XXXIV National conference with international participants PROCESSING AND ENERGY IN AGRICULTURE - PTEP 2022 Sokobanja, hotel "Moravica", April 3rd — 8th september 2022



EFFECT OF SUBSTITUTION OF WHEAT FLOUR BY SOURDOUGH AND WHEY PROTEINS ON THE PROPERTIES OF SPONGE CAKE

Jelena TOMIĆ*, Dubravka ŠKROBOT, Tamara DAPČEVIĆ-HADNAĐEV, Nikola MARAVIĆ, Miroslav HADNAĐEV

University of Novi Sad, Institute of Food Technology, Bulevar cara Lazara 1, 21000 Novi Sad, Serbia



*contact: jelena.tomic@fins.uns.ac.rs

INTRODUCTION

As a result of consumer preferences, including the demand for healthier and high protein and high dietary fibre plant-based food, there is a trend towards fortifying or completely replacing refined wheat flour with whole grains or alternative ingredients. Incorporation of proteins and/or fibres from different sources in food formulations present one of the most used approaches. Recently, the application of sourdough technology has gained research interest due to its complexity as well as its ability to promote beneficial modifications on sensory, technological and nutritional properties of bakery products. The technological application of sourdough can offer several advantages such as improving texture and palatability of cereal based products, stabilizing or increasing levels of various bioactive compounds, retarding starch bioavailability and improving mineral bioavailability.

This study aims to investigate the effects of substitution of wheat flour by sourdough from whole wheat flour (at levels 20% and 30%) and whey protein concentrate (at level 20%) on the quality of sponge cakes.

MATERIAL AND METHODS

- ➤ The basic formula of sponge cake consisted of wheat flour (100%), sugar (85%), whole egg (85%), baking powder (3.5%) and water (35%). Sourdough (SD) made from whole wheat flour was incorporated into sponge cakes at 2 levels (20%, and 30% w/w) while whey protein concentrate (P) was incorporated at level of 20% by replacing equivalent amount of wheat flour of the cake mixture. Because sourdough contains a certain amount of wheat flour and water, the corresponding amounts of wheat flour and water were reduced in basic formulation. An additional batches of sponge cake batter with sourdough were produced and subsequently fermented at 30 °C and 80% relative humidity in a fermentation chamber for 1 hour. Cake batter (30 g) with and without previous fermentation was poured into non-stick 12-cup muffin pans and baked in a preheated electrical baking oven (MIWE condo, Arnstein, Germany) at 200 °C for 12 min.
- > Chemical composition of sponge cake samples
- > Spesific volume, colour and textural properties of sponge cake samples
- > Sensory analysis of sponge cake samples
- Statistical analysis: One way ANOVA followed by Tukey's HSD test

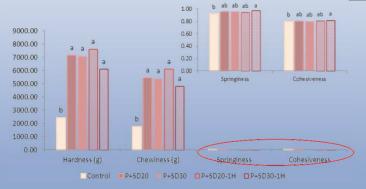
RESULTS

Table 1. Proximate composition of sponge cake samples

	/	•	•	•	•	
/	Parameter	Control	P+SD20	P+SD30	P+SD20-1H	P+SD30-1H
	Moisture (%)	23.37±0.1°	19.38±0.01 ^d	24.72±0.02a	18.84±0.1e	24.26±0.04b
	Protein (%)	9.14±0.1 ^d	14.07±0.1 ^b	14.16±0.1bc	14.56±0.00a	14.41±0.04 ^{ab}
	Crude fat (%)	3.86±0.1ab	3.49±0.1bc	3.93±0.02 ^a	3.82±0.1 ^{abc}	3.39±0.2 ^c
	Carbohydrates (%)	62.35±0.1a	61.88±0.2 ^b	55.74±0.1e	61.32±0.01°	56.61±0.1 ^d
	Ash (%)	1.29±0.00 ^d	1.18±0.01e	1.44±0.02 ^b	1.46±0.01a	1.34±0.00°
	Energy (kcal)	321	335	315	338	315

Table 2. Colour properties and specific volume of sponge cake samples

		•	,	, ,				
Parameters		Control	P+SD20	P+SD30	P+SD20-1H	P+SD30-1H		
Colour properties								
L*	Crust	77.11±1.28 ^a	63.29±5.71 ^b	56.72±3.04°	64.07±5.78 ^b	57.59±3.22°		
L	Cross section	77.29±1.34 ^d	83.36±0.97 ^a	81.15±0.80 ^b	81.01±1.26 ^b	79.33±0.99 ^c		
a*	Crust	4.03±1.05 ^c	13.46±1.79 ^b	15.31±0.90 ^a	13.26±2.22 ^b	14.76±0.93 ^{ab}		
	Cross section	-1.84±0.18 ^d	-0.62±0.13 ^c	-0.14±0.20 ^a	-0.41±0.14 ^b	-0.12±0.25 ^a		
b*	Crust	36.44±0.82 ^a	34.80±2.21 ^b	34.08±1.05 ^b	36.79±1.88 ^a	35.59±1.44 ^{ab}		
	Cross section	25.23±1.13 ^a	23.56±0.80 ^b	24.92±0.77 ^a	24.79±0.59 ^a	25.51±0.78 ^a		
Specific volume (ml/g)		3.04±0.09 ^a	2.72±0.06 ^b	2.72±0.03 ^b	2.78±0.03 ^b	2.78±0.08 ^b		



Adhesiveness

60

60

40

40

20

20

Cohesiveness

Pore uniformity

Sweet aftertaste

Egg flavour

Bitterness

Fig 1. Textural properties of sponge cake samples



Fig. 2. Sensory analysis of sponge cake samples

P+SD30-1H

---P+SD20 ---P+SD30

Control P+SD20 P+SD30 P+SD20-1H P+SD30-1H

CONCLUSIONS

The incorporation of proteins resulted in creation of product which can be labelled as protein source since more than 12% of their energy value is provided by protein. Compared to the control sample, reduction of wheat flour by sourdough and whey proteins caused a significant decrease in specific volume while values of hardness of tested samples were significantly higher. Regarding the sensory analysis, samples with sourdough and proteins exhibited much denser structure with a noticeable number of non-uniform large pores. Reduction of wheat flour by sourdough and whey proteins caused the loss of bitter taste, flavour and odour on eggs while the sweetness for these samples was significantly pronounced. The results indicate that this combination of used ingredients have a potential to be considered as an alternative value-added food ingredients for bakery products but further research should be conducted in this area..

