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Effect of Pre-Weaning Starter on Lamb's Performance

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Abstract: Twenty eight Ossimi new born male lambs, with an average live body weight 4.75 kg and 7 days age were randomly assigned to two feeding groups each of 14 animals to study the effect of pre-weaning diet on lamb's performance. Both the two groups suckled their dams until being weaned at 12 weeks of age (natural weaning). The first group depended completely on dams milk as a solely available feed (control), while the other was supported by a starter ration (13.83% DCP and 81% TDN) besides dams milk from 2-12 weeks old. Lambs separated from their dams before the digestibility trial and fed starter only, had 663g DMI / h/day. The nutritive value of starter was found to be 19.1% CP (14.5% DCP) and 81.0% TDN value, with high digestibility coefficients for different nutrients items. Growth performance data showed similar final live body weight and daily gains 10.5 and 10.0 kg and 100 and 102 g/h/day for both the two reared groups, respectively during their early life (2-8 weeks of age). While lambs in age 9-12 showed higher *(P<0.05)* gains, being about two times that achieved by the solely milk fed-group 213 *vs* 101 g/h/day for groups II and I, respectively. Higher feed costs/kg gain *(P<0.05)* was obtained by T1 (4.5L.E) compared with starter feed (2.76 L.E) due to the higher price of milk (1.6 *vs* 0.662 LE), respectively.

Key words: Lambs % Natural weaning % Starter % Performance

INTRODUCTION

The intake of solid feed is vital to the calf for making the transition from a pre-ruminant animal to a functioning ruminant [1].

Schichowski *et al.* [2] concluded that lambs weaned by the traditional method of abrupt separation based on behavioral data had distressed. Proper development of the rumen is an important task that can be controlled to benefit both the newborn calf, lamb and the producer. Normally, weaned ruminants might lose some weight when change liquid feed to solid feed because of undeveloped rumen which reflected on performance. The process of rumen development does not occur "magically" and with the right management the cost of raising calves and lambs can be decreased [3]. The mechanisms that are responsible for rumen development have not been completely characterized; however, solid feed consumption stimulates rumen morphological development [4]. Also, the important component in successful newborn rearing programs is an early transition to starter grain.Anderson *et al*, [5] concluded that development of rumen papillae is aided by the fermentation of newborn starter to volatile fatty acids (VFA). Growth of rumen papillae aids in allowing the newborn to change from mono-gastric form to one characteristic of adult ruminants [6]. When young animals consume both starter and water at an early age, maturation of the rumen occurs at an earlier age compared with milk feeding alone.

Lane and Jesse, [7] found that, calves fed milk alone show little rumen development, but those fed milk plus solid feed show a marked increase in rumen volume and weight, exhibiting increased papillary length and density as well as improved animal performance. Local sheep breeds are characterized by their lower milk yield, which in turn would be reflected on the growth rate of their offspring. Hence, the aim of the present study was to justify the effect of pre-weaning diet on the efficiency of production from the local weaned lambs through a comparable study between two lamb groups weaned naturally at 12 weeks. The first group depended solely on suckling their dams, while the second was supported by a creep feeding ration, in addition to suckling their dams.

MATERIALS AND METHODS

Experimental rations and animals management: Twenty eight Ossimi newborn male lambs, with an average live body weight 4.75 Kg and 7 days age were

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Table 1: Ingredients and chemical composition of creep feeding ration offered to natural reared lambs from 2-12 weeks old (DM basis)

Type of weaning	Natural rearing 12 wk, (NR)	Natural rearing (NR)+Starter (St)	
			Current price
% ration composition	T1	T2	L.E /ton
Yellow Corn	-	55.00	500
Soybean meal	-	30.00	950
Wheat bran	-	7.00	400
Molasses	-	5.00	240
Lime stone	-	1.50	50
Salt	-	1.00	100
Mineral mix. and Vit. (Premix)*	-	0.50	12000
Price LE / Ton	-	663.80	-
% DCP	-	13.83	-
% TDN	-	81.00	-

Chemical composition						
DM	OM	CP	EE	CF	NFE	Ash
90.9	93.8	19.1	3.1	4.4	67.2	6.2

* Primex, contained/kg Mn. 33 mg, Zn 25 mg, Fe 20 mg, Cu 6 mg, I 800 mg, Sel 66 mg and Co 160 mg.

randomly assigned to two feeding groups each of 14 animals. Both the two groups suckled their dams until being weaned at 12 weeks of age (natural weaning). The first group depended completely on dam's milk as a solely available feed T1 (control), while the other was supported by a starter ration T2 (13.83 DCP and 81 TDN) (Table 1), besides dam's milk. Experimental rations were formulated and calculated according to NRC recommendations [8] and offered to lambs *ad libitum*. Residuals were daily collected, while a composite sample was taken and dried for determination of dry matter intake and further proximate analysis. Lambs were kept in semi-opened pens, while water and salt blocks were freely available. Animals were fasted weighed biweekly intervals, while daily feed intake, changes in live body weight, average daily gain, feed conversion (kg DMI/kg. gain) and feed costs (LE/kg. gain) were estimated.

