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DURUM WHEAT BREADS ENRICHED WITH CITRUS FRUITS PECTIN AND FLAVONOIDS

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ABSTRACT

The present work shows the results of a study aimed at the production of bread enriched with citrus fruit pectin and flavonoids in order to obtain a product with functional properties. The first phase of the work was focused on the qualitative characterization of durum wheat wholegrain flour and citrus fruit pectin and flavonoids. The second phase was focused on the production of bread in industrial bakery with wholemeal flour enriched with 1.0% of pectin and/or 2.0% of citrus flavonoids. Chemical (pH, total acidity, moisture) and morphometric (volume, height, weight, porosity, crust and crumb color) parameters were determined to study the effect of the different level of enrichment on the final product and during storage. Results showed that the addition of citrus flavonoids, associated with pectin have shown a better bread volume and improved the other quality parameters. Moisture content was comparable between bread samples independently from the levels of pectin and flavonoids. The results obtained indicate that the addition of citrus fruit pectin and flavonoids to durum wheat flour could be considered an innovative way to obtain functional breads.

Keywords: wholegrain flour, durum wheat bread, flavonoids, shelf-life, pectin

1. INTRODUCTION

Dietary fibers and polyphenols are recognized as active nutrients responsible for the health benefits of fruit and vegetables. Interest in incorporating bioactive ingredients such as dietary fiber and flavonoids into popular foods like bread has grown rapidly, due to the increased consumer health awareness.
Many attempts have been made to increase the nutritional value of bread by adding dietary fibre and/or other bioactive compounds as for example grape seeds, pomegranate peel powder, apple pectin and lemon pomace fiber (ALTUNKAYA *et al*., 2013; CHANG *et al*., 2015; MERAL *et al*., 2013; SIVAM *et al*., 2011). Nevertheless, fiber enrichment is usually associated with various technological problems, and there is the need to optimize the composition of the blends employedwithout impairing the technological quality of the final product (ŠKARA *et al*., 2013).
The aim of this work was the evaluation of citrus flavonoids (F) and citrus pectin and flavonoids (FP) addition on the properties of durum wheat bread. Breads were subjected to quality and chemical evaluation (attributes including moisture, color, porosity, weight and volume) during 90 days of storage.

2. MATERIALS AND METHODS

2.1. Bread making process

Bread samples were produced in an industrial bakery (Valle del Dittaino - Agricultural Cooperative Society a.r.l.,Assoro, Enna, Italy), packaged under MAP conditions using 70 % N_2:30 % CO_2 gas combination and stored at 25 °C up to 3 months. For each dough 50 kg of durum wheat semolina was used and mixed with tap water and compressed yeast and addedwith flavonoids and pectin. Code for samples and composition of flavonoids and pectin of dough were reported in Table 1.

Table 1: Code for samples and composition in flavonoids and pectin of the dough.

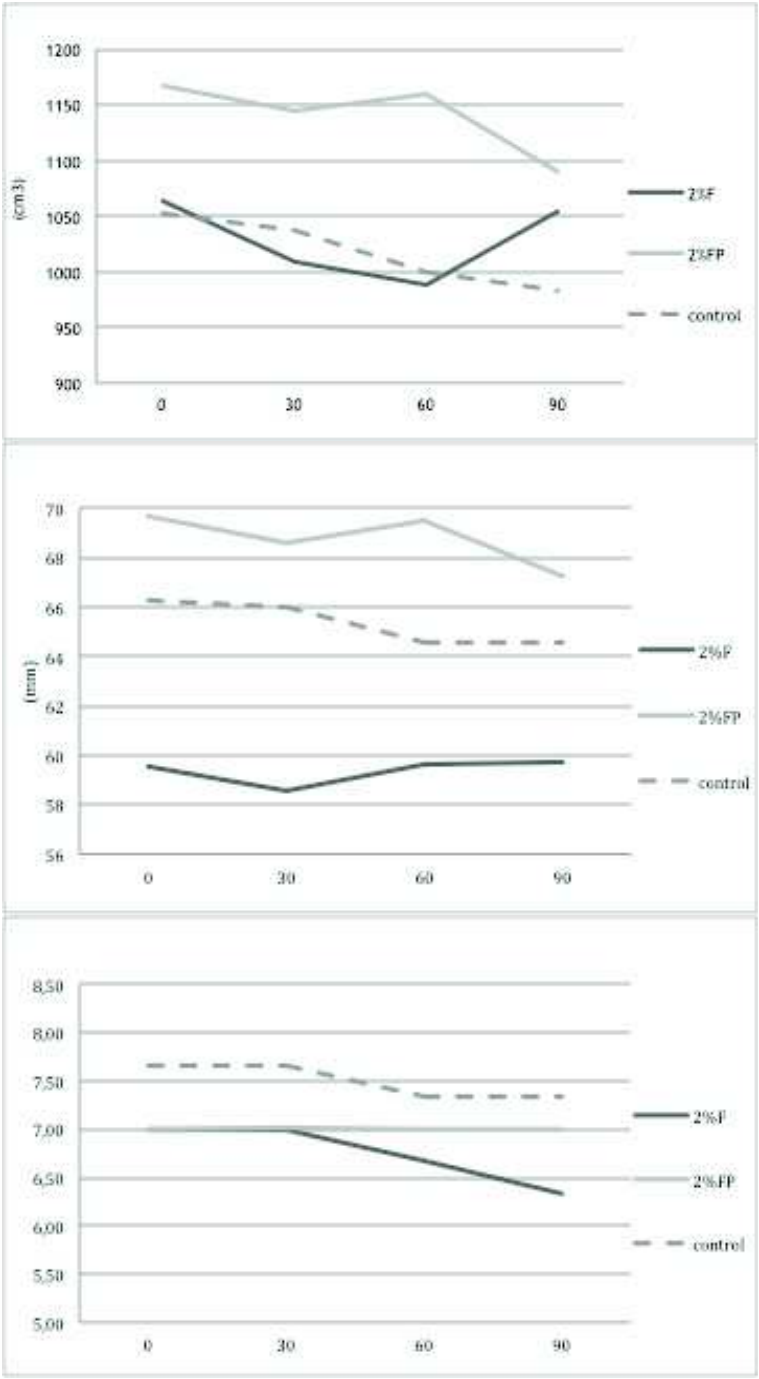
Sample code	Citrus flavonoids (g/100 g)	Citruspectin (g/100 g)
Control	-	-
2% F	2	-
2% FP	2	1

