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EFFECT OF FEEDING OLIVE PULP ON PRODUCTIVE PERFORMANCE OF AWASSI EWES AND THEIR LAMBS UNDER SUBTROPICAL CONDITIONS

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ABSTRACT

In order to use olive pulp as alternate source for cheap energy in the new reclaimed lands in Egypt, two experiments were carried out. In the 1st experiment, 18 pregnant Awassi ewes (at 6-8 weeks before the expected date of parturition) were divided into three equal groups. The 1st group (control) was fed on concentrate feed mixture, soybean meal and rice straw. The 2nd and 3rd groups received 20% and 40% of their TDN requirements (control diet) as olive pulp (OP).

In the 2nd experiment, 12 lambs were divided randomly into two equal groups of 6 each. The 1st group (control) was fed on concentrate feed mixture, soybean meal and rice straw, while group 2 received 25% of TDN requirements as OP.

The obtained results could be summarized as follows:

In experiment 1, there were no significant effects on birth weight and body weight (at 1st and 2nd months) of Awassi lambs due to feeding their mothers on OP up to 40% of their nutrient requirements. However, lambs body weight (BW) at the 3rd month, weaning weight (WW), daily weight gain (DWG) and daily milk yield during suckling period were reduced significantly in ewes fed 40% olive pulp whereas changes in these traits when OP was given at level of 20% were not significant. Milk intake per lamb was significantly correlated with total weight gain, DWG and WW.

In experiment 2, DWG and feed efficiency and adrenal, liver and kidney functions as well as serum total protein, albumin and globulin did not change significantly by feeding the growing lambs 25% OP of their TDN requirements. However, blood total lipids and cholesterol increased significantly ($P<0.05$) by 15 and 23%, respectively in growing lambs fed 25% OP than the control group.

It could be concluded that olive pulp could be used efficiently up to 20% of the recommended requirements for growing, pregnant and lactating sheep without any adverse effects on their health, productivity or reproductivity.

Key words: Olive pulp, sheep, productivity, blood metabolites.

INTRODUCTION

Under North Sinai conditions, as new reclaimed desert lands, there is a great shortage in animal feedstuffs particularly during summer season and early autumn. Feed shortage has been emphasized as an obstacle in the development of high productive animals. Incorporation of cheap untraditional feedstuffs such as agro-industrial by-products in the animal diets may help in solving the problem of feed shortage, decrease feeding cost and alleviate pollution problems (Abdel-Samee *et al.*, 1992 and 1994; El-Kerdawy, 1997; Mousa, 1999 and Shetaewi *et al.*, 1999).

Olive pulp represents the major agro-industrial by-product available in the Sinai desert. Olive pulp has been demonstrated by many investigators as energy source for rabbits (Alicata *et al.*, 1986 and El-Kerdawy, 1997); sheep and goats (Abou El-Nasr, 1985; El-Shaer *et al.*, 1986; Khamis *et al.*, 1989 and Mousa, 1999) and growing camels (Mohamed *et al.*, 1997).

In light of these reports, the present study was carried out to investigate the effect of partial substitution of traditional dietary components by olive pulp on productive performance of Awassi sheep and some associated physiological and biochemical changes under North Sinai conditions.

MATERIAL AND METHODS

The present study was conducted on Awassi sheep flock at the farm of Animal Production Department, Faculty of Environmental and Agricultural Sciences, EL-Arish, Suez Canal University.

Two experiments were performed, from November 1997 to May 1998. In experiment 1, 18 pregnant Awassi ewes (38.5 kg body weight and aging 3-7 years) were randomly allotted to three dietary groups. The experiment lasted from 6-8 weeks prior to the expected date of parturition till the weaning age of their lambs (86 days). Ewes were fed a basal ration of concentrate feed mixture (CFM), soybean meal (SBM) and rice straw in late pregnancy while they were fed on CFM and rice straw during the lactation period. The requirements were adjusted every two weeks according to the live body weight and milk production. Total nutrient requirements were calculated according to NRC (1975). Ewes of groups 2 and 3 were fed the same basal ration, but 20 and 40%, respectively of the total digestible nutrients (TDN) were replaced by olive pulp (OP) which was mixed with CFM before feeding.

