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STUDIES ON ABERDEEN - ANGUS MILK : PHYSICOCHEMICAL CHARACTERISTICS, RHEOLOGICAL PROPERTIES AND MICROSTRUCTURE

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ABSTRACT: Aberdeen Angus is a breed of cattle commonly used in beef production in most parts of the world. The present study was conducted to compare the characterstic of Aberdeen-Angus, Friesian and Baladi cow's milk. Total milk samples of Aberdeen Angus, Friesian and Baladi cows were collected, and examined for physicochemical characters, rheological properties and microstructure. The results showed that, high amount of total solids, fat content, pH value, and the calorific value were observed in Baladi cow's milk. Aberdeen Angus milk contain significantly less fat content, while, Friesian milk was lower in lactose , solid non- fat content , specific gravity and higher in freezing point as compared with other milk types under study. The protein and ash contents were similar for all milk types. On the other side, there were significant differences between mineral contents of different milk types. All samples of three milk types, in this study, were characterized by a significantly high concentration of iron compared with other studies and recommended standards. Syneresis, and wheying off values in Aberdeen-Angus and Baladi cow's milk curd were considerably ($P<0.05$) low, but water holding capacity was high .However, Friesian milk curd showed the lowest water holding capacity and the highest in syneresis, and wheying off. The microstructure of Aberdeen-Angus milk curd showed much thicker chains of casein network and a highly compact structure with no/few pores, which play a role in the formation of the curd structure. Finally, Aberdeen-Angus milk could be a particularly promising in the manufacture of good-quality dairy milk.

Key words: Aberdeen milk, Friesian milk, Baladi cow's milk, chemical, physicochemical, rheological, microstructure.

INTRODUCTION

Milk is one of the common important foods defined as the normal, clean and fresh secretion, without any addition or subtraction, extracted from the udder of healthy cows, and free from colostrum. Milk is a compound mixture of proteins, fats, lactose, minerals, vitamins and other miscellaneous constituents sporadic in water (Harding, 1999). The composition of milk differe between species, breeds and individual animals. There are several dairy-producing animals, like cows, buffaloes, goats, sheep, camels and clickers; but the most widespread and the highest production in the world are cows. Milk is the most versatile of all the animals desired food commodities, and is a basic source for many products such as; cheese, yoghurt, ice cream, butter, ghee, powder milk, and many other forms of milk (Khan *et al*., 2007). Cows are divided into three types: the first type, which produce milk only such as; Ayrshire, Dairy Shorthorn, Guernsey and Jersey. The second type produce meat only such as; Aberdeen Angus, Beef Shorthorn, Belgian Blue, Belted Galloway, Charolais, Devon, Hereford, Highland, Limousin, Lincoln Red, Sussex, Welsh Black, and White Park .Third type produce meat and milk such as; Brown Swiss, Dexter, Friesian, Gloucester, Holstein, Kerry,

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Red Poll and Shetland (AIM Bovine Statistics Report, 2008). Aberdeen Angus cattle have been bred in Scotland for more than 400 years. These cattle are naturally polled black or red in colour however, black is the predominant colour, white may occasionally appear on the udder. Angus female's especial polled black breed of cattle is considered to have a long life span, high fertility, precocity and easy calving. It's resistant to harsh weather, undemanding, adaptable, better natured, mature extremely early and have a high carcass yield with nicely marbled meat (Vasconcellos *et al*., 2003). Therefore Aberdeen-Angus cattle used widely in crossbreeding to improve carcass quality and milking ability (Pilarczyk and Wójcik, 2007). Crossbreeding between genetically distant breeds as a means to increase milk production of beef cows and to reinforce nutrient content of the milk (Rodrigues *et al*., 2014). Fraga, (2013) found the average total milk production from crossbreds between Angus; Friesian, Jersey and Kiwi produced more milk at all stages of lactation when compared with reds Angus only. In this study, as the proportion of Friesian or Jersey in the crossbreds increased up to 50% was expected compared the Aberdeen-Angus cows. The relatively high usage of Aberdeen Angus bulls in dairy herds reflects a preference for their use on heifers because of their shorter gestation length and lower incidence of calving difficulty (Keane, 2002). Little information is available on the composition and properties of milk of beef cattle and possibility to use it in manufacture of milk products.

The aim of this study was to compare and evaluate the quality of Aberdeen Angus milk with Friesian and Baladi cows in terms of chemical composition, physicochemical characteristics, rheological properties and microstructure.

