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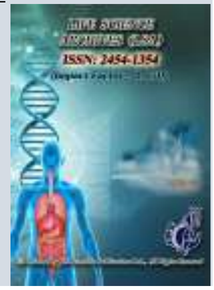

Research Article

COFFEE BEAN PROTEIN

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Abstract

The objective of this work to check the protein profile in coffee bean. Coffee is the most drinking beverage among the others. Using coffee bean spent the extraction process are carryout. Coffee Arabica bean spent were used for the extraction process. Extracted coffee protein was analyzed by using USP methods and ICP – MS method. Amino acid profile, Microbial test, Protein Assay, Heavy metals etc. was analyzed. The results proven that the protein present in spent of the coffee and it contains nearly 20 amino acids.

Article History

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Key words: Coffee Arabica, USP Method, ICP – MS method and Protein profile.

1. Introduction

Coffee is one of the most consumed beverages in worldwide (Silverio et al., 2013). Coffee is the most important agricultural commodity in the world and is second only to petroleum in global trade activity and value. According to the International Coffee Organization, about 120 million bags of coffee are produced annually worldwide; corresponding to over 7 million of coffee beans per year. Coffee has taken an important place in human society for at least 1200 years. Coffee is currently grown in some 80 countries in four continents. Brazil is the world's largest coffee producer, followed alternately by Colombia and Vietnam. Many African countries including Uganda, Burundi, Rwanda and Ethiopia have coffee as their main source of foreign exchange. In addition, the vast majority of coffee plantations worldwide belong to smallholders, which makes the activity highly important in maintaining rural lifestyles, providing better incomes, and wealth distribution (Da Matta and Ramalho, 2006). Coffee is widely consumed by all social classes as an international dietary habit. Among the various bioactive substances present in the beverage, caffeine and polyphenols stand out (Samoggia and Riedel, 2019). Coffee contains diverse ingredients, such as Cafe Royal, caffeol, chlorogenic acid, potassium, niacin, and magnesium. Such ingredients as caffeine are known to affect diverse physiological functions in our bodies (Song *et al*., 2006). Of the several species in the genus Coffea (Rubiaceae), only Coffea Arabica and *Coffee canephora* var. *robusta* are cultivated for commercial production. *Coffea arabica* was the first species of the genus Coffea to be commercially cultivated and therefore became the reference for beverage quality (Samsalee and Sothornvit, 2021).

2. Types of Coffee Beans

Among some 90 species of the Coffea genus, *C. arabica* L. (Arabica coffee) and *C. canephora* Pierre (Robusta coffee) economically dominate the world coffee trade, being responsible

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for about 99 % of world bean production. Presently, Arabica coffee accounts for about 62 % of coffee consumed, and Robusta coffee for the rest. Compared with Arabica, Robusta coffee generally appears to be more vigorous, productive and robust, but the quality of the beverage derived from its beans is considerably inferior to that from Arabica. Robusta is the most widely cultivated variety of *C. canephora* in the world, so that the name of this variety is used to designate the common name of the species. Nevertheless, in Brazil, Kouillou (also known as Conilon) is practically the sole cultivated variety of *C. canephora*. Within *C. arabica*, Catuai and Mundo Novo are the most traditional cropped cultivars, but many others are also economically important worldwide (Da Matta and Ramalho, 2006).

