American-Eurasian J. Agric. & Environ. Sci., 19 (4): 263-270 2019
ISSN 1818-6769

DOI: 10.5829/idosi.aejaes.2019.263.270

Comparative Evaluation of Vitamin and Lactose Content of Milk Obtained from Selected Domestic Animals

[1]Stanley Chijioke Eluu, [1]Augustine Okpani Oko, [2]Ngele Kalu Kalu, [3]Uchendu Iheanacho Odo and [4]Oluwole Akinjide Omoniyi

[1]Department of Biotechnology, Faculty of Science,
Ebonyi State University, Abakaliki, Nigeria
[2]Biology, Microbiology, Biotechnology, Federal University,
Ndufu-Alike, Ikwo, Abakaliki, Nigeria
[3]Department of Pharmaceutical Microbiology and Biotechnology,
Nnamdi Azikiwe University, Nigeria
[4]Department of Materials Science and Engineering,
African University of Science and Technology Abuja, Nigeria

Abstract: To evaluate the vitamins and lactose content of milk obtained from selected ranched and unranched domestic animals from Abakaliki and Ugeb; 12 lactating animal breeds comprising 3 white Fulani Cow breed, 3 red Sokoto Goat, 3 Hausa sheep and3 pigs were used. Samples were collected before morning grazing. Representative samples of milk obtained from each breeds were bulked separated and analyzed for proximate composition ofvitamins and lactose using the method reported by AOAC. .The result shows that the vitamin A level was significantly higher in sheep (21.30 ± 1.83 unit of measurement??) but lowest in pig (5.45 ± 0.49); vitamin B_1 level was higher in cow: 16.50 ± 0.00, but lowest in pig: 2.85 ± 0.07unit of measurement??); vitamin E level was found to be higher in cow: 5.40 ± 1.55 but lower in pig: 0.40 ± 0.00unit of measurement??); vitamin C level was higher in cow: 6.07 ± 0.007 but lower in goat: 3.34 ± 0.00unit of measurement??) and vitamin D was found to be higher in goat. Also, lactose level was significantly higher in cow: 3.62 ± 0.71 but lower in pig: 1.56 ± 0.07unit of measurement??). The vitamins and lactose contents of unranched cow were significantly higher than that of the ranched cow. Vitamins A, B_1 and E were higher in unranched goat while vitamin C was higher in ranched goat but no significant difference whereas lactose was equal in both. Vitamin A and E were only higher in unranched sheep whereas B and C were higher in ranched sheep while lactose was found to be the same. Although the unranched cow was found to have better vitamins, it can be suggested that combination of milk from different unranched animals could give a better nutritional value.

Key words: Comparative · Evaluation · Vitamin · Lactose · Milk · Domestic animals

INTRODUCTION

Milk is a white fluid secreted by the mammary glands of female mammals for the nourishment of their young that consists of minute globules of fat suspended in a solution of casein, albumin, milk sugar and inorganic salts [1]. Milk and dairy products are part of a healthy diet. The composition of the milk of various animal species differs, but in every case it has a high priority in human nutrition. In most countries, the principal source of milk is the cow, but other animals such as sheep, goats, buffaloes, camel, pig and yak are also raised for milk production, particularly in the tropics. Nevertheless, the dairy cow produces more milk over longer periods than other animals [2].

All milk contains the same kind of constituents but in varying amount. Within a given species, genetic factors (breed), type of feed, nutritional status of the animal, stage of lactation, milking, environmental conditions and storage (mode of preservation) influence the composition

Corresponding Author: Stanley Chijioke Eluu, Department of Biotechnology,
Faculty of Science, Ebonyi State University, Abakaliki, Nigeria.

[3]. The major components of milk include water, fats, proteins, carbohydrates, minerals, organic acids, enzymes and vitamins. The quality of milk samples including infant formulas, milk powder, raw (unprocessed) milk, human milk and animal milk from various countries have been extensively studied [4]. The nutritional value of milk is particularly high due to the balance of the nutrients that compose it. Therefore, it must furnish all nutritive requirements for maintenance and growth, such as energy, amino acids, minerals and vitamins. The biological function of milk is to supply nutrition and immunological protection to the young mammal. The composition varies among animal species and breeds within the same species and also from one dairy to the other, depending on the period of lactation and diet. Organic substances are present in about equal quantity and are divided into elements builders, proteins and energy components, carbohydrates and lipids.

