

# Biyostatistik

16

Bağımsız Gruplarda  
Varyans Analizi  
(**A**nalysis **o**f **V**ariance = **A**NOVA)

# Varyans Analizi

## (Analysis of Variance = ANOVA)

- Parametrik test niteliklerini taşıyan örneklem gruplarının sayısı ikiden fazla ise Student's-*t* testleri yerine varyans analizi testleri kullanılmalıdır:
  - Tek yönlü varyans analizi (One-Way ANOVA) (bağımsız gruplarda kullanılır),
  - İki yönlü varyans analizi,
  - Çok faktörlü denemelerin varyans analizi,
  - Tekrarlayan ölçümlerde varyans analizi (bağımlı gruplarda kullanılır).

# Tek yönlü varyans analizi (ANOVA)

- Örnek:
  - X bitkisinden elde edilen uçucu yağ ekstresinin sıçanlarda karbon tetra klorürle (CCl<sub>4</sub>) oluşturulmuş akut karaciğer toksisitesi üzerine koruyucu etkisinin olup olmadığını AST ve ALT enzimleri (değişkenleri) yönünden araştırınız.

# Tek yönlü varyans analizi (ANOVA)

- **Kullanılacak istatistik yönteminin bulunması:**
  - Ölçüm şekli: **sayısal**,
    - Denek sayısı 20'nin altında olduğu için One-Sample Kolmogorov-Smirnov testi uygulandı;  $p > 0.05$  bulunduğu için verilerin normal dağılım gösterdiği kabul edildi..
  - Çalışma gruplarının bağımlı-bağımsız olması durumu:
    - **Bağımsız gruplar.**
  - Grup sayısı: **İkiden fazla grup.**

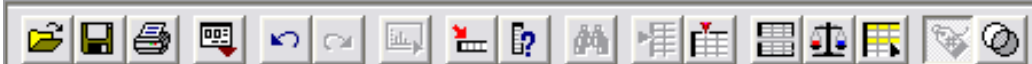
Kullanılacak test: **Bağımsız gruplarda tek yönlü varyans analizi (One-way ANOVA)**

## Çalışmanın Gruplarının Belirlenmesi (n=7)

- 1. Grup: SF (serum fizyolojik),
- 2. Grup: Olive oil (zeytin yağı),
- 3. Grup: EtOh (Etil alkol),
- 4. Grup: CCl<sub>4</sub>,
- 5. Grup: CCl<sub>4</sub>+Silibinin,
- 6. Grup: 0.25 mL/kg ekstre+CCl<sub>4</sub>,
- 7. Grup: 0.50 mL/kg ekstre+CCl<sub>4</sub>,
- 8. Grup: 1.00 mL/kg ekstre+CCl<sub>4</sub>.

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|    | Name | Type    | Width | Decimals | Label | Values          | Missing | Columns | Align | Measure |
|----|------|---------|-------|----------|-------|-----------------|---------|---------|-------|---------|
| 1  | grup | Numeric | 8     | 2        |       | {1,00, SF (seru | None    | 8       | Right | Scale   |
| 2  | ast  | Numeric | 8     | 2        |       | None            | None    | 8       | Right | Scale   |
| 3  | alt  | Numeric | 8     | 2        |       | None            | None    | 8       | Right | Scale   |
| 4  |      |         |       |          |       |                 |         |         |       |         |
| 5  |      |         |       |          |       |                 |         |         |       |         |
| 6  |      |         |       |          |       |                 |         |         |       |         |
| 7  |      |         |       |          |       |                 |         |         |       |         |
| 8  |      |         |       |          |       |                 |         |         |       |         |
| 9  |      |         |       |          |       |                 |         |         |       |         |
| 10 |      |         |       |          |       |                 |         |         |       |         |
| 11 |      |         |       |          |       |                 |         |         |       |         |
| 12 |      |         |       |          |       |                 |         |         |       |         |
| 13 |      |         |       |          |       |                 |         |         |       |         |
| 14 |      |         |       |          |       |                 |         |         |       |         |
| 15 |      |         |       |          |       |                 |         |         |       |         |
| 16 |      |         |       |          |       |                 |         |         |       |         |
| 17 |      |         |       |          |       |                 |         |         |       |         |
| 18 |      |         |       |          |       |                 |         |         |       |         |
| 19 |      |         |       |          |       |                 |         |         |       |         |
| 20 |      |         |       |          |       |                 |         |         |       |         |
| 21 |      |         |       |          |       |                 |         |         |       |         |
| 22 |      |         |       |          |       |                 |         |         |       |         |
| 23 |      |         |       |          |       |                 |         |         |       |         |
| 24 |      |         |       |          |       |                 |         |         |       |         |
| 25 |      |         |       |          |       |                 |         |         |       |         |
| 26 |      |         |       |          |       |                 |         |         |       |         |
| 27 |      |         |       |          |       |                 |         |         |       |         |
| 28 |      |         |       |          |       |                 |         |         |       |         |

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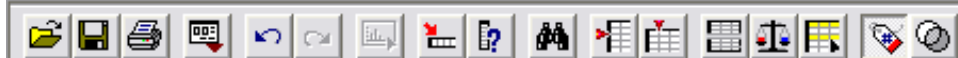
1 : grup

|    | grup | ast | alt | var | var | var | var | var | var | var | v |
|----|------|-----|-----|-----|-----|-----|-----|-----|-----|-----|---|
| 1  |      |     |     |     |     |     |     |     |     |     |   |
| 2  |      |     |     |     |     |     |     |     |     |     |   |
| 3  |      |     |     |     |     |     |     |     |     |     |   |
| 4  |      |     |     |     |     |     |     |     |     |     |   |
| 5  |      |     |     |     |     |     |     |     |     |     |   |
| 6  |      |     |     |     |     |     |     |     |     |     |   |
| 7  |      |     |     |     |     |     |     |     |     |     |   |
| 8  |      |     |     |     |     |     |     |     |     |     |   |
| 9  |      |     |     |     |     |     |     |     |     |     |   |
| 10 |      |     |     |     |     |     |     |     |     |     |   |
| 11 |      |     |     |     |     |     |     |     |     |     |   |
| 12 |      |     |     |     |     |     |     |     |     |     |   |
| 13 |      |     |     |     |     |     |     |     |     |     |   |
| 14 |      |     |     |     |     |     |     |     |     |     |   |
| 15 |      |     |     |     |     |     |     |     |     |     |   |
| 16 |      |     |     |     |     |     |     |     |     |     |   |
| 17 |      |     |     |     |     |     |     |     |     |     |   |
| 18 |      |     |     |     |     |     |     |     |     |     |   |
| 19 |      |     |     |     |     |     |     |     |     |     |   |
| 20 |      |     |     |     |     |     |     |     |     |     |   |
| 21 |      |     |     |     |     |     |     |     |     |     |   |
| 22 |      |     |     |     |     |     |     |     |     |     |   |
| 23 |      |     |     |     |     |     |     |     |     |     |   |
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| 25 |      |     |     |     |     |     |     |     |     |     |   |



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| 1 : grup |               | 1      |         |     |     |     |     |     |     |     |     |     |
|----------|---------------|--------|---------|-----|-----|-----|-----|-----|-----|-----|-----|-----|
|          | grup          | ast    | alt     | var | var | var | var | var | var | var | var | var |
| 1        | SF (seru      | 68,00  | 34,00   |     |     |     |     |     |     |     |     |     |
| 2        | SF (serum     | 76,00  | 41,00   |     |     |     |     |     |     |     |     |     |
| 3        | SF (serum     | 56,00  | 40,00   |     |     |     |     |     |     |     |     |     |
| 4        | SF (serum     | 89,00  | 39,00   |     |     |     |     |     |     |     |     |     |
| 5        | SF (serum     | 78,00  | 28,00   |     |     |     |     |     |     |     |     |     |
| 6        | SF (serum     | 65,00  | 32,00   |     |     |     |     |     |     |     |     |     |
| 7        | SF (serum     | 69,00  | 56,00   |     |     |     |     |     |     |     |     |     |
| 8        | Olive oil (ze | 75,00  | 45,00   |     |     |     |     |     |     |     |     |     |
| 9        | Olive oil (ze | 77,00  | 43,00   |     |     |     |     |     |     |     |     |     |
| 10       | Olive oil (ze | 88,00  | 50,00   |     |     |     |     |     |     |     |     |     |
| 11       | Olive oil (ze | 68,00  | 22,00   |     |     |     |     |     |     |     |     |     |
| 12       | Olive oil (ze | 64,00  | 54,00   |     |     |     |     |     |     |     |     |     |
| 13       | Olive oil (ze | 83,00  | 29,00   |     |     |     |     |     |     |     |     |     |
| 14       | Olive oil (ze | 90,00  | 33,00   |     |     |     |     |     |     |     |     |     |
| 15       | Etil alkol    | 66,00  | 45,00   |     |     |     |     |     |     |     |     |     |
| 16       | Etil alkol    | 56,00  | 56,00   |     |     |     |     |     |     |     |     |     |
| 17       | Etil alkol    | 47,00  | 54,00   |     |     |     |     |     |     |     |     |     |
| 18       | Etil alkol    | 89,00  | 53,00   |     |     |     |     |     |     |     |     |     |
| 19       | Etil alkol    | 92,00  | 50,00   |     |     |     |     |     |     |     |     |     |
| 20       | Etil alkol    | 90,00  | 67,00   |     |     |     |     |     |     |     |     |     |
| 21       | Etil alkol    | 88,00  | 70,00   |     |     |     |     |     |     |     |     |     |
| 22       | CCI4          | 956,00 | 1554,00 |     |     |     |     |     |     |     |     |     |
| 23       | CCI4          | 978,00 | 1600,00 |     |     |     |     |     |     |     |     |     |
| 24       | CCI4          | 875,00 | 1764,00 |     |     |     |     |     |     |     |     |     |
| 25       | CCI4          | 679,00 | 990,00  |     |     |     |     |     |     |     |     |     |
| 26       | CCI4          | 800,00 | 900,00  |     |     |     |     |     |     |     |     |     |
| 27       | CCI4          | 783,00 | 1423,00 |     |     |     |     |     |     |     |     |     |
| 28       | CCI4          | 882,00 | 1209,00 |     |     |     |     |     |     |     |     |     |
| 29       | CCI4+Silibi   | 453,00 | 354,00  |     |     |     |     |     |     |     |     |     |

