



## **PRECISION VALUES OF THE METHODS OF ANALYSIS ADOPTED BY THE INTERNATIONAL OLIVE COUNCIL**

In compliance with the decision taken by the International Olive Council (IOC) at its 93rd session (November 2005), the Executive Secretariat set up a working group which was given the brief of reviewing the precision values of the physico-chemical testing methods drawn up and adopted by the IOC and inserted in the trade standard for olive oils and olive-pomace oils.

The working group, which met at the IOC offices on 14 November 2006, drew up this document for consideration at the chemists' meetings in 2007.

The document reports:

- (a) The precision values for the following methods bearing the reference COI/T.20:
- COI/T.20/Doc. no. 11 – Determination of stigmastadienes in vegetable oils;
  - COI/T.20/Doc. no. 17 – Determination of *trans* unsaturated fatty acids by capillary column gas chromatography;
  - COI/T.20/Doc. no. 10 – Determination of the composition and content of sterols by capillary column gas chromatography;

In these cases, the precision values were calculated on the basis of the interlaboratory test conducted in 1998 by 19 IOC-recognised laboratories from eight countries, reported in the document referenced T.20/Doc. no. 42-2 of 9 March 2000.

- (b) The precision values for COI/T.20/Doc. no. 24 – Preparation of the fatty acid methyl esters from olive oil and olive-pomace oil;

- (c) The precision values for the following methods :
- COI/T.20/Doc. no. 20 – Determination of the difference between actual and theoretical content of triacylglycerols with ECN<sub>42</sub>;
  - COI/T.20/Doc. no. 16 – Determination of sterenes in refined vegetable oils;
  - COI/T.20/Doc. no. 10 – Determination of the composition and content of sterols by capillary column gas chromatography (relative solely to brassicasterol);
  - Determination of free acidity;
  - Determination of erythrodiol + uvaol content;

- Determination of the peroxide value;
- COI/T.20/Doc. no. 24 – Preparation of the fatty acid methyl esters (relative solely to heptadecanoic acid and heptadecenoic acid)
- COI/T.20/Doc. no. 18 – Determination of wax content by capillary column gas liquid chromatography;
- COI/T.20/Doc. no. 19 – Spectrophotometric analysis in the ultraviolet.
- COI/T.20/Doc. no. 23 – Determination of the percentage of 2-glyceryl monopalmitate (2007 data);
- COI/T.20/Doc. no. 26 – Determination of aliphatic alcohols content by capillary gas chromatography;

These have been calculated from the data for 2000–2006 supplied by the laboratories of 13 countries for earning entitlement under the IOC recognition scheme. The results underwent statistical analysis according to ISO 5725 “Accuracy (trueness and precision) of measurement methods and results” and with the aid of the AOAC Statistical Manual (W.J. Youden, E.H. Steiner). Outliers were detected by applying the Ranking, Cochran and Grubbs tests to the laboratory results for all the samples (replicates a and b) .

The tables on the next pages report the following data for each parameter studied:

<b>n</b>	number of laboratories which participated in the test
<b>outliers</b>	number of laboratories with outlying values
<b>mean</b>	mean of the accepted results
<b>r</b>	repeatability
<b>S<sub>r</sub></b>	repeatability standard deviation
<b>RSD<sub>r</sub>(%)</b>	repeatability coefficient of variation ( $S_r \times 100 / \text{mean}$ )
<b>R</b>	reproducibility
<b>S<sub>R</sub></b>	reproducibility standard deviation
<b>RSD<sub>R</sub>(%)</b>	reproducibility coefficient of variation ( $S_R \times 100 / \text{mean}$ )

**Table 1. Waxes (mg/kg)**

	<b>A</b>	<b>B</b>	<b>C</b>	<b>D</b>	<b>E</b>	<b>F</b>	<b>G</b>	<b>H</b>
<b>n</b>	44	48	48	48	49	49	49	53
<b>outliers</b>	2	7	1	4	1	2	6	8
<b>mean</b>	2607.7	87.9	1564.1	167.8	660.4	738.1	63.88	825.8
<b>r</b>	100.6	9.4	80.4	12.0	24.9	24.5	6.7	20.4
<b>S<sub>r</sub></b>	35.9204	3.3663	28.7059	4.2734	8.9020	8.7594	2.3812	7.2883
<b>RSD<sub>r</sub>(%)</b>	1.4	3.8	1.8	2.6	1.4	1.2	3.7	0.9
<b>R</b>	679.4	34.3	311.96	49.9	164.8	163.6	25.6	122.7
<b>S<sub>R</sub></b>	242.6280	12.2568	111.41	17.8225	58.8404	58.4183	9.1457	43.8244
<b>RSD<sub>R</sub>(%)</b>	9.3	13.9	7.1	10.6	8.9	7.9	14.3	5.3

