Scientific Papers. Series D. Animal Science. Vol. LVII, 2014
ISSN 2285-5750; ISSN CD-ROM 2285-5769; ISSN-L 2285-5750

EFFECT OF USE OF DATE PROCESSING BY-PRODUCT ON SOME PHYSICO-CHEMICAL AND SENSORY PROPERTIES OF SAUSAGE

Seyed Ebrahim HOSSEINI[*1], Nasrin HASHEMIAN[1], Masoud MASHADI AKBAR BOUJAR[2], Gholamhassan ASADI[1]

[1]Department Of Food Science and Technology, Science and Research Branch, Islamic Azad University, Tehran, Iran. P. O. Box: 14515/775, Email: ebhosini@srbiau.ac.ir
[2]Department Of Molecular and Cellular Science, Kharazmi University, Tehran, Iran, Email: aboojar@yahoo.com

Corresponding author email: ebhoseini@srbiau.ac.ir

Abstract

Five concentrations (0, 1.25, 2.5, 3.75 and 5%) of date processing by-product powder as fat replacer and antioxidant were added to sausages. Chemical, physicochemical, lipid oxidation, residual nitrite level and sensory evaluation were done. The moisture, dietary fibre and protein content were significantly increased. Fat content and colour coordinates lightness (L) and redness (a*) were significantly reduced but yellowness (b*) was not severely affected by the date processing by-product content. Moreover, the addition of date processing by-product to sausages represented an improvement in their nutritional properties, possibly due to the presence of active bio compounds which induce a significant decrease in residual nitrite level and lipid oxidation. Also, in terms of overall acceptability, panellists preferred samples with added 5% date processing by-product.*

Keywords*: sausage, date processing by-product, fat replacer, antioxidant*

INTRODUCTION

Nowadays consumers are more concerned with their health and its relation with diet, demanding healthier foods. However, meat products are associated with a high content of fat, cholesterol, salt, nitrite or lipid oxidation products, which are related with several illnesses, such as cardiovascular diseases, cancer, hypertension and obesity (Martin-Sanchez et al., 2011). Therefore, production of low fat and healthy meat products is very important.

The date palm (*Phoenix dactilifera L.*) is an important member of the family *Arecaceae* (Palmae) (Sanchez-Zapata et al., 2011). Iran with an expected production of 1100000 ton of dates in 2013 is the second major producer after Egypt. In view of this, several date processing industries are developing new processes to produce many products like date juice, date syrup, date dip and date vinegar from various date varieties. Unfortunately, this progress of production is accompanied by a substantial increase of date losses during conditioning of the dates. These by-products that are rich in phytochemicals such as dietary fiber, phenolics and natural antioxidant, are used in animal feeding (Sanchez-Zapata et al., 2011).

Dietary fiber may also be used for its functional and technological properties. Thus, fiber rich by-products may be incorporated into food products as inexpensive and non-caloric bulking agents, as enhancers of water and oil retention and to improve emulsion or oxidative stabilities (Aguedo et al., 2012).

Incorporation of date by-products could be an easy and economical strategy to develop healthier meat products and with improved technological properties, but also to increased the eco-efficiency in the date palm and meat industry (Martin-Sanchez et al., 2011).

The objective of this study was to develop low-fat sausages whit antioxidant properties.

MATERIALS AND METHODS

Date processing by-product preparation

The date processing by-product obtained from date syrup production plant. The seeds were ground by hammer mill, separately. Seeds and pastes were dried by cabinet dryer (Armfield, England) at the air flow rate and temperature of 1.1 m/s and 50°C, respectively in 10-12 h.

Dehydrated date by-product were ground in a domestic mill, passed through a 60 mesh sieve to a particle size of 0.250 mm. This powder was kept in three layer polyethylene pouches at 4°C.

Sausage manufacture

Lean beef meat and fat were ground separately in a grinder (BEEHIVE DEBONER, USA) through a 4 mm plate and according to Pearson square were mixed to achieved desired fat level. The main ingredients in formulated sausages were shown in Table 1.

At first, meat and fat were transferred to the cutter (Iran steel, Iran). During the comminution in a bowl cutter the nonmeat ingredients were added (null flour, wheat starch, modified potato starch, gluten, casein, spices, salt, phosphate, sugar, isolated soy, garlic, capsicum, egg white, nitrite and ascorbic acid).

After homogenization, the mixture stuffed into polyamide casing and cooked in a water bath (77°C, 55 min). Next, the sausages were chilled with cold water. After reaching chilling temperature, the products were transferred to the lab. All analyses were carried out in triplicate for each formulation.

Proximate composition

Table 1. The main ingredients of sausages

4	3	2	1	control	Treatment / Ingredient (%)
55 12%fat	55 14%fat	55 16%fat	55 18%fat	55 20%fat	Beef meat
3	5	7	9	11	oil
18.95	18.2	17.45	16.7	15.95	ice
5	3.75	2.5	1.25	0	Date processing by-product

Moisture, ash, protein and dietary fiber were determined by AOAC methods (AOAC, 1997). Moisture (g water/100 g sample) was determined by drying a 3-g sample at 105°C to constant weight. Ashing was performed on a 2-3g sample after combustion in a muffle furnace at 550°C for 8 h (g ash/100 g sample). The protein (g protein/100 g sample) was analyzed according to the Kjeldahl method, using a factor of 6.25 for the conversion of nitrogen to crude protein. The fat (g fat/100 g sample) was calculated by weight loss by extraction for 8 h with n-hexane in a Soxhlet apparatus. Total dietary fibers (TDF) were determined using an enzymatic method.

