Indian Journal of Animal Sciences **93** (1): 100–104, January 2023/Article
https://doi.org/10.56093/ijans.v93i1.128486

Evaluation of production performance of Binjharpuri cattle of Odisha

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Received: 28 September 2022; Accepted: 28 November 2022

ABSTRACT

Binjharpuri, a dual purpose indigenous breed of Odisha is commonly reared for its various advantages, viz. optimum milk production in low input management system, excellent draft ability in hot humid climate condition and heat resistance ability. In the present study, attempt was made to evaluate production performance along with influence of non- genetic effects such as location, lactation order and season of calving on production traits of binjharpuri cattle. The overall average least square means along with standard error for lactation milk yield, average daily milk yield, peak yield, lactation length and dry period were found to be 974.490±6.788 kg, 3.557±0.023 kg, 4.633±0.021 kg, 274.444±1.249 days and 121.913±0.611 days, respectively. Location had highly significant effect on lactation milk yield, average daily milk yield, lactation length and dry period, whereas non-significant effect on peak yield. Lactation order too had highly significant effect on the traits considered under study. Season of calving had highly significant effect on lactation milk yield, average daily milk yield; significant effect on lactation length whereas non-significant effect on peak yield and dry period. Significant influence of non-genetic factors and significant variations in traits under study is suggestive that remarkable improvement in the Binjharpuri cattle populace can be targeted through better management and by nurturing effective breeding strategies.

Keywords: Average daily milk yield, Lactation length, Lactation milk yield, Peak yield

Livestock rearing has been an integral part of the rural livelihood systems in Odisha, and is equitably distributed in all sections of the society, and has immense impact on the economic status of inhabitants. Livestock is reared by the villagers for multiple purposes such as milk, meat, egg, skin, fibre, manure, draught power and employment (Das and Das 2016). Out of the various livestock species reared by the households, cattle is the predominant. The state is a home to various indigenous breeds of cattle such as Binjharpuri, Motu, Ghumusari, and Khariar.

Binjharpuri cattle, a dual purpose breed is claimed to still exist in its purest form even after subjecting to much crossbreeding through the process of artificial insemination. This breed of cattle is known to yield sufficient amount of milk in low input system of rearing and also well known for its draft ability and heat tolerance capacity. They are well adapted to the local agro-climatic conditions and have proven their potential in hot and humid condition (Dash *et al.* 2013).

However, there is a lack of comprehensive study on the performance and potentiality of Binjharpuri breed of cattle. The success of dairy farming largely depends on the level of production and production efficiency traits of the animals. There are several genetic and non-genetic factors that influence the phenotypic expression of production traits. The present study was designed to evaluate the production traits and the non-genetic factors affecting them in Binjharpuri breed of cattle.

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MATERIALS AND METHODS

The data for present study was collected from 507 cattle through personal visits and interaction with livestock keepers of five villages, viz. Chandramu, Chatishdebil, Ratlanga, Rudrapur and Sujanpur of Jajpur district of Odisha in the prescribed format of questionnaire (as per NBAGR, Karnal) during the period of November, 2018 to January, 2020. Different traits studied were lactation milk yield (LMY), average daily milk yield (ADMY), peak yield (PY), lactation length (LL) and dry period (DP). The raw data collected on the characters under study were classified in suitable sub-class frequency and were subjected for correction. The data obtained for production traits were classified and designated on the basis of location, viz. Chandramu (C1), Chatishdebil (C2), Ratlanga (C3), Rudrapur (C4) and Sujanpur (C5); lactation order First (L1), Second (L2), Third (L3), Fourth (L4) and Fifth (L5) and season of calving: Summer season, S1 (March to June); Rainy season, S2 (July to October) and Winter season, S3 (November to February).

Statistical analysis: The records on various production traits of Binjharpuri cattle were analysed by Least squares analysis (LSA) technique of fitting constants (Harvey

1990) for the estimation of genetic parameters as well as to examine the simultaneous effects of different genetic and non-genetic factors affecting any trait.

