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Research Article

EFFECT OF DIFFERENT EXTENDERS ON PHYSICAL, CHEMICAL AND SENSORY CHARACTERISTICS OF SAUSAGE PRODUCTION

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ABSTRACT

Sausage is one of the popular comminuted meat products available around the world. In sausage production, binders are added to improve texture, cooking yield and as an aid in improving quality attributes such as taste and juiciness. Mostly wheat flour is the main ingredient used as the binder in the sausage production. In present study, four types of binders were tested with wheat flour. Rice (red kekulu), maize (Hybrid-Sampath), mung bean (MI 6) and cowpea (Dawala) were used in place of wheat flour binder to produce sausages. Cooking yield is higher in control treatment because wheat flour has ability to hold more water than other type of flour. Sensory evaluation showed that aroma and overall acceptance are higher in maize flour filled sausages and was superior to other sausages. Taste of maize filled sausages was comparable with wheat filled sausages. The other binding agents tasted were performed poorly. Proximate analysis result showed that there is no much deviation of parameters tested among wheat and maize filled sausages. Based on these results maize can successfully be used to replace wheat flour in sausage filling.

INTRODUCTION

Consumer demand for quality meat products are increasing through the development of meat products by incorporating health enhancing ingredients. The long standing positive consumer perception that meat and meat products are the best sources of minerals, vitamins and complete proteins (Verbeke, 2010). The addition of non-meat ingredients not only improve the quality of the meat products, but also reduce the cost and have beneficial health effects on consumers (Abdolghafour, 2014). The effect of incorporation of corn (maize) flour in quail meat rolls as extenders were studied at the level of 3%,6%,and 9% and observed significant ($p<0.05$) increase in emulsion stability and cooking yield (Yadev, 2008). The corn (Maize) flour added sausages had shown better colour and appearance, tenderness, juiciness and overall acceptability scores than oat flour added sausages (V.Govind., 2013.). The experiment on beef sausage which was made with rice flour revealed that treatment effect ($P < 0.05$) was observed for percentage cooking weight loss and was lowest (1%) in Batch 5 and highest (2%) in the Control (Snawo, 2012).

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Sausage with sodium caseinate had the highest ($P<0.05$) yield (92.20%), this was followed by products with cowpea (89.14%), soybean (89.00%) however, the least was obtained with product containing groundnut (80.02%) (Babatunde, 2013).

The main objective of the current study is to evaluate the different extenders (binders) which are important for physical, chemical and sensory attributes of cooked sausage. The experiment was conducted with legumes (Mungbean (*Pisum sativum*) variety MI 06, Cowpea (*Phaseolus vulgaris*) variety Dawala) and cereal binders (Red rice (*Oriyzastaiva*) and Maize (Zea maize) variety Sampath).

MATERIALS AND METHODS

Location of study

The sausage production was conducted at Nelna group of companies (pvt) Ltd Kirindiwela. The rest of the experiment was conducted at Grain Legumes and Oil Crops Research and Development Centre, Angunakolapelessa. The colour of the sausage was analyzed at meat analysis laboratory in department of Animal Science, Faculty of Agriculture, University of Peradeniya.

Sausage recipe

Ingredients used for making sausage batter includes meat ingredients 67% (Mechanically de-bone chicken meat (MDCM) 40%, boneless meat 5.5% and skins 21.5%), spices 1%(crush pepper 42%,chilli powder 31%, coriander powder 21% and cinnamon powder 6%), additives 3%(phosphate 15%, Curing salt7%, Sugar 11.25%, Ascorbate 0.75%, Ascorbic acid 1.5% and vacuum salt 64.5%), water 15% & binders 14% (Maize, Wheat, Mung bean, Cowpea and rice separately per each sausage)

Experimental Design

The experiment was conducted with complete randomized design with three replicates. The treatments were different extenders (binders) such as maize flour, rice flour, mungbean flour, cowpea flour and wheat flour as control.