Physicochemical analysis

The pH was measured in a suspension resulting from blending a 10 g sample with 10 ml de-ionized water for 2 min using a pH-meter (HANNA, Romania) (Sanchez-Zapata et al., 2011).

Color was studied in the CIELAB color space using a hunter lab (colorflex, USA). The CIELAB coordinates studied were lightness (L*), co-ordinate red/green (a*) and co-ordinate yellow/blue (b*).

Residual nitrite

Residual nitrite level (mg $NaNo_2$/kg sample) was determined according Iranian National Standard 923.

TBA values

Lipid oxidation was assessed by the 2-thiobarbituric acid (TBA) method of Choi et al. (2010).

Sensory evaluation

A hedonic sensory test was performed on cooked sausages. The sensory panel consist of ten trained panelists evaluated six attributes of sausages (taste, odor, texture, color, appearance and palatability). Each attribute was evaluated on a scale from 1 to 5. The samples were served on a white paper plate, labeled with a three-digit number, and served in random order.

Statistical analysis

All tests were carried out in triplicate. Statistical analyses were carried out using MSTAT-C in a randomized complete block design. Analysis of variance (ANOVA) was used to determine significant differences ($P<0.01$) between sausages with different date processing by-product. Comparison between means was performed using Duncan's multiple range tests.

RESULTS AND DISCUSSIONS

Chemical composition of sausages

Results of chemical composition of sausages are presented in Table 2. Date processing by-product addition and reduction of fat increased (P<0.01) moisture, protein and TDF content and decreased (P< 0.01) fat content but ash content was not significantly affected (P> 0.01).

The increase in water level in all formulations along with addition of date processing by-product level increased moisture content. The protein increase could be due to the high protein content of date processing by-product because the amount of meat and binders as sources of protein in all samples was fixed. Also, the increase in TDF content was higher (P<0.01) when high amount of date processing by-product was added because this by-product is a rich source of dietary fiber. The differences (P<0.01) observed in fat content between treatments could be explained by the reduction of fat level in all formulations.

Table 2. Chemical composition (g/100 g sample) of sausages

	Protein	fat	Moisture	Ash	TDF
control	12.61±0.11b	18.99±0.3a	60.6±0.2e	2.1±0.1a	0.22±0.08d
1.25%date powder	12.90±0b	16.45±1.05b	62.35±0.95d	2.05±0.05a	0.50±0.11d
2.5% date powder	12.97±0.37b	14±0c	63.55±0.25c	1.8±0.3b	0.77±0.11c
3.75% date powder	13.57±0.27a	11.95±0.25d	64.9±0.6b	2.05±0.05a	1.62±0.25b
5% date powder	13.5±0.5a	10.3±0.4e	67.4±0.7a	2.0±0a	2.14±0.28a

Values with different letters in the same column are significantly different (P<0.01).

Residual nitrite

Results of residual nitrite are shown in Table 3. The incorporation of date processing by-product at amount higher than 1.25% to sausages produced a significant decrease (P<0.01) in residual nitrite level, which could be due to the reactions of nitrite with the active bio-compounds present in the date processing by-product. This decrease in residual nitrite level is healthy because it reduces the possibility of nitrosamine formation: a risk related to the consumption of meat products with nitrite in their formation (Fernandez-Gines et al., 2004).

Lipid oxidation

The effect of the different level of date processing by-product and reduction of fat on lipid oxidation of sausages is shown in Table 3. Lipid oxidation was studied to evaluate the effects of adding date processing by-product, rich in phenolic compounds (Martin-Sanchez et al., 2011).

The date processing by-product caused a significant reduction (P<0.01) in TBA values for all treatments. These results must be due to the phenolic compounds present in the date processing by-product. Moreover, fat reduction in formulation of sausages could also reduce the lipid oxidation (Martin-Sanchez et al., 2011).

pH and color parameters of sausages

pH and color parameters of sausages are shown in Table 4. The pH value declined (P<0.01) with increasing percentages of date processing by-product in the formulation. This pH decrease would be related with the date processing by-product pH (5.81), lower than that of the control sausage (6.25), probably due to the presence of organic acids in the fruit (Martin-Sanchez et al., 2011).

L* and a* values decreased (P<0.01) when date processing by-product was added. May be in this case, the higher contribution of Maillard reactions in sausages with date processing by-product take a role to play in L* value, causing the darkening of the product (Sanchez-Zapata et al., 2011). Also, reduction of fat resulted in a darker product (Seraroglu and Ozsumer, 2003).