Aroma

Lipids and proteins contribute to the formation of the aromas and flavours of coffee beverages. Lipids are responsible for flavour retention, and they influence the stability of foam in the beverage. Lipids are also known to have a taste and aroma trapping volatile compounds within the foam layer. Proteins are important precursors of aromas and flavours of the beverage due to reactions with sugars during roasting. Lipids and proteins are influenced by growing conditions, and negative correlations with accumulation in coffee beans have been observed between them. Lipids are found in amounts ranging from 10 to 15 % in coffee, of which 75 % are triglycerides and 20 % are esters of fatty acids diterpenics. Cafestol, kahweol, and 16-O-methyl cafestol in free form (16-OMC) are the primary diterpenes found in coffee oil. Diterpenes have been the subject of many studies, especially those characterizing relationships to human health. Desirable and adverse effects have been reported. The amino acids and proteins found in green coffee beans are known to be precursors of many important aroma compounds found in roasted coffee. Green coffee storage proteins, the 11S storage protein in particular, account for 45% of the total protein content of green coffee beans and represent an important reservoir for free amino acids and peptides (Kitzberger *et al*., 2016). Typical sensory attributes have been ascribed to Arabicas (*Coffea arabica*) and Robusta (*Coffea canephora*, genetic aspects) or too immature and mature cherries (metabolic aspects), for a long time. Coffee aroma may be composed by >800 volatile compounds. Precursors responsible for the generation of these many volatile compounds have been identified: sugars, amino acids, peptides, trigonelline, chlorogenic acids, organic acids, lipids, and carotenoids. Interactions between reducing sugars and amino groups of amino acids, peptides, and even proteins (known as the Maillard reaction) have been extensively studied in model systems and also in complex beverages such as coffee. This type of reaction is recognized as essential for coffee aroma development. Along this line, free amino acid and peptide profiles were investigated in green coffee beans. The contribution of mixtures of these nitrogenous compounds to the development of coffee flavor was suggested by model roasting trials **(**Mazzafera *et al*., 2019). Basically, coffee can be processed by three different methods, as follows: natural or dry processing, by which coffee fruit is harvested and taken directly to drying; wet processing, by which coffee fruit is pulped and demucilated in water tanks; and semidry processing, by which coffee fruit is pulped and taken to dry (Bressani *et al*., 2020). Coffee is the number one diet source of antioxidants in many countries including the United States, Italy, Spain, and Norway. Coffee beans contain phenolic antioxidant compounds. The major polyphenol in coffee is chlorogenic acid.

Chlorogenic Acids

One of the richest sources of a specific type of phenolic compound, the chlorogenic acids (CGAs), is actually the coffee bean. CGAs constitute a family of esters formed between certain transcinnamic acids (caffeic and ferulic) and quinic acid. Considering the content of chlorogenic acids in coffee [7 - 10 and 5 - 7.5 % on a dry matter basis for Robustas and Arabicas, respectively, autoxidation of CGAs might be expected during coffee processing. In fact, the importance of such reactions has long been recognized in wine aging or staling and haze formation in beer. Chlorogenic acidic one of the major strong antioxidant compounds in coffee. The antioxidant activity of coffee depends on the chemical composition. In addition, it was observed that the antioxidant activity of coffee varies according to the degree of roasting. Maximum antioxidant activity was measured for the medium-roasted coffee.

Caffeine

Although caffeine is a major component of coffee, the con- tent is highly variable - ranging between 30 mg and 175 mg in a cup of home-prepared coffee. Caffeine is the most widely consumed psychoactive drug worldwide and appears to exert most of its biological effects through the antagonism of the adenosine receptor. Adenosine is an endogenous inhibitory Neuro modulator that prompts feelings of drowsiness, and thus caffeine induces generally stimulatory effects in the central nervous system. In addition, the physiological effects of caffeine intake include acute elevation of blood pressure, increasing metabolic rate, and diuresis.

3. Materials and Methods

Coffee bean of *Coffee arabica* was used for the coffee protein extraction and the extracted coffee protein was used for protein assay and other tests.

Analysis

The test as done using the coffee protein which as extracted from the coffee spent. The tests are Amino acid profile, Appearance, Colour, Odour, Taste, Loss on drying, Protein Assay, Heavy Metals (Mercury, Arsenic, Cadmium and Lead) and Microbial test.

Appearance, Colour, Odour and Taste

That should be analyzed using a Physical methods.

