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NEW METHOD FOR DETERMINATION OF PROTEIN CONTENT OF GOAT'S MILK AND COMPARED WITH DIFFERENT METHODS

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ABSTRACT

A total of 45 samples of goats milk were collected during the milk production season to estimate %protein by Kjeldahl method and also as much as formol number. All samples were analyzed and correlation coefficient between the results was calculated to get a constant factor from which we can estimate protein content by formol titration method directly.

The calculated factor was 2.505 and the suggested concluded equation for protein determination was as follows: Protein content (%) = 2.505 x formol No – 0.114. However, the differences when applying such equation and Kjeldahl method were statistically insignificant. Protein content (%) by Kjeldahl method (A) differed significantly from that given by Milkoscan method (B) as shown in the following equation: A = 1.2008 x B – 0.4428

Keywords: Goat's milk, protein content, different methods.

INTRODUCTION

Milk proteins, from many points of view, have more complicated personalities which greatly affected by many factors. Species of animal may be the main factor in this respect (Woodward, 1976 ; Jenness, 1980 ; Prakash & Jenness, 1986 ; Abdel-Salam and El-Shibiny, 2011). Concerning goat's milk, although its share in the world milk production is modest, it nevertheless plays an important role in certain parts of the world, notably in the Mediterranean countries and in the Middle East. In Egypt, goat's milk ranks the third after buffalo's and cow's milk.

Due to such importance of goat's milk, the International Dairy Federation (IDF) as early as 1986 published a comprehensive review concerning production, composition and utilization of goat's milk. Protein of goat's milk was the objective of many studies in the pre-mentioned review. More recently, it was reported that goat's milk contains less α_{s1}-casein and more β-casein than cows milk and richer in some amino acids like aspartic acid histidine, threonine, methionine and phenylalanine and also in some fatty acids (Sarkar and Misra, 2006). Also, the mineral content of goat's milk is considerably higher than cow's milk (Posecion, 2001).

Such variations may affect suitability of method of protein determination since it is known that there are many methods to estimate milk protein, including Kjeldahl, formol titration and Milkoscan methods. Formol titration method has been widely applied to determination of milk proteins owing to it is rapid with reasonable accuracy (Ling, 1963).

The aim of this study was to compare between the Kjeldahl method formol titration and Milkoscan method's for the determination of protein in goat's milk.

MATERIALS AND METHODS

Goat's milk samples were obtained from the herd of Sakha Animal Production Research Station, belonging to Animal Production Research Institute.

Nine milk samples were collected from goats monthly for five months (45 samples) and each sample was divided into three equal portions for the following:

1- Analysis of total nitrogen (TN) by semi-micro Kjeldahl method
Total protein = TN× 6.38.

2- The modified Pyne's method (1932) was used for formol titration as described by Ling (1963).

3- Milk protein was determined also using Milkoscan (133B N. Foss Electric, Denmark.

Analysis of variance, the ranges of variation, standard division and standard error were carried out using a SPSS computer program (SPSS, 1999).

RESULTS AND DISCUSSION

The Kjeldahl method of nitrogen determination is one of the most widely used analytical procedures. It was introduced on March 7, 1883 by the Danish scientist Johan G. W. T. Kjeldahl, but as Kjeldahl wrote, "this was a relatively slow procedure since a single analysis requires several hours of work and during this period demands the continuous attention of the analysis" (Kjeldahl, 1983). Many improvements were introduced to the method after its first publication to give it obvious advantages. Kebler (1946) reported that in the history of analytical chemistry, no method has been so universally adopted, in so short a time, as the Kjeldahl method for the estimation of nitrogen. However, all details about original Kjeldahl apparatus, the chemical used and the improvements done in this respect were reviewed by Ottesen (1983).

In the present study, all goat's milk samples were analysed for nitrogen determination by Kjeldahl method and the conversion factor of 6.38 was used for calculation of protein as follows:

Protein content (%) = Total nitrogen (%) x 6.38

Formol titration for the same samples were also done and the attained results were plotted against protein contents as given in Fig. (1).

