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Evaluation of Physicochemical Properties of Fermi macaroni after Adding Spray Dried Lactic Acid Sourdough

Khanjani Rahele[1,*], Razavi Seyyed Hadi[2] and Eyvazzadeh Orang[1]

[1]Islamic Azad University, Varamin Branch, Iran.

[2]Tehran University, Tehran, Iran.

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ABSTRACT

Sourdough fermentation is one of the oldest biotechnological methods of food preparation. Macaroni, as one of the world's most widely consumed cereal products, used in large quantities, because of its nutritional value, significant amounts of complex carbohydrates, protein, vitamin B & iron. In this study, We evaluated physicochemical properties of fermi macaroni after adding spray dried lactic acid sourdough (12, 8, 5% w/w) of three species of *Lactobacillus acidophilus, Lactobacillus cazei & Lactobacillus plantarum* in 10 treatments of semolina with 88, 92, 95 & 100 grams. As a result, according to the obtained data, the sample containing 8% Lactobacillus acidophilus was chosen as the sample with superior physicochemical properties.

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Introduction

Pasta is considered a slowly digestible starch food, a feature generated by the particular physical characteristics of the product (Rajeswari *et al*., 2013). Sourdough is a mixture of flour and water, in which lactic acid bacteria are dominant microorganisms leading to dough acidification (Iacumin *et al*. 2009). This will lead to a reduction of dough elasticity and firmness (Arendt *et al*. 2007). Sourdoughs are complex biological systems characterized by a dynamic interaction among endogenous lactic acid bacteria (LAB), yeasts, and the substrate as previously reported (Gobbetti, 1998). Altamura bread sourdoughs were reported to be rich in facultative heterofermentative LAB (Lactobacillus plantarum, Lb. paracasei and L. casei) (Ricciardi, 2005), while Saccharomices cerevisiae was the only yeast isolated (Ricciardi et al., 2002). It is reported that dried sourdoughs increased the water absorption of the flour, however, dough stability was decreased (Kulp & Lorenz 2003). Lyhs (2002) believe that the Lactic acid bacteria are those bacteria that are involved in sour sourdough. Golshan Tafti *et al*, (2013) evaluated effects of Spray-Dried Sourdough (3, 6, 9, and 15% w/w) on flour characteristics and rheological properties of dough degree of softening significantly increased with an increase in the sourdough level and dough stability was significantly reduced. Doughs incorporating sourdough powder showed higher resistance to extension and lower dough extensibility than the control dough. Past research showed that Spaghetti can be supplemented with soy flour or its protein concentrates, fish protein concentrate, legumes and their protein concentrates and corn distillers dries grains (Dimitrios, 2006; Rajeswari *et al*., 2013) but research is limited on lactic acid, hence present study aims to understand the effect of adding spray dried lactic acid sourdough on physicochemical properties of fermi macaroni.

Material and Methods

Chemical characteristic: The chemical characteristics of semolina flour and Dried Lactic Acid Sourdough were showed at table 1 and 2, respectively.

Method of preparation of pasta: All procedures of pasta trial production were carried out in the Zar Macaron factory. Table3 shows different percentages of sourdough powder formula Pasta.

Result and discussion

Humidity

The results of humidity determination are shown in Figure 1. it was determined that treatments had statistical significant effect on Humidity at 1% probability levels, also mean comparisons showed that highest (10.48) and lowest (10.41) value were observed by 5% *Lactobacillus acidophilus* and 8% *Lactobacillus cazei*, respectively.

Ash

The ANOVA showed that treatments had statistical significant effect on Ash at 1% probability levels, also mean comparisons showed that highest (0.632) and lowest (0.531) value were observed by 8% *Lactobacillus cazei* and 8% *Lactobacillus acidophilus* , respectively (figure 2).

Protein

The results of protein determination are shown in Figure 3. it was determined that treatments had statistical significant effect on Protein at 1% probability levels, also mean comparisons showed that highest (13.62) value was observed by 8% *Lactobacillus plantarum* and lowest (12.69) value was observed by 8% *Lactobacillus cazei*, (figure 3).

pH

According to the analysis of variance, it was determined that treatments had statistical significant effect on pH at 1% probability levels, also mean comparisons showed that highest (5.95) and lowest (4.95) value were observed by control and 8% *Lactobacillus plantarum*, respectively (figure 4).

Acidity

According to the analysis of variance, it was determined that treatments had statistical significant effect on acidity at 1% probability levels, also mean comparisons showed that highest (3.85) and lowest (2.05) value were observed by 12% *Lactobacillus plantarum* and control, respectively (figure 5). In this regard, Pérez-Chabela *et al*. (2012) observed that *Propioni bacterium acidilacti* UAM15c and *euconostoc plantarum*

Tele:

E-mail addresses: zbreeder@gmail.com

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Table 1. The chemical characteristics of semolina flour

	%humidity	%Ash	%Protein	%Fat	%Fiber	Grading flour			
						150	180	250	355
semolina flour	12.27	0.453	11.3	1.21	0.41	9	64	19	5
Standard	<14	<0.9	>10	<1.5	-	<10	>50	>20	>2

Table 2. The chemical characteristics of semolina flour and Dried Lactic Acid Sourdough

	%humidity	%Ash	pH
Lactobacillus plantarum	8.76	0.634	3.73
Lactobacillus cazei	5.08	0.953	3.88
Lactobacillus acidophilus	6.93	0.583	3.94

