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PII: S0308-8146(97)00014-9

Food Chemistry, Vol. 60, No. 4, pp. 465–467, 1997

0308-8146/97 $17.00 + 0.00

RAPID COMMUNICATION

Creamatocrit as a rapid method to estimate the contents of total milk lipids

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(Received 7 October 1996; accepted 13 December 1996)

The Gerber test has been extensively used as an extremely accurate standard method for determining the content of milk lipids. However, it is risky to laboratory workers and hazardous to the environment due to the need for use of reagents. The research and development of alternative methods is of great importance especially for industrial application. In this work, the Creamatocrit method is evaluated to estimate the content of milk fatty material from mammals. Capillary tubes were filled with milk samples and centrifuged at 15 000 rpm for 5 min using an adequate micro centrifuge. The total content of lipids was determined by taking the ratio between the cream phase and the total sample length within the capillary tube. The results obtained show a satisfactory correlation (0.968) between the Creamatocrit and Gerber methods. Thus, we propose the use of the Creamatocrit method as an advantageous alternative to the Gerber method for industrial purposes. © 1997 Elsevier Science Ltd

INTRODUCTION

Determining the percentage of fatty material in the milk is one means to verify whether the milk has been adulterated, since dosage of lipid and other milk constituents provide a useful indication of milk integrity (de Oliveira, 1986).

Among the tests usually employed to determine the lipid contents of milk, the 'Gerber acid-butirometric' test is the most used, being taken as a standard test in relation to the others (Behmer, 1976).

The Gerber method is a process composed basically of two subprocesses: (i) a milk sample is prepared with sulfuric acid and isoamilic alcohol; (ii) lipid contents are determined by immediate reading of the butirometer scale (Behmer, 1976).

The accuracy and reproducibility of the Gerber test is based on its very small variability of results and on its relative constancy of procedure. The use of sulfuric acid produces an exothermic reaction that can heat the sample up to 80°C, making the process very dangerous to laboratory and industry workers. Common accidents include hand burns and injuries to the eyes when the butirometer breaks down as a result of increase in temperature and pressure. Besides that, damage to the environment can happen due to the reagents employed in this method.

Many alternative methods for milk fat determination have been developed but only a few of them have been applied routinely on a large scale. This is especially the case for the Spectro-turbidimetric method. Instrumental methods for routine turbidimetric fat determination have been available since the middle 1960s (Doreau *et al.*, 1985; Cronin *et al.*, 1990). Infrared Spectrometry has been commonly used for the quantitative analysis of multicomponent systems of milk since 1970 (Abd el-Salam *et al.*, 1986; Carl, 1991; Harris, 1986). Both are rapid, accurate and nondestructive tests, however, they still have to be calibrated using the Gerber method.

In 1964, Fleet and Linzell proposed a rapid method of estimating fat in very small quantities of goat milk by simply spinning untreated milk in an haematocrit centrifuge at 10 000 rpm for 15 min. Five years later, Ganguli *et al.* used the same indirect micromethod for the determination of cows' as well as rats' milk. The results showed a good correlation ($R^2 = 0.99$) between micro centrifugation values and the standard chemical methods of Babcock and modified Roese-Gottlieb (Mojonnier) methods for the determination of milk fat.

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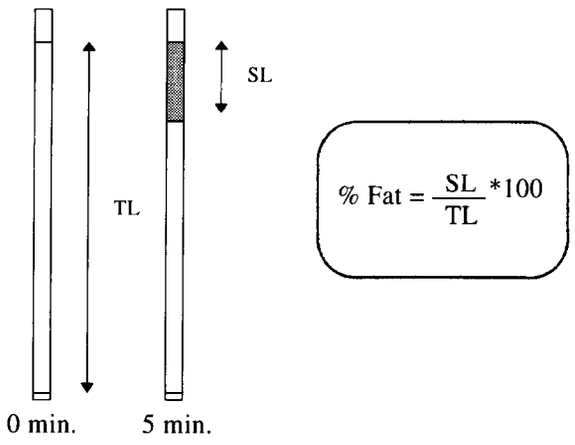

Fig. 1. Diagram of capillary tube with the marks showing the length of sample (TL) and fatty phase (SL).

Other applications of this micro method have been reported, for example to evaluate fecal fat content in newborn infants for the diagnosis of many intestinal diseases (Iacono *et al.*, 1990*a,b*, 1992; Phuapradit *et al.*, 1981; Tran *et al.*, 1994), and to estimate fat concentration of human milk (Lucas *et al.*, 1978).