Milk intake determination: Average daily milk intake determined once weekly during the rearing period, by milk difference technique according to Louca *et al.* [9].

Digestibility trails and N. balance: Simultaneously, by the end of the study (12 weeks), four representative lambs per each dietary treatment were separated from their dams and randomly chosen and used in a digestibility trail. Lambs were placed in metabolic cages, weighed at the start and the end of the trail. The duration period of the trail, consisted of 10 days as an adaptation and preliminary period, followed by another 7 days as a collection one. Over the collection period, daily amounts of feed consumed and residuals were accurately weighed and recorded, meanwhile, faeces and urine were quantitatively collected once daily at 9 a.m.

Faeces collection: The daily faeces were weighed and samples (10%) of it immediately frozen at -20°C. At the end of the collection period, a composite sample for each lamb was prepared and dried in a drying oven at 65°C for 48 hours and then grinding and stored in suitable jars for proximate analysis. Also a composite sample of experimental rations were prepared and stored in tight jars for further chemical analysis.

Urine sampling: Five m1 of diluted sulphuric acid (1:1) were added in the urine collecting bottles to avoid ammonia losses. The urine output was measured daily for each animal and representative samples (10%) were taken and stored at -20ºC for nitrogen determination.

Chemical analysis: Samples of feeds and faeces were analyzed for dry matter (DM), crude protein (CP), crude fiber (CF), ether extract (EE), ash contents and nitrogen in urine also was determined according to AOAC [10] procedures.

Statistical analysis: Data were analyzed using the general linear models procedure adopted by SAS [11]. Difference between means was tested for significance using the L.S.D test according to Duncan [12]. One way analysis of variance was adopted using the following equation:

$$Yij = u + Ti + Eij$$

Where:
Yij = The observations of the parameter measured.
U = Overall means
Ti = The effect of replication
Eij = The random error term.

RESULTS AND DISCUSSION

Digestion Coefficients, N. Balance and nutritive values of the starter: As shown in Table 2, lambs separated from their dams before the digestibility trial fed starter ration only, had 663g DMI / head/day. The nutritive value of such ration was found to be 19.1% CP (14.5% DCP) and

Table 2: Digestion coefficients, N balance and nutritive values % of lambs fed the starter ration

Item	Natural reared lambs
DM intake (Starter) g /h/day	663.0
Digestibility %	
DM	79.1
OM	81.5
CP	75.8
CF	80.7
EE	82.4
NFE	85.2
Nutritive values %	
TDN	81.0
DCP	14.5
Utilization of dietary N(g/h/d)	
NI	20.3
FN	4.9
UN	7.6
DN	15.4
NB	7.8

NR = Natural rearing at 12 weeks old

Table 3: Effect of pre-weaning diet on lamb's performance from (2-8 weeks) of age

Item	T1	T2	SE
Mean feed intake g / h / d ± SE			
Milk (ml/h/d) (1)	310[a]	274[b]	±3.39
Starter DM (g/h/d) (2)	--	134	--
DMI (g/h/d)	40[b]	169[a]	±20.66
EngI (Mcal/h/d)	0.04[b]	0. 33[a]	±0.05
CPI (g/h/d)	16.9[b]	40.5[a]	±3.90
Body weight gain ± SE			
Av. Initial B.W (kg)(3)	5.85	5.70	±0.53
Av. Final B.W (kg)(4)	10.05	10.00	±0.69
Total B.W. gain (kg)	4.20	4.30	±0.50
Av. Daily gain (g)	100	102	±12.66
Feed efficiency and feed cost (pt.)/kg gain ± SE			
Kg DMI/kg gain	0.40[b]	1.66[a]	±0.60
Feed cost (LE) kg gain	5.0	5.3	±0.49

a and b different letters indicate significant difference *(P = 0.05)*

(1) Current price of 1kg ewes milk (2002) = 0.160 LE.

(2) Current price of 1kg starter (2002) = 0.662 LE.

(3) Av. Initial B.W = 2 weeks old

(4) Final B.W = 8 weeks old

81.0% TDN value, with higher digestibility coefficients for different nutrients items, the matter which coincide with NRC recommendations [8] for the features of creep feeding rations of newborn lambs; being palatable and enriched with higher caloric and protein contents, while the protein must be of higher biological value for raising lambs in their early life. Klein *et al.* [13], reported that calves fed starter weaned earlier and have fewer digestive problems. There are several advantages of early weaning when compared to the prolonged feeding of milk. Labor is greatly reduced when calves are fed starter rations when compared to feeding sole milk. Nitrogen balance for such creep feeding ration reflected its higher nutritive value, since it resulted in positive N- balance (7.8 g/h/day).