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1 : grup 1

|    | grup          | ast    | alt     | var | var | var | var | var | var | var | var | var |
|----|---------------|--------|---------|-----|-----|-----|-----|-----|-----|-----|-----|-----|
| 1  | SF (seru      | 68,00  | 34,00   |     |     |     |     |     |     |     |     |     |
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1 : grup 1

1 : grup 1

|    | grup          | ast    |         | var | var | var | var |
|----|---------------|--------|---------|-----|-----|-----|-----|
| 1  | SF (seru      | 68,0   |         |     |     |     |     |
| 2  | SF (serum     | 76,0   |         |     |     |     |     |
| 3  | SF (serum     | 56,0   |         |     |     |     |     |
| 4  | SF (serum     | 89,0   |         |     |     |     |     |
| 5  | SF (serum     | 78,0   |         |     |     |     |     |
| 6  | SF (serum     | 65,0   |         |     |     |     |     |
| 7  | SF (serum     | 69,0   |         |     |     |     |     |
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| 15 | Etil alkohol  | 66,00  | 45,00   |     |     |     |     |
| 16 | Etil alkohol  | 56,00  | 56,00   |     |     |     |     |
| 17 | Etil alkohol  | 47,00  | 54,00   |     |     |     |     |
| 18 | Etil alkohol  | 89,00  | 53,00   |     |     |     |     |
| 19 | Etil alkohol  | 92,00  | 50,00   |     |     |     |     |
| 20 | Etil alkohol  | 90,00  | 67,00   |     |     |     |     |
| 21 | Etil alkohol  | 88,00  | 70,00   |     |     |     |     |
| 22 | CCI4          | 956,00 | 1554,00 |     |     |     |     |
| 23 | CCI4          | 978,00 | 1600,00 |     |     |     |     |
| 24 | CCI4          | 875,00 | 1764,00 |     |     |     |     |
| 25 | CCI4          | 679,00 | 990,00  |     |     |     |     |
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Reports  
 Descriptive Statistics  
 Tables  
**Compare Means**  
 General Linear Model  
 Correlate  
 Regression  
 Classify  
 Data Reduction  
 Scale  
 Nonparametric Tests  
 Time Series  
 Multiple Response  
 Missing Value Analysis...

Means...  
 One-Sample T Test...  
 Independent-Samples T Test...  
 Paired-Samples T Test...  
**One-Way ANOVA...**

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1 : grup 1

|    | grup        | ast    | alt     | var | var | var | var | var | var | var | var | var | var |
|----|-------------|--------|---------|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
| 1  | SF (seru    | 68,00  | 34,00   |     |     |     |     |     |     |     |     |     |     |
| 2  | SF (ser     |        |         |     |     |     |     |     |     |     |     |     |     |
| 3  | SF (ser     |        |         |     |     |     |     |     |     |     |     |     |     |
| 4  | SF (ser     |        |         |     |     |     |     |     |     |     |     |     |     |
| 5  | SF (ser     |        |         |     |     |     |     |     |     |     |     |     |     |
| 6  | SF (ser     |        |         |     |     |     |     |     |     |     |     |     |     |
| 7  | SF (ser     |        |         |     |     |     |     |     |     |     |     |     |     |
| 8  | Olive oi    |        |         |     |     |     |     |     |     |     |     |     |     |
| 9  | Olive oi    |        |         |     |     |     |     |     |     |     |     |     |     |
| 10 | Olive oi    |        |         |     |     |     |     |     |     |     |     |     |     |
| 11 | Olive oi    |        |         |     |     |     |     |     |     |     |     |     |     |
| 12 | Olive oi    |        |         |     |     |     |     |     |     |     |     |     |     |
| 13 | Olive oi    |        |         |     |     |     |     |     |     |     |     |     |     |
| 14 | Olive oi    |        |         |     |     |     |     |     |     |     |     |     |     |
| 15 | Etil a      |        |         |     |     |     |     |     |     |     |     |     |     |
| 16 | Etil a      |        |         |     |     |     |     |     |     |     |     |     |     |
| 17 | Etil alkol  | 47,00  | 54,00   |     |     |     |     |     |     |     |     |     |     |
| 18 | Etil alkol  | 89,00  | 53,00   |     |     |     |     |     |     |     |     |     |     |
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| 28 | CCI4        | 882,00 | 1209,00 |     |     |     |     |     |     |     |     |     |     |
| 29 | CCI4+Silibi | 453,00 | 354,00  |     |     |     |     |     |     |     |     |     |     |
| 30 | CCI4+Silibi | 466,00 | 333,00  |     |     |     |     |     |     |     |     |     |     |
| 31 | CCI4+Silibi | 243,00 | 245,00  |     |     |     |     |     |     |     |     |     |     |
| 32 | CCI4+Silibi | 254,00 | 543,00  |     |     |     |     |     |     |     |     |     |     |
| 33 | CCI4+Silibi | 231,00 | 378,00  |     |     |     |     |     |     |     |     |     |     |

**One-Way ANOVA**

Dependent List:

Factor:

Contrasts... Post Hoc... Options...

OK Paste Reset Cancel Help

SPSS Data Editor window titled "Untitled - SPSS Data Editor". The menu bar includes File, Edit, View, Data, Transform, Analyze, Graphs, Utilities, Window, and Help. The toolbar contains icons for file operations, editing, and analysis. The data grid shows a variable named "grup" with a value of 1 in the first row. The dependent variables are "ast" and "alt".

|    | grup         | ast    | alt     | var | var | var | var | var | var | var | var |
|----|--------------|--------|---------|-----|-----|-----|-----|-----|-----|-----|-----|
| 1  | SF (seru     | 68,00  | 34,00   |     |     |     |     |     |     |     |     |
| 2  | SF (ser      |        |         |     |     |     |     |     |     |     |     |
| 3  | SF (ser      |        |         |     |     |     |     |     |     |     |     |
| 4  | SF (ser      |        |         |     |     |     |     |     |     |     |     |
| 5  | SF (ser      |        |         |     |     |     |     |     |     |     |     |
| 6  | SF (ser      |        |         |     |     |     |     |     |     |     |     |
| 7  | SF (ser      |        |         |     |     |     |     |     |     |     |     |
| 8  | Olive oi     |        |         |     |     |     |     |     |     |     |     |
| 9  | Olive oi     |        |         |     |     |     |     |     |     |     |     |
| 10 | Olive oi     |        |         |     |     |     |     |     |     |     |     |
| 11 | Olive oi     |        |         |     |     |     |     |     |     |     |     |
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| 15 | Etil a       |        |         |     |     |     |     |     |     |     |     |
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| 20 | Etil alkohol | 90,00  | 67,00   |     |     |     |     |     |     |     |     |
| 21 | Etil alkohol | 88,00  | 70,00   |     |     |     |     |     |     |     |     |
| 22 | CCI4         | 956,00 | 1554,00 |     |     |     |     |     |     |     |     |
| 23 | CCI4         | 978,00 | 1600,00 |     |     |     |     |     |     |     |     |
| 24 | CCI4         | 875,00 | 1764,00 |     |     |     |     |     |     |     |     |
| 25 | CCI4         | 679,00 | 990,00  |     |     |     |     |     |     |     |     |
| 26 | CCI4         | 800,00 | 900,00  |     |     |     |     |     |     |     |     |
| 27 | CCI4         | 783,00 | 1423,00 |     |     |     |     |     |     |     |     |

The "One-Way ANOVA" dialog box is open, showing the following configuration:

- Dependent List: ast, alt
- Factor: grup
- Buttons: OK, Paste, Reset, Cancel, Help, Contrasts..., Post Hoc..., Options...

The "Options..." button is highlighted with a red rectangle.

