Original

Dairy productivity in milking in the morning, afternoon and total in a semi stable goat system

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ABSTRACT

Objective. The objective of this work was to calculate descriptive statistics of milk yields. **Materials and methods**. 6733 milk controls were carried in the morning, afternoon and total/day milkings produced by 21 goats saanen, alpina americana and togenburen breeds in a semi stable system located in the Ocaña region, Norte de Santander; **Results.** Milk yield (milliliters) in the morning, afternoon and daily total was 564.99±242.38, 259.30±112.81 and 824.29±350.07. Also, it was observed that in the non-parametric statistical tests of the probability distribution of the phenotypic expression of the morning, afternoon and daily total yield, they presented highly significant normalities (p<0.0001). **Conclusions.** the results obtained are in the expected for the species, also, it is suggested that the calculated yield values were possibly influenced by effects not considered in the study.

Keywords: Goat; herd; milk; lactation (Source: AGROVOC).

RESUMEN

Objetivo. El objetivo de este trabajo fue calcular estadísticas descriptivas de la producción de leche. **Materiales y métodos.** Se realizaron 6733 controles de leche en los ordeños matutino, vespertino y total / día producidos por 21 cabras de las razas saanen, alpina americana y togenburen en un sistema semi estabulado ubicado en la región de Ocaña, Norte de Santander; **Resultados.** La producción de leche (mililitros) por la mañana, la tarde y el total diario fue de 564.99±242.38, 259.30±112.81 y 824.29±350.07. Asimismo, se observó que en las pruebas estadísticas no paramétricas de la distribución de probabilidad de la expresión fenotípica de la mañana, tarde y rendimiento total diario, presentaron normalidades altamente significativas (p<0.0001). **Conclusiones**. los resultados obtenidos son los esperados para la especie, además, se sugiere que los valores de rendimiento calculados posiblemente fueron influenciados por efectos no considerados en el estudio.

Palabras clave: Cabras; rebaño; leche; lactancia (Fuente: AGROVOC).

INTRODUCTION

In Colombia, goat production systems can be characterized according to the resources used for their nutrition, the productive objective and the community where they are developed and have been used for family support that guarantees food security within the peasant economy. Goat production has presented in general terms quite noticeable dynamics since 1980, presenting greater productive development of the different breeds existing in the country through crossbreeding, investment in infrastructure, progress in the technical management of farms, as well as health aspects, nutritional and reproductive (1)

Taking into account the post-conflict scenario in Colombia, goat production systems are seen as an alternative development alternative whose species attract attention due to their adaptation to terraced lands, degraded soils and areas with low forage yield (2). Advantages have generated some interest in populations that see a productive potential in the species in order to obtain raw materials such as milk; product that becomes the livelihood of millions of people related to the development of the dairy industry (3). However, to obtain this raw material, production systems must be taken into account; highlighting the semi stable (4); that allow promoting the productive development of the species, which, in turn, offer quality products and generate yields (5).

Likewise, for a good management of the goat production system, it is convenient to implement processes of systematization of the yield information, using tools such as yield milk control, which allows an adequate taking of zootechnical records, which facilitates the quantification of the trajectory yield as well as allowing the sustainable use of genetic resources. Consequently, the implementation of milk control programs allows the analysis of yield data individually and / or in groups (1) and allows inferences on productivity and profitability in goats (6).

The International Committee for Animal Registration (ICAR) 7 establishes three methods for registering milk yield, according to their frequency every 2, 4 or 6 weeks, to the number of milkings 1X (one milking) or 2X (two milkings) and the institutions or those responsible for said registry. The measurement of milk yield, under any of the established methodologies (ICAR), will allow a graphic representation of said production, as a function of time.

The management of the respective records linked to milk yield control, help to establish the daily evolution of the milk production that the goat has within its lactation, thus evaluating its behavior at the productive level (7). The following work aimed to calculate the descriptive statistics of milk yield in the morning, afternoon and total / day milking, in a semi stable goat system located in the Ocaña region, Norte de Santander.

MATERIALS AND METHODS

Study site. The goat production system of the UFPSO dedicated to the specialized yield of milk in semi-stables, is developed in the Experimental Farm, located on the right bank of the Algodonal River, with an area of 105 ha, 1150 meters above sea level, average temperature of 23ºC , relative humidity 70%.

