EFFECT OF NON-ALLERGEN BINDERS ON FUNCTIONALITIES AND SENSORY CHARACTERISTICS OF LOW SODIUM PORK BOLOGNAS

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Abstract — In this study, selected non-allergen ingredients (hydrolyzed collagen, white navy bean flour, potato starch and pea starch) were compared to wheat flour in low fat reduced sodium pork bolognas. Low salt (LS) and regular salt (RS) bolognas processed with no binders served as controls. Results indicated that all non-allergen binders significantly enhanced the cooking yield compared to LS control and were equivalent to wheat flour. Texture properties of non-allergen bolognas were similar to wheat flour treatment. Of the binders tested potato starch outperformed wheat flour for overall consumer acceptability. There may be potential for substituting wheat flour with little change in functionality and without compromising consumer acceptability.

Key words — Non-allergen, Low sodium, Pork bologna.

I. INTRODUCTION

It is estimated that approximately 7% of Canadians are suffering from food allergy [1]. However, some allergens like wheat flour are widely used in meat products as binders. Meanwhile, sodium intake is related to noncommunicable diseases (NCDs) and decreasing sodium intake may reduce the risk of associated NCDs [2]. Some binders could improve cooking and physicochemical properties of low sodium meat products, which consumers recently prefer. This study aims to investigate the functionalities and consumer acceptability of LS bolognas with selected non-allergen binders.

II. MATERIALS AND METHODS

Seven low fat (10%) pork bologna formulations were produced: regular salt (RS) and low salt (LS) bolognas processed with no binder addition and LS bolognas containing either 3% wheat flour, 3% white navy bean flour, 3% potato starch, 3% pea starch or 1% hydrolyzed collagen. The RS treatments were formulated to contain 1.8% NaCl; whereas in the LS bolognas, sodium chloride was replaced with Saltwell (commercial salt replacer, containing 65% sodium chloride and 30% potassium chloride). The required quantities of ground pork, pork fat, spices, ice/water, and, where required, wheat or non-allergen ingredients were combined and mixed at high speed for 5 min in a silent cutter. The batter was vacuum stuffed into moisture proof casings (105 mm diameter) and the bologna sausages were thermally processed in a smokehouse to a final internal temperature of 71°C. Hydration properties (cook loss, expressible moisture, purge during storage of vacuum packaged slices), and textural (Texture Profile Analysis) and colour (CIE L* a* b*) characteristics of bolognas were determined by methods of Sanjeewa *et al*. [3]. Consumer acceptance of appearance, flavour, texture, juiciness, firmness, chewiness and aftertaste, and overall acceptability were evaluated on 9-point hedonic scales. Data were analyzed, using two-way ANOVA with treatment as fixed effect and processing replication or panelist as random effect. Tukey's HSD test was used to determine the differences between means ($P < 0.05$).

III. RESULTS AND DISCUSSION

LS bolognas with no binder had the highest cooking loss, followed by RS treatment (Table 1). All non-allergen binders effectively reduced cooking losses compared to no binder RS and LS bologna. Wheat flour treatment showed the best moisture retention as indicated by the lowest expressible moisture and along with potato starch was the most effective for purge control during 8 weeks of storage. Among all the treatments, only pea starch slightly affected colour by decreasing the redness of cooked bolognas. TPA results indicated that potato starch produced a harder texture compared to LS treatment formulated without

binder and exhibited greater springiness than other groups except for wheat flour. Only hydrolyzed collagen reduced the chewiness compared with wheat flour.

