Journal of Animal and Veterinary Sciences
2015; 2(3): 22-27
Published online May 30, 2015 (http://www.openscienceonline.com/journal/javs)

Open Science

Influence of Sex and Calf Weight on Milk Yield and Some Chemical Composition in the Egyptian Buffalo's

Hamad M. N. F.[1, *], M. M. El-Moghazy[2]

[1]Dairy Science Department, Faculty of Agriculture, Damietta University, Damietta, Egypt
[2]Animal Production Department, Faculty of Agriculture, Damietta University, Damietta, Egypt

Email address

dr_mnour@du.edu.eg (Hamad M. N. F.), mnour20002005@yahoo.com (Hamad M. N. F.), elmoghazymm@yahoo.com (M. M. El-Moghazy)

To cite this article

Hamad M. N. F., M. M. El-Moghazy. Influence of Sex and Calf Weight on Milk Yield and Some Chemical Composition in the Egyptian Buffalo's. *Journal of Animal and Veterinary Sciences.* Vol. 2, No. 3, 2015, pp. 22-27.

Abstract

Data used in this study consisted of 30 monthly milk records during the lactation period from November 2011 to February 2012 (cold season). Data concerning daily milk yield, total milk yield monthly, percentage of milk fat, protein, lactose, total solids, and solids not fat for (14 males and 16 females) reared in the Tabanoha village, Dakahlia governorate, Egypt, were collected. Sex of birth had a significant ($p>0.05$) effect on milk yield at 60, 90, 120 and 150 days while non-significance showed on 30 days. Calf weight had not a significant ($p>0.05$) effect on all milk yield traits, but the interaction between sex and calf weight had a significant effect ($p<0.05$) on yield of 60, 90, 120 and 150 day. There is no significant effect of sex and weight of the calf and the overlap between them ($p>0.05$) on yields of fat, protein, lactose, total solids and solid non-fat at all months with the exception of the effect of the interaction between sex and calf weight was significant ($p<0.05$) on the yield of fat at 2nd, lactose at 2nd, 3rd, total solids at 2nd and solid non-fat at 1st, 2nd.

Keywords

Yield, Lactose, Protein, Sex of Birth, Calf Weight, Egyptian Buffalo's

1. Introduction

Buffalo productivity in Egypt is about 210-280 days/lactation, an average of seven lactations and milk yielding of 1600 kg. The age at the first calving is 34-41 months [18]. As the average natural content of the milk is higher than 4% fat and 3.3% protein the (ECM) “energy corrected milk”, milk volume is 721.4 mills which is 12.4 mill more. Once it comes to milk deliveries [22] is estimating that only 62% of world milk production is delivered to milk processors. The remaining 38% are consumed on the farms or sold informally. Milk is the almost complete and nutritious food for human diet and the first food of the newly born human being and other mammals. It is a food that contains all the nutrients required for the newly born baby to old age. There is no doubt that milk and milk products have played a key role throughout the development of human civilization and supply most of the essential nutrients in significant amounts than any other single food. It is very essential for the growth and development of newly born child. Milk contains all the essential nutrients like protein, fat, lactose, vitamins, mineral matter etc. [34].

Buffalo milk has higher levels of fat, lactose, protein, ash and Ca, and vitamins A and C and lower levels of vitamin E, riboflavin and cholesterol; an absence of carotene; and the presence of the blue-green pigment (biliverdin) as well as a bioactive pentasaccharide and gangliosides, the fat has slightly higher levels of saturated fatty acids and has quantitative differences in the distribution of triglycerides and physical properties, the casein micelles of buffalo milk are larger and richer in minerals, the primary structures of all buffalo milk proteins have been established. Buffalo milk ás1-casein and á-casein have lower levels of phosphorylation, the viscosity and curd tension of buffalo milk are higher; rennet coagulation is faster, and heat stability is lower than that of cow milk [3].

Buffalo milk contains about twice as much butterfat as cow milk and higher amounts of total solids and casein, making it highly suitable for processing various types of yogurt and resulting in creamy textures and rich flavor profiles [35]. [30] reported heritabilities of lactose percentage to be intermediate

to those for fat and protein percentages. Buffalo milk is much preferred by consumers for its rich nutrition and is drunk or transformed into valuable products such as cheese, curd, yogurt and ice cream [23, 26].

