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STUDY OF LIPID AND PROTEIN FRACTION IN THE MOST IMPORTANT ITALIAN SUNFLOWER VARIETIES

The genetical improvement programmes undertaken by the Agronomical Institute of Pisa have produced four varieties: Ala, Albinia, Amiata and Argentario, using initially the Russian varieties VNIIMK 8931, Smena, Enisei and Peredovik (A. Benvinuti, G. Vicentini, 1973).

At present these varieties are widespread particularly in central Italy. In fact, they have given positive results in the different agroclimatic zones and proved to be much more adaptable than the recently introduced hybrid varieties (especially in zones with unfavourable conditions).

In order to increase our knowledge about the nutritive value of the products obtained from the new varieties, the following analytical researches have been carried out:

(a) main analytical constants and UV spectra of oil extracted with petroleum ether;

(b) silicic acid column chromatography of total lipids extracted with chloroform-methanol (2:1) using the modified Bligh and Dyer method (E. G. Bligh, W. J. Dyer, 1959);

(c) thin layer chromatography of neutral lipids according to Stahl (E. Stahl, 1962) (dissolved by the mixture of petroleum ether, diethyl ether and acetic acid (90 : 10 : 1 v/v/v) in a standard chromatography tank);

(d) gas liquid chromatography of fatty acids of total lipids and neutral lipids and of glycolipids and phospholipids (absorbed by 20% of polyethelene-glycol-succinate on 80-100 mesh chromosorb W/AW);

(e) proximate composition of the defatted meals (raw protein, raw fibre, ashes and N-free extracts);

(f) automatic analyses of amino acidic composition of meals ("Aminolyzer", Optica, Milano).

The analytical data concerning seeds and oils of cultivars Ala, Amiata, Albinia and Argentario and of the hybrid HS 52 showed that the oil content in seeds is roughly the same for all varieties (mean value 59.9%) and is higher than the hybrid tested (55.8%) which also gave a kernel yield (72.7%) slightly less than the mean value of the four varieties (76.1%).

Neither do the cultivars studied essentially differ in the iodine value (126 on average) and Saponification value (190.8).

The lipid composition, as results from the column chromatography and T.L.C. (Table 1), is remarkably similar for all four varieties and for the hybrid under examination.

As is shown in T.L.C. neutral lipid except triglycerides which represent almost all neutral lipids, contain small quantities of diglycerides, fatty acids, sterols and traces of monoglycerides and hydrocarbons.

The results of the G.L.C. of total lipids analysis (Table 2) show the presence of typically fatty acids on total lipids with the presence of the following acids: myristic, myristoleic, palmitic, palmitoleic, stearic, oleic, linoleic and arachic.

From a quantitative point of view we observe that the samples present a remarkable homogeneity. In particular the most represented fatty acids are linoleic and oleic with mean percentage values for the four cultivar respectively 57.38 and 30.28%. Also the ratio oleic acid/linoleic acid and unsatured acids/satured acids are extremely uniform.

As far as the fatty acid distribution percentage in the different lipid fractions is concerned, we note, above all, a perfect agreement between the fatty acids in the neutral fraction, which rep-

Table 1

Composition of Total and Neutral Lipids

	Varieties	Hybrid
Total lipids		
Neutral lipids	97.4–97.8	96.7
Glycolipids	0.5–0.6	0.8
Phospholipids	1.3–1.8	2.1
Neutral lipids		
Triglycerides	97.65–98.12	97.48
Diglycerides	0.45–0.64	0.61
Fatty acids	0.35–0.61	0.41
Sterols	0.39–0.46	0.43
Sterol esters	0.17–0.30	0.21

Table 2

Fatty Acid Composition of Total Lipids, Neutral Lipids and Phospholipids, %

Fatty acids	Total lipids		Neutral lipids		Glycolipids		Phospholipids	
	varieties	hybrids	varieties	hybrids	varieties	hybrids	varieties	hybrids
1	2	3	4	5	6	7	8	9
$C_{14:0}$	0.09	0.05	0.06	tr.	1.26	1.13	tr.	tr.
$C_{14:1}$	tr.	tr.	tr.	tr.	0.15	0.22	0.05	tr.
$C_{16:0}$	6.57	6.06	6.44	5.79	17.30	18.80	11.94	13.04
$C_{16:1}$	0.11	tr.	0.05	tr.	2.17	2.50	0.07	tr.
$C_{18:0}$	5.37	4.76	5.38	4.75	7.31	7.28	4.64	4.12
$C_{18:1}$	30.28	30.93	30.44	31.10	48.96	46.58	15.97	14.88

Table 2 (cont.)

