Nig. J. Anim. Prod. 2022, 49(3):44-48. https://doi.org/10.51791/njap.v49i3.3532
Nigerian Journal of Animal Production

Effect of animal species on proximate composition of raw milk

[1]Oladunmoye, G. A., [1]Adewumi, O. O., [1]Aina, A. B. J. and [2]Awoyomi, O. J.
[1]*Department of Animal Production and Health,*
[2]*College of Veterinary Medicine; Federal University of Agriculture Abeokuta.*
Corresponding author:ganiyatoladunmoye@gmail.com; +2347033277064

Abstract

Cow milk is generally the primary source of milk consumption, especially in developing countries. However, its allergenic potentials coupled with the higher digestibility and therapeutic potentials of small ruminant milk make the milk of ewe and doe a suitable alternative to consider. Although several researches have been carried out to assess compositions of milk of animals, assessments across their proximate alongside their cow milk counterpart have not been extensively reported. This study was carried out to assess the proximate compositionof raw milk from cow, ewe and doe.Bulk sample of fresh milk from cow ewe and goat were obtained once and analysed in four(4) replicate per species. Protein, fat, lactose and solids non fat of cow and ewe milk were analysed using the automated lactoscan milk analyser. Doe milk parameters as well as total solids and ash content of all samples were analysed according to the standard methods of the A.O.A.C.Data generated were subjected to One-way Analysis of Variance in a Completely Randomized Design. Significant differencesbetween treatment means were separated using Duncan Multiple range test. Results obtainedindicated that ewe milk had the highest ($p<0.05$) percentage of milk protein (4.51%), fat (6.65%) and totalsolids (16.15%). Solids non-fat (SNF) contentwasnot($p>0.05$) influenced by animal species. The study indicates higher nutritional profile of ewe milk over cow and doe milk in terms of milk protein and fat.

Keywords: Species; proximate; milk; milk products

Effet d'espèces animales sur la composition proximité du lait cru

Résumé

Le lait de vache est généralement la principale source de consommation de lait, en particulier dans les pays en développement. Cependant, ses potentiels allergènes associés à la digestibilité la plus élevée et aux potentiels thérapeutiques du petit lait de ruminant font du lait de brebis et font une alternative appropriée à considérer. Bien que plusieurs recherches ont été menées pour évaluer les compositions de lait d'animaux, les évaluations de leur proximité à côté de leur contrepartie de lait de vache n'ont pas été rapportées de manière approfondie. Cette étude a été réalisée pour évaluer la composition proximité du lait cru de la vache, de la brebis et de l'échantillon de lait frais de lait frais provenant de la femme de base de vache et de chèvre a été obtenue une fois et analysée dans quatre (4) répliquées par espèce. Les protéines, la graisse, le lactose et les solides non gras de lait de vache et de brebis ont été analysées à l'aide de l'analyseur de lait lactoscan automatisé. Les paramètres de lait de biche ainsi que les solides totaux et la teneur en cendres de tous les échantillons ont été analysés en fonction des méthodes standard de l'A.O.A.C. Les données générées ont été soumis à une analyse allée simple de la variance dans une conception complètement randomisée. Différences significatives entre les moyens de traitement ont été séparées à l'aide du test de plage multiple de Duncan. Les résultats ont indiqué que le lait de brebis avait le pourcentage le plus élevé ($P<0,05$) de protéines de lait (4,51%), de la graisse (6,65%) et des totauxsolides (16,15%). Le contenu de solides non gras (SNG) ($p> 0,05$) n'était pas

influencé par les espèces animales. L'étude indique un profil nutritionnel plus élevé du lait de brebis sur le lait de vache et la biche en termes de laitprotéine et de graisse.

Mots-clés: espèce; proche; Lait; produits laitiers

Introduction

Milk is the normal secretion of the mammary gland of various mammals such as cow, buffalo, doe, ewe and camel, which serves primarily as food, and source of antibodies in protecting the newly born mammals against infection (Bylund, 1995). Aside importation of processed milk products, the indigenous cattle breeds have continued to dominate the dairy sub-sector despite the fact that their genetic merit for milk production has consistently fallen short of demand especially in the urban centres and containing proteins with allergic potential (El-Agamy, 2007).Advantages of small ruminant milk over cow milk make it important to look at ways of improving animal milk using small ruminants (Adewumi and Olorunnisomo, 2009). Beyond the need to meet demand, the nutritive quality, health benefits and high processing potential of milk from small ruminants (Park *et al.,* 2007; Milani and Wendorff, 2011; Barlowska *et al*., 2011) as well as low allergy causing potentials (Ramunno *et al.,* 2000) and easy digestibility (D'Urso *et al.,* 2008) have made them a possible alternative to cow milk. Small ruminants are easier to acquire and maintain than cattle, with little feed and management requirement, hence their milk can be produced more efficiently using minimal resources.