Milk furnishes all nutritive requirements for maintenance and growth, such as energy, amino acids, minerals and vitamins. The biological function of milk is to supply nutrition and immunological protection to the young mammal. The composition varies among animal species and breeds within the same species and also from one dairy to the other, depending on the period of lactation and diet.

A cup of hot sheep milk before retiring to bed aids a peaceful night rest [5]. This has been shown to be particularly beneficial for children and elderly people with a bedwetting problem [6]. Jandal[7] recommended a change to sheep and goat milk product to aid the treatment of asthma, eczema and other related problems. Milk is reported to be the antidote to aluminum poisoning from consumption of large amounts of tea and coffee. Milk can provide a non-immune disease defense and control of microbial infections. Human milk provides protection against infection, sudden infant death syndrome, diabetes and chronic digestive diseases (America Academy of Pediatrics, 2014). The level of water, fats, proteins, carbohydrates, minerals, organic acids, enzymes and vitamins in milk have many significant differences in their compositions from the milk of other mammalian species, especially in relative proportions of the various milk proteins and fats and in their genetic polymorphisms [8].

Milk is a valuable source of vitamins, both water-soluble and fat-soluble ones. Goat and sheep milk are characterized by higher vitamin A concentration in comparison with cow milk [9]. The entire β-carotene in milk from goats and sheep is converted into retinol, resulting in the white color of that milk. Goat milk is a good source of vitamin A, niacin, thiamin, riboflavin and pantothenic acid. However, it has low concentration of vitamin B12 and folic acid. The lack of these two vitamins in human diet is said to result to anemia [10-12].

Milk allergy is an example of a relatively rare nutrition related problem that can be life threatening but is easily treated with modified diet. Consequently in the United States, the safety of commercially prepared infant formula is regulated by the Food Development Association on the recommendation of the America Academy of Pediatric Committee on nutrition, which specifies the levels of nutrients to be present in infant formula (America Academy of Pediatrics, 2014).

In Nigeria and Africa at large, people depend mainly on milk from cow leading to overlaboring of cow and these may lead to global shortage of milk in the future. Hence, there is need to determine the nutritional composition of milk from other animals. To evaluate the importance of ranching and unranching method of breeding of cow, goat, sheep and pig reared in Ugep and Abakaliki using standard methods.The aim of this work was to evaluate and compare the vitamin and lactose composition of milk from ranched and unranchedcow, goat, sheep and pig obtained from Ugeb and Abakaliki. To determine the vitamin composition of cow, goat, sheep and pig milk Lactose composition of the milk samples.

MATERIALS AND METHODS

Study Site: The present study was carried out in Abakaliki and Ugep. Abakaliki is the capital of Ebonyi State and is located in the Southeast part of Nigeria. It lays approximately within longitude 7°30[1] and 7°E and, latitude 5°40[1] and 6°45[1] N. Ugep, on the other hand, is a town in Cross River State, Southern Nigeria. It is the capital of Yakurr Local Government Area. The village is populated by the Yakurr people.

Herd Management: All the cows, sheep, pigs and goats used for this study were owned by pastoralists of different herds and were reared semi-intensively in a temporary settlement in both the study areasof Abakaliki and Ugeb. The cows were randomly selected from the experimental sites. Routine grazing was carried out twice daily (morning and night). They were fed on natural pasture comprising mainly guinea grass (*panicum maximum*) and other forages (Tridaxprocumbens, Eleusinespp and Asphilla Africana). Ranched hand-milking was done by the Fulani herdsmen on the farm between 06.00 am and 07.30 am on daily basis before morning grazing.

Sample Collection and Processing: Milk samples for constituent analysis were collected in hygienic conditions of the same herd milk from each cow, sheep, pig and goat breeds. Raw milk samples (0.25L) were collected from twelve (12) lactating animal breeds comprising three (3) white Fulani Cow breed, three (3) red Sokoto Goat, three (3) Hausa sheep and three pigs. Samples were collected before morning grazing. Representative samples of milk were obtained from each breeds were bulked separated and collected into clean, whiteplastic containers of 120mL. To avoid contamination, containers used for sample collection were sterilized using distilled water and finally dried ready for sample collection and each of the animals nipples were also sterilized by whipping the nipples with cotton soaked in diluted ethanol prior to milking. The samples were then transported to the laboratory in an ice-filled box for analysis.

