THE EFFECT OF PLANT PROTEIN TYPE AND PRE-HYDRATION LEVEL ON TECHNOLOGICAL PROPERTIES OF HYBRID BEEF PATTIES

Zuo Song[1, 2], Joseph P. Kerry[2], Brijesh K. Tiwari[1], and Ruth M. Hamill[1*]

[1]Teagasc Food Research Centre, Ashtown, Dublin 15, Ireland

[2]Department of Food and Nutritional Sciences, University College Cork, Ireland

*Corresponding author email: Ruth.Hamill@teagasc.ie

I. INTRODUCTION

There is growing interest in plant-based meat analogues, but such products can differ significantly from counterpart meat products in technological and sensory (in particular texture and flavour) attributes [1]. For consumers seeking to increase the proportion of plant-based protein in their diet, hybrid meat products that incorporate a large fraction of alternative proteins are emerging as a prospective alternative format that may more closely match the sensory experience of traditional meat products. The objective of this study was to compare the properties of hybrid patties formulated with three plant-based proteins at 12.5% substitution level with each other and with a 100% beef control and under different protein pre-hydration levels, across a range of technological parameters.

II. MATERIALS AND METHODS

A control and nine experimental formulations of beef patties were prepared using 95% V/L beef where approximately 12.5% of meat protein was substituted with dry or hydrated faba bean extract (25% protein, plant ingredient in water (w/v): 0.5, 0.2), pea protein concentrate (80% protein, plant ingredient in water (w/v): 0.5, 0.25), and rice protein concentrate (85% protein, plant ingredient in water (w/v): 0.5, 0.35). Technological properties including cook loss, proximate analysis, fat and moisture retention, colour and texture of raw and cooked hybrid patty formulations were analysed.

III. RESULTS AND DISCUSSION

Hybrid beef patties had reduced cook loss compared to the control samples (Table 1). Moisture retention in a ground meat product is an important parameter, since it significantly affects both the textural quality and final weight of the product. The addition of plant proteins in this study effectively increased capability of retaining moisture and fat during the cooking, resulting in lower cook loss.

Table 1 Cooking loss, moisture/fat retention and texture profile analysis of beef/ hybrid patties

No.	Beef/Hybrid patties	Cooking loss (%)	Moisture retention (%)	Fat retention (%)	Hardness (N)	Chewiness (N)	Gumminess (N)
1	Control (100% beef)	30.2^{a}	42.6^{fg}	61.5^{e}	134^{cd}	443^{c}	54.6^{c}
2	Faba bean hybrid (dry)	13.3^{e}	49.0^{b}	81.9^{a}	31.3^{e}	17.8^{d}	5.41^{e}
3	Faba bean hybrid (0.5)	19.0^{d}	48.1^{c}	83.6^{a}	20.9^{f}	9.26^{d}	3.50^{e}
4	Faba bean hybrid (0.2)	19.3^{d}	53.8^{a}	75.9^{b}	13.2^{f}	4.66^{d}	2.21^{e}
5	Pea protein hybrid (dry)	23.3^{cd}	46.8^{d}	68.4^{cd}	143^{c}	433^{c}	49.5^{cd}
6	Pea protein hybrid (0.5)	24.3^{bc}	43.5^{e}	76.6^{b}	141^{cd}	445^{c}	52.8^{cd}
7	Pea protein hybrid (0.25)	27.5^{abc}	46.8^{d}	72.3^{bc}	131^{d}	407^{c}	47.7^{d}
8	Rice protein hybrid (dry)	26.7^{abc}	43.0^{ef}	63.2^{de}	177^{a}	546^{b}	66.4^{b}
9	Rice protein hybrid (0.5)	28.5^{ab}	42.2^{g}	73.5^{bc}	173^{a}	601^{a}	73.0^{a}
10	Rice protein hybrid (0.35)	27.0^{abc}	43.0^{ef}	68.7^{cd}	162^{b}	556^{b}	64.8^{b}
	Stand error of mean	1.19	0.68	1.41	9.43	34.9	4.03
	P-value	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001

^{abcdefg} *Indicate significantly different (P<0.05) per formulation for cooking loss, moisture/fat retention, and texture results.*

The high content of starch and fibre in faba bean protein extracts (>60%) may interact with the protein of the ground meat matrix thereby acting to prevent migration of moisture and fat from the product [2]. The cooking loss of hybrid beef patties was observed to increase with higher pre-hydration levels of plant proteins. The texture of all rice and faba bean hybrid beef patties, differed significantly from the control, but the pea protein hybrid products had similar texture to controls. Hardness, chewiness, and gumminess values for faba bean hybrid beef patties were low, while hybrid beef patties with rice protein had the highest hardness, which is consistent with literature [3]. Furthermore, increasing the pre-hydration level of plant proteins in hybrid beef patties resulted in lower hardness values. Lightness (L*), redness (a*), and yellowness (b*) were increased following the addition of pea and rice protein, in comparison to the control beef patty (Fig. 1).

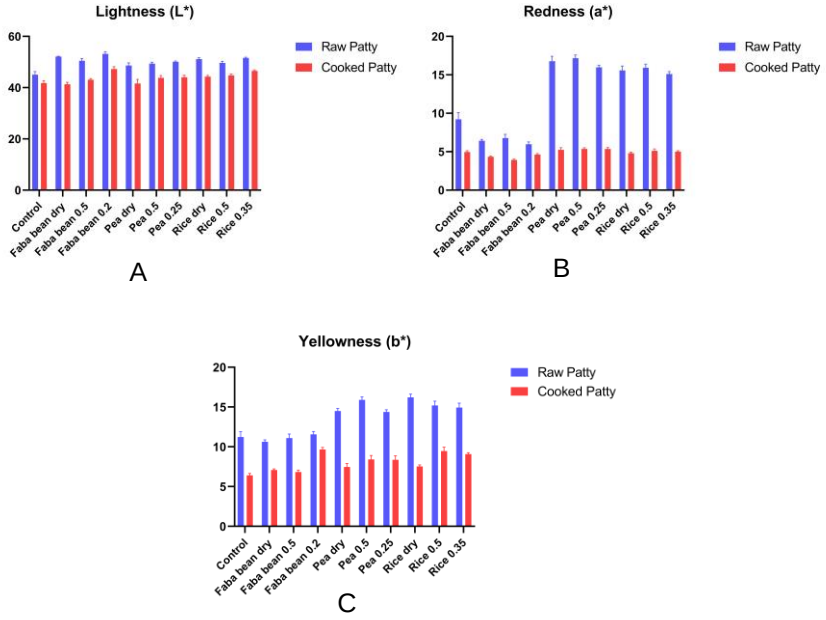

Figure 1. Colour evaluation of raw and cooked patties A) Lightness (L*), B) Redness (a*), C) Yellowness (b*)

IV. CONCLUSION

Hybrid beef patties incorporating plant proteins at different pre-hydration levels showed variability in their technological quality. In terms of texture, rice protein was hardening, faba bean protein was associated with softer textures, while hybrid pea protein patties were similar to the control. Cooking loss and colour were variable in hybrid patties. This work highlights the importance of selecting suitable plant protein extracts and optimising pre-hydration level of plant protein-based ingredients in production of hybrid meat products to optimise technological properties.

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