Marketing and consumer science

CHARACTERISTICS OF LIVERWURST PREPARED WITH PORK, BEEF OR CHICKEN LIVER

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Background

Liverwurst (braunschweiger) is a specialty type of finely minced or emulsified cooked sausage that is primarily prepared with pork liver. Liver from other species has been approved and used (Pearson and Gillette, 1999) although country-to-country regulations do apply as to minimums of liver and/or meat contents, specific product labeling, and the use of meat by-products (deHoll, 1993; Ranken, 2000). Studies of flavor characteristics of braunschweiger (pork) have been conducted by Chry et al. (1980) on effects of liver pretreatment, cooking temperature and nitrite addition, by Baccus-Taylor et al. (1991) on use of turkey livers, and by Hilmes and Fischer (1997) on development of burnt off-flavor in canned product. Similarities exist in the composition of livers from pork, beef and chicken, and for composition of liverwurst prepared with pork or pork and beef (USDA, 2002).

Objective

The research objective was to compare composition, color and sensory properties of liverwurst made with pork, beef and chicken liver.

Experimental methods

Liverwurst was prepared in 3.6 kg batches using sliced (2.54 cm thick) pork and beef livers and unsliced chicken livers. For each source of liver, fresh livers had been frozen at –20°C and thawed at 2°C for 24 hr prior to use. The meat portion of the formulation was 1.82 kg of liver, 0.91 kg of pork jowls and 0.91 kg of 50% lean pork trim. The following ingredients were also added (per kg of combined liver and meat weight): 0.156 g $NaNO_2$, 0.47 g sodium erythorbate, 20.0 g NaCl, 10.0 g seasoning mix, 35.0 g non-fat dry milk powder, and 40 g ice if pork or beef liver or 20 g ice if chicken liver.

The liver portion (2°C) was chopped in a Hobart Food Cutter (Model 84191-D) until bubbles began to appear at the surface (2-3 min). Then the ground pork meats were chopped in for about 1 min followed by addition of the $NaNO_2$ and sodium erythorbate and chopping for another 1 min. NaCl and seasonings were chopped into the mixture for an additional 2 min, the ice and non-fat dry milk added and chopping continued to 11-12 min total. Final mix temperatures were 18±1°C. Batters were stuffed in 71 mm diameter MP fibrous casings (Viskase, Chicago, IL), linked in approximately 0.45 kg chubs and transferred to a single truck air-conditioned smokehouse (Vortron Model HL) for steam cooking (dampers closed). The liverwurst was initially heated at 82°C for 30 min and then held at 71°C until an internal product temperature of 66.7°C was obtained. After cooking, the chubs were cooled to approximately 20°C with a cold water spray and then placed at 4°C until analyzed.

Moisture, protein (N x 6.25) and fat contents of cooked liverwurst were determined following AOAC (1995) methods. Color values (L, a, b) were measured with a Gardner Color Difference Meter (Gardner Laboratory, Bethesda, MD). Color characteristics are reported as lightness (L) and the "a" and "b" values were converted to saturation (S), and hue (h) (ASTM, 1987). For shear measurements, a Food Technology Corporation Press equipped with a 136 kg load cell was operated at a 30 sec down-stroke at range 30. The shearing device was a multi-blade Kramer cell. Shearing force of 5 mm thick product slices was calculated as kg force/g sample.

Sensory taste preference was determined using a panel of 15 untrained members. Although untrained, the panel members were familiar with the taste of commercial liverwurst. Evaluations were conducted using quartered slices of products served at room temperature (approximately 22°C) under fluorescent lighting. Slices were served in randomized order and panelists scored their preference ratings on a nine-point hedonic scale (9=like extremely; 1=dislike extremely).

Data for each treatment (type of liver) response variable was analyzed with the general linear model procedure of SAS (1990). If a significant ($P \leq 0.05$) F-statistic was obtained, separation of response means was accomplished using the lsmeans command of SAS.

Results and discussion

Moisture, fat and protein contents were not different between pork and beef liverwursts (Table 1). Liverwurst prepared with chicken liver had a higher ($P<0.05$) moisture content and therefore lower ($P<0.05$) fat and protein contents than the beef and pork products. The composition of the pork and beef liverwursts agrees with that reported by Chry et al. (1980). They reported 55% moisture and 24% fat contents for braunschweiger made with 50% pork liver and 50% pork trim (50% fat/50% lean).