Untitled - SPSS Data Editor

File Edit View Data Transform Analyze Graphs Utilities Window Help

1 : grup 1

|    | grup        | ast    | alt     | var | var | var | var | var | var | var | var | var | var | var |
|----|-------------|--------|---------|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
| 1  | SF (seru    | 68,00  | 34,00   |     |     |     |     |     |     |     |     |     |     |     |
| 2  | SF (seru    |        |         |     |     |     |     |     |     |     |     |     |     |     |
| 3  | SF (seru    |        |         |     |     |     |     |     |     |     |     |     |     |     |
| 4  | SF (seru    |        |         |     |     |     |     |     |     |     |     |     |     |     |
| 5  | SF (seru    |        |         |     |     |     |     |     |     |     |     |     |     |     |
| 6  | SF (seru    |        |         |     |     |     |     |     |     |     |     |     |     |     |
| 7  | SF (seru    |        |         |     |     |     |     |     |     |     |     |     |     |     |
| 8  | Olive oi    |        |         |     |     |     |     |     |     |     |     |     |     |     |
| 9  | Olive oi    |        |         |     |     |     |     |     |     |     |     |     |     |     |
| 10 | Olive oi    |        |         |     |     |     |     |     |     |     |     |     |     |     |
| 11 | Olive oi    |        |         |     |     |     |     |     |     |     |     |     |     |     |
| 12 | Olive oi    |        |         |     |     |     |     |     |     |     |     |     |     |     |
| 13 | Olive oi    |        |         |     |     |     |     |     |     |     |     |     |     |     |
| 14 | Olive oi    |        |         |     |     |     |     |     |     |     |     |     |     |     |
| 15 | Etil a      |        |         |     |     |     |     |     |     |     |     |     |     |     |
| 16 | Etil a      |        |         |     |     |     |     |     |     |     |     |     |     |     |
| 17 | Etil a      | 47,00  |         |     |     |     |     |     |     |     |     |     |     |     |
| 18 | Etil alkol  | 89,00  |         |     |     |     |     |     |     |     |     |     |     |     |
| 19 | Etil alkol  | 92,00  |         |     |     |     |     |     |     |     |     |     |     |     |
| 20 | Etil alkol  | 90,00  |         |     |     |     |     |     |     |     |     |     |     |     |
| 21 | Etil alkol  | 88,00  |         |     |     |     |     |     |     |     |     |     |     |     |
| 22 | CCI4        | 956,00 |         |     |     |     |     |     |     |     |     |     |     |     |
| 23 | CCI4        | 978,00 |         |     |     |     |     |     |     |     |     |     |     |     |
| 24 | CCI4        | 875,00 | 1764,00 |     |     |     |     |     |     |     |     |     |     |     |
| 25 | CCI4        | 679,00 | 990,00  |     |     |     |     |     |     |     |     |     |     |     |
| 26 | CCI4        | 800,00 | 900,00  |     |     |     |     |     |     |     |     |     |     |     |
| 27 | CCI4        | 783,00 | 1423,00 |     |     |     |     |     |     |     |     |     |     |     |
| 28 | CCI4        | 882,00 | 1209,00 |     |     |     |     |     |     |     |     |     |     |     |
| 29 | CCI4+Silibi | 453,00 | 354,00  |     |     |     |     |     |     |     |     |     |     |     |
| 30 | CCI4+Silibi | 466,00 | 333,00  |     |     |     |     |     |     |     |     |     |     |     |
| 31 | CCI4+Silibi | 243,00 | 245,00  |     |     |     |     |     |     |     |     |     |     |     |
| 32 | CCI4+Silibi | 254,00 | 543,00  |     |     |     |     |     |     |     |     |     |     |     |
| 33 | CCI4+Silibi | 231,00 | 378,00  |     |     |     |     |     |     |     |     |     |     |     |
| 34 | CCI4+Silibi | 328,00 | 465,00  |     |     |     |     |     |     |     |     |     |     |     |
| 35 | CCI4+Silibi | 330,00 | 446,00  |     |     |     |     |     |     |     |     |     |     |     |

One-Way ANOVA

Dependent List:  
ast  
alt

One-Way ANOVA: Options

Statistics

- Descriptive
- Fixed and random effects
- Homogeneity of variance test
- Brown-Forsythe
- Welch

Means plot

Missing Values

- Exclude cases analysis by analysis
- Exclude cases listwise

SPSS Processor is ready

14

23:38

Untitled - SPSS Data Editor

File Edit View Data Transform Analyze Graphs Utilities Window Help

1 : grup 1

|    | grup        | ast    | alt     | var | var | var | var | var | var | var | var | var | var | var |
|----|-------------|--------|---------|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
| 1  | SF (seru    | 68,00  | 34,00   |     |     |     |     |     |     |     |     |     |     |     |
| 2  | SF (seru    |        |         |     |     |     |     |     |     |     |     |     |     |     |
| 3  | SF (seru    |        |         |     |     |     |     |     |     |     |     |     |     |     |
| 4  | SF (seru    |        |         |     |     |     |     |     |     |     |     |     |     |     |
| 5  | SF (seru    |        |         |     |     |     |     |     |     |     |     |     |     |     |
| 6  | SF (seru    |        |         |     |     |     |     |     |     |     |     |     |     |     |
| 7  | SF (seru    |        |         |     |     |     |     |     |     |     |     |     |     |     |
| 8  | Olive oi    |        |         |     |     |     |     |     |     |     |     |     |     |     |
| 9  | Olive oi    |        |         |     |     |     |     |     |     |     |     |     |     |     |
| 10 | Olive oi    |        |         |     |     |     |     |     |     |     |     |     |     |     |
| 11 | Olive oi    |        |         |     |     |     |     |     |     |     |     |     |     |     |
| 12 | Olive oi    |        |         |     |     |     |     |     |     |     |     |     |     |     |
| 13 | Olive oi    |        |         |     |     |     |     |     |     |     |     |     |     |     |
| 14 | Olive oi    |        |         |     |     |     |     |     |     |     |     |     |     |     |
| 15 | Etil a      |        |         |     |     |     |     |     |     |     |     |     |     |     |
| 16 | Etil a      |        |         |     |     |     |     |     |     |     |     |     |     |     |
| 17 | Etil aiki   | 47,00  |         |     |     |     |     |     |     |     |     |     |     |     |
| 18 | Etil alkol  | 89,00  |         |     |     |     |     |     |     |     |     |     |     |     |
| 19 | Etil alkol  | 92,00  |         |     |     |     |     |     |     |     |     |     |     |     |
| 20 | Etil alkol  | 90,00  |         |     |     |     |     |     |     |     |     |     |     |     |
| 21 | Etil alkol  | 88,00  |         |     |     |     |     |     |     |     |     |     |     |     |
| 22 | CCI4        | 956,00 |         |     |     |     |     |     |     |     |     |     |     |     |
| 23 | CCI4        | 978,00 |         |     |     |     |     |     |     |     |     |     |     |     |
| 24 | CCI4        | 875,00 | 1764,00 |     |     |     |     |     |     |     |     |     |     |     |
| 25 | CCI4        | 679,00 | 990,00  |     |     |     |     |     |     |     |     |     |     |     |
| 26 | CCI4        | 800,00 | 900,00  |     |     |     |     |     |     |     |     |     |     |     |
| 27 | CCI4        | 783,00 | 1423,00 |     |     |     |     |     |     |     |     |     |     |     |
| 28 | CCI4        | 882,00 | 1209,00 |     |     |     |     |     |     |     |     |     |     |     |
| 29 | CCI4+Silibi | 453,00 | 354,00  |     |     |     |     |     |     |     |     |     |     |     |
| 30 | CCI4+Silibi | 466,00 | 333,00  |     |     |     |     |     |     |     |     |     |     |     |
| 31 | CCI4+Silibi | 243,00 | 245,00  |     |     |     |     |     |     |     |     |     |     |     |
| 32 | CCI4+Silibi | 254,00 | 543,00  |     |     |     |     |     |     |     |     |     |     |     |
| 33 | CCI4+Silibi | 231,00 | 378,00  |     |     |     |     |     |     |     |     |     |     |     |
| 34 | CCI4+Silibi | 328,00 | 465,00  |     |     |     |     |     |     |     |     |     |     |     |
| 35 | CCI4+Silibi | 330,00 | 446,00  |     |     |     |     |     |     |     |     |     |     |     |

One-Way ANOVA

Dependent List:  
ast  
alt

One-Way ANOVA: Options

Statistics

- Descriptive
- Fixed and random effects
- Homogeneity of variance test
- Brown-Forsythe
- Welch

Means plot

- Means plot

Missing Values

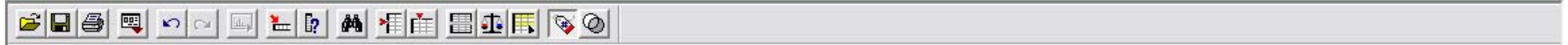
- Exclude cases analysis by analysis
- Exclude cases listwise

