EFFECTS OF PSYLLIUM HUSK POWDER ON A COLD-SET RESTRUCTURED GROUND TURKEY PRODUCT

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Abstract – The objectives of this study were to determine the effects of 0, 0.6, 1.0, and 1.5% psyllium husk powder in a restructured turkey product. The aim was to determine if this fiber affected the function of an alginate binding system regarding cook yield, pH, texture, water activity, moisture percentage, and water holding capacity. Samples were prepared at 23º C and given a 24-hour period to set in a 4º C refrigerator. Samples were then cooked to an internal temperature of 72º C via water bath. It was observed that as the concentration of fiber increased, the binding strength decreased and water holding capacity increased (P<0.05). No significant differences (P>0.05) were observed for water activity and pH values. Both 1.0 and 1.5% treatments had the highest (P<0.05) cook yield and moisture percentage values. Overall, adding fiber into a restructured system can add desirable nutritional and yield characteristics, but cohesion of the product is diminished. Further research is needed to confirm sensory acceptance of the product.

Key Words –Calcium alginate, fiber, processing

I. INTRODUCTION

Restructuring of meat products enables the use of low-price cuts from mature animals to produce high quality meat products at reduced cost [1]. The cold-set alginate system uses an organic acid to modulate calcium solubility for greater internal binding strength [1]. Previous research has shown that dietary fibers can function in meat products as fat substitutes, emulsifiers, texture enhancers, and water binders [2, 3, 4]. Psyllium husk powder has shown to contain dietary fiber and levels of bioactive compounds that are essential for reducing coronary heart disease [4, 5]. The objective of this study was to compare the functional properties of a cooked turkey product restructured using the cold-set alginate system and increasing amounts of psyllium husk powder.

II. MATERIALS AND METHODS

Ground turkey was obtained locally and used to create four treatment batches with 0.6% sodium alginate, 0.6% encapsulated lactic acid and 0.2% $CaCl_2$ as a base mixture to which 0, 0.6, 1.0 or 1.5% psyllium husk powder (PHP) was added. Each treatment was mixed using a Kitchen Aid Mixer and stuffed into eight Fisherbrand 50mL polypropylene tubes. Samples were prepared at 23º C and given a 24-hour period to set in a 4º C refrigerator. Samples were then cooked to an internal temperature of 72º C via a Fisher Scientific (Model Isotemp 210) water bath. The entire experiment was repeated four times and within each replicate every treatment (0, 0.6, 1.0, 1.5%) was prepared at the same time. After cooking, each treatment was analyzed for pH, texture, water holding capacity, water activity, cook yield, and moisture percentage.

For pH, 10 g of ground turkey was homogenized with 90 mL of distilled water, and the readings were measured by a Mettler Toledo (Model FiveEasy FE20) pH meter. Eight 1 cm thick turkey discs were used to determine binding strength with the Stevens-LFRA Texture Analyzer. The equipment was programmed to travel 20mm at a speed of 2.0mm/sec for each puncture test. The highest value (in grams) was recorded. Water holding capacity was measured using 0.5 g samples on 150 mm Whatman #4 filter paper. Duplicates of each treatment were pressurized for five minutes at 34.5 MPa using a Carver Laboratory Press (Model C). The measurements were recorded as a ratio of water area to meat area. Water activity was measured using a standard Aqua Lab CX-2 water activity meter. Duplicates of each treatment were performed. The raw and cooked weights of all eight tubes for each treatment were recorded to determine cooking yield ([(final wgt-initial wgt)/initial wgt] x 100%). Finally, moisture percentage was determined on duplicate 5g samples in a National Appliance Company (Model 3640 VO) vacuum oven for 24 hrs at a constant temperature of 80º C. The moisture percentages were determined using this equation: [(initial wgt-final wgt)/initial wgt] x 100%.

One-way ANOVA was used to analyze the data with 0.05 as the significance level and a Tukey multiple range test was used to separate means.

III. RESULTS AND DISCUSSION

Results for each functional parameter tested is in Table 1. The average pH measurements decreased as the concentration of psyllium husk powder (PHP) increased; however, no significant differences ($P<0.05$) were observed. The average binding strength had differences ($P<0.05$) among the treatments. The control treatment concluded significantly higher binding strength (202.72 g) than all three treatments. Likewise, the 0.6% PHP treatment showed significantly higher binding strength than the 1.5% treatment with 167.03 and 143.66 g, respectively. No other significant differences were observed for texture. Similarly, the control treatment had significantly lower water holding capacity (3.08) than the other three treatments. No other significant differences were observed for water holding capacity. For all treatments, there were no differences for water activity values. Finally, both cook yield and moisture content had the same pattern. The 1.0 and 1.5% PHP treatments had significantly higher cooking yield and moisture percentage (80.03% and 70.24%) (81.15% and 70.64%), respectively, compared to the control and 0.6% treatment. Also, the 0.6% treatment had significantly higher cook yield and moisture percentage (76.88% and 68.65%), respectively, compared to the control.

Table 1 Functional property means for each restructured turkey treatment

Treatment[d]	pH	Texture	Water Holding Capacity	Water Activity	Cook Yield %	Moisture %
Control (0%)	6.314[a]	202.72g[a]	3.080[a]	0.999[a]	69.19[c]	66.31[c]
0.6% PHP	6.298[a]	167.03g[b]	2.137[b]	0.994[a]	76.88[b]	68.65[b]
1.0% PHP	6.259[a]	149.94g[bc]	2.012[b]	0.992[a]	80.03[a]	70.24[a]
1.5% PHP	6.259[a]	143.66g[c]	1.979[b]	0.990[a]	81.15[a]	70.64[a]

[abc] Different letters in each column indicate significant difference ($P<0.05$).
[d] PHP: Psyllium Husk Powder.

IV. CONCLUSION

Increasing the concentration of fiber in a restructured meat product has beneficial effects such as increasing cook yield and moisture. Unfortunately, the water holding capacity and texture of the product decreases with the addition of fiber. This can be a direct result of the fiber not performing as well as the water holding capacity of calcium alginate. Plus, the fiber's ability to retain moisture allows for a decrease value in binding strength. However, there are limitations on these observations because no sensory evaluation was performed to determine overall acceptability. Psyllium husk powder has the potential to increase meat characteristics and provide a health benefit, but further research needs to be performed to conclude this.

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