International Journal of Agriculture and Animal Production
ISSN: 2799-0907
Vol: 04, No. 06, Oct-Nov 2024
http://journal.hmjournals.com/index.php/IJAAP
DOI: https://doi.org/10.55529/ijaap.46.56.62

A Comparative Study of Raw Buffalo Milk Components from Two Sources: Local Markets and Buffalo Breeders' Fields in Shatrah City

Muayad Abdulwahid Jaber Al-Fayad*

[*]Department of Animal Production, Faculty of Agricultureand Marshlands, University of Thi-Qar, 64001, Iraq.

Corresponding Email: [*]muaeid@utq.edu.iq

Received: 04 June 2024 **Accepted:** 21 August 2024 **Published:** 07 October 2024

***Abstract:** A study was conducted in Shatrah City, Iraq, from April 1 to August 1, 2022, to compare and evaluate the physicochemical Composition of raw buffalo milk from two sources: local markets (including street vendors and dairy shops) and buffalo breeders' fields. 100 raw buffalo milk samples were collected, with 50 samples from each source. The results showed that raw buffalo milk samples from breeders' fields had significantly higher ($p < 0.05$) fat, solid non-fat, protein, lactose, total solids, ash, and milk density than those from local markets. In contrast, raw buffalo milk samples from local markets had significantly ($p < 0.05$) higher water content (moisture) than those from breeders' fields. The mean values of fat, solid non-fat, protein, lactose, total solids, water, ash, and density in samples from breeders' fields and local markets were as follows: (31.33±0.590, 0.62±0.0142, 85.98±0.312, 14.01±0.312, 4.97±0.122, 3.28±0.073, 8.89±0.204, 5.25±0.150) ((24.42±0.745, 0.49±0.016, 90.22±0.256, 9.76±0.251, 3.92±0.125, 2.59±0.083, 6.99±0.225, 2.77±0.130), respectively. The study results indicated that some vendors in the local markets of Shatrah City (street vendors and dairy shops) adulterated raw buffalo milk to increase their profit margins by adding water, partially removing fat, or using other readily available adulteration methods.*

***Keywords:** Raw Buffalo Milk, Milk Composition, Milk Adulteration.*

1. INTERACTION

Milk is a highly nutritious food source, containing high-quality nutrients such as proteins, fats, carbohydrates, and minerals in significant quantities compared to other foods (Neumann C et al., 2002). Despite its high % biological value of 82%, milk is one of the cheapest animal protein sources, compared to 67% in red meat (Sleiman et al., 2005).
Buffalo milk is distinguished by its high total solids content, high-fat content ranging from 7% to 13%, high total mineral content, especially calcium and phosphorus, and bright white

International Journal of Agriculture and Animal Production
ISSN: 2799-0907
Vol: 04, No. 06, Oct-Nov 2024
http://journal.hmjournals.com/index.php/IJAAP
DOI: https://doi.org/10.55529/ijaap.46.56.62

colour compared to cow's milk (Al-Qudsi& Ilya, 2010). Buffalo milk is rich in unsaturated fatty acids and has a higher shelf life than cow's milk (Borghes&Moioli, 2002; Zicarelli,2004).

These characteristics make buffalo milk an essential raw material in producing dairy products such as liquid milk, cream, cheese, butter, yogurt, and ghee (animal fat). Aspilcut-Borquis et al., (2010) pointed out that buffalo milk has desirable processing properties in the dairy industry, making it suitable for producing mozzarella cheese.

The importance of studying milk components lies in the fact that some of these components, such as the fat content, determine the product's price products price, which is an important economic factor for the farmer. It also helps protect consumer health, ensure the safety of dairy products, and reduce milk adulteration. Branciari et al., (2000) indicated that the classification of raw milk from dairy animals has become essential for food safety economically and for the consumer's health.

Some farmers and dairy sellers resort to milk adulteration to obtain an additional profit margin at the expense of product quality and consumer health. Adulteration can be either natural or artificial. Natural adulteration involves adding water to milk, removing some of the fat, adding water and skimmed milk, or combining these methods (Abdel-Hamid, 2002; Abdel-Sabour, 2007).

