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Research Article

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Response of Seminal Traits of Horro Rams to Different Levels of Supplementation under Grazing of Natural Pasture

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Abstract

The fertility of the male animals is often reported to have a greater influence on stock performance than does the fertility of females, which further greatly affected by nutritional factors. An experiment was conducted to evaluate the response of seminal traits of Horo rams to nutritional supplementation of Noug seed cake and Wheat bran mixture under grazing of natural pasture in western Ethiopian, where 18 uniform intact yearling Horro rams with average initial body weight of 18.55 ± 0.99kg (mean ± SD) were involved in the experiment. The treatments consisted grazing natural pasture alone (T1;Control), or T1 supplemented with concentrate mixture at 0.9% of body weight (T2) or T1 supplemented with concentrate mixture at 1.5% of Body weight (T3). The experimental design used was complete randomize where six rams per treatment were randomly allocated to three dietary treatments. Supplementation significantly (P<0.05- P<0.00) improved most seminal traits. With the exception of semen volume (SV), sperm concentration per ml (SCO), sperm mass motility(SMM), and sperm progressive individual motility(SPIM), there was no significant (P>0.05) difference between T2 and T3, with respect to parameters considered. In general, since supplementation at 1.5% of body weight (T3) significantly improved SV, SCO, SMM and SIM, compared to T2, T3 could be recommended as appropriate feeding strategy to improve the reproductive performance and exploit the genetic potential of the Horro rams, especially for Artificial Insemination program.

Keywords: Supplementation, Seminal traits, Horro rams, Natural pasture

Introduction

In global context, sheep is economically viable and contributes a substantial amount to total household income and plays multi-functional roles in different production systems for the rural community of Ethiopia where regular income, meat and manure are the tangible benefits of sheep [1]. In the western part of Ethiopia, Horro sheep is an important and integral part of the rural communities farming activity, contributing substantially to the household income and food security [2].

In spite of such multi-purpose role, the productivity of sheep in Ethiopia is generally low with an estimated annual off take rate of 33% and carcass yield of 10kg most often attributed to low fertility of breeding stock in Ethiopia, where the fertility of the males is reported to have a greater influence on stock performance than does the fertility of females, which further greatly affected by nutrition [3-6]. Research works have revealed that Horro rams supplemented with concentrate had higher body weight gain and testis weight under controlled grazing management [7,8]. In fact, Nutritional regimes that improve daily gain are likely to enhance testicular development, which was evidenced by Fernandez et al., who reported improved body weight, testicular size, semen characteristics and fertility as a result of improving protein content of feed [9,10].

However, as in the case of other tropical countries, in Ethiopia livestock obtains most of their feed from grazing of natural pasture and crop residues which are generally poor in nutritive value, and animals cannot meet their nutritional requirement, consequently resulting in reduced growth rate, low production, poor fertility and high mortality particularly in dry season [11].

This arise the need to devise practical and relevant strategies in order to enhance animal performance, which include supplementation of low quality feeds with agro-industrial by-products, that contain high crude protein and metabolizable energy, low fiber constituents, better availability, and relatively cheaper compared to grains [12].

The most common agro-industrial by-products available in western part of Ethiopia included noug seed cake (Guizotia abyssinica) and wheat bran (Triticum aestivum). The fact that noug seed cake and wheat bran contain moderate to high CP and metabolizable energy, with low fiber constituents makes the combination an excellent supplement to improve animal performance under extensive husbandry. However, information with regard to the response of seminal traits of Horro rams to different levels of supplementation of noug seed cake and wheat bran mixtures under grazing natural pasture is lacking. This study was conducted to fill this gap by generating information which can contribute to the characterization and evaluation endeavor of Horro rams under grazing of natural pasture so as to suggest the level of supplementation at which libido and seminal attributes are optimal for breeding/semen collection.

The study was conducted with hypothesis that seminal traits of Horro rams positively respond to nutritional supplementations. As hypothesized, most seminal traits were significantly improved in supplemented rams, as opposed to none supplemented ones.

Materials and Methods

Description of the study area

The study was conducted at Bako Agricultural Technical and Vocational Education and Training College, West Shewa zone of Oromia National Regional State. The college is located at a distance of about 250 km west of Addis Ababa on the main road to Nekemte, the capital of East Wollega Zone. The average elevation of the area is about 1560m above sea level. The soil texture of the area is sandy clay loam [13]. Bako has a hot and humid climate and receives a mean annual rainfall of about 1219 mm, more than 80 % of which is recorded in the months of May to September. The mean monthly maximum and minimum temperatures are 28 and 14°C, respectively.

