

## The influence of different proportions of Spirulina (*Arthrospira plantensis*) on the quality of pasta

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### Abstract

The purpose of this research was to study the influence of the addition of spirulina (*Arthrospira platensis*) on the pasta quality and to determine the consumer preferences. Spirulina "super food" is a cyanobacterium (blue-green algae) which contains a vitamins complex (A, B, D, E, and K), minerals (calcium, potassium, sodium, phosphorus, magnesium, iron), amino acids, essential fatty acids and pigments, compounds required to ensure a balanced diet. This rich natural source of digestible protein (two times higher than soybeans), provides all essential amino acids useful for the human body.

To accomplish the objectives were analysed comparatively several experimental prototypes (PM - blank test without added spirulina, P1 - sample with 2% added spirulina, P2 - sample with 5% added spirulina). After obtaining all three prototypes of pasta they were subjected to a set of physicochemical (proteins, antioxidant capacity, moisture, acidity, ash) and sensory analysis to highlight the influence of various spirulina ratios on the pasta quality.

The obtained results reveals that the nutritional value of the product was significantly improved by the addition of spirulina compared with the control sample. Also, all the analysed samples were favourably evaluated by the tasters, but the most popular was the prototype enriched with 5% spirulina.

**Keywords:** *Arthrospira platensis*, spirulina, pasta, quality control, sensory analysis

### 1. Introduction

Pasta is a popular food with origins from first century and continues to be popular around the world owing to the simplicity of production, low cost, storage stability and nutritional qualities. Because the pasta is consumed as a staple food in all parts of the world, many researchers are trying to develop new products with enhanced nutritional value.

*Arthrospira platensis* (spirulina) is a water blue-green microalga which belongs to the *Oscillateriaceae* family [1]. It contains a complex

of vitamins (A, B, D, E, K) [7,10,17], minerals (iron, nickel, calcium, potassium, chromium, sodium, zinc, magnesium, manganese, copper, selenium, lead) [11,12], carotenoids and essential fatty acids (3,6 gamma-linolenic acid, alpha-linolenic acid, stearidonic acid, eicosapentaenoic acid, docosahexaenoic acid, and arachidonic acid) [1,16], necessary for a balanced diet. Also, spirulina is the richest natural source of digestible protein that offers all essential amino acids to the human body [8,7].

Due to the presence of these phytonutrients, it has corrective properties against several diseases like

cancer, diabetes, hypertension, hypercholesterolemia, anaemia [3].

Moreover, most research has focused on the health effects of spirulina as a dietary supplement for humans and animals, [13] that can be found in various forms such as: tablets, capsules or in liquid form. It also can be included in: pasta, snacks, candies, gums and drinks [9]. Of global production, spirulina is used in a proportion of 30% in animal nutrition [3], while over 50% of production is used as a nutritional supplement in human food [14].

The addition of spirulina to pasta delivers a very complete nutritional profile and has a strong positive effect on the immune system. For this reason, the purpose of this research was to study the influence of the addition of spirulina (*Arthrospira platensis*) on the pasta quality and determine the consumer preferences.

## 2. Materials and methods

### 2.1 Materials.

To obtain enriched-spirulina pasta has been used as raw materials durum wheat flour, salt, eggs and organic spirulina powder in 2% and 5% proportion. The control sample (PM) was made without the addition of spirulina. The products were made in the Bakery Pilot Station of UASMV, Cluj-Napoca and analysed in the Food Quality Control and Sensory Evaluation laboratories of the Faculty of Food Science and Technology.

### 2.2 Methods.

In this study, a variable experiment was conducted to determine the specific effects of varying spirulina powder percentage on the physicochemical properties important for pasta quality. Also, sensory evaluation was conducted to determine the most important qualities to consumers and to establish the optimal prototype for the industrial-scale production.

**2.2.1 Physicochemical analysis.** Moisture content, total protein, ash and titratable acidity were determined according to AOAC method (2000) [2]. A commonly used method for quantification of antioxidant capacity is the 1,1-diphenyl-2-picrylhydrazyl (DPPH) assay, which measures the ability of the compound to scavenge the DPPH

stable radical [18]. The reactions for free radicals capture induce a change in sample colour, from blue to yellow and a relative decrease in absorbance. The antioxidant activity is expressed as antiradical activity of samples. Absorption of the samples was measured on a Shimadzu UV-1700 at 515 nm and the antioxidant activity was calculated as follows:

% DPPH scavenging activity =  $[(A_0 - A_1)/A_0] \cdot 100$ , where

$A_0$  was the absorbance of the control reaction and  $A_1$  the absorbance in the presence of the sample.

