International Journal of Agriculture, Environment and Biotechnology
Citation: *IJAEB*: **18**(01): 01-06, March 2025
DOI: 10.30954/0974-1712.01.2025.1

ASSOCIATION FOR AGRICULTURE ENVIRONMENT AND BIOTECHNOLOGY

RESEARCH PAPER

Effect of Some Non-Genetic Parameters on Persistence of Milk Production in Crossbred Cows

Al-Hayani, A.A.[1,2*], Tarig, A.A.[1] and Abu Nikhaila, A.M.[1]

[1]Department of Dairy Production, Faculty of Animal Production, Khartoum, University, Shambat, SUDAN
[2]Department of Animal Production, Faculty of Agriculture and Veterinary Medicine, Thamar University, Thamar, YEMEN

*Corresponding author: abdulaziz.alhayani@tu.edu.ye (**ORCID ID:** 0000-0002-5190-112X)

Paper No. 1196 **Received:** 16-12-2024 **Revised:** 21-02-2025 **Accepted:** 03-03-2025

ABSTRACT

The current study aimed to assess the effects of non-genetic parameters (stage lactation, parity order, and gender of calving) on the persistence of milk production in crossbred. The study was carried out on twenty-eight crossbreed dairy cows in the fields of the University of Khartoum educational farm under unified administrative and nutritional conditions. The cows were in different production parity orders for milk (the second season to the seven season) and physiological status**.** The results showed that the persistence in milk production was good in the early (99.82%) and midem (93.54%) lactation stages, the percentage of persistence peaked in the second month (102.14%). In addition, this may be attributed to the use of bulls with high breeding values for milk yield. The parity order of crossbred cows had a significant (P<0.05) effect in months two and three The highest lactation persistency (162.67 and 115.20%) was observed in primiparous cows, compared to the multiparous, which reached (140.32 and 111.86%), respectively. The calving of the gender of crossbred cows had a significant (P<0.05) effect in months two and third in the persistency of milk production, the highest lactation persistency (168.93 and 131.98%) was observed in cows giving birth to males, compared to the cows giving birth to females, which reached (126.24 and 117.72%). respectively. For optimal milk production and efficiency, cows with high lactation persistence are preferred.

HIGHLIGHTS

- The percentage of persistence peaked in the second month.
- The parity of crossbred cows had a significant effect in months two and three.
- The highest lactation persistency was in primiparous cows compared to the multiparous.
- The highest lactation persistency in cows giving birth to males, compared to the cows giving birth to females.

Keywords: Lactation carve, persistency, parity order, crossbred cows

Lactation persistency in dairy cows is a crucial economic trait, reflecting a cow's ability to maintain milk production after reaching peak yield. This trait is particularly important in crossbred cows, where genetic and environmental factors can influence milk yield and persistence. Understanding the persistency percentage at different periods of milking in crossbred cows can help improve dairy farm productivity and management practices (Koloi, and Mandal, 2020; Prabhakar *et al*. 2023). Animals that provide milk with high persistence are considered inexpensive since they reduce and stabilize production expenses, resulting in higher profits. Cows that secrete a high rate of milk for a longer duration of lactation are known as persistent producers, but others become dry or reduce their supply within a few weeks and are thus referred to

How to cite this article: Al-Hayani, A.A., Tarig, A.A. and Abu Nikhaila, A.M. (2025). Effect of Some Non-Genetic Parameters on Persistence of Milk Production in Crossbred Cows. *Int. J. Ag. Env. Biotech.*, **18**(01): 01-06.

Source of Support: None; **Conflict of Interest:** None

as non-persistent. A lactation curve is a graphical representation of the relationship between milk yield and lactation length that is also thought to reflect the total milk yield of a single lactation. Persistency refers to the slope of the falling phase of a curve or the level of peak yield maintained, Wood (1967). Lactation persistence helps lower the production system's costs Because of the correlation between lactation persistence and feeding and health expenses, reproductive performance, disease resistance, and milk yield during a 305-day production cycle, (Dekkers *et al*. 1996). According to El-Amin and Osman's (1971) research, the month of calving has no impact on the persistence of Northern Sudan Zebu cattle. Ibeawuchi, (1988) found that parity had a substantial (P<0.05) effect on the lactation persistence of Friesian x White Fulani F1 cattle. The curve is important because it can be used to choose breeding herds as well as evaluate existing lactation herds. A significant factor in milk production costs is the persistency of lactation, or the pace at which production declines after reaching its peak milk yield. After the peak yield, the rate of decline in milk production is around 7% each month (Val-Arreola *et al*. 2004).