This study aims to compare and evaluate raw buffalo milk's chemical composition and physical properties obtained from local markets (including street vendors and dairy shops) and buffalo breeders' fields in Shatrah City, DhiQar Governorate.

2. RELATED WORKS

Milk adulteration is defined as adding any foreign substance to milk or removing any of the natural components milk in a way that harms the health and economy of the consumer or deceives him for the purpose of obtaining illegitimate profit(Mahmoud and Mansour,1992).

Al-Diab and Zayoud(2018) indicate that there are several methods of adulterating milk, such as adding water, urea, starch, gelatin, and others, these methods cause a decrease in the nutritional value of milk, and some additives may cause health problems for the consumer. While Soomro et al.,(2014) reported that most of the milk samples taken from the brokers were adulterated with water, this addition greatly affected the chemical properties of the milk, except for the lactose content. Barham et al.,(2015) reported that water was the most contaminated substance in market milk samples, followed by detergents, rice flour, caustic soda, salt and sugar, the percentage of adulteration by adding water was higher in market milk samples compared to milk samples taken from dairy producers, this addition caused a decrease in the specific gravity of milk, as well as an increase in the freezing point and change in the PH value towards neutrality.

3. METHODOLOGY

A study was conducted in Shatrah City, DhiQar Governorate, Iraq, from April 1 to August 1, 2022, to compare and evaluate the physicochemical Composition and some physical properties of raw buffalo milk from two sources: local markets (including street vendors and dairy shops) and buffalo breeders' fields.

International Journal of Agriculture and Animal Production
ISSN: 2799-0907
Vol: 04, No. 06, Oct-Nov 2024
http://journal.hmjournals.com/index.php/IJAAP
DOI: https://doi.org/10.55529/ijaap.46.56.62

100 raw buffalo milk samples were collected, with 50 samples from each source. Each sample was 100 ml in volume. After collection, the samples were immediately stored in a box filled with crushed ice and transported to the laboratory for analysis using a German-made EKO Milk device. The device was used to estimate the percentages of fat (F%), protein (P%), lactose (L%),solid non-fat (SNF%), and milk density.
The total solids (TS%) were estimated according to Javaid et al., (2009).
The ash content (Ash%) was estimated using the following equation:
Ash% = SNF% - (L% + P%)
The water content (moisture%) in milk was estimated using the following equation:
W% = 100 - TS%

Statistical Analysis:
The data were statistically analyzed using the SPSS (2006) statistical software, and the significance of the means was tested using the LSD test.

4. RESULTS AND DISCUSSION

The results of the study showed a significant superiority ($p < 0.05$) of raw buffalo milk samples collected from breeders' fields in all major components (fat,solid non-fat, protein, lactose) compared to raw buffalo milk samples collected from local markets.

Fat:
The fat content in the breeders' samples was lower than that reported in studies by Abdullah (2018) and Prasad et al., (2018) and higher than that reported in studies by Al-Fartousi and Al-Moussawi (2017) and Al-Fayad (2022).
The fat content in the market samples was lower than that reported in studies by Abdel-Sabour (2007) and Abdel-Hameid (2002) and slightly higher than that reported in studies by Al-Fartousi and Al-Moussawi (2017).
The lower fat content in the market samples may be attributed to milk adulteration, which involves removing some fat and adding water (Eman et al., 2015).

Solid Non-Fat:
The solid non-fat content in the breeders' samples was lower than that reported in studies by Hamad and Baiomy (2010) and Abdullah (2018) and higher than that reported in studies by Kanwal et al., (2004), Prasad et al., (2018), and Al-Fayad (2022). The solid non-fat content in the market samples was lower than that reported in studies by Abdel-Sabour (2007) and Al-Fartousi and Al-Moussawi (2017) and higher than that reported in studies by Prasad et al., (2018). The lower solid non-fat content in the market samples may be attributed to milk adulteration by adding water (Harding, 1995).

