Physicochemical and sensory qualities of pork sausage incorporated with blood

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ABSTRACT

A study was conducted to find out the effect incorporating whole blood on the physicochemical and sensory qualities of the pork sausage. Four formulations were prepared with 10, 15 and 20% incorporation of whole blood and compared with the control sample which was prepared with 55% lean pork, 10% lard, 5% diced pork fat, 10% rice flour, 2.5% skim milk powder, 4% spice mix, 1.5% salt, 5% ice, 4% soya and 3% egg. The ingredients were blended and stuffed into natural goat casings and cooked in hot water at 82°C for 30 min. Emulsion stability, pH value, TBA, water holding capacities and water activities were found to be increased with increase in blood incorporation level (P<0.01) whereas cooking loss showed a lower trend with incorporation of blood. Moisture, protein and ash contents of the sausages showed significantly increasing trend (P<0.01) but fat percent showed a significantly decreasing trend with incorporation of blood. Sensory evaluation revealed that product with 10% blood was highly preferred by the panelists.

Key words: Blood, Physicochemical, Pork, Sausage, Sensory properties.

INTRODUCTION

The availability of protein foods of animal origin is becoming more difficult throughout the world including India. The need for an ever increasing volume of nutritionally balanced foods demands production of foods from unconventional sources like food wastes and industrial by-products. Animal blood is underutilized slaughter house by-product and is a source of high quality protein generated by meat industry. Blood contributes about 3-5% of the total body weight at slaughter (Filstrup, 1976) and contains around 18-19% protein(Gracey, 1986). Which can be a major potential protein source. The utilization of blood as human food is limited by lack of hygienically accepted method of blood collection, organoleptic consumption barrier, short stability, limited preference by consumers, religious taboos, ban on use of blood by some sections of people and want of suitable method of preparation of food products etc. (Hazarika, 1989).

Blood obtained from animals at slaughter contains about 18-23 per cent solid of which 18-19 per cent is protein and the protein content of plasma and red blood corpuscles are 6-8 per cent and 34-38 per cent respectively (Gracey, 1986). Because it contains high quality and quantity of protein as much as lean meat, it is sometimes referred to as “LIQUID MEAT” (Wismer-Pedersen, 1979).

At present most of the blood of slaughter house origin is either getting wasted in most of the developing countries including India or only a negligible quantity is used for human consumption. This is undesirable from an ecological and environmental point of view and it is equivalent to pouring money down the drain which represents a loss of potential earnings. Processing of animal blood would provide valuable source of protein whilst concomitantly alleviating pollution problem. Since blood is a by-product, there is tremendous potential for recovery and use as protein source for human nutrition. By doing so, the meat industries may make profit and effluent disposal and pollution problem could be controlled.

Many ethnic tribal people of North Eastern region of India use blood in culinary practices. Considering the future demand for animal protein, the rising cost of meat and meat products and the fact that blood represents a high percentage of total weight of the animals, the possibilities of using blood in production of foods for human consumption, the possibilities of controlling the environmental pollution problems and the potential source of additional earnings, studies were undertaken to utilize blood as human food.

MATERIALS AND METHODS

Fresh pig blood was collected from healthy animals in sterile glass containers at the time of slaughter from nearby

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markets. Fresh pork was also collected simultaneously and brought to the laboratory and stored at 4±1°C until use. The pork was deboned, minced and used for preparation of the sausage.

**Preparation of Sausage:** The control pork sausage was prepared with the following ingredients i.e. Pork (55%), lard (10%), diced lard (5%), rice flour (10%), skimmed milk powder (2.5%), soya paste (4%), egg (3%), salt (1.5%), ice (5%), and spice mix (4%). In this formulation, pork blood was incorporated replacing lean pork at the levels of 10, 15 and 20 percent. The sausage mix was stuffed into animal casings, linked and cooked at 82°C core temperature for 30 minutes in hot water. The sausages were then showered, cooled and packed in food grade polyethylene and then subjected to different physicochemical and sensory qualities evaluation.