In experiment 2, 12 ewe lambs were randomly allotted to two similar groups. Their average body weights were 19.33 and 19.17 kg, respectively. The animals were fed on CFM, SBM and rice straw. The requirements were adjusted every week according to live body weight. Total nutrient requirements were calculated according to NRC (1975). Lambs of group 2 were fed the same ration, but 25% of TDN were replaced by OP which was mixed with CFM before feeding. This experiment lasted from January to March 1998.

In the two experiments, both SBM and CFM were given in two equal parts at 700 and 1600 h, whereas rice straw was offered at 900 h. Concentrate feed mixture consisted of cotton seed meal (13%), wheat bran (39%), yellow corn (25%), beans straw (3%), berseem straw (5%), molasses (1.5%) rice hulls (10%), limestone (2.5%) and salt (1%) and contained 2.91 Mcal digestible energy/Kg. The proximate analysis of the experimental feedstuffs were carried out according to A.O.A.C. (1984) and is presented in Table (1). The chemical composition of OP was similar to the values given by Abou El-Nasr (1985). Therefore, the nutritive values of OP as total digestible nutrients (TDN) was calculated in the present study according to Abou El-Nasr (1985). While, the TDN values of the other ingredients were calculated according to Schiemann *et al.* (1972) and Devendra and Mcleroy (1982). Mineral composition of drinking water (Table 2) was determined using Atomic Absorption Spectrophotometer according to Page (1982).

Table (1): Proximate analysis (%) and calculated TDN of the experimental feedstuffs.

Items (%)	Concentrate feed mixture	Rice straw	Olive pulp	Soybean meal
Dry Matter (%)	89.20	92.10	89.80	90.98
Dry matter composition (%):				
Organic matter (OM)	86.60	83.90	92.95	95.50
Crude protein (CP)	13.80	3.50	7.85	40.60
Ether extract (EE)	2.10	1.50	16.60	4.00
Crude fiber (CF)	11.80	36.60	26.45	7.35
Nitrogen free extract (NFE)	58.90	42.30	42.05	43.55
Ash content	13.40	16.10	7.05	5.50
TDN	59.2	4.40	54.00	82.00

Table (2): Chemical analysis of underground water.

Items	TDS ppm	pH	Na ppm	K ppm	Cl ppm	P ppm	Ca ppm	Mg ppm	Ca ppm
Drinking water	3600	7.3	714	16.8	54.5	18.0	90.36	6.72	0.44

The animals of each group were group fed and were housed in 5 x 6 m^2 semi–open shaded pens. Drinking water from a natural well and mineral mixture blocks were available at all times. All animals received natural well water containing 3600 ppm TDS.

The experimental work was conducted during winter and spring, where the minimum and maximum relative humidity averaged 62.6 to 89.8%. Whereas, minimum and maximum ambient temperature averaged 11.1 and 23.4^{o}C.

Birth weight (BW), weaning weight (WW) at age of 86 days, total gain, average daily gain (DG), total of milk consumed during the suckling period and feed efficiency (kg milk intake / kg live body weight gain) were estimated in experiment 1.

Total body weight gain, DG, feed efficiency (kg TDN / kg gain in weight), as well as blood biochemical changes and adrenal, liver and kidney functions were recorded in experiment 2.

Blood samples were individually collected from all animals before morning feeding by jugular veinpuncture. The samples were centrifuged at 2000 r.p.m. for 20 min. and serum was separated and stored at – 20^{o}C until analysed.

Serum total protein, albumin, total lipids, Cholesterol, urea, creatinine, glutamic oxaloacetic transaminase (GOT) and glutamic Pyruvic transaminase (GPT) levels were determined colorimetrically using commercial kits, purchased from Bio-Merieus, Laboratory Reagent and Products, France. The globulin values were obtained by subtracting albumin values from total protein values.

Data were subjected to statistical analysis using analysis of variance (ANOVA) according to Gomez and Gomez (1984). Differences among group means were tested according to Duncan's multiple range test (Duncan, 1955).

RESULTS AND DISCUSSION

Experiment I:

Productive performance of ewes:

Table (3) shows that average values of lambs birth weight were 3.67, 3.64 and 3.58 kg for the three tested ewe groups, fed diets containing 0% (control), 20 and 40% olive pulp, respectively. The differences among the three groups were not significant. Such findings are in agreement with those reported by Khamis *et al.* (1989) who found that birth weight of lambs born for ewes that received olive pulp and conventional diet were not significantly different, and supplementation was calculated to supply maintenance energy requirements.