Protein:
The protein content in the breeders' samples was lower than that reported in studies by Abdullah (2018) and slightly higher than that reported in studies by Al-Fartousi and Al-Moussawi (2017). The protein content in the market samples was lower than that reported in studies by Al-Fartousi and Al-Moussawi (2017) and Prasad et al., (2018).

Lactose:
The lactose content in the breeders' samples was lower than that reported in studies by Soliman (2005) and higher than that reported in studies by Abdullah (2018) and Al-Fayad

International Journal of Agriculture and Animal Production
ISSN: 2799-0907
Vol: 04, No. 06, Oct-Nov 2024
http://journal.hmjournals.com/index.php/IJAAP
DOI: https://doi.org/10.55529/ijaap.46.56.62

(2022). The lactose content in the market samples was lower than that reported in studies by Al-Fartousi and Al-Moussawi (2017) and similar to that reported in studies by Kanwal et al., (2004).
The study showed a clear superiority in the components of raw buffalo milk taken from breeders' fields compared to samples taken from local markets. This may indicate adulteration of buffalo milk in local markets by removing some of the fat or adding water.

Table 1: Mean (± Standard Error) of Major Milk Components in Raw Buffalo Milk Samples from Local Markets and Breeders' Fields

Milk Sources	Views No.	Fat %	Solid non fat%	Protein (%)	Lactose (%)
Market samples	50	2.77^{b}±0.130	6.99^{b}±0.225	2.59^{b}±0.083	3.92^{b}±0.125
Breeders' samples	50	5.25^{a}±o.150	8.89^{a}±0.204	3.28^{a}±0.073	4.97^{a}±0.122

Different letters within one column indicate a significant difference ($p<0.05$)
The results showed a significant superiority ($p < 0.05$) of raw buffalo milk samples collected from breeders' fields in total solids, ash content, and milk density. The raw buffalo milk samples collected from local markets had a significantly higher ($p < 0.05$) moisture content. The mean values of total solids%, moisture%, ash%, and density in raw buffalo milk samples collected from breeders' fields and local markets were as follows:
(31.33±0.590, 0.62±0.014, 85.98±0.312, 14.01±0.312)
(24.42±0.745, 0.49±0.016, 90.22±0.256, 9.76±0.251)

Total Solids:

The results for the breeders' samples were lower than those reported by Soliman (2005) and Hamad and Baiomy (2010), higher than those reported by Prasad et al. (2018) and Al-Fayad (2022), and similar to those reported by Kanwal et al., (2004). The results for the market samples were lower than those reported by Prasad et al. (2018) and Al-Fayad (2022) and consistent with those reported by Kamel et al., (2011).

Moisture:

The results for the breeders' samples were higher than those reported by Soliman (2005) and lower than those reported by Al-Fartousi and Al-Moussawi (2017) and Prasad et al. (2018). The results for the market samples were higher than those reported by Al-Fartousi and Al-Moussawi (2017) and Prasad et al., (2018). The higher moisture content in the market samples may be attributed to the lower total solids content due to the partial skimming of fat and the addition of water. The results of this study are consistent with those of Kamel et al., (2011), Eman et al., (2015), and Barham et al., (2018).

Ash:

The results for the breeders' samples were lower than those reported by Soliman (2005) and Hamad and Baiomy (2010) and higher than those reported by Kanwal et al., (2002) and Kanwal et al., (2004). The results for the market samples were lower than those reported by Al-Fartousi and Al-Moussawi (2017) and higher than those reported by Kanwal et al., (2002) and Kanwal et al., (2004). This study's results are inconsistent with those of Kamel et al., (2011).

International Journal of Agriculture and Animal Production
ISSN: 2799-0907
Vol: 04, No. 06, Oct-Nov 2024
http://journal.hmjournals.com/index.php/IJAAP
DOI: https://doi.org/10.55529/ijaap.46.56.62

Density:
The results for the breeders' samples were lower than those reported by Abdullah et al. (2018) and higher than those reported by Kanwal et al. (2004), Sabry (2006), and Abdel-Sabour (2007). The results for the market samples were lower than those reported by Abdel-Hameid (2002) and Sabry (2006), and higher than those reported by Kanwal et al., (2004) and slightly higher than those reported by Al-Fartousi and Al-Moussawi (2017). The lower density of raw buffalo milk in the market samples may be attributed to milk adulteration by adding water (Eman et al., 2011).
The results of this study are consistent with those of Kamel et al., (2011) and Eman et al., (2015).

