A Comparative Analysis of Shop-Bought and Home-Produced Milk in Different Region of Swat valley

*Talha Haroon[1] **, Niaz Ali Khan[1], Shaheer Hamid[3], Fawad Khan[1], Hussain Jawad Khan[1], Jawad Anwar[2*], Iftikhar Aziz[1], Suliman khan[1], Malak Abrar[1], Mehboob Ali[1] and Nasir khan[4]*
[1]*Department of Food science and technology, The University of Agriculture Swat*
[2]*Department of Agricultural chemistry and Biochemistry, The University of Agriculture Swat*
[3]*Department of Food science and technology, the University of Agriculture Peshawar*
[4]*Department of Food science and technology, Agriculture research institute, Mingora, swat*

Corresponding Authors email: *Jawad Anwar* and *Talha Haroon*: dr.jawad@auos.edu.pk , talhaharoon9818@gmail.com

Abstract: Milk, a white liquid obtained from mammals like cows, buffaloes, or goats, is widely consumed and used in the production of cheese and yogurt. Rich in calcium, vitamin D, and essential proteins, milk plays a crucial role in bone health, development, and overall body maintenance. This study delves into the quality of milk sourced from three locations—Matta, Bahrain, and Khwaza Khela—by sampling from both commercial establishments and home environments. A detailed analysis of parameters including Fat, Solid Not Fat, Density, Lactose, Salts, Protein, Added Water, Temperature Sample, freeze point, and Conductivity reveals significant variations, particularly in Added Water content. Home milk consistently shows 0.0% added water, while store-bought milk exhibits differences. In Tehsil Matta, shop-bought milk contains 17.77% added water, compared to 05.74% in Tehsil Bahrain and 32.03% in Tehsil Khwaza Khela. These variations, notably in water content, may impact other parameters such as fats. For instance, home milk in Tehsil Matta has a fat content of 10.23%, contrasting with 03.18% in shop-bought milk. Similar disparities are observed in Tehsil Bahrain and Khwaza Khela. This emphasizes the significance of considering the source of milk, urging consumers to be aware of these distinctions when making informed choices about their milk purchases. The study, through a comparative analysis of shop-bought and home-produced milk characteristics, provides valuable insights into potential variations in milk quality, influencing factors in consumer choices, and health considerations.

Key words: Milk, Water and Swat.

INTRODUCTION

Milk is a complex mixture consisting of an oil-in-water type emulsion which is stabilized by phospholipids and proteins that are absorbed on the surface of fat globule. In addition, it contains

protein in colloidal dispersions, lactose, numerous minerals, particularly calcium and phosphorous, fat soluble and water-soluble vitamins, enzymes and various organic compounds. (Louis *et al*., 1970). Buffalo milk is a valuable source of nutrients with high content of milk protein, lipids, vitamins, and other biologically active substances (Mikailoglu *et al*., 2005).

Milk is an important source of nutrient required for growth in infants and children and for maintenance of health in adults. Milk is a perfect food, readily digested and absorbed. It is the sole natural food for infants and children. It is chiefly a valuable source of good quality protein, fat, carbohydrates, vitamins, and minerals. Protein in diet supplies the amino acids required for growth of infants and children. It is also required for maintenance of tissues in adults. Milk is the characteristics secretion of mammary glands of all mammals. Milk plays a tremendous role in building a healthy society and can be used as vehicle for rural development, employment and slowing down the migration of the rural population (Sarwar *et al*., 2002).

Milk is a complex mixture of all the essential components in a nearly balanced form. This makes milk significant for human consumption as a complete food supplement in various parts of the world which is obtained from different animal species such as goats, cows, buffaloes, and camels. It is estimated that 85% of all milk worldwide is produced from cows, about 11% by buffaloes, 2% by goats, 1.4% by sheep and 0.2% by camels. So, cow's milk dominates commercial production worldwide (FAO, 2011).

In the year 2009-2010, Pakistan produced 43,562 million tons of milk; of which 62.04% was contributed by buffaloes, 34.39% by cows, 1.65% by goats, 0.08% by sheep and 1.83% by camels (Mahmood, 2010). Buffalo is the most valuable animal and is highly liked by the people of sub-continent. Buffalo milk is preferred more than cow milk (Bilal *et al*., 2006).