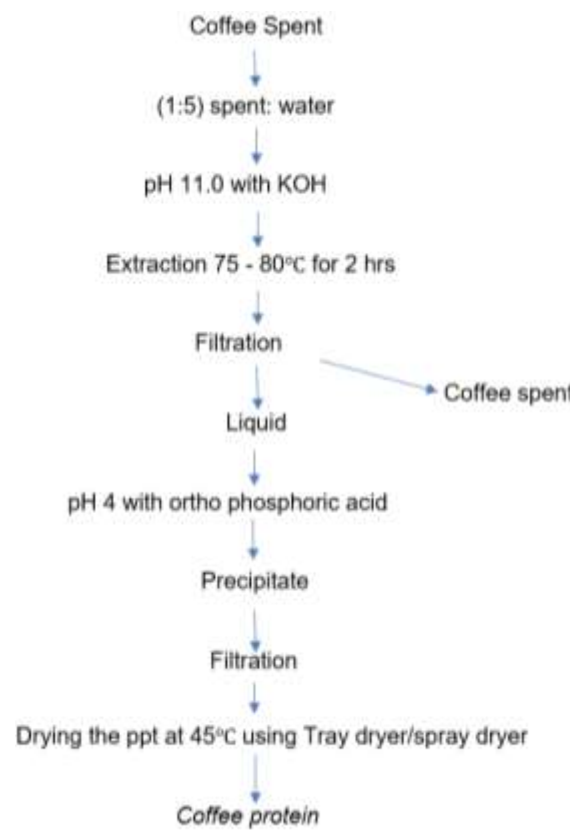
Loss on drying

Loss on drying were analysed using a method called USP method.

Protein assay

Protein Assay was analysed by USP method.

Coffee protein preparation procedure



Amino Acid Profile

Amino acids are building blocks of proteins and it contains 22 amino acids.

Heavy metals

Heavy metals were analysed by ICP –MS Method. Using this method, the Mercury, Arsenic, Cadmium, and Lead were analysed.

Microbial test

Microbial test was analysed by USP method. For microbial test two organisms were used: (i) *Escherichia coli* and (ii)*Salmonella* sp. Both organisms are Gram negative bacteria.

4. Results

The Analysis carried out using green coffee bean of *Coffee arabica*.

Appearance, Colour, Odour and Taste

The appearance, colour, odour andtaste were analysed by physical method.

Loss on Drying

By using USP Method the loss on drying was analysed. The results are given below.

Table - 1: Result of Coffee Protein's Loss on Drying

S.No	Sample	Method	Result
1.	Coffee Bean	USP	3.26%

Protein assay

Protein Assay was done by using a method called USP. The results are shown below.

Table – 2: Result of Coffee Protein's Protein Assay

S.No	Sample	Method	Result
1.	Coffee Bean	USP	45%

Amino Acid Profile

Amino acid is building blocks of proteins. Totally 22 amino acids are present. Amino acids are two types, (i) Essential amino acids and (ii) Non-essential amino acids. The amino acids are examined in the coffee protein.

The results shows that, in coffee protein totally 20 amino acids are present. And it contains both essential and non-essential amino acids. The table shown that amount of each amino acids present in the coffee protein.

Heavy metals

Using an ICP-MS method Heavy metals test was conducted.

Table – 3: The Table Shows That the Result of Coffee Protein's AMINO ACID Profile

Parameters	Coffee protein (g/100g)
L-Arginine	2.40
Taurine	0.04
L-Leucine	3.80
L-Iso leucine	1.53
L-Valine	2.35
L-Cystine	0.34
Glycine	2.65
Histidine	1.12
Serine	1.99
Aspartic Acid	4.83
Glutamic Acid	10.65
Threonine	1.87
Alanine	1.93
Proline	1.80
Lysine	2.55
Throsine	1.36
Methionine	0.32
Iso Leucine	3.88
Phenyl Alanine	2.67
Tryptophan	<0.01

Table – 4: Result of Coffee Protein's Heavy Metals

Sample	Method	Heavy metals	Result
Coffee Bean	ICP-MS	Lead	3.0ppm
		Arsenic	0.1ppm
		Mercury	1.0ppm
		Cadmium	0.1ppm

Table – 5: Result of Coffee Protein's Microbial Test

Sample	Method	Microorganism	Result
Coffee Bean	USP	*Escherichia coli*	Negative
		Salmonella sp.	Negative

Microbial test

Using USP method the microbial test was analysed in the coffee bean protein. Gram negative bacteria are used for the microbial test. They are *Escherichia coli* and *Salmonella* sp.