Management of the experimental animals

The experiment was conducted during the dry period from January through April, 2011 for a period of 120 days. Initially, twenty four intact yearling Horro rams were purchased from the local market and quarantined for 3-weeks during which they were dewormed against common endo-parasites, sprayed against common ecto-parasites and vaccinated against pastuerellosis. A total of 18 rams with mean (± SD) initial body weight of 18.55 ± 0.99 kg were selected for the experiment and acclimatized for additional 2-weeks' time for the experimental feeds and the environment. The animals were maintained on natural pasture land grazing for 8 hrs a day and supplemented with different levels of concentrate. The natural pasture of the grazing land is dominated with Hyperrhenia grass species. Water was given twice a day and mineral salt (block) was made available in their individual pen at night. All the experimental animals were ear tagged.

Experimental design and treatments

The experiment involved 3 treatments and laid out completely at random and dietary treatments were randomly allocated to animals so that each animal had equal chance of receiving one of the treatments. Treatments consisted grazing on native pasture alone (Control; T1), grazing on native pasture and supplemented with concentrate at 0.9% of body weight (T2), and grazing on native pasture and supplemented with concentrate at 1.5% of body weight (T3).

Feed preparation and sampling

Noug seed cake and wheat bran were purchased from local edible oil extraction mill in Bako town and Ambo Wheat flour milling factory, respectively, and the required amount was mixed daily (at 1:1 ratio) throughout the feeding period. Supplementary feeds were fed individually once a day at dusk after the animals returned back from grazing. Representative samples of feed ingredients were taken from each batch, and pooled by feed type over the feeding period. At the end of the experiment, feed samples were sub-sampled, ground to pass through 1mm sieve size and stored pending chemical analysis.

Biomass yield of the grazing pasture

One hectare of pasture land was demarcated and allocated for the experimental animals for grazing. The biomass yield of the grazing land was estimated by taking samples at three different times during the experimental period using quadrate. Five quadrate samples of 1m x 1m was established within a hectare of grazing land, four at the corners and one at the center of the hectare initially. The second and third samples were taken every month by randomly throwing the quadrate five times during sample taking time with in the grazing pasture. In both cases from each entire quadrate the herbaceous vegetation's were clipped at ground level using hand shears, weighed and dried under the shade to the constant weight. The biomass yield was then determined based on the average DM content of the samples taken at three different times. Representative feed samples were ground to pass through 1 mm sieve size and stored pending chemical analysis.

Data collection procedure

Data on seminal variables were taken after the 4th week of the commencement of the research assuming that the time taken, including acclimatization period, might be sufficient to see the effect of the treatment on seminal parameters. Thus, Libido assessment and semen collection and evaluation were conducted for 6 periods (every two weeks interval).

Sexual behavior (Libido)

Libido was assessed during semen collection period, according to the system described by Osborne, et al., and Mulugeta, et al., for bulls [14,15].

Semen collection and evaluation

Semen was collected from the rams every two weeks interval by using artificial vagina (AV). Prior to collection, the temperature of the AV was maintained to about 42- 450C by filling the space between the outer external case and the inner lining of the AV with warm water. This was aided by filling the same cabinet with air in order to maintain pressure. The inner wall of the AV was also thinly lubricated with Vaseline before collection. Semen collection tubes and pipettes were warmed at about 370c before semen collection. For the purpose of semen collection, ewes at estrous were made available from the flock kept in the college, and rams were exposed individually to estrus ewes for 5 minutes. Semen was collected in the morning (7:30 to 10:30 a.m.) over two consecutive days by taking three rams randomly from each treatment each day.

