PHYSICAL , CHEMICAL AND SENSORIAL EVALUATION OF MEAT SAUSAGE CONTAINING AUTOLYSATE, EXTRACT AND PHOSPHORYLATED PROTEIN CONCENTRATE FROM ALCOHOL DISTILLERY YEAST (*SACCHAROMYCES SP*)

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Background

Alcohol distillery's yeast has been widely recognized as an excellent source of protein and B-vitamins. However, a large portion of this yeast is discharged as a waste or used basically in animal feeding. Yeast extract and autolysates have been proposed in the patent literature since about 1965 as suitable ingredients for simulating meat flavors, which are currently required for flavoring meat analogs (AMES & MAC LEOD, 1985). The yeast extract and autolysate are used in the food industry to bring about or enhance "meat" flavors, replacing part or completely the meat extract.

Objective

The aim of this work was the physical, chemical and sensorial evaluation of meat sausage containing yeast derivatives from alcohol distillery in comparison to meat sausage containing texturized soy protein.

Material and methods

Yeast cells suspension containing plasmolizing agents were autolised at 55ºC during 24h. The autolisate was spray dried (AUT). Part of autolysate was centrifuged to obtain the soluble fraction that was concentrated, added of maltodextrin and spray dried, the yeast extract (EXT). Yeast cells suspension were broken using a Dyno Mill KDL-PILOT, centrifuged and the soluble fraction was phosphorylated by sodium trimetaphosphate, precipitated at pH 3.2 and separated by centrifugation. The precipate after washing, was suspended in water, neutralized and freeeze dried to obtain phosphorylated protein concentrate (PYC). The texturized soy protein (TSP) used for comparison, was MAXTEN R-100 commercial product.

– Sausage processing

The sausages were formulated to replace 1.5% meat protein by AUT, EXT, PYC and TSP protein mantaining 4.7 moisture/protein ratio. Three replications of each treatment were processed. The meat (beef shoulder and shunk – about 32%, mechanically deboned chicken meat – 34.5% and pork backfat (15%) were ground separately in a Hermann grinder through a 15mm plate. During the conminution of meat in a bowl cutter (Kramer Grebe), the following nonmeat ingredients were added: about 9.7% water, 2% cassava starch, 1.8% salt, 0.23% curing salt, 0.23% antioxidant, 0.23% sodium tripolyphosphate, 0.5% seasoning and 3.2%EXT or 4.0%AUT or 2.5%PYC or 3.0%TSP. The final temperature of the batters never exceeded 15ºC. The batters (8 kg each treatment) were stuffed into 22mm cellulose casings. Sausages were heat treated in a Becker chamber following the steps: drying at 50ºC /15min; readening at 60ºC/15min and scalding until 72ºC was reached in the core and thereafter cooled down in cold running water for 15 min, kept at 10ºC for 60 min. The sausages were peeled, vacuum packed in Viskase Perflex film, and stored at 2 to 5ºC.

Proximate percentage composition – Water content, ash and crude protein (Nx6.25) were determined by AOAC (2000) procedures. Total lipids were determined by BLIGH & DYER (1959) method. **Cooking loss**. The cooking loss was determined weighing the product before and after the heat treatment and 10ºC/60 min cooling. **Emulsion stability**. It was determined according PARKS & CARPENTER (1987) method, expressed as % liberated juice. **Exudate**. The vacuum packaged sausages in Viskase Perflex 11 film, were stored at 2 to 5ºC for 30 days and the amount of exsudate determined. **Water holding capacity (WHC).** The GRAU & HAMM method modified by HOFFMANN *et al.* (1982) was followed. **Shear value.** The shear force was measured with the texturometer TAX-T2 SMS fitted with Warner Bratzler shear attachment and the peak force was recorded with Texture Expert software. **Color evaluation**. External and internal CIE L*a*b* color co-ordinates of sausage using a Minolta Spectrophotometer CM 508d with specular component excluded, 8 mm measuring area, iluminate D65 and CIE 10º standard observer, were measured. **pH**. pH values of sausage were measured by Digimed DM2 pHmeter equiped with DME-CF1 electrode.