In this work, the 'Creamatocrit' micro centrifugation method is assessed for estimating the fat content of milk. We show that this method can be used as an alternative to the Gerber test with advantages of safety and costs in industrial application.

MATERIAL AND METHODS

Tests were made with the Creamatocrit and Gerber methods (Behmer, 1976) in order to evaluate the correlation existing between them, using 51 samples of 'in natura' or pasteurized milk from different sources (goat, ewe, mare, buffalo, and cow).

Additional tests with 10 samples of 'in natura' or pasteurized cow milk were made to determine the accuracy of the proposed method in the quantification of milk fat content.

The proposed method consists of filling capillary tubes with milk samples, closing them using a Bunsen flame. After centrifugation at 15000 rpm for 5 min (FANEM centrifuge — Excelsa Baby mod 208N), the fatty phase (SL) is measured with a graded magnifying glass and the length of total sample (TL) with a pachymeter. The fat content is calculated as the ratio between TL and SL (Fig. 1).

The tests with the Gerber method were made in duplicate and as with the Creamatocrit, the lipids percentage was obtained by the arithmetic average over 12 repetitions.

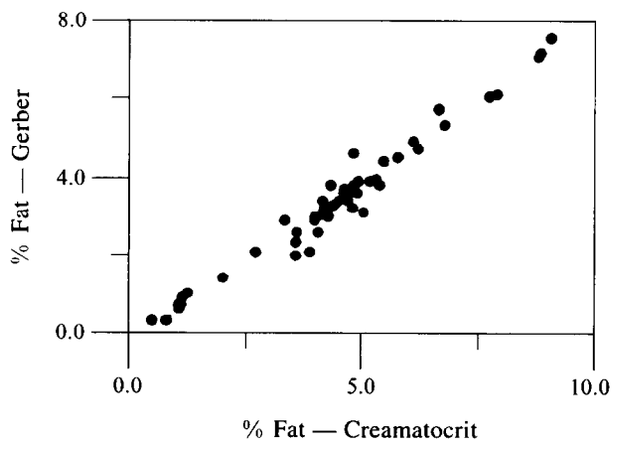

Fig. 2. Graph showing the statistical correlation between the Gerber and the Creamatocrit methods.

RESULTS AND DISCUSSION

Figure 2 shows the results obtained from the analysis of 51 samples of 'in natura' or pasteurized milk from different sources, using the Gerber and Creamatocrit methods.

An excellent statistically significant correlation was found between the two methods ($R^2 = 0.968$).

In the prediction study of milk fat content by the proposed method, the data obtained by the analysis of 10 samples of 'in natura' or pasteurized cow milk were corrected by the following equation of the obtained model:

$$y = 0.823 * x - 0.298$$

The predicted values of the Creamatocrit presented an error of about 0.77% and 4.86% in relation to the standard Gerber method (Table 1). Therefore, the milk lipids content will be estimated by the proposed method in a standard of 95% confidence limits.

In conclusion, we have shown that the Creamatocrit method is an adequate alternative to the Gerber test for estimating the lipid contents of the 'in natura' or

Table 1. Comparison data between the analysed methods

% FAT			Error
S[a]	G[b]	ES[c]	(%)
4.90	3.60	3.73	3.61
4.88	3.60	3.72	3.33
4.82	3.50	3.67	4.75
3.80	2.80	2.83	1.07
5.14	3.90	3.93	0.77
4.54	3.60	3.44	4.44
4.60	3.45	3.49	1.16
4.16	3.05	3.12	2.30
4.52	3.30	3.42	3.64
4.83	3.50	3.67	4.86
4.01	2.90	3.00	3.45

[a]Creamatocrit value.
[b]Gerber value.
[c]Corrected value by the pattern equation.

pasteurized milk. The Creamatocrit technique provides an efficient, simple, rapid and inexpensive micro method for milk fat determination. With very little practice, samples can be analysed at the rate of 50 or more per h. The equipment required is readily portable and tests can be made wherever electric power is available. In this procedure, reagents are not used, therefore handling accidents may not occur so frequently. It constitutes, therefore, an excellent alternative for industrial application, reducing operational costs, analysis time and the risks of work accidents.

ACKNOWLEDGEMENTS

This work has been partially funded by a grant from the FAPEMIG - Fundação de Apoio à Pesquisa de Minas Gerais (No. 1706/95). The authors would like to thank Professor Dr Edgard F. Collares (Faculdade de Medicina — UNICAMP) for his suggestions, Prof. Antônio V. Mundin (Universidade Federal de Uberlândia) and Professor Maria Aparecida M. Rodrigues (Universidade Federal de Uberlândia) for providing some of the laboratory facilities used in this work.

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