**Table 2.  $\Delta$ ECN<sub>42</sub>**

	<b>A</b>	<b>B</b>	<b>C</b>	<b>D</b>	<b>E</b>
<b>n</b>	29	29	29	29	29
<b>outliers</b>	1	3	7	1	3
<b>mean</b>	0.05	0.70	0.18	0.26	0.49
<b>r</b>	0.02	0.03	0.02	0.04	0.04
<b>S<sub>r</sub></b>	0.0074	0.0122	0.0084	0.0136	0.0147
<b>RSD<sub>r</sub>(%)</b>	14.6	1.7	4.6	5.3	3.0
<b>R</b>	0.08	0.35	0.14	0.15	0.13
<b>S<sub>R</sub></b>	0.0269	0.1236	0.0515	0.0530	0.0459
<b>RSD<sub>R</sub>(%)</b>	52.8	17.7	28.2	20.5	9.3

**Table 3. Stigmastadienes (mg/kg)**

	<b>A</b>	<b>B</b>	<b>C</b>	<b>D</b>	<b>E</b>
<b>n</b>	19	19	19	19	19
<b>outliers</b>	3	5	7	2	5
<b>mean</b>	0.01	0.8	9.5	0.22	7.6
<b>r</b>	0.01	0.1	0.4	0.05	0.5
<b>S<sub>r</sub></b>	0.004	0.03	0.14	0.01	0.17
<b>RSD<sub>r</sub>(%)</b>	32.4 <sub>(not sig.)</sub>	3.7	1.5	8.4	2.3
<b>R</b>	0.03	0.2	2	0.1	2
<b>S<sub>R</sub></b>	0.012	0.05	0.59	0.025	0.57
<b>RSD<sub>R</sub>(%)</b>	98.6 <sub>(not sig.)</sub>	6.7	6.3	11.5	7.6

**Table 4. Sterenes (mg/kg)**

	<b>A</b>	<b>B</b>	<b>C</b>	<b>D</b>	<b>E</b>
<b>n</b>	31	31	31	31	31
<b>outliers</b>	4	4	5	4	4
<b>mean</b>	9.5	31	46	9.0	11.4
<b>r</b>	0.2	1	1	0.3	0.5
<b>S<sub>r</sub></b>	0.0730	0.3276	0.3924	0.0984	0.1778
<b>RSD<sub>r</sub>(%)</b>	0.8	1.0	0.9	1.1	1.6
<b>R</b>	2	5	12	1	1
<b>S<sub>R</sub></b>	0.5802	1.6758	4.1960	0.5293	0.4974
<b>RSD<sub>R</sub>(%)</b>	6.1	5.3	9.1	5.9	4.4

**Table 5. C18:1T (%)**

	<b>A</b>	<b>B</b>	<b>C</b>	<b>D</b>	<b>E</b>
<b>n</b>	17	17	17	17	17
<b>outliers</b>	5	2	4	0	0
<b>mean</b>	0.01	0.02	0.02	0.02	0.05
<b>r</b>	0.01	0.01	0.01	0.01	0.02
<b>S<sub>r</sub></b>	0.003	0.003	0.004	0.004	0.007
<b>RSD<sub>r</sub>(%)</b>	22.6	20.2	32.1	22.0	14.1
<b>R</b>	0.01	0.02	0.02	0.02	0.03
<b>S<sub>R</sub></b>	0.004	0.008	0.008	0.008	0.011
<b>RSD<sub>R</sub>(%)</b>	31.0	46.6	32.1	50.0	21.7