Sensorial evaluation. Sensorial evaluation was carried out using a composite mixture from three processing replicate sausages, for each treatment. **Acceptability test**. Acceptability was evaluated by 55 consumer panel according to MEILGAARD *et al.*, (1991) and STONE & SIDEL (1985) recommendations. A 7 point verbally anchored hedonic acceptance scale was used to evaluate overall liking (from 1-disliked very much to 7-liked very much). A complete randomized block design was used. Data were subjected to one way analysis of variance and Tukey's means comparison test ($p<0.05$) using Statistica package (V.5). **Attitude test –purchase intent** a 5 point scale for likelihood to purchase a similar product was used. **Ranking test – overall preference** and **internal color preference.** A form to fill samples number where the most prefered sausage was scored with 1 point and the less prefered, with 4 points were used. The treatments were judged in Spectralight Macbeth color chamber with D65 light. A complete randomized block design was used. The results were analysed by the critical difference between the total ordenation at 95% confidence, extracted from NEWEL & Mc FARLANE (1987) table.

Results and discussion

The sausage composition are given in Table 1. There were no differences in the sausage composition among treatments. The treatments did not differ ($p>0.05$) (Table 2) in cooking loss, WHC, shear force, external L*a*b* color, internal L* and b* color. The EXT, TSP and AUT presented higher internal redness (a*) than PYC sausages. The sausages pH differences were resulted from derivatives pH differences.

The TSP and PYC sausage presented higher emulsion stability, followed by AUT and the EXT sausage, the lower stability. The presence of cell wall material in the AUT introduced higher emulsion stability in relation of EXT that did not contain this material. The results of sausage exudate did not show difference among treatments, however presented a tendency of lower percentages in TSP sausages, followed by PYC, AUT and the EXT, this last with the higher exsudate percentage. The mean values taste parameter of AUT, PYC and TSP sausages did not present difference ($p>0.05$) (Table 3). Also the means for taste acceptance of the AUT did not differ from EXT sausage, however EXT added sausage showed inferior for taste compared to TSP and PYC added sausage. The means for odor and texture in the acceptance test did not differ ($p>0.05$) among treatments. The means for odor and taste acceptance for all treatments varied from indifferent to like slightly and the texture was evaluated as like slightly. The overall preference (Table 4), did not differ among treatments, suggesting the possibility of replacement of meat by ingredients evaluated in this test conditions. However, the results showed a tendency of preference for TSP sausage and the less prefered was EXT sausage. The internal color of EXT and TSP added sausage was prefered compared with AUT and PYC added sausage. It

can be noticed that the major number of answers in purchase intent (Figure 1) were concentrated between certainly would buy and may buy or may not buy for all sausages tested, suggesting high purchase intent. In this answer group, it can be noticed major percentage of purchase intent for TSP, followed by AUT sausage. On the other hand, the major percentage of answer for certainly or probably would not buy was for the EXT sausage. This suggest that AUT can replace the soy (all or in part) as functional ingredient in meat emulsion product. On the other hand, the EXT at tested concentration (3.2% EXT or 1.5% of protein), depreciate the product. Due to the strong flavor perceived by consumers, the EXT concentration would have to be reduced to achieve satisfactory use.

Conclusion

Meat replacement (1,5% protein) promoted highest emulsion stability for TSP and PYC. The EXT presented the lowest and the AUT intermediate stability. No difference was found for acceptability among treatments.

Table 1. Proximate percentage composition of sausages containing yeast and soy derivatives.

