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Evaluating the Rations Containing of Corn, Triticale and Oat Silages on the Growth Performance and Semen Quality of Ram Lambs

Hamed M. Gaafar[1], Mohamed E. El-Sharawy[2], Ahmed A. Elbana[2], Ahmed A. Galal[3], Mohamed F. Ali[2] and Mohamed M. El-Badawy[1]

[1] *Animal Production Research Institute, Agriculture Research Center, Kafrelsheikh, 33717, Egypt.*
[2] *Animal Production Department, Faculty of Agriculture, Kafrelsheikh University, Kafrelsheikh, 33516, Egypt.*
[3] *Agronomy Department, Faculty of Agriculture, Kafrelsheikh University, Kafrelsheikh, 33516, Egypt.*

THE present work investigated the effect of corn, triticale, and oat silages on the growth performance, puberty, and semen quality of male lamb. At the age of 4-5 months, twenty-four crossbred male lambs (half Finnish Landrace and half Rahmani) weighing22.09±0.37 kg live body weight were allocated into three groups, each with eight lambs. Male lambs were fed concentrate feed mixture (CFM) plus silages of corn (R1), triticale (R2), and oat (R3) for five months in each of the different groups. The quantity of CFM at the beginning of the experiment was 500 g/day, with an increase of 100 g every month, whereas silages were given ad-libtum. According to the findings, R1 consumed much less CP than R2 and R3, but R2 and R3 consumed significantly more DM and TDN. For lambs fed by R3, compared to R1 and R2, the final body weight, total weight increase, and average daily gain were all considerably (P0.05) greater. Feed conversion improved significantly ($P<0.05$) with feeding R2 and R3. Male lambs of R3 expressed first ejaculate (puberty) at 35.6 days earlier, which was significantly earlier than those of the control (R1). Also, scrotal circumference and testes volume of R2 and R3 were significantly ($P<0.05$) increased compared with R1. Semen quality of R3 and R2 was improved ($P<0.05$) compared to R1. Finally, the addition of triticale or oat silages had an economic to be advantage, puberty at an earlier age, improved the growth performance and reproductive ability of male lambs compared to corn silage. We concluded that, the addition of triticale or oat silage had an economic advantage compared to corn silage. Also, male lambs fed on triticale or oat silage had puberty at an earlier age and improved their growth performance and reproductive ability.

Keywords: Silages; Growth Performance; Semen quality; Male Lambs.

Introduction

The scarcity of feed supply is the main obstacle for further increasing the animal population [1]. Furthermore, animals suffer from malnutrition, particularly during the summer season, where green forages with reasonable protein content are not sufficient for optimizing animal productivity [2]. Throughout the year, the availability of fodder is a crucial necessity [3]. However, by conserving forages in the form of hay and silage, feed shortages can be managed [4]. When the quality of the pasture is poor, silage can be utilized in conjunction with grains to produce lamb [5].

Lambs only on silage diets were shown to have low live weight gains, and adding grain to the diet improved the production metrics [6]. According to Harrison et al. [7], it is now routine practice in many livestock production systems to cultivate cereal crops for silage, grazing, and hay production. The

*Corresponding author: Hamed M. Gaafar, E-mail: hamedgaafar@gmail.com, Tel.: +201063087881
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high nutritional qualities of cereal forages were discovered in the early vegetative stage (tillering-stem elongation), which is akin to feeding a concentrate and coincides with the requirement for high-quality feed in the early spring [8]. It is possible to maintain grazing throughout the season and cut the expense of supplemental feed by feeding green cereal fodders from the early vegetative stage through advanced growth stages [7,9]. Due to their productivity and nutritional value, wheat grain, barley, oat, rye, and triticale are essential feeds. These plants are planted at the beginning of winter, and they are harvested in the late spring [10].

Triticale is characterized by strong vegetative growth in terms of plant height and surface area of the leaves and an increase in the number of side branches [11,12]. Cherney and Marten [13] indicated that in vitro organic matter (OM) and dry matter (DM) digestibility seem to be more significant for barley silage than oat silage. Besides, CP concentrations tend to be higher in triticale, wheat, and barley than in oat silage. Moreover, using triticale silage and its mixture in ruminant rations had positive effects on digestion coefficients, feeding values, productive performance, and some metabolic parameters [14].

Temperate grasses like barley and oats are frequently referred to as grasses that do well in colder climates [15]. Oats are quickly growing, delicious, and nutritious crops that are primarily fed as greens [16]. In order to feed livestock during times of crop scarcity, the excess is saved as hay. Oat hay has a high and acceptable nutritional content in terms of total digestible nutrients, protein, fat, minerals, and vitamins [17]. Oat fodder, however, is a crucial source of nutrition for tiny breeding animals and dairy ruminants [18].

