EFFECTS OF CITRUS FIBER ON TEXTURE PROPERTIES OF CHICKEN NUGGET BATTER MADE WITH WOODEN BREAST

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I. INTRODUCTION

The wooden breast (WB) myopathy has caused substantial loss of revenue for the poultry meat industry [1]. Wooden breast is described by excessive deposition of adipose and connective tissue leading to an unusual hardness and diminished water-holding capacity. Utilising WB meat in further processed products is being explored as a new avenue for value addition. However, incorporation of WB meat in ground meat products, such as meatballs and patties, was reported to diminish overall product quality [2, 3]. Xing *et al*. [4] also reported that WB inclusion had adverse effects on meat batter water-holding capacity, gelation, and rheological properties. Others reported the inclusion of salt into ground WB sausage ameliorated some of the differences when compared to sausages made with 100% normal breast meat [5]. In addition to salt, other functional ingredients may offer additional benefits when using WB in ground type products. The objective of this study was to determine if citrus fiber could be used in ground and formed chicken nugget batter made with WB to improve water-holding capacity and textural properties.

II. MATERIALS AND METHODS

Across 3 replications approximately 475 kg of normal breast meat and severe WB meat were selected 4 h post-mortem from a commercial broiler facility and transported (50 km) on ice to the University of Georgia Meat Science and Technology Center. Collected breast fillet samples were individually evaluated by manual palpation and visual characterisation to confirm normal and severe WB characteristics. The central cartilage, rib meat, fascia, fat, and visible connective tissue was removed. The trimmed breast fillets were boxed and stored overnight (16 h; 2±2°C). The next day, the rib meat and fat removed from the whole breast was mixed with normal and severe breast fillets in equal proportions and ground (1.27 cm). Coarse ground breast meat was separated into six 11.34 kg batches based on WB content resulting in 2 batches each for 0% WB (0), 50% WB (50), and 100% WB (100). One batch from each WB blend had 0.1134 kg (1%) removed for replacement with 0.1134 kg citrus fiber (Nutrava, CP Kelco, Atlanta, GA). A 2.5% spice blend (0.75% NaCl, 0.65% sucrose, 0.6% onion powder, 0.3% garlic powder, and 0.1% white pepper and paprika), 10% water, and the fiber (F or NF for no fiber), when required, was added to the meat, mixed, and fine ground (0.48 cm). The batters were extruded through a three-slot die (0.95 x 3.17 cm; Colosimo's Original Inc, Magna, UT) attached to a vacuum stuffer (Model 500; Vemag Maschinenbau GmbH, Verden, Germany) to form nugget strips. The strips were placed in a blast freezer (-40°C) for 30 min, and cut to 5 cm lengths. Twenty nuggets (10 texture and 10 Allo-Kramer shear) were randomly selected from each treatment•replication^{-1}. The nuggets were cooked using a steam combination oven to 76°C and subjected to Texture Profile Analysis (TPA) and Allo-Kramer shear force. Data were analysed as a randomized complete block design with a 2 x 3 factorial arrangement using JMP (V17, SAS Inst). Means were separated using Tukey HSD at $\alpha < 0.05$.

III. RESULTS AND DISCUSSION

Nuggets formulated with 100% WB had greater cook loss than 0% WB nuggets ($P < 0.01$) but 50% WB nuggets were similar to 0% regardless of fiber inclusion ($P > 0.05$). The addition of fiber improved cook yield ($P < 0.01$) by 6.4, 8.5, and 8.9%, respectively for 0%, 50%, and 100% WB (Table 1). Without fiber, nuggets formulated with 50 and 100% WB required less energy and force to shear than normal breast meat nuggets ($P < 0.01$). The addition of 1% citrus fiber created a WB nugget that was similar in shear energy and force to normal nuggets ($P > 0.05$) and required less energy and force to shear than nuggets made without fiber ($P < 0.01$). Similarly, the addition of citrus fiber created a softer and less chewy nugget than those made without fiber ($P < 0.01$). The addition of fiber also negated the difference reported between 0NF and 100NF ($P < 0.01$) for hardness and chewiness.

Table 1 Least squares means for cook loss, Allo-Kramer (AK) shear, and texture properties of formed and cooked chicken nugget batter with severe wooden breast (0, 50, 100%) with and without citrus fiber (F, NF)

	Treatment						
Trait	0F	50F	100F	0NF	50NF	100NF	SEM
Cook loss, %	15.3^{d}	15.5^{cd}	17.6^{c}	21.7^{b}	24.0^{b}	26.5^{a}	0.65
AK energy, J	1.16^{c}	1.15^{c}	1.05^{c}	1.69^{a}	1.48^{b}	1.36^{b}	0.05
AK peak force, kg/g	1.50^{c}	1.44^{c}	1.44^{c}	2.29^{a}	2.05^{b}	2.04^{b}	0.13
Hardness, g	5848^{c}	5442^{c}	4944^{c}	9480^{a}	8812^{a}	7107^{b}	267.4
Chewiness, g	222,231^{c}	216,350^{c}	190,497^{c}	561,987^{a}	514,225^{a}	402,986^{b}	14,952.4
Cohesion, %	58.9^{b}	58.2^{bc}	55.8^{c}	73.8^{a}	72.2^{a}	72.0^{a}	0.86
Springiness, %	64.5^{c}	67.8^{bc}	68.7^{b}	80.3^{a}	81.1^{a}	78.9^{a}	0.98

^{abc}Means in the same row with different superscripts differ ($P < 0.01$).

IV. CONCLUSION

Chicken nugget processors can include citrus fiber in chicken nugget batter containing up to 100% wooden breast meat to improved cook yield. The addition of citrus fiber produced a chicken nugget that was softer, required less force and energy to shear than nuggets without citrus fiber and ameliorated the effects of WB.

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