Table 3. Residual nitrite level and TBA values

	Residual nitrite (mg/kg)	TBA (mgMA/kg)
Control	48.9±6.23a	2.68±0.16a
1.25%DP	49.35±3.45a	2.18±0.11b
2.5% DP	36.8±4.51b	1.85±0.23b
3.75% DP	23.56±4.63c	1.28±0.1c
5% DP	21.9±3.74c	0.8±0.08d

Values with different letters in the same column are significantly different (P<0.01).

The a* behavior is similar to moisture content behavior, so the samples with the highest moisture content correspond with the samples

with the lowest a* values. In fact, water has a dilution effect for a* values (Fernandez-Gines et al., 2004). b* did not differ (P 0.01) between control and treated samples. This indicates that date processing by-product did not have any positive or negative effects on b* values of sausages. The reason why date processing by-product did not affect b* values of sausages could be that yellow compounds presents in date processing by-product would have been masked by meat emulsion (Fernandez-Gines et al., 2004).

Sensory evaluation

Results from sensory evaluation are presented in Table 5. Addition of date processing by-product and fat reduction caused an increased (P<0.01) in all evaluated parameters. According to other researches reduction of fat or increase in moisture content may be reduce meat products quality but in this case incorporation of date processing by-product reversed this effect.

Table 4. pH and color parameters sausages

	pH	L*(Lightness)	a*(Redness)	b*(Yellowness)
Control	6.25±0.7a	66.68±0.17a	9.46±0.03a	14.76±0.06a
1.25% DP	6.14±0.016b	64.41±0.03b	8.16±0.01c	14.94±0.01a
2.5% DP	6.13±0.03b	59.01±0.02c	7.86±0.03d	14.92±0.07a
3.75% DP	5.98±0.02c	57.59±0.06d	8.12±0.01c	13.8±0.01a
5% DP	5.93±0.06c	55.26±0.22e	8. 5±0.01b	14.16±0.01a

Values with different letters in the same column are significantly different (P<0.01).

Table5. Results of sensory evaluation of sausages

	Appearance	Palatability	Color	Texture	Odor	Taste
Control	2±0c	2.33±0.57b	2±0b	2±0b	2±0c	3±0c
1.25%DP	2.66±0.57b	3±1ab	2.66±0.57b	2.66±0.57ab	2.66±0.57bc	3.33±0.57 bc
2.5%DP	3.66±0.57a	3.66±0.57a	3.66±0.57a	3±1ab	3±0ab	2.66±0.57c
3.75%DP	4±0a	3.66±0.57a	4±0a	3.33±0.57a	3.66±0.57a	4±0ab
5%DP	4±0a	3.66±0.57a	4±0a	3.66±0.57a	3.66±0.57a	4.33±0.57a

Values with different letters in the same column are significantly different (P<0.01).

CONCLUSIONS

The results presented that date processing by-product has been successfully added (until 5%) to the sausages. The addition of date processing by-product to sausages and fat reduction decreased their pH and fat content but increased TDF, moisture and protein content in formulated sausages. Moreover, data processing by-product decreased residual nitrite and lipid oxidation, both aspects contributes to increase the nutritive value of the products. In addition, sausages with date processing by-product were greatly accepted by trained panelists. Therefore, date processing by-product showed potential as a good source of dietary fiber and antioxidant which can be used as functional ingredient for meat products.

REFERENCES

AOAC, 1997. Official methods of analysis(16th ed.). Washington, DC: Association of official analytical chemists.

Aguedo M., Kohnen S., Rabetafika N., Vanden Bossche S., Sterckx J., Blecker C., Beauve C., Paquot M., 2013. Composition of by products from cooked fruit processing and potentional use in food products. Journal of Food Composition and Analysis, 27, p.61-69.

Choi Y., Choi J., Han D., Lee M., Jeong J., Chung H., Kim C., 2010. Effects of replacing pork back fat with vegetable oils and rice bran fiber on the quality of reduced-fat frankfurters. Meat Science, 84, p.557-563.

Fernandez-Gines J.M., Fernandez-Lopez J., Sayas-Barbera E., Sendra E., Perez-Alvarez J.A., 2004. Lemon albedo as a new source of dietary fiber: Application to bologna sausages. Meat Science, 67, p.7-13.

Grigelmo-Miguel N., Albadias-Seros M., Martin-Belloso O., 1999. Characterisation of low-fat high-dietary fibre frankfurters. Meat Science, p.247-256.

Martin-Sanchez A., Ciro-Gomez G., Sayas E., Vilella-Espla J., Ben-Abda J., Prez-Alvarez J., 2011. Date palm by-product as a new ingredient for the meat industry: Application to a pork liver pate. Meat Science, 93, p.880-887.

Sanchez-Zapata E., Fernandez-Lopez J., Penaranda M., Fuentes-Zaragoza E., Sendra E., Sayas E., Perez-Alvarez J., 2011. Technological properties of date paste obtained from date by-product and its effect on the quality of a cooked meat product. Food Research International, 44, p.2401-2407.

Serdaroglu M., Ozsumer M., 2003. Effects of soy protein, whey powder and wheat gluten on quality characteristics of cooked beef sausages formulated with 5, 10 and 20% fat. Electronic journal of polish agricultural university, 6.