The goal of this study was to evaluate the effects of feeding various rations to crossbred male lambs that included concentrate feed mixture plus corn, triticale, or oat silages on feed intake, digestibility, feeding values, serum biochemicals, body weight gain, feed conversion, puberty, sexual behavior, and physical semen characteristics.

Material and Methods

Animals and experimental rations

Twenty-four crossbred male lambs (1/2 Finnish Landrace ×1/2 Rahmani) aged 4-5 months and averaged 22.09±0.37 kg live body weight (LBW) randomly divided into three groups (8 lambs in each) based on initial body weight and age. Lambs male in several groups were fed for five months on concentrate feed mixture (CFM) plus silages of corn (R1), triticale (R2), and oat (R3), respectively. The quantity of CFM at the beginning of the experiment was 500 g/day, with an increase of 100 g every month, whereas silages were given ad-libtum. These silages were prepared after cutting at moisture content at the ensiling time was around 70%. By using 3% molasses on a fresh weight basis, triticale and oat silages were created. Table 1 displays the chemical analysis of CFM and several silage types.

TABLE 1. Chemical composition of feed ingredients and experimental rations

Item	Composition of dry matter %									
	DM	OM	CP	CF	EE	NFE	Ash	NDF	ADF	ADL
Feed ingredients										
CFM*	90.65	91.15	14.35	11.58	2.64	62.58	8.85	28.76	10.68	2.67
CS	30.45	93.36	8.15	26.97	2.72	55.52	6.64	48.25	27.96	2.84
TS	29.86	88.05	13.73	33.4	2.38	38.54	11.95	66.80	39.87	4.20
OS	29.32	87.22	13.20	31.96	2.56	39.50	12.78	34.47	22.94	4.72
Experimental rations**										
R1	42.87	92.40	10.85	20.26	2.69	58.60	7.60	39.75	20.42	2.77
R2	44.17	89.55	14.03	22.86	2.51	50.16	10.45	48.42	25.77	3.46
R3	43.55	89.12	13.76	22.12	2.60	50.65	10.88	31.71	17.02	3.73

Concentrate Feed Mixture (CFM); Corn Silage (CS), Triticale Silage (TS); Oat Silage (OS); organic matter (OM); dry matter (DM); crude protein (CP); crude fiber (CF); nitrogen-free extract (NFE); ether extract (EE); total inorganic matter (Ash).

* Concentrate feed mixture (CFM) consisted of 37.7% wheat bran, 31% yellow corn grains, 28% undecorticated cotton seeds meal, 4% molasses, 2% limestone, 1% common salt and 0.3% minerals and vitamins premix.

** R1 = Concentrate plus corn silage; R2 = Concentrate plus triticale silage; R3 = Concentrate plus oat silage.

Feeding management

The meals under test were fed to the male lambs in the various experimental groups in a group setting. Every two weeks, the amount of feed consumed was calculated together with the dry matter intake (DMI) and modified in accordance with changes in body weight. At 8 a.m. and 3 p.m. each day, food was distributed, and water was always accessible. At the start of the feeding study, the male lambs were weighed before being fed in the morning after fasting for two days in a row. Then, every two weeks, calculate body weight gain and determine live body weight. For each lamb, the feed conversion ratio—expressed as the quantities of DM, TDN, CP, and DCP needed for every kilogram of weight gain—was computed.

Digestibility trial

To assess the digestibility and feeding qualities of the experimental diets, a digestibility trial using the insoluble acid ash (AIA) method was carried out at the conclusion of the feeding trial on three animals from each group. Following the procedures outlined in [20], samples of feed and excrement were examined for DM, CP, CF, EE, and ash. The procedures [21] were used to identify neutral detergent fiber (NDF), acid detergent fiber (ADF), and acid detergent lignin (ADL). Equations [22] were used to calculate digestibility coefficients.

Rumen fluid samples

Three hours post-feeding, during the digestibility trial, samples of rumen fluid were collected from three animals in each experimental group using a stomach tube. The samples were immediately exposed to pH value assessment after being filtered through three layers of gauze. Total volatile fatty acids (VFAs) were calculated using the method [24], and the concentration of ammonia nitrogen (NH3-N) was measured in accordance with Conway [23].

Blood samples

At the conclusion of the growing period, blood samples were taken from the jugular vein just prior to feeding (3 animals in each group). Blood samples were centrifuged for 20 minutes at 4000 rpm. The portion of the separated serum that was used for calorimetric biochemical studies was kept frozen at -20°C until the other biochemical analyses were completed. The amounts of total protein (TP), albumin (AL), creatinine (27), urea (28), and liver enzymes (ALT and AST) were all measured [25-29].