1	2	3	4	5	6	7	8	9
$C_{18:2}$	57.38	57.88	57.49	58.05	21.12	21.52	67.34	67.96
$C_{20:0}$	0.20	0.32	0.14	0.31	1.74	1.99	-	-
$\frac{C_{18:1}}{C_{18:2}}$	0.52	0.53	0.52	0.53	2.31	2.16	0.23	0.21
$\frac{\text{Saturated}}{\text{Unsaturated}}$	7.20	7.93	7.34	8.21	2.62	2.42	5.04	4.82

resents almost all the lipids, and the fatty acid content of the total lipids.

As far as glycolipids and phospholipids are concerned we observed noticeable differences from the neutral lipid fraction. In particular, in the glycolipids we observed a remarkable increase in the palmitic acid (up to 18%) and in the oleic acid (up to 47-49%) and a corresponding decrease in the linoleic acid (up to 21%), as a consequence the ratio value C18:1/C18:2 decreased. In this intermediate polarity fraction the presence of minor acids, such as myristic, myristoleic, palmitoleic and arachic increases, while the value of the unsaturated acid/saturated acid ratio decreases noticeably, which indicates a minor insaturation of the fatty acids.

As regards the phospholipids the predominant acid is linoleic (mean value 67.46%), while the oleic acid has the lowest values found in the other fractions. The unsatured acid/satured acid ratio indicates an intermediate degree of saturation betv n glycolipids and neutral lipids.

The analysis of meals showed that by there are no differences between the varieties and the hybrid in the proportion of protein, raw fibre, ashes and N-free extractive substances. One can only note an increased proportion of protein in the hybrid (55.5%) as compared to the varieties (51.0-55.3%) and decreased proportion of extractive substances (31.4% as against 34.2-36.9% in the varieties). The amino-acid content of meals is shown in Table 3. No differences were observed in the qualitative composition between the new varieties and the hybrid. Glutamic acid prevails in quantitative terms to be followed by aspartic acid. Moreover, reasonable quantities of leucine, arginine, glycine and serine were always present, while there were minor quantities of sulphurated aminoacids.

Compared to the wheat and soya proteins

Table 3

Amino Acid Composition of the Defatted Meals (g/100 g s.s.)

Amino	cv. Ala	cv. Amiata	cv. Albinia	cv. Argentario	romsun HS 52
Asp.	6.1	6.0	6.0	6.0	6.6
Thr.	2.2	2.0	2.2	2.3	2.0
Ser.	3.2	3.3	3.2	3.0	3.8
Glu.	12.0	11.9	12.0	12.3	13.5
Gly.	4.0	4.1	4.0	4.1	4.2
Ala.	2.6	2.8	2.8	2.9	2.4
$(Cys)_2$	0.4	0.6	0.5	0.2	0.1
Val.	1.6	1.5	1.5	1.5	1.7
Met.	0.8	1.0	0.8	0.8	1.3
Ile.	1.5	1.6	1.4	1.7	1.5
Leu.	4.1	4.3	4.1	4.0	4.7
Tyr.	1.9	1.9	2.1	1.9	2.1
Phe.	2.5	2.2	3.0	2.6	2.4
Pro.	2.1	2.8	2.5	2.2	2.2
Try.	1.2	1.1	1.2	1.2	1.3
Lys.	1.7	1.5	1.6	1.7	1.7
His.	1.1	1.2	1.3	1.2	1.1
Arg.	4.0	4.1	4.0	3.9	5.0

Table 4

Essential Amino Acids in Proteins of Same Vegetables
(g/16 g N)

Amino acid	Sunflower	Wheat	Soybean	Model FAO
Thr.	4.1	3.0	3.5	2.8
Val.	2.9	4.3	5.3	4.2
Met.	1.6	1.7	1.3	2.2
Ile.	2.9	3.9	4.7	4.2
Leu	7.4	6.8	7.0	4.8
Phe.	4.9	4.8	4.6	2.8
Lys.	3.0	2.0	6.1	4.2
Try.	1.2	1.5	1.8	1.4

and the FAO model (Table 4) the main amino-acids in the proteins present in the sunflower four new varieties (averaged data) have a favourable composition as regards threonine, leucine and phenyalanine while they are slightly lacking in lysine, valine, methionine and tryptophane.

It is clear from the data adduced that sunflower merl protein is worse off than soya protein in the quantity of some indispensable amino-acids but is even better than what protein.

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