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Microbiological quality during refrigerated storage of fresh pork patties added with extracts of date byproducts
(#589)

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Introduction
Microbial activity is one of the primary causes of meat and meat products deterioration. The microbial growth on meat, depends on factors that persist during processing, transportation and storage (Nychas et al. 2008). Consumers' concerns about the freshness of meat and meat products are daily increasing, so that searching for innovative solutions to this problem is a clear opportunity (Nychas et al. 2008; Byun et al. 2003). Food by-products are good sources of antimicrobial compounds, including alkaloids, essential oils, glycosides, peptides, saponins and phenolic compounds (Guil-Guerrero et al. 2016). Fruit by-products might be used as alternatives to synthetic food preservatives (Guil-Guerrero et al. 2016; Andrés et al. 2017). In fact, addition of by-products derived from tomato, red grape, olive and pomegranate to lamb patties reduced their microbial counts and concomitantly increased redness (a* value) and antioxidant status (Andrés et al. 2017). Also, it has been demonstrated that date seeds exert antimicrobial growth against Gram-positive (*Bacillus subtilis and Staphylococcus aureus*) and Gram-negative bacteria (*Escherichia coli* and *Pseudomona fluorences*) (Ammar et al. 2009). Based on the aforementioned findings the aim was to assess the microbiological quality during refrigerated storage of fresh pork patties added with extracts of date byproducts.

Methods
Ethanol extracts were obtained from date byproducts using 1-h ultrasonic extraction. Pork patties were formulated to represent four treatment groups [date seed extract (DSE, 0.2%), date fruit extract (DFE, 0.2%), butyl hydroxy toluene (BHT, 0.2%) and control (C)] and stored at 4 °C for 9 days, under refrigerated conditions. Proximate composition (moisture, fat, protein and ash content) of pork patties were evaluated on day 0, while pH values were evaluated during storage (AOAC, 1995). Assesments of microbiological quality during storage included lactic acid bacteria (LAB), psychrophilic bacteria (PSB) and total viable plate (TVC) counts (NOM-092-SSA1-1994). Two replicates of the experiment were carried out. In each replication, three patties per analysis were sampled. Data were subjected to ANOVA and means were separated by the Tukey's test ($P<0.05$).

Results
Proximate composition of pork patties was within the expected ranges (Table 1). The pH of patties was unaffected ($P>0.05$) by the addition of date extracts and decreased ($P<0.05$) from 5.75 to 5.47 throughout storage period. Changes in LAB, PSB and TVC are shown inTable 2. LAB and TVC increased ($P<0.05$) during storage but their values were lower than 8 log UFC/g. DSE and DFE samples exhibited significantly lower PSB values at day 9 (7.48 and 7.33 log UFC/g, respectively) as compared to both control and BHT counterparts (9.00 and 8.07 log UFC/g, respectively).

Conclusion
The pH values for all treatments were within the typical range observed for pork meat (5.4-5.8) and are in agreement with a report on pork patties added with brown extract (*Laminaria digitata*) (Moroney et al. 2013). TVC and LAB counts complied with the value (7 log cfu g^{-1}) set by the International Commission on Microbiologial Specifications for Foods (ICMSF) whereas, both C and BHT treatments exceeded the ICMSF benchmark for PSB (ICMSF, 1986). The latter finding suggest that the lack of antimicrobial compounds in the non-extract treatments favoured growth of PSB during refrigerated storage. Conversely, the antimicrobial activity of bioactive compounds present in date seed by-products, including phenolic acids and flavonoids such as catechin (Ammar et al. 2009), could affect PSB cells, attacking the phospholipid bilayer of the de cell membrane, disrupting enzyme system, and compromising their genetic material (Tajkarimi, Ibrahim, & Cliver, 2010). The present results highlight the potential usage of date by-products as an efficient ingredient to retard microbial growth during chilled storage or raw pork patties.

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Table 2. Microbiological quality and pH during refrigerated storage of pork patties added with date byproducts extracts.

Time (day)	C	DSE	DFE	BHT
	pH value			
0	5.78±0.12^{aX}	5.70±0.03^{aX}	5.74±0.03^{aX}	5.77±0.13^{aX}
9	5.49±0.05^{aY}	5.47±0.21^{aY}	5.46±0.00^{aY}	5.45±0.30^{aY}
	Total viable count (log UFC/g)			
0	4.22±0.07^{aX}	3.70±0.55^{bX}	3.91±0.41^{bX}	3.49±0.17^{bX}
9	7.04±0.13^{aY}	6.83±0.26^{aY}	6.86±0.24^{aY}	7.11±0.22^{aY}
	Lactic acid bacteria (log UFC/g)			
0	3.05±0.04^{aX}	3.06±0.00^{aX}	3.02±0.03^{aX}	3.09±0.01^{aX}
9	7.12±0.02^{aY}	6.79±0.20^{aY}	6.72±0.05^{aY}	7.00±0.37^{aY}
	Psychrophilic bacteria (log UFC/g)			
0	4.06±0.05^{aX}	3.93±0.01^{aX}	3.59±0.02^{bX}	3.87±0.02^{aX}
9	9.00±0.03^{aY}	7.48±0.01^{cY}	7.33±0.02^{cY}	8.07±0.03^{bY}

C; control, DSE; date seed extract (0.2%), DFE; date fruit extract (0.2%), BHT; butyl hydroxy toluene (0.2%). Mean values for treatments bearing different letters (a-c) in the same row indicate differences (P<0.05), while mean values for storage times bearing different letters (X,Y) in the same column indicate significant differences (P<0.05).

Table 2

Table 2. Microbiological quality and pH during refrigerated storage of pork patties added with date byproducts extracts.

Table 1. Chemical composition of pork patties added with date byproducts extracts.

Treatment	Moisture	Fat	Protein	Ash
C	55.06±1.44	17.61±1.07	18.60±1.62	8.13±0.09
DSE	54.34±1.40	17.78±0.81	18.10±0.09	8.20±0.02
DFE	55.36±2.47	17.73±1.76	19.07±0.73	8.33±0.02
BHT	54.64±1.13	16.84±0.30	19.03±0.95	8.26±0.13

All values are expressed as g/100 g of sample. C; control, DSE; date seed extract, DFE; date fruit extract, BHT; butyl hydroxy toluene.

Table 1

Table 1. Proximate composition of pork patties added with date by-products extracts.

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