Puberty assay for male lambs

From the start of the experimental period until adolescence (first successful ejaculate with motile spermatozoa), male lambs in all test groups were subjected to observation to look for changes in sexual behavior at 10-day intervals. Two or more ewes were hormonally synced to go into estrus in order to guarantee their availability. For five days in a row, each sheep received an injectable dosage of 25 mg progesterone (Luton, Misr Co. for Pharma Ind. SAA, Cairo), and then 24 hours later, 5 mg of estradiol benzoate (Folone, Misr Co. for Pharma Ind. SAA, Cairo). 24-48 hours after the previous hormone dosage (using interact male), oestrus was detected in ewes. The timing that worked for the libido test was chosen for the oestrous synchronization treatment. Age, body weight, scrotal circumference, and testes volume were used to calculate the first ejaculation of motile spermatozoa at the first mounting, mounting with erection, first penile protrusion with erection, and puberty stages of sexual activity. Up to the completion of the trial, measurements of testes volume, scrotal circumference, and body weight were made every two weeks. The maximum circumference of the paired testes and scrotum were measured using flexible plastic tape around the widest point of the testes [30]. Using calipers, the testicular length was determined at the intersection of the testis' top and bottom measurements. According to Mohamed's computation [31], the calculated test volume (cm3) was as follows: Testis volume (cm3) = scrotal circumference (cm) X 2 (average testis length).

Semen evaluation

Using an artificial vagina, the first ejaculate at puberty or throughout the collection age was collected for semen. Male lambs were sexually excited before ejaculating by permitting two false mounts and then 5 minutes of restraint. Sperm cell concentration (109/ml) was microscopically assessed using a Neubauer haemocytometer, and estimates of ejaculate volume, percentage of mass motility [32], live/dead, and abnormal spermatozoa [33] were made for the semen. Multiplying the sperm concentration per milliliter by the ejaculate volume per milliliter yielded the total sperm output (109/ejaculate).

Statistical analysis

Common linear models (GLM), as modified by IBM SPSS Statistics [34] for the user's guide with one-way ANOVA, were used to statistically assess the findings. To ascertain the level of significance between the means of treatments, the Duncan test was conducted using the SPSS program.

Results

Nutrients digestibility and feeding values

Table (2) lists the nutrient digestibility and feeding values of the experimental meals. When compared to triticale and oat silage rations, corn silage rations had significantly ($P<0.05$) higher values for DM, OM, EE, NFE, and TDN digestibility. In contrast to triticale and oat silage rations, corn silage rations had significantly reduced CP and CF digestibility and DCP content ($P<0.05$).

TABLE 2. Digestibility nutrients and feeding values of the different rations.

Item	Experimental rations			SEM
	R1	R2	R3	
Nutrients digestibility, %				
DM	67.91[a]	65.82[b]	65.50[b]	0.54
OM	69.30[a]	67.16[b]	66.84[b]	0.55
CP	65.85[b]	69.03[a]	68.76[a]	0.64
CF	62.26[b]	64.86[a]	64.12[a]	0.53
EE	72.35[a]	69.65[b]	71.00[ab]	0.57
NFE	73.44[a]	70.06[b]	70.26[b]	0.68
Feeding values, %				
TDN	67.17[a]	63.59[b]	63.38[b]	0.72
DCP	7.14[b]	9.68[a]	9.46[a]	0.41

a, b: Means in the same row with different superscripts differ significantly (P<0.05).
Dry matter (DM); Organic matter (OM); Crude protein (CP); Crude Fiber (CF); Ether extract (EE); Nitrogen-free extract (NFE); Total inorganic matter (Ash). Corn Silage (CS), Triticale Silage (TS); Oat Silage (OS);
R1 = Concentrate plus corn silage; R2 = Concentrate plus triticale silage; R3 = Concentrate plus oat silage.

Rumen fermentation activity

Rumen liquor parameters of lambs fed the different kinds of silage are shown in Table (3). The Rumen pH value was nearly similar for the different groups, being 6.40-6.45. The lower pH value might be attributed to feeding concentrate and silage. The concentration of total VFA was significantly higher (P<0.05) for rations containing corn silage (R1) compared to those containing triticale silage (R2) and oat silage (R3). However, the ammonia nitrogen (NH3-N) concentration was significantly lower (P<0.05) for R1 than those of R2 and R3.