Buttons: Continue, Cancel, Help

SPSS Processor is ready

15

23:38



1 : grup 1

|    | grup        | ast    | alt     | var | var | var | var | var | var | var | var | var | var | var |
|----|-------------|--------|---------|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
| 1  | SF (seru    | 68,00  | 34,00   |     |     |     |     |     |     |     |     |     |     |     |
| 2  | SF (ser     |        |         |     |     |     |     |     |     |     |     |     |     |     |
| 3  | SF (ser     |        |         |     |     |     |     |     |     |     |     |     |     |     |
| 4  | SF (ser     |        |         |     |     |     |     |     |     |     |     |     |     |     |
| 5  | SF (ser     |        |         |     |     |     |     |     |     |     |     |     |     |     |
| 6  | SF (ser     |        |         |     |     |     |     |     |     |     |     |     |     |     |
| 7  | SF (ser     |        |         |     |     |     |     |     |     |     |     |     |     |     |
| 8  | Olive oi    |        |         |     |     |     |     |     |     |     |     |     |     |     |
| 9  | Olive oi    |        |         |     |     |     |     |     |     |     |     |     |     |     |
| 10 | Olive oi    |        |         |     |     |     |     |     |     |     |     |     |     |     |
| 11 | Olive oi    |        |         |     |     |     |     |     |     |     |     |     |     |     |
| 12 | Olive oi    |        |         |     |     |     |     |     |     |     |     |     |     |     |
| 13 | Olive oi    |        |         |     |     |     |     |     |     |     |     |     |     |     |
| 14 | Olive oi    |        |         |     |     |     |     |     |     |     |     |     |     |     |
| 15 | Etil a      |        |         |     |     |     |     |     |     |     |     |     |     |     |
| 16 | Etil a      |        |         |     |     |     |     |     |     |     |     |     |     |     |
| 17 | Etil alkol  | 47,00  | 54,00   |     |     |     |     |     |     |     |     |     |     |     |
| 18 | Etil alkol  | 89,00  | 53,00   |     |     |     |     |     |     |     |     |     |     |     |
| 19 | Etil alkol  | 92,00  | 50,00   |     |     |     |     |     |     |     |     |     |     |     |
| 20 | Etil alkol  | 90,00  | 67,00   |     |     |     |     |     |     |     |     |     |     |     |
| 21 | Etil alkol  | 88,00  | 70,00   |     |     |     |     |     |     |     |     |     |     |     |
| 22 | CCI4        | 956,00 | 1554,00 |     |     |     |     |     |     |     |     |     |     |     |
| 23 | CCI4        | 978,00 | 1600,00 |     |     |     |     |     |     |     |     |     |     |     |
| 24 | CCI4        | 875,00 | 1764,00 |     |     |     |     |     |     |     |     |     |     |     |
| 25 | CCI4        | 679,00 | 990,00  |     |     |     |     |     |     |     |     |     |     |     |
| 26 | CCI4        | 800,00 | 900,00  |     |     |     |     |     |     |     |     |     |     |     |
| 27 | CCI4        | 783,00 | 1423,00 |     |     |     |     |     |     |     |     |     |     |     |
| 28 | CCI4        | 882,00 | 1209,00 |     |     |     |     |     |     |     |     |     |     |     |
| 29 | CCI4+Silibi | 453,00 | 354,00  |     |     |     |     |     |     |     |     |     |     |     |
| 30 | CCI4+Silibi | 466,00 | 333,00  |     |     |     |     |     |     |     |     |     |     |     |
| 31 | CCI4+Silibi | 243,00 | 245,00  |     |     |     |     |     |     |     |     |     |     |     |
| 32 | CCI4+Silibi | 254,00 | 543,00  |     |     |     |     |     |     |     |     |     |     |     |
| 33 | CCI4+Silibi | 231,00 | 378,00  |     |     |     |     |     |     |     |     |     |     |     |
| 34 | CCI4+Silibi | 328,00 | 465,00  |     |     |     |     |     |     |     |     |     |     |     |
| 35 | CCI4+Silibi | 330,00 | 446,00  |     |     |     |     |     |     |     |     |     |     |     |

**One-Way ANOVA**

Dependent List:  
\* ast  
\* alt

Factor:  
\* grup

OK  
Paste  
Reset  
Cancel  
Help

Contrasts... **Post Hoc...** Options...



Untitled - SPSS Data Editor

File Edit View Data Transform Analyze Graphs Utilities Window Help

1 : grup 1

|    | grup        | ast    | alt     | var | var | var | var | var | var | var | var | var | var | var |
|----|-------------|--------|---------|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
| 1  | SF (seru    | 68,00  | 34,00   |     |     |     |     |     |     |     |     |     |     |     |
| 2  | SF (seru    |        |         |     |     |     |     |     |     |     |     |     |     |     |
| 3  | SF (seru    |        |         |     |     |     |     |     |     |     |     |     |     |     |
| 4  | SF (seru    |        |         |     |     |     |     |     |     |     |     |     |     |     |
| 5  | SF (seru    |        |         |     |     |     |     |     |     |     |     |     |     |     |
| 6  | SF (seru    |        |         |     |     |     |     |     |     |     |     |     |     |     |
| 7  | SF (seru    |        |         |     |     |     |     |     |     |     |     |     |     |     |
| 8  | Olive oi    |        |         |     |     |     |     |     |     |     |     |     |     |     |
| 9  | Olive oi    |        |         |     |     |     |     |     |     |     |     |     |     |     |
| 10 | Olive oi    |        |         |     |     |     |     |     |     |     |     |     |     |     |
| 11 | Olive oi    |        |         |     |     |     |     |     |     |     |     |     |     |     |
| 12 | Olive oi    |        |         |     |     |     |     |     |     |     |     |     |     |     |
| 13 | Olive oi    |        |         |     |     |     |     |     |     |     |     |     |     |     |
| 14 | Olive oi    |        |         |     |     |     |     |     |     |     |     |     |     |     |
| 15 | Etil a      |        |         |     |     |     |     |     |     |     |     |     |     |     |
| 16 | Etil a      |        |         |     |     |     |     |     |     |     |     |     |     |     |
| 17 | Etil a      |        |         |     |     |     |     |     |     |     |     |     |     |     |
| 18 | Etil a      |        |         |     |     |     |     |     |     |     |     |     |     |     |
| 19 | Etil a      |        |         |     |     |     |     |     |     |     |     |     |     |     |
| 20 | Etil a      |        |         |     |     |     |     |     |     |     |     |     |     |     |
| 21 | Etil a      |        |         |     |     |     |     |     |     |     |     |     |     |     |
| 22 | CCI4        | 978,00 | 1600,00 |     |     |     |     |     |     |     |     |     |     |     |
| 23 | CCI4        | 875,00 | 1764,00 |     |     |     |     |     |     |     |     |     |     |     |
| 24 | CCI4        | 679,00 | 990,00  |     |     |     |     |     |     |     |     |     |     |     |
| 25 | CCI4        | 800,00 | 900,00  |     |     |     |     |     |     |     |     |     |     |     |
| 26 | CCI4        | 783,00 | 1423,00 |     |     |     |     |     |     |     |     |     |     |     |
| 27 | CCI4        | 882,00 | 1209,00 |     |     |     |     |     |     |     |     |     |     |     |
| 28 | CCI4        | 453,00 | 354,00  |     |     |     |     |     |     |     |     |     |     |     |
| 29 | CCI4+Silibi | 466,00 | 333,00  |     |     |     |     |     |     |     |     |     |     |     |
| 30 | CCI4+Silibi | 243,00 | 245,00  |     |     |     |     |     |     |     |     |     |     |     |
| 31 | CCI4+Silibi | 254,00 | 543,00  |     |     |     |     |     |     |     |     |     |     |     |
| 32 | CCI4+Silibi | 231,00 | 378,00  |     |     |     |     |     |     |     |     |     |     |     |
| 33 | CCI4+Silibi | 328,00 | 465,00  |     |     |     |     |     |     |     |     |     |     |     |
| 34 | CCI4+Silibi | 330,00 | 446,00  |     |     |     |     |     |     |     |     |     |     |     |
| 35 | CCI4+Silibi |        |         |     |     |     |     |     |     |     |     |     |     |     |

One-Way ANOVA

One-Way ANOVA: Post Hoc Multiple Comparisons

Equal Variances Assumed

- LSD
- Bonferroni
- Sidak
- Scheffe
- R-E-G-W F
- R-E-G-W Q
- S-N-K
- Tukey
- Tukey's-b
- Duncan
- Hochberg's GT2
- Gabriel
- Waller-Duncan
- Dunnett

Type I/Type II Error Ratio: 100

Control Category: Last

Test:  2-sided  < Control  > Control

Equal Variances Not Assumed

- Tamhane's T2
- Dunnett's T3
- Games-Howell
- Dunnett's C

Significance level: .05

Continue Cancel Help

Data View Variable View

SPSS Processor is ready

Microsoft PowerPoint ...

Untitled - SPSS Data ...