Mathematical models used for Least squares analysis for estimation and analysis of production traits:

$$Y_{ijkm}=\mu + C_i + L_j + S_k + E_{ijkm}$$

Where, Y_{ijkm}, record of m^{th} cow calved in k^{th} season, i^{th} location and recorded in j^{th} lactation order; μ, population mean common to all observations; C_i , effect of i^{th} location; L_j, effect of j^{th} lactation order; S_k , effect of k^{th} season; E_{ijkm}, random error.

After analysis of variance, the significant effects were further analysed to make all the pair-wise comparisons by Duncan's Multiple Range Test (DMRT) as modified by Kramer (1957).

RESULTS AND DISCUSSION

The average least squares means (LSM) for LMY, ADMY, PY, LL and DP of Binjarpuri cows along with the standard errors (SE) were found to be 974.490±6.788 kg, 3.557±0.023 kg, 4.633±0.021 kg, 274.444±1.249 days and 121.913±0.611 days (Table 1), respectively. Butana cattle in Sudan expressed similar LL and DP whereas higher LMY and ADMY (Musa *et al.* 2005). The DP of Binjharpuri cattle corroborated with the obvervations in Gaolao (Kothekar *et al*. 2006). Pundir and Singh (2008) and Sai Reddy (2010) reported similar ADMY in Red Sindhi cattle and Ongole cattle, respectively. Singh *et al.* (2011a) in case of crossbred cattle Vrindavani, reported higher values for each trait under study. Singh *et al.* (2011b) in Hariana cattle in case of LMY observed similar results. The LL estimated in the present study was in approximation with the results reported by Dangi *et al.* (2013) in Rathi cattle and Kumar *et al*. (2014) in Holstein-Friesian (HF). PY was at par with the report of Chandran *et al.* (2014) in Bachaur cattle. Similar LMY were observed by Mohanty (2015) in Binjharpuri cows. The DP of Binjharpuri cattle corroborated with the observations in indigenous cattle of Mizoram (Pundir *et al*. 2015). Higher DP values were reported in Gir cows and

Table 1. Least square means and standard errors for lactation milk yield, average daily milk yield, peak yeld and lactation length according to location, lactation order and season of calving

Sub class no.	Lactation milk yield (kg)	Average daily milk yield (kg)	Peak yield (kg)	Lactation length (Days)	Dry period (Days)
Overall	974.490 ±6.788 (507)	3.557±0.023 (507)	4.633±0.021 (507)	274.444±1.249 (507)	121.913 ± 0.611 (507)
Location					
C1	1015.153^{a}±14.440 (100)	3.544^{a}±0.050 (100)	4.604±0.045 (100)	286.582^{a}±2.658 (100)	119.941^{a}±1.301 (100)
C2	923.699^{b} ±14.280 (102)	3.331^{b}±0.049 (102)	4.661±0.045 (102)	277.275^{b}±2.628 (102)	120.243^{a}±1.286 (102)
C3	946.804^{b}±14.058 (103)	3.602^{a}±0.048 (103)	4.701±0.044 (103)	263.994^{c}±2.588 (103)	127.059^{b}±1.266 (103)
C4	1026.883^{a}±14.103 (100)	3.712^{c}±0.049 (100)	4.608±0.044 (100)	277.269^{b}±2.596 (100)	121.146^{a}±1.270 (100)
C5	959.914^{b}±13.710 (102)	3.596^{ac}±0.047 (102)	4.592±0.043 (102)	267.102^{c}±2.524 (102)	121.173^{a}±1.235 (102)
Lactation order					
L1	857.069^{a}±14.719 (89)	3.327^{a}±0.051 (89)	4.385^{a}±0.046 (89)	259.441^{a}±2.709 (89)	136.098^{a}±1.326 (89)
L2	916.699^{b}±11.349 (149)	3.438^{ac}±0.039 (149)	4.502^{a}±0.036 (149)	267.451^{b}±2.089 (149)	123.229^{b}±1.022 (149)
L3	992.712^{c}±11.968 (135)	3.492^{b}±0.041 (135)	4.672^{b}±0.038 (135)	277.594^{c}±2.203 (135)	111.985^{c}±1.078 (135)
L4	1112.320^{d}±14.494 (91)	3.837^{cd}±0.050 (91)	4.825^{c}±0.045 (91)	290.379^{d}±2.668 (91)	99.687^{d}±1.305 (91)
L5	994.153^{c}±21.584 (43)	3.590^{bc}±0.074 (43)	4.784^{bc}±0.068 (43)	277.356^{c}±3.973 (43)	138.5637^{a}±1.944 (43)
Season of calving					
S1	920.297^{a}±11.578 (153)	3.304^{a}±0.040 (153)	4.588±0.036 (153)	278.947^{a}±2.131 (153)	122.061±1.043 (153)
S2	969.542^{b}±10.589 (187)	3.553^{b}±0.036 (187)	4.651±0.033 (187)	272.548^{ab}±1.949 (187)	121.320±0.954 (187)
S3	1033.632^{c}±10.992 (167)	3.808^{c}±0.038 (167)	4.662±0.034 (167)	271.839^{b}±2.023 (167)	122.356±0.990 (167)

