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ALFALFA CONCENTRATE – A RICH SOURCE OF NUTRIENTS FOR USE IN FOOD PRODUCTS

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Study objective

Evaluation of chemical composition of alfalfa (*Medicago sativa* L.) concentrate, a by-product resulted from the production process of the dietary supplement

Alfalfa (*Medicago sativa* L.)

Minerals: *Calcium, phosphorus, iron, magnesium, potassium, zinc, copper, selenium, organic silicon, manganese*

Vitamins: *C, K, D, E, U, provitamin A, B1, B2, B6, B12, folic acid/B9, biotin, niacin*

β -carotene

Essential amino acids: *Alanine, lysine, arginine, histidine, cysteine, proline, methionine, tyrosine*

Materials

Alfalfa provenience

By-product resulted from the production process of the dietary supplement "Alfalfa Complex“

(kindly supplied by Hofigal Export – Import SA (Bucharest, Romania)



Analysis methods

Chemical Analysis

Crude fiber content analysis

Mineral content analysis

Amino acid content analysis

Statistical analysis



Chemical analysis methods

Moisture content: ICC Standard No. 110/1

Ash content: ICC No. 104/1

Total fat content: Soxhlet Foss System 2055

Total nitrogen and total protein: Macro Kjeldahl Method

Carbohydrate content: calculated by difference from the rest
sum

All experiments were performed in triplicate



Crude fiber analysis methods

Crude fibers include cellulose, hemicellulose, and lignin. Determined using a Fibretherm-Gerhardt apparatus treating the sample with an acid detergent solution filtration.



Mineral analysis methods

Mineral content was determined using an atomic absorption spectrophotometer (ContrAA 700; Analytikjena)). Total ash was determined by incineration at 550°C, in an oven. Analysis was performed using an external standard. Dried samples were digested in a mixture of concentrated HCl.



Amino acids analysis methods

Hydrolysis: 100–120 °C in 6N hydrochloric acid for 22–24 hours under vacuum

Evaporation

Dilution: 4 mM stock solution of Norleucine

Alfalfa chemical score:

$$\text{Chemical Score} = \frac{\text{mg/g of essential amino acid in test protein}}{\text{mg/g of essential amino acid reference protein}} \times 100$$



Statistical analysis methods

Program: Microsoft Excel 2003

Level of significance: 95%

Variance analysis: ANOVA and Tukey test

Results and discussion

Table 1. Chemical composition of alfalfa concentrate flour (g/100 g, based on dry weight)

Constituents	Alfalfa concentrate flour*
Total protein (N x 6.25)	34.24 ± 0.26
Ash	11.65 ± 0.11
Crude fibers	21.38 ± 0.32
Crude lipids	1.39 ± 0.11
Total carbohydrates	57,17 ± 0.05

* Results given as: M ± SD (means ± standard deviation) of triplicate trials.



Results and discussion

Table 2. Mineral contents of alfalfa concentrate flour (mg /100 g)

Constituents	Alfalfa concentrate flour (mg/100g)	RDI (FDA 2011)
Potassium	2300 ± 2.05	4700
Calcium	2100 ± 0.89	1000
Magnesium	790 ± 1,20	400
Iron	17 ± 1.85	18
Sodium	9 ± 1.6	2400
Manganese	3.8 ± 1.91	400
Zinc	2.5 ± 1.70	15

Results and discussion

Table 3. Amino acids composition of alfalfa concentrate flour (as g amino acid/100 g protein).

Type	Amino acids	Alfalfa concentrate flour (mg/100g)
Dispensable amino acids	Glutamic ac.	7.49
	Glycine	4.34
	Serine	3.54
	Proline	4.74
	Aspartic ac.	5.71
	Alanine	4.83
	Tyrosine	2.35
	Arginine	3.94
	Cysteine	0.53

