CONSUMERS' ACCEPTABILITY OF A FUNCTIONAL PLANT STEROL-ENRICHED DELI-STYLE TURKEY PRODUCT

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Abstract – Low-fat meat products could be excellent carriers for functional ingredients since they appeal to a wide range of consumers, they are versatile and they intrinsically contain high-quality nutrients. In this study we manufactured a deli-style turkey enriched with plant sterols, at a level sufficient to deliver the maximum plant sterols amount recommended for cholesterol reduction by the European Food Safety Authority (3 g of plant sterols per day) in a 70 g portion. Sensory analysis by blind hedonic test was carried out on plant sterol-enriched turkey manufactured on a small scale in University College Dublin using an untrained panel (n=32). Data analysis revealed that sensory acceptability of plant sterol enriched turkey samples on 1-9 scales was significantly lower than control samples for texture ($p \leq 0.0001$), flavour ($p \leq 0.01$) and overall liking ($p \leq 0.0001$), but not for color ($p > 0.05$). Also, texture was rated on average at 4.9 ± 1.7/9, below the minimum acceptability limit of 5/9. Plant sterols could be used as a potential health promoting meat ingredient and further studies could concentrate on improving the texture, flavour and overall acceptability of this plant sterol-enriched turkey product.

Key Words – sensory analysis, consumers' acceptability, functional meat product.

I. INTRODUCTION

Consumers are becoming more and more aware of the link between diet and health [1]. This trend has led to increased interest in functional foods: foods that are not only healthy and nutritious but that also confer additional benefits for the consumer [2]. In 2011 the global functional food global market was valued at US $ 232 billion [3]. Meat products could be excellent matrices for functional foods: they appeal to a wide range of consumers; they are versatile (e.g. minimally processed to comminuted products) and they intrinsically contain high quality nutrients (proteins, vitamins and minerals) [2]. In this context, our group has developed a functional meat product consisting of a deli-style turkey product enriched with plant sterols at a level sufficient for an European Food Safety Authority (EFSA) health claim on cholesterol reduction [4]. Turkey meat was chosen as a meat carrier for its inherent healthiness and for its relatively low fat and cholesterol content [5]. Plant sterols were chosen for their popularity: according to a study carried out across 16 EU countries by Euromonitor International [3], plant sterols currently dominate the retail sales of "Heart Healthy" products, representing the predominant ingredient in this product category with 84 % of the market share. To date there have only been two studies investigating the incorporation of plant sterols into meat products [6, 7] and none with regard to how their incorporation may affect the sensory quality of the final product. The aim of the present study was to use a hedonic test to explore the sensory acceptability of a turkey product enriched with plant sterols at a sufficient concentration to deliver the maximum plant sterol amount recommended for cholesterol reduction by the EFSA (3 g of plant sterols per day) in a 70 g turkey portion.

II. MATERIALS AND METHODS

Deli-style turkey (control and plant sterol-enriched) was manufactured in University College Dublin, Ireland. Table 1 shows the ingredients used in the two turkey formulations.

Table 1 Ingredients used in control and plant sterol enriched deli-style turkey formulations.* To account for the purity of the plant sterol powder (90 %), its level of addition was 4.7 %, giving a plant sterol content in the product of 4.2 %

Ingredient	Control (%)	Plant Sterol (%)
Turkey	89	84.3
Water	10	10
Plant Sterols	0	4.7*
Salt	1	1

Turkey meat was ground using a mincer (La Minerva, Bologna, Italy) through 9 mm mincing plates and mixed with brine containing the other ingredients (water, plant sterol powder and salt) for 15 min using a Hobart A120 mixer (Hobart UK, London). The 90 % pure sterol powder (HSF Biotech, Xi'an, China) was added during manufacturing at a level sufficient to allow a potential EFSA health claim on cholesterol reduction [4] to be made on a 70 g portion of final product. Previous work carried out by this group [8] showed that the sterol content in the final product was retained at a level sufficient to allow an EFSA health claim after cooking and during a 7-day shelf life test. The homogenous mix was inserted in plastic casings (Fispak, Dublin, Ireland) using a sausage stuffer (Kenwood KM800 with AT950 attachment) and sealed with plastic ties. The logs were cooked in a water batch at 77 °C for ≈ 1 hour and 10 minutes, until the internal temperature reached 72 °C for a minimum of 2 min. The logs were cooled down by immersion in an ice bath and then refrigerated overnight at 4 °C. Logs were then cut into 2 mm slices (Medoc, Logroño, Spain) and immediately used for sensory analysis.