23:40

Untitled - SPSS Data Editor

File Edit View Data Transform Analyze Graphs Utilities Window Help

1 : grup 1

|    | grup        | ast    | alt     | var | var | var | var | var | var | var | var | var | var | var |
|----|-------------|--------|---------|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
| 1  | SF (seru    | 68,00  | 34,00   |     |     |     |     |     |     |     |     |     |     |     |
| 2  | SF (seru    |        |         |     |     |     |     |     |     |     |     |     |     |     |
| 3  | SF (seru    |        |         |     |     |     |     |     |     |     |     |     |     |     |
| 4  | SF (seru    |        |         |     |     |     |     |     |     |     |     |     |     |     |
| 5  | SF (seru    |        |         |     |     |     |     |     |     |     |     |     |     |     |
| 6  | SF (seru    |        |         |     |     |     |     |     |     |     |     |     |     |     |
| 7  | SF (seru    |        |         |     |     |     |     |     |     |     |     |     |     |     |
| 8  | Olive oi    |        |         |     |     |     |     |     |     |     |     |     |     |     |
| 9  | Olive oi    |        |         |     |     |     |     |     |     |     |     |     |     |     |
| 10 | Olive oi    |        |         |     |     |     |     |     |     |     |     |     |     |     |
| 11 | Olive oi    |        |         |     |     |     |     |     |     |     |     |     |     |     |
| 12 | Olive oi    |        |         |     |     |     |     |     |     |     |     |     |     |     |
| 13 | Olive oi    |        |         |     |     |     |     |     |     |     |     |     |     |     |
| 14 | Olive oi    |        |         |     |     |     |     |     |     |     |     |     |     |     |
| 15 | Etil a      |        |         |     |     |     |     |     |     |     |     |     |     |     |
| 16 | Etil a      |        |         |     |     |     |     |     |     |     |     |     |     |     |
| 17 | Etil alk    |        |         |     |     |     |     |     |     |     |     |     |     |     |
| 18 | Etil alk    |        |         |     |     |     |     |     |     |     |     |     |     |     |
| 19 | Etil alk    |        |         |     |     |     |     |     |     |     |     |     |     |     |
| 20 | Etil alk    |        |         |     |     |     |     |     |     |     |     |     |     |     |
| 21 | Etil alk    |        |         |     |     |     |     |     |     |     |     |     |     |     |
| 22 | CCI4        | 938,00 | 1334,00 |     |     |     |     |     |     |     |     |     |     |     |
| 23 | CCI4        | 978,00 | 1600,00 |     |     |     |     |     |     |     |     |     |     |     |
| 24 | CCI4        | 875,00 | 1764,00 |     |     |     |     |     |     |     |     |     |     |     |
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| 29 | CCI4+Silibi | 453,00 | 354,00  |     |     |     |     |     |     |     |     |     |     |     |
| 30 | CCI4+Silibi | 466,00 | 333,00  |     |     |     |     |     |     |     |     |     |     |     |
| 31 | CCI4+Silibi | 243,00 | 245,00  |     |     |     |     |     |     |     |     |     |     |     |
| 32 | CCI4+Silibi | 254,00 | 543,00  |     |     |     |     |     |     |     |     |     |     |     |
| 33 | CCI4+Silibi | 231,00 | 378,00  |     |     |     |     |     |     |     |     |     |     |     |
| 34 | CCI4+Silibi | 328,00 | 465,00  |     |     |     |     |     |     |     |     |     |     |     |
| 35 | CCI4+Silibi | 330,00 | 446,00  |     |     |     |     |     |     |     |     |     |     |     |

One-Way ANOVA

One-Way ANOVA: Post Hoc Multiple Comparisons

Equal Variances Assumed

- LSD
- Bonferroni
- Sidak
- Scheffe
- R-E-G-W F
- R-E-G-W Q
- S-N-K
- Tukey
- Tukey's-b
- Duncan
- Hochberg's GT2
- Gabriel
- Waller-Duncan
- Type I/Type II Error Ratio: 100
- Dunnett
- Control Category: First
- Test:  2-sided  < Control  > Control

Equal Variances Not Assumed

- Tamhane's T2
- Dunnett's T3
- Games-Howell
- Dunnett's C

Significance level: .05

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|----|-------------|--------|---------|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
| 1  | SF (seru    | 68,00  | 34,00   |     |     |     |     |     |     |     |     |     |     |     |
| 2  | SF (ser     |        |         |     |     |     |     |     |     |     |     |     |     |     |
| 3  | SF (ser     |        |         |     |     |     |     |     |     |     |     |     |     |     |
| 4  | SF (ser     |        |         |     |     |     |     |     |     |     |     |     |     |     |
| 5  | SF (ser     |        |         |     |     |     |     |     |     |     |     |     |     |     |
| 6  | SF (ser     |        |         |     |     |     |     |     |     |     |     |     |     |     |
| 7  | SF (ser     |        |         |     |     |     |     |     |     |     |     |     |     |     |
| 8  | Olive oi    |        |         |     |     |     |     |     |     |     |     |     |     |     |
| 9  | Olive oi    |        |         |     |     |     |     |     |     |     |     |     |     |     |
| 10 | Olive oi    |        |         |     |     |     |     |     |     |     |     |     |     |     |
| 11 | Olive oi    |        |         |     |     |     |     |     |     |     |     |     |     |     |
| 12 | Olive oi    |        |         |     |     |     |     |     |     |     |     |     |     |     |
| 13 | Olive oi    |        |         |     |     |     |     |     |     |     |     |     |     |     |
| 14 | Olive oi    |        |         |     |     |     |     |     |     |     |     |     |     |     |
| 15 | Etil a      |        |         |     |     |     |     |     |     |     |     |     |     |     |
| 16 | Etil a      |        |         |     |     |     |     |     |     |     |     |     |     |     |
| 17 | Etil alkol  | 47,00  | 54,00   |     |     |     |     |     |     |     |     |     |     |     |
| 18 | Etil alkol  | 89,00  | 53,00   |     |     |     |     |     |     |     |     |     |     |     |
| 19 | Etil alkol  | 92,00  | 50,00   |     |     |     |     |     |     |     |     |     |     |     |
| 20 | Etil alkol  | 90,00  | 67,00   |     |     |     |     |     |     |     |     |     |     |     |
| 21 | Etil alkol  | 88,00  | 70,00   |     |     |     |     |     |     |     |     |     |     |     |
| 22 | CCI4        | 956,00 | 1554,00 |     |     |     |     |     |     |     |     |     |     |     |
| 23 | CCI4        | 978,00 | 1600,00 |     |     |     |     |     |     |     |     |     |     |     |
| 24 | CCI4        | 875,00 | 1764,00 |     |     |     |     |     |     |     |     |     |     |     |
| 25 | CCI4        | 679,00 | 990,00  |     |     |     |     |     |     |     |     |     |     |     |
| 26 | CCI4        | 800,00 | 900,00  |     |     |     |     |     |     |     |     |     |     |     |
| 27 | CCI4        | 783,00 | 1423,00 |     |     |     |     |     |     |     |     |     |     |     |
| 28 | CCI4        | 882,00 | 1209,00 |     |     |     |     |     |     |     |     |     |     |     |
| 29 | CCI4+Silibi | 453,00 | 354,00  |     |     |     |     |     |     |     |     |     |     |     |
| 30 | CCI4+Silibi | 466,00 | 333,00  |     |     |     |     |     |     |     |     |     |     |     |
| 31 | CCI4+Silibi | 243,00 | 245,00  |     |     |     |     |     |     |     |     |     |     |     |
| 32 | CCI4+Silibi | 254,00 | 543,00  |     |     |     |     |     |     |     |     |     |     |     |
| 33 | CCI4+Silibi | 231,00 | 378,00  |     |     |     |     |     |     |     |     |     |     |     |
| 34 | CCI4+Silibi | 328,00 | 465,00  |     |     |     |     |     |     |     |     |     |     |     |
| 35 | CCI4+Silibi | 330,00 | 446,00  |     |     |     |     |     |     |     |     |     |     |     |

**One-Way ANOVA**

Dependent List:  
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SPSS Processor is ready

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  - Oneway
    - Title
    - Notes
    - Descriptives
    - Test of Homogeneity of Variance
    - ANOVA
  - Post Hoc Tests
    - Title
    - Multiple Comparisons
  - Homogeneous Subsets
    - Title
    - AST
    - ALT

