

Original Research Article

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## Correlation Coefficient Matrix of Surti Buck Semen Parameters

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### ABSTRACT

The present work was carried out to study seminal parameters of fresh ejaculates of Surti bucks and their correlations. Four healthy mature Surti bucks above one years of age were selected. Fresh semen was collected twice a week for 8 weeks from each buck, i.e., 64 ejaculates (16 from each buck). Fresh semen was analyzed for color, volume, density, mass activity, sperm concentration/mL, and total sperm count/ejaculate. In the present study, the fresh semen colour was pale yellow in all ejaculates of Surti buck. The overall mean values of semen volume, density, mass activity/motility, sperm concentration, and total sperm count recorded were  $0.53 \pm 0.02$  mL,  $3.23 \pm 0.08$ ,  $3.34 \pm 0.09$ ,  $3683.36 \pm 60.17$  million/mL, and  $1880.8 \pm 29.51$  million, respectively. All the parameters of ejaculate semen were non-significantly differed among bucks. Correlation coefficients (r) between various parameters of Surti buck fresh semen revealed that the semen volume showed significant ( $p < 0.01$ ) positive correlation with total sperm count ( $r = 0.851$ ) and significant ( $p < 0.01$ ) negative correlation with sperm concentration ( $r = -0.896$ ) whereas, non-significant negative correlation with semen density ( $r = -0.092$ ) and mass activity ( $r = -0.064$ ). The study established the normal values of fresh semen quality parameters of Surti bucks and their interrelations. By understanding the interrelations between these parameters, breeders can now make informed decisions and achieve better breeding outcomes.

#### Keywords

Correlations,  
Semen parameters,  
Surti bucks, dual-  
purpose breed

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### Introduction

Goat (*Capra hircus*) domestication is documented in the highlands of western Iran at 10,000 calibrated calendar years ago (Zeder and Hesse, 2000). Goat is an important livestock species in India and other developing countries.

Because it provides a good source of meat, milk, fiber, and skin, it is popularly known as the “poor man's cow” (Machugh and Bradley, 2001). Given the goat's low

production potential and the importance of its milk, genetic enhancement through the introduction of Artificial Insemination (AI) programmes based on semen preservation is critical. This is only achievable with the long-term storage of excellent bucks' sperm with appropriate extenders, for the success of AI programmes.

Goat sperm can be kept at ambient temperature for a short time or refrigerated for 24 to 48 hours (Ferdinand *et al.*, 2012) or cryopreserved (Beltran *et al.*, 2013) for long

term storage. Surti goat is a medium sized dual-purpose breed and mostly confined to small towns and cities situated on the western coastal belt of the South Gujarat and mostly reared under the semi-intensive management system.

Studies on the semen quality of Surti bucks from South Gujarat are scarce (Atara *et al.*, 2019; Patel *et al.*, 2020). Hence, the present study was conducted to study the semen parameters of fresh ejaculates of Surti bucks and their correlation.

## Materials and Methods

Total four apparently healthy Surti bucks above one years of age maintained under All India Coordinated Research Project (AICRP) on Goat at Livestock Research Station, Kamdhenu University, Navsari were selected. The selected bucks were managed under uniform managerial and feeding conditions.

The selected bucks were housed in a common covered pen and under naturally existing photoperiod and air temperature of the South Gujarat. The animals were allowed to graze between 2:30 PM to 4:30 PM and fed with good quality fodder ad libitum along with 500gm of concentrate per animal per day. They were dewormed four times in a year using different types of dewormer and regularly vaccinated against common diseases viz. Peste des Petits Ruminants (PPR) and Foot and Mouth Disease (FMD).

The selected bucks were housed in a common covered pen and separated from females. The bucks were trained for one month before the study to donate the semen in artificial vagina by using female (doe) as dummy. The semen was collected regularly by using artificial vagina twice a week from each buck for up to 8 weeks and total 64 semen ejaculates (16 from each buck) were collected.

Immediately after semen collection, the samples were transferred to the laboratory within 10 minutes, where they were evaluated by various tests viz., semen colour, semen volume, density, mass activity, sperm concentration and total sperm count by using the standard method. Statistical analysis was carried out using a Software Statistical Package for Social Sciences (SPSS) version 1.0. Descriptive statistics was used to calculate means  $\pm$  SE. Finally, the Pearson's correlation coefficients among all the parameters were worked out at 5 and 1% level of significance.

