EFFECT OF EXTRACTS FOOD BY-PRODUCTS FROM OLIVE, POMEGRANATE, AND GRAPE ON PROTEIN OXIDATION OF CLEAN LABEL CHICKEN NUGGETS.

L. Martínez, R. Peñalver, A. Serrano, G. Ros, and G. Nieto*

Department of Food Technology, Nutrition and Food Science, Faculty of Veterinary Sciences, Murcia University, Murcia, Spain

*Corresponding author email: gnieto@um.es

I. INTRODUCTION

Based on Spanish Food Consumption Statistics, a high percentage is consumed in form of “Fast Food” or “ready-to-eat” products, such as chicken nuggets, due to the reduced preparation time necessary, their low cost and long shelf-life under frozen storage [1]. In this sense, to preserve the shelf-life under frozen storage and prevent lipid peroxidation and thiol loss, antioxidants are widely used. Among them, synthetic antioxidants, such as BHT (butyl-hydroxytoluene), BHA (butyl-hydroxyanisole), propil gallate (PG), and tert-butylhydroquinone (TBHQ) are widely applied in frozen chicken nuggets. However, increasing concerns about nutrition and health have resulted in new trends towards “natural products” that are, free from synthetic food additives. This is the origin of “Clean label” meat products that are increasingly demanded by consumers in some European countries and the USA [2]. Particularly, and in relation to the huge amount of food by-products obtained from fruit and vegetables (F&V) losses, the obtention of natural preservatives from these sources results an interesting tool to reduce the F&V wastes in the initial steps of the food production chain. Therefore, the main objective of the present work was to develop a potential application of extracts obtained from olive, pomegranate, and grape by-products as main natural antioxidants in Clean Label chicken nuggets.

II. MATERIALS AND METHODS

Elaboration of nuggets: Four different chicken nugget samples were elaborated. Chicken nugget samples were enriched exogenously with natural extracts obtained from F&V by-products (Pomegranate (*Punica granatum*) peel extract (PP), Grape (*Vitis vinifera*) seed extract (GS), olive (*Olea europaea*) leave extract rich in hydroxytyrosol (OL_HXT), all of them supplied by Nutrafur (Alcantarilla, Murcia, Spain). A control (CTRL) sample was elaborated with no natural extracts. After mixing all ingredients (67 % chicken meat, 25 % water, 7.5 % salt and species, and 0.5 % natural extract) trimmed chicken meat was placed in a cutter and homogenised for 1 min or until reaching a temperature of 15 °C in a room at 4 ºC. Chicken nuggets were prepared in characteristic shapes of 5 x 3 x 1 cm, each weighing 25 g and frozen at -18 ºC. Subsequently, all the nugget batches were pre-fried using a household fryer (Taurus S.L., Lérida, Spain) for 30 s at 165 ºC in sunflower oil. The pre-fried nuggets were packaged in polyethylene bags and stored at -18 ºC until analysis at month 0, 3, 6, and 9 by quintuplicated. Colour meat was assessed by using a colorimeter during the storage and colour variations were studied. Protein oxidation was related with the thiol concentration. The concentration of thiol groups was determined spectrophotometrically after derivatisation by Ellman’s reagent, 5, 5-Dithiobis (2-nitrobenzoic acid) (DTNB) [3]. The analysis was carried out at 0, 3, 6, and 9 months in triplicate. Data were statically analyzed with the statistical package SPSS 15.0 (Statistical Package for the Social Science for Window (IBM, Armonk, New York, USA). A value of $p < 0.05$ was considered statistically significant.

III. RESULTS AND DISCUSSION

Colour variations results (Figure 1.A) indicate as the incorporation of natural extracts increased by twice the colour changes during the frozen storage. By contrast, no significant differences were obtained regarding Chroma values (Figure 1.B) and the visual appreciation (Figure 1.C) among studied treatments. In this sense, also the protein oxidation was assessed through the analysis of thiol groups.

Obtained results showed as the thiol concentration for CTRL samples after processing was 21.52 ± 1.5 nmol thiol/mg protein, which decreased after 3, 6, and 9 months of frozen storage to 18.2 ± 1.5, 18.6 ± 1.5, and 15.8 ± 1.5 nmol thiol/mg protein, respectively. These values were compared to those obtained by PP, GS, and OL_HXT samples and the percentage of protection against thiol loss is showed in Figure 2.

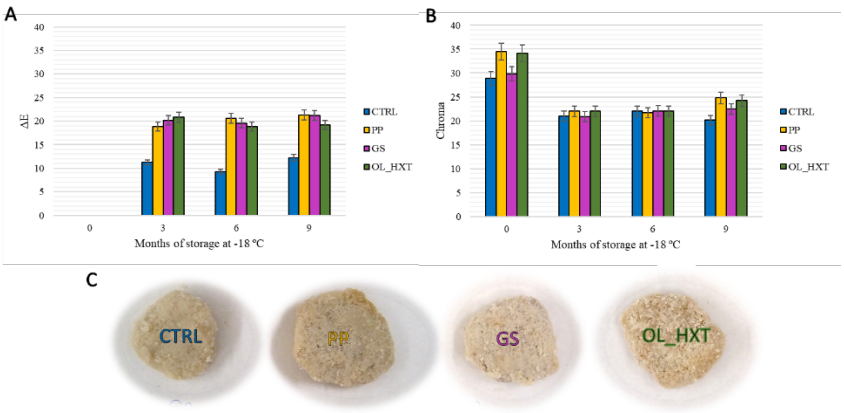

Figure 1. Colour variations (ΔE) (A), Chroma values (B), and visual appreciation (C) chicken frozen nuggets for nine months of frozen storage.

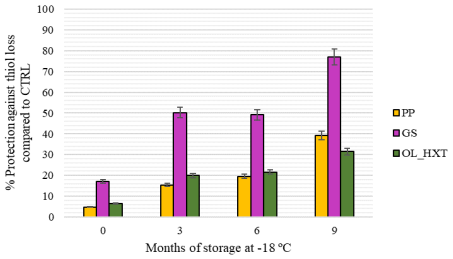

Figure 2. Protein oxidation expressed as percentage (%) of protection against thiol loss compared to CTRL samples in chicken frozen nuggets for nine months of frozen storage.

As appreciated, all the natural extracts studied protected against protein oxidation, being GS the most powerful to avoid this phenomenon, followed by OL_HXT and PP, which did not show significant differences between them. Nevertheless, the lower percentage of reduction of PP and OL_HXT can be explained by the fact that these polyphenols (punicalagin from PP and hydroxytyrosol from OL_HXT) can lead to the formation of protein cross-links showing a unexpected reduction in thiol loss values. In this sense, Jongberg et al. [4] observed a reduction in protein oxidation in pork loins containing green tea or mate extracts during chilled storage. It is clear, then, that antioxidant compounds can reduce the concentration of thiol groups, acting as an indicator of protein oxidation, while high quantities of polyphenols can reduce the amount of thiol groups, leading to the formation of protein cross-links, and penetrating inter-fibrillar regions of proteins forming crosslink peptide chains.

IV. CONCLUSION

The present study showed that the addition of phenolic compounds in form of natural extracts from F&V by-products, can reduce the protein oxidation of chicken nuggets during 9 months of frozen storage, while did not alter the colour and visual appearance of these products. In particular, the GS samples were significantly more resistant to oxidative reactions, being a compound highly protective against thiol loss. Therefore, the use of antioxidant natural sources provided by food by-products may be considered a good way to replace synthetic additives in meat products and a further step towards obtaining “Clean label” meat products.

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