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Proceeding Paper

Nutrient Composition of Fresh Pasta Enriched with Chia (*Salvia hispanica* L.) †

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Abstract: Pasta is traditionally made from durum wheat semolina, but this can be substituted with other flour or semolina types and pasta can contain other ingredients. The nutritional characteristics depend on the ingredients, but, generally, pasta contains about 70% carbohydrate, mainly starch. Chia (*Salvia hispanica*) and their byoproducts are well-known for their high nutritional value, containing essential fatty acids (omega-3 and omega-6), a high mineral and vitamin content, and a high amount of fibre. The purpose of this study was to investigate the effects of different chia byproducts on pasta's technological parameters, their nutritional/functional characteristics (proximate composition, phytic acid) and a sensory evaluation (hedonic scale of nine points). The results showed a higher contribution of minerals in formulations with chia byproducts compared to the control sample. However, the mineral bioavailability could be compromised, as indicated by the phytic acid increment in formulations with chia byproducts. However, the glycaemic indexes were significantly similar to the control sample, with the exception of the samples with chia seeds. Regarding the technological characteristics of the formulations with chia, they did not show significant differences compared to the control sample. In this sense, the chia byproducts could be nutritional ingredients for use in pasta enrichment without depletion of the product quality.

Keywords: *Salvia hispanica* L.; chia byproducts; fresh pasta; nutritional characteristics

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1. Introduction

The presence of cereals in the diet has varied in terms of the evolution of the different patterns of food consumption. [1]. Pasta has been consumed in the Mediterranean countries for many centuries and takes second place, after bread, in world consumption [2]. For this reason, there is a food trend of enhancing pasta with quality food products to achieve nutritional improvements [3]. Dried pasta is traditionally made from durum wheat semolina, but this can be substituted with other flour or semolina types and pasta can contain other ingredients, e.g., eggs or spices [4]. The nutritional characteristics depend on the ingredients, but, generally, pasta contains about 70% carbohydrates, mainly starch [5].

In this sense, chia (*Salvia hispanica* L.) and their byproducts are well-known for their high nutritional value, as they contain essential fatty acids (omega-3 and omega-6) [4], have a high mineral and vitamin content, and are also an excellent source of dietary fibre [1]. This means that chia could be used to enrich food formulations.

The purpose of this study was to investigate the effects of different chia products (seeds, flour and by-products from cold-pressing oil extraction) on pasta's processing properties and to evaluate their nutritional value.

2. Materials and Methods

2.1. Raw Materials

Commercial Spanish wheat flour (W) was obtained from the local market. Chia seeds (CWS); chia whole flour (CWF), chia fibre (CF), and chia proteins (CP) were provided by BENEXIA Company (Santiago, Chile).

2.2. Pasta Production

The produced pasta was of the tagliatelle type, on a pilot scale, according to the specifications and procedure of the automatic pasta-maker (Nina, Springlane, Düsseldorf, Germany). Five types of pasta were produced: a control made of 100% wheat flour, and four fortified pastas with added chia seeds, chia whole flour, chia fibre and chia proteins (at a 10% substitute level).

2.3. Chemical Composition

Chemical analyses of the pasta were realized to determinate moisture (AOAC 925.09 Method) [6], protein (ISO/TS 16634-2) [7], total dietary fibre (TDF) and starch according to the approved AOAC 991.43 and 996.11, respectively [6].

The concentration of phytic acid (InsP_6) was determined as a phosphorus released by phytase and alkaline phosphatase by a quantity K-PHYT method, where the phosphate release was measured by a colorimetric technique (AOAC method 986.11) [8].

2.4. Preliminary Sensory Evaluation

The preliminary sensory evaluation was carried out by 20 untrained testers who consume pasta in their everyday life. The parameters that were evaluated were as follows: texture, appearance, colour, taste, odour and overall acceptability in a 9-point hedonic scale Iglesias-Puig et al. [9].

2.5. Statistical Analysis

Multiple sample comparison of the means (ANOVA) and Fisher's least significant differences (LSD) were applied to establish statistically significant differences between samples ($p < 0.05$).

3. Results

Regarding the results obtained for moisture and lipids, it was observed that the highest values were obtained in the control samples, followed by whole chia flour, chia fibre and chia proteins, respectively, as shown in Figure 1. In addition, the results obtained for protein and ash showed that the highest obtained value was for the chia protein sample, followed by chia fibre, whole chia flour and control sample. The value of starch on control sample was significantly higher than in samples with chia byproducts; however, the GI did not show significant differences between samples (Figure 2). The highest amount of phytic acid was in the formulation of chia fibre, followed by the whole chia flour, chia protein sample, and the lowest value was in control sample, as was expected (Figure 3).

Regarding the preliminary sensory evaluation, the highest values were obtained by the control paste with the maximal overall acceptability at values of around eight points, as was expected (Figure 4). A slight decline in the overall acceptability of pasta with chia byproducts was obtained, but close to the control, which good acceptability by consumers.