Table 2: Mean (± Standard Error) of Total Solids, Moisture, Ash, and Density in Raw Buffalo Milk Samples from Local Markets and Breeders' Fields

Milk Sources	Views No.	Total solids%	Water%	Ash %	Density
Market samples	50	9.76^{b}±0.251	90.22^{a}±0.256	0.49^{b}±0.016	24.42^{b}±0.745
Breeders' samples	50	14.01^{a}±0.312	85.98^{b}±0.312	0.62^{a}±0.014	31.33^{a}±0.590

Different letters within one column indicate a significant difference ($p<0.05$)

5. CONCLUSIONS

It is concluded from the study that raw buffalo milk samples taken directly from the breeders fields were significantly superior in milk component ratios and density, while market milk samples were significantly superior in water percentage.Milk samples taken from the markets were adulterated by one or more means of adulteration.

6. REFERENCES

1. Abdel-Hameid, K., G. (2002). Studies on the sanitary condition of raw milk in Qena Governorate. M.V.Sc., Thesis, Fac. Vet. Med., Assiut, Univ., Egypt.
2. Abdel-Sabour, R.O. (2007). Detection of Milk Adulteration In Assiut Governorate, M.V.Sc., Thesis, Fac. Vet. Med., Assiut, Univ., Egypt.
3. Abdullah,Q.S.A.(2018).Effects of Changes on some Chemical Characteristics and Physical Properties for The Milk of(Cows, Sheep, Goats, Buffalos, Camels) By Application of EKo-milk Total in The City of Kirkuk/Iraq.J of Kirkuk University for Agricultural Sciences.Vol (9).No(2).
4. AL-Fartosi,K.G.;AL-Moussawi,N.H.H.(2017).The effect of the sex of birth on the physical and chemical characteristics of buffal milk in the marshes of southern Iraq. Journal of College of Education for Pur Sciences,7(1):11.
5. Al-Fayad, M. AbdulwahidJaber.(2022). Evaluation of Different Chemical and Physical Components of Milk in Cows, Buffalos, Sheep, and Goats Archives of Razi Institute, Vol. 77, No. 1:451-455.

International Journal of Agriculture and Animal Production
ISSN: 2799-0907
Vol: 04, No. 06, Oct-Nov 2024
http://journal.hmjournals.com/index.php/IJAAP
DOI: https://doi.org/10.55529/ijaap.46.56.62

