ELECTROPHORETIC ANALYSIS OF BETA-CASEIN A1 PROTEIN IN MILK DERIVED FROM THREE DAIRY CATTLE BREEDS AND THE INDIGENOUS CATTLE BREED IN SRI LANKA

H.K.A. Premachandra[1], H.A.M. Wickremasinghe[2], J.K. Vidanarachchi[1], D.R.A. Dissanayake[3] and K.F.S.T. Silva[1]

[1]*Department of Animal Science, Faculty of Agriculture, University of Peradeniya.*
[2]*Department of Agricultural Biology, Faculty of Agriculture, University of Peradeniya.*
[3]*Department of Pathobiology, Faculty of Veterinary Medicine and Animal Science, University of Peradeniya.*

Introduction

The composition and quantities of the constituents of milk vary from species to species and even between the breeds and among individuals. A significant variation in milk protein composition can be seen among different dairy cattle breeds. Epidemiological studies have shown that higher correlation exists between the presence of β-casein A1 protein in the food supply chains and the prevalence of Ischemic Heart Diseases (IHD) as well as Type-1 diabetes among the populations (Laugesen and Elliott, 2003). McLachlan (2001) published a 17 country ecological study demonstrating a high correlation between β-casein A1 protein/capita in the food supply circa 1980 and ischemic heart disease (IHD) mortality in 1985 and 1990. The main objective of this study was to analyse the presence of β-casein A1 in milk collected from three dairy cattle breeds and indigenous cattle found in Sri Lanka using electrophoresis.

Materials and Methods

A total of 21 dairy cattle belonging to Friesian (n=5), Ayrshire (n=1), Jersey (n=5) breeds and Indigenous (n=10) category were selected for sample collection. Isolation of β-casein was performed according to two methods; chemical procedure as described by Igarashi (1999) and enzymatic (rennet) procedure as described by Huppertz *et al.* (2006). The purity of the isolated β-casein fractions was determined using alkaline urea Polyacrylamide Gel Electrophoresis (PAGE) and the concentration was measured using spectrophotometric method. The fractionation of β-casein to its genetic variants was performed with the acid urea PAGE.

Results and Discussion

β-casein was successfully isolated and resolved only by the enzymatic procedure. The fraction was determined by alkaline urea PAGE and comparing with the results reported by Huppertz *et al.* (2006).

β-caseins from Friesians gave four bands corresponding to the positions of β-casein B, A1, A2 and A3 as reported earlier (Figure 1). β-casein from Ayrshire cows also showed same four bands. However, the β-casein A1 band of Friesians had much higher intensity than that of Ayrshire. β-casein isolated from both Indigenous and Jersey cattle

had similar banding pattern with absence of a band in the position corresponding to β-casein A1 band. In addition, there was an additional band with low molecular weight observed in Indigenous breed.

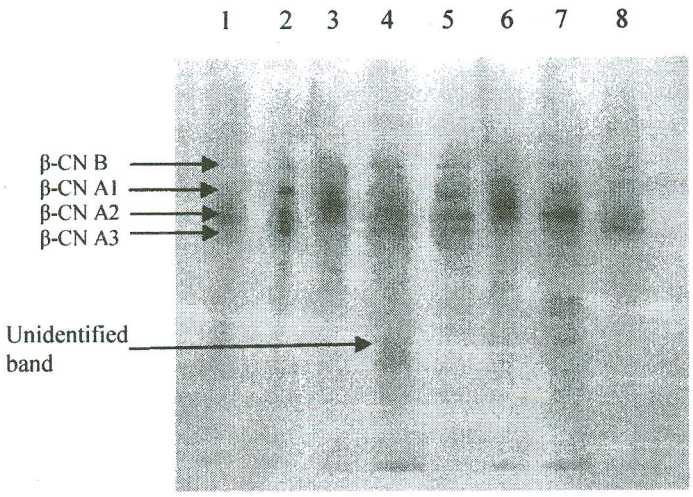

Figure 1. Acid Urea–PAGE electrophoretogram of β-casein isolated by enzymatic procedure from Indigenous (lane 1, 4 and 7), Friesian (lane 2)

Conclusions

Enzymatic method is more appropriate for isolation of β-casein from bovine milk than chemical procedure. Acid urea PAGE can be successfully used for separation of β-casein, isolated from all four breeds in to its genetic variants. β-casein A1 protein is present only in milk from Friesian and Ayrshire breeds whereas it is absent in Indigenous and Jersey breeds. There is an unidentified specific low molecular weight band present only in milk samples obtained from Indigenous dairy cattle.

References

Laugesen, M. & Elliot, R.B., 2003. Ischemic heart disease, Type 1 diabetes, and cow milk A1 β-casein. *New Zealand Medical Journal*, 116: 1168-1187.

Huppertz, T., Hennebel, J.B., Considine, T., Rehman, S.U., Kelly, A.L. and Fox, P.F. (2006). A method for large scale isolation of β-casein. *Food chemistry*, 99: 45-50.

McLachlan, C. N. S. (2001). Beta-Casein A1, ischaemic heart disease mortality, and other illnesses. *Medical Hypotheses*, 56(2), 262-272.

Igarashi,Y. (1999). Separation of caseins by chemical procedures. *International journal of dairy science*, 9, 377-378. and 5), Jersey (3 and 6) and Ayrshire (lane 8) cattle.