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The Effect of Non-Genetic Factors on Relative Growth Rate of Sonadi Sheep at Different Ages

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Authors' contributions

This work was carried out in collaboration among all authors. All authors read and approved the final manuscript.

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ABSTRACT

The present study was conducted to assess the effect of non-genetic factors on relative growth rate of Sonadi sheep of different age groups. In this study data on 1396 Sonadi sheep maintained over the period of 2012-2019 under the Mega Sheep Seed Project, College of Veterinary and animal Science, Navania, Vallabhnagar, Rajasthan were analysed to assess the effect of non-genetic factors (year of birth, season of birth, sex, type of lamb) on relative growth rate viz. 0-3, 3-6, 6-9 and 9-12 months age groups. The overall least-squares mean along with standard error for RGR1 (0-3M), RGR2 (3-6M), RGR3 (6-9M) and RGR4 (9-12M) were 1.32±0.03, 0.42±0.02, 0.226±0.19 and 0.277±0.02 Percent per day, respectively. Year of birth had highly significant (P≤0.01) for RGR1,

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RGR2 and RGR4 group while significant (P≤0.05) effect on RGR3 group. Effect of season of birth on relative growth rate was also highly significant (P≤0.01) for RGR1 and RGR2 group while significant for RGR3 and RGR4 groups. Sex of lamb showed significant (P≤0.05) effect on RGR1 and RGR2 while non-significant on rest of the groups (RGR3, RGR4) whereas effect of type of birth on relative growth rate was found to be non-significant on all groups. The assessment of non-genetic factors plays an important role to formulate effective breeding programme for improvement of growth performance.

Keywords: Least square mean; non-genetic factors; relative growth rate; significant; Sonadi.

1. INTRODUCTION

Sheep with its multi-faceted value for fleece, meat, milk, skin and compost form a significant segment of rustic economy, especially in dry, semi-dry and hilly zones of the nation where atmosphere stays unfavourable. Sheep husbandry play an important role in the livelihood of rural masses and a crucial function in the financial upliftment of a large portion of the under privileged communities and ranchers. They contribute greatly to the agrarian economy, especially in areas where crop and dairy farming are not economical. Evidently, raising sheep productivity is crucial for generating wealth and raising smallholder farmers' standards of living Lakew et al. [1]. An amount of 535.95 million kg meat and 43.50 million kg fleece were produced by sheep in 2016-2017 [2]. As per NBAGR [3], Rajasthan which is also the 4th biggest sheep rearing state of India has 8 well defined breeds out of total 44 enlisted breeds.

Sonadi breed of sheep is reared for mutton purpose because towards mutton there is no prejudice by any community in India. Meat is a nutritious food that has a significant part in human balanced diet. Accordingly, there is an interest to increase the rate of meat production and utilization all through the world Ahmed et al. [4]. Consequently, an expansion in small ruminant production could add to the achievement of food self-sufficiency in the nation especially because of protein necessity for the increasing human population and improve the export of mutton. Attributes identified with growth are of intricate qualities. They reflect the impacts of an intricate net of gene actions affected by the climate. Accordingly, to improve the growth performance of animals, improvement in both their hereditary structure and the climate they are encircled by is required [5]. Growth profile attributes are acceptable markers of versatility of an animal to the current ecological conditions. In this manner, better growth is fundamental for suitable proliferation, creation and survivability in sheep. The growth characteristics assume a significant function in efficiency and are one of the significant selection attributes in sheep breeds. Life of an animal is known to be impacted by both hereditary and natural elements which must be assessed prior to arranging and actualising a sheep breeding plan Mandal et al. [6]; Gbangboche et al. [7]. Relative growth rate is proportion of real growth of animal and is a corresponding growth as technique for changing the state of the growth curve [8]. It is likewise alluded to be true proportion of growth rate and expresses the percent weight gain per unit of time. It is valuable for contrasting weight gain of people and broadly different body weight [9]. The current investigation was imagined with the accompanying to evaluate some fixed effect on growth performance in terms of relative growth rate in Sonadi sheep.

