Development of an energy drink using soybean (*Glycine max*) and quinoa (*Chenopodium quinoa Willd*)

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***Abstract*—In this research a protein nutritional supplement was obtained, using soybean (*Glycine max*) and quinoa (*Chenopodium quinoa Willd*). Initially a flour which was mixed in different soybean / quinoa and adding water to obtain searching a protein coagulum, this was lyophilized preparing various formulations of a drink ratios was obtained, and subjected to a sensory analysis to determine the characteristics in flavor, color, aroma, body and sweetness. The content of vitamin B6 was adjusted by adding to the commercial tablets of vitamin B6 drink, the mixture was lyophilized again and relevant evidence to protein content, and microbiological profile of essential amino acids were performed. A protein nutritional supplement enriched with vitamin B6, containing 57.73% protein and vitamin B6 2,85mg of was obtained. Which contributes between 17,319g - 28,865g protein per 30g 50g lyophilized. Based on the results it is concluded that the food product is rich in protein, with an amino acid profile within the parameters required by the FAO and microbiologically safe.**

Keyword- Functional food, High performance, Energy drink, Nutritional supplement.

I. INTRODUCTION

The formulation of mixtures of cereals and legumes, allows to obtain an improvement in the amino acid balance, which translates into a superior value in the quality of the protein compared to each one separately, because legumes are a better source of lysine than cereals and these represent a higher source of sulfur amino acids [1,2,3].

Soy is a product of high biological value that has gained recognition by the consumer for the association made to health benefits [4], this has generated a growing market for food products with soy protein, which is currently produced in large volumes: 155 million metric tons of soybeans are cultivated worldwide, of which 38% are in the United States, followed by Brazil (25%), Argentina (19%), China (7%), India (3%), Canada (2%), and Paraguay (2%), while the rest of the countries cultivated only about 4%, on an average of 40% protein contained in soybeans, 63.6 million metric tons of soy protein per year, available for consumption [5].

Likewise, due to its high agricultural and nutritional potential, interest in quinoa has increased in the last years, until it became a diversification alternative for the Andean region [6]. At present it is considered a product "star" in the world for its nutritional and medicinal properties. It presents different varieties of species, and it is the only one among the cereals that owns all the amino acids, besides being the unique alternative between the foods of vegetal origin to replace the animal protein. In this sense, to a large extent, the increase in its production and export is attributable to such qualities [7,8].

Within all the applications that have at the food level are the drinks with soy protein, which may be neutral, such as the so-called soy milk that are the most current consumption [9] and acidic, which correspond to mixtures with juices of fruit [10]. Quinoa within the Andean grains is the most versatile for consumption. Whole grain, raw or toasted flour, flakes, semolina and instant powder can be prepared in multiple ways [11,12]. The objective of this work was to obtain a protein nutritional supplement using soy and quinoa grains, enriched with vitamin B6, intended for people with high physical performance.

II. MATERIALS AND METHODS

Physical Determination and Proximal Chemical Composition

The physicochemical determinations are the tests that refer to the bromatological characteristics, were made by estimation of the proximal composition through finely ground samples. The methods used for physicochemical characteristics are shown in Table 1.

Table I. Methodology for physico-chemical analysis

Parameter	Method
Humidity	AOAC 925.10
Protein	AOAC 920.87
Total Carbohydrates or Carbohydrates	AOAC 995.13
Grease	AOAC 920.39
Ashes	AOAC 923.03

Obtaining the flour

To ensure a fine and homogeneous material, two grinds were made to the grain samples, an initial one in order to achieve a low tegument flour. In addition, a second to get smaller particles. Both grinding products will be sifted; the soybeans will be partially defatted.

Protein Extraction Method

The method for the extraction of proteins was done by wet method, the flour obtained from soybean and quinoa was obtained, then the flour with a higher protein content was chosen and flour-water suspensions were prepared in ratios of 1: 6, 1 : 7: 1: 8: 1: 9, 1:10. The mixture is heated at 40 ° C for 40 min. With constant stirring and adjusting the pH of the medium to 7 using 1N NaOH, then let stand and decant. The supernatant is removed and the amylaceous residue obtained in the bottom is washed twice with water under the same conditions of time and temperature, with stirring to solubilize the protein of the mixture, adjusting pH, centrifuging for a determined time and decanting to obtain the proteins and starch residues. Finally, the protein extract and the supernatants are deposited in the same container [13].

Obtaining the final formulation of the beverage

Having obtained the results of the sensory analysis, the ideal formulation for the final beverage is chosen, based on those parameters that influence the evaluated characteristics, as for example for its color the most relevant parameter is the addition of dye, therefore the amount of this is the one that gives us the characteristic of intensity and tone.

III. RESULTS AND DISCUSSION

Initial Characterization

The bromatological analyzes show that soy has a much higher protein content than that of quinoa, and these are found in 30.255% and 19.90% of protein, comparing with some other vegetable products we are aware that they are highly protein rich products and which complement each other perfectly. For the extraction of the flours, equal weights were used, taking 8000 g of soybean and quinoa, from which was obtained 6175 g of Integral soybean meal and 6900 g of integral quinoa flour, this being a yield of 77.18% and 86.26% respectively.

Table 2 shows the evaluation of the flour sample preparation process, the flour combination with the highest protein content was the formula 70/30, with a protein content of 28.59%, as measured that the content of soybeans increased as protein content increased, we can infer that soybeans by containing a higher percentage of protein is the element that contributes more of this nutritional component.