The breeds of the animals in the study Saanen, Alpina, Toggenburg, Canaria, Santandereana, Nubiana and their crosses, Delaval tandem mechanical milking of two stalls with capacity for four stalls is handled, the system has 2.31 ha, distributed in the following form: grazing area divided into 27 lots that add up to an area of 0.94 ha, equivalent to 40.7% of the total area, sown with a combination of Mombasa (*Kpanicum maximum*) and Pará (*Brachiaria mutica*); grazing areas with 0.15 ha, a forage bank with an area of 1.22 ha, equivalent to 52.7% sown in buttercup (*Tithonia diversifolia*), Alfalfa (Medicago sativa) and Forage Sorghum (Sorghum vulgare). Regarding nutritional management, the animals graze in a rotational system they graze from 8:30 to 11:30 a.m., the rest of the day they remain in the sheepfolds. According to management, the productive and reproductive stages have been divided as follows: infants up to 1 month of age, lift up to 4 months, breeding and production 12 months. The age at the first service is 16-20 months, the first delivery 21-25 months. Monthly sanitary control of *Haemonchus contor*tus is carried out, with the use of the FAMACHA system.

The data for the study, come from 21 goats since 2016. The herd presents first (number of offspring; 4), second (10), third (12) and fourth (20) calvings, respectively. The handling of kids was as follows: at the moment of birth, the goat is expected to recognize its goat kid, at the moment the calf gets up, an operator

immediately cleans the navel with an iodine solution, then it is tied and cut. After, the kids are put to breastfeed for 4 days (colostrum) with the mother. After this time the females enter the milking (AM) and after the milking the males are left for 30 days with the mother in the afternoon (2 hours/day). In the case of females, they are left for a period of 90 days with the residual milk after milking and remain with the Goat in the afternoon (2 hours/day). In the case of the goat kids after 30 days they are given commercial concentrated feed.

The dairy control was carried out in 12 months with the help of mechanical milking and taking into account, the international standards contained in the so-called A4 system - International Regulation for milk recording in goats, which are based on the first control should be performed between 10 and 45 days postpartum (1).

Analysis of the information. The zootechnical information collected was stored in the Excel and specialized software called Ovisweb, then the probability density functions of the continuous variables for milk production in the morning, afternoon and total yield of the day were analyzed, based on daily dairy controls for every milking Descriptive statistics for each variable were calculated using the SAS statistical package (8).

RESULTS

Analyzes and tests of the probability density functions were performed for the continuous variables of milk yield in the morning and afternoon milking, considering the repeated means, which were performed in each milking, results shown in table 1 and Figure 1, together with the descriptive statistical analysis of the information. The results of the mean test (tukey-test) suggested a significant difference ($p < 0.005$ and $p < 0.005$) between the morning and afternoon milk yields compared to the total yield, respectively.

Table 1. Descriptive statistical data of milk yield (milliliters).

Variable	N	Average	DE	Var	C.V	E. E	25	50	75
Yieldam	6733	564.99	242.38	58748.98	42.9	3.0	400	550	700
Yieldpm	6733	259.31	112.82	12728.32	43.5	1.4	179	260	335
Yieldtot	6733	824.3	350.08	122555.7	42.5	4.3	567	820	1041

Note: Milk yield in the morning (Pdnam), afternoon (Pdnpm) and total (Pdntot). Number of data (N), Standard deviation (SD), Variance (Var), Coefficient of Variation (C, V), Standard Error (E, E) and Percentiles 25, 50 and 75.

The trajectory of the average monthly milk yield (milimeters) as a function of the days in milk with their respective standard deviations(std Dev) in dairy goats during the study. An expected normal trajectory for the species was observed (Figure 1).
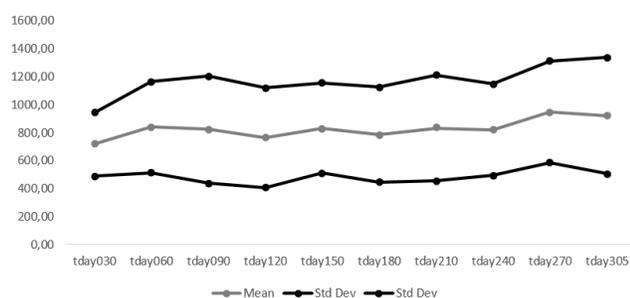

Figure 1. Descriptive statistical data of monthly milk yield (milliliters).