2. MATERIALS AND METHODS

The data on growth of 1396 animals (Sonadi sheep) spread over period of 8 years from 2012-2019 were taken from Mega Sheep Seed Project coordinating Sonadi sheep unit, Vallabhnagar, Udaipur (Rajasthan) where they are maintained under semi-intensive system of management. On the basis of year of birth, data was categorized into eight classes and coded from i_1- i_8 for the corresponding year. Season of birth was categorised into three seasons as j_1 (monsoon: July to October), j_2 (winter: November to February) and j_3 (summer: March to June). Sex of lamb was classified according to male (k_1) and female (k_2) while type of birth according to single (l_1) and twin (l_2). The data on growth efficiency was analysed through Mixed Model Least-Squares and Maximum Likelihood method designed by Harvey [10].

To estimate the effect of various non-genetic factors on relative growth rate was estimated through the following model:

$$Y_{ijklm} = \mu + A_i + B_j + C_k + D_l + E_m + e_{ijklm}$$

Where,

Y_{ijklmn}= Growth records of the n^{th} progeny of i^{th} sire belonging to l^{th} sex, k^{th} season, j^{th} period and m^{th} type of birth
μ = Population mean
A_i = Fixed effect of i^{th} period of birth (i = 1, 2, 3, 4, 5, 6, 7, 8)
B_j = Fixed effect of j^{th} season of birth (j = 1, 2, 3)
C_k= Fixed effect of k^{th} sex of birth (k = 1, 2)
D_l = Fixed effect of l^{th} type of birth (l = 1, 2)
e_{ijklmn} = Residual error, NID (0, σ^2)

Duncan's Multiple Range Test (DMRT) was used to make pair wise comparison among the least squares means (Kramer, 1956).

3. RESULTS AND DISCUSSION

The overall least-squares mean along with standard error of relative growth rate were observed as 1.32±0.03, 0.42±0.02, 0.226±0.19 and 0.277±0.02 percent per day for RGR1, RGR2, RGR3 and RGR4, respectively which are shown in Table 1 & Figs. 1-4.

Our findings of RGR1 (0-3) were found to be in close agreement with Devendran et al. [11] for Madras red lamb as 1.36±0.006 percent per day while the findings of RGR2 (3-6) was in close agreement with Jeichitra et al. [12] for Mecheri sheep as 0.41 ± 0.006 percent per day. The close agreement of RGR3 (6-9) was reported by

Table 1. Year, Season, Sex, TOL wise least square mean and standard error of relative growth rate trait of sonadi sheep

Effect	RGR1 (0-3 months)	RGR2 (3-6 months)	RGR3 (6-9 months)	RGR4 (9-12 months)
μ	1.32±0.03	0.42±0.02	0.226±0.19	0.277±0.02
N	1060	831	630	506
Year	**	**	*	**
2012	1.57^{c}±0.04 (130)	0.377^{cd}±0.03 (94)	0.26^{d}±0.02 (74)	0.315^{ab}±0.02 (64)
2013	0.95^{a}±0.03 (188)	0.572^{d}±0.29 (163)	0.321^{e}±0.02 (136)	0.402^{b}±0.02 (120)
2014	0.90^{a}±0.03 (127)	0.628^{e}±0.02 (106)	0.344^{e}±0.02 (91)	0.339^{ab}±0.02 (79)
2015	1.402^{b}±0.04 (99)	0.390^{b}±0.03 (85)	0.168^{abc}±0.02 (54)	0.220^{a}±0.02 (54)
2016	1.430^{b}±0.03 (157)	0.354^{b}±0.03 (92)	0.221^{bcd}±0.02 (71)	0.260^{ab}±0.02 (59)
2017	1.396^{b}±0.03 (135)	0.317^{b}±0.03 (104)	0.122^{a}±0.02 (72)	0.218^{a}±0.02 (62)
2018	1.603^{c}±0.03 (147)	0.236^{a}±0.02 (138)	0.153^{ac}±0.02 (115)	0.190^{a}±0.02 (61)
2019	1.353^{b}±0.04 (77)	0.522^{d}±0.03 (49)	0.225^{cd}±0.03 (17)	0.269^{ab}±0.05 (7)
Season	**	**	*	*
Season I (Monsoon)	1.29^{a}±0.03 (413)	0.427^{b}±0.02 (354)	0.241^{b}±0.19 (272)	0.268^{a}±0.02 (216)
Season II (Winter)	1.27^{a}±0.03 (517)	0.472^{c}±0.02 (384)	0.209^{a}±0.19 (283)	0.258^{a}±0.02 (220)
Season III (Summer)	1.41^{b}±0.03 (130)	0.374^{a}±0.03 (93)	0.227^{ab}±0.25 (75)	0.304^{b}±0.02 (70)
Sex	*	*	NS	NS
Male	1.34^{b}±0.03 (509)	0.441^{b}±0.02 (400)	0.235±0.02 (295)	0.281±0.02 (236)
Female	1.30^{a}±0.03 (551)	0.408^{a}±0.02 (431)	0.217±0.02 (335)	0.27±0.02 (270)
TOL	NS	NS	NS	NS
Single	1.37±0.01 (1031)	0.415±0.009 (810)	0.238±0.007 (614)	0.239±0.008 (495)
Twin	1.27±0.05 (29)	0.434±0.04 (21)	0.213±0.03 (16)	0.314±0.04 (11)

