GOAT MEAT AND BEEF PROTEIN IN SODIUM OR POTASSIUM CHLORIDE MIXED WITH κ-CARRAGEENAN AND GELLAN. TEXTURAL IMPLICATIONS.

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Background

Hydrocolloids in meat industry are widely employed to improve texture characteristics. In other hand, the affinity of these macromolecules (v.g., carrageenans and gellan) to certain ions (potassium, to be specific) needed to gelation is well documented (Therklensen, 1993; Kang and Pettitt, 1993). In this view, the interactions and resulting gelled systems between meat proteins and hydrocolloids could be interesting looking for novel textures in meat products. Potassium can be used as sodium replace in meat products, via the affinity of hydrocolloids to this ion. Besides, the use of other animal species like goat in meat products is a good alternative in regions where cattle breeding is expensive.

Objectives

Evaluate the different textures obtained by mixing goat meat and beef muscle proteins with kappa-carrageenan and gellan in sodium or potassium chloride systems.

Methods

Goat meat and beef were obtained from local abattoirs with approximately same postmortem time. Meat protein extraction was made modified form Ngapo et al. (1996). Equal parts of meat, ice and tap water were homogenized and the resulting suspension was resuspended during 15 minutes in an ice bath and 2:3 vol of ice water were added and resuspended for 10 minutes more. The homogenized was centrifuged at 2,000 x g during 20 minutes at 4°C. The pellet was then resuspended in a brine solution (0.6 M sodium or potassium chloride, 0.5% brine phosphates, 0.1% sodium azide) and the protein content adjusted at 20 mg/ml. Gellan and κ-carrageenan (0.5% w/v) were added and mixed during 5 h at 4°C in order to allow complete dissolution of the hydrocolloid. Meat protein mixed gels were formed in test tubes heating during 23 min at 70°C. Test condition was according to the reported by Hickson et al. (1982) for penetration test, where penetration work and viscosity index were determined. Meat protein mixed suspension were placed in polyamide casing (20 mm ∅), closed in both sides and heated during 20 min at 70°C. After that, gels were carefully removed form the casing and cut in 20 mm height cylinders. Textural profile analysis was performed in a texture analyzer TAXT2 (Texture Technologies Corporation, Scarsdale, NY/ Stable Microsystems, Godalming, Surrey, UK). Gel samples were deformed 75% height with a 30 mm ∅ probe at a constant rate of 5 mm/s, a return speed of 1 mm/s and a wait period of 5 s. Results are the average curve of at least 5 reproducible repetitions.

Results and discussions

In penetration test (penetration work and viscosity index) were no effect by the kind of hydrocolloid employed ($P<0.160$ and $P<0.1497$, respectively), whereas there were a significantly effect by the salt employed ($P>0.0003$ and $P>0.0021$) and animal specie ($P>0.0001$ and $P>0.0001$). Sodium chloride samples formed stronger and elastic gels that those with potassium chloride, and κ-carrageenan presented higher values than potassium gels (Figure 1). In the same way, goat meat protein extracts had a more solid structure than beef protein gels. Textural profile analysis showed that salt exerts a significantly effect on hardness ($P>0.0381$), cohesiveness ($P>0.0001$) and resilience ($P>0.0001$) of gel samples. Sodium containing samples were more hard and cohesive than the potassium samples. Goat meat protein mixed gels were had higher values in cohesiveness, elasticity, resilience and adhesiveness than beef protein gels. Gellan containing samples were more hard, resilience and adhesive than the κ-carrageenan gels, with no significantly difference in the other textural parameters (Figure 2). κ-carrageenan addition to meat systems enhance the protein matrix strength affecting protein transition temperatures (Foegeding and Ramsey, 1986). The increase reported in water capacity retention and a harder texture seem to be due to the mechanical entrapment of water, depending on κ-carrageenan concentration because at low concentrations (i.e., 0.5% w/w), there were no thermal changes in meat proteins (De Freitas et al., 1997). Gellan, as well as carrageenan, needs potassium ions for gelation (Moritaka et al., 1995). These results indicate that in the main of textural characteristics of the samples there were no difference in the use of sodium or potassium chloride, open the possibility to reduce sodium in meat products. In other hand, goat meat had shown the same or better functional performance than beef muscle proteins. Finally, the differences in the effect of the hydrocolloids in texture can be handled according to the desire characteristics.

