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Incorporation of β-Glucans and Microcrystalline Cellulose in Meat Emulsions

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Objectives

Developing meat products with high levels of dietary fiber, low calorie levels, and suitable technological properties creates both opportunity and challenge for the meat industry. β-glucans (βG) are a source of soluble fiber and soluble fiber has been associated with decreasing glycemic index and cardiovascular health. Microcrystalline cellulose (MCC) is an insoluble fiber recommended for application in many food products. So far, interactive effects between βG and MCC with intentions of reaching high levels of dietary fiber in the final product has not been evaluated. This study evaluated the influence of the incorporation of βG, MCC, and a mixture of both on the technological properties of beef emulsions when compared with traditional emulsions using starch.

Materials and Methods

βG, MCC, and starch were added to emulsions containing lean ground beef, olive oil (15%), salt (2.36%), and water (22.14%). Inclusion levels of 1, 2, and 3% of βG, MCC, or starch were tested independently. Additionally, a mixture of βG (1.5% inclusion level) and MCC (1.5% inclusion level) was tested. The ingredients and hydrocolloids (treatments) were mixed in a food processor until a complete emulsion was obtained. The emulsions were packaged in polyethylene bags, weighed, vacuum sealed, and stored under refrigeration at 4 ± 0.5°C until further analysis was completed. Cooking loss, βG (%), instrumental color, and texture profile analyses (TPA) were determined using 3 independent replications. One-way ANOVA analysis and means separation using a Tukey's multiple comparison adjustment was performed using Statistica version 7.0.

Results

Cooking loss was not different ($P > 0.05$) among treatments and was less than 1.3% for all treatments indicating the high water holding capacity of the hydrocolloids used in this study. βG remaining in the emulsions after processing were between 0.71 ± 0.02 and 2.07 ± 0.11 (w/w) with a significant difference in the samples containing βG. These levels of βG are potentially available to function during digestion forming viscous solutions in the intestine, which would increase stool volume, and prevent accelerated absorption of glucose and lipids. In both raw and cooked emulsions, emulsions with the greatest levels of MCC (3%) and starch (3%) had greater ($P < 0.05$) lightness (L*) and presented the greatest ($P < 0.05$) hardness values compared with all other treatments. In contrast, βG inclusion at 3% presented the least L*(darkest samples), the least hardness values, greatest adhesiveness, and lowest cohesiveness and springiness compared ($P < 0.05$) with all other treatments. The mixture of βG and MCC showed an intermediate level of hardness, cohesiveness, springiness, gumminess, and chewiness values compared with other treatments.

Conclusion

A combination of βG (1.5%) and MCC (1.5%) resulted in emulsions with appropriate technological properties (low cooking loss and intermediate TPA and L* values). The type of hydrocolloid used influenced color and texture of emulsions; although, the formation of the interstitial film in the emulsion was not affected. The consumption of 100 g of these emulsions could supply approximately 2.5% of the daily dietary fiber intake. The amount of βG in the emulsions could meet recommended intake levels of soluble fiber with 1 serving (0.75g). Starch could be replaced effectively by an insoluble fiber (MCC) in emulsions to maintain suitable technological properties.