2. Materials and Methods

2.1. Animals and Management

Total of 30 multiparous Egyptian buffaloes kept under the field condition of two medium size holdings in Tabanoha village, Dakahlia governorate were used in this study. The experimental buffaloes ranged between 5–6 years of age. All animals normally calved and diagnosed as free of reproductive diseases at the beginning of this field study. Animals were calved throughout the period from November 2011 to February 2012 (cold season).

Born Calves were classified in two groups depending on the sex:

Group (A): included male calves.

Group (B): included female calves.

Then classified in three groups according to the weight of Birth:

Group (C): included a weight of 30 to 34, kg.

Group (D): included a weight of 40 to 44, kg.

Group (E): included a weight of 45 to 50, kg.

Animals were used essentially for milk production and not for work. All buffaloes were hand milked twice daily at about 6:00 h and 17:00, the calves remains with the dam five days to receive the colostrum, and then it joins the dam until weaning or disposal. Animals were kept under the regular systems of feeding and management adopted by the Egyptian farmers. The buffaloes were housed in a hovel and we're continually tied, throughout the experimental period (till day 155 postpartum). They were fed on berseem and concentrates during winter-spring season.

2.2. Milk Sampling

Milk samples were collected twice daily to determine yields. The samples were collected starting from 5 days postpartum until five months or the end of the experimental period (155 days postpartum).

2.3. Chemical Analysis

Composite individual milk samples, were taken weekly from morning and evening milk (5 ml/kg of produced milk). The samples were analyzed for fat content by the standard Gerber method [13], lactose was determined according to [8] and protein content by the Micro Kjeldahl method [8]. Total solids (TS %) content was determined gravimetrically using the method of [28] and solid not fat (SNF %) was calculated by the difference (TS% - F %).

2.4. Statistical Analysis

PROC GLM procedure of the Statistical Analysis Systems [31] was used to analyze the Least-squares means (LSM) and standard errors (SE) for yield and some chemical composition of milk in each level of the fixed factors (sex, weight and interaction) and the differences between means were detected by Duncan`s Multiple Range Test [17].

3. Results

The average yield of fat, protein, lactose, total solids and solids non-fat ranged from 15.47±3.38 to 19.44±4.66, 9.75±3.33 to 12.63±1.74, 11.42±4.18 to 15.57±2.38, 38.01±12.08 to 48.58±7.55 and 22.37±7.67 to 29.73±3.77, respectively, while average percentages ranged from 6.18±0.47 to 7.17±1.25, 4.27±0.33 to 4.51±0.45, 5.03±0.55 to5. 56±2.01, 16.20±1.63 to 17.16±1.18 and 9.92±0.57 to 10.28±0.45, respectively as showed in Table, 1.

The results of fat content of buffalo milk in this study were in agreement with the findings of various authors [1, 2, 6, 9, 20, 19, 25, 33]. On the other hand, buffalo's milk samples in this study were found to contain more fat at lower values than that found by [14], who found fat at a higher level (8.54%) and lower value (6.0%) was detected by [4].

Protein was in agreement with [1, 2, 7, 25], and higher than that detected by [24] (3.23%) and [4]. Lactose is the second major constituent of buffalo milk with a minimum and maximum of 4.5 and 5.2 gm/100g^{-1}, respectively [3]. Total solids experiments were in agreement with [2, 6, 21, 33, 35]. [11] shows that buffalo milk contains the total solids content more than 16% in the months of November through March as compared to April through October. Results of solids non-fat percentage were in agreement with those reported by [2] who showed that buffalo milk contains the total solids not fat content ranged between 9.8–10.1%.

Data in Table (2) shows the effect of sex, calf weight and the interactions between them on total milk yield at 30, 60, 90, 120 and 150 days. Sex of birth had not a significant ($p>0.05$) effect on milk yield at 30 days of lactation, while a significant ($p<0.05$) effects were observed at 60, 90, 120 and 150 day. Milk production in the case of male birth is lower than in the case of female at all stages may be due to the longer post-partum estrous interval in buffaloes giving birth to male calves, this is in agreement with [5, 12, 15], while non-significant effect reported by [29].