5. Conclusion

The study concludes that the coffee is a worldwide beverage and the spent from coffee bean as protein content.

- From coffee spent – coffee protein was extracted.

- Extracted protein were undergoes for the test to analysis the protein content and the other beneficial source.
- It proven that coffee protein from the coffee spent has optimal protein content and it contains 20 amino acids out of 22.

6. Reference

1) Alessandra dos Santos Danziger Silverio & Rosemary Gualberto Fonseca Alvarenga Pereira & Adriene Ribeiro Lima &Fernanda Borges de Araujo Paula & Maria Rita Rodrigues & Lineu Baldissera Jr. & Stella Maris da Silveira Duarte, The Effects of the Decaffeination of Coffee Samples on Platelet Aggregation in Hyperlipidemic Rats, Plant Foods Hum Nutr (2013) 68:268–273.
2) Ana Paula Pereira Bressani, Silvia Juliana Martinez, Leonardo de FigueiredoVilela, Disney Ribeiro Dias and Rosane Freitas Schwan, Coffee protein profiles during fermentation using different yeast inoculation methods, Pesq. agropec. bras., Brasilia, v.55, e01159, 2020.
3) Antonella Samoggia and Bettina Riedel, Consumers' Perceptions of Coffee Health Benefits and Motives for Coffee Consumption and Purchasing, Nutrients 2019, 11, 653.
4) Cintia Sorane Good Kitzberger, Maria Brigida dos Santos Scholz, Luiz Filipe Protasio Pereira, Joa Batista Goncalves Dias da Silva, and Marta de Toledo Benassi, Profile of the diterpenes, lipid and protein content of different coffee cultivars of three consecutive harvests, AIMS Agriculture and Food, 1(3): 254-264.
5) Fangfang Song a, Ji Eun Oha, Kyung Won Lee b, Mi Sook Cho a, The effect of coffee consumption on food group intake, nutrient intake, and metabolic syndrome of Korean adults 2010 KNHANES (V-1). NFS Journal 4 (2016) 9–14.
6) Fabio M. DaMatta and Jose D. Cochicho Ramalho, Impacts of drought and temperature stress on coffee physiology and production: a review, Braz. J. Plant Physiol., 18(1):55-81, 2006
7) Jae-HoonBae, Jae-Hyung Park, Seung-Soon Im, Dae-Kyu Song, Coffee and health.
8) Krit Somnuk, Pichai Eawlex, Gumpon Prateepchaikul, Optimization of coffee oil extraction from spent coffee grounds using four solvents and prototype-scale extraction using circulation process, Agriculture and Natural Resources 51 (2017) 181e189.
9) Namfon Samsalee and Rungsinee Sothornvit, Physicochemical, functional properties and antioxidant activity of protein extract from spent coffee grounds using ultrasonic-assisted extraction, AIMS Agriculture and Food, 6(3): 864–878.
10) Paulo Mazzafera, Flavia Schimpl and Eduardo Kiyota, Proteins of Coffee Beans: Recent Advances, January 2019.
11) Philippe Montavon, Eliane Duruz, Gilbert Rumoand Gudrun Pratz, Evolution of Green Coffee Protein Profiles with Maturation and Relationship to Coffee Cup Quality. J. Agric. Food Chem. 2003, 51, 2328 - 2334.
12) Rachael Z Stolzenberg-Solomon, Edgar R Miller III, Maureen G Maguire, Jacob Selhub, and Lawrence J Appel, Association of dietary protein intake and coffee consumption with serum homocysteine concentrations in an older population, Am J Clin Nutr., 1999; 69: 467 – 475.
13) Thierry Leroy, Fabienne Ribeyre, Benoit Bertrand, Pierre Charmetant, Magali Dufour, Christophe Montagnon , Pierre Marraccini and David Pot. Genetics of coffee quality, Braz. J. Plant Physiol., 18(1): 229 - 242, 2006.

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