Methodology

Extenders (Fillers/binders) preparation

Mungbean and cowpea whole seed were taken from the grain legume division. They were cleaned by washing and dry under sunlight 2 days. The clean whole seeds were ground in to flour by pin mill and sieved by No. 60 (Retch, Germany) test sieve. Red rice was brought from the market and maize was collected from the agronomy division. They were cleaned and dry under sunlight for two days. The clean whole seeds were ground in to flour by pin mill and sieved by No. 60 (Retch, Germany) test sieve.

Sausage batter preparation

Sausage batter was prepared according to mentioned recipe. MDCM and boneless chicken meat were placed in the bowl chopper and chopped by adding chilled water. When, the meat was cut in to fine particle, chicken fat and pre-mixtures were added. Then, the mixture was chopped at high speed mode to form emulsion. Finally, the extender and the chilled water were added and chopped for few more minutes. The sausage batter was removed and filled into cellulose casing by using vacuum filling machine. The size of the portion was ranged 22 to 23.3g. The raw sausage was cooked in a cooking chamber nearly for one hour and five minutes. The cooked sausages was taken out and cooled under clean water shower prior to peel. The peeled sausage was vacuumed packed.

Determination of Physical Properties of Sausages

Cooking yield was determined by measuring the difference in the sample weight before and after cooking and was calculated according to Serdaroglu and Degirmencioglu (2004). Moisture retention capacity representing the amount of moisture retained in the cooked product per 100 g of sample and was determined according to equation by El-Magoli *et al* (1996).

Colour was determined using a Minolta 38012012 series portable spectrophotometer (Konica, Japan).The instrument was standardized with the white standard plate. The results were recorded for lightness (L*), redness (a*) and yellowness (b*).

Determination of Chemical Properties of Sausages

The crude protein content was measured using Kjeldhal method. Moisture content was determined by oven dry method (AOAC, 1995).

Crude fat content was determined by soxtherm extractor (BS 65, Yamata Scientific Co LTD, and Japan). The mineral content was determined according to AOAC (1995) and the sample was kept in the muffle furnace (FM 28, Yamata, Japan) at 550^{o}C followed by direct flaming.

Sensory Analysis of Sausages

Sensory analysis was conducted using 20 panelists in the Grain Legumes and Oil Crops Research and Development Centre. Panellists were asked to indicate how much they like or dislike for developed products. Quality attributes and overall acceptability were scored based on five point hedonic scale (5= like extremely and 1= dislike extremely). All sausage samples were prepared by steaming for 10 min. Sausage pieces (1.5 cm long) were placed in paper plates and served to the panelists with three digits code in a randomized order for evaluation. Panellists were asked to rinse mouth with water during tasting of consecutive sample.

Statistical analysis

Sausage processing and all analyses of each treatment were carried out in triplicate. Data were analyzed statistically by analysis of variance (ANOVA) using SAS for Window version 9.1. Means with a significant difference ($p < 0.05$) were compared by Least significant different tests. Sensory data was analyzed by freidmann test with SPSS 16.0 statistical software.

RESULTS AND DISCUSSION

Cooking yield and Moisture retention

The cooking yield was significantly ($p<0.05$) among the treatments (Table 1). The highest cooking yield was observed in sausage made of wheat flour (control) compared with the other fillers. The moisture retention was almost similar among the sausages and ranged between 34% and 36%.

Table 1. Percentof Cooking yield and Water retention of sausages

Types of filler	Cooking yield (%)	Water retention (%)
T_1Wheat flour	91.2^{a*}	36.0^{a}
T_2Mung bean flour	88.0^{bc}	35.9^{a}
T_3Cowpea	88.8^{b}	34.1^{b}
T_4Rice	88.4^{bc}	35.6^{a}
T_5Maize	87.8^{c}	35.6^{a}

Means with the same letters of superscript along the column are not significantly different at $p<0.05$, * significantly different

Different

The result clearly showed that the cooking yield and the moisture retention were higher in the sausage which made of wheat flour which has higher water absorption ability than the other fillers. However, all the sausages showed low moisture retention, due to high fat content which reduces the water retention of the sausage.

