Physico-Chemical Characteristics of Pork Sausage during Refrigerated Storage

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Abstract

A study to compare the effectiveness of Tapioca Starch (TS) and Potato Flour (PF) for preparation of pork sausage with 50 per cent lean and 30 per cent low value meat (Head, Heart and Tongue in the ratio of 70:15:15) was carried out. Sausages were prepared with 5 per cent level of PF and 7 per cent of TS and were subjected to physico-chemical characteristics viz., pH, shear force, TBARS and TV to study the keeping quality at refrigerated storage (4±1^{0}C) for 30 days. Inclusion of 30 per cent low value meat had not much effect compared to full meat sausages. The results revealed that during storage there was a highly significant (P<0.01) decrease in pH, shear force, and increase in TBARS and TV with the increase in storage days in both the treatments. Sausages prepared with 5 per cent PF and 7 per cent TS were acceptable upto 25 days of refrigerated storage (4±1^{0}C). Sausages with potato flour had lower values of TBARS and hence considered more acceptable compared to TS incorporated sausages.

Keywords: Pork sausage, Tapioca Starch, Potato Flour, Sensory evaluation, microbial analysis, Refrigerated Storage

Introduction

Slaughter of animal produces a considerable amount of edible byproducts (Head meat, heart, tongue, tripe etc.) with high biological value and low palatability attributes. Comminuted meat products offer an attractive avenue for utilization of these low value cuts and edible offals by replacing a certain proportion of skeletal meat to reduce their cost of production (Mir Salahuddin et al., 1991). However products prepared with these low value cuts and offals have poor cooking yield and emulsion stability because of its poor emulsifying and water binding capacity (Hendrick et al, 1994; Kondiah and Panda, 1992; Ambosiadis and Wirth, 1984). These shortfalls can be rectified by addition of binders such as starches, especially those of plant origin to compensate when a nutritionally equivalent meat source of low cost and reduced functionality is used (Bawa *et al*, 1998). Potato has long been used by meat processors in the form of starches and flour (Berry, 1997 and Hughes *et al*, 1998) and several workers have tried tapioca starch as a binder for preparing sausages and other meat products (Skerde, 1989; Berry, 1997; Hughes et al, 1998; Lyon et al, 1999). However little evidence is available about the use of Tapioca starch and potato flour in pork sausages made with low value meat. With this viewpoint, the present study was undertaken to compare the effectiveness of tapioca starch and potato flour binder in pork sausage with 50 per cent lean meat and 30 per cent low value (Head, Heart and Tongue) meat under refrigerated condition (4±1^{0}C) over a period of 30 days.

Materials and Methods

Meat, head and cheek meat, heart and tongue were collected after slaughter, cleaned and were packed in polyethylene bags separately and frozen at –20^{0}C until use. Commercially available Tapioca starch and Potato Flour was prepared by scalding fresh potatoes at 80^{0}C for 10 minutes and then peeling off the skin. Scalded potatoes were cut into small pieces and dried in an oven at 60^{0}C overnight. The dried potatoes were ground into a fine powder using a Cyclotec of 1 mm sieve.

Preparation of sausages: Frozen meat, (LVM- Head, Heart and Tongue) and fat were tempered at 4^{0}C and were cut into small pieces and minced using 4.5 mm plate in Electrolux mincer (Omas, Model-16789). LVM was minced twice in order to remove additional

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connective tissues. The minced meat lean meat (50%), lean meat (30%) along with (STPP-0.3 per cent, Salt-2 per cent and Sodium nitrite-120 ppm) were chopped in a bowl chopper for 1 minute and fat (20%) were added and chopped for another 2 minutes then spice mix at 1.5% level , Green condiments at 3 percent (Onion : Garlic –3:1) and added water in the form ice at 10 % level were added and chopped for few minutes. At the final step tapioca starch and Potato flour was added at 7 and 5 per cent respectively and chopped for another 1.5 min. From this emulsion samples were taken for pH and emulsion stability. Emulsion was then stuffed in sheep casing of 19 mm diameter, using a manual sausage stuffer and linked manually. Stuffed sausages were kept in refrigerator (4±1^{0}C) for 1 hour to ensure proper setting. Sausages were then cooked in water bath at 80^{0}C for 15 minutes so as to reach core temperature of 72±3^{0}C. Total of six batches of sausages were prepared. The sausages prepared were packed in polyethylene bags and kept in refrigerator (4±1^{0}C). Samples were drawn at 5 days interval and were analyzed for pH by following the method described by Trout et al (1992) using a digital pH meter (Cyberscan PH 510, Merck). Shear force was determined using Warner Bratzler Shear press and recorded as per Rao et al, 1999, TBARS was determined using method of Tarladgis et al, 1960 and expressed as mg of malanoldehyde/ Kg of sample, Tyrosine Value (TV) was determined by the modified method of Strange et al, 1977 over a period of 30 days. Data generated from each trial was analyzed by following standard procedure described by Snedecor and Cochran (1994).