Table (3): Productive performance of Awassi ewes as influenced by feeding olive pulp (X±SE).

Item	G1	G2	G3
No. of born lambs	6	6	6
Overall birth weight (kg)	3.67±0.37	3.64±0.25	3.58±0.16
Male birth weight (kg)	4.35±1.14	3.87±0.27	3.80±0.60
Female birth weight (kg)	3.34±0.07	3.17±0.42	3.47±0.28
Weaning weight (86 days, kg)	15.02±1.24^{a}	13.90±1.07^{a}	11.02±0.7^{b}
Total gain / head (kg)	11.35^{C}	10.26^{C}	7.44^{D}
Daily gain / head (gm)	131.97^{C}	119.30^{C}	86.51^{D}
Total milk intake during suckling period (kg/lamb)	64.31±3.2^{a}	65.85±5.9^{a}	51.95±1.7^{b}
Daily milk yield during suckling	0.75	0.76	0.60
Feed efficiency (kg milk intake / kg live body weight gain)	5.66	6.42	6.98

a, b, means in the same row with different superscripts differ significantly (P<0.05).
C, D, means in the same row with different superscripts differ significantly (P<0.01).

Birth weight of males tended to be heavier than females for the three groups. Similar results were reported by many investigators (Mousa, 1989; El Shennawy, 1993; Shaat, 1995 and Mousa, 1996).

Starting from week 2, body weight was generally higher in groups 1 and 2 than the control group, but the differences were not significant during the ages of 2 and 10 wk, while it was significant (P<0.05) at 12 wk of age (Fig. 1).

Weaning weight of the control group and group 2 were significantly (P<0.05) higher by 36% and 26% than those in group 3. Similar results were reported by Khamis *et al.* (1989) who found that weaning weights differed significantly (P<0.05) between lambs born from ewes that received OP and conventional diet (13.38 vs. 16.42 kg).

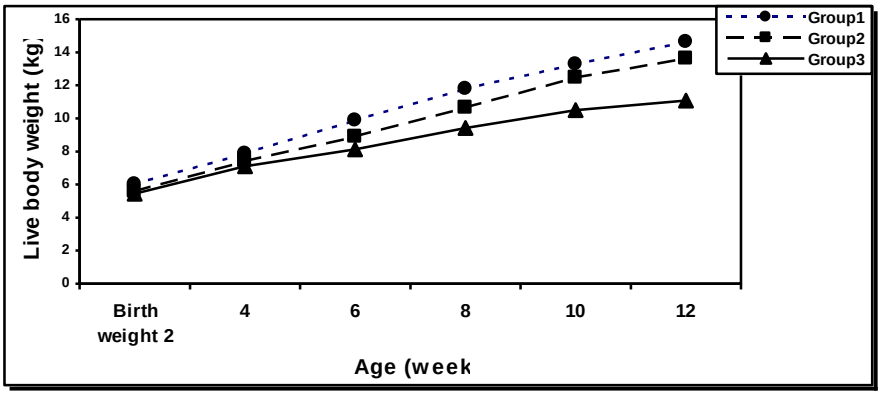

Figure (1): Growth performance of lambs in different dietary groups.

Daily body weight gain of lambs born from ewes that received 20% OP was similar to the lambs of the control group. However, it decreased significantly (P<0.05) for the lambs of ewes received 40% OP (Table 4). This may be due to higher milk intake during the suckling period (64.01 and 66.35 kg) for lambs of groups 1 and 2 than lambs in group 3 (51.45 kg).

It could be concluded that feeding OP up to 20% from TDN requirements of Awassi ewes did not affect growth performance of their lambs from birth to weaning. However, replacement 40% of the TDN by OP in Awassi ewes diets reduced their lambs weaning weight significantly (P<0.05) by 36%. This may be due to the reduced total milk yield for dams by about one third. The decrease in milk yield may be attributed to the high contents of crude fat and fiber of OP which reduce the digestibility of the ration (Mohamed *et al.*, 1997). On the other hand, the diets contained high levels of EE that may inhibit some rumen microbes particularly the cellulolytic bacteria which reduce the CF digestibility (Henderson, 1973).