Cows have contributed greatly to human welfare supplying draft power, milk, meat, hides, fuel and a variety of other products (Hodgson, 1979). Cow 's milk has long been considered a highly nutritious and valuable human food and is consumed by millions daily in a variety of products (Heeschen, 1994).

Milk proteins are heterogeneous mixtures which consist of casein and whey protein as the basis, enzymes, and minor amounts of non-protein nitrogen containing compounds. 73% of protein is casein and 8% of its whey protein (Fox and McWeeney, 2003). Because of the essential amino acid content, milk protein is known as high quality protein and is used as standard for estimation of protein quality in foods (Davoodi 2016).

Based on needs from the diet for nitrogen balance or growth, amino acids were traditionally classified as nutritionally essential (indispensable) or non-essential (dispensable) for humans and animals. Essential amino acids for humans are Arginine, Histidine, Isoleucine, Leucine, Lysine, Methionine, Phenylalanine, Threonine, Tryptophan and Valine. Non-essential amino acids for humans are Alanine, Asparagine, Aspartate, Cysteine, Glutamate, Glutamine, Glycine, Proline, Serine, Taurine and Tyrosine (Guoyao, 2009).

Lactose, which is the fundament carbohydrate of milk forms 4, 7% of milk and 54% of milk-solids-non-fat (McCance and Widdowson, 1988). Its concentration represents a balance between the high nutrient requirements of the infant and the constraints of carbohydrate concentration in milk due to osmolarity. Most milk contains small amounts of glucose and galactose, the biosynthetic precursors of lactose. The oligosaccharide content varies greatly among species, and within human populations oligosaccharides also manifest great heterogeneity both qualitatively and quantitatively (Jensen, 1995).

Lipids, which influence milk appearance, taste, flavor and resistance, are a source of energy, essential fatty acids and fat-soluble vitamins. Milk contains triglycerides (between 97-98%), phospholipids (between 0.2-1.0 %), free sterols (between 0.22- 0.41%) such as cholesterol, waxes, etc., fat soluble vitamins [A, D, E, K] and more than 400 free fatty acid derivatives (Gehardt and Thomas 2006). Although milk fat contains 5% saturated fatty acids, it is important in terms of health for the positive events in chronic diseases since contains conjugated linoleic acid, sifingomiyelin, butyric acid and myristic acid (Ebringer *et al*. 2008).

Milk contains all the fat-soluble vitamins which are A, D, E, K and water-soluble vitamins which are ascorbic acid and the B family (thiamine, riboflavin, niacin, pantothenic acid, pyridoxine, folacin, biotin, choline, inositol, and vitamin B12). They are essential to human nutrition and health. Although it is a poor source of ascorbic acid (vitamin C), milk is one of the richest food sources of all vitamins (Louis, 1970).

Milk contains all the 14 essential minerals which are major group-calcium, phosphorus, potassium, magnesium, sulfur, sodium, and chlorine: microgroup-iron, copper, cobalt, manganese, iodine, zinc, and fluorine. Milk and dairy products are an excellent source of calcium and a good source of phos-phorus that are the two major tooth-and-bone-building elements but are a poor source of iron and a variable source of iodine (Louis, 1970).

MATERIALS AND METHODS

The research investigation took place at the University of Agriculture Swat, and the specimens underwent processing at the Kp Food Safety & Halal Food Authority Swat.

Sample collection:

A total of six milk samples, each measuring 25 ml, were collected from milk points (home & shop) in sterilized bottles in November 2023. These samples were then transported to the Kp Food Safety & Halal Food Authority Swat.

Sample processing:

The samples were either processed on the same day as collection or stored at 0°C in the event of any delay.

Milk Composition Analysis:

Milk samples collected from milk points underwent analysis using the Lactoscane machine (auto analyzer), using standard protocol. This process determined the percentages of milk Fat, Solid Not Fat, Density, Lactose, Salts, Protein, Added Water, Temp. Sample, Freeze. Point & Conductivity at the Kp Food Safety & Halal Food Authority Swat.

Machine Operation:

Milk samples were loaded into the Lactoscane machine as per the machine's capacity (25ml). The parameter analysis for each sample was analyzed separately.

Data Recording:

Results obtained from the Lactoscane machine for each milk sample was recorded documentation of values for milk fats, Solid Not Fat, Density, lactose. Salts, Protein, Added Water, Temp. Sample, Freeze. Point & Conductivity was ensured.