## Results and Discussion

### Semen Parameters

The fresh semen parameters viz. semen colour, semen volume, semen density, mass activity, sperm concentration and total sperm count are presented in tabular as well as graphical form in table 1 and Figure 1.1 and 1.2.

In the present study, the semen colour was pale yellow in all ejaculates of Surti buck, which is comparable with the earlier study of Dias *et al.*, (2017) in Alpine buck; Patil *et al.*, (2019) in Berari buck; Kumbhar *et al.*, (2019) in Osmanabadi bucks; Sharma *et al.*, (2021) in Gaddi and Chegu buck; John *et al.*, (2022) in Malbari buck; David kumar *et al.*, (2022) and Karthik *et al.*, (2022) in Surti buck, who recorded an ejaculate colour of buck semen varies from yellowish, creamy, yellowish, whitish, yellowish, creamy, yellowish white, pale yellow to creamy, creamy and pale yellow, respectively. In fact, colour varies between bucks and between ejaculates from the same buck.

The mean semen ejaculate volume was non-significantly differs between the bucks with an overall mean ejaculate volume of Surti buck semen was  $0.53 \pm 0.02$  of the different bucks, which was agreement the mean semen ejaculate volume (ml) as  $0.47 \pm 0.02$  ml reported by David Kumar *et al.*, (2022) and  $0.45 \pm 0.03$  ml reported by Karthik *et al.*, (2022) in Surti buck.

The mean semen ejaculate volume (ml) of Surti buck in the present study was little bit lower than that observed as  $0.81 \pm 0.02$  ml by Kumbhar *et al.*, (2019) in Osmanabadi bucks;  $0.81 \pm 0.01$  ml by Gopinathan *et al.*, (2021) in Malabari bucks;  $0.66 \pm 0.04$  ml and  $0.77 \pm 0.04$  ml by Sharma *et al.*, (2021) in Gaddi and Chegu goats, respectively;  $0.62 \pm 0.04$  ml by John *et al.*, (2022) in Malbari buck; Whereas, some other studies reported higher ejaculate volume than that recorded in the present study.

The mean ejaculate volume in these studies was  $1.08 \pm 0.05$  ml and  $1.18 \pm 0.04$  ml by Goswami *et al.*, (2020) in Beetal and Sirohi bucks, respectively. While, David Kumar *et al.*, (2022) and Karthik *et al.*, (2022) in Surti goat reported lower mean semen ejaculate volume as compared to present study. Seminal attributes are affected by many factors, including the breed, body weight, age, management, climatic conditions, nutrition,

method of semen collection, degree of sexual stimulation (Zamiri and Heidari, 2006). Therefore, this could be the reason for variations in the ejaculate volume reported by various researchers.

The overall mean semen density of Surti buck semen was  $(3.23 \pm 0.08)$  in the ejaculates of different bucks. The mean semen density was non-significantly differs between the bucks. Which was corroborated the mean semen density as  $3.25 \pm 0.11$  to  $3.56 \pm 0.13$  reported by Karthik *et al.*, (2022) and as  $3.31 \pm 0.08$  reported by David Kumar *et al.*, (2022) in Surti buck. whereas, as compared to present study higher mean semen density was observed by Atara *et al.*, (2019) in Surti buck during dry season ( $3.83 + 0.03$ ) and rainy ( $3.85 + 0.03$ ) season; by Patel *et al.*, (2020) in Surti buck as  $3.99 \pm 0.01$  during rainy season; by John *et al.*, (2022) in Malbari bucks as 4.0. Contrary to present findings Kumbhar *et al.*, (2019) in Osmanabadi bucks reported lower mean semen density in their experiments.