MATERIALS AND METHODS

Milk Samples

The experimental materials comprised milk samples collected in sterile screw capped bottles from 20 Aberdeen Angus cows on February, 2016 from herd cattle, Department of Animal Production , Faculty of Agriculture, New Valley Branch, El-Kharga, Assuit University, Egypt .As well as 40 samples from Friesian cow's and similarly from Baladi cows' milk samples were collected from dairy farms of El-Kharga City, New Valley Governorate, Egypt, and immediately, screw capped bottles were transported to the laboratory for analysis.

Examination of Milk Samples

The milk samples were analyzed by Lactoscan apparatus (Ultrasonic milk, Bulgaria) in triplicate for chemical composition at field level to determine milk constituents (fat, solid non-fat (SNF), protein, lactose and ash) and physicochemical characteristics (pH value and freezing point). Total solid contents were determined according to the following equation:

TS contents = SNF (%) + Fat (%). Specific gravity was determined by using Lactometer .Calorific value of milk was calculated from the proximate analysis results using the following generalized equation (Salman *et al*. 2014):

$$\text{Kcal/100g} = (\text{protein } \% \times 4) + (\text{fat } \% \times 9) + (\text{lactose } \% \times 4)$$

Determination of Mineral Contents of Milk

Mineral contents as calcium (Ca), magnesium (Mg), and iron (Fe) were assessment in the ash using atomic absorption, (AOAC, 1981). Phosphorous (P) was estimated colorimetrically in the ash according to AOAC (1981).The Ca/P was calculated**.**

Coagulation Tests

Acid clotting time

Skim milk of all types were heated in water bath at 72 °C for 15 sec, and cooled immediately to 5 ± 1°C in an ice bath. Milk was heated into 42°C, Lyophilized-mixed starter cultures containing *Streptococcus thermophilus* and *Lactobacillus delbrueckii* subsp. *bulgaricus* (Chr. Hansen, Horsholm, Denmark) were used as a starter culture at the rate of 0.2%. The milk samples of all types were allowed to coagulate to measure the coagulation time (hr.).

Rennet clotting time

Skim milk of all types were pasteurized at 72°C for 15 Sec. in a water bath and cooled immediately to 5 ± 1°C in an ice bath. Milk was heated into 37°C, 0.04% calcium chloride and rennet powder (Chr. Hansen's Lab., Copenhagen, Denmark) at the rate of 4 g./100 kg of milk was added. The milk of all types was allowed to coagulate to measure the coagulation time (min) (Shahein *et al*., 2014).

Rheological properties

Rheology properties were determined after complete milk coagulation (about 24 hr.). Degree of syneresis was expressed as proportion of free whey, and measured with some modifications as described by Al-Kadamany *et al*. (2003). A 10 g of curd samples were placed on a filter paper resting on the top of a funnel. After 30 min of drainage the whey, the quantity of remained curd was weighted and syneresis was calculated as follow:

Free whey (g/100g) = (weight of initial sample - weight of sample after filtration /weight of initial sample) ×100.

The relative amount of whey drained off (in ml / 100 g of initial sample) was calculated as the whey drainage (Fiszman *et al.,* 1999).

The water-holding capacity (WHC) was determined as described by Arslan and Ozel (2012). A 10-g milk curd samples were centrifuged at 4000 rpm at 15 °C for 30 min. The WHC was expressed as percentage of pellet weight relative to the original weight of the sample.

Electron Microscopy of milk curd

The microstructure of acid and rennet curd was observed using scanning electron microscopy (SEM), analysis was carried out according to Omar *et al*. (2014).

Statistical Analysis

SPSS program (SPSS , 2009) software was used for all statically analysis. The chemical composition, physicochemical characteristics, and elements of different milk types were assessed using analysis of variance (ANOVA). Significant means were compared using Duncan's test on the level of P < 0.05.