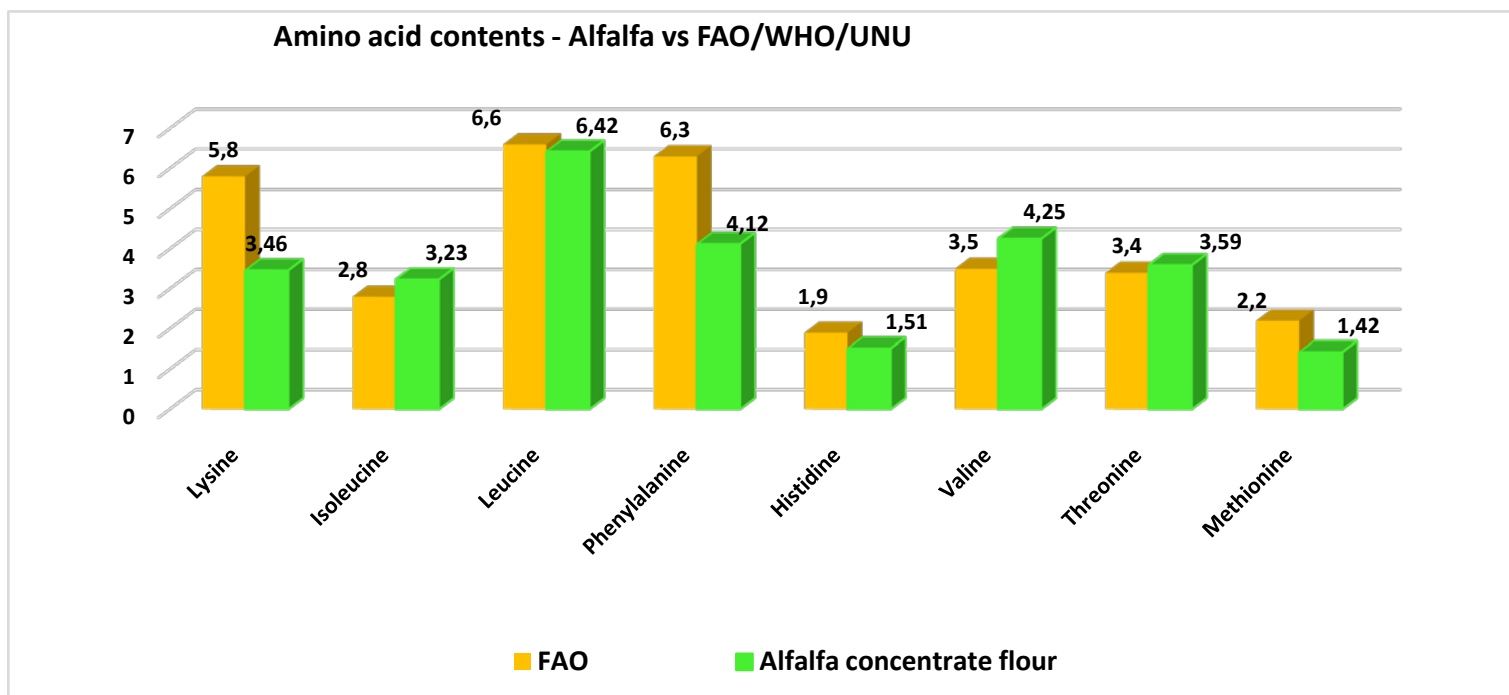
Results and discussion

Table 3.1. Amino acids composition of alfalfa concentrate flour (as g amino acid/100 g protein).

Type	Amino acids	Alfalfa concentrate flour
Indispensable amino acids	Methionine	1.42
	Leucine	6.42
	Valine	4.25
	Lysine	3.46
	Phenylalanine	4.12
	Isoleucine	3.23
	Threonine	3.59
	Histidine	1.51

Results and discussion

Fig.1. The percentages of amino acids in the alfalfa concentrate protein in comparison with the percentages of amino acids in the standard protein set by FAO/WHO/UNU (1985).



Results and discussion

Table 4. Chemical scores of amino acids in the alfalfa concentrate flour

	FAO/WHO /UNU	Alfalfa concentrate flour	% Amino Acid Scores
Lysine	5.80	3.46	59.66
Isoleucine	2.80	3.23	115.36
Leucine	6.60	6.42	97.27
Phenylalanine	6.30	4.12	65.40
Histidine	1.90	1.51	79.47
Valine	3.50	4.25	121.43
Threonine	3.40	3.59	105.59
Methionine	2.20	1.42	64.55

Conclusions

The chemical composition of the alfalfa concentrate flour was assessed using both classical and spectral methods.

The characterization performed in this study proved that the alfalfa concentrate flour is a valuable source of minerals, especially potassium, calcium, magnesium and iron.

Increasing the content of alfalfa concentrate flour in various food products can lead to an increase in content of dietary fibers, minerals, protein and amino acids.

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