Materials and methods

Experimental procedures

Fresh milk of ewe and doe were obtained by hand milking from Adegbite farms ($70^0$14'08.4" N, $30^0$26'05.6" E), and cow milk was purchased from herdsmen around Molaaka village ($70^0$13'50" N, $30^0$26'39.53" E). The milk wasanalyzed in four (4) replicates per species at the Animal Products Processing Laboratory of the Department of Animal Production and Health, Federal University of Agriculture Abeokuta; all within Abeokuta metropolis.Fresh milk samples from cow and ewe were analyzed for crude protein, fat, lactose and solids non-fat content using the automated lactoscanmilk analyzer. Doe milk parameters as well as total solids and ash content of all samples were determined as follows:

Determination of total solids was done using evaporation under controlled condition method of AOAC (2005). Fat content was determined using Babcock method (Pereira, 1988) by centrifugation. And protein by Kjeldahl's method (BIS, 1981).The solid-not-fat content of each milk sample was determined by estimation of the difference between percentage solid and percentage fat content of the milk. This is represented with the formula:

SNF= Milk Total Solid – Milk Fat content

Statistical analysis

Data obtained were analyzed using one-way Analysis of variance (ANOVA) as contained in SPSS (version 20). Significant differences among treatment means were separated using Duncan Multiple range test.

Results and discussion

Effect of animal species on chemical properties of raw milk

Proximate composition of raw milk is presented in Table 1. Species influenced all parameters measured in the raw milk except for solid-non-fat.

Table 1: Effect of species on proximate composition of milk

Parameters (%)	Cow	Ewe	Doe	SEM
Protein	3.67^{b}	4.51^{a}	3.70^{b}	0.14
Fat	3.86^{c}	6.65^{a}	4.15^{b}	0.38
Lactose	5.54^{a}	4.26^{b}	3.49^{c}	0.27
Total Solids	13.90^{b}	16.15^{a}	11.68^{c}	0.56
Solids Non Fat	10.04	7.25	7.52	0.79
Ash	0.84^{a}	0.73^{a}	0.34^{ab}	0.07

a,b; means with different superscripts on the same row are significantly different ($p<0.05$)

The comparable content of crude protein (CP) of milk observed in the present study is in line with the work of Park *et al*. (2007) who reported similar levels (3.4g/100g) for both cow and doe milk. However, their reported CP for ewe milk is higher than that documented in this study. Ghada (2005) while comparing the chemical composition of various milk types in Egypt, opined that the higher protein content in ewe milk may be due to requirement of more protein for wool development. Cow milk fat recorded was in line with the findings of Kanwal *et al.* (2004) and Adewumi *et al*. (2016). The study also compares with those of Hayam *et al.* (2017) and Asif and Sumaira (2010) who both reported a significantly higher fat content in ewe milk than in doe and cow milk. In contrast, cow milk fat recorded in the present study was lower than that reported by Lingathurai *et al*. (2009) while ewe milk fat was lower than that reported by Pavic *et al.*(2002) and Adewumi and Olorunnisomo, (2009. The high fat content in ewe and doe milk can be attributed to the high concentration of fat globules in them (Balthazar *et al*., 2017). Lactose content recorded compares to the report of Hayam *et al.* (2017) of lower lactose content in ewe milk than cow milk; and similar to 8.85% reported by Adewumi *et al.* (2016) in a study to ascertain physicochemical, microbial and sensory properties of milk and ice cream. The present finding negates the statement of Asif and Sumaira (2010) that lactose content of cow, ewe and doe milk were similar. High total solids recorded for ewe milk may be attributable to the high protein and fat content of the milk. Adewumi and Olorunnisomo (2009) reported similarly high value for ewe milk total solids in a study of comparison of ewe breeds. Similar value of 13.80% was also recorded for cow milk total solids by Adewumi *et al*. (2016). This result agrees with that of Hayam *et al*. (2017) who recorded similar trends for total solids content of cow, ewe and doe milk. The lower ash content of doe milk than ewe and cow milk may be directly attributed to the low level of total solids observed for doe milk. Ash content of cow milk compares closely with (0.90%) reported by Adewumi and Idowu, (2014) for White Fulani cow, while a similar value was also reported for West African Dwarf ewe milk by Adewumi and Olorunnisomo, (2009). The result however differs from that of Bhosale *et al*. (2009) and Enb *et al*. (2009) as well as Hayam *et al*. (2017) who reported non-significant variation in ash contents of milk of cow, ewe and doe milk.

Conclusion

From the present study, it can be concluded that milk of cow, ewe and doe were different in their proximate compositions, with ewe and doe milk better in nutritional composition than cow milk. Furthermore, ewe milk had the highest content of milk protein, fat and ash.

References

Adewumi, O. O. and Idowu, O. M. 2014. Physicochemical, Microbial Load and Sensory Properties of Milk,

Yoghurt with or without Garlic. *Nigerian Journal of Animal Science.* 16(1):166-172.

