THE EFFECT OF DIETARY FIBER EXTRACTED FROM RICE BRAN ON THE PHYSICAL AND SENSORY PROPERTIES OF FRANKFURTERS

Y. S. Choi[1], J. Y. Jeong[1], J. H. Choi[1], D. J. Han[1], H. Y. Kim[1], M. A. Lee[1], L. H. Yu[2], and C. J. Kim*[1]

[1] *Department of Food Science and Biotechnology of Animal Resources, Konkuk University, Seoul, 143-701, South Korea*
[2]*National Livestock Research Institute R. D. A., Suwon, 441-350, South Korea*

Key Words: dietary fiber, rice bran, frankfurter, sensory properties

Introduction

Rice bran is milled from important rice cultivators in Korean, has high contents of dietary fiber, lipid, protein and vitamin B (Saunders, 1990; Kim *et al.*, 2000). However, rice bran has a high liquid content, which hinders its storage (Warren and Farrel, 1990). Quality of the rice bran is very rapidly deteriorated resulting in the development of off-flavor and high content of free fatty acid due to the presence of various enzyme such as lipase (Rhee and Yoon, 1984). Therefore, the utilization of rice bran as commercial products so far is limited to the production of bran oil and animal feed (Hargrove, 1994). Not enough work has been done on the addition of different sources of bran on meat products. Also, Wheat bran and barley bran were used as replacements for fat in beef sloppy-joes (Vosen *et al*., 1993). Meat products containing those fiber added products were found to be inferior in flavor, juiciness, texture and overall acceptability. The trend toward functional foods has lead to the publication of including functional properties in various types of dietary fiber food, within which meat and meat products deserve special attention.

Modern consumers are increasingly interested in their personal health and the foods expect to eat beyond tasty and attractive. High intake of dietary fiber is associated with decreased risk for obesity, some types of cancer, high blood cholesterol, hypertension and coronary heart disease (Turhan, 2005). Dietary fibers can be used in meat products to increase the cooking yield thanks to their water- and fat- binding properties, and to improve texture (Thebaudin, *et al*., 1997). To the best of our knowledge, there are no reports on the use of extracted rice bran as a dietary fiber source in meat products. Therefore, our objectives were to evaluate the effects of adding different levels of dietary fiber extracted from rice bran of frankfurter.

Materials and Methods

Rice bran was from Ansung, Korean. Dietary fiber was extracted using the modified AOAC enzymatic-gravimetric method (Prosky *et al.*, 1988). The proximate compositions of dietary fiber extracted rice bran were 53.27% dietary fiber, 6.10% crude fat, 22.99% crude protein, 12.78% crude moisture and 7.41% crude ash. Fresh pork hams were purchased from a local market at 48 h post mortem. Pork back fat was also collected. Lean materials were initially ground through a 13 mm plate and the pork back fat was ground through an 8 mm plate. Each batch of samples consisted of four meat batters which differed in composition with respect to level of added defatted dietary fiber extracted from rice bran. Fore different frankfurters were formulated as follows: raw meat was homogenized and ground for 1 min in a silent cutter (Cutter Nr-963009, Scharfen, Germany). 1.5% NaCl and 0.2% sodium tripolyphosphate was added to the meat along that had been previously dissolved in water and chilled (2 ˚C), and the whole was mixed again for 1 min. After that, the rice bran was also added and batters homogenized for 1 min. Mixing time was standardized to 5 min. After emulsifying, meat batter was stuffed into collagen casing using a stuffer (Stuffer IS-8, Sirman, Italy). And then meat batters were heated at 75 ±2˚C for 30 min in a water bath (Dae Han Co, Model 10-101, Korea). The cooked meat batters were then cooled by cold water. Respectively, the 10 kg batches of each frankfurter were prepared. The pH values of frankfurters were measured in a homogenate prepared with 5 g of sample and distilled water (20 ml), using a pH meter (Model 340, Mettler-Toledo GmbH, Schwerzenbach, Switzerland). Moisture, protein (N×6.25), fat and ash contents were determined according to AOAC (1990) procedure. The color of the frankfurters were measured by the CIE LAB system using a color meter (Minolta Chroma meter CR-200; illuminate C, calibrated with white plate, L^*=+97.83, a^*=-0.43, b^*=+1.98). Cooking loss was determined for frankfurters per rice bran by calculating the weight differences of frankfurter before and after cooking. Texture measurements in form of texture profile analysis were performed at room temperature with a texture analyzer (TA-XT2*i*, Stable Micro Systems, England). The samples (25 mm cube) parallel to the longitudinal orientation of the muscular fibers were taken from the central part of each portion from each group. The frankfurters were sensory evaluated for color of appearance, flavor, juiciness, tenderness and overall acceptability. Frankfurters were cooked as previously described, the cooked samples were cooled to room temperature and cut into quarters and served to the panelists in random order. Data were analyzed in a one-way analysis of variance through the analysis of variance (ANOVA) procedure of the SAS statistical package (SAS Institute Inc., USA).