The Milk samples after collection were taken to the Food Science and Technology Laboratory (FST) of University of Nigeria, Enugu, within 5-7 hrs. Each milk samples was analyzed for nutritional composition. The proximate composition of Vitamins and lactose were determined by using the method reported by Association of Analytical Chemistry (AOAC), 2010.

RESULTS

Vitamin and Lactose Composition of Milk Samples Collected from Unranched Experimental Animals: The result presented in below shows that the vitamin and lactose composition of milk samples from unranched sheep, goat, cow and pig. The result shows that the vitamin A level were 21.30 ± 1.83, 18.80 ± 0.63, 12.50 ± 2.82 and 5.45 ± 0.49; vitamin B_1 level were 16.40 ± 0.00, 9.60 ± 0.00, 16.50 ± 0.00 and 2.85 ± 0.07; vitamin E level were 0.60 ± 0.28, 0.90 ± 0.42, 5.40 ± 1.55 and 0.40 ± 0.00; vitamin C level were 3.34 ± 0.00, 4.00 ± 0.00, 6.07 ± 0.007 and 4.08 ± 0.007 in sheep, goat, cow and pig milk respectively. Also, lactose level were 2.03 ± 0.02, 1.90 ± 0.007, 3.62 ± 0.71 and 1.56 ± 0.007 in sheep, goat, cow and pig milk respectively.

Comparison of Vitamin D Composition of Milk Samples Collected Unanched Sheep, Goat, Cow and Pig: The result presented in figure 1 shows the vitamin D composition of milk samples collected from unranched sheep, goat, cow and pig. It shows that the vitamin level sheep, goat and cow were 12.80 ± 2.82, 58.05 ± 1.90 and 39.30 ± 2.12 for vitamin D respectively.

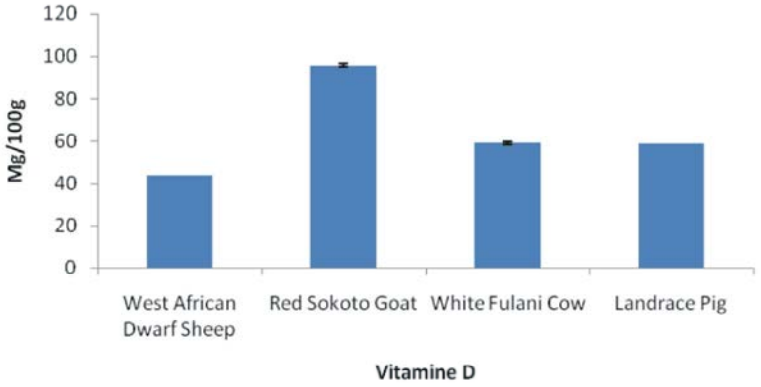

Fig. 1: Vitamin D composition of milk samples collected from sheep, goat, cow and pig

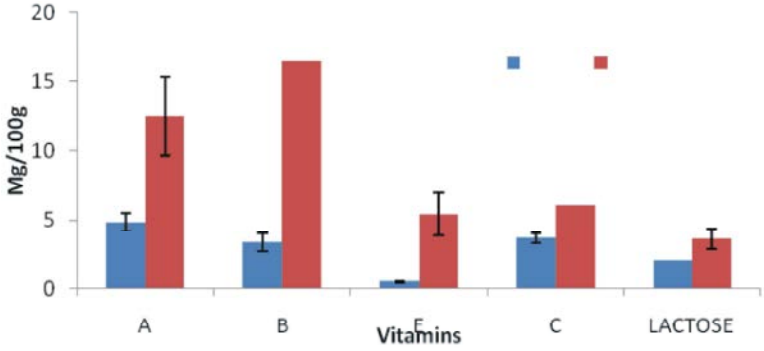

Fig. 2: Vitamin and lactose composition of milk samples collected from ranched and unranched Cow