RESULTS AND DISCUSSION

Chemical Composition of Milk

The compositional analyses of Aberdeen Angus, Friesian and Baladi cow's milk are shown in Table 1. The results, revealed that the average of total solids were 10.76%, 11.78%, and 12.02%, while solids non-fat recorded; 8.46%, 8.28% and 8.48% and fat valued 2.3%, 3.50% and 3.54%, respectively. The per cent of protein were 3.09%, 3.04%, 3.11% and for lactose 4.65%, 4.55%, 4.65%, meanwhile, the ash contents were 0.69%, 0.68% and 0.69% for the three milk types, respectively. The total solid and fat contents of Aberdeen –Angus milk were the lowest while, Baladi cows' was the highest compared with other milk types. These results indicated that the increase in fat concentrations was associated with the increased dry matter content. Fat content showed a significant different (P < 0.05) among the types of milk. Aberdeen-Angus milk ranked lowest fat (%). This might be due to that milk fat represents highly demanding in energy in the beef cow (Dado *et al*., 1993). The fat contents in Aberdeen-Angus milk observed in this study was higher than those obtained by Pacheco Contreras *et al*. (2015) for Charolais animal's milk (0.77%). Also, it was lower than the results reported by Montanholi *et al*. (2013) (5.07%), for cattle beef. On the other hand, Rodrigues *et al*. (2014) found that main component of total solids, fat, protein and lactose valued 11.58, 3.21, 2.90 and 4.65% in Angus milk, respectively. These results agree with present study in lactose and higher in total solid, fat and protein contents. According to the results of current study, milk from Friesian cows had lower solids non-fat and lactose. Similar results were obtained by Abeykoon *et al*. (2016) .It is obvious that though lactose content has positive relationship with the dissolve salts. This might be happened in the variability of ash content under present study (Pacheco Contreras *et al*., 2015). The mean levels of protein and ash were practically similar in all milk types. All the results from the analysis were compared to the standard values suggested by Tamime (2009). The total solids were below the recommended limit (12.5%) in all milk types. The average SNF was within the recommended level (8.5%) in milk types of Aberdeen –Angus and Baladi cows', but was below in Friesian milk. The fat% was similar with the minimum recommended level (3.5%) in Friesian and Baladi cows' milk, but was under recommended percentage in Aberdeen- Angus milk. The protein was within the recommended limit (2.9%) in all milk types.

Table 1. Chemical composition of Aberdeen Angus, Friesian and (Baladi) cows' milk

Content		Type of milk		
		Aberdeen Angus	Friesian	(Baladi) cows'
Total Solids (%)	Minimum	10.01	10.90	9.83
	Maximum	11.09	13.06	13. 67
	Mean± SD	10.76±0.50^{b}	11.78±0.98^{a}	12.02±0.96^{a}
Solids non fat (%)	Minimum	8.39	8.17	8.06
	Maximum	8.58	8.39	9.03
	Mean± SD	8.46±0.09^{ab}	8.28±0.09^{b}	8. 48±0.34^{a}
Fat (%)	Minimum	1.55	2.62	1.89
	Maximum	2.70	4.67	5.61
	Mean± SD	2.30±0.45^{c}	3.50±0.95^{a}	3.54±0.62^{b}
Protein (%)	Minimum	3.07	3.00	2.97
	Maximum	3.14	3.08	3.31
	Mean± SD	3.09±0.03^{b}	3.04±0.03^{b}	3.11±0.13^{a}
Lactose (%)	Minimum	4.60	4.48	4.40
	Maximum	4.72	4.60	4.96
	Mean± SD	4.65±0.05^{b}	4.55±0.05^{c}	4.65±0.18^{a}
Ash (%)	Minimum	0.68	0.67	0.66
	Maximum	0.70	0.69	0.74
	Mean± SD	0.69±0.01^{ab}	0.68±0.01^{b}	0. 69±0.03^{a}

Mean± SD values having different superscript letters in columns are differ significantly ($p \leq 0.05$)

The lactose and ash contents were within the recommended limit (4.2% and 0.6-0.8%, respectively) in all milk types. The different content of the samples from milk could been attributed to a variety of factors including the feed, species, genetic factors, environmental conditions, stage of lactation, disease and season of the year which influence on chemical composition and nutritional qualities (Montanholi *et al*., 2013).