The overall mean mass activity of Surti buck semen was  $3.34 \pm 0.09$  in the ejaculates of different bucks. The mean mass activity was non-significantly differs between the bucks. Which was corroborated the mean mass activity as  $3.45 \pm 0.13$  reported by Kumbhar *et al.*, (2019) in Osmanabadi buck; as  $3.39 \pm 0.08$  by David Kumar *et al.*, (2022) in Surti buck;  $3.50 \pm 0.13$  to  $3.38 \pm 0.13$  by Karthik *et al.*, (2022) in Surti buck. whereas, higher mean mass activity was observed by Patil *et al.*, (2019) as  $3.92 \pm 0.14$  in Berari bucks; by Patel *et al.*, (2020) as  $4.84 \pm 0.04$  in Surti buck during rainy season; by Goswami *et al.*, (2020) as 3.71 and 3.92 in Beetal and Sirohi goat, respectively; by Gopinathan *et al.*, (2021) as  $4.80 \pm 0.02$  in Malabari goat and by Sharma and Sood (2021) reported average mass activity was  $3.89 \pm 0.04$  and  $3.92 \pm 0.03$  in Gaddi and Chegu bucks, respectively. The mass activity is individually measure, it may differ with operator's skill and scale pattern. The variation in the mean mass activity of semen in present and other research may be due to the used of different scale pattern which varies from 0 to 4 and 0 to 5.

The overall mean sperm concentration of Surti buck semen was  $3683.36 \pm 60.17$  million/ml in the ejaculates of different bucks. The sperm concentration was non-significantly differs between the bucks. Which was corroborated the mean sperm concentration reported by Patil *et al.*, (2019) as  $3417.36 \pm 59.48$  million/ml in Berari bucks and David Kumar *et al.*, (2022) as  $3932.81 \pm 43.25$  million/ml in Surti buck. Contrary to

present findings Kumbhar *et al.*, (2019) in Osmanabadi bucks; Patel *et al.*, (2020) in Surti bucks; Goswami *et al.*, (2020) in Sirohi and Beetal bucks; Gopinathan *et al.*, (2021) in Malabari bucks; Sharma and Sood (2021) in Gaddi and Chegu bucks; John *et al.*, (2022) in Malabari bucks and Karthik *et al.*, (2022) in Surti buck reported lower mean sperm concentration in their experiments. The differences in the sperm concentration recorded in different studies may be due to factors like age, nutrition, breed, collection method, season, the technique of assessment of sperm concentration and frequency of semen collection (Narwade *et al.*, 2018). The overall mean total sperm count of Surti buck semen was  $1880.80 \pm 29.51$  million/ml in the ejaculates of different bucks. Total sperm count was non-significantly differs between the bucks. Which was corroborated with the mean of total sperm count as  $2.26 \pm 0.81$  million and  $2.26 \pm 0.87$  million reported by Patel *et al.*, (2020) in Surti bucks;  $1839.69 \pm 72.75$  by David Kumar *et al.*, (2022) in Surti bucks; where higher total sperm count was observed by Goswami *et al.*, (2020) as  $3574.71 \pm 131.63$  million and  $3669.00 \pm 126.42$  million in Beetal and Sirohi buck semen, respectively. Contrary to present findings Atara *et al.*, (2018) and Karthik *et al.*, (2022) reported low mean total sperm count in Surti buck semen in their experiments.

### Correlation among various semen parameters

The correlation coefficients (r) among various seminal parameters of Surti buck neat semen is shown in Table 2. In the present study, correlation coefficients (r) between various parameters of Surti buck fresh semen revealed that the semen volume showed significant ( $p < 0.01$ ) positive correlation with total sperm count ( $r = 0.851$ ) and significant ( $p < 0.01$ ) negative correlation with sperm concentration ( $r = -0.896$ ) whereas, non-significant negative correlation with semen density ( $r = -0.092$ ) and mass activity ( $r = -0.064$ ). The semen density showed non-significant positive correlation with sperm concentration ( $r = 0.095$ ) and mass activity ( $r = 0.064$ ) whereas, negative correlation with total sperm count ( $r = -0.067$ ). The semen mass activity showed non-significant negative correlation with sperm concentration ( $r = -0.021$ ) and total sperm count ( $r = -0.115$ ). The sperm concentration showed significant negative correlation with total sperm count ( $r = -0.552$ ). Similar results was also found by Karthik *et al.*, (2022) as sperm concentration was negatively correlated with total sperm count ( $-0.818$ ) and ejaculated volume ( $-0.901$ ) whereas positively correlated with density ( $0.915$ ).