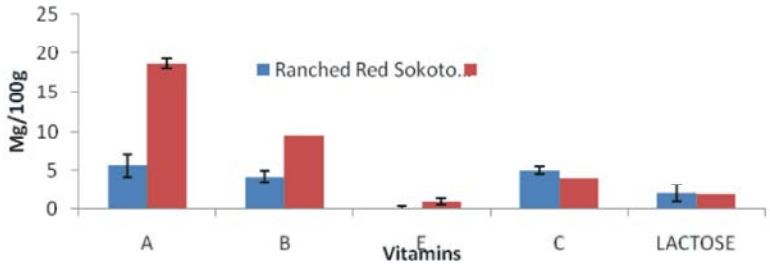

Fig. 3: Vitamin and lactose composition of milk samples collected from ranched and unranched goat

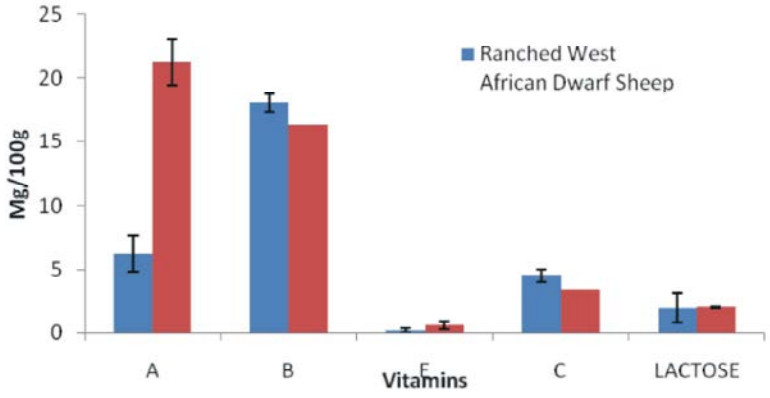

Fig. 4: Vitamin and lactose composition of milk samples collected from ranched and unranched sheep

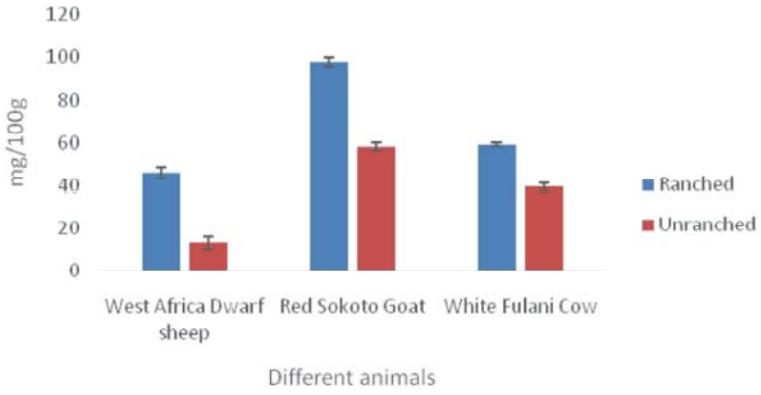

Fig. 5: Vitamin D composition of milk samples collected from ranched and unranched sheep, goat and cow.

Vitamin and Lactose Composition of Milk Samples Collected from Ranched and Unranched Cow: The result presented in Figure 2 shows the vitamin and lactose composition of milk samples from ranched and unranched cow. The result shows that the vitamin and lactose level for ranched cow were 4.85 ± 0.63, 3.35 ± 0.63, 0.45 ± 0.07, 3.67 ± 0.34 and 2.00 ± 0.007 for vitamin A, $B_{1,}$, E, C and lactose respectively while unranched cow were 12.50 ± 2.82, 16.50 ± 0.00, 5.4 ± 1.55, 6.06 ± 0.007 and 3.62 ± 0.71 for vitamin A, $B_{1,}$, E, C and lactose respectively.

Vitamin and Lactose Composition of Milk Samples Collected from Ranched and Unranched Goat: The result presented in Figure 3 shows the vitamin and lactose composition of milk samples collected from unranched and ranched goat. It shows that the vitamin and lactose level for ranched goat were 5.60 ± 1.41, 4.20 ± 0.70, 0.20 ± 0.14, 4.995 ± 0.48 and 2.01 ± 1.13 for vitamin A, $B_{1,}$ E, C and lactose respectively while unranched goat were 18.80 ± 0.63, 9.60 ± 0.00, 0.90 ± 0.42, 4.00 ± 0.00 and 1.90 ± 0.007 for vitamin A, $B_{1,}$ E, C and lactose respectively.