Immediately after semen collection, semen color, volume, semen pH and semen motility were measured. The volume of the ejaculate was read to the nearest 0.1ml directly from a graduated collection tube, and the collection tube with semen was immediately put into water bath (about 32-340C) for further semen evaluation. Subjective assessment was employed to determine the color of the semen using the scoring method of Hafez and Hafez (2008). Semen pH was determined by pH indicator paper. Sperm mass motility (SMM) was scored subjectively as per the method described by Tomar et al., [16]. Sperm individual progressive motility (SIM) was also subjectively estimated by placing a drop of diluted semen in 3.8% sodium citrate solution under cover slip, and examined under a microscope (400 x) and scored at 10% unit intervals. Sperm concentration per ml of ejaculate was determined by Neubauer haemocytometer counting chamber at 400x magnification as follows. The semen sample was first diluted with distilled water at the ratio of 1:200 (semen: distilled water). Ten µl of the diluted sperm was taken and placed under the cover slip on the haemocytometer where the sperm cells lying inside the 5 counting chambers that formed diagonal line on the grid were counted. The count was then multiplied by five to get the concentration of sperm cells in millions per ml.

The percent of dead or alive spermatozoa was determined by mixing a drop of semen sample with two drops of eosin-nigrosine stain on pre warmed clean slide. About 200 spermatozoa was then examined in different fields of the slide and categorized into colored (dead) and non-colored (alive) sperm cells under a microscope (400x).

The proportion of morphologically abnormal spermatozoa was evaluated as recommended by Salisbury et al., [17]. Evaluation of the semen was conducted at Bako Agricultural Technical and Vocational and training College.

Chemical analysis of feeds

Dried feed samples were ground to pass a 1 mm sieve mesh and analyzed for dry matter (DM), organic matter (OM) and crude protein (CP) as described by AOAC [18]. Neutral detergent fiber (NDF), acid detergent fiber (ADF) and acid detergent lignin (ADL) were analyzed according to the method of Van Soest and Robertson [19]. ME (MJ/kg DM) = 0.16*IVDOMD [20]. The IV DOMD (In vitro digestible organic matter in dry matter) was determined as method of Tilly and Terry [21].

Statistical data analysis

Data were analyzed using General Linear Model (GLM) procedure of the statistical analysis system (version SAS 9.1) Data on sperm concentration and scored data were transformed into log and square root, respectively, before analysis. Since the interaction between treatment and feeding period was found to be none significant, only feeding period was included in the model for analysis of libido and seminal traits. Pearson coefficient of correlation was employed to assess the existence of associations among seminal traits. The difference among treatment means were examined using Tukey's adjustment and declared significant at $P<0.05$.

Model:

$y_{ij} = \mu + \tau_i + p_j + e_{ij}$

y_{ij} =observations/Libido and seminal traits/

μ = Over all mean

τ_i = the effect of ith level of treatment

p_j =the effect of jth feeding period

e_{ij} = residual effect

Results and Discussion

Chemical composition of the feeds

The chemical composition of natural pasture, crude protein (CP), in vitro organic matter digestibility (OMD), neutral detergent fiber (NDF) and acid detergent fiber (ADF) components were presented in (Table 1).

Table 1: Chemical compositions of feed stuff

Feed type	DM (%)	%OM					IVDOMD (%)
		OM	CP	NDF	ADF	ADL	
NSC	91.84	91.18	32.54	34.93	29.3	6.45	65.76
WB	89.48	94.94	15.77	46.53	15.1	4	76.78
Natural pasture	72.33	91.04	6.07	67.78	36.9	6.14	54.61

**NSC=Noug seed cake; WB= Wheat bran; DM=dry matter; OM=organic matter; CP= crude protein; NDF= neutral detergent fiber; ADF= acid detergent fiber; ADL= acid detergent lignin; IVOMD= in vitro organic matter digestibility.*

Seminal Traits

Semen Color

About 75% of the animals in the control group produced semen with watery to milky color, while the proportion of rams producing the same semen color was reduced to 42% in treatment 2 (T2) and only 25% in treatment 3 (T3) (Table 2).

Table 2: Semen color attributes (%) of Horro rams grazing natural pasture and supplemented with different levels of noug seed cake & wheat bran mix

Description	Treatments		
	T1	T2	T3
Watery	11.11%	0	2.78%
Milky	63.89%	41.67%	22.22%
Thin creamy	25%	36.11%	36.11%
Creamy	0	13.83%	22.22%
Thick creamy	0	8.3%	16.65%

On the other hand, the proportion of rams, which produced semen with thin to thick creamy was only 25% in T1 compared to 58.2% in T2 and 75% in T3. It should be noted that the physical appearance of semen at time of collection has due importance in judging the quality of semen, because it is the number of sperm cell in a given volume that affects its appearance. Thus, the current study indicated that semen from supplemented groups (T2-T3) tended to be creamier than non-supplemented, which may be attributed to higher sperm concentration. This is in agreement with Mulugeta et al., who reported creamier semen in supplemented compared to non-supplemented group in Horro bulls [22].