Minerals Composition of Milk

Table 2 shows the average mineral contents of Aberdeen Angus, Friesian and Baladi cow's milk. The main mineral constituents (mg/Kg) *i.e.* Calcium (Ca), Phosphorus (P), Magnesium (Mg), and Iron (Fe) were 1238.91, 892.13, 165.99 and 8.87 for Aberdeen Angus, respectively. While, for Friesian milk they were 721.95, 530.05, 159.89 and 12.08 and for Baladi cow's milk they were 1141.74, 1132.74, 129.26 and 5.96, respectively. Data shows that Aberdeen Angus milk relatively represented a good source of minerals. Aberdeen Angus milk had the highest level of Ca and Mg and middle levels of P and Fe. Both Ca and P are important in cheese making as they influence the coagulation process and the final consistency of the curd (Fossa *et al*., 1994). Friesian milk had the highest level of Fe and the lowest levels of Ca and P. As well as, Baladi cow's milk had the highest level of P and the lowest levels of Mg and Fe. Overall, Ca, Mg, P and Fe exhibited the lowest and the highest concentration at the beginning and end of lactation (Toffanin *et al.,* 2015). The results of Birghila *et al*. (2008) showed higher P and Mg in cow's milk than in

Table 2. Mineral contents of Aberdeen Angus, Friesian and (Baladi) cows' milk

Mineral (mg/kg)		Type of milk		
		Aberdeen Angus	Friesian	(baladi) cows'
Calcium	Minimum	1063.424	656.202	1036.200
	Maximum	1392.130	779.285	1250.574
	Mean± SD	1238.91±133.01 [a]	721.95±44.29 [b]	1141.74±114.38 [a]
Phosphorus	Minimum	541.061	467.273	939.830
	Maximum	1142.733	570.013	1298.993
	Mean± SD	892.13±265.39 [b]	530.05±34.08 [c]	1132.74±279.74 [a]
Magnesium	Minimum	131.168	134.568	113.622
	Maximum	290.378	199.287	145.182
	Mean± SD	165.99±52.93 [a]	159.89±25.75 [a]	129.26±17.10 [a]
Iron	Minimum	2.709	1.904	4.214
	Maximum	21.182	17.901	7.606
	Mean± SD	8.87±7.37 [b]	12.08±8.01 [a]	5.96±1.75 [b]
Calcium / Phosphorus	Maximum	0.98	1.17	0.96
	Minimum	2.35	1.67	1.10
	Mean± SD	1.39±0.51 [a]	1.37±0.17 [a]	1.02±0.12 [b]

Mean± SD values having different superscript letters in columns are differ significantly ($p \leq 0.05$)

the current study. The present results showed a good agreement with the data obtained by Pilarczyk *et al*. (2013). Finally the present study revealed that all milk types had high content of Fe. On the other hand, comparing the results with regulation of (FAO/WHO 1999), it could be observed that the determined values are within the acceptable limits. While, iron levels were above the required limits. This might be due to the drinking water of the New Valley Governorate, which is characterized by high iron percentage (USAID, 2007). In general content of main elements in milk mostly dependent on elemental composition of dairy animal feed, element levels in the environment and reveal elemental composition of soil, and water .These metals are taken in by plants and consequently accumulate in their tissues and could be excreted into milk at various levels during lactating (Ayar *et al*., 2009). Aberdeen Angus milk contains the highest, significant Ca: P ratio followed by Friesian milk and Baladi cow's milk was the lowest. These high ratios hinder the development of hypocalcaemia and secondary hyperparathyroidism in the newborn, while low Ca: P ratio reason toxicity disease (Fomon, 1993), and it may also lead to bone loss (Murray *et al*., 2000). Establishment of dietary phosphorus intake recommendations on the basis of an optimal calcium-to-phosphorus ratio, usually 1.5–2.0:1 on a molar basis is an unproven but common practice (Abrams and Atkinson, 2003). Minerals fount a small part of milk (about 8-9 g/l) and they contribute in different chemical forms: inorganic ions and salts or as parts of proteins, nucleic acids, fats and carbohydrates (FAO/WHO 1999), so milk as main source of nutrients in child and adolescent nutrition (Whitney *et al*., 1990). In recent years, there has been a growing interest in microelements as their presence in foods is the index of qualitative parameters such as processing conditions, environmental pollution, and husbandries this may be and may affect the chemical and functional properties of milk.