→ Oneway

**Descriptives**

|       |                           | N  | Mean      | Std. Deviation | Std. Error | 95% Confidence Interval for Mean |             | Minimum | Maximum |
|-------|---------------------------|----|-----------|----------------|------------|----------------------------------|-------------|---------|---------|
|       |                           |    |           |                |            | Lower Bound                      | Upper Bound |         |         |
| AST   | SF (serum fizyolojik)     | 7  | 71,5714   | 10,56499       | 3,99319    | 61,8004                          | 81,3424     | 56,00   | 89,00   |
|       | Olive oil (zeytin yağı)   | 7  | 77,8571   | 9,78823        | 3,69960    | 68,8045                          | 86,9097     | 64,00   | 90,00   |
|       | Etil alkol                | 7  | 75,4286   | 18,72482       | 7,07732    | 58,1110                          | 92,7461     | 47,00   | 92,00   |
|       | CCl4                      | 7  | 850,4286  | 104,48103      | 39,49012   | 753,7997                         | 947,0574    | 679,00  | 978,00  |
|       | CCl4+Silibinin            | 7  | 329,2857  | 97,27232       | 36,76548   | 239,3238                         | 419,2476    | 231,00  | 466,00  |
|       | 0.25 mL/kg ekstre + CCl4  | 7  | 493,5714  | 85,13295       | 32,17723   | 414,8366                         | 572,3063    | 353,00  | 567,00  |
|       | 0.50 mL/kg ekstre + CCl4  | 7  | 318,4286  | 23,42262       | 8,85292    | 296,7663                         | 340,0909    | 287,00  | 354,00  |
|       | 0.100 mL/kg ekstre + CCl4 | 7  | 152,1429  | 19,84463       | 7,50057    | 133,7896                         | 170,4961    | 132,00  | 189,00  |
| Total |                           | 56 | 296,0893  | 262,23239      | 35,04228   | 225,8630                         | 366,3156    | 47,00   | 978,00  |
| ALT   | SF (serum fizyolojik)     | 7  | 38,5714   | 9,01586        | 3,40767    | 30,2331                          | 46,9097     | 28,00   | 56,00   |
|       | Olive oil (zeytin yağı)   | 7  | 39,4286   | 11,70267       | 4,42319    | 28,6054                          | 50,2517     | 22,00   | 54,00   |
|       | Etil alkol                | 7  | 56,4286   | 8,99735        | 3,40068    | 48,1074                          | 64,7497     | 45,00   | 70,00   |
|       | CCl4                      | 7  | 1348,5714 | 324,75830      | 122,74710  | 1048,2201                        | 1648,9228   | 900,00  | 1764,00 |
|       | CCl4+Silibinin            | 7  | 394,8571  | 98,08063       | 37,07099   | 304,1477                         | 485,5666    | 245,00  | 543,00  |
|       | 0.25 mL/kg ekstre + CCl4  | 7  | 458,1429  | 92,28837       | 34,88172   | 372,7904                         | 543,4954    | 300,00  | 567,00  |
|       | 0.50 mL/kg ekstre + CCl4  | 7  | 290,0000  | 107,88883      | 40,77815   | 190,2195                         | 389,7805    | 124,00  | 450,00  |
|       | 0.100 mL/kg ekstre + CCl4 | 7  | 94,2857   | 18,22740       | 6,88931    | 77,4282                          | 111,1432    | 67,00   | 122,00  |
| Total |                           | 56 | 340,0357  | 433,29553      | 57,90155   | 223,9984                         | 456,0730    | 22,00   | 1764,00 |

**Test of Homogeneity of Variances**

|     | Levene Statistic | df1 | df2 | Sig. |
|-----|------------------|-----|-----|------|
| AST | 7,309            | 7   | 48  | ,000 |
| ALT | 14,964           | 7   | 48  | ,000 |



### Test of Homogeneity of Variances

|     | Levene Statistic | df1 | df2 | Sig. |
|-----|------------------|-----|-----|------|
| AST | 7,309            | 7   | 48  | ,000 |
| ALT | 14,964           | 7   | 48  | ,000 |

ity of Variat

irisons

Subsets

### ANOVA

|     |                | Sum of Squares | df | Mean Square | F       | Sig. |
|-----|----------------|----------------|----|-------------|---------|------|
| AST | Between Groups | 3607363        | 7  | 515337,548  | 141,546 | ,000 |
|     | Within Groups  | 174757,7       | 48 | 3640,786    |         |      |
|     | Total          | 3782121        | 55 |             |         |      |
| ALT | Between Groups | 9510718        | 7  | 1358673,990 | 79,995  | ,000 |
|     | Within Groups  | 815258,0       | 48 | 16984,542   |         |      |
|     | Total          | 10325976       | 55 |             |         |      |

### Post Hoc Tests

#### Multiple Comparisons

|  |      |    |
|--|------|----|
|  | Mean | 21 |
|--|------|----|

# Levene Testi Sonucu

- Levene Testi  $p \geq 0.05$  ise varyanslar homojen olarak kabul edilir.
  - Buna göre Post-hoc testlerden ***Equal variances assumed*** başlığı altındaki post-hoc testlerden biri kullanılır.
- Levene Testi  $p < 0.05$  ise varyansların homojen olmadığı kabul edilir.
  - Buna göre Post-hoc testlerden ***Equal variances not assumed*** başlığı altındaki post-hoc testlerden biri kullanılır.
- Bu çalışmada Levene testi sonucu hem ALT hem de AST için  $p < 0.05$  ( $p = 0.000$ ) bulunduğu için post-hoc test olarak **Tamhane's T2** testi seçilir.



## Post Hoc Tests

### Multiple Comparisons

| Dependent Variable | (I) GRUP  | (J) GRUP                  | Mean Difference (I-J)     | Std. Error            | Sig.     | 95% Confidence Interval |             |           |
|--------------------|-----------|---------------------------|---------------------------|-----------------------|----------|-------------------------|-------------|-----------|
|                    |           |                           |                           |                       |          | Lower Bound             | Upper Bound |           |
| AST                | Tukey HSD | SF (serum fizyolojik)     | Olive oil (zeytin yağı)   | -6,2857               | 32,25251 | 1,000                   | -108,4709   | 95,8994   |
|                    |           |                           | Etil alkol                | -3,8571               | 32,25251 | 1,000                   | -106,0423   | 98,3280   |
|                    |           |                           | CCI4                      | -778,8571*            | 32,25251 | ,000                    | -881,0423   | -676,6720 |
|                    |           |                           | CCI4+Silibinin            | -257,7143*            | 32,25251 | ,000                    | -359,8994   | -155,5291 |
|                    |           |                           | 0.25 mL/kg ekstre + CCI4  | -422,0000*            | 32,25251 | ,000                    | -524,1851   | -319,8149 |
|                    |           |                           | 0.50 mL/kg ekstre + CCI4  | -246,8571*            | 32,25251 | ,000                    | -349,0423   | -144,6720 |
|                    |           |                           | 0.100 mL/kg ekstre + CCI4 | -80,5714              | 32,25251 | ,221                    | -182,7566   | 21,6137   |
|                    |           |                           | Olive oil (zeytin yağı)   | SF (serum fizyolojik) | 6,2857   | 32,25251                | 1,000       | -95,8994  |
|                    |           | Etil alkol                | 2,4286                    | 32,25251              | 1,000    | -99,7566                | 104,6137    |           |
|                    |           | CCI4                      | -772,5714*                | 32,25251              | ,000     | -874,7566               | -670,3863   |           |
|                    |           | CCI4+Silibinin            | -251,4286*                | 32,25251              | ,000     | -353,6137               | -149,2434   |           |
|                    |           | 0.25 mL/kg ekstre + CCI4  | -415,7143*                | 32,25251              | ,000     | -517,8994               | -313,5291   |           |
|                    |           | 0.50 mL/kg ekstre + CCI4  | -240,5714*                | 32,25251              | ,000     | -342,7566               | -138,3863   |           |
|                    |           | 0.100 mL/kg ekstre + CCI4 | -74,2857                  | 32,25251              | ,313     | -176,4709               | 27,8994     |           |
|                    |           | Etil alkol                | SF (serum fizyolojik)     | 3,8571                | 32,25251 | 1,000                   | -98,3280    | 106,0423  |
|                    |           | Olive oil (zeytin yağı)   | -2,4286                   | 32,25251              | 1,000    | -104,6137               | 99,7566     |           |
|                    |           | CCI4                      | -775,0000*                | 32,25251              | ,000     | -877,1851               | -672,8149   |           |
|                    |           | CCI4+Silibinin            | -253,8571*                | 32,25251              | ,000     | -356,0423               | -151,6720   |           |
|                    |           | 0.25 mL/kg ekstre + CCI4  | -418,1429*                | 32,25251              | ,000     | -520,3280               | -315,9577   |           |
|                    |           | 0.50 mL/kg ekstre + CCI4  | -243,0000*                | 32,25251              | ,000     | -345,1851               | -140,8149   |           |
|                    |           | 0.100 mL/kg ekstre + CCI4 | -76,7143                  | 32,25251              | ,275     | -178,8994               | 25,4709     |           |
|                    |           | CCI4                      | SF (serum fizyolojik)     | 778,8571*             | 32,25251 | ,000                    | 676,6720    | 881,0423  |
|                    |           | Olive oil (zeytin yağı)   | 772,5714*                 | 32,25251              | ,000     | 670,3863                | 874,7566    |           |