Effect of Pre-weaning diet on lamb's performance: Data obtained in Table 3 showed higher *(P<0.05)* milk intake by lambs of T1 in comparison with T2 (supported with creep feeding ration), this matter may be due to the continuous stimulation of milk secretion in comparison with T2 which usually separated from their dams for shorter times to accelerate their solid feed consumption or may be due to the introduction of solid diets which satisfied to somehow their daily requirements and in turn lowered *(P<0.05)* their daily milk intake. On the other hand, lambs of T2 consumed higher *(P<0.05)* DMI in comparison with the natural reared group one (169 *vs* 40 g/h/day) for both groups, respectively. This phenomena may be related to supporting lambs of T2 with starter, in addition to the lower DM content of the milk 12-15% DM on the average, which in turn was reflected on the lower *(P<0.05)* DMI of T1. Lower *(P<0.05)* gross energy and protein intakes were noticed with lambs depended solely on milk as the unique available feed resource. Growth performance data showed similar final live body weight and daily gains about 10 kg and 100 and 102 g/h/day for both the two reared groups, respectively, during their early life (2-8 weeks of age).

Concerning data indicated best *(P<0.05)* feed efficiency for lambs of T1 and lower feed cost/kg gain. This matter was clearly related to the similar growth rate for both the two groups, but with the higher *(P<0.05)* DMI for lambs of T2. Also, may be due to the highly efficient of milk for suckling new born.

Growth performance (9-12 weeks old lambs): Data presented in Table 4 indicated, in general lower milk intake for both the two lambs groups as a normal milk yield decline for local dam breeds, but with higher DMI for lambs of T2. Since the lower available milk secreted encouraged such lambs to satisfy their daily feed requirements through the available creep feeding ration (466 g/h/day). In consequence to the prevailing circumstances; lower *(P<0.05)* DMI, gross energy and

Table 4: Effect of pre-weaning diet on lamb's performance from (9-12 weeks) of age

Item	T1	T2	SE
Mean feed intake g / h / d ± SE			
Milk (ml/h/d)	280	158	± 5.49
Starter DMI (g/h/d)	--	466	--
DMI (g/h/d)	36[b]	486[a]	± 0.06
EngI (Mcal/h/d)	0.04[b]	1.04[a]	± 0.13
CPI (g/h/d)	15.23[b]	97.60[a]	± 9.91
Body weight gain ± SE			
Av. Initial B.W (kg)	10.05	10.00	± 0.69
Av. Final B.W (kg)	12.87[b]	15.95[a]	± 1.15
Total B.W. gain (kg)	2.82[b]	5.95[a]	± 0.58
Av. Daily gain (g)	101[b]	213[a]	± 20.78
Feed efficiency and feed cost (pt.)/kg gain ± SE			
Kg DMI/kg gain	0.36[b]	2.28[a]	± 0.22
Feed cost (LE) kg gain	4.5[b]	2.77[a]	± 0.17

a and b different letters indicate significant difference *(P =0.05)*

CP intakes were observed for lambs of T1 in comparison with lambs of T2.This restricted milk feeding as in T1 is generally associated with depressed performance because of low nutrient availability [14,15], depressed behavior [16], poor health [17] and reduced productivity of dairy calves [18].

The intake of starter and total DMI increased with age of the lambs in T2 but not for T1 which nursing dams only. The same results were obtained by Coverdale *et al.* [1] and Khan *et al.* [19]. Growth performance data indicated also higher *(P<0.05)* final live body weight and body weight gains for lambs of T2 in comparison with lambs of T1, due to the restricted available milk intake for lambs of group T1. Lambs of T2 showed higher *(P<0.05)* gains, being about two times that achieved by the solely milk fed-group 213 *vs* 101 g/h/day for groups 2 and 1, respectively. Balwant *et al*. [20] reported that, rumen tissue weight was positively correlated with rumen capacity (r=0.92); DMI (r=0.74) and daily body weight gain (r=0.71). The length of rumen papillae increased (P<0.05) and was positively correlated with daily body weight gain (r = 0.5) and DM intake (r = 0.6). They concluded that, these findings are consistent with the view that rumen development could be enhanced by early feeding of solid food. Results indicated that false best feed efficiency for lambs of T1, due to their lower available feed intake, which in turn resulted in lower *(P<0.05)* daily gain (101g/h/day). This increase of feed intake for T2 from 2- 12 weeks may have caused the large increase in ruminal VFA concentrations. In addition, the restricted intake for lambs in T1 may have resulted in an immature rumen epithelium that was not capable of rapid VFA absorption and caused a low feed intake and poor gain [21]. Higher feed costs/kg gain *(P<0.05)* was shown with T1 due to their higher price of milk compared with starter feed (1.6 *vs* 0.662 LE), respectively.

In the light of the present results, it could be concluded that the nature of available feed introduced to newborn lambs affected and promoted significant activation to the functional organ. This result might due to the introduction of solid- feed for lambs of T2, which enhanced the production of VFA's, which in turn activated the papillary development of such group biologically and functionally and this might be increased the utilization from ingredients of the diet which reflected on lambs gain and efficiency. Similar results were reported by Warner *et al.* [4], who showed that the mechanisms that are responsible for rumen development have not been completely characterized; however, solid feed consumption stimulates rumen morphological development. Calves fed milk alone showed little rumen development, but those fed milk plus solid feed showed a marked increase in rumen volume and weight, as well as exhibiting increased papillary length and density which reflected in improving calves performance.

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