6. AL-Fayad,Muayad.A.J.;Shareef.H.M.(2022).The effect of Parity and Calf gender on milk yield and Composition of buffalo, Bubalusbubalis, inhabiting southern Iraqi Wetlands.Int. J. Aquat.Biol.10(1):74-77.
7. Al-Qudsi, N. H., & Elia, J. Victor. (2010). Milk cattle production. Department of Livestock, College of Agriculture, University of Baghdad.
8. Aspilcueta- Borquis. R.R, Dipalo. R, Araujo Neto.F.R, Baldi.F, decamargo. GMF,deAlbuquerque.L.G, Zicarelli. L. and Tonhati.H. (2010).Genetic parameter estimates for buffalo milk yield, milk quality, and mozzarella production, as well as Bayesian inference analysis of their relationships. Genetic and Molecular Research 9(3): 1636-1644.
9. Borghese, A. and Moioli, B.(2002). Buffalo husbandry, Mediterranean Region. In: Hubert, R.(ed.) Encyl. Of Dairy Sciences. Oxford: Elsevier.
10. Braham,G.S.;Khaskheli,M.;Soomro,A.A.;Nizamani,Z.A.;Shoh,A.H.;Kaskheli.G.B.(2018).Frequent Supply of Adulterated Milk at Southern Zone of Sindh, Pakistan. J Dairy.Res Tech 1:002.
11. Branciari,R.;Nijim,,I.J.;Pls,M.E.;DiAntonio,E. and Lenstra,J.A.(2000). Species origin in Italian Mozzarella Cheese and Greek Feta Cheese.J. Food Production.36:406-411.
12. Eman MS, Abd-Alla AA, Elaref MY .(2015). Detection of raw buffalo's milk adulteration in Sohag governorate. Assiut Vet Med J 61: 38-45.
13. Hamad M, Baiomy A.(2010). Physical properties and chemical Composition of cow's and buffalo's milk in Qena governorate. J Food Dairy Sci. 1(7):397-403.
14. Harding, F. (1995). Milk Quality. 1st Ed. Blackie Academic and Professional; Chapman and Hall, New York, London, Tokyo, Madras.
15. Ibrahim, S., Muhammad, J., Ahmed, M. (2005). The final estimate for the animal products marketing project, Academy of Scientific and Technological Research.
16. Javaid S, Gadahi J, Khaskeli M, Bhutto M, Kumbher S, Panhwar A.(2009). Physical and chemical quality of market milk sold at Tandojam, Pakistan. Pak Vet J.;29(1):27-31.
17. Kamael,Dalia.G.;Gomah,Nanis.H.;Hasan,A.I.(2011).Comparative Study on Chemical Composition and Minerals Content of Buffaluo Milk in Assiut City. AssiutJ.of Agric.Sci.,42.No.(4)(1-12).
18. Kanwal R, Ahmed T, Mirza B.(2004). Comparative analysis of quality of milk collected from buffalo, cow, goat and sheep of Rawalpindi/Islamabad region in Pakistan. Asian J Plant Sci. 3(3):300-5.
19. Kanwal, R., T. Ahmed, I.H. Athar and B. Mizza .(2002).Comparative analysis of quality of milk collected from Rawolpindi / Islamabad-region. Pak. J. Food Sci., 12:2933.
20. Neumann C, Harris DM, Rogers LM .(2002). Contribution of animal sourcefoods in improving diet quality and function in children in the developingworld. Nutr Res 22: 193-220.
21. Prasad,N.;Shukla,S.;Ramteke,P.W.(2018).Physico-Chemical Properties of Milk and Dairy Products collected from Allahabad city, India.Int.J.Curr.Microbiol.APP.Sci.Vol 7. N 7.
22. Sabry, Y.M. (2006). Sanitary Improvement of Serving Milk And Dairy Products In AssiutUniv, Hospital, Ph.D., Thesis, Fac. Vet. Med., Assiut., Univ., Egypt.

International Journal of Agriculture and Animal Production
ISSN: 2799-0907
Vol: 04, No. 06, Oct-Nov 2024
http://journal.hmjournals.com/index.php/IJAAP
DOI: https://doi.org/10.55529/ijaap.46.56.62

23. Soliman GZ.(2005). Comparison of chemical and mineral content of milk from human, cow, buffalo, camel and goat in Egypt. Egypt J Hosp Med. 21(1):116-30.
24. SPSS.(2006) .Statistical Packages of Social Sciences. Version is.USA.
25. Zicarelli. L .(2004). Buffalo milk: its properties, dairy yield and mozzarella production. Vet. Res. Commun (suppl 1)28:127-135.
26. Soomro,A.A.,Khaskheli,M.,Memon,M.A.,Barham,G.S..UL-Haq,I..Fazlani,S.N.,Al-Ikhan,I.,Lochi,G.M.,and Soomro,R.N.(2014).Study on Adulteration and composition of milk sold at Badin.Impact Journals.V(2),N(9),57-70.
27. Mahmoud,A.A.,and Mansor,K.,W.(1992).Practical dairy principles.Faculty of Agriculture.University of Basra.
28. Barham,G.S.,Khaskheli,M.Soomro,A.H.,and Nizamani,Z.A.(2015).Surveillance of milk adulteration and its impact on physical characteristics of milk.Advance in Biochemistry and Biotechnology.V(1).N(1).
29. Al-Diab,D., and Zayoud,F.(2018).Detection of adulteration with urea in some local milk products.Tishreen University Journal for Research and Scientific Studies-Health Sciences,V(40).N(5).