|  |                           |                           |            |          |       |           |           |
|--|---------------------------|---------------------------|------------|----------|-------|-----------|-----------|
|  |                           | 0.25 mL/kg ekstre + CCl4  | 356,8571*  | 32,25251 | ,000  | 254,6720  | 459,0423  |
|  |                           | 0.50 mL/kg ekstre + CCl4  | 532,0000*  | 32,25251 | ,000  | 429,8149  | 634,1851  |
|  |                           | 0.100 mL/kg ekstre + CCl4 | 698,2857*  | 32,25251 | ,000  | 596,1006  | 800,4709  |
|  | CCl4+Silibinin            | SF (serum fizyolojik)     | 257,7143*  | 32,25251 | ,000  | 155,5291  | 359,8994  |
|  |                           | Olive oil (zeytin yağı)   | 251,4286*  | 32,25251 | ,000  | 149,2434  | 353,6137  |
|  |                           | Etil alkol                | 253,8571*  | 32,25251 | ,000  | 151,6720  | 356,0423  |
|  |                           | CCl4                      | -521,1429* | 32,25251 | ,000  | -623,3280 | -418,9577 |
|  |                           | 0.25 mL/kg ekstre + CCl4  | -164,2857* | 32,25251 | ,000  | -266,4709 | -62,1006  |
|  |                           | 0.50 mL/kg ekstre + CCl4  | 10,8571    | 32,25251 | 1,000 | -91,3280  | 113,0423  |
|  |                           | 0.100 mL/kg ekstre + CCl4 | 177,1429*  | 32,25251 | ,000  | 74,9577   | 279,3280  |
|  | 0.25 mL/kg ekstre + CCl4  | SF (serum fizyolojik)     | 422,0000*  | 32,25251 | ,000  | 319,8149  | 524,1851  |
|  |                           | Olive oil (zeytin yağı)   | 415,7143*  | 32,25251 | ,000  | 313,5291  | 517,8994  |
|  |                           | Etil alkol                | 418,1429*  | 32,25251 | ,000  | 315,9577  | 520,3280  |
|  |                           | CCl4                      | -356,8571* | 32,25251 | ,000  | -459,0423 | -254,6720 |
|  |                           | CCl4+Silibinin            | 164,2857*  | 32,25251 | ,000  | 62,1006   | 266,4709  |
|  |                           | 0.50 mL/kg ekstre + CCl4  | 175,1429*  | 32,25251 | ,000  | 72,9577   | 277,3280  |
|  |                           | 0.100 mL/kg ekstre + CCl4 | 341,4286*  | 32,25251 | ,000  | 239,2434  | 443,6137  |
|  | 0.50 mL/kg ekstre + CCl4  | SF (serum fizyolojik)     | 246,8571*  | 32,25251 | ,000  | 144,6720  | 349,0423  |
|  |                           | Olive oil (zeytin yağı)   | 240,5714*  | 32,25251 | ,000  | 138,3863  | 342,7566  |
|  |                           | Etil alkol                | 243,0000*  | 32,25251 | ,000  | 140,8149  | 345,1851  |
|  |                           | CCl4                      | -532,0000* | 32,25251 | ,000  | -634,1851 | -429,8149 |
|  |                           | CCl4+Silibinin            | -10,8571   | 32,25251 | 1,000 | -113,0423 | 91,3280   |
|  |                           | 0.25 mL/kg ekstre + CCl4  | -175,1429* | 32,25251 | ,000  | -277,3280 | -72,9577  |
|  |                           | 0.100 mL/kg ekstre + CCl4 | 166,2857*  | 32,25251 | ,000  | 64,1006   | 268,4709  |
|  | 0.100 mL/kg ekstre + CCl4 | SF (serum fizyolojik)     | 80,5714    | 32,25251 | ,221  | -21,6137  | 182,7566  |
|  |                           | Olive oil (zeytin yağı)   | 74,2857    | 32,25251 | ,313  | -27,8994  | 176,4709  |
|  |                           | Etil alkol                | 76,7143    | 32,25251 | ,275  | -25,4709  | 178,8994  |
|  |                           | CCl4                      | -698,2857* | 32,25251 | ,000  | -800,4709 | -596,1006 |
|  |                           | CCl4+Silibinin            | -177,1429* | 32,25251 | ,000  | -279,3280 | -74,9577  |
|  |                           | 0.25 mL/kg ekstre + CCl4  | -341,4286* | 32,25251 | ,000  | -443,6137 | -239,2434 |
|  |                           | 0.50 mL/kg ekstre + CCl4  | -166,2857* | 32,25251 | ,000  | -268,4709 | -64,1006  |
|  | Tamhane                   | SF (serum fizyolojik)     |            |          |       |           |           |
|  |                           | Olive oil (zeytin yağı)   | -6,2857    | 5,44359  | 1,000 | -27,9781  | 15,4067   |
|  |                           | Etil alkol                | -3,8571    | 8,12613  | 1,000 | -38,6218  | 30,9075   |
|  |                           | CCl4                      | -778,8571* | 39,69150 | ,000  | -986,6452 | -571,0690 |
|  |                           | CCl4+Silibinin            | -257,7143* | 36,98170 | ,011  | -450,9608 | -64,4677  |





Tamhane

|  |                         |                           |            |          |       |           |           |
|--|-------------------------|---------------------------|------------|----------|-------|-----------|-----------|
|  |                         | 0.25 mL/kg ekstre + CCl4  | -341,4286* | 32,25251 | ,000  | -443,6137 | -239,2434 |
|  |                         | 0.50 mL/kg ekstre + CCl4  | -166,2857* | 32,25251 | ,000  | -268,4709 | -64,1006  |
|  | SF (serum fizyolojik)   | Olive oil (zeytin yağı)   | -6,2857    | 5,44359  | 1,000 | -27,9781  | 15,4067   |
|  |                         | Etil alkol                | -3,8571    | 8,12613  | 1,000 | -38,6218  | 30,9075   |
|  |                         | CCl4                      | -778,8571* | 39,69150 | ,000  | -986,6452 | -571,0690 |
|  |                         | CCl4+Silibinin            | -257,7143* | 36,98170 | ,011  | -450,9608 | -64,4677  |
|  |                         | 0.25 mL/kg ekstre + CCl4  | -422,0000* | 32,42406 | ,000  | -590,7262 | -253,2738 |
|  |                         | 0.50 mL/kg ekstre + CCl4  | -246,8571* | 9,71183  | ,000  | -290,4449 | -203,2694 |
|  |                         | 0.100 mL/kg ekstre + CCl4 | -80,5714*  | 8,49730  | ,000  | -117,3752 | -43,7677  |
|  | Olive oil (zeytin yağı) | SF (serum fizyolojik)     | 6,2857     | 5,44359  | 1,000 | -15,4067  | 27,9781   |
|  |                         | Etil alkol                | 2,4286     | 7,98596  | 1,000 | -32,2965  | 37,1537   |
|  |                         | CCl4                      | -772,5714* | 39,66304 | ,000  | -980,5649 | -564,5779 |
|  |                         | CCl4+Silibinin            | -251,4286* | 36,95115 | ,013  | -444,8933 | -57,9639  |
|  |                         | 0.25 mL/kg ekstre + CCl4  | -415,7143* | 32,38921 | ,000  | -584,6834 | -246,7451 |
|  |                         | 0.50 mL/kg ekstre + CCl4  | -240,5714* | 9,59485  | ,000  | -284,3233 | -196,8195 |
|  |                         | 0.100 mL/kg ekstre + CCl4 | -74,2857*  | 8,36335  | ,000  | -111,1101 | -37,4614  |
|  | Etil alkol              | SF (serum fizyolojik)     | 3,8571     | 8,12613  | 1,000 | -30,9075  | 38,6218   |
|  |                         | Olive oil (zeytin yağı)   | -2,4286    | 7,98596  | 1,000 | -37,1537  | 32,2965   |
|  |                         | CCl4                      | -775,0000* | 40,11929 | ,000  | -979,9480 | -570,0520 |
|  |                         | CCl4+Silibinin            | -253,8571* | 37,44047 | ,010  | -444,1284 | -63,5859  |
|  |                         | 0.25 mL/kg ekstre + CCl4  | -418,1429* | 32,94636 | ,000  | -583,6593 | -252,6264 |
|  |                         | 0.50 mL/kg ekstre + CCl4  | -243,0000* | 11,33413 | ,000  | -288,6831 | -197,3169 |
|  |                         | 0.100 mL/kg ekstre + CCl4 | -76,7143*  | 10,31247 | ,000  | -117,7823 | -35,6463  |
|  | CCl4                    | SF (serum fizyolojik)     | 778,8571*  | 39,69150 | ,000  | 571,0690  | 986,6452  |
|  |                         | Olive oil (zeytin yağı)   | 772,5714*  | 39,66304 | ,000  | 564,5779  | 980,5649  |
|  |                         | Etil alkol                | 775,0000*  | 40,11929 | ,000  | 570,0520  | 979,9480  |
|  |                         | CCl4+Silibinin            | 521,1429*  | 53,95526 | ,000  | 306,1747  | 736,1110  |
|  |                         | 0.25 mL/kg ekstre + CCl4  | 356,8571*  | 50,93961 | ,000  | 151,9630  | 561,7513  |
|  |                         | 0.50 mL/kg ekstre + CCl4  | 532,0000*  | 40,47028 | ,000  | 329,0618  | 734,9382  |
|  |                         | 0.100 mL/kg ekstre + CCl4 | 698,2857*  | 40,19612 | ,000  | 493,8011  | 902,7703  |