Physicochemical Characteristics of Milk

Average pH, specific gravity, freezing point and calorific values all of types of milk are shown in Table 3. Aberdeen-Angus milk had pH value of 6.82. The specific gravity, freezing point and calorific values were 1.032, -0.515 ^{0}C and 51.61 Kcal, respectively. Friesian milk had pH value of 6.63, specific gravity, freezing point and calorific value were 1.029, -0.489^{o}C and 61.84 Kcal, respectively. The Baladi cows' milk, had pH value of 6.84, specific gravity, freezing point and calorific values were 1.032, -0.531^{0}C and 62.90 Kcal, respectively. The results showed that pH and calorific values in Baladi cows' milk were the highest, while Friesian milk had the lowest pH value, specific gravity and highest freezing point, whereas Aberdeen – Angus milk had the lowest calorific value. There were significant differences of specific gravity between Friesian milk and other milk types, because despite a solid non-fat content of milk from Friesian milk. On the other hand freezing point of milk from Baladi cows' milk was lower compared with other milk types. This may be due to higher total solids in Baladi cows' milk. High freezing point in Friesian milk was affected by many properties in milk, such as lactose content, lower lactose increasing the freezing point, which may account for often 60% of the variation in freezing point (Brouwer 1981). Ķedzierska-Matysek *et al*. (2011) found correlation between freezing point and chemical composition of milk .The results in the present study indicate that Aberdeen-Angus milk had the lowest calorific value. The calorific value calculated in Baladi cows' milk was remarkably significant ($P<0.05$) higher than that of Aberdeen-Angus and Friesian milk. Nevertheless, the difference in calorific value might be attributed to the variation in lactose, fat and protein percentages in milk .Standard values suggested by Tamime (2009), pH value and specific gravity were within the recommended range (6.6-6.8 and 1.027-1.035, respectively). As well as, freezing point was within the recommended range (-0.525^{o}C to -0.550^{o}C) in Baladi cows' milk and was below the recommended one in Aberdeen-Angus and Friesian milk.

Rheological Properties of Milk Curd

Coagulation tests

Coagulation time of acid and rennet curd of Aberdeen Angus, Friesian and Baladi cow's milk are shown in Fig.1. Aberdeen Angus milk had acid and rennet coagulation time of 2.12 hr., and 12.00 min. Friesian milk had 3.28 hr., and 23.67 min. Baladi cow's milk had 2.52 hr., and 7.67 min., respectively. The coagulation test shows, that Aberdeen Angus milk had the lower acid coagulation time than Baladi cow's and Friesian milk. These results revealed that acidity of starter and casein forms in different milk types, which improved the starter ability and cured properties. Similar results were obtained by Ismail and El-Demerdash (2003), in Kareish cheese. There was a positive engagement between coagulum properties and both milk protein and lactose contents in acid coagulation (Abeykoon *et al*., 2016).On the other side Baladi cow's milk had the lowest rennet coagulation time followed Aberdeen Angus and Friesian milk. Friesian acid and rennet milk curd noticed an increase in the coagulation time. The aggregation rate of rennet is very sensitive to the concentration of ionic calcium. This effect of ionic calcium could be expounded by the masking of charged groups and the hydrophobicity increase (Eck and Gillis, 2000). The length of lag phase decreases with increasing calcium ion activity. Consequently calcium reduces the rennet coagulation time.

Syneresis

Fig. 1. presents the syneresis of acid and rennet milk curd. The syneresis, in Aberdeen Angus, was 33.43 and 28.19. Friesian milk curd 41.24 and 41.03. Baladi cow's milk curd, 38.68 and 8.60 g/100g for acid milk as compared for the rennet milk, respectively. Measurement of syneresis investigated Friesian acid and rennet milk increase the curd syneresis. Abeykoon *et al*. (2016) reported that coagulation time and syneresis in Friesian curd were higher than other cattle in both coagulation processes. Aberdeen Angus acid milk resulted in decreasing the curd syneresis. As soon as Baladi cow's rennet milk had the lowest.

Table 3. Physico-chemical characteristics of Aberdeen Angus, Friesian and (Baladi) cows' milk

Indices		Type of milk		
		Aberdeen Angus	Friesian	(Baladi) cows'
	Minimum	6.72	6.50	6.81
pH Value	Maximum	6.98	6.75	6.87
	Mean± SD	6.82±.12^{b}	6.63±.13^{b}	6.84±0.033^{a}
	Minimum	1.031	1.028	1.031
Specific gravity	Maximum	1.033	1.031	1.033
	Mean± SD	1.032±.001^{a}	1.029±.001^{b}	1.032±0.001^{a}
	Minimum	-0.479	-0.459	-0.486
Freezing point (^{0}C)	Maximum	-0.544	-0.535	-0.575
	Mean± SD	-0.515±.027^{b}	-0.489±.033^{c}	-0.531±0.045^{a}
Calorific	Minimum	44.83	53.89	47.54
value	Maximum	54.98	72.81	79.95
(Kcal/100g)	Mean± SD	51.61±4.09^{c}	61.84±8.69^{a}	62.90±6.84^{b}