Note: Least square means and standard errors with different superscripts differ significantly at P<0.05.

Red Sindhi cattle by Savaliya *et al.* (2016) and Chigale *et al.* (2016), respectively. Pundir *et al*. (2019) reported similar ADMY and shorter LL in case of indigenous cattle of Meghalaya. Dhofari cows (Bahashwan 2020) were found to have lower LL than that of Binjharpuri cattle. Getahun *et al.* (2020) in Borena × HF crosses observed higher LMY, ADMY and LL. The LL estimated in the present study was in approximation with the results reported by Alem (2021) in Horro and Arsi cattle of Ethopia. Red Chittagong Cattle, indigenous and crossbred cattle in Bangladesh were found to have lower LL than that of Binjharpuri cattle. However, crossbred cattle in Bangladesh were reported to have higher LMY in comparison to the present study whereas lower estimates were reported in Red Chittagong cattle and indigenous cattle of Bangladesh (Hossain *et al*. 2021). PY, LMY and LL were found to be lower in indigenous cattle of Arunachal Pradesh. However the DP of Binjharpuri cattle corroborated with the DP of indigenous cattle of Arunachal Pradesh (Kakki and Zaman 2021). Lower estimates of LMY were reported by Parameswari *et al.* (2021) in Alambadi cattle. A comparatively higher PY, however lower LL and ADMY was reported in Ongole cattle by Rao *et al*. (2021). Thakkar *et al*. (2021) in Kankrej cattle observed higher LMY, ADMY and LL. Kumar *et al.* (2022) in case of Sahiwal cows reported a higher LMY. Shahid *et al.* (2022) in indigenous cattle of Northern Azad Jammu and Kashmir reported lower values for the traits under study except for DP which was longer that the present study.

Various non-genetic effects on the different production traits under study are discussed here.

Effect of location: In the present investigation highly significant (P≤0.01) influence of location on LMY, ADMY and DP; significant (P≤0.05) effect on LL was observed whereas non-significant effects were observed on case of peak yield. The maximum value for lactation milk yield was found in location C4 and minimum at location C2. The highest average daily milk yield was observed in the cows reared in location C4 and lowest value in cows reared in C2. The DMRT revealed significant difference between the values of average daily milk yield of C1 with C2 and C4. The highest value of lactation length was found for the animals reared under C1 followed by C2, C4, C5 and C3. However there were significant differences in the values of dry period from C3 location than rest other locations which is revealed by DMRT. The dry period was recorded to be longest in C3 and shortest in C1. Sai Reddy (2010) reported significant effects of location on LMY, AMY and DP. Similarities with present study were accounted for LMY and DP in Sahiwal cattle (Kumar and Gandhi 2011). In a study conducted in Holstein Friesian cross breds, Kumar et al. (2014) reported effects similar to the study in case of LMY, LL but the effects on PY was found to be significant unlike the present study. Dhaka et al. (2015) reported similar finding in case of LMY, PY and DP in a study conducted on Khillar cattle. Kumar et al. (2016) also reported significant effects of location on PY in Ongole. Although, Jagdale (2019) in case of Khillar cattle reported dissimilar effects of location on LMY and PY, the obsevations were similar in case of DP. Kakki and Zaman (2021) reported highly significant effects in case of LMY and LL, however non-significant effects of location were observed in PY and DP. The variations in the pattern might be due to the changes in environment and availability of quality feed and green fodder.

