PE10.04 The Effect of Broccoli Puree on Some Quality Characteristics of Beef Meatballs 215.00

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Abstract— Different amounts of broccoli puree (10%, 15% and 20%) was used for meatball preparation in this study. Control samples were formulated with 10% rusk. Meatballs were analyzed for moisture, fat, protein, ash and energy value and pH. Cooking properties were also evaluated. Incorporation of broccoli puree increased moisture content and decreased protein, fat and ash contents of meatballs significantly. Utilization of broccoli decreased the energy value of meatballs in comparison to control. The pH values of raw and cooked meatballs ranged between respectively 5.80 to 5.85 and 6.06 to 6.12. The highest cooking yield value obtained from control group. All the broccoli puree treatments achieved higher fat retention than control.

Index Terms— meatball, broccoli puree, cooking parameters

I. INTRODUCTION

Meat and meat products are essential in the diet. Their principal components, besides water, are proteins and fats, with a substantial contribution of vitamins and minerals of a high degree of bioavailability. Both meat and its associated products can be modified by adding ingredients considered beneficial for health or by eliminating or reducing components that are considered harmful. There are various possible strategies for developing healthier meats and meat products, including functional foods. One of the most important of these strategies is to design foods that will reduce the concentration of some unhealthy compounds (fat or sodium) and promote the presence of healthy compounds [1, 2]. To achieve this, various non-meat ingredients have been used in the formulation of meat-based functional foods.

Epidemiological studies have pointed out that the consumption of fruits and vegetables has health benefits, e.g. reduced risk of coronary heart disease and stroke, as well as certain types of cancer [3].

Like other species of the Brassica family, broccoli is a rich source of health promoting phytochemicals [4, 5]. Broccoli is becoming increasingly popular as a fresh vegetable and is a significant source of nutritional antioxidants, such as vitamins and carotenoids, as well as biologically active dietary components, such as the flavonol glycosides [6], hydroxycinnamic acids [7] and sulphur-containing compounds, such as the glucosinolates [8]. Broccoli is also a good source for dietary fiber.

The objective of this research was to evaluate the effects of broccoli as a binder and extender on proximate composition, energy value and cooking parameters of meatballs.

II. MATERIALS AND METHODS

The minced lean beef (ground through a 3 mm plate) was mixed with 7% minced beef fat, 0.3% onion powder, 0.2% black pepper, 0.2% red pepper, 0.1% white pepper, and 1.5% salt and kneaded for 15min by hand. Dough was divided into four equal portions. Four different meatball samples were prepared with respectively 10% moistened rusk, 10%, 15% and 20% broccoli puree. Each portion was kneaded for 15min to obtain homogeneous dough and processed into meatballs (1 cm thick and 80 mm diameter) by using a metal shaper. Meatballs were placed on plastic trays and wrapped with polyethylene film and frozen at -18 oC until further analysis. Moisture, protein, fat, and ash contents measurements were done according to the methods described by AOAC [9]. pH of meatballs was determined by blending 10 g of sample with 100 ml of distilled water for 1 min. Total calories (kcal) were calculated in relation to 100-g samples using the Atwater values for fat (9 kcal g_1), protein (4.02 kcal g_1) and carbohydrates (3.87 kcal g_1).

Cooking yield and fat retention [10], moisture retention [11] and reduction in meatball diameter were calculated. The data obtained from two replications were analyzed by one way ANOVA using the MINITAB statistical package program [12].

III. RESULTS AND DISCUSSION

Mean values for the proximate composition, pH and energy values of raw meatballs are given in Table 1. Incorporation of broccoli puree with an increased portions (10% to 20%) also increased moisture content and decreased protein, fat and ash contents of meatballs significantly ($p<0.05$). The higher moisture content of broccoli treatments could be depending on higher water retention ability of their fibers. Protein levels in meatballs ranged from 18.91% to 16.16%. Protein levels decreased as the broccoli content increased ($p<0.05$) and this could be to the decrease in red meat content. Similar results were reported by Candogan [13] for beef patties with added tomato paste. The fat contents of control meatballs were 10.17% and ranged between 9.36% and 8.91% for meatballs with added broccoli. Ash contents of meatballs ranged from 1.89% to 2.19% ($p<0.05$). Broccoli treatment did not change the carbohydrate

value of meatballs ($p>0.05$). Similarly adding up to 15% of rice bran significantly decreased protein and fat content of emulsified pork meatballs [14]. Eim et al. [15] found similar results with the use of carrot dietary fiber in fermented sausages. The highest energy values were obtained from control samples (173.81 kcal/100g). The energy values for broccoli puree added meatballs ranged between 151.68 and 165.38 kcal/100 g. Energy reduction with respect to control could depend on fat reduction because fats are most concentrated dietary energy source, providing 9 kcal/100 g, more than twice that supplied by proteins or carbohydrates. The pH values of raw and cooked meatballs ranged between respectively 5.80 to 5.85 ($p>0.05$) and 6.06 to 6.12 ($p<0.05$).The addition of broccoli did not change raw meat pH ($p>0.05$). As similar Porcella et al. [16] reported that addition of soy protein isolate did not change the pH significantly compared to control samples. The highest pH values (6.12) were obtained from the 20% broccoli puree added for cooked sample. Similar results were reported by Candogan [13] for beef patties with added tomato paste. The increase in pH value of cooked meatballs is probably caused by a reduction in available carboxylic groups on proteins and also through the liberation of calcium and magnesium ions from proteins, as proposed by Medynski et al. [17]. Cooking properties of the meatballs are given in Table 2. The meatballs tend to shrink during the cooking process, due to the denaturation of the meat proteins and loss of water and fat also contribute to the shrinking process. Although it is expected to obtain higher cooking yield values from broccoli groups however it is not realized. The highest cooking yield value obtained from control group. This result can be related to the high moisture content of broccoli puree and in contrast to some researchers [18]. All the broccoli puree treatments achieved higher ($p<0.05$) fat retention than control. There are no significant differences ($p>0.05$) for moisture retention values among treatments. Diameter reduction was lowest for B10 treatment (22.48%). However, all the differences in size reduction of samples with broccoli during cooking were relatively minor. These results supported the findings of Mansour and Khalil [19] in low fat burgers made with various types of wheat fibres.

IV. CONCLUSION

The addition of broccoli puree into the meatballs at the levels of 10%, 15% and 20%, respectively would improve their nutritional value and health benefits. According to above results 15-20% of broccoli puree addition can be recommended in meatball production.

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