DISCUSSION

It was observed that the highest yield was in the morning milking (564.99 ml) and the lowest in the afternoon milking (259.31 ml), when relating the result to other studies, the morning yield is found by above the suggested (475.32 ml) (10), but the average yield of the afternoon does not fit the argument in the investigation. However, the total yield was expected for the species as reported by the literature. (9,10,11,12).

The CVs for Pdnam, Pdnpm and Pdntot were similar when compared to other studies (13). However, (14,15,16) estimated CVs higher than 55% and that were higher than those reported in this study (Table 1), possibly these differences in the variation of milk yield may be influenced by factors immersed in production and driving.

The distribution of the univariate probability function of the phenotypic expression of milk yield on the day of the control for the morning, afternoon and total/day milking in semi stable goats was estimated (Figure 2). observing that the probability function of the production in the morning, afternoon and total milking presents its highest values around 500 and 700, 220 and 310 and 760 and 980 milliliters, respectively (Figure 2). It was observed for milk yield in milkings in the morning, afternoon and total, a normal distribution for production records was observed.

Descriptive statistics and non-parametric statistical tests of probability distribution in the phenotypic expression of milk yield (milliliters) on the day of control in the morning, afternoon and total were estimated (Table 2). It was observed that the coefficient of asymmetry (skewness) for the morning, afternoon and total was 0.327, 0.311 and 0.211, respectively. Consequently, a moderately biased distribution could be determined, presenting a positive asymmetry with a rightward inclination for the three traits. In this sense and with respect to kurtosis, a plastic distribution was estimated because the values obtained (-0.018, -0.005 and -0.330) are less than 0, which allows analyzing that there is a lower concentration of data around the average (Table 2 and Figure 2), according to the literature this could be presented as milk yield decreases markedly as the days in breastfeeding progress (17,18,19).

Table 2. Descriptive statistics and non-parametric statistical test for the yield (milliliters) of milk on the day of the control for the morning milking (Yieldam), afternoon (Yieldpm) and total / day (Yieldtot) in semi establish goats.

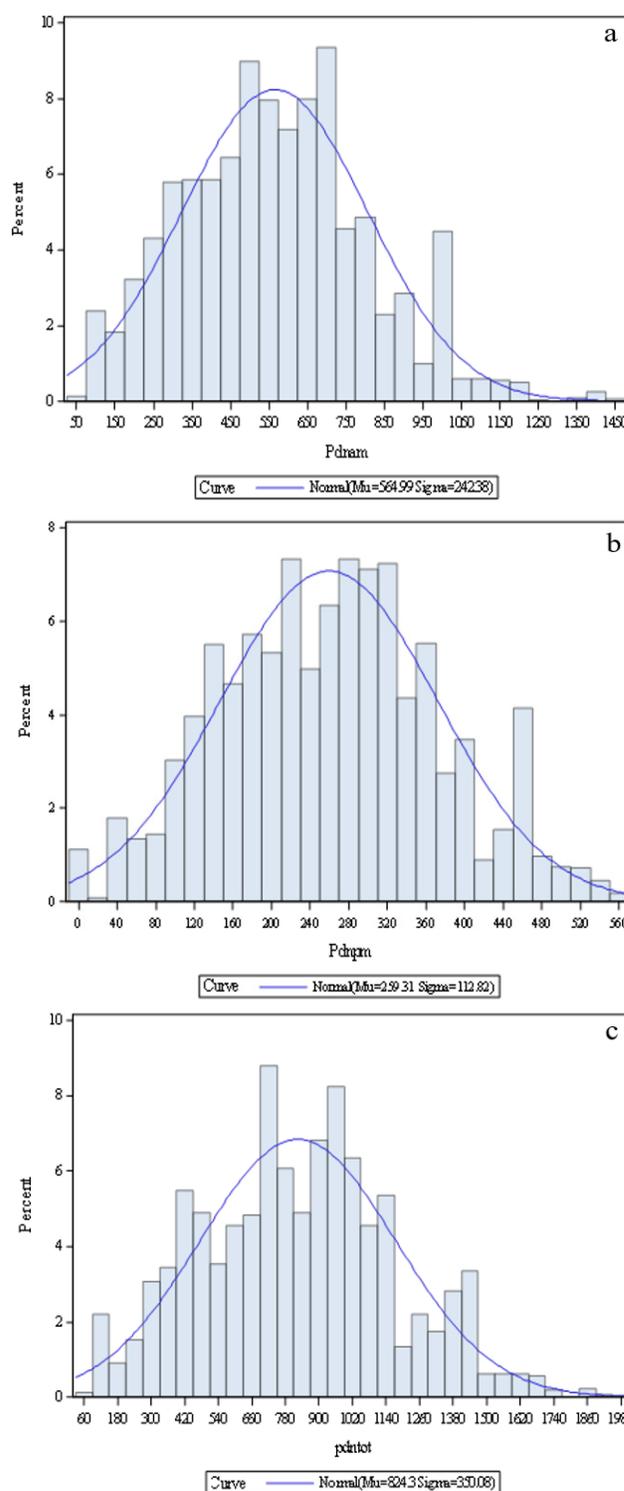|	N	Skewness	Kurtosis	Test student's T	p valor
Yieldam	6733	0.327	-0.018	197.270	<0.0001
Yieldpm	6733	0.311	-0.005	188.595	<0.0001
Yieldtot	6733	0.211	-0.330	193.207	<0.0001