Highly significant correlation coefficients (P<0.01, Table 5) were found between total milk intake (kg per lamb) during suckling period (TMD) and each of weaning weight (WW), total gain (TG) and average daily gain (DG). Similar findings were reported by Lawlor and Hopkins (1981) and Salama (1993).

Table (4): Correlation coefficients among total milk intake (TMI) and each of weaning weight (WW), total gain (TG) and daily gain (DG) of the experimental lambs.

Item	WW	TG	DG
R	0.679**	0.665**	0.688**
Probability	0.002	0.002	0.001

Feed efficiency, for the lambs of the control ewes, was 5.66, it decreased to 6.12 and 6.93 kg for lambs of ewes received 20 and 40% OP. It seems that efficiency of milk conversion into weights is closely related to the amount of milk consumed by the lambs. Similar results were obtained by Mousa (1996).

Saline water intake for ewes and growing lambs had no adverse effects on their performance and health. Similar results from Bircham and Crouchley (1976) who found that no effect of types of water on growth, wool production and health of lambs.

Experiment 2:

Effect of feeding OP on live body weight, DG and feed efficiency (kg TDN / kg gain) of the growing lambs are presented in Table (5). Final weight, DG and feed efficiency did not change significantly due to feeding 25% OP compared with the controls. Inclusion of 25% in the diets of pregnant and location Awasi ewes may help in reducing the costs of feeding by nearly 22%, since the price of one ton of OP is LE 50 while that of CFM is LE 40.

The present findings are in agreement with El-Shorfa and Faqih (1982); Abou El-Nasr (1985); El-Shaer *et al.* (1986); Salama *et al.* (1993) and Mousa (1999).

Table (5): Effect of olive pulp feeding on growth traits of growing Awassi lambs (X±SE).

Items	G1	G2
No. of ewe lambs	6	6
Experimental period (days)	73	73
Initial weight (kg)	19.33±1.83	19.17±1.14
Final weight (kg)	29.20±1.69	27.67±1.11
Total gain (kg)	9.88	8.50
Daily gain (gm)	135.36±7.82	116.44±6.12
Feed efficiency (kg TDN/kg weight gain)	4.39	5.37

Serum cortisol (Table 6), as indicator of adrenal function, did not differ significantly in growing Awassi lambs as a function of feeding diets contained 25% of their TDN requirements as OP. Similarly, serum concentrations of alkaline and acid phosphatase, GOT and GPT as indicators for liver function did not change significantly due to feeding ration contained 25% OP (Table 7).

Table (6): Blood biochemical changes and adrenal, liver and kidney functions in female Awassi lambs as influenced by olive pulp feeding under subtropical conditions (X±SE).

Items	Control	75% control diet + 25% olive pulp
Adrenal functions:		
Serum cortisol, ng/ml	38.30±5.09	43.70±6.18
Liver functions:		
Alkaline phosphatase, Unit/L	120.00±12.3	129.00±13.6
Acid phosphatase, Unit/L	50.20±3.19	57.30±4.29
SGPT, Unit/L	2.19±0.07	2.37±0.09
SGOT, Unit/L	7.21±0.25	7.78±0.29
Kidney functions:		
Creatinine, mg/L	16.90±0.65	18.10±0.67
Urea-N, mg/L	192.00±10.5	201.00±11.6
Blood metabolites:		
Total protein, g/L	83.90±4.71	89.10±5.05
Albumin (A), g/L	39.20±2.23	43.00±3.14
Globulin (G), g/L	44.70±2.41	46.10±4.45
A/G, ratio	0.88±0.04	0.93±0.04
Total lipids, g/L	5.37 ± 0.27^{b}	6.18 ± 0.19^{a}
Cholesterol, g/L	0.91 ± 0.08^{b}	1.12 ± 0.10^{a}
Triglycerides, mg/L	2.19±0.57	2.56±0.49

a, b, means in the same raw with different superscripts, differ significantly (P<0.05).
SGPT, serum glutamic pyruvic transminase
SGOT, serum glutamic oxaloacetic transminase

In addition, creatinine and urea-N, as an indicators for kidney functions, as well as, serum total protein, albumin, globulin and albumin to globulin ratio did not differ significantly between lambs of the two experimental groups (Table 7).

