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Extended Abstract

Physicochemical and Antioxidant Properties of Ultrafiltrated White Cheese Fortified with Microencapsulated of Wheat Germ Extract by Spray and Freeze Dryers

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Abstract

In this study, wheat germ extract at different concentrations (2.5, 10 and 20%) and wheat germ extract powder produced by spray and freeze drying process method at three concentrations (0.2, 0.4 and 0.6%) was added to the ultrafiltrated white cheese and physicochemical properties of that were evaluated in thirty days during retention time. Moisture, acidity, total protein contents and antioxidant activity decreased in all samples during retention time and pH value increased during retention time. The results showed that freeze drying is a better method for preserving antioxidant compounds in wheat germ extract. Also, increasing the concentration of the wheat germ extract and powder of the wheat germ extract by both spray and freeze drying methods increased the antioxidant activity of the cheese compared to the control. Therefore, it is possible to use powdered wheat germ extract powder with freeze dryer as a functional ingredient in Ultrafiltrated White Cheese.

Keywords: Antioxidant activity, Freeze dryer, Spray dryer, Ultrafiltrated white cheese, Wheat germ

Introduction

There are a few studies on wheat germ antioxidants. The phenolic compounds in wheat germ regarding content and their contribution to the overall antioxidant activity of wheat germ is less discussed. Phenolic compounds are the main antioxidant compounds and their content is directly proportional to their antioxidant activity (Zhu, Lian, Guo, Peng, & Zhou, 2011). The aim of this study was to investigate the effect of different concentrations of wheat germ extract and the powder obtained from wheat germ extract, coated using spray drying and freezing, on antioxidant activity and physicochemical properties of refined white cheese during 30 days of storage.

Materials and methods

The wheat germ was purchased from a local flour production factory. Wheat germ (30 g) was mixed with 450 mL of distilled water, heated in a water bath at 60 °C for 15 min, and

centrifuged at 5000 rpm for 20 min. The supernatant was collected in dark vessels and stored at -18 °C in a freezer (Mohamed, Seleet, Bayoumi, & Fathy, 2015). DPPH free radical scavenging activity of the wheat germ extract (WGE) was determined by the free radical scavenging ability using DPPH method (Tan, Kha, Parks, Stathopoulos, & Roach, 2015; Zhu *et al*., 2011). Measurement of moisture content, dry matter, protein, fat, ash, and fiber percent was carried out by Tan *et al*. (2015). The contents of antioxidant activity, moisture, dry matter, protein, fat, ash and Fiber in WGE were 14.633 95.830, 4.170, 1.702, 2.521, and 0.129, 0 %, respectively. Microencapsulation of wheat germ extract by spray dryer and freeze dryer with various amounts of maltodextrin and WPC, ratios of 1:3, 2:2, and 3:1 w/w were conducted according to the results of other investigations and preliminary tests (Ezhilarasi, Indrani, Jena, & Anandharamakrishnan, 2013; Tan *et al*., 2015; Yazicioglu, Sahin, & Sumnu, 2015).

Production of cheese containing wheat germ extracts, spray-dried and freeze-dried powders was done according to the proposed method of Mohamed *et al*. (2015). Concentrated extract of wheat germ (2.5, 10 and 20%) and spray-dried and freeze-dried powders (0.2, 0.4 and 0.6%) were added to the retintate (Mohamed *et al*., 2015). The samples were kept for 30 days to be evaluated based on some physicochemical properties, determination of antioxidant activity (Tan *et al*., 2015; Zhu *et al*., 2011), moisture content (Iranian National Standardization Organization [ISIRI], 2002), total acidity and pH (Iranian National Standardization Organization [ISIRI], 2006), Salt (Iranian National Standardization Organization [ISIRI], 1977) and total protein (Iranian National Standardization Organization [ISIRI], 2015) method. Different samples of ultra-filtrated White Cheese are shown in Table (1). Data were analyzed in a two-factor, completely randomized design with SPSS 16 software. Means of data were compared with Duncan's multiple range test at 95% confidence level.