Colour

All the measurements were taken after the sausage cooked by smoked oven and after blast freezing. The colour values were significantly different (ANOVA, $p<0.05$) for the different types of flour which was taken for production of sausage (Table 2). The lightness of the sausage was ranged 32.53 to 36.56, redness was ranged 9.36 to 15.06 and yellowness was ranged 8.36 to 11.43.The sausage made with wheat flour had a significantly higher value for lightness compared to other filler and had high yellowness. Maize filled sausage had highest value for redness, but not significantly different compared to wheat filler.

Table 2:-Colour (L,a,& b) values of sausages

Type of filler	L*Lightness	a*Redness	b* Yellowness
Wheat flour	34.9^{b}	15.0^{a}	10.4^{ab}
Mungbean flour	32.5^{c}	9.3^{b}	8.3^{b}
Cowpea flour	33.8^{cb}	11.3^{b}	8.4^{b}
Rice flour	34.6^{b}	15.1^{a}	8.9^{b}
Maize flour	36.5^{a}	14.4^{a}	11.4^{a}

Means with the same letters of superscript along the column are not significantly different at $p<0.05$, * significantly different

The results indicate that sausages with maize flour as the filler had highest lightness value compared to other all the treatments. Yellowness of the sausage is higher in maize filled sausage and wheat flour is next to that, however, maize and wheat flour gives yellow colour to the sausage. Mungbean and cowpea fillers give more redder in colour than others because their seed coats gave dark colour to flour.

Proximate Composition

The proximate composition of sausages made of the all the fillers showed significantly difference (ANOVA, $p<0.05$) for the moisture, protein, fat and ash content and carbohydrate content (Table 3). The moisture content was in the range between 38% and 41%, protein was ranged between 11% and 13%, fat was ranged between 33% and 37%, ash was ranged between 3% and 3.7 % and carbohydrate was ranged between 5% and 12%.The proximate compositions differed among samples as different with the type of filler used. Moisture content of sausages is more or less similar with type of filler. It proves that there is not direct impact on the increase moisture level with the type of filler which used. Ash content of sausage is significant and it is higher in sausages with mungbean and cowpea flour, Because of legume crops are having higher mineral composition than the cereals.

Fat content of sausages is very high, because catering sausages are produced by using more mechanically deboned meat and chicken skins. In this formula, more than 60% raw material include with MDCM and chicken skin. There is no much difference among the protein content and sausages with mungbean and cowpea flour shows the higher content of protein, because of legumes are having higher proportion of protein than the cereals. Carbohydrate content shows significant difference among sausages and higher in sausage made with maize and wheat flour. Sausage with mungbean, rice and cowpea flour show lower content of carbohydrate.

Table 3. Proximate composition of sausages

Type of filler	Moisture content %	Ash content %	Fat %	Protein %	CHO%
Wheat flour (control)	39.4^{b}	3.1^{c}	34.6^{c}	11.9^{abc}	10.7^{ab}
Mung bean flour	40.7^{a}	3.6^{a}	37.2^{a}	12.6^{ab}	5.6^{c}
Cowpea flour	38.4^{c}	3.6^{a}	36.3^{ab}	13.0^{a}	8.5^{b}
Rice flour	40.3^{a}	3.1^{c}	36.8^{a}	11.3^{bc}	8.3^{b}
Maize flour	40.5^{a}	3.2^{b}	33.0^{c}	11.0^{c}	12.1^{a}

Means with the same letters of superscript along the column are not significantly different at $p<0.05$, * significantly different

Table 4. Median ranks of sensory properties of sausages

	Appearance	Aroma	Texture	Taste	Juiciness	Overall acceptability
Maize	4.2a	4.0a	3.5a	4.0a	3.5a	4.0a
Mungbean	2.0b	2.5c	2.5b	2.5b	2.5b	1.5d
Rice	3.5a	2.5c	3.0b	2.5b	3.0a	3.0b
Wheat	3.5a	3.5b	3.3ab	3.5ab	3.5a	3.0b
Cowpea	2.00b	2.0c	2.5b	3.0b	2.0b	2.5c
Significant	0.000	0.000	0.038	0.010	0.003	0.000

