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**Abstract—** Sensory quality (Meat Colour; Meat Odour; Meat Flavour; Rancid Odour; Rancid Flavour) of three cooked pork burgers batches [Control (no-extracts); Extract Type I (*High-Low Instantaneous Pressure*+alcoholic extraction) and Extract Type II (only alcoholic extraction) (600 mL/kg of final product concentration for both)] packed under aerobic conditions at 4°C were analysed by panellists at 0, 3 and 6 days post-packing. The effect of the type of burger (Control, Type I and Type II) and the storage time (0, 3 and 6 days post-packing) were analysed and Pearson's coefficients were estimates to evaluate the relation of both factors on meat deterioration measured as Thiobarbituric acid reactive substances level and  $a^*$  colour coordinate value. At initial time (0 days) not significant differences between the three burgers groups were found in the sensory scores. From 3 to up 6 days post-packing samples with added extracts were better scores than the Control burgers. In addition the extract Type I promoted the best Meat Odour score ( $P<0.01$ ) and the lowest Rancid Flavour ( $P<0.001$ ) which indicates the potent antioxidant effect of this extract on pork burgers preservation.

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**Index Terms—** Burger, pork meat, grape, extracts, sensory

## I. INTRODUCTION

Natural antioxidants report important antiradical activity in order to have an important nutritional and therapeutic effect for the health consumer [1]. Industrial residues are an alternative source of natural antioxidant like the red grape pomace derived from the wine and juices industries, that is highly rich in polyphenolics compounds [2]. On the other hand pork has relatively high unsaturated fatty acids proportion that favours the beginning of the oxidative process in meat which can alter as sensory (odour, colour, flavour) as physico-chemical parameters [3]. Literature enhanced the potent antioxidant effect of grape polyphenols (*Vitis vinifera*) in pork muscle food (pork:

[4], [5]). By other side some studies [6], [7], [1] pointed out that total antioxidant components can vary in grape residues depending to the extraction procedures. The present study was focused on a system to make more efficient the solvent-extraction method, optimizing the purity of the extracts added to muscle food-stuffs. Therefore the aim of this work was to evaluate the effect of two different extracts from red grape pomace extracted by two different ways on the sensory scores of pork burgers and its relation with meat deterioration (measured as TBARS level and  $a^*$  coordinate).

## II. MATERIALS AND METHODS

Both extracts were obtained from red grape pomace (*Vitis vinifera*, var. Monastrell) by alcoholic extraction: the extract Type I was previously subjected to a *High-Low Instantaneous Pressure* (HLIP) procedure and the Type II extracted directly. Three pork burgers batches (100 g each) were made by following the formulation 70:30 lean:fat and 2% salt: one batch no-extract added (Control, C) and others two with the different extracts (I and II) at 600 mL concentration per kg of the final product (for TI: 26.7%; TII: 12.2% purity respectively). After homemade, burgers were placed on polystyrene clear trays covered with a polypropylene film oxygen permeable. All samples were stored at 4°C for 0, 3 and 6 days in a display cabin illuminated with white fluorescent light (620 lux) simulating retail display conditions. On raw burgers were measured Thiobarbituric acid reactive substances (TBARS) level (as mg malonaldehyde/kg sample) [8] and  $a^*$  (redness) colour coordinate (Minolta colorimeter CR400, Japan). For the sensory analysis burgers were cooked at 150°C for six minutes reaching an internal temperature of 72°C. The panel was formed of six judges chosen from the university community. There were four training sessions. In the two first sessions, the colour, odour and flavour descriptors of cooked burgers were studied; the next two sessions was concerned with identifying, selecting and quantifying the attributes to be evaluated in the burgers. A five-point linear scale of 1 (minimum) to 5 (maximum): 1=non-perceivable; 2=perceivable; 3=slight; 4=moderate; 5=strong. The descriptors used were: Meat Colour; Meat Odour; Meat Flavour; Rancid Odour; Rancid Flavour. Data were analysed using the SPSS 15.0 version statistical

package using an analysis of variance to determine the effect of the type of burger (Control, Type I, Type II) on sensory scores. A Tukeys' test ( $P < 0.05$ ) was carried out to check the differences between pairs of groups. The differences due to the effect of the storage time (from 0 to 6 days) were analyzed using an analysis of variance. Pearson's coefficients were carried out to estimate the relation among the sensory attributes and meat deterioration (as TBARS and  $a^*$  value) along time.

### III. RESULTS AND DISCUSSION

In Table 1 are shown the sensory scores (mean $\pm$ S.E.) obtained in cooked pork burgers stored under aerobic conditions for 0, 3 and 6 days post-packing.

In general, the type of burgers (C, I, II) did not affect the sensory attributes at day 0 which agrees with others studies in pork [4] [5]. However at day 3 post-storage burgers from both extracts groups (I, II) seems to be scored in a similar way by panellists and better sensory scores were reached in these two groups than in the Control burgers ( $P < 0.05$ ). This fact indicates the positive effect of red grapes pomace extracts on meat quality preservation. Same results were found by other authors [9] in beef and pork burgers contained grape seeds extracts at 0.01 and 0.02% concentration.

However after 6 days of storage Meat Odour was the best valued in burgers added with the extract Type I (3.72). In this sense Rancid Flavour was retarded in this group (1.7 Type I vs 2.55 and 2.11 for C and Type II, respectively,  $P < 0.001$ ) due to the potential antioxidant effect of this extract [10] since oxidation process promotes off-flavour precursors development [11]. Therefore similar trend was observed in Rancid Odour attribute that was slight superior in burgers from Control group ( $P < 0.001$ ).

In this sense also Meat Colour from the Type I extract group were maintained under similar and high scores (4.61 average) during all the storage time (from 0 to 6 days) which can be related to the high polyphenols concentration of this extract added to patties as respect the Type II (half purity) or the Control burgers (no-extract) [6]. As well as Meat Flavour was slightly perceptible in burgers treated under natural antioxidant until day 6 post-storage while in the Control group Rancid Flavour was more intense from up day 3 of packing ( $P < 0.001$ ).

On the other hand Pearson's coefficients showed that TBARS values were positively related to Rancid Odour and Rancid Flavour and inversely to Meat Colour, Meat Odour and Meat Flavour (Table 2). Contrary trend showed the  $a^*$  value since this colour coordinate

is related to freshness of muscle foods [12]. These facts confirm the potential antioxidant effect of the extract Type I and the positive feature of this extraction system on the samples analysed.

### IV. CONCLUSIONS

Both of the red grape pomace extracts used in the present study can delay the meat deterioration in pork burgers packed in aerobiosis after 6 days post-packing. The extract Type I (double purity) produced the best sensory scores since rancid flavour was retarded and meat odour was maintained longer in burgers than in the others two groups.

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