Adewumi, O. O. and Olorunnisomo, O. A. 2009. Milk Yield And Milk Composition Of West African Dwarf, Yankasa and Crossbred Sheep In Southwest Of Nigeria. *Journal of Livestock Research For Rural Development* 21;33-37.

Adewumi, O.O., Adesina, T.A. and Adeola, A.A. 2016. Physicochemical, microbial and sensory attributes of milk, ice cream and garlic ice cream. *Journal of Animal Production and Resources* 28:56-61.

A.O.A.C (Association of official Analysts), 2005. Dairy Products. In AOAC Official Methods of Analysis, 18th Edition Gainthesburg.

Asif, M. and Sumaira, U. 2010. A comparative study on the Physico-chemical Parameters of Milk Samples Collected from Buffalo, Cow, Goat and sheep of Gujrat, Pakistan. *Pakistan Journal of Nutrition* 9 (12): 1192-1197. ISSN 1680-5194.

Balthazar, C. F., Silver, H. L. A. and Esmerino, E. 2017. The addition of inulin and Lactobacillus casei 01 in Sheep milk ice cream. *Food Chemistry* 246. Doi: 10.1016/j.foodchem.2017.12.002

Barlowska J., Swajkoska, M, Litwinczuk Z. and Krol, J. 2011. Nutritional value and Technological Suitability of Milk from Various Animal Species Used for Dairy Production. Comprehensive Reviews in Food Science and Food Safety 10(6): 291-302.

Bhosale, S.S., Kahate, P.A., Kamble, K, Thakare, V.M., and Gubbawar, S.G. 2009. Effect of lactation on physicochemical properties of local goat milk. *Vet. World*, 2: 17-19.

BIS 1981. Hand Book Of Food Analysis. Part Xi.Dairy Products. Bureau of Indian Standards. ManakBhayan, New Delhi.

Bylund G.1995. Dairy processing handbook. Tetra Pak processing systems, AB S-221 86 Lund, Sweden. pp: 436.

D'Urso, S., Cutrignelli, M.I, Calabro, S., Bovera, F, Tudisco, R., Piccolo, V. and Infascelli, F. 2008. Influence of pasture on fatty acid profile of goat milk. *Journal of Animal Physiology and Animal Nutrition* 92(3):405–10.

El-Agamy E.I. 2007. The challenge of cow milk protein allergy. *Small Ruminant Research* 68(1–2):64–72.

Enb, A., AbouDonia, M.A., Abd-Rabou, N.S., Abou-Arab A.K.A. and El-Senaity M.A. 2009. Chemical composition of raw milk and heavy metals behavior during processing of milk products. Global Vet., 3: 268-275.

Ghada, Z.A.S. 2005. Comparison of Chemical and Mineral Content of Milk from Human, Cow, Buffalo, Camel and Goat in Egypt. *The Egyptian Journal of Hospital Medicine.* Vol., 21:116-130. I.S.S.N:12084.

Hayam, M.A., Afaf, O.A., Jihan, M.K. and Wafaa, M.Z. 2017. Evaluation of Different Types of Egyptian Milk from Biochemical Aspects. *International Journal of Dairy Science. ISSN 1811-9743.* DOI: 10.3923/ijds.2017.130.136

Kanwal, R., Ahmed, T. and Mizra, B. 2004. Comparative analysis of quality of milk collected from buffalo, cow, goat and sheep of

Pakistan. *Asian Plant Science.*3:300-305.

Lingathurai, S., Vellathurai, P., Ezil, V. S. and PremAnand, A. A. 2009. A comparative study on the microbiological and chemical composition of cow milk from different locations in Madurai, Tamil Nadu. *In. J. Sci. Technol*., 2: 51-54.

Milani, F.X. and Wendorff, W.L. 2011. Goat and sheep milk products in the United States (USA). *Small Ruminant Research* 101: 134-139. https://doi.org/10.1016/j.smallrumres. 2011.09.033 .

Park, Y.W., Juárez, M., Ramos, M. and Haenlein, G.F.W. 2007. Physico-chemical characteristics of goat and sheep milk. *Small Ruminant Research* 68(1–2): 88–113.

Pereira, F. 1988. Alimentos. Manual de ana'lisisfi'sicoqui'mico. Universidad Auto'noma de Yucata'n. Direccio'n general de difusio'n y comunicacio'n. Me'ridaYucata'n, Mexico, p.190.

Ramunno, L., Cosenza, G., Pappalardo, M. and Pastore, N. 2000. Identification of the goat CSN1S1(F) allele by means of PCR-RFLP method. *Animal Genetics* 31(5):342-3 DOI:10.1046/j.1365-2052.2000.00663.

Received: 7th November, 2021
Accepted: 26th February, 2022