Several environmental factors influence lactation persistence, including genetic group, sire effect, herd management, lactation number, food, gestation, and animal calving season. As a result, the current study sought to examine the impact of some non-genetic parameters (stage lactation, parity order, and gender calving) on the lactation persistency of crossbred cows. The current study aimed to evaluate the effects of non-genetic parameters (stage lactation, parity order, and gender of calving) on the persistence of milk production in crossbreds.

MATERIALS AND METHODS

Study location and management of experimental animals

The research was carried out on (Twenty-Eight crossbreed cows) dairy cows in the fields of the University of Khartoum educational farm under conditions Unified administrative and nutritional. The cows were in different production parity orders for milk (the second season to the seventh season), and physiological status. The cows were differently rated for gender calving (male or female), Parity order, Stages of lactation. The study was conducted lasted for 11 months from (January to November) 2022.

Persistence calculate

Persistency is a measure of the rate of change in milk production between tests, (milk yield at one test as a percentage of milk yield at an early test). The period between each test was 30 days. The monthly test-day intervals of 30 days were considered starting from days (15, 45, 75, 80, 105, 135, 165, 195, 225, 255, and 285) of lactation. Therefore, lactation persistency was evaluated for each cow experimentally via persistence. The persistency measures (P %) used were ratios between average milk yields obtained in different parts of the stage of lactation. The (P %) was calculated as proposed by Johansson and Hansson, (1940).

(P %) = (Milk L at later test / Milk L at earlier test) * 100

The amount of milk recorded in 24-hour duration on any particular day is called the test-day (TD) milk yield and is expressed in a letter.

STATISTICAL ANALYSIS

We examined the impact of stage lactation, parity order, and gender calving. On persistency, and peak yield, The Duncan test was used to determine significant (P<0.05) differences between means using a program (SAS, 2012). The following model was used to investigate the effect of each trait on persistency, and peak yield.

$$\mathcal{E}_{ijk} = \mu + a_i + b_j + c_k + \varepsilon_{ijk}.$$

Where: μ = overall mean of persistency, peak yield. a_i = impact of stage lactation (early-mid-late). b_j = fixed effect of parity order (primiparous or multiparous). c_k = influence of gender calving (male, and female). ε_{ijk}= Random error. The curves were drawn after statistical analysis of the data using Excel.

RESULTS AND DESICCATION

The results showed Non-significant differences (P≥0.05). In the percentage of persistence in milk

production in the first three months, which reached its peak in the second month (102.14%). Then there was a gradual decrease from the third, fourth, and fifth, then increased again in the sixth month (96.07%) of production, as shown in Table 1 and Fig. 1. The significant differences (P<0.05) were high between the lactation stages (early, midem, late). As shown in Table 1 and Fig. 1.

Table 1: Least squares mean and standard error for persistency percentage at stage lactation, in crossbred cows.

Stage lactation	*% Persistency	Std. Error
Month 1	97.55^{ab}	0.96
Month 2	102.14^{a}	2.94
Month 3	99.79^{a}	0.13
Month 4	91.38^{bc}	0.89
Month 5	93.18^{b}	0.85
Month 6	96.07^{ab}	0.42
Month 7	94.33^{b}	0.93
Month 8	88.40^{c}	1.09
Month 9	82.59^{c}	1.30

**Persistency % = (Milk L at later test / Milk L at earlier test)* 100; ^{a,b} Means in same row and breed within a factor carrying different superscripts differ (p<0.05).*

Dairy crossbred cows have a lactation curve that begins with the initial milk yield, increases until the peak of lactation, and then declines until the cow dries out. Fig. 1. Equations for the lactation curve are useful tools that show the lactation curve and allow for predicting factors such as persistency, peak time, and peak yield (Appuhamy, 2006). According to Pereira *et al*. (2012) persistency is not correlated with milk production levels or milk yield breeding values, but rather with the lactation curve's shape.