**Table 6. C18:2T + C18:3T(%)**

	<b>A</b>	<b>B</b>	<b>C</b>	<b>D</b>	<b>E</b>
<b>n</b>	16	17	16	17	17
<b>outliers</b>	5	2	2	4	0
<b>mean</b>	0.01	0.03	0.01	0.04	0.30
<b>r</b>	0.01	0.01	0.01	0.01	0.04
<b>S<sub>r</sub></b>	0.004	0.004	0.003	0.004	0.015
<b>RSD<sub>r</sub>(%)</b>	34.9	13.4	19.0	9.9	5.1
<b>R</b>	0.02	0.02	0.02	0.02	0.1
<b>S<sub>R</sub></b>	0.006	0.007	0.006	0.008	0.047
<b>RSD<sub>R</sub>(%)</b>	47.7	25.6	42.8	22.4	15.4

**Table 7. Total sterols (mg/kg)**

	<b>A</b>	<b>B</b>	<b>C</b>	<b>D</b>	<b>E</b>
<b>n</b>	19	19	19	19	19
<b>outliers</b>	5	3	4	5	3
<b>mean</b>	1547	1720	1618	1498	1578
<b>r</b>	86	75	57	52	61
<b>S<sub>r</sub></b>	<b>30.57</b>	<b>26.81</b>	<b>20.35</b>	<b>18.68</b>	<b>21.72</b>
<b>RSD<sub>r</sub>(%)</b>	2.0	1.6	1.3	1.3	1.4
<b>R</b>	<b>95</b>	<b>182</b>	<b>157</b>	164	155
<b>S<sub>R</sub></b>	34.09	64.94	56.02	58.66	55.38
<b>RSD<sub>R</sub>(%)</b>	2.2	3.8	3.5	3.9	3.5

**Percentage composition of sterol fraction**

**Table 8. Cholesterol (%)**

	<b>A</b>	<b>B</b>	<b>C</b>	<b>D</b>	<b>E</b>
<b>n</b>	17	17	17	17	17
<b>outliers</b>	2	2	4	5	3
<b>mean</b>	0.2	0.2	0.16	0.1	0.16
<b>r</b>	0.1	0.1	0.04	0.06	0.04
<b>S<sub>r</sub></b>	0.03	0.03	0.01	0.02	0.01
<b>RSD<sub>r</sub>(%)</b>	19.4	17.4	11.1	17.6	10.5
<b>R</b>	0.2	0.2	0.1	0.1	0.2
<b>S<sub>R</sub></b>	0.07	0.08	0.05	0.04	0.05
<b>RSD<sub>R</sub>(%)</b>	43.4	42.9	31.8	35.3	34.2

**Table 9. Brassicasterol (%)**

	<b>A</b>	<b>B</b>	<b>C</b>	<b>D</b>	<b>E</b>
<b>n</b>	35	35	35	35	35
<b>outliers</b>	3	2	2	6	6
<b>mean</b>	1.76	4.6	0.07	0.07	0.02
<b>r</b>	0.04	0.1	0.02	0.02	0.01
<b>S<sub>r</sub></b>	0.0135	0.0376	0.0064	0.0068	0.0032
<b>RSD<sub>r</sub>(%)</b>	0.8	0.8	9.8	9.9	19.0
<b>R</b>	0.1	0.3	0.1	0.1	0.1
<b>S<sub>R</sub></b>	0.0442	0.1122	0.0377	0.0427	0.0208
<b>RSD<sub>R</sub>(%)</b>	2.5	2.5	57.4	62.1	123.1

**Table 10. Campesterol (%)**

	<b>A</b>	<b>B</b>	<b>C</b>	<b>D</b>	<b>E</b>
<b>n</b>	15	15	15	15	15
<b>outliers</b>	0	0	0	0	0
<b>mean</b>	4.1	5.0	4.0	4.0	4.3
<b>r</b>	0.1	0.2	0.2	0.2	0.1
<b>S<sub>r</sub></b>	0.05	0.07	0.07	0.05	0.04
<b>RSD<sub>r</sub>(%)</b>	1.3	1.5	1.8	1.4	1.0
<b>R</b>	0.3	0.3	0.3	0.2	0.3
<b>S<sub>R</sub></b>	0.09	0.12	0.09	0.07	0.10
<b>RSD<sub>R</sub>(%)</b>	2.3	2.5	2.5	1.8	2.4