Calf weight had not a significant ($p>0.05$) effect on all traits. While significant effects were obtained from [36] who obtained that *Najdi* ewes, which gave birth to *heavier* lambs, produced more milk than those of lighter weight lambs, [27] also reported similar results in *Awassi* ewes and stated that greater suckling stimulus by bigger lambs accelerated the synthesis of milk. The overlap between sex and calf weight had not a significant effect ($p>0.05$) on the yield of 30 day milk, but there is a significant effect ($p<0.05$) on 60, 90, 120 and 150 days, unfortunately, there are no previous studies on the effect of the overlap between sex and calf weight on milk secretion and its components.

Tables 3, 4, 5, 6 and 7 indicates that the sex had not a significant effect on the yield of fat, protein, lactose, total solids and solid non-fat at all months, these results were in

agreement with [10] who reported that the sex of birth did not produce any significant effect on milk yield and its composition, also the fat and total protein contents were not affected [25, 32]. On the other hand [16] obtained that the relationship between calf birth weight and each yield measure was linear and positive for calf birth weights between 23 and 50 kg. Expected differences in 200-day yields of milk, fat, and solids were 15.2, 11, and 18.8% higher for 50 kg calf birth weight as compared to 30 kg calf birth weight. Corresponding differences in 305 day milk, fat, and solids were 9.4, 4.5, and 11.8%.

Table 1. *Chemical composition of buffalo's milk during experimental period.*

	Experimental period (Month)				
Traits	**1st**	**2nd**	**3rd**	**4th**	**5th**
F %	6.18±0.47	6.63±1.25	6.34±0.83	6.71±1.19	7.17±1.25
P %	4.51±0.45	4.31±0.32	4.42±0.39	4.27±0.33	4.38±0.21
L %	5.56±2.01	5.31±0.47	5.09±0.41	5.03±0.55	5.08±0.40
TS %	16.41±0.93	16.57±1.49	16.25±1.22	16.20±1.63	17.16±1.18
SNF %	10.28±0.45	10.15±0.44	10.13±0.33	9.92±0.57	10.01±0.42
F (kg)	15.47±3.38	19.44±4.66	17.94±4.05	17.22±4.55	15.70±4.98
P (kg)	11.30±2.47	12.63±1.74	12.47±2.32	10.94±2.26	9.75±3.33
L (kg)	13.84±5.65	15.57±2.38	14.37±2.77	12.89±3.23	11.42±4.18
TS (kg)	40.52±8.90	48.58±7.55	45.93±8.69	41.56±9.15	38.01±12.08
SNF (kg)	24.95±5.93	29.73±3.77	28.63±5.02	25.45±5.57	22.37±7.67

Table 2. *Effect of sex and birth weight on monthly milk yield.*

Item	**Y (kg)**				
	1st	**2nd**	**3rd**	**4th**	**5th**
Effect of sex:					
A	232.3±10.71	509.51±17.19^{b}	785.12±20.75^{b}	1025.94±30.66^{b}	1234.08±44.73^{b}
B	260.46±14.33	562.75±21.3^{a}	857.28±24.77^{a}	1123.28±35.91^{a}	1350.62±41.54^{a}
Effect of body weight of sex birth:					
C	252.75±16.98	542.42±26.11	831.21±32.25	1090.64±46.65	1324.57±55.15
D	240.37±8.81	532.42±21.16	815.27±25.75	1062.62±36.09	1258.22±48.50
E	246.25±22.88	536.50±25.11	819.75±21.56	1073.41±33.32	1293.50±54.40
Interaction between of sex and body weight birth:					
A*C	224.10±20.62	473.20±27.46^{b}	729.30±34.32^{b}	958.10±60.85^{b}	1166.80±93.10^{b}
A*D	245.85±13.45	545.25±30.66^{ab}	834.05±33.01^{ab}	1079.35±45.81^{ab}	1277.45±82.19^{ab}
A*E	225.62±24.69	510.25±24.07^{ab}	793.75±20.84^{ab}	1044±37.07^{ab}	1264±41.03^{ab}
B*C	268.66±22.85	580.88±31.56^{ab}	887.83±34.35^{a}	1164.27±50.74^{a}	1412.22±50.93^{a}
B*D	234.90±12.40	519.60±31.52^{ab}	796.50±41.45^{ab}	1045.90±60.21^{ab}	1239±60.39^{ab}
B*E	287.50±40.50	589±43.26^{a}	871.75±17.75^{a}	1132.25±56.75^{ab}	1352.50±116.05^{ab}