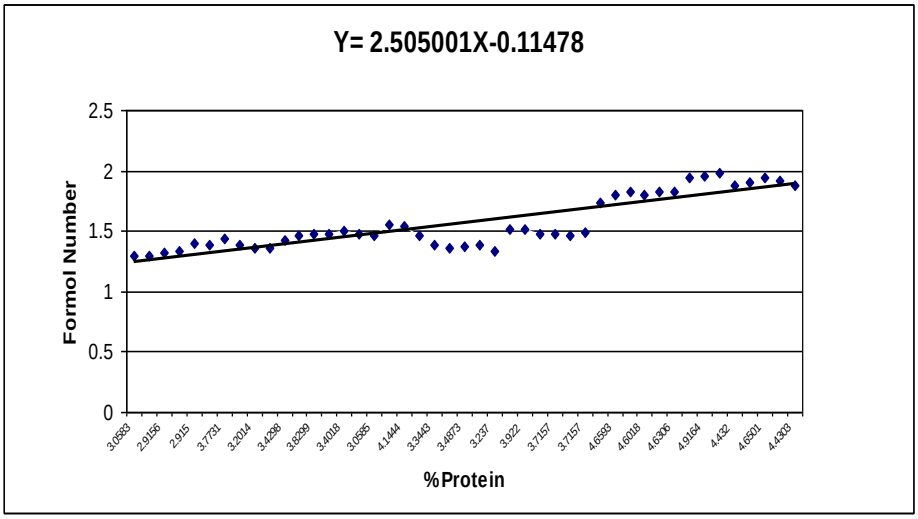

Fig. (1):The relation between formol number and total protein measured by Kjeldahl method.

Formula factor of goat's milk protein using formol number and Kjeldahl methods was as follow:

	Factor		
% Protein =	2.50500	X	- 0.11748

X = ml 0.1 N NaOH / 100 ml milk titer required to neutralize the acidity brought about by the addition of formalin.

As regard to the above equation, we can ignore the figure (-0.11478), because it is minute without significance when the results are approximated to the decimal number (Fig. 1). Thus, the percentage of goat's milk protein can be calculated by multiplying the factor 2.51 by the number of ml of 0.1 N NaOH per 100 of milk. The comparison between the results obtained by Kjeldahl method and formol titration method using the factor calculated in the present work showed that the differences in this respect were insignificant.

Data in the Tables (1&2) revealed the statistical analysis between estimated protein by Kjeldahl method and formol titration using 45 samples of goat's milk. After analyzing the results on the ANOVA (statistical analysis method), it was found that the differences were insignificant between protein contents measured by the two pre-mentioned methods.

Table (1): Protein (%) using Kjeldahl method and the estimated protein using the formol titration method.

Method	Samples No.	Mean	Std Error
Kjeldahl	45	3.816	0.094
Formol titration	45	3.931	0.082

Table (2): ANOVA of analysis of protein using Kjeldahl method and formol titration method.

Items	Sum of Squares	Standard deviation	Mean Square	F-value	Sig.
Between Groups	0.299	1	0.299	0.856	0.357
Within Groups	30.793	88	0.350		
Total	31.093	89			

The infrared method has emerged as the technique most suited for the wide scale analysis of milk and has a tremendous impact on the dairy technology.

In the present study, Milkoscan 133 BN (Foss electric) was evaluated for measuring protein content of individual goat's milk samples and the attained data were compared with those measured by Kjeldahl method. Fig. (2) reveals the relation between the data obtained using the two pre-mentioned methods.

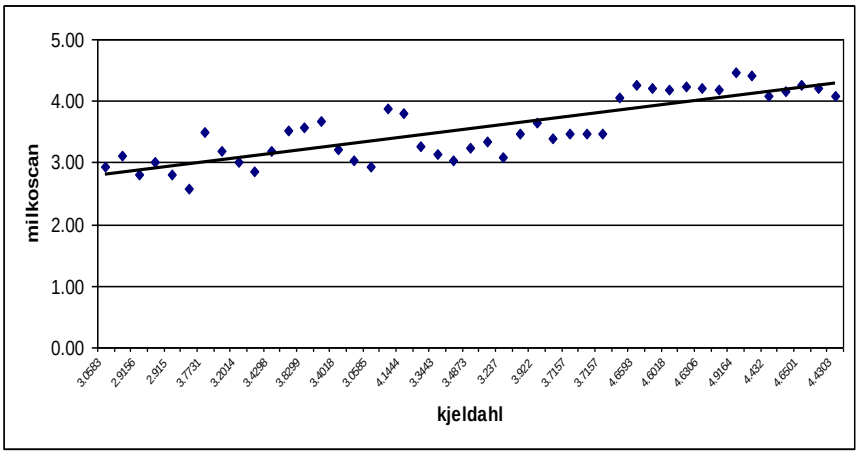

Fig. (2). The relation between total protein using Kjeldahl and Milkoscan methods.