2.2. Bread quality parameters

The volume was determined according to the rapeseed displacement in a loaf volume meter; the loaf height was measured by a digital caliper (Digi-Max™, Scienceware®, NJ, U.S.A.). The internal structure was visually estimated by eight evaluator subjects, and the crumb porosity was estimated using the Mohs scale, complemented by a DALLMANN (1958), based on the analysis of visual and subjective 8 photos representing different cross sections of loaves with different porosity. Crumb color was measured by Minolta CR 300Colorimeter.
Moisture content was determined on grounded samples by gravimetric method. pH and total titratable acidity were determined according to SPINA *et al*. (2015).

3. RESULTS AND CONCLUSIONS

Regarding bread volume (Fig. 1a) FP bread samples showed, during the entire storage period, a higher bread volumecompared to control and F samples considering the structuring action of the soluble fiber (pectins). Similar trend was observed for loaves height (Fig. 1b) as the two parameters are usually related. In this case, however, the F bread sample reported during the entire storage period less voluminous loaves, probably due to the inhibitory effect on microorganisms of flavonoids during fermentation.



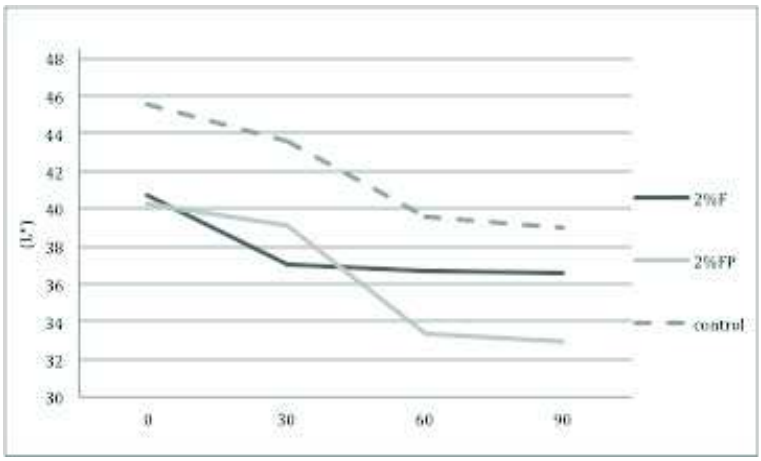


Figure 1: Effect of pectin and flavonoid addition on physical properties of bread during 90 days of storage. a) Loaf volume (cm³); b) Height (mm); c) Porosity (8); d) Lightness (L*).

As regards for the porosity (Fig. 1c) the control bread showed a limited development of the alveo (value 7.5) during 90days of storage, while the other samples, up to 30 days, had an equal performance (value 7). At 60 days of storage bread sample with flavonoids (F) maintained a better porosity (value 6.5).
With regard to crust color (Fig. 1d), F and FP bread samples have shown lower values of Lightness (L*) compared to the control due to the effect of the flavonoid addition. During storage a decrease of crust brightness in all bread samples, as expected, was determined.
Moisture content in the control bread and in FP bread samples was about 38% (Fig. 2).

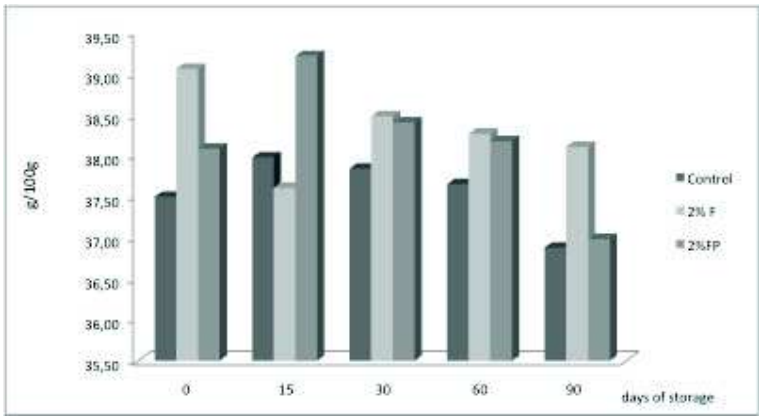


Figure 2: Evaluation of the moisture content of the bread samples during storage.

During storage, moisture levels remain almost constant in all bread samples but generally, control bread had the lowest moisture level, indicating a favourable effect induced by the addition of pectin and flavonoids on the ability to retain water by the dough.pH and total acidity of bread samples were similar independently from the presence of the flavonoids and pectin. pH in fresh samples was about 6.1, and remained almost constant during storage, as well as total titratable acidity.

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