Determination	EXT	AUT	PYC	TSP
Moisture (g/100g)	55.46±1.04^a	54.24±0.62^a	55.41±0.88^a	54.85±0.54^a
Total fat (g/100g)	24.75±1.00^a	24.28±0.44^a	24.41±0.82^a	24.03±0.57^a
Protein (g/100g)	12.37±0.08^a	12.89±0.45^a	13.24±0.31^a	13.13±0.38^a
Ash (g/100g)	2.98±0.07^a	2.93±0.09^a	2.94±0.10^a	2.93±0.08^a
Carbohydrate* (g/100g)	4.4	5.7	4.0	5.1

Means±st deviation (row) with a common superscripted letter did not differ (p>0.05)
*Calculated by difference

Table 2. Physical and mechanical properties evaluation of sausages containing yeast EXT, AUT, PYC and TSP, replacing 1.5% meat protein.

Measured parameter	EXT	AUT	PYC	TSP
Cooking loss (%)	5.0±0.7^a	5.1±0.3^a	5.4±0.4^a	5.3±1.1^a
Emulsion stability (%juice)	6.7±0.4^a	3.6±0.36^b	3.2±0.2^{bc}	2.3±0.4^c
Exuded liquid (%)	0.6±0.5^a	0.4±0.3^a	0.2±0.2^a	0.1±0.1^a
WHC (G)	0.44±0.10^a	0.49±0.05^a	0.45±0.06^a	0.47±0.06^a
Shear force (kgf)	1.68±0.19^a	1.72±0.10^a	2.04±0.17^a	1.95±0.19^a
L*-external brightness	55.42±0.19^a	54.37±0.76^a	53.87±1.11^a	55.49±0.74^a
a* - external redness	14.87±1.89^a	13.63±1.44^a	12.64±2.03^a	13.81±1.81^a
b* -external yellowness	14.52±0.82^a	14.76±0.59^a	14.65±0.94^a	14.01±0.64^a
L*-internal brightness	60.14±1.99^a	61.30±1.09^a	60.90±0.71^a	62.23±0.43^a
a* -internal redness	12.40±0.56^a	10.92±0.38^{ab}	10.73±0.68^{bc}	12.29±0.72^{ab}
b* -internal yellowness	12.07±1.07^a	12.18±0.08^a	11.43±0.25^a	11.17±0.14^a
pH	5.46±0.10^c	5.59±0.05^{bc}	5.94±0.11^a	5.84±0.15^{ab}

Means±st deviation (row) with same superscripted letter did not differ (p>0.05)

Table 3. Sausage containing yeast and soy derivatives acceptance profiles

Parameter	EXT	AUT	PYC	TSP
Odor	4.5±1.5^a	4.4±1.3^a	4.8±1.2^a	4.9±1.1^a
Taste	4.2±1.6^b	4.7±1.6^{ab}	4.9±1.6^a	4.9±1.3^a
Texture	5.1±1.2^a	5.2±1.4^a	4.9±1.5^a	5.1±1.3^a

Means±st deviation in a row with same superscripted letter did not differ significantly (p> 0.05)
(1=disliked very much; 2=disliked moderately; 3=disliked slightly; 4=indifferent; 5=liked slightly; 6=liked moderately and 7=liked very much)

Table 4. Overall and internal color acceptability results of sausages that 1.5% meat protein was replaced by yeast and soy derivatives

Sausage	Overall acceptability	Internal color acceptability
EXT	156^a	68^b
AUT	132^a	135^a
PYC	138^a	129^a
TSP	124^a	68^b

Result expressed as the total points sum gave by the judges
(1 for the most prefered to 4 to the less prefered: lower value is the most prefered)

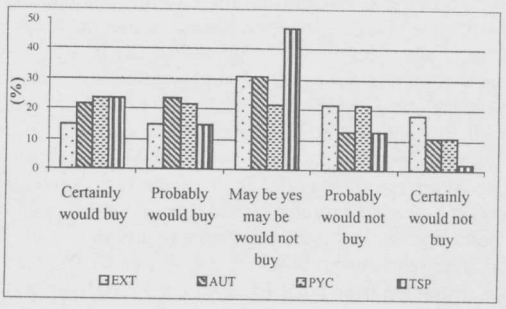

Figure 1. Consumers purchase intent

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