Note: Where N: number of data.

Figure 2. Distribution of the univariate probability function of the phenotypic expression of milk yield (milliliters) on the day of the control for the milking of the morning (a), afternoon (b) and total/day in semi stable goats.

The results obtained in this study for the statistics were found within the expected for the species, considering the environmental conditions, seasonality, and feeding where the animals produce. On the other hand, it is necessary to consider that the mentioned and genetic factors can limit the phenotypic expression of milk yield in this type of herd (20,21).

In conclusion the variability in milk yield in the morning, afternoon and total milkings presented a normal distribution with significal diferences. However, as breastfeeding days increase, yield is affected, therefore asymmetry and kurtosis will be affected. Descriptive statistics for milk yield in the morning, afternoon and total were found within what was reported for the species. It is suggested that for future studies environmental and management effects to which animals are exposed are considered so that the difference in productivity in milking in the morning and afternoon can be better understood.

Conflict of interest

The authors declare that there are no conflicts of interests regarding the publication of this paper.

REFERENCES

1. Yépez H, Rúa CV, Idárraga Y, Arboleda E, Calvo S, Montoya A, et al. Estimación de las curvas de lactancia y producción de leche de cabras del departamento de Antioquia, usando controles lecheros quincenales y mensuales. Rev CES Med Vet Zootec. 2010; 5(2):30-35. https://revistas.ces.edu.co/index.php/mvz/article/view/1425

2. Rúa C, Rosero R, Posada S. Efecto del sistema de producción en la producción de leche y consumo de alimentos en cabra. Revista MVZ Córdoba. 2017; 22(3):6266-6275. https://doi.org/10.21897/rmvz.

3. Martínez G, Suárez V. Lechería de leche. Instituto Nacional de Tecnologia Agropecuaria INTA: Argentina; 2018. https://inta.gob.ar/sites/default/files/inta_lecheria_caprina.pdf

4. Timaure-Jiménez C; Pozo J, Soto-Yesea Y, Guerere-Morales A. Sistemas de producción caprina y ovina en la subregión Costa Oriental del Lago de Maracaibo. Tecnología en marcha. 2015; 28(1):1 -20 https://www.scielo.sa.cr/pdf/tem/v28n1/0379-3982-tem-28-01-00071.pdf

5. Bidot FA. Composición, cualidades y beneficios de la leche de cabra: revisión bibliográfica. Rev Prod Anim. 2017; 29(2):32-41. https://revistas.reduc.edu.cu/index.php/rpa/article/view/1686

6. Ruiz-Morales F, Mena-Guerrero Y, Castel-Genís JM. Indicadores técnico-económicos para explotaciones caprinas lecheras: forma de cálculo y modo de utilización. Copisterías Don Folio S.L: España; 2007. http://www.uco.es/zootecniaygestion/img/pictorex/30_13_14_Ruiz_Manual.pdf

7. Solis-Lucas LA, Lanari MR, Oyarzabal MI. Tipificación integral de sistemas caprinos de la provincia de Santa Elena, Ecuador. La Granja. 2020, 31(1):72-85. https://doi.org/10.17163/lgr.n31.2020.06