Table 1 Hydration and textural properties of bolognas

Treatment	Cooking loss (%)	Expressible moisture (%)	Purge loss 8 weeks (%)	Hardness (N)	Cohesiveness	Springiness (mm)	Chewiness (N-mm)
No binder RS	4.33±1.43^{b}	13.69±3.37^{a}	2.63±0.43^{ab}	36.06±7.63^{ab}	0.16±0.02^{ab}	3.42±0.28^{b}	20.09±6.14^{bcd}
No binder LS	6.28±0.71^{a}	14.13±1.75^{a}	2.79±0.45^{a}	33.46±6.65^{b}	0.16±0.03^{ab}	3.39±0.35^{b}	18.37±5.09^{cd}
Wheat flour LS	3.10±0.95^{cd}	10.14±1.80^{b}	2.04±0.35^{c}	41.15±9.28^{ab}	0.16±0.02^{ab}	3.81±0.47^{ab}	25.02±8.42^{abc}
Hydrolyzed collagen LS	3.96±1.44^{bc}	12.74±2.83^{ab}	2.34±0.43^{bc}	36.30±3.67^{ab}	0.15±0.02^{b}	3.40±0.37^{b}	18.17±4.40^{d}
White navy bean flour LS	3.06±1.17^{cd}	13.52±2.50^{ab}	2.50±0.48^{ab}	36.30±4.54^{ab}	0.16±0.02^{ab}	3.66±0.22^{b}	21.54±3.48^{bcd}
Potato starch LS	2.33±0.24^{d}	10.80±1.93^{ab}	2.04±0.18^{c}	43.70±8.40^{a}	0.18±0.03^{a}	4.16±0.47^{a}	31.73±6.25^{a}
Pea starch LS	3.04±1.56^{cd}	13.38±3.32^{ab}	2.50±0.19^{ab}	39.68±6.13^{ab}	0.17±0.03^{a}	3.63±0.49^{b}	25.13±6.30^{ab}

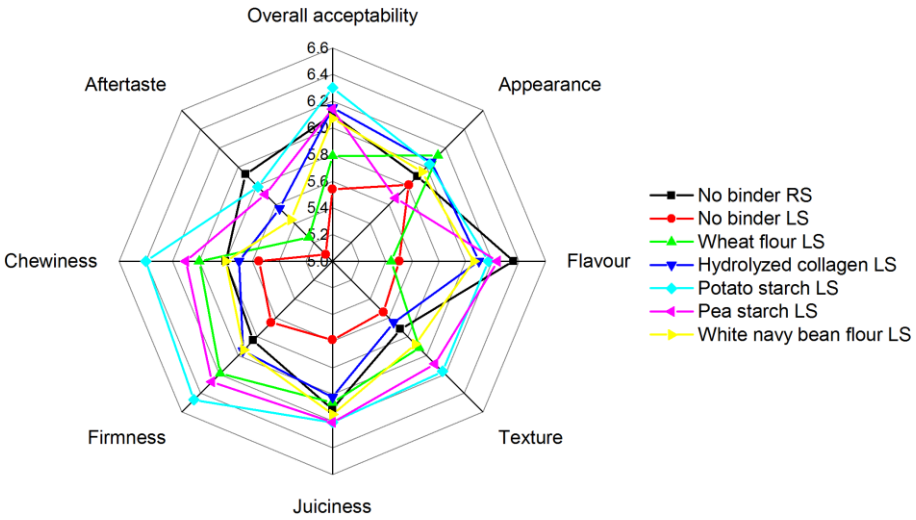

Figure 1. Sensory hedonic scores of bolognas

Liking scores demonstrated that potato starch provided better sensory acceptance of LS bolognas in terms of overall acceptability, compared to wheat flour and no binder treatments (Figure 1). Pea starch had lower appearance scores than potato starch, hydrolyzed collagen and wheat flour. And consumers preferred potato starch than hydrolyzed collagen and no binder LS for overall texture, firmness and chewiness. Regular salt offered better flavour and aftertaste than wheat flour.

IV. CONCLUSION

All non-allergen binders were equivalent to wheat flour and favourably affected hydration properties and thermal stability, yielding lower cooking loss as compared to LS control. Substituting NaCl with salt replacer resulted in lower cook yield and negatively affected consumer acceptability. However, detrimental effect was partially overcome by addition of binders. Of the ingredients tested potato starch showed the greatest potential to be utilized as gluten-free alternative to wheat flour for bologna binder applications.

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