**Determination of physicochemical properties:** The cooking loss was determined from the differences of raw and cooked weights of the sausages and expressed in terms of percentage. Emulsion stability was measured by the method of Mongale *et al.* (1985). The water holding capacity and water activity were measured by the methods of Wardlaw *et al.* (1973) and Labuza *et al.* (1970) respectively. pH and TBA values were determined by the methods of Pippen *et al.* (1965) and Witte *et al.* (1970) respectively. Proximate compositions of the sausages were analyzed as per method of AOAC (1970) (Table 1).

**Determination of sensory qualities:** The sensory evaluation was conducted by using 9-point hedonic scale (Bratzler, 1971).

**Statistical analysis:** The data obtained from the above study were analysed statistically following the standard statistical method as described by Snedecor and Cochran (1994).

**RESULTS AND DISCUSSION**

Emulsion stability was found to be significantly (p<0.01) higher in all blood incorporated samples. The increase in emulsion stability with increasing levels of blood may be attributed to higher emulsifying property of blood proteins as emulsion stability increases with increase in concentration of protein (Crewelge *et al.*, 1974). Cooking losses were also found to be significantly (p<0.01) lower in blood incorporated sausage samples due to higher water binding capacity of blood proteins which is a desirable finding with respect to weight loss and commercial point of view.

Strong emulsion formation because of blood proteins binding the water molecules tightly results in lower cooking loss. pH values of the sausage products increased significantly (p<0.01) with incorporation of higher levels of blood which might be due to alkaline nature of the blood. Similar results were also reported by Hazarika and Biro (1993) in Hungarian Lesco sausage. Thiobarbutoric acid (TBA) values of sausage products indicated that there was a significantly (P<0.01) decreasing exidation with increasing blood levels on 1st day of storage. However, there was a steady increase in TBA values with subsequent storage periods in

**TABLE 1:** Physico-chemical properties and sensory attributes of blood sausages with different levels of whole blood

<table>
<thead>
<tr>
<th>Parameters</th>
<th>Control</th>
<th>10%</th>
<th>15%</th>
<th>20%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Emulsion stability</td>
<td>1.98±0.02</td>
<td>1.52±0.02</td>
<td>0.90±0.06</td>
<td>0.50±0.03</td>
</tr>
<tr>
<td>Cooking loss (%)</td>
<td>7.03±0.31</td>
<td>5.20±0.33</td>
<td>3.20±0.23</td>
<td>1.96±0.15</td>
</tr>
<tr>
<td>WHC (%)</td>
<td>41.13±0.66</td>
<td>47.53±0.78</td>
<td>55.33±0.60</td>
<td>62.53±0.76</td>
</tr>
<tr>
<td>pH</td>
<td>5.54±0.02</td>
<td>5.60±0.31</td>
<td>5.70±0.04</td>
<td>5.74±0.02</td>
</tr>
<tr>
<td>Water activity</td>
<td>0.86±0.009</td>
<td>0.88±0.01</td>
<td>0.91±0.006</td>
<td>0.94±0.009</td>
</tr>
<tr>
<td>Moisture (%)</td>
<td>61.06±0.16</td>
<td>61.84±0.36</td>
<td>62.72±0.33</td>
<td>63.71±0.29</td>
</tr>
<tr>
<td>Protein (%)</td>
<td>11.14±0.12</td>
<td>11.68±0.18</td>
<td>13.00±0.27</td>
<td>14.70±0.21</td>
</tr>
<tr>
<td>Fat (%)</td>
<td>10.87±0.06</td>
<td>9.70±0.11</td>
<td>9.50±0.17</td>
<td>8.50±0.11</td>
</tr>
<tr>
<td>Ash (%)</td>
<td>0.92±0.03</td>
<td>0.94±0.02</td>
<td>1.00±0.03</td>
<td>1.04±0.02</td>
</tr>
<tr>
<td>TBA values 0 day</td>
<td>3.13±0.03</td>
<td>2.28±0.08</td>
<td>2.09±0.05</td>
<td>2.04±0.07</td>
</tr>
<tr>
<td>3rd day</td>
<td>a3.31±0.04</td>
<td>b2.50±0.13</td>
<td>b2.26±0.06</td>
<td>b2.08±0.06</td>
</tr>
<tr>
<td>6th day</td>
<td>c3.44±0.04</td>
<td>c2.65±0.19</td>
<td>c2.40±0.09</td>
<td>c2.23±0.05</td>
</tr>
<tr>
<td>9th day</td>
<td>d3.56±0.07</td>
<td>d2.80±0.19</td>
<td>d2.55±0.09</td>
<td>d2.35±0.07</td>
</tr>
<tr>
<td>12th day</td>
<td>e3.68±0.08</td>
<td>e2.91±0.19</td>
<td>e2.70±0.06</td>
<td>e2.48±0.08</td>
</tr>
<tr>
<td>Appearance</td>
<td>7.64±0.26</td>
<td>8.16±0.18</td>
<td>8.12±0.18</td>
<td>7.72±0.30</td>
</tr>
<tr>
<td>Tenderness</td>
<td>7.56±0.20</td>
<td>7.92±0.22</td>
<td>7.80±0.23</td>
<td>7.60±0.30</td>
</tr>
<tr>
<td>Juiciness</td>
<td>7.44±0.28</td>
<td>8.08±0.16</td>
<td>7.92±0.19</td>
<td>7.76±0.29</td>
</tr>
<tr>
<td>Flavour</td>
<td>7.48±0.30</td>
<td>7.72±0.26</td>
<td>7.64±0.19</td>
<td>7.58±0.28</td>
</tr>
<tr>
<td>Overall acceptability</td>
<td>7.46±0.21</td>
<td>8.14±0.16</td>
<td>8.04±0.16</td>
<td>7.78±0.27</td>
</tr>
</tbody>
</table>