The persistence production of the crossbred cows in this study is good in the early (99.82%) and midem (93.54%) lactation stages and this may be attributed to the use of bulls with high breeding values for milk yield. Persistence was highest because of the hot weather. This is consistent with the findings of (Yilmaz and Koc, 2013; Torshizi and Mashhadi, 2016), who reported that the warm season of calving, is responsible for higher persistency.

The parity order of crossbred cows had a significant (P<0.05) effect in months two and three in the persistency percentage of milk production, the highest lactation persistency (162.67 and 115.20%) was observed in primiparous cows, compared to the multiparous cows, which reached (140.32 and 111.86%), respectively, Table 2, and Fig. 2. Persistence decreased at the production in the mid-lactation period of 4, 5, and 6 months, but parity order had no effect (P ≥0.05). In the late lactation period, it became clear that there was significance non-statistical as they were higher in the cows multiparous, as shown in Table (2) and Figure (2).

This study is similar to the literature (Yilmaz *et al*. 2013; Zurwan *et al*. 2017; Koloi *et al*. 2018) and found a significant (P<0.05) impact of the parity order of cows on the persistence of lactation. In a similar study by YILMAZ and A. KOC (2013), the highest persistency was obtained for the first parity, in Red Holstein (RH) cows. The cause for cows primiparous more in lactation Persistence in this study may be due to the existence of more secretary

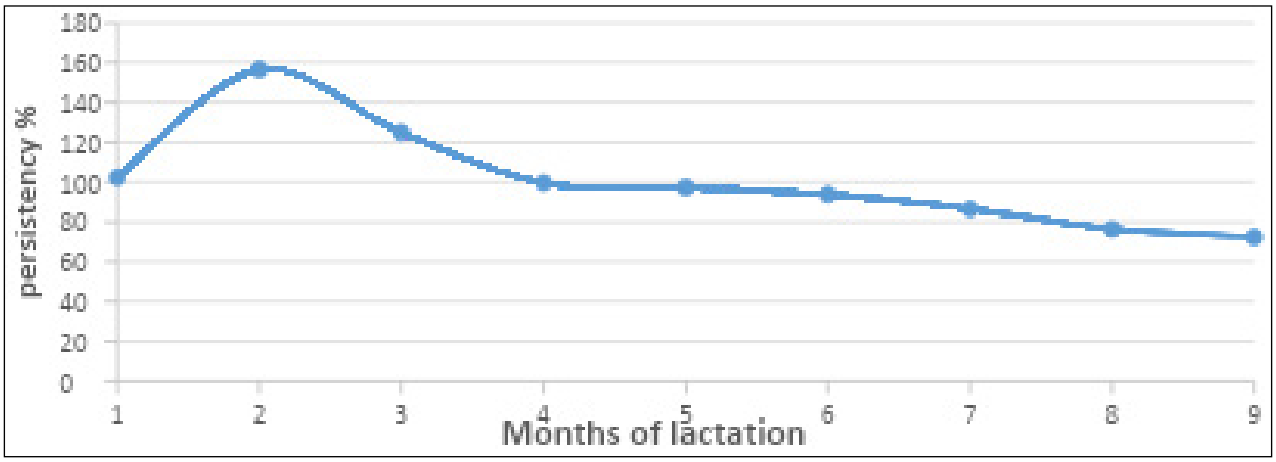

Fig. 1: Curve persistency percentage period milking of crossbred cows

Table 2: Last square Mean persistency percentage period milking of effect Parity order and calving Gender in crossbred cows

Traits	Parity order		Gender calving	
	Multiparous	Primiparous	Female	Male
	*% Persistency		Persistency%*	
N	16	12	13	15
Month 1	101.17±3.59	101.73±2.9	99.95±1.41	102.50±1.31
Month 2	140.32±8.10^{b}	162.67±9.09^{a}	126.24±18.88^{b}	168.93±17.71^{a}
Month 3	111.86±19.66^{b}	115.20±18.80^{a}	117.72±12.16^{b}	131.98±12.97^{a}
Month 4	99.36±3.31	100.40±2.69	99.69±1.30	99.55±1.22
Month 5	96.62±2.85	97.56±3.00	97.50±1.24	96.96±1.16
Month 6	93.39±1.42	94.49±1.43	93.86±0.61	93.73±0.58
Month 7	88.00±3.14	86.12±3.15	88.21±1.36	86.83±1.28
Month 8	81.73±3.68	76.76±3.67	81.69±1.59^{a}	76.15±1.49^{b}
Month 9	77.93±4.37	72.71±4.36	77.83±1.89^{a}	71.76±1.77^{b}