Data in Tables (3&4) revealed the statistical analysis between results by Kjeldahl method compared with Milkoscan method for determination the protein in goat's milk. After, analyzing the results using the ANOVA

(statistical analysis method) it was found that there was significant difference between Kjeldahl and Milkoscan methods in this respect.

Table (3). Protein (%) using Kjeldahl and Milkoscan methods.

Method	Samples No.	Mean	Std. Error
Kjeldahl	45	3.816	0.094
Milkoscan	45	3.546	0.078

Table (4): ANOVA of analysis for protein using Kjeldahl and Milkoscan methods.

Item	Sum of Squares	Standard deviation	Mean Square	F-value	Sig.
Between Groups	1.633	1	1.633	4.857	0.030
Within Groups	29.587	88	0.336		
Total	31.220	89			

Depending on the results shown in Table (4) we found that such significant differences between Kjeldahl and Milkoscan methods concluded that using Milkoscan method gave not accurate results. On the other hand, the results obtained from Kjeldahl method were more accurate. So, we found that the correlation coefficient between Kjeldahl and Milkoscan methods could be obtained via equation as follows:

Formula factor of goat's milk protein using Kjeldahl and Milkoscan methods:

	Factor		
Kjeldahl =	1.2008	X	- 0.4428

X = (%) Protein determined using Milkoscan method.

In the literature, it was reported that the Milkoscan 203 and 300 were tested, recommended and approved by the AOAC for milk analysis (Biggs, 1978). Van De Voort (1980) mentioned that Milkoscan 104 to be caple of matching the AOAC specifications set for fat, protein and lactose analysis.

Recently, Abdel-Salam et al. (1986) evaluated Milkoscan 104 A/B for analysis of fat, protein, lactose and total solids in milk from individual cow's buffalo's, goat's and sheep and compared the attained results with those from reference methods. Their results indicated presence of some differences in the reproducibility and accuracy tests for the different milk constituents in the milk from different animals but in general they concluded that Milkoscan was capable for analysis of milk other than cow's with comparable accuracy.

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طريقة جديدة لتقدير بروتين لبن الماعز ومقارنتها بعدة طرق.

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استخدم ٤٥ عينة فردية من لبن الماعز لتقدير البروتين الكلي بطريقة كلداهل وكذلك برقم الفورمول وكذا تم تقديره بجهاز Milkoscan . واوضحت النتائج إلي وجود علاقة بين رقم الفورمول والنسبة المئوية للبروتين المقدر بطريقة كلداهل . وقد أمكن تمثيل العلاقة حسابيا واستنتاج المعادلة الآتية :

% للبروتين بطريقة الفورمول = ٢,٥٠٥ س - ,١١٧٤

حيث أن س = عدد الملليترات من الصودا الكاوية س/١٠ بالضبط اللازمة لمعادلة الحموضة الناشئة بعد اضافة الفورمالين .

بمقارنة النتائج المتحصل عليها حسابيا لكل من البروتين المقدر بطريقة الفورمول ، وتلك المقدرة كميا بطريقة كلداهل وكانت الفروق غير معنوية احصائيا بين الطريقتين . كذلك تم تقدير البروتين الكلي باستخدام Milkoscan ومقارنتها بطرقة كلداهل وكانت الفروق معنوية احصائيا بين الطريقتين وتشير النتائج ايضا الي وجود علاقة بين البروتين الكلي المقدر بطريقة Milkoscan والبروتين الكلي المقدر بطريقة كلداهل . وقد أمكن تمثيل العلاقة حسابيا بالمعادلة الآتية :

% للبروتين المقدر بطريقة كلداهل = ١,٢٠٠٨ س - ,٤٤٢٨ حيث ان س = النسبة المئوية للبروتين المقدرة بجهاز Milkoscan

قام بتحكيم البحث

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