**Table 11. Stigmasterol (%)**

	<b>A</b>	<b>B</b>	<b>C</b>	<b>D</b>	<b>E</b>
<b>n</b>	15	15	15	15	15
<b>outliers</b>	1	0	0	1	0
<b>mean</b>	1.0	2.3	1.1	1.4	2.4
<b>r</b>	0.1	0.1	0.1	0.1	0.2
<b>S<sub>r</sub></b>	0.02	0.04	0.03	0.03	0.05
<b>RSD<sub>r</sub>(%)</b>	1.9	1.9	30.6	2.2	2.3
<b>R</b>	0.1	0.2	0.1	0.1	0.2
<b>S<sub>R</sub></b>	0.04	0.07	0.04	0.04	0.07
<b>RSD<sub>R</sub>(%)</b>	3.9	3.1	4.6	2.9	3.1

**Table 12.  $\Delta$ -7-Stigmastenol (%)**

	<b>A</b>	<b>B</b>	<b>C</b>	<b>D</b>	<b>E</b>
<b>n</b>	15	15	15	15	15
<b>outliers</b>	0	0	0	1	0
<b>mean</b>	0.1	2.3	0.2	0.5	0.6
<b>r</b>	0.1	0.2	0.1	0.1	0.1
<b>S<sub>r</sub></b>	0.03	0.06	0.02	0.03	0.03
<b>RSD<sub>r</sub>(%)</b>	24.7	2.7	15.3	6.4	5.3
<b>R</b>	0.1	0.3	0.1	0.1	0.1
<b>S<sub>R</sub></b>	0.04	0.09	0.04	0.04	0.04
<b>RSD<sub>R</sub>(%)</b>	30.7	4.3	22.6	7.9	8.5



**Table 13. Apparent  $\beta$ -sitosterol (%)**

	<b>A</b>	<b>B</b>	<b>C</b>	<b>D</b>	<b>E</b>
<b>n</b>	15	15	15	15	15
<b>outliers</b>	0	1	0	0	0
<b>mean</b>	93.9	88.7	93.9	93.2	91.6
<b>r</b>	0.3	0.4	0.4	0.3	0.3
<b>S<sub>r</sub></b>	0.10	0.13	0.13	0.10	0.12
<b>RSD<sub>r</sub>(%)</b>	0.1	0.2	0.1	0.1	0.1
<b>R</b>	0.9	0.9	0.7	0.9	0.9
<b>S<sub>R</sub></b>	0.31	0.32	0.25	0.32	0.32
<b>RSD<sub>R</sub>(%)</b>	0.3	0.4	0.3	0.4	0.4

**Spectrophotometric analysis in the ultraviolet**

**Table 14. K<sub>270</sub>**

	<b>A</b>	<b>B</b>	<b>C</b>	<b>D</b>	<b>E</b>	<b>F</b>	<b>G</b>	<b>H</b>
<b>n</b>	44	48	48	49	51	51	52	51
<b>outliers</b>	5	3	4	3	2	4	1	1
<b>mean</b>	0.12	0.14	0.12	0.24	0.20	0.39	0.40	0.46
<b>r</b>	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.02
<b>S<sub>r</sub></b>	0.0026	0.0024	0.0018	0.0025	0.0024	0.0035	0.0047	0.0054
<b>RSD<sub>r</sub>(%)</b>	2.4	1.7	1.6	1.0	1.2	0.9	1.2	1.2
<b>R</b>	0.03	0.03	0.03	0.03	0.02	0.03	0.06	0.05
<b>S<sub>R</sub></b>	0.0090	0.0092	0.0090	0.0101	0.0067	0.0095	0.0207	0.0162
<b>RSD<sub>R</sub>(%)</b>	8.3	6.7	7.8	4.2	3.3	2.5	5.2	3.5

**Table 15.  $\Delta K$**

	<b>A</b>	<b>B</b>	<b>C</b>	<b>D</b>	<b>E</b>	<b>F</b>	<b>G</b>	<b>H</b>
<b>n</b>	17	18	18	18	18	48	49	51
<b>outliers</b>	1	2	0	1	1	6	5	2
<b>mean</b>	0.000	0.020	0.010	0.003	0.04	0.002	0.006	0.019
<b>r</b>	-	0.001	0.003	0.002	0.007	0.001	0.002	0.003
<b>Sr</b>	-	0.001	0.001	0.01	0.003	0.0004	0.0006	0.0010
<b>RSDr(%)</b>	-	7.7	17.9	25.7	6.4	26.8	9.1	5.0
<b>R</b>	-	0.004	0.01	0.004	0.02	0.003	0.004	0.012
<b>SR</b>	-	0.002	0.002	0.002	0.006	0.0009	0.0015	0.0042
<b>RDS<sub>R</sub>(%)</b>	-	8.3	37.0	50.2	14.	58.3	24.3	21.9