**Persistency % = (Milk L at later test / Milk L at earlier test) * 100; ^{a,b} Means in same row and breed within a factor carrying different superscripts differ ($p<0.05$).*

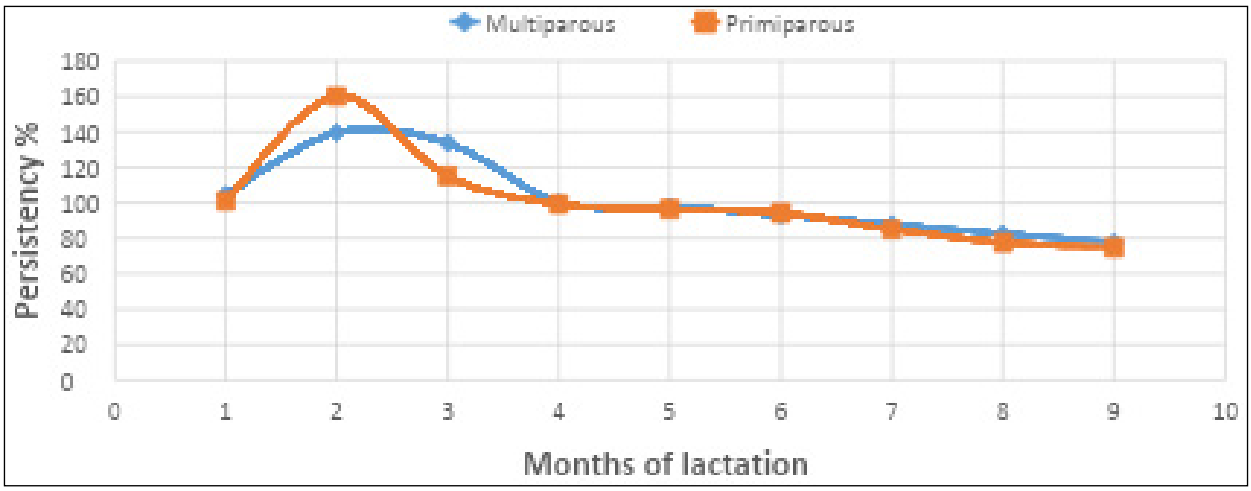

Fig. 2: Persistency curve production milk with effect Parity order (multiparous and primiparous) in crossbred cows

cells in the mammary gland, which sustain their secretary activity for a longer period in primiparous as compared to multiparous. This study is similar in primiparous to the literature by Farhangfar and Rowlinson, (2007) and Cilek *et al*. (2009), which revealed a negative phenotypic connection between early milk production and persistency. Cows with a high early milk production during lactation would likely have reduced persistency. The multiparous study bears similarities to the literature by Bouallegue *et al*. (2013). According to the positive phenotypic connection, persistency is higher in cows that have a slower rate of drop in milk yield after peak. The findings of Kamidi, (2005) are consistent with the data shown in Table 2 Persistency percentage. According to these persistency estimates, Sudanese cows that give birth in the warm seasons have a similar persistency to those that give birth in the cold seasons (winter and autumn).

Contrary to what he found (Suresh Jingar *et al.* 2014); the fourth parity cows produced the highest milk yield when compared to the first, second, and third parity cows. Contrary to our findings, earlier lactation curve research (Torshizi *et al.* 2019) revealed that the lactation curves of cows in the first and later parities had different shapes, with the multiparous producing more milk at peak than primiparous. In Appuhamy's (2006) study, the lactation curves of primiparous cows with high, average, and low persistency showed entirely distinct shapes; for example, very persistent cows produced more