The study was approved by the University College Dublin (UCD) Human Research Ethics Committee (ref. No. LS-14-33). Untrained panellists (32 post graduate students and staff of the School of Agriculture and Food Science at University College Dublin, Ireland) were recruited within UCD and gave written informed consent to take part in the study. Consumers were recruited considering their interest in participating and their turkey meat consumption. Sensory testing was carried out in one session in UCD using a sensory laboratory designed in accordance with ISO 8589 [9], in standard sensory booths and under artificial daylight type illumination, with temperature control (22–24 °C) and air circulation. A total of two 16 g samples were presented at 4 °C on odourless white plastic plates (Figure 1).

Figure 2. Pictures of control (a) and plant sterol enriched deli-style (b) turkey formulations

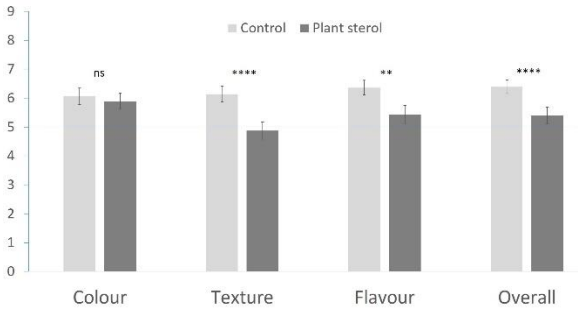
A sequential monadic order and a randomised complete block design were used. Panellists were offered a control and a plant sterol-enriched sample labelled with random three-digit numbers. For each sample, they were asked to rate their liking, using 1-9 hedonic scales on colour, texture, flavour and overall linking, ranging from 1 = "extremely dislike" to 9 = "extremely like". Still mineral water was used for rinsing between samples.

T-tests were used to compare the liking of control vs plant sterol-enriched samples. Statistical analyses were performed using Microsoft Excel 2010 (Microsoft Co.) and SPSS (version 20) statistical software (IBM Inc. Chicago, IL, USA).

III. RESULTS AND DISCUSSION

Average liking of control and plant sterol-enriched samples is illustrated in Figure 2.

Figure 2. Liking of control vs plant sterol enriched cooked turkey. Error bars indicate standard errors. **** indicates $p \leq 0.0001$,** indicates $p \leq 0.01$, ^{ns} indicates $p \geq 0.05$.



Consumers rated both control and plant sterol-enriched samples at scores above the central point (5 = neither like nor dislike) for liking, indicating that both control and sterol samples were characterized by an acceptable eating quality. Only the texture liking of plant sterol-enriched turkey scored an average 4.9 ± 1.7/9, which is

lower than the minimum acceptability value of 5 in the 1-9 scale.

The liking of plant sterol-enriched samples was significantly lower than the liking of control samples for texture ($p \leq 0.0001$), flavour ($p \leq 0.01$) and overall liking ($p \leq 0.0001$). No significant differences were observed for colour acceptability between control and plant sterol-enriched samples ($p > 0.05$). A previous study carried out by this group detected significant instrumental colour differences between control and plant sterol-enriched samples as a result of the addition of the white plant sterol powder ('L*'= 100.17, 'a*'= -0.52, 'b*'= 1.11) into the meat matrix [8]. Interestingly, these instrumental differences did not lead to a difference in acceptability for colour, suggesting that panelists were not concerned by the lighter colour of the plant sterol-enriched samples.

IV. CONCLUSION

In this study the acceptability of a plant sterol-enriched turkey product was investigated. The plant sterol addition affected the sensory acceptability of the final product; however the lighter colour of the sterol enriched samples did not have an impact on the samples' acceptability. While there is potential for the development of a cholesterol-lowering functional turkey meat product that could have a favourable impact on consumer health, future work could focus on more in-depth sensory characterisation and insights into the influence of the meat matrix on consumers' willingness to buy.

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