Basic configuration of determination of Fat, Protein, Lactose and TS, SNF in infant formula milk powder by using MilkoScan FT120

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Abstract— Considering the importance of infant feeding which mainly depends of milk that is first place in the food chain and purposes of ensuring the health and safety by getting the best with a standard specification product nutritionally sufficient to contribute to normal growth and development of the protein content, fat , Total solid , Solid Nonfat and lactose of the five types in infant formula milk powder (over 6 months) circulating in the local markets and pharmacies , which are used as substitutes for breast milk during the first day of opening the box to the expiration date .The average composition of Milk types were : 29.27% fat, 21.90% protein, 45.66% Lactose 2.39 Total solid and 0.78% Solid Nonfat. There was a medium positive correlation between the ratio of fat to protein in milk (r = 0.91-1.61)(0.77- 0.92) between Total Solid and Solid nonfat and medium negative correlation between the ratio of fat and protein to Lactose (r=0.92)in milk . It was identified using standard analytical methods; a MilkoScan ™ FT 120 accelerated solvent extractor (ASE) .The concentration of Parameters Protein, Fat, Lactose, Total Solids (TS), Solid nonfat (SNF). Different analytical used for statistical measurements including coefficient evaluation Report, Mean prediction error (Pe) , correlation coefficient and infraclass correlation Factor. Repeatability and reliability, Results obtained with calibrated MilkoScan ™ FT 120 compared with those obtained using Standard methods due Is a fast and cost-effective and are used widely in Dairy laboratories all over the world, which should make it universally accessible environment for scientists to study in Imported milk (non-local). This result indicated that all milk powder companies understudied are following the legal and quality standard of Specifications standard World and Iraqi of composition powder milk.

Keywords___ Milk, Food safety, Nutrient, MilkoScan FT120.

1 INTRODUCTION

Milk contains all the essential nutrients for all physiological function of the body system, It has contains most biological molecules necessary to sustain life, the average composition of milk is fat 3.70%, water 87.20%, Protein 3.50%, dry matter 12.80%, Lactose 4.90% and Ash 0.70%). Milk is also the good source of phosphorus, calcium, fat-soluble and vitamins. [1], for this reason, it is the nature's most nearly perfect food according [2]. Although most mammals stop drinking milk at maturity, and many (not all) human cultures continue to drink milk and eat dairy products (for example, cheese, butter, and cream) throughout the whole of their lives.

Milk is important for the growth of bones and teeth as well as Many metabolic processes, including cell division, ATP synthesis .

The milk must be integrated food during the first few weeks or months of life for all infants. Infant formulas prepared from products for use only as food for babies because of their own simulation of human milk or suitability full or partial human milk as an alternative [3].

A few published works evaluated the milk as MilkoScan™ FT120 analyzer. It allows you to control and standardize while simultaneously screening for abnormalities. It is ideal for rapid control at the platform for optimal segregation, fair payment and screening for abnormalities and Milk standardization for optimal use of raw material and consistent quality products also monitoring the quality of final products, It can provide a complete analysis of product composition with up to 24 parameters in just 30 seconds [4]. Their characteristic MilkoScan FT 120 is suitable for both process control and sophisticated analysis in the laboratory. Basic configuration offers a report of fat, protein, lactose, total solid material and solids non-fat in milk, cream and dairy products simple. Free open source software provides transferable ready to use calibration for a wide range of dairy products such as milk and whey center, children's milk, ice cream, juice, quark, cheese and

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yoghurt. In addition, special modules allow development of user-defined calibration.