Ejaculate volume (EV)

Supplemented group (T2 & T3) had significantly higher ($P<0.001$) semen volume than the control (Table 3).

Table 3: Mean ±SE sperm production characteristics of Horro rams grazing natural pasture and supplemented with different levels of wheat bran and noug seed cake mixture

Parameters	Treatment (Mean±s.e)			Overall Mean±SE	Significance	
	T1	T2	T3		T	P
Ejaculate volume (mL)	0.37±0.00^c	0.54±0.1^b	0.64±0.02^a	0.51±00	***	NS
Sperm concentration per mL (x109)*	2.14±0.05^c	2.84±0.4^b	3.06±0.12^a	2.69±0.1	***	*
Sperm mass motility (0-5)*	2.94±0.09^c	3.36±0.02^b	3.68±0.08^a	3.32±0.06	***	NS
Sperm individual motility (%)	63.67±.33^c	70.97±0.6^b	75.13±1.3^a	69.9±1.7	***	NS
Live spermatozoa (%)	65.4±0.5^b	73.0±2.31^a	77.1±1.39^a	71.8±1.5	***	**
Semen pH	7.2±0.01	7.02±0.03	6.93±0.12	7.02±0.3	NS	NS

** Values are mean ±SE of original data on sperm concentration &, Sperm mass motility; a-c Means with the same letter across the rows are not significantly different (P>0.05); ***=p<0.001;**=P<0.01; *= P<0.05; NS= not significant; T= treatment effect; P= period effect.*

Similar result of 0.67 ± 0.07 mL was reported for Horro rams at 12 months age [23]. Though values for semen volume (SV) for supplemented groups in the current study were within the range

reported in the literature (0.5 to 0.7ml for young rams, it was lower than 0.79 ml reported for the same breed under grazing management [24]. This variation might be due to age difference in the experimental animals used. Hafez and Hafez (2000) reported that SV for mature rams range from 0.5 to 2 ml. In contrast to the current result, SV of 1.1 ml per ejaculate was reported for Arsi-ram fed on chickpea haulm and supplemented with Leucaena leaf hay at 200g/head/day [25]. This variation in SV could most probably be attributed to breed difference. The higher SV recorded for supplemented group in the current study might partly be attributed to higher CP content of the supplementary diets that activates hormone involved in spermatogenesis. As protein intake increases, an increase in gonadotrophins, a follicle stimulating hormone (FSH) can be expected which consequently followed by an increase in the level of testosterone [26]. Testosterone activates the secretary function of the accessory glands Salisbury et al., which in turn increases SV as observed in the current study [17]. The decline in SV for the rams in the control could be related to low level of nutrition since forage biomass yield and quality from grazing land deteriorates during dry season when this experiment was conducted.

Sperm concentration (SCO)

Mean sperm concentration in the current study significantly varied ($p<0.001$) across the different dietary treatments. Thus, rams in T2 and T3 had significantly higher ($p<0.05$) sperm concentration per mL compared to un-supplemented group (T1). The normal SCO of rams ranges from 2-3 (x109) /ml of semen (Hafez, 2008), which is inconsistent with the current finding. The increase in sperm concentration for the supplemented groups (T2 and T3) compared to the control (T1) could be due to supplementation which contained better nutrients required for optimum sperm production. Further, among supplemented groups, supplementation at 1.5% of body weight (T3) resulted in superior (SCO) compared to rams in T2. The current finding clearly demonstrates the role of nutrition in imparting sperm cell proliferation. Grazing native pasture without supplementation during the dry period when the quality and quantity of the same is poor could not maintain maximum spermatogenesis which consequently results in lower fertility because the number of spermatozoa per milliliter of semen is extremely important. When combined with low volume of the ejaculate, low number of spermatozoa negatively influences the number of females bred/inseminated.