Vitamin and Lactose Composition of Milk Samples Collected from Ranched and Unanched Sheep: The result presented in Figure 4 shows the vitamin and lactose composition of milk samples collected from ranched and unranched sheep. It shows that the vitamin level for ranched sheep were 6.25 ± 0.63, 18.05 ± 20.43, 0.2 ± 0.14, 4.50 ± 1.55 and 2 ± 0.35 for vitamin A, $B_{1,}$, E, C and lactose respectively while unranched sheep were 21.30 ± 1.83, 16.4 ± 0.00, 0.60 ± 0.28, 3.34 ± 0.00 and 2.03 ± 0.02 for vitamin A, $B_{1,}$ E, C and lactose respectively.

Vitamin D Composition of Milk Samples Collected from Ranched and Unanched Sheep, Goat and Cow: The result presented in figure 5 shows the vitamin D composition of milk samples collected from ranched and unranched sheep, goat and cow. It shows that the vitamin level for ranched sheep, goat and cow were 46 ± 2.82, 97.90 ± 2.05 and 59.10 ± 0.70 for vitamin D respectively while unranched sheep, goat and cow were 12.80 ± 2.82, 58.05 ± 1.90 and 39.30 ± 2.12 for vitamin D respectively.

DISCUSSION

Milk has long been associated with good health, making it one of the most consumed beverages throughout the World [13]. Milk is a white liquid produced by the mammary glands of mammals. All mammals, including humans, normally produce milk to feed their offspring until they are ready for solid food. It contains valuable nutrients and it can offer a range of health benefits [14].

This research comparatively evaluated the vitamin and lactose composition in milk of sheep, goat, cow and pig as represented in figure 1. Vitamin A was seen to be higher in sheep followed by pig, goat and cow. The high concentration of vitamin A in milk of sheep observed in this study may be due to the high ability of sheep to convert all the carotenoids in their food into vitamin A. The result also, showed that goat milk had the highest concentration of vitamin B followed by sheep and pig. The concentration of vitamin C and D (Figure 1) was also seen to be higher in goat milk followed by pig, cow and sheep milk. The high concentration of vitamin C and D in goat milk may be due to the kind of nutrition the goat are exposed to and the environmental condition. Vitamin E concentration was seen to be significantly high in cow milk followed by pig and goat while sheep has lowest concentration of vitamin E.

The lactose composition was also seen to be significantly higher in cow followed by goat, sheep and less in pig; this may be due to specie difference, adaptation to the environmental condition or due to biochemical reactions such as lactose operon.

The result as represented in Figure 3 shows the vitamin and lactose composition in milk of ranched and unranched cow obtained from Ugeb and Abakaliki respectively, this results are in line with the work of Rennes (2005) who reported the percentage concentrations of vitamins in cow, he stated that the variation in the vitamin composition of cow may be due to the environment, health condition of the cow, the specie and the kind of nutrition they are exposed to. The unranched cow milk has highest concentration of vitamin B_1 16.50±0.54 followed by vitamin A 12.52.±2.82, Vitamin C 6.06±0.007 and E 5.40±1.55 while the lactose concentration is higher in ranched compared to unranched cow milk. This may be due to the above mentioned reason.

Figure 4 shows vitamin and lactose composition in red sokoto goat, the figure showed that unranched goat milk has high composition of vitamin A 18.80±0.63 followed by Vitamin $B_1$9.63±0.09 while ranched goat milk have high concentration of vitamin C 4.995±0.48 and unranched goat milk have high concentration of vitamin E 0.90±0.42. The lactose composition was seen to be slightly different. These results are in agreement with the work of other researchers who reported that the Vitamin and lactose composition in milk of goat varies depending on number of factors. Pandy and Ghodke [15] who reported that goat milk had the highest amounts of Vitamin A than sheep and cow milk. Vitamin A, plays an important role in gene transcription [16]. This result indicates that goat milk can serve as a reliable substitute for vitamin A. Vitamin A helps in good vision, support to immune system and inflammatory systems, cell growth and development, antioxidant activity, promoting proper cell communication [17].