Mean± SD values having different superscript letters in columns are differ significantly (p≤0.05)

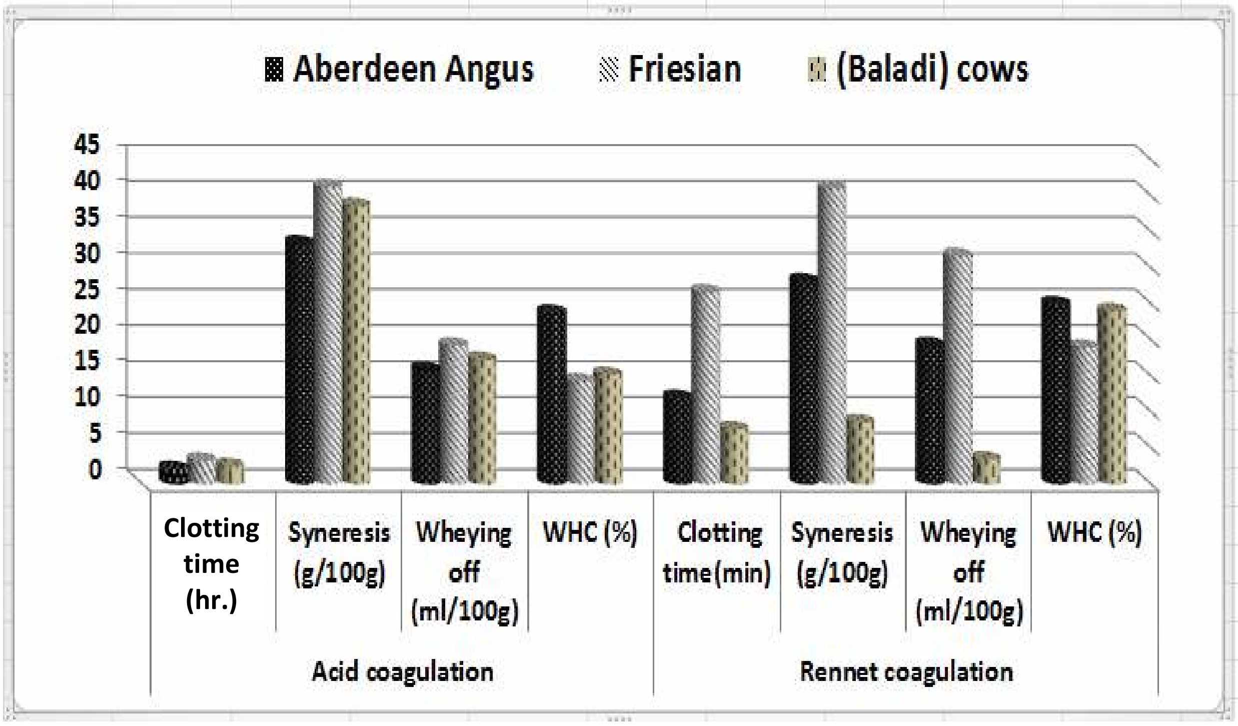

Fig.1. Rheological properties of milk curd from Aberdeen Angus, Friesian and Baladi cows milk

Wheying off

As shown in Fig. 1, the wheying off for acid and rennet curds, in Aberdeen Angus, were 15.96 and 19.32.While in Friesian milk they were 19.26 and 31.71, but in Baladi cow's milk they were 17.28 and 3.44 ml /100g for acid milk as compared for the rennet milk, respectively. Wheying off decreased in Aberdeen Angus acid milk curd and Baladi cow's rennet milk curd, but increased in Friesian milk in both acid milk and rennet milk. Frąckowiak (2004) showed that the highest calcium content of milk, confirm the suitability of this raw material for curd production. Whey drainage refers to the appearance of whey on the curd structure.

Water holding capacity (WHC)

Fig. 1 illustrates the water holding capacity of curd from different milk types. Aberdeen Angus milk, were 23.86 and 24.98 .Friesian milk 14.34 and 18.95. Baladi cow's milk, 15.21 and 24.06 (%) for acid milk as compared for the rennet milk, respectively. It was found that curd of Friesian milk significantly lower than in curd milk from Aberdeen Angus and Baladi cow's milk. The water holding capacity of curd is dependent on the protein content of the product and on the type of protein (Cho *et al*., 1999). The whey drainage indicated weakness of the gel network; reducing the water holding capacity and increase syneresis. The increase in syneresis was probably due to the decreasing water holding capacity that led to more release of whey. Aberdeen Angus and Baladi cow's milk curd had a smooth texture, low syneresis and wheying off.

