EFFECTS OF INCLUSION OF DATE SEED OIL AND EXTRACT ON LIPID OXIDATION AND FATTY ACID COMPOSITION OF PORK PATTIES

M. A. de la Rosa-Alcaraz[1], G. R. Torrescano-Urrutia[1], M. C. Estrada-Montoya[1], H. Astiazarán-García[1], A. F. González-Córdova[1], B. Vallejo-Galland[1], J. A. Pérez-Álvarez[2], J. Fernández-López[2], A. Sánchez-Escalante[1*]

[1]Centro de Investigación en Alimentación y Desarrollo, A.C. Coordinación de Tecnología de Alimentos de Origen Animal. Carretera a Ejido La Victoria Km 0.6, Hermosillo, Sonora, 83304, México.

[2]Universidad Miguel Hernández, Escuela Politécnica Superior de Orihuela, Departamento de Tecnología Agroalimentaria, Ctra. a Beniel Km 3.2 (03312) Orihuela, Alicante, España.

*Corresponding author email: armida-sanchez@ciad.mx

I. INTRODUCTION

For decades, meat fat and meat products have been related to chronic degenerative diseases and explicitly associated with the oxidation products derived from fat, such as malondialdehyde [1]. The replacement of animal fat by vegetable oil and the addition of ingredients such as polyphenols and antioxidants are strategies that have aimed to attend to consumer demand for healthier products. In particular, fruits and their coproducts, such as seeds, are an excellent source of bioactive compounds. Different date seed extracts have been selected for potential use in delaying oxidative damage to functional molecules such as lipids and proteins both *in vivo* and *in vitro* [2]. However, there is little information about their applications in foods. The objective of this study was to evaluate the effects of the addition of date seed oil and natural extract in cooked pork patties on the fatty acid profile and oxidative stability.

II. MATERIALS AND METHODS

Date seeds (Medjool cultivar) were directly isolated from 50 kg of date fruit collected at the “Tamar stage” (full ripeness) and cultivated in Sonora, Mexico. Seeds were cleaned to eliminate any adhering date flesh, were dried at 50 °C for 48 h, and were then ground to make a powder that was sifted with 1–2 mm mesh. From this powder, date seed oil was extracted using the Soxhlet method. Four treatments were designed with partial substitution of vegetal oil and named depending on the fat source used in the patties formulation: T1 (olive oil), T2 (date seed oil [DSO]), T3 (olive oil + date seed extract [DSE]), T4 (DSO+DSE), and a control (pork fat). The proximate composition of pork patties was evaluated as described by AOAC [3]. Lipid oxidation was assessed by quantification of malondialdehyde (MDA) using the TBARS method [4]. Fatty acid methyl esters (FAME) were prepared according to Sandler and Karo (1992) [5] and were analyzed using gas chromatography (Hewlett-Packard HP-5890A). The fatty acid identification was carried out by comparing the retention time of FAME for the different samples with reference standards. The quantitative composition was analyzed by relating the areas under the curve of the peaks of interest with the standard areas under the curve. The quantitative data were then corrected for differences in the response of the detector trough by comparing to standard fatty acids according to Sampugna et al. (1982) [6]. The first stage of statistical analysis consisted of general lineal modeling (GLM) to encounter significant differences between the main factors. Tukey tests were then performed in the NCSS statistical software (2012).

III. RESULTS AND DISCUSSION

The results show that the substitution of oils affected ($p<0.05$) the fat and protein contents. With respect to the control, the addition of vegetal oil increased ($p<0.05$) the TBARS values, since their chemical composition is more susceptible to oxidation. However, treatment with both olive oil and DSE diminished this parameter (Table 1). The fatty acid profile of cooked pork patties was modified with olive oil; in particular, oleic acid, linoleic, and ΣMUFA significantly increased ($p<0.05$). These results are in agreement with

Rodriguez-Carpena *et al*. [7] (Table 2). DSO changed the saturated fatty acid content (mainly palmitic and stearic acids) and atherogenic index; however, the n6/n3 ratio was not was affected.