$^{a \text{ and } b}$ means in the same row followed by different letters are significantly different, Duncan ($p<0.05$)

Table 3. *The effect of sex of birth, calf weight on Fat (Kg) in buffalo milk.*

Item	**F (Kg.)**				
	1st	**2nd**	**3rd**	**4th**	**5th**
Effect of sex:					
A	14.62±0.81	19.02±1.67	17.42±1	15.87±1	14.03±1.32^{b}
B	16.21±0.89	19.79±0.68	18.37±1.08	18.39±1.23	17.15±1.17^{a}
Effect of the calf weight:					
C	15.63±0.97	18.25±0.89	18.3±1.02	17.29±1.38	16.67±1.41
D	15.07±0.92	21.22±2.0	17.57±1.38	17.76±1.57	14.52±1.34
E	15.77±1.64	19.23±1.56	17.69±1.05	16.19±0.87	15.37±2.32
Effect of interaction between sex of birth and calf weight:					
A*C	14.32±1.76	15.40±0.91^{b}	15.83±0.93	14.83±2.69	13.43±2.45
A*D	14.98±0.76	22.76±3.93^{a}	19.27±2.36	17.14±0.59	12.97±2.11
A*E	14.54±1.91	18.89±2.04^{ab}	17.12±1.42	15.60±1.24	16.10±2.66
B*C	16.36±1.15	19.83±0.95^{ab}	19.67±1.66	18.64±1.45	18.48±1.50
B*D	15.15±1.79	19.67±1.11^{ab}	15.87±1.28	18.37±3.25	16.08±1.59
B*E	18.22±3.13	19.91±3.29^{ab}	18.81±1.52	17.34±0.29	13.91±8.92

$^{a \text{ and } b}$ means in the same row followed by different letters are significantly different, Duncan ($p<0.05$)

Table 4. *The effect of sex of birth, calf weight on Protein (Kg) in buffalo milk.*

Groups	P (Kg.)				
	1st	2nd	3rd	4th	5th
Effect of sex:					
A	10.73±0.54	12.04±0.51	12.25±.05	10.17±0.53	9.13±1.02
B	11.79±0.69	13.14±0.35	12.66±0.64	11.61±0.58	10.28±0.7
Effect of the calf weight:					
C	11.28±0.71	12.48±0.50	13.03±0.70	11.04±0.77	10.48±0.99
D	11.09±0.55	12.95±0.64	11.90±0.58	10.92±0.59	8.91±0.80
E	11.66±1.35	12.46±0.37	12.13±0.94	10.74±0.50	9.43±1.52
Effect of interaction between sex of birth and calf weight:					
A*C	10.25±0.51	10.99±0.84	12.45±1.28	9.53±1.40	9.27±2.31
A*D	10.91±0.62	12.90±1.04	12.39±0.83	10.36±0.37	8.62±1.63
A*E	11.10±1.81	12.27±0.43	11.82±0.70	10.72±0.67	9.57±1.56
B*C	11.85±1.05	13.30±0.44	13.35±0.87	11.88±0.85	11.15±0.91
B*D	11.28±0.98	12.10±0.85	11.40±0.84	11.48±1.13	9.19±0.46
B*E	12.79±2.39	12.84±0.83	12.75±3.12	10.77±1.04	9.14±4.44

[a and b] means in the same row followed by different letters are significantly different, Duncan ($p<0.05$).

Table 5. *The effect of sex and weight of the calf on Lactose (Kg) in buffalo milk.*

Item	L (Kg.)				
	1st	2nd	3rd	4th	5th
Effect of sex:					
A	13.55±2.04	14.48±0.58	13.71±0.5	11.89±0.67	10.82±1.24
B	14.08±0.84	16.52±0.54	15.0±0.93	13.78±0.9	11.94±0.95
Effect of the calf weight:					
C	13.35±1.04	15.64±0.75	14.99±0.93	12.9±1.13	12.03±1.19
D	12.66±0.67	15.62±0.81	13.59±0.58	13.26±0.75	10.65±1.13
E	16.93±4.53	15.32±0.30	14.21±0.84	12.26±0.75	11.28±2.01
Effect of interaction between sex of birth and calf weight:					
A*C	11.97±1.19	12.98±0.77[b]	12.51±0.74[b]	10.64±1.29	11±2.60
A*D	12.86±0.91	15.61±1.24[ab]	14.31±0.91[ab]	12.55±1.01	10.45±2.27
A*E	14.64±2.88	14.94±1.05[ab]	14.45±1.28[ab]	12.61±1.63	11.05±2.24
B*C	13.67±1.93	17.11±0.70[a]	16.38±0.85[a]	14.16±1.08	12.59±1.49
B*D	12.46±1.08	15.63±1.19[ab]	12.88±0.67[ab]	13.96±1.12	10.86±0.74
B*E	13.52±0.95	16.06±0.23[ab]	13.74±2.67[ab]	11.57±0.50	11.73±3.17

