

protein determination (as the sum of whey protein and casein) in comparison to the direct measurement on the basis of a true protein calibration. The advantage of independent calibrations for each protein fraction is the flexibility in application and quality control over time: each calibration can be independently designed, improved, controlled, corrected and applied according to the specific needs of the analyst or the requests of the customer, or in accordance with regulatory agreements between the milk producers and the dairy industry. The present study also implies that reliable estimates of whey protein contents of milk can be calculated as the difference of the infrared results of true protein and casein with no loss of accuracy when these calibrations are under statistical control and maintained correctly.

Acknowledgements

The authors wish to thank the numerous farmers and cheese-makers for their conscientious support in the collection of the milk samples used in the study.

5. References

(1) ANDERSEN, S.K., HANSEN, P.W., ANDERSEN, H.V.: In: Handbook of vibrational spectroscopy (Ed. J.M. CHALMERS, P.R. GRIFFITHS), John Wiley & Sons, Chichester, Vol. 5, 3672 (2002)

(2) Foss Electric: Application Note No. 102. Calibration for casein in cow milk - MilkoScan FT 120. Denmark (1997)

(3) GRAPPIN, R., LEFIER, D., MAZEROLLES, G.: In: La spectroscopie infrarouge et ses applications analytiques (Ed. D. BERTRAND, E. DUFOUR), Tec & Doc. Paris, 497 (2000)

(4) HEWAVITHARANA, A.K., VAN BRAKEL, B.: Analyst **122** 701-704 (1997)

(5) IDF Internat. Standard 20-1:2001 Milk - Determination of nitrogen content. Part 1: Kjeldahl method; Internat. Standard 20-4:2001 Part 4: Determination of non-protein-nitrogen content. Brussels (2001)

(6) IDF Internat. Standard 29:1964 Determination of the casein content of milk. Brussels (1964)

(7) IDF Internat. Standard 141C:2000 Whole milk - Determination of milkfat, protein and lactose content. Guidance on the operation of mid-infrared instruments. Brussels (2000)

(8) IDF Bull. **383** 5-32, 48-51 (2003)

(9) LUGINBÜHL, W.: Food Sci. Technol. **35** 554-558 (2002)

(10) LUGINBÜHL, W., EYER, H.: Food Sci. Technol. **25** 316-320 (1992)

(11) LYNCH, J. M., BARBANO, D. M.: J. Ass. Off. Anal. Chem. **82** (6) 1389-1398 (1999)

(12) MARTENS, H., NAES, T.: Multivariate calibration, 2nd ed., John Wiley & Sons, Chichester, 298 (1996)

(13) MATYSSEK, M., FEHRMANN, A., HOFFMANN, A., RUDZIK, L.: Dtsch. Milchwirtsch. **51** 965-967 (2000)

(14) SØRENSEN, L.K., LUND, M., JUUL, B.: J. Dairy Res. **70** 445-452 (2003)

(15) JENNESS, R.: In: Fundamentals of dairy chemistry, 3rd ed. (Ed. N.P. WONG), Van Nostrand Reinhold, New York, 5 (1988)

(16) JENNESS, R.: In: Fundamentals of dairy chemistry, 3rd ed. (Ed. N.P. WONG), Van Nostrand Reinhold, New York, 5, 15 (1988)

(17) WHITNEY, R. McL.: In: Fundamentals of dairy chemistry, 3rd ed. (Ed. N.P. WONG), Van Nostrand Reinhold, New York, 81 (1988)

The effect of heat treatment, pasteurization and different storage temperatures on insulin concentrations in camel milk

U. WERNERY¹, P. NAGY¹, I. BHAI², W. SCHIELE¹ and B. JOHNSON¹

¹Central Veterinary Research Laboratory, P.O.Box 597, Dubai, United Arab Emirates

²Dubai Hospital, P.O.Box 7272, Dubai, United Arab Emirates

The effect of heat treatment, pasteurization and different storage temperatures on the insulin concentration of 19 dromedary milk samples was tested. Insulin concentrations between the milk samples obtained from individual camels varied widely, and the overall mean insulin value of fresh camel milk taken 3 times within one month was 41.9 ± 7.38 μ U/ml (mean \pm SEM). There was a significant difference in insulin concentration between the 3 milk samples collected on three different occasions within a one month period. Pasteurization, freeze drying or storage of camel milk at 4°C for 4 days as well as freezing at -20°C resulted in a statistically significant reduction in insulin concentrations; however, this was minimal. Contrary to other researchers, our study demonstrated that the mean insulin concentration in camel milk does not significantly exceed the values found in bovine milk. However, the fact that camel milk, in comparison to bovine milk, does not coagulate in acid environment most probably is the main factor for its therapeutic effect on insulin-dependent diabetes mellitus patients.

Wirkung der Wärmebehandlung, Pasteurisierung und unterschiedlicher Lagerungstemperaturen auf die Insulinkonzentrationen von Kamelmilch

Es wurde die Wirkung einer Wärmebehandlung (Kochen), der Pasteurisierung und unterschiedlicher Lagerungstemperaturen auf die Insulinkonzentration von 19 Dromedarmilch-Proben untersucht. Die Insulinkonzentrationen der einzelnen Kamele unterschieden sich sehr, und der Gesamtinsulinwert der innerhalb eines Monats dreimal genommenen frischen Kamelmilch lag bei $41,9 \pm 7,38$ μ U/ml (Durchschnitt \pm SEM). Ein signifikanter Unterschied der Insulinkonzentration bestand zwischen den 3 Milchproben, die innerhalb eines Monats zu 3 unterschiedlichen Zeiten ge-