RESULTS AND DISCUSSION

The research was conducted at the University of Agriculture Swat, and the specimens were processed at the Kp Food Safety & Halal Food Authority Swat.

Sample ware collected from three different location (matta, bahrain & khwaza khela). The Milk samples obtained from milk collection points (Shop and Home) were subjected to analysis using the Lactoscane machine, an auto analyzer, in accordance with the established standard protocols. Results obtained are discussed below:

Table 1: **Milk Composition of Home and Shop obtained from Tehsil Matta**

PERAMETRS	BUFFALO (HOME MILK)	BUFFALO (SHOP MILK)
Fat	10.23 %	03.18 %
Solid not fat	09.42 %	07.10 %
Density	23.96	23.05
Lactose	05.19 %	03.90 %
Salts	00.81 %	00.59 %
Protien	03.46 %	02.61 %
Added water	00.00 %	17.77 %
Tempratre sample	24.55	21.5
Freez. Point	-0.696	-0.444
Conductivity	03.36	03.93

Table 1 presents data on milk composition of home and shop collected from Tehsil Matta. The fat content in home milk from Tehsil Matta was measured as 10.23%, while shop milk in the same region exhibited a fat content of 3.18% while 7.38 % was reported in the milk of buffalo according to FAO, 1992. Data on solids not fats (SNF) revealed values of 9.42% for home milk and 7.10% for shop milk. The density of home milk was recorded as 23.96, whereas shop milk had a density of 23.05. Lactose content in home milk was found to be 5.19%, compared to 3.90% in shop milk whereas lactose content in the milk of buffalo reported by FAO, 1992 was 5.48. Salt content was registered at 0.81% for home milk and 0.59% for shop milk. Protein constituted 3.46% of the composition in home milk, while in shop milk, it was 2.61%. As compared to protein found in milk of buffalo reported in 1992 by FAO which was 3.60. A crucial parameter, added water, was not found in home milk (0.0%), but shop milk showed a presence of 17.77% added water. Additional parameters, such as temperature, sample freeze point, and conductivity, were also examined. The temperature of the home milk sample was recorded at 24.5, whereas shop milk had a temperature of 21.5. The freeze point of home milk was -0.696, and shop milk had a freeze point of -0.444. The conductivity of home milk was 3.36, while shop milk exhibited a conductivity of 3.93.

Table 2: **Milk Composition of Home and Shop obtained from Tehsil Bahrain**

PERAMETRS	BUFFALO (HOME MILK)	BUFFALO (SHOP MILK)
Fat	07.32 %	03.36 %
Solid not fat	10.16 %	08.04 %
Density	29.92	26.35
Lactose	05.58 %	04.41 %
Salts	00.86 %	00.67 %
Protien	03.73 %	02.95 %
Added water	00.00 %	05.74 %
Temprature sample	24.4	25.4
Freez. Point	-0.727	-0.509
Conductivity	03.43	04.49

Table 2 displays comprehensive data on milk composition of home and shop collected from Tehsil Bahrain. In Tehsil Bahrain, the fat content in home milk was determined to be 7.32%, whereas shop milk in the same region exhibited a fat content of 3.36%. The data regarding solids not fats (SNF) disclosed values of 10.16% for home milk and 8.04% for shop milk. Home milk recorded a density of 29.92, while shop milk's density was 25.35. Lactose content in home milk measured as 5.58%, contrasting with the 4.41% found in shop milk. Salt content was documented at 0.86% for home milk and 0.67% for shop milk. Protein made a composition of 3.73% in home milk, whereas in shop milk, it constituted 2.95%. The presence of added water was 0% in home milk, while shop milk exhibited a substantial presence of 5.74% added water. The temperature of the home milk sample was recorded at 24.4, whereas shop milk had a temperature of 25.4. The freeze point of home milk was -0.727, and shop milk had a freeze point of -0.509. The conductivity of home milk measured 3.43, while shop milk exhibited a conductivity of 4.49.