Blood serum biochemical

According to blood serum biochemical test results (Table 3), R3 had substantially greater levels of total protein and globulin (P<0.05) than R1 and R2. The concentration of albumin was essentially the same across all groups. In R3, globulin showed the greatest increase in total protein. In R1 compared to R3, the albumin-to-globulin ratio was substantially greater (P< 0.05), but not statistically different from R2. Additionally, R1 and R2 had considerably greater quantities of urea and creatinine (P< 0.05) than R3 did. Blood urea concentration and ruminal ammonia concentration were inversely associated, showing that the rumen bacteria used ammonia to produce microbial protein. Alanine aminotransferase (ALT) and aspartate aminotransferase (AST) enzyme activities were essentially identical among groups, with no discernible changes.

TABLE 3. Rumen fermentation activity and some blood serum biochemical of lambs fed the different rations.

Item	Experimental rations			SEM
	R1	R2	R3	
Rumen fermentation				
pH	6.4	6.43	6.45	0.02
TVFA's (mM/100 ml)	19.20[a]	18.17[b]	18.11[b]	0.2
NH_3-N (mg/100 ml)	14.79[b]	17.37[a]	16.92[a]	0.41
Blood serum biochemical				
Total protein (g/dl)	6.89[b]	6.87[b]	7.05[a]	0.05
Albumin (g/dl)	3.30	3.23	3.22	0.04
Globulin (g/dl)	3.59[b]	3.64[b]	3.83[a]	0.06
Albumin: globulin ratio	0.92[a]	0.89[ab]	0.84[b]	0.02
Creatinine (mg/dl)	0.80[a]	0.79[a]	0.74[b]	0.01
Urea (mg/dl)	42.43[a]	41.14[a]	38.17[b]	0.69
AST (IU/L)	69.86	70.43	69.17	1.08
ALT (IU/L)	20.57	20.00	19.67	0.28

a, b: means in the same row with different superscripts differ significantly (P<0.05).
R1 = Concentrate plus corn silage; R2 = Concentrate plus triticale silage; R3 = Concentrate plus oat silage.

Feed intake

According to information on the feed consumption of lambs in Table (4), maize silage ration (R1) considerably (P<0.05) outperformed triticale silage ration (R2) and oat silage ration (R2) in terms of DM and TDN intake. Even if TDN consumption grew as TDN content did (Table 2). Although R1 had significantly (P<0.05) lower CP and DCP intake than R2 and R3, this was due to the latter's higher CP content (Table 1) and DCP value (Table 2).

Live body weight and weight gain

Table (4) shows the live body weight and weight gain of lambs fed various types of silage. The starting body weights of the various groups in the experiment were remarkably comparable. Oat silage ration (R3) was considerably (P<0.05) greater than corn silage ration (R1) and triticale silage ration (R2) in terms of ultimate body weight, total weight growth, and average daily gain. Lambs fed oat silage gained 5.63 kg (or 13.33%) more final body weight than lambs fed corn silage and 1.88 kg (or 4.45%) more than lambs fed triticale silage. Additionally, compared to R1 and R2, the average daily gain of lambs fed R3 rose by 29.81% and 20.12%, respectively.

Feed conversion ratio

For each kg of weight growth, the amounts of DM, TDN, CP, and DCP necessary for conversion feed are shown in Table (4). Lambs fed R1 substantially (P 0.05) had the highest levels of DM and TDN per kilogram of weight gain, followed by those fed R2, while lambs fed R3 had the lowest levels. While CP and DCP per kg of weight growth were substantially higher (P<0.05) in lambs given R2 than in those fed R1, they were lower in R3.

TABLE 4. Feed intake, body weight gain, feed conversion and economic efficiency of lambs fed the different rations.

Item	Experimental rations			SEM
	R1	R2	R3	
Feed intake (kg/head/day)				
CFM*	0.778	0.778	0.778	
CS*	2.993	-	-	
TS*	-	2.526	-	
OS*	-	-	2.574	
Total intake*	3.771	3.304	3.352	
Total DM intake	1.617^a	1.460^b	1.460^b	0.029
TDN	1.087^a	0.929^b	0.926^b	0.029
CP	0.175^b	0.205^a	0.201^a	0.008
DCP	0.115^b	0.141^a	0.138^a	0.012
Body weight gain				
Initial weight (kg)	22.13	22.38	21.75	0.37
Final weight (kg)	42.25^b	44.13^b	47.88^a	0.61
Total weight gain (kg)	20.12^b	21.75^b	26.13^a	0.71
Daily gain (g/day)	134.17^b	145.00^b	174.17^a	4.76
Feed conversion ratio (kg/kg weight gain)				
DM	12.05^a	10.07^b	8.38^c	0.53
TDN	8.10^a	6.40^b	5.31^c	0.41
CP	1.304^b	1.414^a	1.154^c	0.09
DCP	0.857^b	0.972^a	0.792^c	0.05
Economic efficiency				
Feed cost (LE/day)	5.30	5.14	5.17	0.04
Feed cost (LE/kg gain)	39.50^a	35.45^b	29.68^c	1.44
Output of weight gain (LE/day)	6.98^c	7.54^b	9.06^a	0.31
Net revenue (LE/day)	1.68^c	2.40^b	3.89^a	0.33
Economic efficiency[1]	1.32^c	1.47^b	1.75^a	0.06
Economic efficiency[2]	31.67^c	46.73^b	75.23^a	6.45

