Chemical Composition of *Rumex crispus* L. Seed

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ABSTRACT: *Rumex crispus* L. seeds harvested in Olavarría (Province of Buenos Aires, Argentina) were extracted with 60–80°C petroleum ether to render 6.0% (dry basis) of a lipid fraction with a 152.4 saponification value and 15.4% unsaponifiable matter. Fatty acid composition obtained by gas–liquid chromatography was: 14:0, 2.7; 16:0, 13.5; 16:1, 1.2; 18:0, 1.2; 18:1, 38.6; 18:2, 36.3; 18:3, 0.5; 20:0, 2.4; 20:2, 0.3; 22:0, 0.9; 22:1, 1.2; and 24:0, 1.2; with traces of 14:1, 15:1, 17:0, and 17:1. Residual meal contained 10.62% crude protein, with a low value of available lysine (3.31 g/16 g N). Ash, crude fiber, sugars, hydrolyzable carbohydrates, total and phytic acid phosphorus, calcium and residual lipids contents are reported here. *JAOCS 72,* 1077–1078 (1995).

KEY WORDS: Chemical composition of seed, residual meal, *Rumex crispus* L., seed oil.

Rumex crispus L. belongs to the *Poligonaceae* family and is commonly known as curly dock ("lengua de vaca" in Argentina). Originating in Europe and adventitious throughout the world, in Argentina it grows in almost every province, particularly as a weed in alfalfa, potato, cereal, and linseed crops (1). It is believed to be an intoxicant in animals. As an allergenic species, it causes dermatitis in susceptible individuals. Its roots are stimulating, tonic, astringent or laxative, according to the dose, and they can enhance gallbladder secretion (2).

Due to the wide distribution of this weed in Argentina and the fact that its seeds are often found as impurities among wheat, linseed, and alfalfa seeds, it was considered of interest to perform a study on the general chemical composition of this seed species, bearing in mind the scanty data available in the literature (3).

MATERIALS AND METHODS

Rumex crispus L. seeds were harvested in Olavarría (Province of Buenos Aires, Argentina). After having determined their general characteristics, the seeds were ground, and the lipid fraction was extracted with 60–80°C petroleum ether (Soxhlet). The remaining solvent was removed from the residual meal (45–50°C, vacuum).

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Lipid fraction examination. The physical and chemical characteristics of the lipid fraction were determined according to the methods indicated: refractive index and saponification value [Association of Official Analytical Chemists (AOAC) methods] (4), unsaponifiable matter and acid value (American Oil Chemists' Society methods) (5), iodine value of the unsaponifiable matter (Rosenmund), total sterols (digitonine) (6), and phosphorus (7,8).

Fatty acid composition was assessed by gas–liquid chromatography (GLC) of the methyl esters of the total acids, free of the unsaponifiable fraction, obtained by esterification with methanol containing 1.5% H_2SO_4. A KONIK 2000 apparatus (Barcelona, Spain) was employed, fitted with a flame-ionization detector and a 3 m × 2 mm stainless-steel column packed with 15% diethylene glycol succinate (DEGS) on Chromosorb W (60–80). Nitrogen was used as carrier gas. Temperatures were 185–190°C for the oven, 210°C for the injector and 230°C for the detector, and 1-μL injections of 15% ester solution in ethyl ether were used. Fatty acid methyl esters were identified by comparison with the retention times of standards, and the peak area method was used for quantitation. The presence of conjugated polyunsaturated acids was investigated spectrophotometrically (5).

Residual meal examination. The analyses were conducted according to the methods of the AOAC (4), except where otherwise noted: moisture (vacuum, 100°C), ash (500–550°C), reducing and nonreducing sugars, hydrolyzable carbohydrates, total nitrogen (Kjeldahl), crude fiber, calcium, total phosphorus (7,8), available lysine (9), phytic acid (10), urease activity (5), alkaloids (11), residual lipids (extracted with ternary mixture: $Cl_3CH/CH_3OH/H_2O$, 10:20:7.6, vol/vol/vol) (12,13) and presence of starch (I_2/KI solution). Phosphorus content was determined in residual lipids as well as in fatty acid composition by GLC after saponification and esterification.