|     |                                   |                          |                          |             |          |       |            |            |
|-----|-----------------------------------|--------------------------|--------------------------|-------------|----------|-------|------------|------------|
|     |                                   |                          | 0.25 mL/kg ekstre + CCl4 | -341,4286*  | 33,03986 | ,001  | -506,4494  | -176,4077  |
|     |                                   |                          | 0.50 mL/kg ekstre + CCl4 | -166,2857*  | 11,60313 | ,000  | -212,7851  | -119,7863  |
|     | Dunnnett t (2-sided) <sup>a</sup> | Olive oil (zeytin yağı)  | SF (serum fizyolojik)    | 6,2857      | 32,25251 | 1,000 | -81,1417   | 93,7131    |
|     |                                   | Etil alkol               | SF (serum fizyolojik)    | 3,8571      | 32,25251 | 1,000 | -83,5702   | 91,2845    |
|     |                                   | CCl4                     | SF (serum fizyolojik)    | 778,8571*   | 32,25251 | ,000  | 691,4298   | 866,2845   |
|     |                                   | CCl4+Silibinin           | SF (serum fizyolojik)    | 257,7143*   | 32,25251 | ,000  | 170,2869   | 345,1417   |
|     |                                   | 0.25 mL/kg ekstre + CCl4 | SF (serum fizyolojik)    | 422,0000*   | 32,25251 | ,000  | 334,5726   | 509,4274   |
|     |                                   | 0.50 mL/kg ekstre + CCl4 | SF (serum fizyolojik)    | 246,8571*   | 32,25251 | ,000  | 159,4298   | 334,2845   |
|     |                                   | 0.100 mL/kg ekstre +     | SF (serum fizyolojik)    | 80,5714     | 32,25251 | ,082  | -6,8559    | 167,9988   |
| ALT | Tukey HSD                         | SF (serum fizyolojik)    | Olive oil (zeytin yağı)  | -,8571      | 69,66151 | 1,000 | -221,5647  | 219,8504   |
|     |                                   |                          | Etil alkol               | -17,8571    | 69,66151 | 1,000 | -238,5647  | 202,8504   |
|     |                                   |                          | CCl4                     | -1310,0000* | 69,66151 | ,000  | -1530,7075 | -1089,2925 |
|     |                                   |                          | CCl4+Silibinin           | -356,2857*  | 69,66151 | ,000  | -576,9932  | -135,5782  |
|     |                                   |                          | 0.25 mL/kg ekstre + CCl4 | -419,5714*  | 69,66151 | ,000  | -640,2789  | -198,8639  |
|     |                                   |                          | 0.50 mL/kg ekstre + CCl4 | -251,4286*  | 69,66151 | ,015  | -472,1361  | -30,7211   |
|     |                                   |                          | 0.100 mL/kg ekstre +     | -55,7143    | 69,66151 | ,992  | -276,4218  | 164,9932   |
|     |                                   | Olive oil (zeytin yağı)  | SF (serum fizyolojik)    | ,8571       | 69,66151 | 1,000 | -219,8504  | 221,5647   |
|     |                                   |                          | Etil alkol               | -17,0000    | 69,66151 | 1,000 | -237,7075  | 203,7075   |
|     |                                   |                          | CCl4                     | -1309,1429* | 69,66151 | ,000  | -1529,8504 | -1088,4353 |
|     |                                   |                          | CCl4+Silibinin           | -355,4286*  | 69,66151 | ,000  | -576,1361  | -134,7211  |
|     |                                   |                          | 0.25 mL/kg ekstre + CCl4 | -418,7143*  | 69,66151 | ,000  | -639,4218  | -198,0068  |
|     |                                   |                          | 0.50 mL/kg ekstre + CCl4 | -250,5714*  | 69,66151 | ,016  | -471,2789  | -29,8639   |
|     |                                   |                          | 0.100 mL/kg ekstre +     | -54,8571    | 69,66151 | ,993  | -275,5647  | 165,8504   |
|     |                                   | Etil alkol               | SF (serum fizyolojik)    | 17,8571     | 69,66151 | 1,000 | -202,8504  | 238,5647   |
|     |                                   |                          | Olive oil (zeytin yağı)  | 17,0000     | 69,66151 | 1,000 | -203,7075  | 237,7075   |
|     |                                   |                          | CCl4                     | -1292,1429* | 69,66151 | ,000  | -1512,8504 | -1071,4353 |
|     |                                   |                          | CCl4+Silibinin           | -338,4286*  | 69,66151 | ,000  | -559,1361  | -117,7211  |
|     |                                   |                          | 0.25 mL/kg ekstre + CCl4 | -401,7143*  | 69,66151 | ,000  | -622,4218  | -181,0068  |
|     |                                   |                          | 0.50 mL/kg ekstre + CCl4 | -233,5714*  | 69,66151 | ,031  | -454,2789  | -12,8639   |
|     |                                   |                          | 0.100 mL/kg ekstre +     | -37,8571    | 69,66151 | ,999  | -258,5647  | 182,8504   |
|     |                                   | CCl4                     | SF (serum fizyolojik)    | 1310,0000*  | 69,66151 | ,000  | 1089,2925  | 1530,7075  |
|     |                                   |                          | Olive oil (zeytin yağı)  | 1309,1429*  | 69,66151 | ,000  | 1088,4353  | 1529,8504  |
|     |                                   |                          | Etil alkol               | 1292,1429*  | 69,66151 | ,000  | 1071,4353  | 1512,8504  |
|     |                                   |                          | CCl4+Silibinin           | 953,7143*   | 69,66151 | ,000  | 733,0068   | 1174,4218  |
|     |                                   |                          | 0.25 mL/kg ekstre + CCl4 | 890,4286*   | 69,66151 | ,000  | 669,7211   | 1111,1361  |
|     |                                   |                          | 0.50 mL/kg ekstre + CCl4 | 1058,5714*  | 69,66151 | ,000  | 837,8639   | 1279,2789  |



### Homogeneous Subsets

AST

| GRUP   | N | Subset for alpha = .05 |          |          |          |
|--|---|------------------------|----------|----------|----------|
|  |   | 1                      | 2        | 3        | 4        |
| Tukey HSD <sup>a</sup> SF (serum fizyolojik) | 7 | 71,5714                |          |          |          |
| Etil alkol                                   | 7 | 75,4286                |          |          |          |
| Olive oil (zeytin yağı)                      | 7 | 77,8571                |          |          |          |
| 0.100 mL/kg ekstre + CCl4                    | 7 | 152,1429               |          |          |          |
| 0.50 mL/kg ekstre + CCl4                     | 7 |                        | 318,4286 |          |          |
| CCl4+Silibinin                               | 7 |                        | 329,2857 |          |          |
| 0.25 mL/kg ekstre + CCl4                     | 7 |                        |          | 493,5714 |          |
| CCl4   | 7 |                        |          |          | 850,4286 |
| Sig.   |   | ,221                   | 1,000    | 1,000    | 1,000    |

Means for groups in homogeneous subsets are displayed.

a. Uses Harmonic Mean Sample Size = 7,000.

ALT

| GRUP   | N | Subset for alpha = .05 |          |          |           |
|--|---|------------------------|----------|----------|-----------|
|  |   | 1                      | 2        | 3        | 4         |
| Tukey HSD <sup>a</sup> SF (serum fizyolojik) | 7 | 38,5714                |          |          |           |
| Olive oil (zeytin yağı)                      | 7 | 39,4286                |          |          |           |
| Etil alkol                                   | 7 | 56,4286                |          |          |           |
| 0.100 mL/kg ekstre + CCl4                    | 7 | 94,2857                | 94,2857  |          |           |
| 0.50 mL/kg ekstre + CCl4                     | 7 |                        | 290,0000 | 290,0000 |           |
| CCl4+Silibinin                               | 7 |                        |          | 394,8571 |           |
| 0.25 mL/kg ekstre + CCl4                     | 7 |                        |          | 458,1429 |           |
| CCl4   | 7 |                        |          |          | 1348,5714 |
| Sig.   |   | ,992                   | ,117     | ,258     | 1,000     |

Means for groups in homogeneous subsets are displayed.

a. Uses Harmonic Mean Sample Size = 7,000.

# Post-hoc Testlerin Seçilmesi

- Veri setini oluşturan grup sayısı fazla ise (5 ve üstü) LSD testini (least significant difference test) kullanmayınız
  - LSD test=Student's-*t* independent test.
  - LSD testi Tip-I hataya en açık testtir.
  - Tip I hata: Gruplar arasında anlamlı fark olmadığı halde bu farkı anlamlı gösterme.
- Gruplardaki eleman sayısı birbirine eşit ise:
  - Tukey's HSD (Tukey's honestly significant difference test) tercih edilebilir
  - Tukey's HSD, Tip-II hataya en açık testtir.
  - Tip II hata: Gruplar arasında anlamlı fark olduğu halde bu farkı anlamsız olarak gösterme.

# Post-hoc Testlerin Seçilmesi

- Gruplardaki eleman sayısı birbirine eşit değil ise **Scheffe** testini tercih ediniz.
- Amacınız kontrol grubu ile diğer grupları karşılaştırmak ise **Dunnett** testini tercih ediniz.
- Varyanslar homojen değilse (Test of homogeneity of variance'da yani Levene testi'nde  $p < 0.05$  ise) **Tamhane's T2** testini tercih ediniz.

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