Fats in Milk are commonly called butterfat. It is suspended as globules in milk, but because the density of butterfat is less than that of water, it will rise and separate Homogenization is a process, which reduces the average size of the fat globules so they will remain homogeneously mixed throughout the milk without separating out for long periods of time. Lactase is produced by all mammalian infants. Adults of mammalian species, except for some humans, cease the ability to produced lactase and consequently are lactose intolerant. The common symptoms of lactose intolerance in adults are gas, cramping, bloating, or diarrhea after consuming dairy products. This is a different condition than a milk allergy, in which the proteins in milk trigger an allergic response. Lactose remains soluble in the whey even after acidification and heating. Includes milk produced a number of phases storage, collection, transportation, Receiver, storage and processing. The use of spectral analysis for facilitating the production of high-quality milk it has been investigated in applications ranging between metabolic monitoring and quality of nutrients, therefore Milk is an excellent source of the most important Minerals for the growth of infants [4. 5]. So it is necessary to be obtained from Healthy sources as well as collected and stored in Terms favorable health free from environmental pollution is that all be Packaging containers made of stainless steel, aluminum [6]. These are the factors involved in many of the enzymes it has an important role in many physiological aspects function and the absence of these metals cause disturbances and disease conditions [7]. The amount of metals in contaminated milk minute and change dramatically during Manufacturing and packaging contamination may occur in several stages over For example from the factory, Equipment for catering glassware and metal containers [8]. The presence of heavy metals, even in low concentrations lead to metabolic Disorders with serious consequences for the very causing serious problems of health Problems [8.9, 10] .Risks Minerals to infants from contaminated foods depends on consumption the relative levels of the metal [11]. Many studies corresponded with this study using different techniques such as; flame atomic absorption spectrometry [12, 13], inductively coupled argon plasma emission spectroscopy [14], capillary zone electrophoresis [15], inductively coupled plasma optical emission spectrometry [16] different pulse anodic stripping voltammetry technique [17] ,flow injection spectrometric methods [18], atomic absorption spectrometer [19], atomic fluorescence spectrometry [20], Rapid and accurate analysis of the protein content of milk because of its important role in determining the nutritional value. Purpose: In this research will be isolate Protein, Fat, Lactose, Total Solids (TS), Solid nonfat (SNF) than five prevalent types of milk substitutes for breast milk. It will be used to select in milk, compared with the standard value recorded date opened the box to expiration.

2 MATERALS AND METHODS

It was isolated and identify some of the fat, protein, lactose Soild nonfat and Total soild of milk in five selected types of local markets in the city of Baghdad - Iraq (city coordinates: 33 ° 20'00 "N 44 ° 26'00" E) and the disclosure of The main components by technology MilkoScan FT120 .

2.1 EXPERIMENTAL PROCEDURES

CALIBRATION OF MILKOSCANTM FT 120

Five infant formula milk powder samples been examined to determine the percentage of fat and protein Total solid, Solid Nonfat and lactose, 8-10 ml for calibrating the MilkoScanTM FT 120 (Foss a/S, Hillerod, Sweeden) were produced by pooling five samples (n= 5, and five replicate each one) First opened the box 8th on December and (n = 5) the last day before the expiration date 28th on December ,we get in the first 25 examination in the second examination mathematical average of the three replicates for each types were determined concentrations with standard methods: for fat and total solids the Roese-Gottlieb method [21] for Protein, the Kjeldahl method [22; for Soild nonfat and Lactose method [23,24).Were run the MilkoScanTM FT 120 to obtain an average infrared spectrum for each milk sample. The values of absorbance at each wavelength and the concentrations of fat, lactose, protein and total solids obtained by the standard methods were then used to develop the calibration equations based on partial least-squares regression procedures [24]. A coefficient of determination R2 = 0.91 was the minimum criterion for calibration of the prediction equations (mean ±SD) concentration in the 10 milk samples was 0.01 ± 0.02% and the total Protien concentration was 1.34 ± 0.29%. To test whether there was a significant improvement in the regression equation or agreement between the methods, the data for protein were corrected and no significant improvement was observed. Milk fat was extracted in

an accelerated solvent extractor (aSe-200, Dionex Corporation, United States) using a mixture of solvents in the ratio of 3:2:1 petroleum-ether/acetone/isopropanol as described by [2]. Calibration range, Up to 50% Fat, Up to 7% Protein Up to 7% Lactose, Up to 55% Total Solids.

2.2 Standards and approvals

Samples at low cost per sample analyzed. The criteria used are calibration and software for a wide range of parameters and products ready for use in a system with flowing strong candidate in line and 50 microns built in the cuvette sample without the need to heat the samples homogeneous, Optional automatic analysis of milk samples, Powerful and easy to use Windows with local language support, Easy to integrate data in a networked environment, Reduced need for special operator skills, Automatic unit clean and put zero safe and efficient operation, Analysis of high-resolution, Is considerable disagreement about the results, Built-in quality assurance with a record of experimental samples program and documentation of analytical results. Validation of the calibration of equation from the MilkoScanTM FT 120 milk samples collected and not including those used for calibration, were used for the validation of the MilkoScanTM FT 120. MilkoScan™ FT1 is CE labelled and complies with the following directives. ElectroMagnetic Compatibility (EMC) Directive 2004/108/EC. Low Voltage Directive (LVD) 2006/95/EC. Packaging and packaging waste Directive 94/62/EC. WEEE Directive 2002/96/EC. REACH Directive 1907/2006/EC Specifications . MilkoScan FT1 is in compliance with AOAC [21,22,23, 24.25].