Conclusions

The addition of hydrocolloids allow to increase certain textural characteristics than could be extrapolated to meat products. The Replacement sodium by potassium chloride seem to produce less hard gels, but no affected the overall texture of the mixed gels. Goat meat proteins had the same of better functional performance than beef proteins, consequently goat meat can be used as a functional source of animal protein.

Pertinent literature

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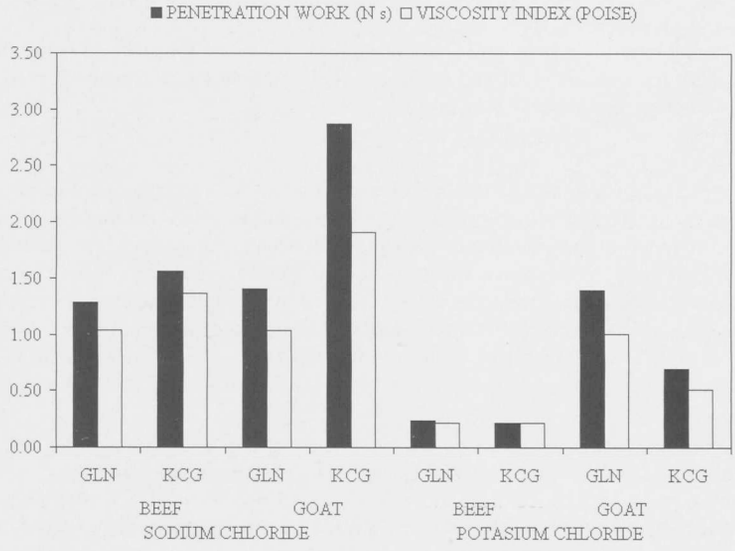

Figure 1. Penetration work and viscosity index for gel samples

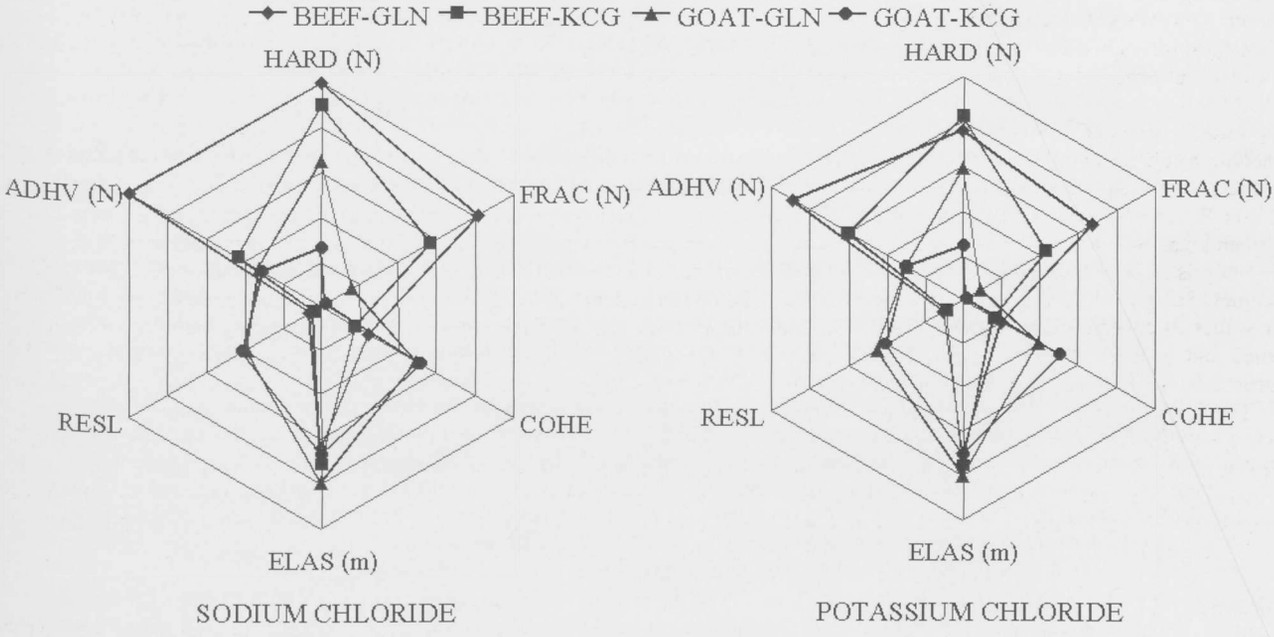

Figure 2. Radial graphs for textural profile analysis parameters in gel samples.