Microstructure of Milk Curd

Fig. 2 shows homogeneous casein micelles in acid curd for Baladi cow's milk, but, Aberdeen Angus milk curd form denser network and the void spaces decreased. Hence, the protein-rich droplets in Aberdeen Angus milk became smaller and more spherical in Baladi cow's milk casein. As far as there are larger dark voids in Friesian milk and transformation of the structure from a homogeneous to very porous network and more amounts of serum syneresis were comparable with Baladi cow's and Aberdeen Angus milk . These observations agree with the rheological results. This dense network might arise due to the increased aggregation of casein micelles and showed more compact structure as reported by Ong *et al*. (2013).

The micrographs of rennet curd from different milk types in Fig.3 show that Aberdeen Angus milk had much thicker chains of casein network and a highly compact structure with no/few pores. This may be prevent whey separation and improve texture. However, Friesian milk curd was denser clusters with large voids toward a larger serum drained. The micrographs of Baladi cow's milk curd showed a protein network composed by chains and aggregates of fused casein micelles, whose globular shape is still discernible. The formation of smaller diameter micelles aggregates and chain matrix regularly, leads to increase water holding capacity. Similar results were reported previously by Omar *et al.* (2014), when described the micrographs of Limburger like cheese made from cow's milk.

Conclusion

The major aim of this paper was to provide valuable information on chemical composition, physicochemical characteristics, rheological properties and microstructure of Aberdeen-Angus milk and milk curd opens perspectives for more comprehensive investigations on the application of milk. Aberdeen-Angus milk with low fat content could be utilized as low fat soft drink and/ or as base material for low fat dairy products. In here, improvement of the Aberdeen Angus breed for milk production through crossbreeding is set as the primary objective to serve the fast growing demand for milk in Egypt, to meet the ever-increasing demand for milk, milk products and beef and thus contribute to economic growth. Define breeding plan for genetic modification of the Aberdeen Angus cattle for meat and milk production.

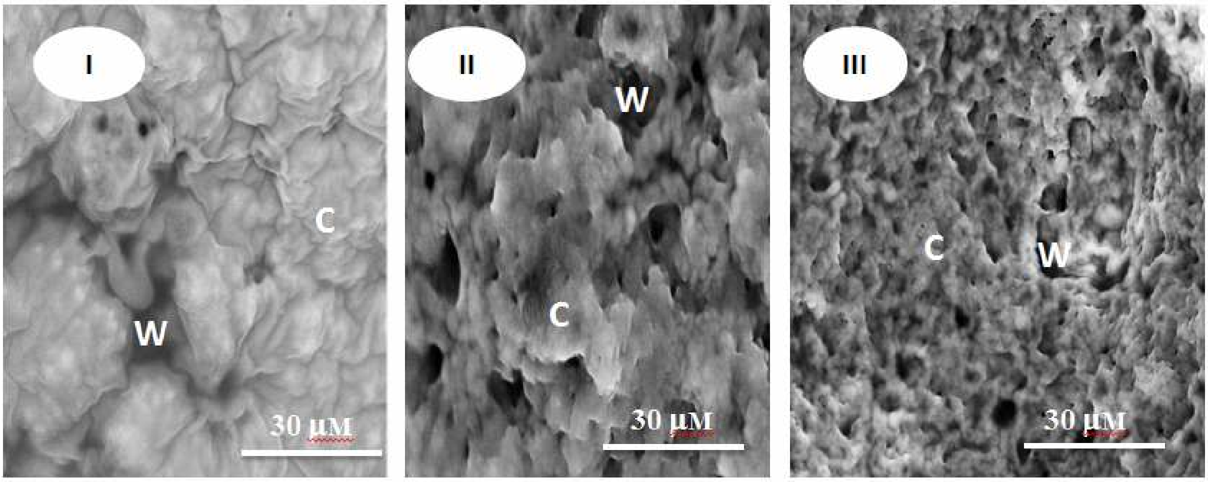

Fig. 2. SEM micrograph of acid milk curd of Aberdeen Angus (I), Friesian (II), Baladi cows (III) (C): casein, (W): whey