Table 1. Different samples of Ultra-filtrated White Cheese.

Samples of Ultrafiltrated White Cheese	Concentration (percentage)	Treatment code
Control	0	T_0
Wheat germ extract	2.5	T_1
	10	T_2
	20	T_3
Microencapsulated of Wheat Germ Extract by Spray Dryers	0.2	T_4
	0.4	T_5
	0.6	T_6
Microencapsulated of Wheat Germ Extract by Freeze Dryers	0.2	T_7
	0.4	T_8
	0.6	T_9

Results and discussion

The results showed that the antioxidant activity during storage time in all samples showed a significant decrease ($P \leq 0.05$). The results showed that the lowest amount of antioxidant activity was related to the control sample, and the highest amount of antioxidant activity was associated with the T_9 sample. The percentage of antioxidant activity increased with increasing the concentration of powders obtained by spray and freeze-drying method and wheat germ extract in cheese.

The percentage of moisture decreases during storage in the control sample, T_1, T_3, T_4, T_5, T_6, T_8 and T_9. The moisture content of the T_2 sample increased until the 15^{th} day and then decreased until the 30^{th} day. Still, the change in moisture content during storage was not statistically significant at the level ($P \leq 0.05$). In samples T_1 and T_7, the percentage of moisture decreases until the fifteenth day and then increases until the thirtieth day. The change in the moisture percentage during storage is statistically significant at the level ($P \leq 0.05$). Based on

the results obtained, the lowest moisture content is in the control sample, and the highest moisture content is in the samples T_2, T_3 and T_4. These three samples did not show a statistically significant difference ($P\leq0.05$). The acidity changes in different samples of cheese during the storage period are different. Based on the results obtained, it was found that the percentage of acidity in samples T_2, T_4, T_5, T_6, T_7, T_8 and T_9 show a significant difference during storage time ($P\leq0.05$). The percentage of acidity of the control sample showed a significant decrease ($P\leq0.05$) until the 15th day, then the percentage of acidity increased until the 30th day but was not statistically significant. In general, the percentage of acidity on the 30th day compared to the first and 15th day during storage in all samples except for the T_8 sample significantly decreased ($P\leq0.05$). The lowest percentage of acidity is related to sample T_5, and the highest percentage of acidity is related to sample T_3 on the 30th day.

The results showed that the pH level in all samples showed a significant increase during storage time ($P\leq0.05$). The lowest pH is related to the T_3 sample, and the highest pH is related to the control sample on the 30th day. The pH of other samples was lower than the control sample, which is statistically significant ($P\leq0.05$). Based on the results obtained, the percentage of salt in all samples did not show a significant difference during storage ($P\leq0.05$). The results obtaining the percentage of protein in the control samples, T_1, T_3, T_8, and T_9 did not show a significant difference during storage time ($P\leq0.05$). The results showed a significant difference ($P\leq0.05$) between the control sample and the studied samples except for the T_9 sample. The highest percentage of protein is related to the T_3 sample, and the lowest percentage of protein is related to the T_7 sample on the 30th day.

Conclusions

The results showed that the amount of moisture, acidity, total protein and antioxidant activity decreased during storage in all samples. The pH increased during storage, and the salt content remained unchanged. The control sample showed the lowest amount of moisture and antioxidant activity compared to other samples. The lowest pH in samples containing 20% of wheat germ extract, the lowest acidity in samples containing 0.4% of spray-dried powder and the lowest protein in samples containing 0.2% of freeze-dried powders was observed.

The highest moisture content in samples containing 10 and 20% of wheat germ extract and the sample containing 0.2% spray-dried powder, acidity in the sample containing 20% of wheat germ extract, antioxidant activity in the sample contains 0.6% freeze-dried powders, pH in the control sample and protein in the sample containing 20% wheat germ extract. The results showed that increasing the concentration of extract and powder obtained from wheat germ extract by both drying methods increases the antioxidant activity of cheese. A comparison between the microencapsulation methods revealed that the freeze-drying method resulted in improvements in the antioxidant activity.

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