These results are in line with the findings of Mousa (1999) who found that adrenal, liver and kidney functions were not affected significantly due to feeding Awassi ewes ration containing 20 or 40% of their TDN requirements as olive pulp.

On the other hand, blood total lipids and cholesterol concentrations (Table 7) increased significantly ($P<0.05$) by 15 and 23%, respectively in treated group subjected to feeding 25% TDN requirements of olive pulp. This may be due to the high ether extract (EE) content of the ration. The present results are in agreement with Mousa (1999) who reported that serum total lipids and cholesterol concentrations increased significantly ($P<0.05$) due to feeding olive pulp.

CONCLUSION

It could be concluded that olive pulp replacement up to 20% of the pregnant sheep diet did not affect significantly birth weight, live body weight at the 1st and 2nd month of age and weaning weight (86 days) of their born lambs.

In addition, feeding the growing lambs up to 25% of their TDN requirements olive pulp had no adverse effects on their adrenal, liver and kidney functions, daily body gain and feed efficiency.

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تـأثير تغذيـة تفل الزيتـون للنعـاج العواسـى وحملانهـا تحـت ظـروف المنـاطق تحـت الاستوائية.

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لدراسة تأثير استخدام تفل الزيتون كمصدر رخيص للطاقة فى علائق الأغنام أجريت تجربتان ، فى التجربة الأولى قسمت 18 نعجة عواسى إلى 3 مجاميع متساوية فى الوزن قبل الولادة المتوقعة بـ 6-8 أسابيع ، المجموعة الأولى (كنترول) غذيت على العلف المركز وكسب فول الصويا وقش الأرز حسب لمقررات NRC (1975) ، بينما تم تغذية المجموعتين الثانية والثالثة على تفل الزيتون بنسبة 20 ، 40% من المقررات الغذائية للأغنام. وفى التجربة الثانية قسمت 12 حولية لمجموعتين متساويتين فى الوزن (6 حوليات بكل مجموعة) ، تم تغذية المجموعة الأولى (كنترول) على العلف المركز وكسب فول الصويا وقش الأرز ، بينما غذيت المجموعة الثانية على عليقة بها 25% تفل زيتون من الإحتياجات الكلية.

ويمكن تلخيص النتائج المتحصل عليها فيما يلى:

- لم تكن هناك فروق معنوية فى وزن الميلاد وكذلك وزن الشهر الأول والثانى للحملان المغذاة أمهاتها على تفل الزيتون بنسبة 20 ، 40% مقارنة بمجموعة الكنترول.
- كانت هناك فروق معنوية بين الحملان المغذاة أمهاتها على تفل الزيتون بنسبة 40% من الإحتياجات الكلية والحملان التى غذيت أمهاتها على عليقة كنترول وكذلك الحملات التى غذيت أمهاتها على نسبة 20% تفل زيتون فى الوزن عند الشهر الثالث ، ووزن الفطام ، الزيادة الكلية فى وزن الجسم وكمية اللبن المستهلك فى الرضاعة يومياً. وكانت هناك علاقة إرتباطية موجبة ومعنوية بين كمية اللبن المأخوذة للحملان وبين الزيادة الكلية ، الزيادة اليومية ووزن الفطام للحملان.
- **وفى التجربة الثانية** ، لم تكن هناك فروق معنوية فى الزيادة اليومية والكفاءة الغذائية ووظائف الأدرينال والكبد والكلية وكذلك نسبة البروتينات الكلية فى الدم للحملان المغذاة على تفل زيتون بنسبة 25% من الاحتياجات الكلية مقارنة بمجموعة الكنترول ، بينما زادت نسبة الدهون الكلية والكوليسترول فى الدم زيادة معنوية فى المجموعة المعاملة عن مجموعة الكنترول.

ومن النتائج السابقة يمكن استنتاج أنه يمكن استخدام تفل الزيتون فى التغذية بكفاءة حتى نسبة 20% من المقررات الغذائية للحملان والنعاج خلال مرحلة الحمل والحليب دون حدوث تأثيرات ضارة على صحة وإنتاجية وتناسل الأغنام.