2.3 Statistical method

The statistical analysis was performed according to the AOAC Protocol [25] .Agreement between analytical methods for fat, protein lactose , Soild Nonfat and total solids was assessed using different measures of statistical sigma ploit and coefficient of determination, interclass correlation coefficient and concordance correlation coefficient, mean prediction error the concentration of fat, protein in samples using a new method (MilkoScanTM FT 120) was the concentration of the same milk component standard method. The coefficient of determination, r2, was calculated where N is the total number of paired observations. A value of r2 = 1 indicates 100% precision between the methods.[26,27] was calculated to determine overall. The mean prediction error (Pe) was computed to describe the predictive performance of the methods and to compare prediction methods to the standard method and to one another [28,29]. The Pe was calculated according to[29,30] as correlation coefficient was used to assess of accuracy of MilkoScanTM FT 120 by data plotting method by used to analyse the agreement between the standard methods and MilkoScanTM FT 120. The 98% limits of agreement were calculated as the mean.

3 Results

The results of the analysis with the MilkoScan FT 120 showed that the fat concentration in Milk was a significant correlation ($r = 0.28$, $P < 0.05$) indicating almost perfect agreement with total value whereas r2 (0.0.91, $P < 0.05$) (Table 1, Fig. 1). The results of the study of Principal Components Analysis Normality Test (Henze-Zinkler) descriptive Statistics (Mean±SD) [(21.770±1.005),(19.194±1.609),(60.922±3.033),(103.316±3.109), (89.880±4.814)] in Fats, Protein, Lactose,Total solid, Solid Nonfat Respectively. The Pe value indicated poor predictability of the MilkoScanTM FT 120 value (0.0.95, $P < 0.05$). A strong and significant correlation was found between the results of the standard MilkoScan TM FT 120 the mean percentage difference in the milk fat concentration results was low at 30% to 25% for fat determination between duplicates in all types. This method had the best and close to the perfect agreement and excellent accuracy as indicated by value ($P < 0.05$) according to the [22.23, 24.25 ,31,32,33] for determination of the milk fat concentration. This study was accordance to previous studies [30.34.35]. Also there was a significant correlation ($r = 0.37$, $P < 0.05$) . The best perfect agreement estimates for prediction (Pe) and accuracy standard Error 0.75 were within the predetermined limits of acceptability (Table 2). There was a strong and significant correlation between duplicated samples for protein concentration by MilkoScan TM FT 120 (0.17%). The results to determine milk protein concentration was good according to the Variance R2 (1.61). That's with [27.33] analysis resulted in a satisfactory mean percentage difference between the milk protein concentrations in duplicated all samples and 17% of the data pairs fell within the 95% limits of agreements Fig 2. This study was accordance to previous studies [30,35].

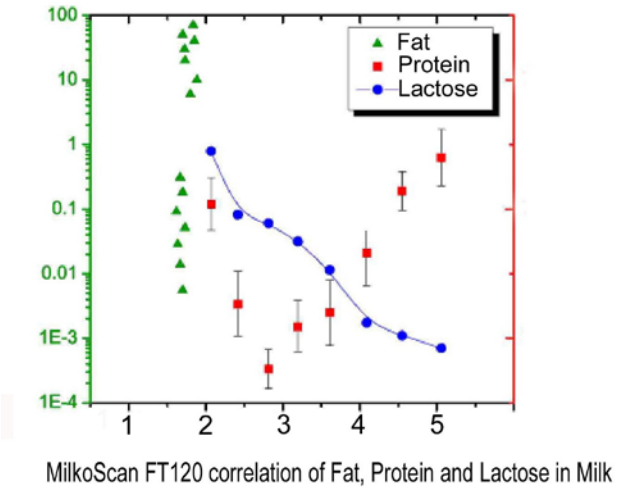

Fig 1: Shows the results of the analysis with the MilkoScan FT 120 correlation of Fats , Protien and Lactose in the Milk study.

About Lactose of milk powder obtained from infant formula milk powder statistically it was found that they were non-significant within the lactose of different types of milk powder collected from local market (Table 1). It was observed that the average value of lactose obtained from Starship (61.88±1.26) was non-significantly higher than the lactose of milk powder of other five samples (Table 1). According to the [32,36] lactose content of milk 38.2 g/100g. From present study it was observed that lactose milk contains 1.92 % lactose. This study was accordance to previous studies [30,35].