**Table 16. Glyceryl monopalmitate (%)**

	<b>A</b>	<b>B</b>	<b>C</b>	<b>D</b>	<b>E</b>	<b>F</b>	<b>G</b>	<b>H</b>
<b>n</b>	12	12	12	12	12			46
<b>outliers</b>	0	0	0	0	0			2
<b>mean</b>	0.5	0.8	0.9	1.8	2.8			2.0
<b>r</b>	0.1	0.1	0.2	0.1	0.3			0.1
<b>Sr</b>	0.0408	0.0408	0.0612	0.0354	0.0935			0.0532
<b>RSDr(%)</b>	8.9	5.	6.8	2.0	3.3			2.7
<b>R</b>	0.1	0.	0.3	1	1			0.4
<b>SR</b>	0.0508	0.950	0.0919	0.2006	0.3068			0.1357
<b>RDS<sub>R</sub>(%)</b>	11.1	12.7	10.2	11.1	10.9			6.8

**Table 17. Aliphatic alcohols (mg/kg)**

	A	B	C	D	E	F	G	H
<b>n</b>				47	48	47	53	50
<b>outliers</b>				6	3	3	6	4
<b>mean</b>				128.50	173.85	105.44	1441.57	241.29
<b>r</b>				10.70	9.57	10.74	98.55	15.64
<b>S<sub>r</sub></b>				3.8209	3.4194	3.8341	35.1963	5.5844
<b>RSD<sub>r</sub>(%)</b>				3.0	2.0	3.6	2.4	2.3
<b>R</b>				49.05	54.87	36.46	472.88	56.51
<b>S<sub>R</sub></b>				17.5175	19.5964	13.0222	168.8854	20.1832
<b>RSD<sub>R</sub>(%)</b>				13.6	11.3	12.4	11.7	8.4

**Table 18. Acidity (%)**

	A	B	C	D	E
<b>n</b>	35	35	35	35	35
<b>outliers</b>	2	2	2	0	1
<b>mean</b>	0.41	0.20	3.91	1.32	0.98
<b>r</b>	0.02	0.01	0.04	0.02	0.02
<b>S<sub>r</sub></b>	0.0064	0.0043	0.0152	0.0071	0.0069
<b>RSD<sub>r</sub>(%)</b>	1.6	2.1	0.4	0.5	0.7
<b>R</b>	0.05	0.05	0.2	0.1	0.1
<b>S<sub>R</sub></b>	0.0162	0.0177	0.0785	0.0330	0.0209
<b>RSD<sub>R</sub>(%)</b>	4.0	8.7	2.0	2.5	2.1

**Table 19. Erythrodiol + uvaol**

	<b>A</b>	<b>B</b>	<b>C</b>	<b>D</b>	<b>E</b>
<b>n</b>	30	30	30	30	30
<b>outliers</b>	4	0	5	1	4
<b>mean</b>	6.6	5.9	4.5	2.0	1.9
<b>r</b>	0.2	0.3	0.1	0.1	0.1
<b>S<sub>r</sub></b>	0.0674	0.0988	0.0378	0.0475	0.0338
<b>RSD<sub>r</sub>(%)</b>	1.0	1.7	0.9	2.3	1.8
<b>R</b>	1	1	1	1	1
<b>S<sub>R</sub></b>	0.3927	0.3645	0.4428	0.2842	0.1846
<b>RSD<sub>R</sub>(%)</b>	6.0	6.2	10.0	14.0	10.0