Table II. Nutritional comparison of soybean, quinoa and flour S / Q 70/30

Parameters	Unit	Soybean	Quinoa	Flour 70/30
Protein	(%)	30,255	14,900	28,590
Grease	(%)	23,920	5,780	18,480
Humidity	(%)	7,600	10,820	8,560
Carbohydrates	(%)	28,890	59,720	35,210
Ashes	(%)	5,350	2,545	4,500
Raw Fiber	(%)	3,985	6,235	4,660

Evaluation of chemical analysis of protein concentrate

After lyophilizing the protein clot, a concentrated product was obtained with 9.5% moisture, 65.85% protein and 24.8% total solids. The weight of the concentrate obtained was 70 g and starting from 100 g of S / Q flour mixture, with three dilutions of which a protein extract of 2500 ml was obtained, which provided 1500 ml of protein coagulum. With a yield of 70% based on the flour mixture S / Q and of 2.8% and 4.66% in relation to the protein extract and the protein clot respectively.

Evaluation of SNPEB6 lyophilization

45.6 g of lyophilizate were obtained, starting from 200 g of the mixture, indicating a yield of 22.8%, the protein content is in the range of 57.73% which gives us 26.32 g. The tests made for reconstitution after being evaluated sensorially, show that 30 grams to 40 grams of lyophilized must be used for 170mL - 160mL of water, providing this mixture an amount of protein between 17.32g - 23.10g per dilution. It is possible to make a dilution with a larger amount of lyophilizate, such as 50g of lyophilized per 150mL of water, although this provides us with a higher protein content of 28.87g, its characteristics were not well accepted by the panel.

Although the protein content of the final product does not meet the recommendations of the FAO / WHO / UN, Colombian Institute of Family Welfare (ICBF) and the GDR, which range from 40g to 60g daily protein for a healthy adult, however it provides about 50% of the requirement, leaving the other 50% to the daily diet, thus becoming a product of excellent protein source and nutritional quality. The amino acid profile of the nutritional supplement is above the essential amino acid requirements of the ideal proteins as shown in Table 2, thus meeting the body's needs during its intake.

Table III. Comparison of essential amino acid requirements of the ideal proteins with the amino acid profile of the protein nutritional supplement

Aminoacids	Young children (0 - 6 months) needs (mg/día/Kg)	Children (10 - 12 years) Needs (mg/día/Kg)	Adults Needs (mg/día/Kg)	Ideal composition (mg/Kg)	Freeze-dried composition (mg/Kg)
Histidine	28	0	0	0	74,6
Isoleucine	70	30	10	18	41,15
Leucine	161	45	14	25	379,9
Lysine	103	60	12	22	47,30
Methionine (+ cysteine) a	58	27	13	24	42,20
Phenylalanine (+ tyrosine) b	125	27	14	25	87,85
Threonine	87	35	7	13	58,70
Tryptophan	17	4	3,5	6,5	61,40
Valine	93	33	10	18	34,50
Total Essential Amino Acids	742	261	83,50	151,50	827,60

a Cysteine can provide up to one-third of the total needs for sulfur amino acids

b Tyrosine can contribute up to one-third of the total aromatic amino acid requirement

If we compare the amino acid content of soybeans with FAO standards we can observe that the product obtained has the characteristics of a good supplement because its content conforms to the FAO standard. We also see that it exceeds soybeans as shown in Table 3 in comparison to its limiting amino acid content, which is methionine + cysteine, with the latter being 42.2 mg / kg and soybeans 28 mg / kg, as with cow's milk, and wheat.

Table IV. Comparative content of essential amino acids and nutritive value of soybean, quinoa and SNPEB6 protein in relation to the FAO standard

Parameters	Cow milk	Chicken egg	Meat (beef)	Wheat	Grain Soybeans	Quinoa beans	Supplement	FAO
Histidine	27	22	34	25	28	27	74,60	0
Isoleucine	47	54	48	35	50	64	41,15	40
Leucine	95	86	81	72	85	71	379,9	70
Lysine	78	70	89	31[a]	70	66	47,30	55
Methionine + cysteine	33[a]	57	40	43	28[a]	45	62,20	35
Phenylalanine + Tyrosine	102	93	80	80	88	74	87,85	60
Threonine	44	47	46	31	42	48	58,70	40
Tryptophan	14	17	11	12	14	11	61,40	10
Valine	64	66	50	47	53	50	34,50	50
Total essential amino acids, without histidine	477	490	445	351	430	429	773	360

a Limiting amino acid in the diet

The amount of vitamin B6 in the protein nutritional supplement is at a rate of 2.85mg, well above the requirement, since the supplement contains between 17 - 23g of protein and the calculation for this amount is 0.345mg. According to the ICBF and the GDR, the vitamin content supplies the daily needs of the different groups of consumers, finding that for these the recommendations are: for infants 0.6mg / day, children 3mg / day, adolescents 1.9mg / day , adults 2.1mg / day and women in pregnancy and / or lactation, 2.6mg / day. Being that the nutritional supplement protein has a content of 2.85mg / kg.

IV. CONCLUSIONS

From the results obtained, the following conclusions can be presented: 1) A protein-rich food product was obtained, with an amino acid profile within the parameters required by the FAO and microbiologically safe; 2) The bromatology tests show that it is a product rich in nutrients, which does not render irrelevant its other components in the strict sense that is not a purely protein product but also contains other nutritional characteristics; 3) The vitamin B6 content makes it a product that ensures its assimilation, as it is within the established, which should be on average 13mg/kg of protein and the reference intakes are based on 15mg/kg of protein.

V. REFERENCES

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