Table 3. Percentages of sourdough powder formula Pasta

treatments	Flour	percentages of sourdough powder	Bacteria	%Water	Total combination
C1	100	-	-	20	%100
C2	95	5	*Lactobacillus cazei*	20	%100
C3	92	8	*Lactobacillus cazei*	20	%100
C4	88	12	*Lactobacillus cazei*	20	%100
C5	95	5	*Lactobacillus acidophilus*	20	%100
C6	92	8	*Lactobacillus acidophilus*	20	%100
C7	88	12	*Lactobacillus acidophilus*	20	%100
C8	95	5	*Lactobacillus plantarum*	20	%100
C9	92	8	*Lactobacillus plantarum*	20	%100
C10	88	12	*Lactobacillus plantarum*	20	%100

Table 4. Analysis of variance for studied traits

	Humidity	Ash	Protein	pH	Acidity
treatment	0.055**	0.003**	0.081**	0.046**	0.342**
Error	0.008	0.002	0.024	0.002	0.005
C.V	8	6	7	6	2.6

UAM10a secreted exopolysaccharides which was related to high moisture stability and better textural properties, as compared with non-inoculated samples. Also, it is known that the low pH values associated with microbiologically acidified wheat dough leads to solubilization of the phytate complex, thus increasing mineral bioavailability, accounting to higher ash content (Larsson and Sandberg, 1991). According to Clarke *et al*. (2002), the addition of sourdough prepared from single-strain or mixedstrain cultures led to significant changes in the behavior of the dough system. It is shown that a drop in pH value during the sourdough fermentation process changes the rheological behavior of dough As a result, according to the obtained data, the sample containing 8% *Lactobacillus acidophilus* was chosen as the sample with superior organoleptic properties.

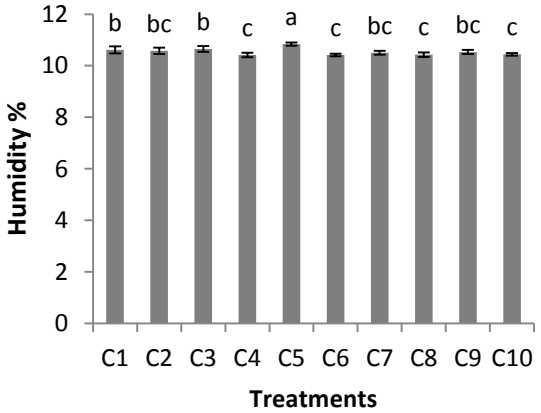

Figure 1. Effects of treatments on Humidity

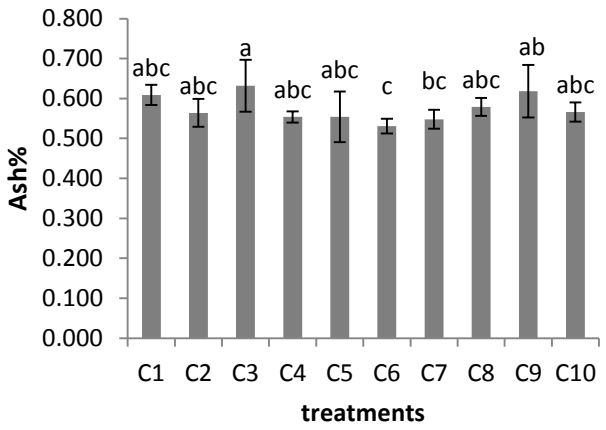

Figure 2. Effects of treatments on Ash

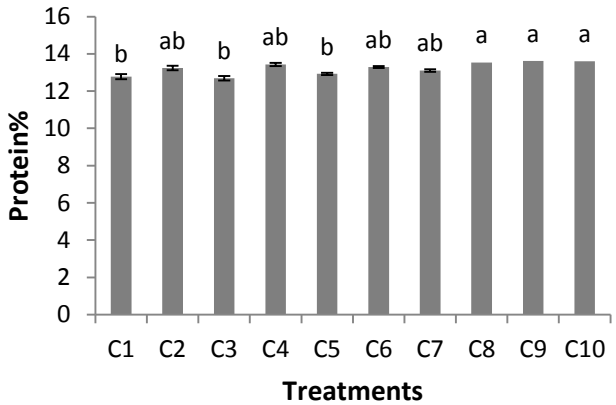

Figure 3. Effects of treatments on Protein

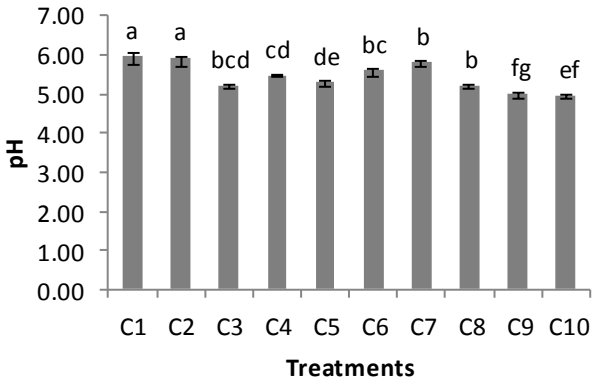

Figure 4. Effects of treatments on pH

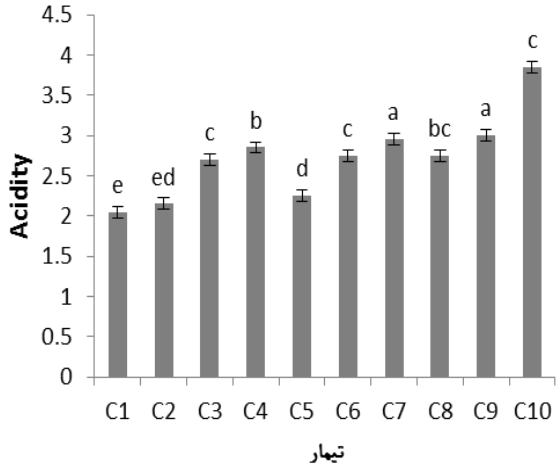

Figure 5. Effects of treatments on acidity

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