Effect of lactation order: LMY, ADMY, PY and LL on basis of lactation order were found to be highly significant (P≤0.01). The traits considered for this study was found to maintain an increasing trend up to 4th lactation after which it declined. This was highly similar with Butana cattle in Sudan where lactation order had highly significant effect on DP and LMY (Musa *et al*. 2005). Vinoo *et al.* (2005) in Ongole observed results in PY and DP which corroborated with the present study. Dangi *et al.* (2013) in Rathi cows reported similar effect in LL and non-significant effects in LMY. Similar results in case of Holstein Friesian × Deoni cows were observed in traits such as ADMY; but contrasting in case of LL by Wondifraw *et al.*(2013). Chigale *et al.* (2016) reported similar findings of LMY and DP in case of Red Sindhi, however found contrasting results for PY. However, Mohan *et al.* (2019) and Parameswari *et al.* (2021) in Deoni and Alambadi cattle, respectively observed results similar to the present study in both LL and LMY. Kumar *et al*. (2022) in Sahiwal, found non-significant effects in LMY.

Effect of season of calving: The effect of season of calving on LMY and ADMY was found to be highly significant (P≤0.01), while significant (P≤0.05) in case of LL. However, it was non-significant in case of PY and DP. Maximum value of LMY and LL was recorded in summer season and the minimum in winter season. The ADMY was found to be highest in winter season and lowest in summer season. Bajwa *et al.* (2004) reported highly significant effect on LL and LMY in Sahiwal cattle for a period of 10 years. Vinoo *et al.* (2005) in Ongole cattle reported non-significant effects on PY and DP which were found to be similar to the present study. Chand (2011) in Tharparkar and Wondifraw *et al.* (2013) in Holstein Friesian × Deoni cows showed similar effetcs on ADMY. Corroborating with the present study, Dhaware *et al.* (2008) and Dangi *et al.* (2013) in Rathi cattle showed significant effects. Bhutkar (2014) revealed significant effect on PY and non-significant effect on LL and DP in Deoni cows. Basak and Das (2018) and Mohan *et al*. (2019) showed similar significant effects on LMY in Deoni cows. Getahun *et al*. (2020) in Borena × HF crosses reported significant effects on LMY, ADMY and LL. However, Kumar *et al.* (2022) observed non-significant effects on LMY in Sahiwal cattle. Non-significant effects on LMY, ADMY and LL for Kankrej cattle were observed by Thakkar *et al*. (2021). The presence of significant seasonal effect on LMY, ADMY and LL might be an indication of the difference in management practices and availability of feeds and fodder during different seasons.

The present study on performance evaluation of Binjharpuri cattle under their native condition revealed optimum production performance which suggested that they can perform and thrive well under low input intensive system in the prevailing climatic conditions of Odisha. Non-genetic factors such as location, lactation order and season of calving had shown significant influence on different traits studied. Study also revealed variations in the traits considered. Looking at this, it can be concluded that remarkable improvement in the Binjharpuri cattle populace can be targeted through better feeding and management and following effective selection and breeding methodologies. As Binjharpuri cattle have potential for improvement, therefore the farmers should be targeted for awareness and motivation for scientific rearing of cattle.

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