a, b, c: Means in the same row with different superscripts differ significantly (P<0.05).
R1 = Concentrate plus corn silage; R2 = Concentrate plus triticale silage; R3 = Concentrate plus oat silage.
*As fed.
[1] Economic efficiency = output of weight gain/feed cost. [2] Economic efficiency = net revenue*100/feed cost.

Scrotal circumference and tests volume

According to the data in Table (5), R3 was followed by R2 in terms of test volume and scrotal circumference of lambs fed the various silages, although R1 had the lowest values. For test volume and scrotal circumference, the differences between the several groups start in the second and third months, respectively.

Incidence of puberty

Table (6) displays sexual behavior together with age and body weight during pre-pubertal and puberty. Male lambs fed corn silage (R1), followed by those fed triticale silage (R2), reach first mounting, first mounting with erection, and first ejaculation (puberty) phases considerably (P0.05) later than those fed oat silages (R3). The body weight for each group throughout the pumping phase was remarkably comparable. Lambs fed R3 had the largest body weight at the first mounting with erection and puberty stages, followed by those fed R2, while those fed R1 had the lowest weight.

Table (6) shows the scrotal circumference and test volume at pre-pubertal stages and puberty. Lambs fed oat silage (R3) significantly ($P<0.05$) recorded the highest test volume at first mounting, first mounting with erection, and first ejaculation (puberty), followed by those fed triticale silage (R2). Lambs fed corn silage (R1) had the lowest test volume. At the first mounting stage, the scrotal circumference of lambs fed various silages was practically identical. The maximum scrotal circumference was seen in lambs fed R3, followed by those given R2, and the lowest value was seen in lambs given R1. Lambs from R3 had testicle sizes that were substantially larger ($P<0.05$) than those of the other groups, which was possibly connected to the expansion of the volume and diameter of seminiferous tubules.

TABLE 5. Scrotal circumference and tests volume of male lambs fed the different rations.

Age	Scrotal circumference (cm)				Tests volume (cm^3)			
(Month)	R1	R2	R3	SEM	R1	R2	R3	SEM
4-5	7.25	7.13	7.38	0.26	80	78.13	75.63	2.21
5-6	13.25	13.38	14	0.39	142.5	150	153.12	3.26
6-7	17.25	18.5	19.5	0.56	186.88^{b}	196.88^{b}	213.75^{a}	3.57
7-8	19.75^{b}	22.13^{ab}	24.50^{a}	0.67	255.00b	266.88^{b}	295.62^{a}	4.59
8-9	23.13^{b}	25.25^{b}	30.25^{a}	0.86	360.00^{b}	385.62^{a}	393.75^{a}	3.78
9-10	24.63^{c}	27.88^{b}	31.38^{a}	0.79	364.38^{c}	385.62^{b}	411.25^{a}	4.49

a, b, c: means in the same row with different superscripts differ significantly ($P<0.05$).
R1 = Concentrate plus corn silage; R2 = Concentrate plus triticale silage; R3 = Concentrate plus oat silage.

TABLE 6. Average of age, live body weight, testes volume and scrotal circumference at pre-pubertal stages and at puberty for male lambs fed different rations.

Stage	Experimental rations			SEM
	R1	R2	R3	
1st mounting				
Age (d)	172.62^{a}	165.62^{a}	148.25^{b}	3.52
Body weight (kg)	27.50	29.25	28.88	0.46
Scrotal circumference (cm)	16.25	16.38	16.75	0.26
Tests volume (cm^3)	161.88^{b}	163.88^{b}	177.00^{a}	2.7
1st mounting with erection				
Age (d)	212.38^{a}	198.75^{a}	177.12^{b}	4.6
Body weight (kg)	32.38^{b}	36.38^{a}	36.63^{a}	0.61
Scrotal circumference (cm)	20.38^{b}	22.38^{ab}	24.00^{a}	0.5
Tests volume (cm^3)	245.62^{b}	260.25^{ab}	267.00^{a}	3.35
1st ejaculation (puberty)				
Age (d)	251.75^{a}	232.25^{b}	227.38^{b}	3.68
Body weight (kg)	38.13^{b}	39.75^{ab}	40.75^{a}	0.51
Scrotal circumference (cm)	24.50^{b}	27.75^{a}	29.00^{a}	0.58
Tests volume (cm^3)	359.38^{b}	384.50^{ab}	407.00^{a}	6.66

a, b, c: means in the same row with different superscripts differ significantly ($P<0.05$).
R1 = Concentrate plus corn silage; R2 = Concentrate plus triticale silage; R3 = Concentrate plus oat silage.

