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Amino Acid Composition of Chilean Hazel Nuts

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ABSTRACT

Samples of selected fully ripened Chilean hazel nuts growing wild in the southern part of Chile were collected for analysis. Protein and amino acid contents were determined. The protein concentration after oil extraction was 16·3%. Eighteen amino acids were found. Glutamic acid, followed by aspartic acid and arginine, were present in the greatest concentrations. Lysine was the limiting essential amino acid when compared with the FAO/WHO (1981) reference amino acid pattern, with a chemical score of 82.

INTRODUCTION

Chilean hazel nuts (*Gevuina avellana*) are a native variety that grow preferentially in the southern part of Chile. The estimated overall production is over 300 000 tonnes per year (Olhagaray & Karnelic, 1984). Chilean hazel nuts are recognized as a source of high energy food (Schmidt & Pennachioti, 1985) with a lipid content of 46%, comparable to rapeseed, sunflower and peanut (Monckeberg & Garrido, 1975). In addition, hazel nuts contain about 12% of protein which, after oil extraction, increases to over 16% (Schmidt & Pennachioti, 1985) but no information on the amino acid composition seems to have been reported in the literature. An investigation was therefore carried out to determine the amino acid composition of this product.

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MATERIALS AND METHODS

Native fully ripened hazel nuts were harvested in the area of Victoria city, close to Temuco, capital city of the IX Región, Chile. The seeds were selected and decorticated and the nuts were oven-dried at 60°C for 8 h.

The samples were ground in a ball mill to a fine homogeneous powder to pass a 0·5 mm mesh screen, and stored in plastic bags at 5°C. The product was submitted to hexane solvent extraction, followed by removal of solvent and grinding to obtain a residue defined as flour. Total nitrogen was determined on the dried defatted hazel nut flour by the Kjeldahl procedure (AOAC, 1980). Protein was calculated by multiplying the total nitrogen value by the factor 5·30.

Individual amino acid analyses were performed on the same material after acid hydrolysis. Test tubes were sealed under vacuum after the addition of about 40 mg of sample and 10 ml of 6N hydrochloric acid. The contents of the tubes were hydrolyzed for 22 h at 110°C and then filtered. Amino acid analyses were carried out by the ion exchange column chromatographic method of Spackman *et al.* (1958) on a Beckman model 12-C amino acid analyzer.

Tryptophan was determined according the method of Simpson *et al.* (1976). Cystine and methionine were estimated by acid hydrolysis following performic acid oxidation (Hirs, 1967). Results are reported as milligrams of the respective amino acid per gram of N. The chemical score was calculated from the provisional amino acid scoring pattern (FAO/WHO, 1981) as follows:

$$\text{Amino acid score} = \frac{\text{mg of amino acid in 1 g test protein}}{\text{mg of amino acid in 1 g WHO reference standard}}$$

RESULTS AND DISCUSSION

The protein concentration found in the fat-free hazel nut flour was 16·3% (Table 1). Results of amino acid analysis are summarized in Table 1. The results are the mean (± SD) of duplicate determinations. Glutamic acid was present in the highest concentrations followed by aspartic acid and arginine. These amino acids accounted for nearly half the total amino acid composition.

The amino acid composition of the Chilean variety showed significant differences from the results reported by Paul & Southgate (1978). There were considerable variations, especially in the essential amino acids. Tryptophan is the essential amino acid present in greatest amounts, with values which are four times higher than those reported by Paul and Southgate. These differences may be due to inherent cultivar differences.

TABLE 1
Protein and Amino Acid Composition (mg/g of Nitrogen) of Hazel Nut Flour

Amino acid	*Hazel nut flour*[b]	*Nazel nut*[c]	*Reference standard*[d]
Essential			
Isoleucine	231·3 ± 5·6	360	187·5
Leucine	487·5 ± 14·7	390	406·5
Lysine[a]	281·3 ± 16·7	180	343·8
Methionine	100·0 ± 9·5	60	—
Cystine	118·8 ± 6·2	70	—
Methionine + cystine	218·8	130	218·8
Phenylalanine	287·5 ± 15·2	230	—
Tyrosine	162·5 ± 8·7	230	—
Phenylalanine + Tyrosine	450·0	460	312·5
Threonine	275·0 ± 5·5	180	250·0
Valine	306·3 ± 11·6	390	250·0
Tryptophan	406·3 ± 18·3	90	62·5
Non-essential			
Arginine	568·8 ± 20·9	910	—
Aspartic acid	606·3 ± 16·3	440	—
Serine	331·3 ± 15·6	600	—
Glutamic acid	1 325 ± 30·5	1 280	—
Proline	350·0 ± 13·5	350	—
Glycine	312·5 ± 1·2	590	—
Alanine	318·8 ± 19·5	—	—
Histidine	156·3 ± 11·1	120	—
Score	82·0		100
Crude Protein (N × 5·30)	16·3%		

[a] Limiting amino acid.
[b] Present study.
[c] Paul & Southgate (1978).
[d] FAO/WHO (1981).
Mean value ± SD.

The essential amino acid pattern was compared with the standard FAO/WHO (1981) amino acid profile. The results showed that all of the essential amino acids were present in greater amounts than in the reference amino acid patterns with the exception of lysine which had a chemical score of 82 and is therefore the limiting amino acid. Other chemical scores were: sulphur amino acids, 100; threonine, 110; isoleucine, 123; leucine, 120; valine, 123; phenylalanine + tyrosine, 144 and tryptophan, 650.

These results suggest that hazel nuts could be used as a complementary protein source for combination with legume-based foods, in view of the low cystine and methionine contents found in legumes.

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