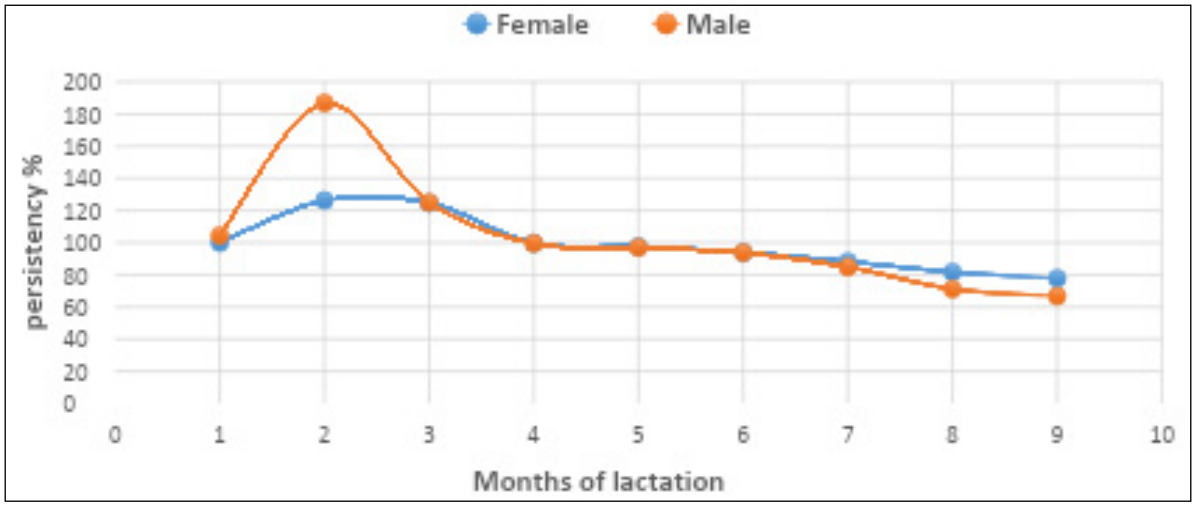

Fig. 3: Persistency curve production milk with effect gender of calving (Female and Male) in crossbred cows

milk at the beginning of lactation and less at the conclusion. The lactation curve is flatter in primiparous individuals, indicating the highest persistency; in multiparous individuals, persistency diminishes. Accordingly, persistence will decline as parity number increases (Weller *et al.* 2006). This Fig. 2 shows that within multiparous cows, persistency decreases compared to primiparous. This is consistent with what I found (Torshizi and Mashhadi, 2016) in Iranian Holstein Dairy Cows.

The gender calving of crossbred cows had a significant (P<0.05) effect in months two and third in the persistency of milk production, the highest lactation persistency (168.93 and 131.98%) was observed in cows giving birth to males, compared to the cows giving birth to females, which reached (126.24 and 117.72%). respectively, Table 2 and Fig. (3). Then, a period of persistence continued in the mid-lactation period without any significant differences between cows giving birth to males, compared to the cows giving birth to females. In the late lactation period, it became clear that there was significance non-statistical as they were higher in the cows giving birth to females, as shown in Table 2 and Fig. 3.

While we did not find any researchers who addressed the effect of gender of calving (Female and Male) on the effect of the persistency percentage period milking. Therefore, according to my knowledge and simple research experience, this is the first study.

CONCLUSION

The significant differences (P<0.05) in the percentage of persistence in milk production were high between the lactation stages (early, Midem, late). The percentage of persistence peaked in the second month (102.14%). Then, there was a gradual decrease from the third, fourth, and fifth months, then increased again in the sixth month (96.07%) of production. Dairy crossbred cows have a lactation curve that begins with the initial milk yield, increases until the peak of lactation, and then declines until the cow dries out. The parity order of crossbred cows had a significant (P<0.05) effect in months two and three in the persistency percentage of milk production; the highest lactation persistency (162.67 and 115.20%) was observed in primiparous cows, compared to the multiparous cows, which reached 140.32 and 111.86%, respectively. The calving of the gender of crossbred cows had a significant (P<0.05) effect in months two and third in the persistency of milk production, the highest lactation persistency (168.93 and 131.98%) was observed in cows giving birth to males, compared to the cows giving birth to females, which reached (126.24 and 117.72%), respectively. For optimal milk production and efficiency, cows with high lactation persistency are preferred.

ACKNOWLEDGMENTS

The authors are thankful to Many thanks to the Head of the Dairy Production Department and the Dean of the College of Animal Production for providing

the necessary facilities for conducting this work. Many thanks to all the staff of the University of Khartoum farm, including management, employees, and workers, for the assistance they provided during the experiment.

