

NOTE

Some Nutritional and Functional Properties of Karkade (*Hibiscus sabdariffa*) Seed Products

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Hibiscus sabdariffa (Roselle or Karkade) is a popular plant (belonging to the family Malvaceae) in some Middle East countries. It is used mainly for its fiber and the calyces of the flower, which are used in cold and warm beverages. Karkade seeds contain considerable amounts of proteins (25–25.2%) and oil (20.3–21%) (Al-Wandawi et al 1984, Abu-Tarboush 1995). Nutritional properties of oil and protein of the whole seeds have been studied by Al-Wandawi et al (1984). Some antinutritional factors in the defatted flour and protein isolate of karkade were studied by Abu-Tarboush and Ahmed (1996). However, the nutritional properties of karkade seed products, as well as their functional properties, have not yet been studied. Therefore, the objectives of this study were to investigate the nutritional and functional properties of some karkade seed products: karkade defatted flour (KDF), protein concentrate (KPC), and protein isolate (KPI).

MATERIALS AND METHODS

Karkade Seed Preparation

Karkade seeds of the variety Al-Rahad were obtained from western Sudan. After cleaning, seeds were milled using an electric grinder to pass through a 0.30-mesh screen. Oil was extracted with *n*-hexane according to the method of El-Tinay et al (1988a). Defatted flours (KDF) were stored in a glass jar at 5°C until used.

Karkade Protein Concentrates and Isolates

Karkade protein concentrates and isolates (KPC and KPI) were obtained from defatted karkade flour as reported by El-Tinay et al (1988b).

Proximate Analysis and Amino Acids

Proximate composition of karkade seed product was determined according to standard methods (AOAC 1995). Total carbohydrates were calculated by difference. Amino acid analysis was performed using reverse phase-high pressure liquid chromatography (LC-10 AD, Shimadzu Corp., Kyoto, Japan) following hydrolysis of the sample with 6N HCl at 110°C for 24 hr (AOAC, 1995). Tryptophan was determined spectrophotometrically according to the method of Devaries et al (1980) after KOH hydrolysis of the sample (AOAC 1995).

Protein Analysis

The multienzyme method of AOAC (1995) was used to determine in vitro protein digestibility (IVPD). Computed protein efficiency ratio (C-PER) was obtained by using data from IVPD and essential amino acid composition of the protein according to stan-

dard methods (AOAC 1995). Animal Nutrition Research Council (ANRC) casein was included for comparison.

Physiochemical Characteristics and Fatty Acids

Specific gravity (25°/25°C), refractive index (27°C), peroxide, iodine, and saponification values were determined according to standard methods (AOAC 1995). Fatty acid composition was determined by gas-liquid chromatography (HP-5840A) equipped with a flame ionization detector. Fatty acid methyl esters were prepared according to standard methods (AOAC 1995).

Functional Properties

The functional properties of karkade seed products (KDF, KPC, and KPI) were determined. Water and oil absorption capacities were determined according to the method of Lin et al (1974) with minor modification (Pardes-López and Ordorica-Falomir 1986). Bulk density was determined by the method of Wang and Kinsella (1976). Emulsifying activity was measured according to the procedure of Wang and Kinsella (1976). Protein solubility profile was determined according to the method described by Bryant et al (1988) with minor modifications.

Statistical Analysis

Data were analyzed using analysis of variance (Steel and Torrie 1980) and SAS programs (SAS 1986).

RESULTS AND DISCUSSION

Proximate Analysis

Karkade whole seed flour (KWSF) contained high amounts of protein (26.48%), crude oil (20.13%), carbohydrate (43.21%), and ash (4.83%). Such results were in agreement with the findings of Al-Wandawi et al (1984). The karkade protein isolate (KPI) showed a higher protein content (88.15%) than the other karkade products (defatted flour 50.63% and protein concentrate 62.24%). However, the protein content of KPI was less than that of *Moringa peregrina* protein isolate (97.8%) and soybean protein isolate (94.0%) reported by Al-Kahtani and Abou-Arab (1993).

Amino Acids

Amino acid compositions of KDF, KPC, and KPI are shown in Table I. The amino acid profiles of KPC and KPI were similar to that of KDF. Therefore, extraction of karkade proteins appeared to have no adverse affect on the amino acid profiles of KPC and KPI. Arginine, aspartic acid, and glutamic acid were found in high amounts in karkade seed products. The amino acid compositions of karkade seed products in this study were in agreement with the findings of Al-Wandawi (1984) for the karkade whole seed. Karkade is considered to be related to okra and results from this study on amino acid composition of karkade seed products were in agreement with the finding of Al-Wandawi et al (1983) for okra seeds.

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