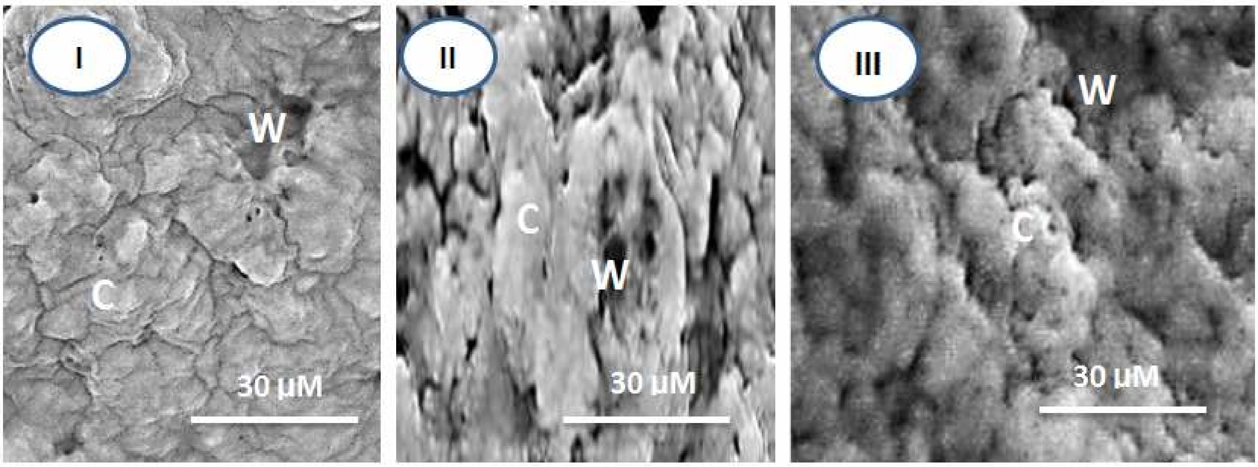

Fig. 3. SEM micrograph of rennet milk curd of Aberdeen Angus (I) ,Frisian (II), Baladi cows (III) (C): casein , (W):whey

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دراسات على لبن الابردين انجس: التركيب الكيماوى والخواص الطبيعية والريولوجية والتركيب الميكروسكوبى

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هدفت الدراسة إلى مقارنة لبن الابردين أنجس (حيوان إنتاج لحم) بألبان الحيوانات الأكثر شيوعا فى مصر مثل الفـريزيـان والبقـر البلدي، شـملت الدراسـة التركيب الكيماوي والصفات الفيزيوكميائية والخواص الريولوجية (syneresis, wheying off and water holding capacity) لخثرة اللبن، إلى جانب التركيب الميكروسكوبى. أوضحت النتائج ارتفاع الجوامد الصلبة الكلية والدهن والـ pH والوزن النوعي والطاقة في لبن البقر البلدي مقارنة بالابردين انجس والفريزيان مع انخفاض واضح في نسبة الدهن وكمية الطاقة في لبن الابردين انجس، أما اللاكتوز والجوامد اللادهنية والوزن النوعى كانت قيمها منخفضة فى لبن الفريزيان مقارنة بالألبان الأخرى و جاءت قيم البروتين والرماد متقاربة ما بين أنواع الألبان الثلاثة، هناك اختلافات نوعية فى محتوى الألبان من العناصر المعدنية واتفقت حدودها مع توصيات منظمة الصحة العالمية ولكن ظهر ارتفاع واضح فى نسبة الحديد فى جميع العينات عما هو بالأبحاث السابقة أو توصيات منظمة الصحة العالمية، أوضحت الدراسات على الخواص الريولوجية لخثرة التجبن الحامضى والانزيمى للألبان الثلاثة زيادة فى تماسك الخثرة والاحتفاظ بالشرش للبن الابردين انجس والبقر البلدى ولكن طرد وانفصال عال للشرش من خثرة لبن الفريزيان، من ناحية أخرى أوضحت صور الميكروسكوب الالكترونى أن ميسلات الكازين لخثرة لبن الابردين أنجس في سلاسل أكثر سمكا واندماجا في التركيب مع قليل أو عدم وجود فراغات أدى إلى تحسن الخثرة الناتجة، وأخيراً أوضحت دراسة الخواص الريولوجية والتركيب الميكروسكوبى لخثرة التجبن الحامض والانزيمى أن لبن الابردين أنجس يمكن أن يكون لبن واعد للاستخدام في صناعة المنتجات اللبنية المختلفة.

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