Meals Per Week