Vitamin A is essential in vision as the precursor for the visual purple, as well as plays a role in immunity. Adequate supply, but not excess vitamin A, is especially important for pregnant and breastfeeding women for normal development. It has been reported that if a human infant fed solely on goat milk, the infant is oversupplied with protein, Ca, P, vitamin A, thiamin, riboflavin, niacin and pantothenate in relation to the FAO-WHO requirements. The reason behind goat milk having the

highest level of vitamin A is because goats convert all -carotene into Vitamin A. Goat milk supplies adequate amounts of Vitamin A and niacin and excesses of thiamin, riboflavin and pantothenate for a human infant [18]. Vitamin A deficiency can occur as either a primary or a secondary deficiency. A primary vitamin A deficiency occurs among children and adults who do not consume an adequate intake of vitamin A carotenoids from fruits and vegetables or preformed vitamin A from animal and dairy products. Early weaning from breast milk can also increase the risk of vitamin A deficiency [19].

Figure 5 shows the result of Vitamin and lactose composition in West African sheep. The results shows that the milk of unranched sheep contain higher concentration of Vitamin A 21.30+1.83 when compared to ranched sheep milk 6.25±0.63 followed by high concentration of vitamin $B_1$18.05±20.43 in ranched sheep, high vitamin C 4.50±1.55 in ranched sheep milk with the lowest concentrations of vitamin E 0.20±0.14 in ranched sheep milk. Vitamin B_1 is essential for energy production and in its coenzyme forms (FMN and FAD), it serves as hydrogen transport systems [20]. Vitamin B_1 involves in the energy production from carbohydrates and fats [21].

Importance of vitamin B_1 can be realized with the fact that it acts as gate keeper among the carbohydrate breakdown (less energy step), Kreb cycle (high energy step) and electron transport chain. So, this vitamin is central in energy metabolism and its deficiency can seriously impair the energy metabolism [22].Vitamin B levels in goat and cow milk is a result of rumen synthesis [23]. Compared to cow milk, goat milk has significant deficiencies in folic acid and Vitamin B_{12}, which cause "goat milk anemia" [24]. Levels of folate and Vitamin B_{12}in cow milk are five times higher than those of goat milk and folate is necessary for the synthesis of hemoglobin [25]. [26, 27]. Vitamin B_{12} deficiency can cause a megaloblastic anemia in infants [28], but the anemia has been attributed mainly to folate deficiency in goat milk [29]. The high quantity of vitamin B_1 in goat milk and sheep milk is similar to the result of Wardlaw, Hampland Di Silvestro [30] which recorded 0.05 and 0.08 mg respectively. Vitamin C is a cofactor in at least eight enzymatic reactions, including several collagen synthesis reactions that, when dysfunctional, cause the most severe symptoms of scurvy[18]. Vitamin C performs numerous physiological functions in the human body. These functions include the synthesis of collagen, carnitine and neurotransmitters; the synthesis and catabolism of tyrosine; and the metabolism of microsome. During biosynthesis ascorbate acts as a reducing agent, donating electrons and preventing oxidation to keep iron and copper atoms in their reduced states [10].

Vitamin C is important in protecting against cancers, improving the body immune system, disease prevention, maintaining of bone and teeth, strengthening of blood vessels, wound healing, increasing the bioavailability of iron in foods, neutralising the actions of toxic substances and minimising cold symptoms [23]. Epidemiological studies indicate that diets with high vitamin C content have been associated with lower cancer risk, especially for cancers of the stomach, colon and lung [30]. One of the most important roles of vitamin D (Figure 6) is to maintain skeletal calcium balance by promoting calcium absorption in the intestines, promoting bone resorption by increasing osteoclast number, maintaining calcium and phosphate levels for bone formation and allowing proper functioning of parathyroid hormone to maintain serum calcium levels.

Vitamin D deficiency can result in lower bone mineral density and an increased risk of reduced bone density (osteoporosis) or bone fracture because a lack of vitamin D alters mineral metabolism in the body. Thus, although it may initially appear paradoxical, vitamin D is also critical for bone remodeling through its role as a potent stimulator of bone resorption [19]. The low content of vitamin C in all the milk samples assayed is in agreement with the study of Ambrosoli, Stasio di and Mazzocco [1] which reported that goat, sheep and cow milk were also deficient in Vitamins C, E and D. These results also are not in agreement with the findings of Jandal [7] who found higher mean values for vitamin E than for vitamin A in cow and goat milk. Dissimilar results were obtained when the vitamin contents of sheep and cow milks were analyzed, the vitamin E contents being much higher than those of vitamin A [29].