Sperm Mass Motility (SMM)

Sperm mass motility (SMM) is an indirect indicator of sperm gross motility and concentration in the sample [27]. SMM in the current experiment was significantly ($P<0.001$) affected by supplementation, where supplemented animals had higher SMM compared to animals in the control (Table 3). Among supplemented animals, rams in T3 were superior ($p<0.05$) in SMM compared to rams in T2. The current result of supplemented animals was similar to 3.57±0.38 reported for Santa Ines breed ram [28]. It was also reported that SMM for 12 months old Menz and Horro ram lambs was 2.65 ± 0.187, However, higher value of 3.9 to 4.3 was reported for Horro ram, which may be related to age difference [23,24].

Sperm Individual Progressive Motility (SIPM)

Supplemented groups (T2 & T3) produced semen with higher ($p<0.05$) SIPM compared to rams in un-supplemented treatment (Control; Table 3). The SIPM for T3 was comparable with the report of Dana et al., who reported as 76 % for Arsi type ram supplemented with Leucaena leucocephala leaf hay up to 300g per head per day fed a basal diet of chickpea haulms. Similar to the current finding, Hassan et al., reported 76.3 ± 2.2 % motile sperm in Jamunipari goat kids [25,29]. However, SIPM in the control group in the current study was lower than 67.0 ± (2.29) reported for Menz and Horro ram lamb at 12 months of age [23]. The SIPM for both treatments were within the threshold of 60-80% suggested in the literature (Hafez, 2008).

Proportion of live spermatozoa (LS)

In this study supplementation at both levels significantly improved ($p<0.001$) the proportion of live spermatozoa (LS) compared to the control (Table 3). Though numerically different from each other, no statistically significant ($P>0.05$) difference was observed.

Semen pH

The semen pH in the current study was found to be 6.93 ± 0.12, 7.03 ± 0.02 and 7.2 ± 0.01 for T3, T2, and T1 (control), respectively, and it was not affected by the current supplementation strategy. Across all the cases, semen pH was within the upper side of the range reported for ram semen of 5.9-7.3.

Sperm morphology

Sperm morphology is an essential parameter that reflects the degree of normality and maturity of the sperm population in the ejaculate and correlates with fertility and is of great concern because infertility is often due to a high proportion of structurally abnormal spermatozoa [30,31]. In the current study, supplementation (T2 &T3) significantly improved ($P<0.001$) the proportion of normal sperm morphology compared to the control (Table 4).

Table 4: Effect of supplementation with different level of wheat bran and noug seed cake mixture on sperm morphology of Horro rams under grazing management

Parameter	Treatment (mean ± s.e)			Overall (Mean±SE)	Significance	
	T1	T2	T3		T	P
HA (%)	7.48 ±0.45 b	3.880±.12 a	3.9±0.12a	5.1±0.43	***	NS
MPA (%)	8.85±0.48b	5.35±0.12a	4.65±0.17a	6.2±0.47	***	NS
TA (%)	4.17± 0.35	4.37±0.24	4.360±.15	4.3±0.6	NS	NS
TOA (%)	18.68±0.78b	13.43±0.89a	13.06±0.57a	15.0±4.2	***	**
TOMN (%)	81.320±.92b	86.57±0.28a	86.94±0.17a	84.94±0.92	***	NS

*HA (%) =Head abnormality; MPA (%) = Mid piece abnormality; TA (%) = Tail abnormality; TOA (%) =Total abnormality; TOMN (%) =Total morphologically Normal spermatozoa; a-bMeans with the same letter across the rows are not significantly different; ***=p<0.001; **=P<0.01; NS= not significant; T= treatment effect; P= period effect*

Thus, the proportion of spermatozoa with total abnormality was higher ($p<0.05$) for non- supplemented compared to supplemented rams. With the exception of tail abnormality, rams in the supplemented treatments (T2&T3) had significantly low ($p<0.05$) abnormality of sperm head and mid piece defects. Consistent with the current findings, reported no significant ($P>0.05$) difference in sperm tail defects among nutritionally supplemented indigenous Ethiopian bucks [32]. The existence of significant variation in most of the sperm morphological characteristics among the treatment groups in the present study may be attributed to the supply of higher CP content and IVOMD (Table 1) of supplementary diets used in supplemented group, which promotes spermatogenesis that reflected

in the production of normal spermatozoa.

