TEXTURAL PROFILE AND MICRO-STRUCTURE OF BLENDED BEEF PATTIES WITH FABA BEAN PROTEIN AND TRANSGLUTAMINASE

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I. INTRODUCTION

Blended meat products are an emerging food product range that meet consumer's demand for meat consumption reduction while maintaining adequate protein intake and acceptable texture and flavour. Faba bean protein is an innovative plant-based protein with excellent gelling and emulsifying properties [1] but addition of faba bean can negatively affect texture properties. In addition, transglutaminase is a commonly used enzyme to improve the properties of meat products, such as cooking loss and texture [2, 3]. As one of the eating qualities, texture affects consumer acceptance and willingness to buy [4]. Microstructures of food products influence their sensory, mechanical, and textural properties. This study aims to investigate the effect of faba bean protein isolate (FPI) and transglutaminase (TG) on the texture and microstructure of blended meat products.

II. MATERIALS AND METHODS

In total, 12 formulae of meat patties were developed with four levels of FPI content (0, 5, 10 and 15%) and three levels of TG content (0, 0.25 and 0.5%) and three batches were made. Faba bean protein isolate (FPI), transglutaminase (TG), beef and other ingredients were purchased from local markets/suppliers. The patties were prepared according to the formulations and stored at 4°C for 24 hours before being frozen at -20°C. After thawing, raw patties were cooked at 180°C until 75°C internal temperature was reached. Cooking loss (%) was calculated using (Raw patty weight - Cooked patty weight)/Raw patty weight. Texture profiles of cooked samples were measured using a texture analyser with a 20mm cylindrical probe. Three patties of each formula for each batch were measured for cooking loss and textural profile. One patty from each formula and each batch was scanned for microstructure measurements using a Phoenix Nanotom. Data was imported into Avizo 3D visualisation software for Region of Interest (ROI) extraction, and then exported to DragonFly software for segmentation. Genstat 19th Edition was used to analyse the quantitative results. A Linear Mixed Model (REML) was used with level of FPI, level of TG and interactions as fixed factors and batch number was included in the random model. Standard error of difference (SED) was used to separate means if there was a significant difference at $P<0.05$.

III. RESULTS AND DISCUSSION

Table 1 shows that adding FPI or TG to patties led to reduced cooking loss compared with conventional beef patties. FPI increased the hardness of blended meat patties ($P=0.02$), especially at the 5% level. Both FPI and TG influenced the springiness of the patties ($P<0.001$). The functional properties such as emulsifying, gelling, and water and fat binding capacities of faba bean protein are comparable with other plant proteins such as soy and pea protein [5]. Furthermore, TG facilitates faba bean protein cross-linking as well as legume protein-to-muscle protein cross-linking [6, 7]. Our results are in agreement with prior studies which have shown that FPI and TG contribute to maintaining the water and fat of cooked patties and assist in formation of cross-links between proteins in blended meat patties. Furthermore, FPI addition tended to result in less porosity at 15% addition ($P=0.07$) in cooked

patties but there was no affect of TG (P>0.10). Our results are similar to a study that found soybean protein reduced porosity in pan-fried patties [8].

Table 1 Effect of faba bean protein isolate (FPI; 0, 5, 10, 15 %) and transglutaminase (TG; 0, 0.25, 0.5%) on cooking loss, textural profile (hardness and springiness) and porosity of blended beef patties.

	FPI level (%)					P-values	
	0	5	10	15	SED[1]	FPI	TG
Cooking loss (%)							
TG level (%) – 0	19.4	18.2	18.7	16.8	0.93	<0.001	<0.001
- 0.25	17.9	17.4	15.5	15.7			
- 0.5	17.4	15.5	13.5	14.8			
Hardness (N)							
TG level (%) – 0	54.6	65.6	62.4	59.9	4.27	0.021	0.585
- 0.25	59.7	69.6	59.3	58.4			
- 0.5	62.5	59.8	61.2	54.6			
Springiness (mm)							
TG level (%) – 0	0.183	0.224	0.223	0.210	0.0188	<0.001	<0.001
- 0.25	0.197	0.252	0.258	0.237			
- 0.5	0.218	0.254	0.270	0.256			
Porosity (%)							
TG level (%) – 0	9.91	12.0	13.6	8.07	1.84	0.072	0.304
- 0.25	12.2	10.8	9.62	8.99			
- 0.5	11.5	12.3	12.8	10.7			

[1]SED is the standard error of the difference and the interaction FPI.TG was not significant for any variates (P>0.05).

IV. CONCLUSION

Faba bean protein and TG reduced the cooking loss and improved the textural properties. FPI tended to increase the porosity of blended meat patties, due to the high gelling and emulsifying functions. Thus, both ingredients are recommended for improving the texture and water-holding capacity of blended meat products.

ACKNOWLEDGEMENTS

This research is funded by “Future Food Hallmark Research Initiative project” of the University of Melbourne.

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