Table 1. Proximate composition and TBARS of pork patties cooked with partial substitution of vegetal oil.

Treatment	Moisture	Fat	Ash	Protein	TBARS*
Control	58.75 ± 2.06^{a}	14.97 ± 0.62^{a}	3.22 ± 0.11^{a}	20.67 ± 0.07^{a}	2.41 ± 0.38^{a}
Olive	55.05 ± 1.02^{a}	16.99 ± 0.45^{b}	3.40 ± 0.01^{a}	21.99 ± 0.05^{a}	0.77 ± 0.20^{b}
DSO	56.20 ± 2.01^{a}	16.96 ± 0.63^{b}	3.15 ± 0.01^{a}	21.12 ± 0.05^{a}	0.85 ± 0.09^{c}
Olive + DSE	57.83 ± 0.71^{a}	16.19 ± 0.22^{c}	2.89 ± 0.05^{a}	20.33 ± 0.13^{a}	0.57 ± 0.02^{d}
DSO + DSE	56.45 ± 1.91^{a}	15.09 ± 0.14^{a}	3.35 ± 0.03^{a}	22.34 ± 0.01^{a}	0.71 ± 0.19^{b}

Chemical composition is expressed as g/100 g of sample. *Values are expressed as mg of MDA/kg of sample.

Table 2. Fatty acid profile in pork patties cooked with partial substitution of fat (g/100 g of product).

Fatty acid	**Control**	**Olive**	**DSO**	**Olive + DSE**	**DSO + DSE**
C16	21.88 ± 0.40^{a}	18.42 ± 2.22^{b}	19.51 ± 1.02^{b}	19.25 ± 0.40^{b}	18.76 ± 0.37^{b}
C18	11.18 ± 0.29^{a}	8.54 ± 0.25^{b}	9.49 ± 0.54^{c}	9.20 ± 0.48^{bc}	8.93 ± 0.47^{c}
C18-1N9c	37.09 ± 4.60^{a}	47.96 ± 1.40^{b}	40.10 ± 1.76^{c}	47.33 ± 1.14^{b}	41.03 ± 2.48^{c}
C18-2N6c	22.94 ± 0.15^{a}	15.54 ± 0.32^{b}	16.27 ± 0.51^{c}	15.08 ± 0.86^{b}	15.84 ± 0.51^{cb}
^{a}SFA	35.36 ± 0.84^{a}	29.05 ± 2.56^{b}	39.02 ± 1.84^{c}	30.57 ± 1.14^{d}	37.25 ± 2.54^{d}
^{b}MUFA	43.34 ± 5.35^{a}	53.57 ± 2.07^{c}	45.19 ± 2.09^{b}	53.01 ± 1.58^{c}	45.87 ± 2.89^{b}
^{c}PUFA	23.95 ± 0.22^{a}	16.98 ± 0.38^{b}	17.25 ± 0.57^{b}	16.02 ± 0.97^{c}	16.98 ± 0.59^{b}
n6/n3	31.13 ± 0.22^{a}	34.95 ± 0.38^{b}	38.06 ± 0.38^{c}	37.70 ± 0.97^{c}	23.25 ± 0.59^{d}
^{d}IA	0.41 ± 0.01^{a}	0.33 ± 0.03^{b}	0.58 ± 0.07^{c}	0.35 ± 0.004^{b}	0.62 ± 0.07^{c}

Results are expressed as means ± standard deviations. Values with a different letter (b-c) in the same row are significantly different ($p<0.05$).^{a}Saturated fatty acids (SFA), ^{b}Monounsatured fatty acids (MUFA), ^{c}Polyunsaturated fatty acids (PUFA), ^{d}Atherogenic Index (C12:0+ 4X C14:0 + C16:0)/(MUFA + PUFA).

IV. CONCLUSION

The addition of DSE shows a protective effect on pork patties and could be used to decrease secondary metabolites, such as MDA, in meat products. This represents an opportunity to advance the use and elaboration of novel natural additives in meat products and other matrices susceptible to oxidation.

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