Devendran et al. [11] for Madras red lamb as 0.257±0.002 percent per day. The lower estimate of RGR4 (9-12) was reported by Devendran et al. [11] as 0.11±0.001 percent per day for Madras red lamb.

It was observed that the relative growth rate amid RGR1 was higher as compared to RGR2, RGR3 and RGR4. This might be due to effect of dam's milk during suckling stage which serves as a complete nutritious food for kid.

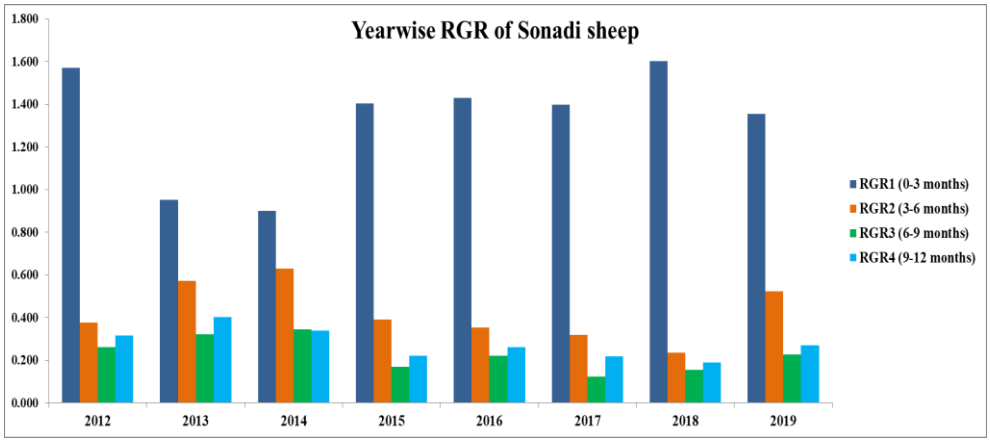

Fig. 1. Yearwise least square mean of relative growth rate trait of sonadi sheep

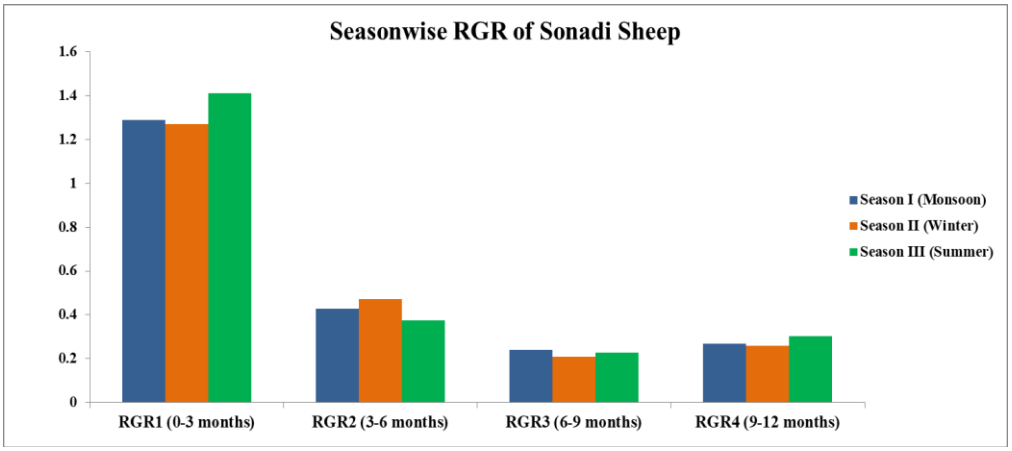

Fig. 2. Season wise least square mean of relative growth rate trait of sonadi sheep