**Table.1** Buck-wise neat semen parameters (Mean±SE) of Surti bucks

Sr. no	Buck No.	N	Volume (ml)	Density	Mass Motility	Sperm Concentration (×10 <sup>6</sup> /ml)	Total Sperm count (×10 <sup>6</sup> )
1	36/21	16	0.52±0.03	3.06±0.19	3.31±0.18	3692.81±95.02	1867.88±76.00
2	44/21	16	0.56±0.04	3.25±0.14	3.25±0.14	3620.00±58.15	1946.31±78.26
3	28/21	16	0.49±0.02	3.44±0.16	3.25±0.19	3822.50±77.49	1830.19±37.01
4	6/22	16	0.54± .03	3.19±0.16	3.56±0.18	3598.13±46.52	1878.81±29.92
<b>Overall</b>		64	0.53±0.02	3.23±0.08	3.34±0.09	3683.36±60.17	1880.8±29.51
<b>F value</b>			0.88	0.89	0.72	0.69	0.66
<b>P value</b>			0.45	0.45	0.54	0.55	0.57

**Table.2** Correlation coefficients (r) among various seminal attributes of Surti buck neat semen

Seminal attributes	Ejaculate Volume	Density	Mass activity	Sperm concentration
<b>Volume</b>	1	--	--	--
<b>Density</b>	-0.092	1	--	--
<b>Mass activity</b>	-0.064	0.064	1	--
<b>Sperm concentration</b>	-0.896**	0.095	-0.021	1
<b>Total sperm count</b>	0.851**	-0.067	-0.115	-0.552**

\*\*Correlation is significant at the 0.01 level.