Physical semen characteristics

The data in Table (7) showed that, when compared to corn silage, oat silage and, to a lesser extent, triticale silage improved semen quality features at the first ejaculation (puberty) of male lambs. The highest mass motility, progressive motility, live sperm, sperm concentration, sperm production, and semen index were substantially higher in lambs fed R3 than in those fed R2, while the lowest values were seen in lambs fed R1. On the other hand, the semen of lambs given R1 had the highest percentages of aberrant and dead sperm, followed by those of lambs fed R2, and the lowest percentages were seen in lambs fed R3.

TABLE 7. Physical semen characteristics of male lambs for different groups.

Item	Experimental rations			SEM
	R1	R2	R3	
Semen Volume (ml)	0.44^{b}	0.57^{a}	0.62^{a}	0.02
Mass Motility (%)	43.88^{b}	52.50^{ab}	62.50^{a}	2.41
Progressive motility (%)	23.75^{c}	31.25^{b}	43.75^{a}	1.95
Live sperm (%)	60.00^{b}	62.25^{b}	71.00^{a}	1.48
Abnormal sperm (%)	15.63^{a}	14.50^{ab}	12.88^{b}	0.42
Dead sperm (%)	24.38^{a}	23.25^{a}	16.13^{b}	1.27
Sperm Concentration (10^9/ml)	169.75^{b}	182.00^{ab}	196.25^{a}	3.27
Sperm output (10^9/ejaculate)	74.67^{c}	102.91^{b}	121.23^{a}	5.13
Semen index*	11.04^{c}	20.04^{b}	38.21^{a}	2.72

a, b, c: means in the same row with different superscripts differ significantly (P<0.05).
R1 = Concentrate plus corn silage; R2 = Concentrate plus triticale silage; R3 = Concentrate plus oat silage.
*Semen index= Semen Volume (ml)× Sperm Concentration (10^9/ml) × Live sperm (%) × Progressive motility (%).

Discussion

Nutritional strategies are essential for improving the performance and productivity of livestock and lambs [35]. Besides, it can affect reproductive behavior and maternal ability. Hence, finding the proper feed ingredients that can be extracted from nontraditional sources is of interest to nutritionists. The present study presents a possible solution to increase the feed digestibility and productivity of lambs by feeding triticale silage. The digestibility coefficients of corn silage rations were higher than those of triticale and oat silage rations. However, compared to triticale and oat silage rations, corn silage had significantly lower CP and CF digestibility and DCP levels. These findings may be a reflection of variances in the chemical make-up of experimental diets brought on by variations in silage composition. These findings complemented those of El-Emam et al. [36], who found that nutrient digestibility increased with increasing their contents in the ration, TDN content increased with increasing NFE content, and DCP content increased with increasing CP content.

The Rumen pH value was nearly similar for the different groups, being 6.40-6.45. The lower pH value might be attributed to feeding concentrate and silage. The concentration of total VFA was significantly higher for rations containing corn silage (R1) compared to those containing triticale silage (R2) and oat silage (R3). However, the ammonia nitrogen (NH_3-N) concentration was significantly lower for R1 than R2 and R3. The higher concentration of TVFA's in rumen liquor with feeding corn silage ration might be to the high content NFE, which rapidly fermented in the rumen to volatile fatty acids. While ammonia concentration in rumen liquor increased with feeding triticale and oat silages due to increasing protein content. The results of our study agreed with those obtained by El-Emam et al. [36], who found that ruminal pH value was not affected by feeding berseem or triticale silage, while ammonia and total VFA were positively correlated with dietary protein and carbohydrate content, respectively.

In comparison to R1 and R2, R3 had significantly greater levels of total protein and globulin. The concentration of albumin was essentially the same across all groups. The albumin-to-globulin ratio in R1 was significantly greater than that in R3, but only marginally different from R2. Moreover, creatinine and urea concentrations were significantly higher in R1 and R2 compared to R3. These results indicated that oat silage improved kidney function. The activity of liver enzymes ALT and AST was nearly similar for different groups without significant differences. Generally, the obtained results indicate those blood components measured showed slight variations due to the source of silages. At the same time, Kaneko [37], stated that all values were within what were considered to be healthy ranges for goats. Additionally, in agreement with Harper et al.'s findings [38], who used triticale and berseem forage and their mixtures in lactating dairy cow's rations.