Results and Discussion

Results (Table 1) revealed that the pH of sausages and the interaction between treatments and storage days showed a highly significant (P<0.01) difference between treatments with sausages with potato flour having higher value. There was a rise in pH from day 0 to day 20 and day 25 in tapioca starch and potato flour incorporated sausages respectively. Thereafter there was a drop in pH values in both treatments (Mittal and Blaisdell, 1982 and Puolanne et al, 2001). A highly significant (P<0.01) and higher shear force value was observed in sausages prepared using potato flour compared to tapioca starch. This may be due to the fact that starch in flour favors formation of strong heat induced structure through swelling of starch granules embedded in protein matrix (Bushway *et al.,* 1982). Upon storage there was a reduction in shear values in both the treatments, which may be due to disintegration of protein matrix that embeds the gel structures of starches. There was a progressive increase (P<0.01) in TBARS number between treatment, between storage and interaction between storage period and treatment. Sausages with Potato flour had lower values compared to that of tapioca starch incorporated sausage and there was a progressive increase in both treatments during storage, which is in concurrence with Drerup *et al* (1981) and Bentley *et al* (1987) and is a reflection of the advance in oxidative changes in pork sausage during storage. Tyrosine value showed a linear and highly significant (P<0.01) increase with the increase in storage days in both the treatments. Potato flour incorporated sausages had higher values compared to tapioca starch containing sausages and might be due to the fact that potato flour has a higher protein content and its breakdown must have boosted the value.

Conclusion

Sausages incorporated with TS were economical in terms of cost involved compared to that of PF incorporated sausages, but in spite of economical reasons since lipid oxidation and protein degradation are the major components which determine the keeping quality and shelf life of the meat products, sausages with potato flour had values lower than that of tapioca starch incorporated sausages it is concluded that sausages with 5 per cent potato flour is considered superior for preparing pork sausages with 70 per cent lean meat and 30 per cent low value meat (Head, Heart and Tongue) compared to that of sausages incorporated with tapioca starch. Sausages prepared with both TS and PF were acceptable till 25 days at (4±1^{0}C).

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Table-1. Mean ± S.E for Physico-chemical (pH, Shear force value, TBARS and Tyrosine Value) and of Pork sausage with 7 per cent Tapioca starch and 5 per cent Potato flour during Refrigerated Storage at 4 ± 1^{0}C

Parameter	Storage Days							Mean ± S.E
	0	5	10	15	20	25	30	
pH								
Tapioca Starch	6.32±0.01^{a}	6.40±0.01^{b}	6.49±0.01^{c}	6.52±0.01^{cd}	6.60±0.01^{f}	6.55±0.02^{def}	6.51±0.01^{cd}	6.48±0.01^{x}
Potato Flour	6.32±0.01^{a}	6.42±0.01^{b}	6.53±0.02^{cd}	6.56±0.01^{def}	6.59±0.02^{ef}	6.73±0.01^{g}	6.54±0.01^{cde}	6.53±0.01^{y}
Days mean ± S.E.	6.32±0.01^{A}	6.41 ± 0.01^{B}	6.51 ± 0.01^{C}	6.54 ± 0.01^{C}	6.59 ± 0.01^{D}	6.64 ± 0.01^{E}	6.53 ± 0.01^{C}	
Shear Force Value								
Tapioca Starch	0.57±0.02^{a}	0.56±0.05^{b}	0.55±0.08^{b}	0.55±0.06^{b}	0.54±0.08^{b}	0.52±0.12^{c}	0.51±0.05^{c}	0.54±0.07^{x}
Potato Flour	0.60±0.13^{a}	0.59±0.07^{a}	0.58±0.09^{a}	0.58±0.12^{a}	0.57±0.09^{ab}	0.55±0.06^{abc}	0.53±0.05^{c}	0.57±0.09^{y}
Days mean ± S.E.	0.59 ± 0.08^{A}	0.57 ± 0.06^{B}	0.56 ± 0.09^{B}	0.56 ± 0.09^{B}	0.56 ± 0.09^{B}	0.53 ± 0.05^{C}	0.52 ± 0.08^{C}	
TBARS (mg of malanolde-hyde/Kg)								
Tapioca Starch	0.29±0.05^{b}	0.34±0.06^{c}	0.54±0.05^{e}	0.59±0.06^{g}	0.69±0.08^{h}	0.86±0.09^{i}	1.14±0.07^{j}	0.63±0.07^{x}
Potato Flour	0.22±0.03^{a}	0.24±0.06^{a}	0.45±0.16^{d}	0.50±0.08^{ef}	0.56±0.08^{fg}	0.66±0.05^{h}	0.89±0.10^{i}	0.50±0.09^{y}
Days mean ± S.E.	0.25 ± 0.04^{A}	0.29 ± 0.06^{B}	0.49 ± 0.06^{C}	0.54 ± 0.07^{D}	0.62 ± 0.08^{E}	0.76 ± 0.07^{F}	1.01 ± 0.09^{G}	
Tyrosine Value (mg of malanolde-hyde/Kg)								
Tapioca Starch	2.29±0.10	3.17±0.10	4.29±0.20	6.58±0.19	8.58±0.07	11.13±0.06	18.08±0.38	7.73±0.16^{x}
Potato Flour	2.50±0.06	3.46±0.03	4.50±0.15	7.58±0.17	9.08±0.15	11.29±0.05	18.33±0.44	8.11±0.15^{y}
Days mean ± S.E.	2.40 ± 0.08^{A}	3.31 ± 0.06^{B}	4.40 ± 0.17^{C}	7.08 ± 0.18^{D}	8.83 ± 0.11^{E}	11.20 ± 0.16^{F}	18.21 ± 0.41^{G}	

Overall means bearing different superscripts between rows (x,y) and between columns (A,B,C,D,E,F,G) differ significantly (P<0.01 or P<0.05). Interaction means bearing different superscripts (a,b,c,d,e,f,g,h,i,j) differ significantly (P<0.01 or P<0.05).

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