[a and b] means in the same row followed by different letters are significantly different, Duncan ($p<0.05$).

Table 6. *The effect of sex and weight of the calf on Total solids (Kg) in buffalo milk.*

Groups	TS (Kg.)				
	1st	2nd	3rd	4th	5th
Effect of sex:					
A	38.02±1.80	46.73±2.54	44.30±2.00	38.38±2.09	35.13±3.56
B	42.71±2.54	50.2±1.27	47.35±2.41	44.35±2.38	40.53±2.67
Effect of the calf weight:					
C	40.84±2.72	46.56±1.97	47.21±2.69	41.71±3.04	40.17±3.42
D	39.86±2.19	51.54±2.79	44.24±2.56	42.57±2.69	35.38±3.14
E	40.87±4.14	48.36±1.83	45.74±2.81	39.53±1.42	37.34±5.97
Effect of interaction between sex of birth and calf weight:					
A*C	36.95±3.50	39.58±2.64[b]	41.92±2.71	35.95±5.67	34.63±7.29
A*D	39.83±1.89	53.20±5.09[a]	46.10±4.60	40.45±1.77	33.28±6.14
A*E	37.08±4.54	47.60±2.04[ab]	45.02±3.01	38.81±1.83	38.07±6.06
B*C	43±3.70	50.44±1.26[a]	50.15±3.63	44.91±3.28	43.25±3.41
B*D	39.89±4.24	49.88±2.79[ab]	42.38±2.56	44.69±5.23	37.48±2.10
B*E	48.42±6.88	49.89±4.65[ab]	47.18±7.85	40.97±2.66	35.90±8.90

[a and b] means in the same row followed by different letters are significantly different, Duncan ($p<0.05$).

Table 7. *The effect of sex and weight of the calf on solid non-fat (Kg) in buffalo milk.*

Groups	SNF (Kg.)				
	1st	2nd	3rd	4th	5th
Effect of sex:					
A	23.56±1.01	28.00±0.96	27.69±0.99	23.61±1.21	21.05±2.31
B	26.17±1.81	31.24±0.83	29.45±1.48	27.05±1.51	23.53±1.69
Effect of the calf weight:					
C	26.20±1.81	29.49±1.16	29.75±1.62	25.61±1.97	23.66±2.16
D	23.17±1.49	30.32±1.31	27.2±1.10	25.77±1.26	20.08±2.05
E	25.00±2.40	29.29±0.52	28.38±1.84	24.52±1.18	21.98±3.76
Effect of interaction between sex of birth and calf weight:					
A*C	22.66±1.70^{ab}	25.16±1.07^{b}	26.24±1.93	21.65±2.86	21.14±4.83
A*D	25.37±1.36^{ab}	30.36±1.94^{a}	28.58±1.80	24.49±1.45	20.22±4.17
A*E	22.41±2.29^{ab}	28.57±0.29^{ab}	28.38±1.35	24.96±1.54	21.98±3.52
B*C	28.16±2.47^{ab}	31.89±1.03^{a}	31.70±2.07	27.81±2.41	25.06±2.16
B*D	20.97±2.38^{b}	30.26±1.98^{a}	25.83±1.13	27.04±2.07	21.39±1.19
B*E	30.20±3.75^{a}	30.72±2.30^{a}	28.37±3.46	23.63±3.95	21.98±5.77

$^{a \text{ and } b}$ means in the same row followed by different letters are significantly different, Duncan ($p<0.05$).

Thus, yields of milk, fat, and solids in Holsteins increase with increasing calf birth weight calf weight and overlap between them had not a significant effect ($p>0.05$) on yields of fat, protein, lactose, total solids and solid non-fat at all months with the exception of the effect of the interaction between sex and calf weight was significant ($p<0.05$) on the yield of fat at 2nd, lactose at 2nd, 3rd, total solids at 2nd and solid non-fat at 1st, 2nd.