The intake of DM and TDN was significantly higher with corn silage ration (R1) than with triticale silage ration (R2) and oat silage ration (R3). The increase in DM intake with corn silage was attributed to the fact that corn silage was more palatable than triticale and oat silage. While TDN intake increased with increasing TDN content. Increases in the forage: concentrate ratio, according to Carvalho et al. [39], encourage the physical management of nutrient intake and, as a result, reduce lamb performance. A statistically higher amount of dry matter was consumed when grass hay was fed than when barley silage was fed [40]. In studies looking at crop silages on lamb and beef, dry matter content and silage fermentation characteristics had an impact on dry matter intake [41].

Oat silage ration (R3) considerably outperformed corn silage ration (R1) and triticale silage ration (R2) in terms of ultimate body weight, overall weight growth, and average daily gain. These findings are in line with those of Jacques et al. [42], who found that merino sheep's body weight gain and nutritional content were affected by conserved oat fodder. A large proportion of concentrate feed or forage has a higher energy content and increases the availability of nutrients for lamb body growth, according to Medeiros et al. [43].

In terms of DM and TDN per kilogram of weight growth, lambs fed R1 significantly had the greatest levels, followed by lambs fed R2, while lambs fed R3 had the lowest levels. While CP and DCP per kg of weight gain were significantly higher for lambs fed R2 compared to those fed R1 and R3. These results show that lambs fed an oat silage ration had better feed conversion, which might be attributed to the lower feed intake and higher weight gain (Table 4). Grass-hay feeding resulted in numerically lower feed efficiency rates than silage [40].

The test volume and scrotal circumference of lambs fed the different silages were significantly higher with R3, followed by R2, but R1 had the lowest values. The variations among the different groups begin at the 2nd month for test volume and the 3rd month for scrotal circumference. Many factors affect the reproductive performance of livestock, of which genetic merit, environment management, and particularly the animal's nutritional status are essential [44,45]. When compared to Ram lambs fed maize stover and silage, feeding them whole plant silage resulted in the largest scrotal circumference and growth rate [46]. Domestic male animals' reproductive capability is predicted by the size and weight of their testicles [47,48,49]. The amount of food consumed and the daily weight increase may have an impact on scrotal circumference [50].

Ram lambs fed corn silage (R1), followed by triticale silage (R2), and oat silage (R3), attain the first mounting, first mounting with erection, and first ejaculation (puberty) stages at an older age. Lambs fed R3 had the largest body weight at the first mounting with erection and puberty stages, followed by those fed R2, while those fed R1 had the least impact. Age at puberty, body growth rate, body condition score, scrotal circumference, scrotal growth rate, and semen quality are a few examples of significant reproductive features that can be used to select young rams for fertility [51]. The prospective reproductive performance of young rams in prolific breeds varies [52]. According to Rosales Nieto et al. [53], providing a high nutritional plan leads to a high rate of weight gain, a high body condition score, and a shorter age at the start of puberty, which highlights the need for getting enough nourishment. Age at puberty onset is primarily a result of weight gain rate, according to Gregory *et al*. [54]. Additionally, 96% of the difference in reaching puberty was explained by the average daily increase and body weight [55].

The weight increase in Menz male lambs after weaning was significantly influenced by post-weaning nutrition, which was connected to testicular development and scrotal circumference at puberty [56]. A number of studies have shown that an increase in protein causes an increase in the volume and diameter of seminiferous tubules, which in turn causes an increase in testicular size [57,58]. Lambs from R3 had testicle sizes that were considerably larger than those of the other groups (P 0.05), and this finding was associated with an increase in the volume and diameter of seminiferous tubules. According to the study's findings, testis volume and testis weight are connected to the number of spermatozoa per ejaculate [59]. 96% of the difference in reaching puberty was explained by gain and body weight [55].