Results & Discussion

The purpose of this study was to investigate quality characteristics of the frankfurters containing dietary fiber extracted from rice bran. The differences between moisture, protein, fat and ash of frankfurters were statistically significant ($p<0.05$). While the lowest moisture contents were determined for control frankfurters as 56.20%, the moisture contents of frankfurters with dietary fiber extracted from rice bran added were close to each other. The lowest protein contents were also determined for control frankfurters as 10.70%. Protein levels in frankfurters with added rice bran ranged from 13.40% to 11.72%. The fat contents of control frankfurters were 26.07% and ranged between 23.89% and 24.56% for frankfurters with added rice bran. Ash contents were the lowest for control frankfurters as 1.92%. Ash levels increased as the rice bran content increased ($p<0.05$). The pH values of frankfurters ranged from 6.34 to 6.49. The addition of rice bran to the formulation did not significantly affect the pH of the products ($p>0.05$). The differences between lightness (L^*- value), redness (a^*- value) and yellowness (b^*- value) values of frankfurters were significant ($p<0.05$). The highest lightness was obtained in the control frankfurters. As the rice bran content increased for frankfurters, lightness value was decreased ($p<0.05$). Redness value ranged between 3.23 and 3.32 for frankfurters with added rice bran. Redness of frankfurters was not influenced by differences in the mount of rice bran added. The lowest yellowness was obtained in the control frankfurters. As the rice bran content increased for frankfurters, yellowness value was increased ($p<0.05$). Compared with control, cooking loss had significantly lower for frankfurters added rice bran. The lowest cooking loss was obtained in the added rice bran 2% for frankfurters. The highest viscosity was obtained in the added rice bran 6% for frankfurters, viscosity of frankfurters added rice bran were observed significantly higher than those in control ($p<0.05$). Compared with control, and then hardness, cohesiveness, gumminess, and chewiness for frankfurters added rice bran were higher than in control ($p<0.05$). Sensory traits for frankfurters with different rice bran levels were statistically significant ($p<0.05$). Control frankfurters had the highest color scores (8.36). Flavor, tenderness, juiciness and overall acceptability scores for frankfurters added rice bran were observed significantly higher than those in control ($p<0.05$).

Conclusions

Dietary fiber extracted from rice bran addition was found to significantly affect certain quality parameters of the frankfurters. Rice bran addition was also found to be effective in improving the reduction in cooking loss. Frankfurters formulated with rice bran had higher viscosity, hardness, cohesiveness than those in control. There was significant increment among sensory scores of frankfurters in respect to rice bran addition. 1% and 2% rice bran added samples had the highest overall acceptability score. In conclusion, 2-4% of rice bran addition can be recommended in the frankfurters production and maintaining acceptable and desirable sensory properties.

Acknowledgement

This research was supported (033-006-001-01-00) by the Rural Development Administration (Republic of Korea).

References

1. Saunders, R. M. (1990). The properties of rice bran as a food stuff. Cereal Foods World. 35, 632-636.
2. Kim, J. S., Godber, J. S., and Prinaywiwatkul, W. (2000). Restructured beef roasts containing rice bran oil and fiber influences cholesterol oxidation and nutritional profile. J. Muscle Foods. 11, 111-127.
3. Warren, B. E. and Farrel, D. J. (1990). The nutritive value of full-fat and defatted Australian rice bran. I. Chemical composition. Anim. Food Sci. Technol. 27, 219-228.
4. Rhee, J. S. and Yoon, H. N. (1984). Stabilization of rice bran by microwave energy. Korean J. Food Sci. Technol. 16(1), 113-119.
5. Hargrove, Jr., K. L. (1994). Processing and utilization of rice bran in the United States. In Rice Science and Technology, W. E. Marshall and J. I. Wadsworth (Ed.) Marcel Dekker, Inc., New York.
6. Vosen, T. R., Rogers, R. W., Halloran, J. D., Martin, J. M., and Armstrong, T. (1993). Effects of bran on sensory, storage, and compositional properties of low fat beef sloppy-joes. J. Muscle Foods, 4, 71-79.
7. Thebaudin, J. Y., Lefebvre, A. C., Harrington, M., and Bourgeois, C. M. (1997). Dietary fibres: nutritional and technological interest. Trends in Food Sci. Technol., 8(2), 41-48.
8. Prosky, L., Asp, N. G., Schweizer, T. F., De Vries, J. W., and Furda, L. (1988). Determination of insoluble, soluble and total dietary fiber in foods and food products: collaboration study. J Assoc. Off. Anal. Chem., 71(5), 1017-1023.
9. AOAC. (1990) Official methods of analysis (15 th ed.). Arlingron, VA: Association of Pfficial Analytical Chemists.
10. Turhan, S., Sagir, I., and Ustun, N. S. (2005). Utilization of hazelnut pellicle in low-fat beef burgers. Meat Sci. 71, 312-316.