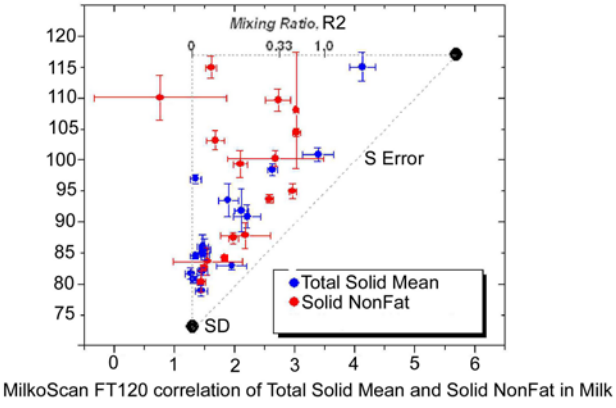

Fig 2: Shows the results of the analysis with the MilkoScan FT 120 correlation of Total solid and Solid nonfat in the Milk study.

From the results obtained to Total solids (TS) in infant formula milk powder (Table 1). Statistically it was found that there were non-significant differences within the TS of different types of milk powder collected from local market. It was observed that the average value of TS (103.96±1.32) was non significantly lower than the TS of other five samples This study was accordance to previous studies [33,37,38,39] found that the average TS content of fresh milk powder was 97.26 g/100g. [34] Kumar and Murthy (1992) found that the average TS of Buffalo whole milk powder from three batches were 96.27, 97.38, 96.97 g/100g. According to [35] BSTI, average TS content of whole milk powder is 96%. According to the [36, 37] the TS of whole milk powder is within the range of 95-98%. The present study agreed with the values of [38]. The Solids-not-fat in infant formula milk powder obtained statistically it was found that there were significant differences (P<O.O5) within the SNF of different types of milk powder collected from local market (Table 1). It was observed that the average value of SNF (86.86±1.24) was significantly (P<O.O5) the present study it was observed that SNF content of all milk samples were nearest to the normal value (65%) This study was accordance to previous studies recommended by [35]. [39, 40, 41] average SNF content of milk powder is 69%. [33] found the average SNF of whole fresh milk powder 72.86%. The average composition of Milk types was: 29.27% fat, 21.90% protein, 45.66% Lactose 2.39 Total solid and 0.78% Solid NonFat. There was a medium positive correlation between the ratio of fat to protein in milk (r = 0.91-1.61)(0.77- 0.92) between Total Solid and Solid nonfat and medium negative correlation between the ratio of fat and protein to Lactose (r=0.92)in milk . Our results reference values as determined by traditional chemical analysis and as predicted .The in-model components correspond to all eigenvalues greater than or equal to the average eigenvalue. When analyzing the correlation matrix, the average eigenvalue is always 1.0. This criterion can be changed in the Test Options dialog on the Criterion panel. The variance of each principal component equals its corresponding eigenvalue. Table (2). The correlation matrix is rank-deficient with numerical rank estimated. The in-model components correspond to all eigenvalues greater than or equal to the average eigenvalue. When analyzing the correlation matrix, the average eigenvalue is always 1.0. This criterion can be changed in the Test Options dialog on the Criterion panel. The variance of each principal component equals its corresponding eigenvalue Fig (3) and Table (2) shows the relationship for all the nutrients under study.

4 Discussion

On comparing values reported in Table 1, a significant improvement in prediction capability for models based on normalized spectra can be observed, Proteins belong to class II nutrients [25]. For this studies the mean prediction error on the samples assayed takes a value of 6%. So the ratio between the nutrient values obtained by the proposed procedure and the label values declared by manufacturer evidences that the established methodology complies with the corresponding statutory values. MilkoScan FT1 Is considered to ensure that Nutritional value to suppliers are neither too high nor too low of milk protect against adulteration. Due to the fact that milk contains distortions that cause health problems and most of them are cheats deliberately by suppliers, especially those from Western countries, for example, with lard or melamine or even what is being mixed with cleaning materials so it was going to educate the use MilkoScan FT1 agree with [20,21,24,33,38,42] can examine the samples contained milk directly to identify the suspect and quickly and naturally as part of everyday life for the purpose of identifying contaminants and a lack of nutrients in nutritional value , This result indicated that all milk powder companies under studied are following the legal standard of composition of powder milk.