**Table 20. Peroxide value (meqO<sub>2</sub>/kg)**

	<b>A</b>	<b>B</b>	<b>C</b>	<b>D</b>	<b>E</b>	<b>F</b>	<b>G</b>	<b>H</b>
<b>n</b>	49	48	48	49	49	51	51	52
<b>outliers</b>	5	9	0	1	2	4	3	3
<b>mean</b>	10.48	3.32	9.45	12.55	9.03	17.75	3.55	3.10
<b>r</b>	0.43	0.32	0.51	0.47	0.38	0.49	0.26	0.33
<b>S<sub>r</sub></b>	0.1542	0.1137	0.1836	0.1672	0.1355	0.762	0.0915	0.1163
<b>RSD<sub>r</sub>(%)</b>	1.5	3.4	1.9	1.3	1.5	1.0	2.6	3.8
<b>R</b>	2.29	2.24	3-28	2.82	2.04	3.19	1.85	1.78
<b>S<sub>R</sub></b>	0.8165	0.7996	1.1697	1.0065	0.7288	1.1389	0.6610	0.6354
<b>RSD<sub>R</sub>(%)</b>	7.8	24.1	12.4	8.0	8.1	6.4	18.6	20.5

**Percentage fatty acid composition**

**Table 21. Myristic acid C14:0 (%)**

	<b>A</b>	<b>B</b>	<b>C</b>	<b>D</b>	<b>E</b>
<b>n</b>	15	15	15	15	15
<b>outliers</b>	0	0	1	1	3
<b>mean</b>	0.01	0.01	0.01	0.01	0.02
<b>r</b>	0.01	0.01	0.01	0.01	0.01
<b>S<sub>r</sub></b>	0.002	0.003	0.004	0.004	0.002
<b>RSD<sub>r</sub>(%)</b>	20	20	36	38	11
<b>R</b>	0.01	0.02	0.02	0.01	0.02
<b>S<sub>R</sub></b>	0.0041	0.0059	0.0062	0.0047	0.0058
<b>RSD<sub>R</sub>(%)</b>	45	47	52	42	32

**Table 22. Palmitic acid C16:0 (%)**

	<b>A</b>	<b>B</b>	<b>C</b>	<b>D</b>	<b>E</b>
<b>n</b>	15	15	15	15	15
<b>outliers</b>	2	3	1	0	0
<b>mean</b>	8.0	10.3	10.4	10.5	9.7
<b>r</b>	0.1	0.2	0.4	0.3	0.4
<b>S<sub>r</sub></b>	0.04	0.06	0.15	0.10	0.14
<b>RSD<sub>r</sub>(%)</b>	0.5	0.6	1.5	1.0	1.4
<b>R</b>	1	0.4	1	1	1
<b>S<sub>R</sub></b>	0.24	0.16	0.33	0.46	0.45
<b>RSD<sub>R</sub>(%)</b>	3.0	1.5	3.2	4.4	4.7

**Table 23. Palmitoleic acid C16:1 (%)**

	<b>A</b>	<b>B</b>	<b>C</b>	<b>D</b>	<b>E</b>
<b>n</b>	15	15	15	15	15
<b>outliers</b>	0	2	0	1	1
<b>mean</b>	0.50	0.68	0.7	0.91	0.64
<b>r</b>	0.04	0.03	0.1	0.03	0.04
<b>S<sub>r</sub></b>	0.014	0.010	0.026	0.012	0.014
<b>RSD<sub>r</sub>(%)</b>	2.9	1.4	3.6	1.3	2.3
<b>R</b>	0.1	0.1	0.1	0.1	0.1
<b>S<sub>R</sub></b>	0.034	0.027	0.047	0.44	0.046
<b>RSD<sub>R</sub>(%)</b>	6.8	4.1	6.4	4.9	7.2

**Table 24. Heptadecanoic acid C17:0 (%)**

	<b>A</b>	<b>B</b>	<b>C</b>	<b>D</b>	<b>E</b>
<b>n</b>	25	25	25	25	25
<b>outliers</b>	1	1	1	2	2
<b>mean</b>	0.18	0.06	0.11	0.14	0.12
<b>r</b>	0.01	0.01	0.01	0.01	0.01
<b>S<sub>r</sub></b>	0.0048	0.0041	0.0035	0.0033	0.0033
<b>RSD<sub>r</sub>(%)</b>	2.7	6.9	3.1	2.3	2.7
<b>R</b>	0.02	0.02	0.02	0.02	0.03
<b>S<sub>R</sub></b>	0.0073	0.0074	0.0087	0.0075	0.0096
<b>RSD<sub>R</sub>(%)</b>	4.1	12.6	7.7	5.2	7.8