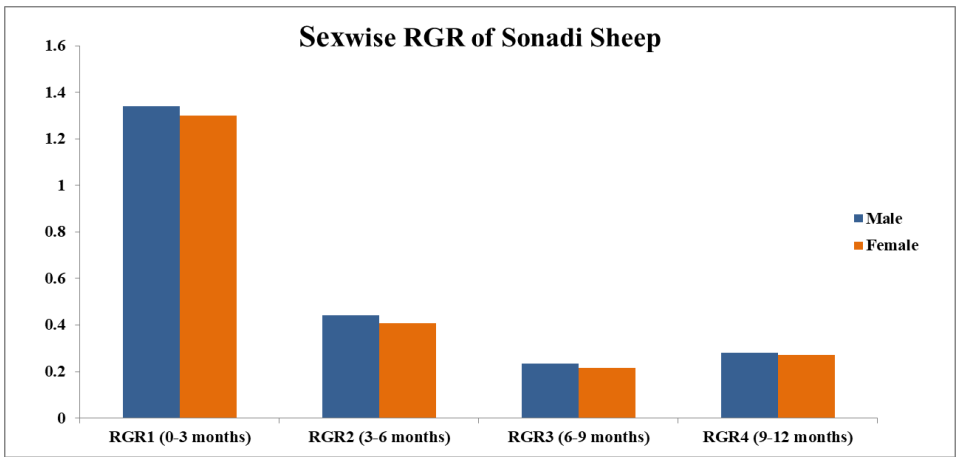

Fig. 3. Sex wise least square mean of relative growth rate trait of sonadi sheep

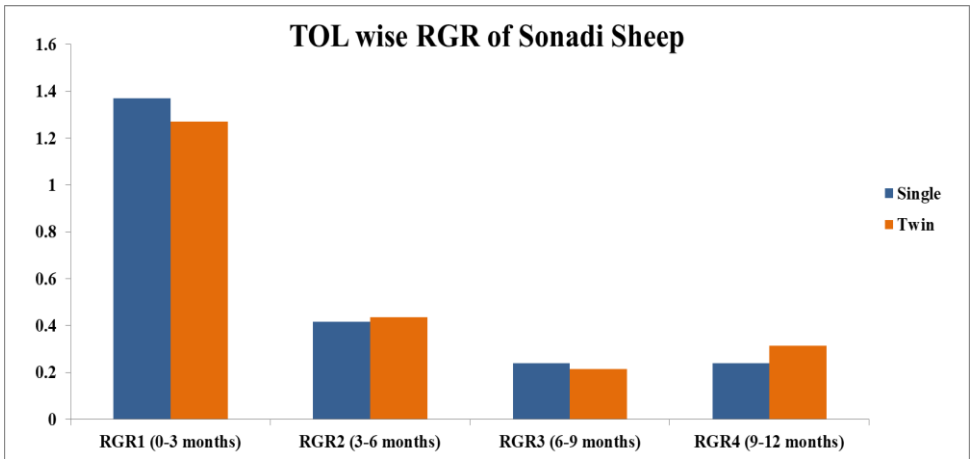

Fig. 4. TOL wise least square mean of relative growth rate trait of Sonadi sheep

3.1 Year of Birth

Year of birth had highly significant (P≤0.01) effect on RGR1, RGR2, RGR4 and while significant for RGR3 of Sonadi sheep. Similar results were reported as Kesbi and Tari [5] in Zandi sheep. On the contrary, Devendran et al. [11] observed non-significant effect of year of birth on relative growth rate for RGR3 and RGR4 in Madras Red sheep. The effect of year on relative growth rate might be caused by differences in agro-climatic conditions & differences in nutrition and management conditions in different years.

3.2 Season of Birth

Effect of season of birth on relative growth rate was highly significant (P≤0.01) for RGR1, RGR2 while significant for RGR3 and RGR4 of Sonadi sheep. However, similar to our findings Jeichitra et al. [12] in Mecheri sheep observed highly significant effect of season of birth on RGR1 and RGR2. Whereas in contrast to our present findings, Devendran et al. [11] also observed significant effect of season of birth on relative growth rate for RGR3 in Madras red sheep. Devendran et al. [11] also observed non-significant effect of season of birth on relative growth rate for RGR4 in Madras red sheep. The effect of season of birth on relative growth rate might be caused due to adaptation to hot humid climatic conditions or may be due to regional differences in the climatic conditions, availability of pasture during different seasons. The changes in nutritional factors due to season have more effect of season on growth rate. However, minimum growth rate was obtained during monsoon born lambs as compared to winter and summer season, which might be attributed to congenial environmental conditions.

3.3 Sex of lamb

Our present findings showed significant (P≤0.05) effect of sex on relative growth rate of RGR1 and RGR2 while non-significant for RGR3 and RGR4 in Sonadi sheep. However, Kesbi and Tari [5] observed highly significant effect of sex for RGR1 and RGR2 in Zandi sheep; Devendran et al. [11] found highly significant for RGR1 and RGR2 in Madras Red sheep. Whereas in contrast to