**Figure.1** Buck wise neat semen parameters of Surti buck.

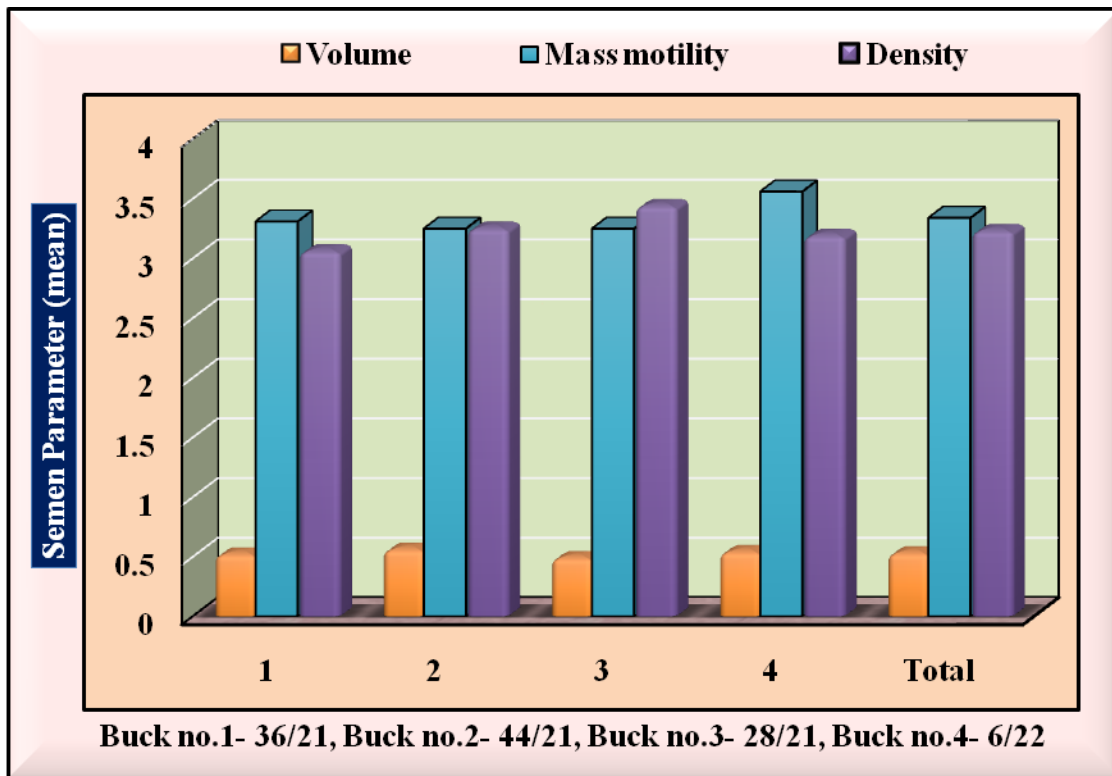
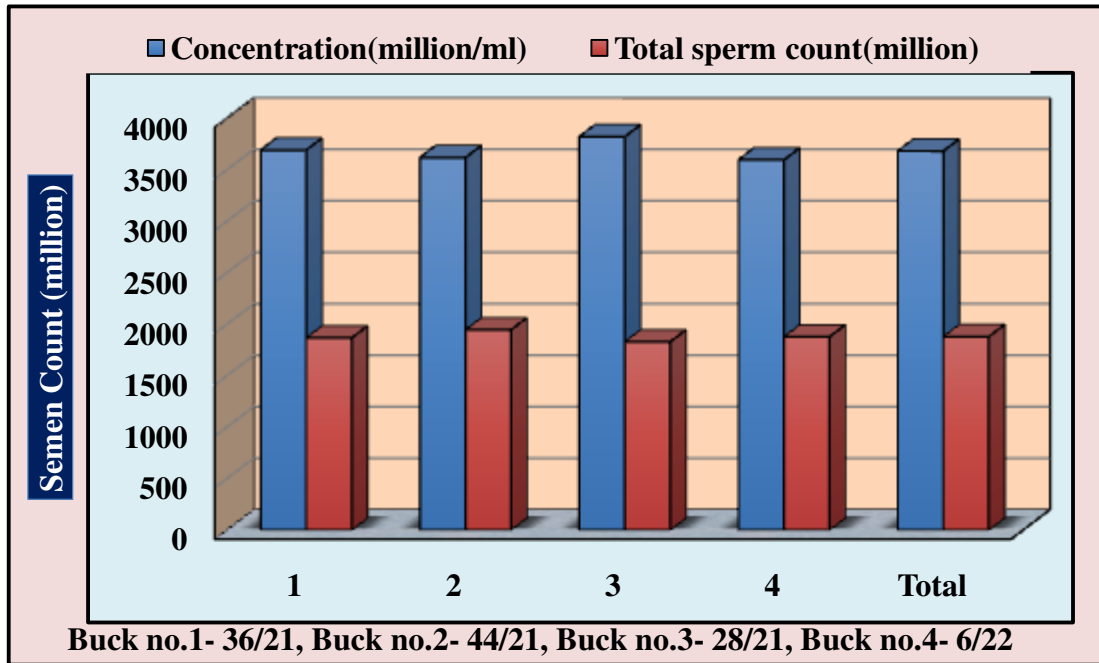


Figure.2 Buck wise neat semen parameters of Surti buck.



In accordance with the present study David Kumar *et al.*, (2022) reported that the ejaculate volume was negatively correlated with sperm concentration and positively correlated with total sperm count. Furthermore, Contrary to the present findings David Kumar *et al.*, (2022) reported mass activity was negatively correlated with sperm concentration (-0.197) whereas positively correlated with semen density (0.152). The study established normal values for the quality parameters of fresh semen of Surti bucks. Additionally, the study found that bucks over one year old can be used for semen collection twice a week. The semen harvested has good quality, as indicated by its physical semen parameters.

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### Author Contribution

A. A. Pathan: Investigation, formal analysis, writing—original draft. L. C. Modi: Validation, methodology, writing—reviewing. N. F. Chaudhari:—Formal analysis,

writing—review and editing. A. S. Kardani: Investigation, writing—reviewing. C. T. Khasatiya: Resources, investigation writing—reviewing.

### Data Availability

The datasets generated during and/or analyzed during the current study are available from the corresponding author on reasonable request.

### Declarations

**Ethical Approval** Not applicable.

**Consent to Participate** Not applicable.

**Consent to Publish** Not applicable.

**Conflict of Interest** The authors declare no competing interests.

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