Table 3: **Milk Composition of Home and Shop obtained from Tehsil Khwaza Khela**

PERAMETRS	BUFFALO (HOME MILK)	BUFFALO (SHOP MILK)
Fat	07.55 %	03.48%
Solid not fat	09.17 %	05.91%
Density	25.97	18.27
Lactose	05.04%	03.25%
Salts	00.78%	00.49%
Protein	03.37%	02.17%
Added water	00.00%	32.03%
Temperature sample	25.9	25.6
Freez. Point	-0.652	-0.367
Conductivity	04.47	03.16

Table 3 provides a comprehensive overview of milk composition of home and shop collected from Tehsil Khwaza Khela. In this region, home milk displayed a fat content of 7.55%, contrasting with the 3.48% fat content observed in shop milk. Solids not fats (SNF) in home milk were measured at 9.17%, while shop milk showed a value of 5.91%. The density of home milk was recorded as 25.97, while shop milk had a density of 18.27.

Lactose content in home milk was 5.04%, compared to the 3.25% found in shop milk. Salt content was documented as 0.78% for home milk and 0.49% for shop milk. Protein constituted 3.37% in home milk, whereas in shop milk, it comprised 2.17%. Notably, home milk had no added water (0.0%), while shop milk showed a significant presence of 32.03% added water.

Temperature measurements revealed that the home milk sample was recorded at 25.9, whereas shop milk had a temperature of 25.6. The freeze point of home milk was -0.652, while shop milk had a freeze point of -0.367. The conductivity of home milk measured 4.47, while shop milk exhibited a conductivity of 3.16.

Table 4: Overall Comparison of Milk composition Obtained from Three Different Tehsil of Swat

PERAMETRS	Matta		Bahrain		Khwaza Khela	
	Buffalo-HOME MILK	Buffalo-SHOP MILK	Buffalo-HOME MILK	Buffalo-SHOP MILK	Buffalo-HOME MILK	Buffalo-SHOP MILK
Fat	10.23 %	03.18 %	07.32 %	03.36 %	07.55%	03.48%
Solid not fat	09.42 %	07.10 %	10.16 %	08.04 %	09.17%	05.91%
Density	23.96	23.05	29.92	26.35	25.97	18.27
Lactose	05.19 %	03.90 %	05.58 %	04.41 %	05.04 %	03.25%
Salts	00.81 %	00.59 %	00.86 %	00.67 %	00.78%	00.49%
Protien	03.46 %	02.61 %	03.73 %	02.95 %	03.37%	02.17%
Added water	00.00 %	17.77 %	00.00 %	05.74 %	00.00%	32.03%
Temp. Sample	24.55	21.5	24.4	25.4	25.9	25.6
Freez. Point	-0.696	-0.444	-0.727	-0.509	-0.652	-0.367
Conductivity	03.36	03.93	03.43	04.49	04.47	03.16

Table 4 represents the comparative study of three different Tehsils of Swat for milk composition. Higher fat content was found in home milk (10.23%) of tehsil matta, followed by Tehsil Khwaza Khela (7.55%) and Bahrain (7.32%). Higher fat content was found in shop milk (03.48%) of tehsil Khwaza Khela followed by Tehsil Bahrain (03.36 %) and Matta (03.18 %). Higher Solids Not Fats (SNF) content was found in home milk (10.16%) of Tehsil Bahrain, followed by tehsil Matta (9.42%) and Tehsil Khwaza Khela (09.17 %) Higher Solids Not Fats (SNF) content was found in shop milk (08.04 %) of tehsil Bahrain followed by Tehsil Matta (07.10 %) and Khwaza Khela (05.91%). Higher Density content was found in home milk (29.92) of tehsil Bahrain, followed by Tehsil Khwaza Khela (25.97) and matta (23.96). Higher Density content was found in shop milk (26.35) of tehsil Bahrain followed by Tehsil Matta (23.05) and Khwaza Khela (18.27). Higher Lactose content was found in home milk (05.58 %). of tehsil Bahrain, followed by Tehsil matta (05.19%) and Khwaza Khela (05.04%). Higher Lactose content was found in shop milk (04.41%) of tehsil Bahrain followed by Tehsil Matta (03.90%) and Khwaza Khela (03.25%). Higher Salt content was found in home milk (00.86%). of tehsil Bahrain, followed by Tehsil matta (00.81%)