Since higher protein intake increases sperm production and positively influences the neuro-endocrine system, consequently resulting in improved semen characteristics the higher CP and IVOMD content of diets fed to T2 & T3 in the current study might have promoted the secretion and maintenance of testicular fluids and hormone involved in sperm production and maturation resulting in higher proportion of normal spermatozoa as reported earlier (Y.Mekasha, 2008) [9,32].

Comparatively, the spermatozoa defects recorded in the current study was higher than 11.6 ±1.51, 5.0 ± 0.55, 1.0 ± 0.32, 3.2 ± 0.41 percentage reported for total abnormality, tail, head and mid piece defects, respectively, in Horro and Menz ram lambs supplemented with concentrate at the rate of 50-100g/head/day at Debrebrhan Research Institute [23]. This variation might be due to relatively high ambient temperature coupled with higher relative humidity of the study site compared to Debrebrihan, which is characterized by minimum temperature ranging from 2.40C to 8.50C and maximum of 18.3- 23.3oC and an altitude of 2780 m a.s.l [33]. However, the result of spermatozoal defects recorded in the current study was within the normal range of spermatozoal abnormalities suggested in the literature as cited by Hundera [34].The overall proportion of sperm head abnormality in this study was less than 10 % (5.1 ± 0.43), above which it has been reported to cause reduced fertility. Similarly the proportion of morphologically normal spermatozoa (84.94 ± 0.92 %) was within the range of 80-95%, which is recommended to be normal for ram semen. On the other hand, higher proportion of total sperm abnormality as high as 18.3% was recorded in un supplemented Egyptian Suffolk rams during the hot summer season, which was comparable with control rams in the current study [35].

Sexual desire (Libido)

The present result indicated that supplementation positively affected (P<0.001) libido (LB) in Horro rams. Thus, rams in the supplemented treatments scored higher values of 3.28 ± 0.14 (T2) and 3.33 ± 0.11 (T3) compared to 2.11 ± 0.09 recorded for rams in the control (T1), indicating that supplemented rams tended to display more sexual desire. The significantly higher LB in the current study for supplemented rams (T2-T3) might be related to better nutrient supply from the supplements. LB is mainly under hormonal control of testosterone secreted by the cells of leyding in the testis [17]. Hence the higher CP content of the supplementary diets might have enhanced the secretion of testosterone hormone and maintained spermatogenesis, consequently more sperm cell production as compared to rams in the control group that fed on natural pasture alone. It has been reported that higher LB was scored in Horro rams during the season with relative availability of adequate feed at Bako area [24,36,37].

In general, independent of whether natural mating or artificial insemination is used for breeding, libido (sex derive) is evidently crucial to reproductive competence in all male animals, and thus, the current study suggested the need for supplementing Horro rams under grazing condition for effective breeding.

Correlation among body size, testicular and seminal traits

There was positive linear associations among seminal variables considered in the current study (table 5).

Table 5: Correlation among seminal traits in Horro rams grazing natural pasture and supplemented with different levels of wheat bran and noug seed cake mixture

	SV	SCO	SMM	SIM
SV	1.	0.88 P<0.001	0.80 P<.001	0.86 P<.001
SCO		1.	0.76 P<0.001	0.88 P<.001
SMM			1.	0.87 P<0.001
SIM				1

SC=semen volume (ml), SCO = sperm concentration (x109), SMM = sperm mass motility (score), SIM = sperm progressive individual motility (%)

Generally, the high and positive correlation among seminal traits established in the current study provides information that will be useful in the early selection of Horro rams for breeding /semen collection.

Conclusions

Most seminal traits of Horro rams were positively respond to different levels of supplementation where T2 & T3 (supplementation at 0.9 and 1.5 % of body weight) significantly improved sexual behavior, semen color, ejaculate volume, sperm concentration sperm mass activity, sperm individual progressive motility, proportion of live spermatozoa and sperm morphology compared to un-supplemented group (T1) in Horro rams grazing natural pasture. Further, since supplementation at 1.5% of body weight (T3) significantly improved semen volume (SV), sperm concentration per ml (SCO), sperm mass motility (SMM), and sperm progressive individual motility (SIM), compared to T2, T3 could be recommended as appropriate feeding strategy to improve the reproductive performance and exploit the genetic potential of the Horro rams, especially for Artificial Insemination program

Moreover, there were positive linear associations among seminal traits considered in the current study suggesting that selection on one or both of these traits would have favorable correlated response in the other traits of Horro rams.

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