In comparison to corn silage, oat silage and, to a lesser extent, triticale silage improved the semen quality features during the first ejaculation (puberty) of ram lambs. Semen volume, mass motility, progressive motility, live sperm, sperm concentration, sperm production, and semen index were all highest in lambs fed R3, followed by lambs fed R2, and lowest in lambs fed R1. On the other hand, the semen of lambs given R1 had the highest percentages of aberrant and dead sperm, followed by those of lambs fed R2, and the lowest percentages were seen in lambs fed R3. The increase in scrotal circumference and test volume may be the cause of the increases in semen quality with oat silage. Dietary energy has a significant impact on spermatogenesis. Stress, food, body weight, and physical activity are a few factors that might affect sperm motility. Increasing dietary consumption of particular vitamins can help increase sperm motility. Numerous studies have been conducted on the impact of nutrition, in particular underfeeding and flush feeding, on female fertility [60]. It is widely known that sheep must have appropriate nutrition in order to successfully mate [61]. A lack of protein can lower the quality of semen and sexual activity, and numerous studies have shown a connection between calorie consumption and reproductive success in adult rams [62]. One of the key elements in the analysis of semen and the effectiveness of male reproduction is semen volume. The type of feed can have an impact on sperm production and the total number of spermatozoa per ml [64,61]. A higher proportion of gradually motile spermatozoa were produced by feeding on a high-energy meal compared to a moderate-energy diet [65]. Rural sheep farmers should be up-skilled in the management principles of sheep production. The government promote sheep production and consider it as an economic diversification derived by including sheep meat production in local meat production improvement schemes [66]. The use of silages in feeding leads to a reduction in the amount of concentrated ration, which reduces feeding costs and in the same time improves nutritional, economic efficiency [67]. The inclusion of MS and THS in traditional winter rations led to increase milk yield, improve economic efficiency and could be save about 50% of FB produced which can be conserve it as silage or hay reduce cultivated berseem area by 53.75% to increase wheat production [68].

Conclusion

In conclusion, the addition of triticale or oat silage had an economic advantage compared to corn silage. Also, male lambs fed on triticale or oat silage had puberty at an earlier age and improved their growth performance and reproductive ability.

Conflicts of interest

"There are no conflicts to declare".

Ethical approve

All experiments were performed according to the guidelines of a local ethics committee for animal care and welfare of Faculty of Agriculture, Kafrelsheikh University, Egypt (Number 08/2016 EC).

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تقييم العلائق المحتوية على سيلاج الذرة و التريتكال و الشوفان على أداء النمو وجودة السائل المنوي لكباش الأغنام

حامد محمد جعفر[1]، محمد السيد الشعراوى[2] ، أحمد عوض البنا[2]، أحمد عبدالرحمن جلال[3] ، محمد فريد على[2] ومحمد محمود البدوى[1]

[1] معهد بحوث الانتاج الحيوانى – مركز البحوث الزراعية - كفرالشيخ 33717 – مصر.
[2] قسم الانتاج الحيوانى – كلية الزراعة – جامعة كفرالشيخ – كفرالشيخ 33516 – مصر.
[3] قسم المحاصيل – كلية الزراعة – جامعة كفرالشيخ – كفرالشيخ 33516 – مصر.

أجريت هذه الدراسه لتقييم العلائق من سيلاج الذرة، التريتكال والشوفان على أداء النمو ، والبلوغ ، ونوعية السائل المنوي في ذكور الحملان. أربعة وعشرون خروفًا هجينًا (Landrace 2/1 الفنلندي × 2/1 رحماني) بعمر 4-5 أشهر (22.09 ± 0.37 كجم من وزن الجسم الحي) تم تقسيمها عشوائيًا إلى ثلاث مجموعات (8 حملان لكل منها). تم تغذية ذكور الحملان في المجموعات المختلفة لمدة خمسة أشهر على مخلوط العلف المركز بالإضافة إلى سيلاج الذرة (R1) التريتكال (R2) ، والشوفان (R3) ، على التوالي. كانت كمية مخلوط العلف المركز في بداية التجربة 500 جرام / يوم ، بزيادة قدرها 100 جرام كل شهر ، بينما تم إعطاء السيلاج حتى الشبع. أظهرت النتائج أن تناول DM و TDN كان أعلى معنوياً (P <0.05)، لكن تناول CP كان أقل معنوياً (P <0.05) بالنسبة لـ R1 عن تلك الخاصة بـ R2 و R3**.** كان وزن الجسم النهائي، إجمالي الوزن المكتسب ، ومتوسط الزيادة اليومية أعلى معنوياً (P <0.05) للحملان التي تغذت على R3 مقارنة بـ R1 و R2. تحسن التحويل الغذائي معنويا (P <0.05) مع التغذية R2 و R3. أعرب الحملان الكبش من R3 عن القذف الأول (البلوغ) في 35.6 يومًا ، وهو ما كان أقدم بكثير من تلك الموجودة في المجموعة الضابطة (R1). كما زاد محيط كيس الصفن وحجم الخصيتين R2 و R3 زيادة معنوية (P <0.05) مقارنة مع R1. تم تحسين جودة السائل المنوي لـ R3 و R2 (P <0.05) مقارنة بـ R1. أخيرًا ، كان لإضافة السيلاج التريتكال أو الشوفان ميزة اقتصادية ، حيث أدى البلوغ في سن مبكرة إلى تحسين أداء النمو والقدرة الإنجابية للحملان مقارنةً بسيلاج الذرة.

الكلمات الدالة: السيلاج أداء النمو ، جودة السائل المنوى ، ذكور الحملان.