and Khwaza Khela (00.78%). Higher Salt content was found in shop milk (00.67%) of tehsil Bahrain followed by Tehsil Matta (00.59%) and Khwaza Khela (00.49%). Higher Protein content was found in home milk (03.73%) of tehsil Bahrain, followed by Tehsil and matta (03.46%) Khwaza Khela (03.37%). Higher Protein content was found in shop milk (03.73 %) of tehsil Bahrain followed by Tehsil Matta (02.61%) and Khwaza Khela (02.17%). Added Water content was not found in home milk (00.00%) of any region, but in shop milk the Higher Added Water content was found in Khwaza Khela (32.03%) followed by Tehsil Matta (17.77%) and in tehsil Bahrain (05.74%). temperature variations ware found Tehsil Khwaza Khela had the highest recorded temperatures for both home and shop milk. Followed by Tehsil Bahrain & Matta. Freeze points vary, with Tehsil Bahrain generally having lower freeze points compared to Tehsil Matta and Tehsil Khwaza Khela. Conductivity levels vary across regions, with Tehsil Khwaza Khela: Home milk having the highest conductivity.

In summary, there are significant variations in milk composition among the three regions, indicating potential regional influences on milk quality and processing.

Conclusion: Home milk, with its controlled environment and absence of additives, emerges as a healthier and more reliable choice compared to store-bought milk. The emphasis on purity in home milk production addresses concerns about potential adulteration and ensures a transparent supply chain.

Recommendation: Opting for home milk is highly recommended for its unparalleled quality and origin assurance. The commitment to purity makes it a preferable and safer option for consumers seeking the highest quality in their daily dairy consumption.

Acknowledgement

The authors express their sincere gratitude to Nasir Khan, (SRO) at Department of FST in ARI Swat, The University of Agriculture Swat, for generously providing the necessary resources and facilities essential for the successful execution of this experiment.

References

Bilal, M.Q., M. Suleman and A. Raziq, 2006. Buffalo: Black gold of Pakistan. *Livestock Research for Rural Development*, 18(9).

Davoodi S.H., R. Shahbazi, S.Esmaeili, S. Sohrabvandi, A.M. Mortazavian, S.Jazayeri, A. Taslimi. 2016. Health-Related Aspects of Milk Proteins. Iran J Pharm Res. 15(3): 573–591.

Ebringer, M., J. Ferencik, A. Krajcovic, 2008 "Beneficial Health Effects of Milk and Fermented Dairy Products", *Folia Microbiology*, 53(5):378 – 394,

Food and Agriculture Organization (FAO), 1992. Small-Scale Food Processing - A Guide for Appropriate Equipment, Intermediate Technology Publications,

Fox, P.F., P.L.H. McWeeney, 2003 Advanced Dairy Chemistry, Springer Verlag, *New York.* 1(3):237-245

Gehardt, SE. RG. Thomas, 2006. Nutritive Value of Foods. *United States Department of Agriculture (USDA).* Agricultural Research Service Home and Garden Bulletin, Number 72.

Guoyao, Wu. 2009 "Amino Acids: Metabolism, Functions and Nutrition", *SpringerLink.* 37(1):1-17,

Hodgson, H.J., 1979. Role of the dairy cow in world food production. *J. Dairy Sci*., 62: 343-351.

Heeschen, W.H., 1994. Introduction. In: Monograph on the significance of pathogenic microorganisms in raw milk. *International Dairy Federation, Brussels*, pp: 8-11.

Jensen, R.G., 1995 Handbook of Milk, *Academic Press*, eBook,

Louis, L., H. Rusoff, 1970 "Milk: Its Nutritional Value at a Low Cost for People of All Ages*", Journal of Dairy Science,* 5 (9):1296-1302,

Mahmood, A., S. Usman. 2010. A Comparative Study on the Physicochemical Parameters of Milk Samples Collected from Buffalo, Cow, Goat and Sheep of Gujrat, Pakistan. *Pakistan Journal of Nutrition.* 9(12): 1192-1197.

Mikailoglu, A.M., I.T. Bayramoglu and A.O. Velioglu, 2005. Amino acid ingredient of milk azeri buffalo. *YYU Vet. Fak Derg*., 16: 103-104

McCance, R.A., E.M. Widdowson, 1988. The Composition of Foods, *Elsevier/North-Holland Biomedical Press, London.,* 12(88)-98

Sarwar, M., M.A. Khan, and Z.I. Mahr-Un-Nisa, 2002. Dairy industry in Pakistan: A Scenario. *Int. J. Agric. Biol*., 4: 420-428.