The higher moisture content of the chicken liverwurst in this study may have resulted from excess surface moisture being carried into the chopper because of the larger surface area that exists for the smaller, wet, freshly rinsed chicken livers as compared to pork or beef livers. Chyr (1980) reported that braunschweiger (pork) moisture content increased from 44.4% when formulated at 35% fat (by lean meat adjustment) to 57.5% moisture at 20% fat. Thus, moisture and fat content are generally related. There are other compositional extremes when turkey liverwurst is prepared using lower lean tissues of lower fat content. Baccus-Taylor et al. (1991) and Acton and Dick (1980) reported that turkey liverwurst made with turkey thigh meat, dark turkey lean trimmings, or mechanically deboned turkey meat and 50% liver had a moisture content of 67-70%, fat content of 3-9% and protein content of 18-24%. The chicken liverwurst of this study was not prepared to be a low fat product so the composition reported here is not comparable to that of the previous turkey liverwurst studies.

Lightness (L), saturation (S) and hue (h) for the products are given in Table 1. Slices of beef liverwurst had higher ($P<0.05$) lightness (L=57.9) as compared to that of the darker chicken liverwurst (L=52.4). Lightness of pork liverwurst (L=54.9) was intermediate to and not different from that made with beef or pork liver. Attributes of color intensity (saturation) and hue angle in the Hunter L,a,b color space were not different among the products. Chyr et al. (1980) found that the increase of fat content in braunschweiger tended to "lighten the color" and sensory panelists in their study rated 20% fat-containing product as "pink" and 35% fat-containing product as "paler pink". Our results (Table 1) indicate that interchanging the source of liver altered no major color characteristic; however, the lightness-to-darkness aspect of the resultant color showed that slices of chicken liverwurst were darker than the beef liverwurst.

Sensory panelists scored pork liverwurst significantly higher ($P<0.05$) in preference than beef liverwurst (Figure 1). Chicken liverwurst scored intermediate and not different from either the pork or beef products. Pork liverwurst scored 7.85, near "like very much" (8.0) versus the score of 6.60 of beef liverwurst which was between "like slightly" (6.0) and "like moderately" (7.0). Panelists volunteered

comments of "stronger flavor" and "real liver flavor" for beef liverwurst and "lacks flavor" for pork and chicken liverwurst samples although the latter comment was generally stated in terms of the products needing more flavor from additional spices and seasonings.

A few panelists noted that chicken liverwurst texture was "too soft", "smooth" or "mushy". Pork liverwurst was noted to have "good texture" although a few panelists had comments of "a few lumps" present or as having a "granular" consistency. When slices of products were evaluated by shearing (Table 1), the softer characteristic noted by panelists were evident in the shear values. Chicken liverwurst had less ($P<0.05$) resistance to shearing in comparison to beef and pork liverwurst samples. Shear values for the liverwursts based on source of liver in the products ranged from highest to lowest in the following order: beef > pork > chicken.

Conclusions

Exchanging pork and beef liver in preparation of liverwurst did not alter composition or color characteristics. Use of chicken liver in place of beef and pork liver resulted in higher moisture, lower fat and protein contents and a darker, yet similar color to the other products. Sensory panelists scored pork liverwurst highest, followed by the chicken and beef liverwursts. The softer texture of the higher moisture-containing chicken liverwurst noted by panelists was confirmed by shear analysis. Overall, interchange among these three liver sources for a liverwurst containing 50% liver results in minimal product differences except for texture.

Pertinent literature

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Table 1. Composition, color and shear characteristics for liverwurst prepared with pork, beef or chicken liver.

Characteristic	Pork	Beef	Chicken
Composition			
Moisture, %	55.5 [b]	54.3 [b]	59.1 [a]
Protein, %	16.7 [a]	16.5 [a]	15.4 [b]
Fat, %	20.7 [a]	21.4 [a]	19.5 [b]
Color Values			
Lightness, L	54.9 [ab]	57.9 [a]	52.4 [b]
Saturation, S	13.8	14.1	14.8
Hue, h	55.1	61.1	58.2
Shear Value			
Force, kg/g	1.38 [b]	1.63 [a]	1.04 [c]

Within a composition or color characteristic, row means with no common letter differ ($P \leq 0.05$).

Figure 1. Sensory panel evaluation for liverwurst prepared with pork, beef or chicken liver.