REFERENCES

Appuhamy, J.A.D.R.N. 2006. Phenotypic relationships between lactation persistency and common health disorders in dairy cows (MSc Thesis, Virginia University).

Bouallegue, M., Haddad, B., Aschi, M.S. and Ben Hamouda, M. 2013. Effect of environmental factors on lactation curves of milk production traits in Holstein – Friesian cows reared under North African condition. *Livestock Research and Rural Development,* **25**: 5–10.

Cilek, S., Keskin, I., Ilham, F. and Sahin, H. 2009. Lactation curve traits of Anatolian population of brown Swiss cows in Turkey. *Archiva Zootechnica,* **12**(2): 71–78.

Dekkers, J.C.M., Jamrozik, J., Ten Hag, J.H., Schaeffer, L.R., and Weersink A. 1996. Genetic and economic evaluation of persistency in dairy cattle. *Interbull Bulletin,* **(12)**: 97–102.

El Amin, F.M. and Osman, A.H. 1971. Some dairy characteristics of Northern Sudan zebu cattle. I. The components of the lactation curve. *Tropical Agriculture*, **48**(3): 197-200.

Farhangfar, H. and Rowlinson, P. 2007. Genetic analysis of wood's lactation curve for Iranian Holstein heifers. *Journal of Biological Sciences,* **7**(1): 127-135.

Ibeawuchi, J.A. 1988. Persistency of milk production in F1 Friesian × White Fulani cattle in a tropical environment. *Bulletin of Animal Health and Production in Africa,* Vol. **36(**3): 215-219.

Johansson, I. and Hansson, A. 1940. Causes of variation in milk and butterfat yield of dairy cows. *Kungliga Lantbruksakademiens Tidskrift* , **79**(60.5): 1-127.

Kamidi, R.E. 2005. A parametric measure of lactation persistency in dairy cattle. *Livestock. Science*, **96**:141-148.

Koloi, S. and Mandal, A. 2020. Genetic analysis of persistency indices of milk yield in Jersey crossbred cattle. *Journal of Dairy Research*, **87:** 330 - 333.

Pereira, R.J., Verneque, R.D.S., Lopes, P.S., Santana, M.L., Lagrotta, M.R., Torres, R.A. and Machado, M.A. 2012. Milk yield persistency in Brazilian Gyr cattle based on a random regression model. *Genetics and Molecular Research*, pp. 1599-1609. http://dx.doi.org/10.4238/2012. June.15.9.

Prabhakar, P., Herbert, S., Singh, R. and Pandey, N. 2023. Estimation of Lactation Persistency in Different Classes of Crossbred Jersey and Red Sindhi Cows. *International Journal of Current Microbiology and Applied Sciences*. https://doi.org/10.20546/ijcmas.2023.1206.007.

Torshizi, M.E., Mashhadi, M.H. and Farhangfar, H. 2019. Different aspects of lactation persistency in dairy cows. *The Indian Journal of Animal Sciences*, **89**(6): 607-614.

Torshizi, M. and Mashhadi, M. 2016. Evaluation of Different Measures of Milk Yield Persistency in Iranian Holstein Dairy Cows. *Journal of Animal Science*, **4**: 58-73.

Val-Arreola, D. Kebreab, E. Dijkstra, J. and France, J. 2004. Study of the lactation curve in dairy cattle on farms in central Mexico. *Journal of Dairy Science*, **87**(11): 3789–3799.

Weller, J.I., Ezra, E. and Leitner, G. 2006. Genetic analysis of persistency in the Israeli Holstein population by the multitrait animal model. *Journal of Dairy Science*, **89**(7): 2738-2746.

Wood, P.D.P. 1967. Algebraic model of the lactation curve in cattle. *Nature*, **216**(5111): 164-165.

Yilmaz. H. and Koc, A. 2013. A research on milk yield, persistency, milk constituents and somatic cell count of red Holstein cows raised under Mediterranean climate conditions. *Bulgarian Journal of animal Science,* **19**(6): 1401-1407.

Zurwan, A., Moaeen-ud-Din, M., Bilal, G., and Khan, M.S. 2017. Estimation of genetic parameters for persistency of lactation in Sahiwal dairy cattle. *Pakistan Journal of Zoology*, **49**(3): 882–877.