5 Recommendation

In order to get information on the properties of quantity and quality of raw materials for milk powder can be achieved by taking advantage of this information that has been obtained from the search by identifying potential in a wide range of applications in the examination of essential nutrients has included the monitoring process, and determine the quality of milk, Origin, related to the study conducted in the laboratory and pilot-scale with the consumption and import, which is growing in size due to the lack of local and national product and because of the greed of merchants and critical situations of great economic losses Therefore, we recommend the use of such techniques that allow rapid analysis of a large volume of samples.

In the production line and the consumption of the product for the purpose of surveillance and use in helping to food safety and quality standards and at reasonable prices. To implement these decisions by using different techniques and in different studies such as; flame atomic absorption spectrometry and inductively coupled argon plasma.

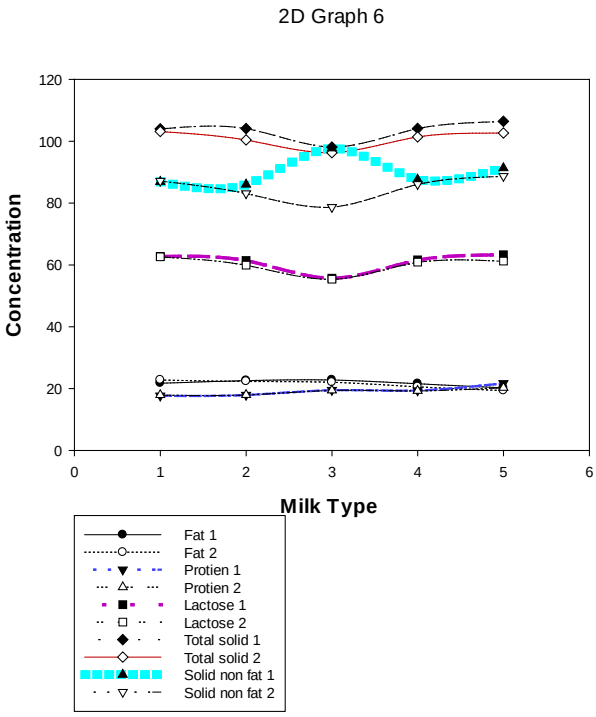

Fig (3) shows the relationship for all the nutrients under study.

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Sample Code	Fats % Mean (T1 ±T2) R2 MilkoScan TM FT 120* 29.27%	Protein% Mean MilkoScan TM FT 120* 21.90%	Lactose % Mean MilkoScan TM FT 120* 45.66%	Total solid % Mean MilkoScan TM FT 120* 2.39%	Solid Nonfat % Mean MilkoScan TM FT 120* 0.78%
1	21.73±22.76	17.64±17.86	62.71±62.56	103.96±103.1	86.86±87.09
2	22.56±22.29	17.88±17.91	61.38±59.88	104.06±100.37	85.97±83.05
3	22.77±22.01	19.45±19.37	55.68±55.32	98.06±96.23	97.69±78.62
4	21.56±20.53	19.33±19.22	61.58±60.84	104.11±101.37	87.58±86.04
5	20.23±19.33	21.67±20.22	63.26±61.19	106.39±102.61	91.30±88.66
SD	1.16	1.12	1.26	1.32	1.24
standard Error	0.95	0.75	0.88	0.35	0.57
Variance R2	0.91	1.61	1.92	0.77	0.92
	p-value: 0.28	p-value: 0.37	p-value: 0.28	p-value: 0.19	p-value: 0.09

Table 1: Shows the results of the analysis with the MilkoScan FT 120 of concentration Milk study.

Variation all type	Fats 1	Fats2	Protein 1	Protein 2	Lactose 1	Lactose 2	Total solid 1	Total solid 2	Solid Nonfat 1	Solid Nonfat 2
Fats1	0.972									
Fats2	0.853	0.936								
Protein 1	-0.707	-0.919	0.991							
Protein 2	-0.585	-0.86	0.978	0.993						
Lactose 1	-0.717	-0.335	0.0513	-0.114	0.993					
Lactose 2	-0.602	-0.191	-0.1	-0.262	0.975	0.981				
Total solid 1	-0.795	-0.463	0.203	0.0425	0.958	0.918	0.948			
Total solid 2	-0.695	-0.31	0.0267	-0.137	0.985	0.971	0.946	0.978		
Solid Nonfat 1	0.213	-	0.485	0.615	-0.789	-0.856	-0.68	-0.796	0.908	

		0.214								
Solid Nonfat 2	-0.846	-0.532	0.279	0.118	0.956	0.904	0.958	0.943	-0.638	0.974

Table (2) shows the relationship for all the nutrients under study.