Some authors have reported that, generally, ewe's milk contains higher amounts of vitamins [11], in particular vitamins A and E [15], than goat and cow milks. However, Collins [3] found higher contents of these vitamins in cow's and sheep's milks than in goat's milk while other authors [9, 10] have reported the opposite. Finally according to Signorello *et al.* [25] sheep's and goat's milks show the highest values of vitamins A and E. Previous results suggest a stronger influence of diet than of species on vitamins A and E contents. The amounts of retinol and α-tocopherol secreted to ruminant milk fat depend directly upon their levels in the ration [19].

These results could be due to the differences in diet, species or breed within species and stage of lactation, location and environmental or management conditions among the milking animals [26].

The availability of lactose in goat milk shows that it can serve as a reliable source to people who are lactose intolerant, lactose is not broken down and provides food for gas-producing gut flora, which can lead to diarrhea, bloating, flatulence and other gastrointestinal symptoms [6]. Lactase deficiency results in unabsorbed lactose being present in the intestinal tract, which has effects that can lead to symptoms of lactose intolerance in susceptible individuals. Hence, a good meal supplemented with goat milk can serve in the prevention of such disease conditions. In a similar study, Raynal-Ljutova *et al.* [20] reported that milk samples collected from sheep showed the lowest lactose content 3.57 % and that of goat showed the highest lactose content 4.66 %, respectively. In their study the lactose contents of milk collected from cow showed 4.03 %. Furthermore, their report showed that goat milk had the highest lactose content 4.65 %. The US Public Health Service milk ordinance, (2010) requires the lactose contents to be around 4.8 % which shows that goat milk was best in lactose content.

CONCLUSION

The results of this study demonstrated that milk samples collected from lactatingcow, pig, sheep and goat contained varying levels of vitamins and lactose and thatthe availability of these nutrients in the milk samples from the different animal species shows that they can serve as suitable substitutes and complements to human milk and therefore can constitute a good part of a nutritious and healthy diet.

REFERENCES

1. Ambrosoli, R., L. Stasio Di and P. Mazzocco, 2015. Content of alpha-s-1-casein and coagulation properties in goat milk. Journal of Dairy Science, 71: 24-28.
2. America Academy of Pediatrics, 2014. Breast feeding and the use of human milk; RE9729, pp: 2035-1039.
3. Collins, G., 1962. Nutritional strategies for skeletal and cardiovascular health: hard bones, soft and arteries. Journal of Clinical Nutrition and Metabolic Care, 7(1): 83-95.
4. Douglas, K.M., 2017. Milk as a white fluid secreted by the mammary glands of female mammals for the nourishment of the young. British Journal Butrics Research, 11: 885-893.
5. Fukuwatari, T., E. Imai, T. Hayakawa, F. Watanabe, H. Takimoto, T. Watanabe and K. Umegaki, 2012. Dietary Reference Intakes for Japanese 2010: Water-Soluble Vitamins. Journal of Nutritional Science and Vitaminology, 5: 67-82.
6. Grand-Pierre, F., J.B. Coulon, C. Agabriel, Y. Chilliard and E. Rock, 2018. Relationships between the conditions of goat's milk production and the contents of some components of nutritional interest in Rocamadour cheese. Small Ruminant Research, 74: 91-106.
7. Jandal, J.M., 2016. Comparative aspects of goat and sheep milk. Small Ruminant Research, 22: 177-185.
8. Jolliffe, D.A., C.J. Griffiths and A.R. Martineau, 2013. Vitamin D in the prevention of acuterespiratory infection: systematic review of clinical studies. Journal of Steroid Biochemistry and Molecular Biology, 136: 321-329.
9. Kala, A. and J. Prakash, 2013. Vitamin B1 retention in cooked, stored and reheatedvegetables. Journal Food Science Technology Mysore, 40: 409-412.
10. Kondyli, E., C. Svarnas, J. Samelis and M.C. Katsiari, 2012. Chemical composition and microbiological quality of ewe and goat milk of native Greek breeds. Small Ruminant Research, 103: 194-201.
11. Lucas, A., J.B. Coulon, C. Agabriel, Y. Chilliard and E. Rock, 2018. Relationships between the conditions of goat's milk production and the contents of some components of nutritional interest in Rocamadour cheese. Small Ruminant Research, 74: 91-106.
12. Malcom, J., 2013. The annual gross milk production in Pakistan estimated at about 17.12 million tones, Encyloopedia for Food and Agriculture, 28: 757-765.
13. Padayatty, S.J., A. Katz, Y. Wang, P. Eck, O. Kwon, J.H. Lee, S. Chen, C. Corpe, A. Dutta, S.K. Dutta and M. Levine, 2013. Vitamin C as an antioxidant: evaluation of its role in disease prevention. Journal of American College of Nutrition, 22(1): 18-35.
14. Pamplona-Roger, G.D., 2015. Encyclopedia of Foods and their Healing power. Editorial Safeliz, Madrid, pp: 27-29.
15. Pandya, A.J. and K.M. Ghodke, 2017. Goat and sheep milk products other than cheeses and yoghurt. Small Ruminant Research, 68: 193-206.