Means with the same letters of superscript along the column are not significantly different at $p<0.05$, * significantly different

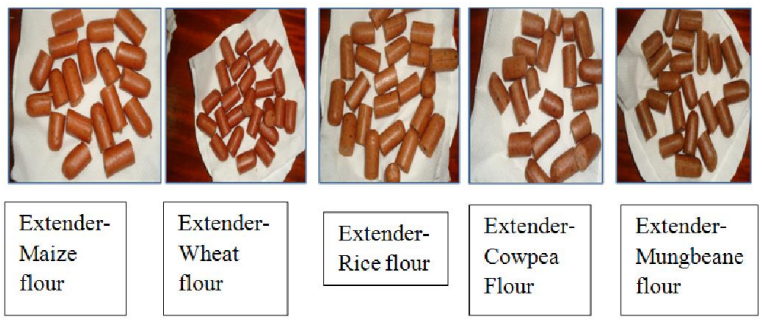

Figure 1. External appearance of sausage made with different types of extenders

Twenty untrained panelists were presented to evaluate the colour, flavour, taste, texture and overall acceptability. Table4 show the ratings of sensory attributes for each sausage made with different fillers. The results of the sensory evaluation were showed that there were significant differences ($p<0.05$) among the five samples with the type of filler used. Table 4 showed that consumer prefrerence based on aroma and overall acceptance were significantly higher value for maize flour filled sausage than other all the type of treatments. Maize flour was having good appealing aroma and taste compared to other fillers. There was a higher value for consumer preference in both maize and wheat flour used sausages by the panelists. The results showed that sausage made with maize flour gives better sensory attributes than the control. Especially sausage with maize flour filler had clear distinct golden yellow colour than other fillers. Although cowpea and mungbean are protein rich crops, they did not have appealing sensory properties, because of dark colour of flour and the beany flavour.

Conclusion

Based on results it can be concluded that sausages filled with maize was superior to that of other fillers in terms of sensory evaluation. Overall acceptability showed maize filled sausage was significant to the other sausages. Therefore, filling sausage with maize which is locally available product can be recommended for the commercial production of sausage.

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REFERENCES

Abdolghafour, B. and Saghir, A. 2014. Development in sausage production and practices- A review. *Journal of meat science and technology*, (2): 40-50.

AOAC. 1995. Official methods of analysis, 16th Ed. Association of Official Analytical Chemist, Washington, Dc.

Babatunde, O.A., Ayodeji, A.V. and Olufemi, O.O. 2013. Quality of Breakfast Sausage Containing Legume Flours as Binders. *Journal of Biology and Life Science,* Vol 4 (2): 310-319.

El-Magoli, S.B., Laroia, S. and Hansen, P.M.T. 1996. Flavor and texture characteristics of low fat ground beef patties formulated with whey protein concentrate. Meat Sci., 42: 179-193.

Govind,V., Prabhakar, K., Rao, B. E. and Mallika, E.N. 2013. Eating quality and physic-chemical properties of fresh emu meat sausages prepared in comparison with broiler and spent hen meat sausages with oat flour and corn flour. *International journal of food, Agriculture and Veterinary Science*, (3): 247-253.

Peteira, N.R., Tarley, C.R.T., Matsushita, M. and Souza, N.E. 2000. Proximate composition and fatty acid profile in Brazilian poultry sausages. *Journal of Food Composition Anal*., 13:915-920.

Serdaroglu, M. and O.Degirmencioglu, 2004. Effects of fat level (5%, 10%, 20%) and corn flour (0%, 2% 4%) on some properties of Turkish type meatballs (koefte). Meat Sci., 68: 291-296.

Snawo, K.A., Makanju, M.O., Iposu, S.O. and Adegbite, J.A. 2012. Effect of substituting rice flour as fillers for wheat flour at varying level in beef. *Bots. J. Agric. Appl.Sci*.,

Yadav, S. and R.Yadava. 2008. Effect of Using Bengal gram flour and corn flour as extenders on physicochemical and nutritional quality of Quail meat rolls. *Veterinary Practitioner*. (9) 2.

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