In turn [3] confirmed that the content of fat and protein in buffalo's milk affected by breeding, feeding and genetics factors**.** The total solids, solids not fat, lactose, and ash content increased with the increase in the number of lactations while, the fat and total protein contents were not affected [25, 32].

4. Conclusion

Milk production in the case of male birth is lower than in the case of female at all stages may be due to the longer post-partum estrous interval in buffaloes giving birth to male calves.

Sex of birth had a significant ($p>0.05$) effect on milk yield at 60, 90, 120 and 150 days while non-significance showed on 30 days.

Calf weight had not a significant ($p>0.05$) effect on all traits but the interaction between sex and calf weight had a significant effect ($p<0.05$) on 60, 90, 120 and 150 day.

There is no significant effect for sex calf weight and the overlap between them ($p>0.05$) on yields of fat, protein, lactose, total solids and solid non-fat at all months with the exception of the effect of the interaction between sex and calf weight was significant ($p<0.05$) on the yield of fat at 2nd, lactose at 2nd, 3rd, total solids at 2nd and solid non-fat at 1st, 2nd.

Acknowledgements

The author was very grateful to Ali, A.E. El-Raghe for his scientific advice on statistical analysis and useful recommendations.

Abbreviation Key

F%= percentage fat, L%= percentage lactose, Y= milk yield, TMY= total milk yield monthly, P%= percentage protein, TS%= percentage total solids, SNF%= percentage solids not Fat.

References

[1] Abd El-Aziz M, Kholif SM, Morsy TA. Buffalo's Milk Composition and Its Fat Properties as Affected by Feeding Diet Supplemented with Flaxseed or Fibrolytic Enzymes in Early Lactation. J Life Sci, 2012, 4(1):19-25.

[2] Abd El-Salam MH, El-Shibiny S . The chemical composition of buffalo milk I. General composition. Indian J Dairy Sci, 1966, 19:151–154.

[3] Abd El-Salam MH, El-Shibiny S. A comprehensive review on the composition and properties of buffalo milk. Dairy Sci and Technol, 2011, 91:663–699.

[4] Abou-Arab AAK Fate of some pollutants in various paper fed to lactating buffaloes and their effect on the milk. J Agri Sci Mansoura Uni, 1996, 21(4):1385-1395.

[5] Afzal M, Anwar M, Mirza MA. Some factors affecting milk yield and lactation length in Nili Ravi Buffaloes. Pakistan Vet J, 2007, 27(3):113-117.

[6] Ahmad S, Gaucher I, Rousseau F, Beaucher E, Piot M, Grongnet JF, Gaucheron F. Effects of acidification on physicochemical characteristics of buffalo milk: A comparison with cow's milk. Food Chem, 2008, 106:11-17.

[7] Ahmad S, Anjum FM, Huma N, Sameen A, Zahoor T. Composition and Physico-chemical characteristics of Buffalo milk with particular emphasis on lipids, Proteins, Minerals, Enzymes and Vitamins. J Anim Plant Sci, 2013, 23(Sup1).

[8] AOAC (2000) Association of Official Agriculture Chemists, Official Methods of Analysis 17th Ed Washington DC, USA.

[9] Asker AA, Ahmed NS, Hofi AA, Mahran GA. Phospholipid contents in buffalo's butter as affected by processing. Egyptian J Dairy Sci, 1974, (2):101–104.

[10] Ayadi M, Matar AM, Aljumaah RS, Alshaikh MA, Abouheif M. Factors Affecting Milk Yield, Composition and Udder Health of Najdi Ewes Int J Anim Veter Adv, 2014, 6(1):28-33.

[11] Barłowska J, Szwajkowska M, Litwińczuk Z, Król J. Nutritional Value and Technological Suitability of Milk from Various Animal Species Used for Dairy Production. Comprehensive Reviews in Food Sci and Food Safety, 2011, (10):291-302.

[12] Basu SB, Tomar SS. Effect of the sire on the subsequent lactation performance in the dam. Anim Prod, 1981, (32):155-158.

[13] British Standard Institution, (1962) British Standard methods for determination of milk fat the Gerber method. Bull P:962.

[14] Castagnetti GB, Chlavari C, Ferri E (1996) Industria-dellatte, 1996, 32(1-2):43-58.