16. Parkash, R. and M. Jenness, 1968. Medical experiments carried out in Sheffield on conscientious objectors to military service during the war. Dairy Science and Food Egineering, 19: 301-326.
17. Park, Y.W., 2010. Nutrient Profiles of Commercial Goat Milk Cheeses Manufactured in the United States. Journal of Dairy Science, 73: 3059-3067.
18. Paul, J.C., 2011. Variation in the chemical and physical composition of milk within a particular species due to factors as breed, feed and nutritional status of the animal. Dairy Science and Food Engineering, 15: 119-126.
19. Rashida, I.R., 2014. Recommendation of a change to sheep and goat products as aid the treatment of Asthma and eczema as well as other related health problems.Diary Technology, 21: 5-59.
20. Raynal-Ljutova, A., J.R. Smith, J. Long, Q. Cai, M.K. Hargreaves, B.W. Hollis and W.J. Blot, 2018. Blood vitamin D levels in relation to genetic estimation of African ancestry. Cancer Epidemiology, Biomarkersand Prevention, 19(9): 2325-2331.
21. Rashida, K., A. Toqeer and M. Bushra, 2014. Comparative Analysis of Quality of Milk Collected from Buffalo Cow Goat and Sheep of Rawalpindi Islamabad Region in Pakistan, Asian Journal of Plant Sciences, 3: 300-305.
22. Rehman, J. and S. Salaria, 2010. The effect of temperature and storage time on nutritional quality of ultra-heat treatment (UHT) of processed buffalo milk. Dairy of Federal Bulletin, pp: 64.
23. Rennes, P., 2005. Content of alpha-s-1-casein and coagulation properties in goat milk. Journal of Dairy Science, 71: 24-28.
24. Sharma, D., S.K. Bøhn, H.L. Wold, P. Laake and R. Blomhoff, 2013. Water-miscible, emulsified and solid forms of retinol supplements are more toxic than oil-based preparations. The American Journal of Clinical Nutrition, 78(6): 1152-1159.
25. Signorello, L.B., S.M. Williams, W. Zheng, J.R. Smith, J. Long, Q. Cai, M.K. Hargreaves, B.W. Hollis and W.J. Blot, 2010. Blood vitamin D levels in relation to genetic estimation of African ancestry. Cancer Epidemiology, Biomarkers and Prevention, 19(9): 2325-2331.
26. Singha, M.A., 2007. Beneficial effects of long-term consumption of a probiotic combination of *Lactobacillus casei* Shirota and *Bifidobacterium breve* Yakult may persist after suspension of therapy in lactose-intolerant patients. Nutritional Clinical Practical, 27: 247-251.
27. Tao, S., 2005. Risk Analysis transfer pesticides to milk. Institute of Livestock. National Inter professional Centre, 12: 9.
28. Tim, C., 2016 .Significance of taking a cup of hot sheep milk before retiring to bed. Dairy of Federal Bulletin, pp: 98-99.
29. US Public Health Service, 2010. Pasteurized milk ordinance. Public Health Service. US department of health, education and welfare. Publication 229, Washington DC, USA, pp: 331-333.
30. Wardlaw, G.M., J.S. Hampl and R.A. Di Silvestro, 2014. Perspective in Nutrition. Sixth edition Mcgraw-Hill College., pp: 1001-1056.