**Table 25. Heptadecenoic acid C17:1 (%)**

	<b>A</b>	<b>B</b>	<b>C</b>	<b>D</b>	<b>E</b>
<b>n</b>	29	29	29	29	29
<b>outliers</b>	3	2	2	3	2
<b>mean</b>	0.26	0.09	0.24	0.22	0.19
<b>r</b>	0.01	0.01	0.01	0.01	0.01
<b>S<sub>r</sub></b>	0.0037	0.0036	0.0049	0.0048	0.0043
<b>RSD<sub>r</sub>(%)</b>	1.4	3.8	2.0	2.2	2.2
<b>R</b>	0.03	0.03	0.04	0.03	0.03
<b>S<sub>R</sub></b>	0.0110	0.0095	0.0147	0.0107	0.0110
<b>RSD<sub>R</sub>(%)</b>	4.3	10.1	6.1	4.9	5.7

**Table 26. Stearic acid C18:0 (%)**

	<b>A</b>	<b>B</b>	<b>C</b>	<b>D</b>	<b>E</b>
<b>n</b>	15	15	15	15	15
<b>outliers</b>	2	0	0	0	1
<b>mean</b>	2.9	2.49	2.6	3.5	3.1
<b>r</b>	0.1	0.03	0.1	0.1	0.1
<b>S<sub>r</sub></b>	0.032	0.012	0.030	0.034	0.038
<b>RSD<sub>r</sub>(%)</b>	1.1	0.5	1.1	1.0	1.2
<b>R</b>	0.2	0.3	0.2	0.4	0.3
<b>S<sub>R</sub></b>	0.061	0.092	0.088	0.131	0.117
<b>RSD<sub>R</sub>(%)</b>	2.1	3.7	3.4	3.8	3.8

**Table 27. Oleic acid C18:1 (%)**

	<b>A</b>	<b>B</b>	<b>C</b>	<b>D</b>	<b>E</b>
<b>n</b>	15	15	15	15	15
<b>outliers</b>	0	0	1	1	0
<b>mean</b>	79.4	74.6	75.6	76.1	75.8
<b>r</b>	0.4	0.3	0.4	0.2	0.5
<b>S<sub>r</sub></b>	0.15	0.11	0.14	0.08	0.16
<b>RSD<sub>r</sub>(%)</b>	0.2	0.2	0.2	0.1	0.2
<b>R</b>	1	1	1	1	2
<b>S<sub>R</sub></b>	0.49	0.45	0.45	0.47	0.64
<b>RSD<sub>R</sub>(%)</b>	0.6	0.6	0.6	0.6	0.9

**Table 28. Linoleic acid C18:2 (%)**

	<b>A</b>	<b>B</b>	<b>C</b>	<b>D</b>	<b>E</b>
<b>N</b>	15	15	15	15	15
<b>Outliers</b>	2	1	0	1	0
<b>Mean</b>	7.3	9.7	8.5	7.2	8.8
<b>R</b>	0.1	0.1	0.2	0.1	0.1
<b>S<sub>r</sub></b>	0.02	0.03	0.06	0.04	0.05
<b>RSD<sub>r</sub>(%)</b>	0.3	0.3	0.7	0.6	0.6
<b>R</b>	0.3	0.5	0.5	0.5	0.6
<b>S<sub>R</sub></b>	0.12	0.19	0.18	0.16	0.21
<b>RSD<sub>R</sub>(%)</b>	1.7	1.9	2.1	2.2	2.4



**Table 29. Linolenic acid C18:3 (%)**

	<b>A</b>	<b>B</b>	<b>C</b>	<b>D</b>	<b>E</b>
<b>n</b>	15	15	15	15	15
<b>outliers</b>	2	0	0	0	4
<b>mean</b>	0.73	0.90	0.86	0.74	0.8
<b>r</b>	0.04	0.05	0.03	0.04	0.1
<b>S<sub>r</sub></b>	0.013	0.017	0.010	0.014	0.020
<b>RSD<sub>r</sub>(%)</b>	1.8	1.9	1.2	1.9	2.6
<b>R</b>	0.1	0.1	0.1	0.1	0.1
<b>S<sub>R</sub></b>	0.029	0.041	0.036	0.028	0.041
<b>RSD<sub>R</sub>(%)</b>	3.9	4.6	4.2	3.8	5.4