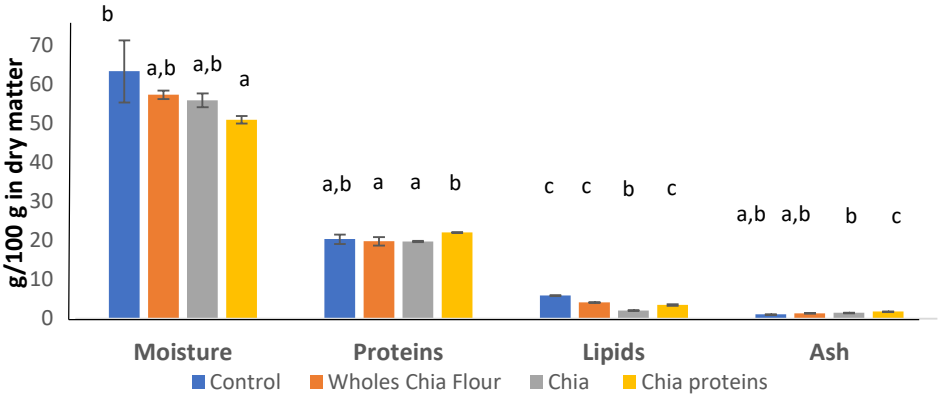

Figure 1. Fresh pasta proximate composition with chia byproducts. Values in bars of the same parameter followed by the same letter are not significantly different at 95% confidence level ($p < 0.05$).

Figure 2. Starch concentrations and glycaemic index of paste with chia byproducts. Values in bars of the same colour followed by the same letter are not significantly different at 95% confidence level ($p < 0.05$).

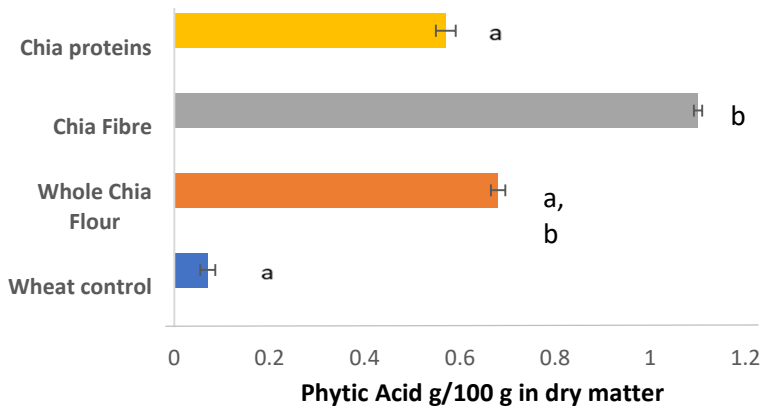

Figure 3. Acid phytic amount in pasta formulations with chia byproducts. Values in bars followed by the same letter are not significantly different at 95% confidence level ($p < 0.05$).

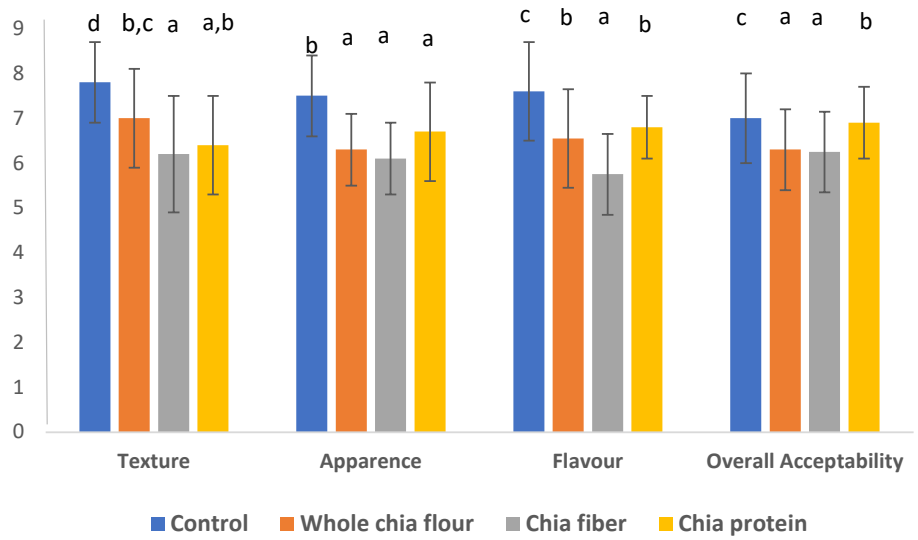

Figure 4. Preliminary sensory evaluation. Values in bars of the same colour followed by the same letter are not significantly different at 95% confidence level ($p < 0.05$).

4. Conclusions

Chia byproducts could be nutritional ingredients for use in the production of egg-free pasta enrichment without a depletion of product quality.

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