*Means with different superscript column wise differ significantly (P<0.01).*
*Treatments having same superscript in the column (small letter) do not differ significantly (P>0.01).*
*Treatments having different superscript in the rows (capital letter) differ significantly (P<0.01).*

the all samples. Results also depicted that lipolysis was higher in control samples than the treated ones. This might be due to low fat content in blood which influences the TBA values. Study of Younathan et al. (1980) supports our study.

Both water activities and water holding capacities of the sausage products were found to be significantly (P <0.01) higher in all blood treated samples when compared to control samples. The replacement of lean meat with whole blood at increasing levels caused an increase in moisture level of sausage products. Besides, higher pH and strong emulsion formation might also have contributed towards higher water activities and water holding capacities in the sausage samples.

Proximate composition with respect to moisture, protein and ash contents of the sausage products showed significantly (P<0.01) increasing trend with increase in levels of incorporation of blood. However, there was a significantly (P<0.01) decreasing trend in percent of fat. Blood contains high amount of moisture, protein and minerals and a very low content of fat which influenced the proximate composition of the end products. The results also depicted that in production of low fat and high protein meat products, blood may be an important ingredient besides helping in enhancing slaughter house economy. Similar results were also reported by Hazarika and Biro (1993) in Hungarian sausage where different blood proteins were used in the products.

Minor differences in panelists scores were noted and no significant (p>0.01) differences were awarded for the attributes. Although highly acceptable scores were offered for all the samples, product with 10% incorporation of blood was found to be comparatively better than other products.

**CONCLUSION**

Whole blood was incorporated in pork blood sausage formulations replacing lean pork at the level of 10, 15 and 20%. Physico-chemical and sensory attributes were evaluated to find the optimum levels of incorporation. The increased level of blood incorporation was found to be associated with increase in emulsion stability, water holding capacity, pH, water activity, TBA values, moisture and protein but decrease in cooking loss and fat percentage. Minor differences in sensory scores awarded for appearance, tenderness, juiciness, flavour and overall acceptability among the sausage products were observed but product with 10 percent incorporation of blood was comparatively better than the other products.

It can be concluded that slaughter house pig blood can successfully be used for preparation of acceptable pork blood sausage. The study also depicts that blood may be an ingredient for development of fat reduced high protein value added meat products in future.

**REFERENCES**