**Table 30. Arachidic acid C20:0 (%)**

	<b>A</b>	<b>B</b>	<b>C</b>	<b>D</b>	<b>E</b>
<b>n</b>	15	15	15	15	15
<b>outliers</b>	1	0	0	1	0
<b>mean</b>	0.39	0.44	0.44	0.42	0.43
<b>r</b>	0.04	0.05	0.04	0.04	0.05
<b>S<sub>r</sub></b>	0.015	0.018	0.013	0.013	0.019
<b>RSD<sub>r</sub>(%)</b>	3.8	4.0	3.0	3.1	4.4
<b>R</b>	0.1	0.1	0.1	0.1	0.1
<b>S<sub>R</sub></b>	0.029	0.032	0.031	0.042	0.036
<b>RSD<sub>R</sub>(%)</b>	7.3	7.2	7.0	9.8	8.6

**Table 31. Eicosenoic acid C20:1 (%)**

	<b>A</b>	<b>B</b>	<b>C</b>	<b>D</b>	<b>E</b>
<b>n</b>	15	15	15	15	15
<b>outliers</b>	1	1	1	0	1
<b>mean</b>	0.37	0.39	0.37	0.28	0.3
<b>r</b>	0.03	0.03	0.04	0.05	0.1
<b>S<sub>r</sub></b>	0.009	0.011	0.013	0.017	0.026
<b>RSD<sub>r</sub>(%)</b>	7.8	3.0	3.5	6.0	8.9
<b>R</b>	0.1	0.1	0.1	0.1	0.1
<b>S<sub>R</sub></b>	0.029	0.034	0.023	0.028	0.027
<b>RSD<sub>R</sub>(%)</b>	7.9	8.7	6.2	10	9.3

**Table 32. Behenic acid C22:0 (%)**

	<b>A</b>	<b>B</b>	<b>C</b>	<b>D</b>	<b>E</b>
<b>n</b>	15	15	15	15	15
<b>outliers</b>	0	1	1	1	3
<b>mean</b>	0.11	0.14	0.14	0.12	0.19
<b>r</b>	0.02	0.04	0.04	0.05	0.04
<b>S<sub>r</sub></b>	0.008	0.013	0.014	0.016	0.013
<b>RSD<sub>r</sub>(%)</b>	7.0	9.6	10.0	14.0	6.9
<b>R</b>	0.04	0.04	0.05	0.1	0.04
<b>S<sub>R</sub></b>	0.014	0.016	0.018	0.020	0.015
<b>RSD<sub>R</sub>(%)</b>	12.0	12.0	13.0	17.0	8.3

**Table 33. Lignoceric acid C24:0 (%)**

	<b>A</b>	<b>B</b>	<b>C</b>	<b>D</b>	<b>E</b>
<b>n</b>	15	15	15	15	15
<b>outliers</b>	1	0	0	0	3
<b>mean</b>	0.04	0.06	0.06	0.05	0.08
<b>r</b>	0.02	0.02	0.03	0.03	0.04
<b>S<sub>r</sub></b>	0.006	0.005	0.012	0.012	0.014
<b>RSD<sub>r</sub>(%)</b>	15.0	8.9	20.0	24.0	19.0
<b>R</b>	0.1	0.1	0.1	0.1	0.04
<b>S<sub>R</sub></b>	0.020	0.026	0.026	0.019	0.014
<b>RSD<sub>R</sub>(%)</b>	49	42	45	39	19

### 3. References

ISO 5725 – Accuracy (trueness and precision) of measurement methods and results – Part 1: General principles and definitions.

ISO 5725 - Accuracy (trueness and precision) of measurement methods and results - Part 2: Basic method for the determination of repeatability and reproducibility of a standard measurement method.

ISO 5725 – Accuracy (trueness and precision) of measurement methods and results – Part 5: Alternative methods for the determination of the precision of a standard measurement method.

ISO 5725 – Accuracy (trueness and precision) of measurement methods and results – Part 6: Use in practice of accuracy values.

AOAC - Statistical Manual of the Association of Official Analytical Chemists.  
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