8. SAS. Free Statistical Software, SAS University Edition: USA. 2018. Disponible en: http://www.sas.com/en_us/software/university-edition.html

9. Martinez G, León-Jurado JM, Suarez VH, Barba-Capote C. Determinación de la curva de lactancia de cabras Saanen del noreste argentino. Revista FAVE – Sección Ciencias Veterinarias. 2018; 17(1):6-11 https://doi.org/10.14409/favecv.v17i1.7159

10. Marin MP, Burrows J, Ramos JC. Producción y calidad de leche caprina en rebaños bajo sistemas de manejo extensivo de la zona central de chile. Arch Zootec. 2001; 50(191):363-366. https://dialnet.unirioja.es/descarga/articulo/279679.pdf

11. Suarez VH, Martínez GM. Características de los tambos caprinos comerciales y posibilidades de mejora genética en el noroeste argentino. Revista Veterinaria Argentina. 2019; 36(370):1-13. https://www.veterinariargentina.com/revista/2019/02/caracteristicas-de-los-tambos-caprinos-comerciales-y-posibilidades-de-mejora-genetica-en-el-noroeste-argentino/

12. Méndez M, Ponde R, García YR, y Rodrígue Y, García D, Mora M, Persistence of milk production of Alpine goats in Cuba. Cuban J Agricul Sci. 2019; 53(1):1-5 http://www.cjascience.com/index.php/CJAS/article/view/865/886

13. Paz RG, Togo JA. López C. Evaluación de parámetros de producción de leche en caprinos (Santiago del estero, argentina). Revista Científica, FCV-LUZ. 2007; 17(2):161-165. https://produccioncientificaluz.org/index.php/cientifica/article/view/15271

14. Irano N, Bignardi AB, Baldi F, Santana ML, Teixeira IA, Tonhati H, et al. Multivariate analysis of test-day and total milk yield in goats. Genet Mol Reserch. 2015; 14(4):13719-13727. https://doi.org/10.4238/2015.october.28.34

15. Pleguezuelos FJ, De La Fuente LF, Gonzalo C. Variation in Milk Yield, Contents and Incomes According to Somatic Cell Count in a Large Dairy Goat Population. J Adv Dairy Res. 2015; 3(3):1-5. https://doi.org/10.4172/2329-888X.1000145

16. Henao KT, Blandón YA, González-Herrera LG, Cardona-Cadavid H, Corrales JD, Calvo SJ. Efectos genéticos y ambientales sobre la curva de lactancia en cabras lecheras del trópico. Livestock Research for Rural Development. 2017; 29(5):29097. http://www.lrrd.org/lrrd29/5/hena29097.html

17. Calvo SJ, González-Herrera LG, Pereira da Silva SN, Cerón-Muñoz MF, Rocha-Sarmento JL, Cardona-Cadavid H. Componentes de varianza para producción de leche en cabras del trópico, utilizando modelos en el día del control. Livestock Research for Rural Development. 2019; 31(6):31082. http://www.lrrd.org/lrrd31/6/samir31082.html

18. Frau S, Togo J, Pece N, Paz R, Font G. Estudio comparativo de la producción y composición de leche de cabra de dos razas diferentes en la provincia de Santiago del Estero. Revista de la Facultad De Agronomía, La Plata. 2010; 109(1):9-15. http://sedici.unlp.edu.ar/handle/10915/15704

19. Noutfia Y, Zantar S, Ibnelbachyr M, Abdelouahab S, Ounas I. Effect of stage of lactation on the physical and chemical composition of Drâa goat milk. AJFAND. 2014; 14(4):1981–1991. https://ajfand.net/Volume14/No4/Noutfia11230.pdf

20. Zamuner F, DiGiacomo K, Cameron AWN, Leury BJ. Effects of month of kidding, parity number, and litter size on milk yield of commercial dairy goats in Australia. J Dairy Sci. 2020. 103(1):954-964. https://doi.org/10.3168/jds.2019-17051.

21. Ibnelbachyr M, Boujenane I, Chikhi A, Noutfia Y. Effect of some non-genetic factors on milk yield and composition of Draa indigenous goats under an intensive system of three kiddings in 2 years. Trop Anim Health Prod. 2015; 47:727–733. https://doi.org/10.1007/s11250-015-0785-8