**2.2.2 Sensory evaluation.** Hedonic testing of the samples was conducted in the Sensory Evaluation Laboratory of the Faculty of Food Science and Technology. Sensory profiling of pasta samples was performed by 30 panellists with age between 21-24 years. Samples of pasta (PM, P2%, P5%) were thermally processed before tasting. Fresh water was used to cleanse the palate between samples.

The panellists evaluated all the pasta formulations for colour, odor, taste, texture and overall acceptability using a 9-point hedonic scale, 0 being “dislike extremely” and 9 being “like extremely”.

## 3. Results and discussion

### 3.1 Physicochemical analysis

To accomplish the objectives were analysed comparatively several experimental prototypes (PM - blank test without added spirulina, P1- sample with 2% added spirulina, P2 - sample with 5% added spirulina). After obtaining all prototypes of pasta they were subjected to a set of physicochemical analysis to highlight the influence of various spirulina ratios on the pasta quality (proteins, antioxidant capacity, moisture, acidity, ash).

The moisture, acidity, ash, protein as well as the antioxidant capacity of the tested pasta formulations is presented in table 1.

As can be observed, the obtained results comply with the limits stipulated by the quality standards for all analysed parameters [15].

Because the protein quality of durum wheat is substandard due to the deficiency in essential amino acids necessary for a balanced diet and for a normal body function, the addition of spirulina helps to completing this lack. Thus, as can be seen in Table 1, protein content increased progressively with

increasing percentage of added spirulina (from 11.81 for the control sample to 15.61 for the pasta with 5% added spirulina). It was also found that both samples containing added spirulina had a higher moisture content compared with the control, but in accordance with the parameters stipulated in the standard.

**Table 1.** Physico-chemical parameters evaluated on spirulina-enriched pasta and control sample

Parameters	Sample		
	PM	P 2%	P 5%
Moisture content, %	7.21	7.37	7.59
Acidity, acidity degrees	1.59	7.56	8.37
Ash, %	0.10	0.14	0.18
Protein content, %	11.81	15.37	15.61
Antioxidant capacity, %	5.34	8.75	20.32

The content of total mineral substances has not been significantly affected by the addition of spirulina; instead acidity was much higher compared to the reference sample.

Also, the addition of spirulina significantly improves the antioxidant capacity, increasing almost four times for the sample with 5% spirulina.

### 3.2 Sensory analysis

It is very important that the organoleptic properties of pasta enriched with spirulina remained acceptable to consumers and the quality level similar to the current commercially available products.

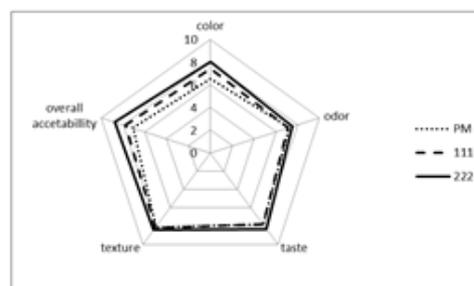


**Figure 1.** Pasta enriched with spirulina and the control sample

The results of sensorial evaluation of pasta formulations containing different level of spirulina compared to the control sample are shown in figure 2.

The average value for the overall acceptability was 7.8 for pasta with 2% addition (111) and 8.75 for pasta with 5% addition (222) from 9 maximum. Also, the color, odor, taste and texture of pasta fortified with spirulina were significantly improved compared with the control for both prototypes.

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**Figure 2.** Acceptability scores of pasta containing different levels of spirulina

### 4. Conclusions

The obtained results reveals that the nutritional value of the product was significantly improved by the addition of spirulina compared with the control sample. Also, all analysed samples were favourably evaluated by tasters, but the most most appreciated by consumers was the prototype enriched with 5% spirulina.

**Compliance with Ethics Requirements.** Authors declare that they respect the journal's ethics requirements. Authors declare that they have no conflict of interest and all procedures involving human / or animal subjects (if exist) respect the specific regulation and standards.

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