our present findings, Devendran et al. [11] observed non-significant effect of sex on relative growth rate for RGR3 in Madras Red sheep. The significant effect of sex on relative growth rate reported may be due to the hormonal differences in their endocrinological and physiological functions [13-15]. In Females, Estrogen hormone limits growth of long bones. In addition, regulatory mechanism of growth hormone secretion is sexually dimorphic which is partly responsible for male-female differences in growth rate.

3.4 Type of Birth

Type of birth had non-significant effect on relative growth rate for RGR1, RGR2, RGR3 and RGR4. However, highly significant had been observed by Kesbi and Tari [5] in Zandi sheep for RGR1 and RGR2. Single born had higher relative growth rate than twin born because of compete feeding of mother milk in twin lambs during pre-weaning age. Single born lambs with higher birth weight grew faster due to better nutrient supply during prenatal as well as pre-weaning period. Twin lambs may show growth spurt during post-weaning periods and utilize feed more efficiently than single lamb.

4. CONCLUSION

The present study highlights that the non-genetic factors *viz.,* year and season of birth and sex of lamb were the major factors affecting relative growth rate of Sonadi sheep. The result obtained in this study showed that the effect of year of birth lambing had a highly significant effect on RGR1, RGR2 andRGR4 while significant on RGR3 of Sonadi sheep and season of lambing had a highly significant effect on RGR1, RGR2 while significant effect on RGR3 and RGR4 of Sonadi sheep as environmental and managemental factors affect the provision of feed requirements. The sex of lamb had shown a significant effect on pre-weaning RGR1 and RGR2 but it did not show any significant effect on post weaning RGR3 and RGR4. The type of lambing showed non-significant effect for RGR1, RGR2, RGR3 and RGR4. Therefore, assessment of non-genetic factors plays an important role to formulate effective breeding programme for improvement of growth performance of Sonadi sheep and measure to be taken for standardizing the management of the flock for sustainable production.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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