RESULTS AND DISCUSSION

The general characteristic values of *R. crispus* L. seeds are density (kg/hL), 44.3; number of seeds/g, 1140, and moisture, 11%. By extraction with petroleum ether, seeds rendered 6% lipid material, a greater value than that reported by Harrold and Nalewaja (3) in 1977. The recovered lipid was whitish-yellow in color and solid at room temperature. Table 1 sum-

TABLE 1
Physicochemical Characteristics of *Rumex crispus* L. Seed Lipid Fraction

Refractive index (40°C)	1.4335
Iodine value	104.6
Acid value (mg KOH/g)	14.6
Saponification value	152.4
Unsaponifiable matter (%)	15.4
Iodine value of unsaponifiable matter	55.4
Phosphorus (mg/100 g)	54
Phospholipids (%)[a]	1.35
Total sterols (mg/100 g, as sitosterol)	501.1

[a]Phosphorus (%) × 25 (Ref. 14).

marizes its physicochemical characteristics, the most noteworthy being the high values for both the unsaponifiable fraction and acid number, the latter perhaps due to enhanced lipase activity.

Fatty acid composition analysis afforded the following results in methyl ester percentages: 14:0, 2.7; 16:0, 13.5; 16:1, 1.2; 18:0, 1.2; 18:1, 38.6; 18:2, 36.3; 18:3, 0.5; 20:0, 2.4; 20:2, 0.3; 22:0, 0.9; 22:1, 1.2; and 24:0, 1.2, with traces of 14:1, 15:1, 17:0, and 17:1. The iodine index was calculated on the basis of this composition (Table 1). Major components were linoleic, oleic, and palmitic acids, in that order. The percentage of saturated acids was 17.8%, mostly consisting of palmitic acid, but it should be noted that there was a significant content of myristic acid. Ultraviolet spectrophotometric analysis disclosed a low proportion of conjugated triene (C_3 = 0.18%), and neither conjugated diene nor tetraene were detected.

Table 2 lists the results achieved from the analysis of the meal. The protein proportion was low, less than the 14.7% reported by Harrold and Nalewaja (3), and it had a poor available lysine content with regard to requirements suggested by Food and Agriculture Organization of the United Nations for children (6.6, 5.8, and 4.4 g/16 g N up to 2, from 2 to 10 and over 10 years of age, respectively), although it would be suitable for adults (1.6 g/16 g N).

The sugar concentration was practically negligible, and that of hydrolyzable carbohydrates was low, and the presence of starch proved undetectable. Calcium concentration was high, but the Ca/P ratio was greater than that required for adequate absorption in infants and adults (1.5:1 and 1:1, respectively). Barely 1.4% of total phosphorus corresponded to phytic acid. Data on ash and phosphorus described by Harrold and Nalewaja (3) are similar to ours, but the calcium content is remarkably lower (0.44%, dry basis).

TABLE 2
Chemical Composition of *Rumex crispus* L. Seed Meal

Moisture%	10.1
Ash% (d.b.)[a]	5.2
Crude protein% (d.b.)(N × 6.25)	10.6
Available lysine (g/16 g N)	3.31
Reducing sugars% (d.b.; as glucose)	0.07
Nonreducing sugars% (d.b.; as sucrose)	0.07
Hydrolyzable carbohydrates% (d.b.; as starch)	8.25
Crude fiber% (d.b.)	31.2
Calcium (mg/100 g; d.b.)	1079.4
Total phosphorus (mg/100 g; d.b.)	407.6
Phytic acid phosphorus (mg/100 g; d.b.)	5.6
Residual lipids% (d.b.)	0.88
Urease activity	Undetected
Alkaloids	Doubtful

[a]d.b., Dry basis.

The fatty acid composition of residual meal lipids (in methyl ester percentage) was as follows: 13:0, 0.4; 13:1, 0.5; 14:0, 3.6; 14:1, 0.1; r-16:0 or 15:1, 0.7; 16:0, 46.5; 16:1, 13.1; 17:0, 1.7; 18:0, 8.9; 18:1, 8.7; 18:2, 3.0; 18:3, 4.4; 20:0, 2.1; 20:2, 3.7; and 22:1, 2.6. Phosphorus content was 370 mg % g, equivalent to 9.24% phospholipids (14).

We believe that these preliminary findings will prove useful for further studies on *R. crispus* L. seed, particularly regarding its potentially toxic components, considering its presence as contaminant of seeds commonly used as food and feed.

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