[15] Chaudhry MA. Factors affecting the lactation length and milk yield in Nili-Ravi buffaloes. Asian Austr J Anim Sci, 1992, 5:375-382.

[16] Chew BP, Maier LC, Hillers JK, Hodgson AS. Relationship between Calf birth weight and Dam's subsequent 200- and 305-Day Yields of Milk, Fat, and Total Solids in Holsteins. J Dairy Sci, 1981, 2401–2408.

[17] Duncan DB. Multiple range and multiple F-test biometrics, 1955, (11):1–24.

[18] El-Kirabi F (1995) Buffalo population and production in Egypt. FAO/RNE, Buffalo Newsletter 3:8.

[19] El-Sokkary AM, Hassan HA. The composition of the milk of Egyptian cows and buffaloes. J Dairy Res, 1949, (16):217-226.

[20] Enb AMA, AbouDonia NS, Abd-Rabou AAK, Abou-Arab AAK, El-Senaity MH. Chemical composition of Raw Milk and heavy metals behavior during Processing of Milk Products. Global Veterinaria, 2009, 3(3):268-275.

[21] Hamad MNE, Baiomy AA . Physical Properties and Chemical composition of Cow's and Buffalo's Milk in *Qena* Governorate. J food and Dairy Sci Mansoura Uni, 2010, Vol 1(7):397-403.

[22] IFCN (2007). Dairy report for a better understanding of milk production. Inter farm comparison Network. World-Wide (pp:86).

[23] Jayamanne VS, Adams MR. Survival of Probiotic bifidobacteria in buffalo curd and their effect on Sensory properties. Int J Food Sci Tech, 2004, (39):719-725.

[24] Kholif AM, Abo El-Nor SAH, Abou-Arab AAK, El-Alamy HA. Effect of spraying diazinon to control the external parasites on the productive performance of dairy animals. I. Yield and composition of buffalo's and Friesian cow's milks. Egypt J Dairy Sci, 1994, (22):145-154.

[25] Kholif AM. Effect of number and stage of lactation on the yield, composition and properties of buffalo's milk. Egypt J Dairy Sci, 1997, (25):25–39.

[26] Moio L, Dekimpe J, EP X, Addeo F (1993) The Neutral volatile compounds of Water Buffalo Milk. Pinerolo, ITALIE: Chiriotti.

[27] Nudda A, Bencini RS, Mijatovic S, Pulina G. The yield and composition of milk in Sarda, Awassi and Merino sheep milked unilaterally at different frequencies. J Dairy Sci, 2002, (85):2879-2884.

[28] Oser LB (1965) Hawks Physiological Chemistry, McGrow–Hill Book Co, New York and London, 14th ed. Pp.390–391.

[29] Ramos A, de Amorim, Mendes Malhado CH, Martins Filho R, Souza Carneiro PL, Antunes de Mello Affonso PR, de Souza JC. Genetic and Environmental effects over milk production of Buffalo Cows in BrazilItal. J Anim Sci, 2007, (6/2):328-330.

[30] Robertson A, Waite R, White JCD. Variations in the chemical composition of milk with particular reference to the solids-not-fat. II. The effect of heredity. J Dairy Res, 1956, (23):82.

[31] SAS (1998) Statistical Analysis System User, Guide: Basis. SAS Inst. Inc Cary. NC.

[32] Sodi SS, Mehra ML, Jain AK, Trehan PK. Effect of Non-genetic factors on the composition of milk of Murrah buffaloes. Indian Vet J, 2008, (85):950–952.

[33] Spanghero M, Susmel P. Chemical composition and energy content of buffalo milk. J Dairy Res, 1996, (63):629–633.

[34] Walstra P, Geurts T, Noomen A, Jellema A, Van Boekel M (1999) Dairy Technology, principles of milk, properties and processes. New York: Marcel Dekker.

[35] Xue Han, Frank L Lee, Lanwei Zhang, Guo MR. Chemical composition of water Buffalo milk and its low-fat symbiotic yogurt development, Research Article, Functional Foods in Health and Disease, 2012, 2(4):86-106.

[36] Yilmaz O, Cak B, Bolacali M. Effects of lactation stage, age, birth type and body weight on chemical composition of Red Karaman sheep milk. Kafkas Univ Vet Fak Derg, 2011, (17):383-386.