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INFLUENCE OF DIETS SUPPLEMENTED WITH FISH OIL ON NUTRIENTS DIGESTIBILITY, SOME RUMEN PARAMETERS, BLOOD CONSTITUENTS, PRODUCTIVE AND REPRODUCTIVE PERFORMANCE OF EWES.

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ABSTRACT

This experiment was carried out to investigate the effects of feeding diets supplemented with fish oil on nutrients digestibility, feeding values of tested diets, some rumen parameters, productive and reproductive performance of ewes during late pregnancy. Fourty two mature ewes (1/2 Finish Landrace x 1/2 Rahmani) were divided into similar three groups (control, G2 and G3), according to their live body weight (53.2±1.95 kg) and reproductive history. The first group was fed a basal (control) diet consisting of concentrate feed mixture (CFM) plus berseem (*Trifolium alexandrinum*, 3rd cut), while in G2 and G3 fish oil was added at the rate of 2% (diet 2) and 4% (diet 3) of DM intake, respectively. Besides three digestion trials were conducted on mature rams to evaluate the nutritive values of tested diets.

The main results showed that the highest total DM intake ($P<0.05$) and DCP g/kg $W^{0.75}$ were noticed by the control group followed by those fed the two levels of fish oil. Highest ($P<0.05$) DM, OM, EE and NFE digestibility coefficients were obtained by rams in G3, however, the lowest ($P<0.05$) values were with the control group, which had the highest ($P<0.05$) CP and CF digestibilities. The digestibilities of NDF and ADF were tented to be lower ($P<0.05$) with G2 and G3 than the control one. Diet 2 and diet 3 recorded higher ($P<0.05$) TDN value (%) than the control one, while the DCP value (%)was lower ($P<0.05$) with diet 2 and diet 3 than the control .Ruminal pH value, Propionate, Valerate and Iso-valeric proportions were tended to be gradually increased ($P<0.05$) with the increasing fish oil level. While, the reverse trend was true in case of NH_3-N, total VFA's, acetate, butyrate concentrations and A/P ratio since they were gradually decreased ($P<0.05$) with increasing fish oil level. Body weight of ewes was tended to be gradually increased ($P<0.05$)with increasing fish oil level. Highest ($P<0.05$) percentage of milk fat, protein, total solids and solids not fat were shown by control group. While, the yields of fat, protein, total solids and solids not fat were tended to be gradually increased ($P<0.05$) with increasing fish oil level. Feed efficiency was higher in G2 and G3 than control one. Feed conversion was tended to be deceased with increasing level of fish oil. The concentrations of total protein, GOT, glucose, total lipids and total cholesterol in serum of ewes in G3 were higher ($P<0.05$) than ewes fed control diet. Average daily gain values of suckling lambs were higher for fish oil groups than that of control one. Ewes in G3 exhibited estrus (%), fertility(%) and litter size higher than control and G2, without significant differences. Duration from lambing to first estrus was shorted in G2 (117 days) followed by G3 (132 day) and control group (139 day).

It could be concluded that fish oil addition at the rate of 2 and 4% of DM intake, to mature ewes had beneficial effects on tested productive performance traits and reproductive performance in mating season, without any adverse effects on blood constituents and animals health in general.

Keywords: fish oil, nutrients digestibility, rumen parameters, productive, reproductive, performance , ewes

INTRODUCTION

Fish oils are a rich source of poly unsaturated fatty acid (n-3 PUFA). However, attempts to incorporate these fatty acids from fish oil into commonly consumed animal products, such as milk and meat, through ruminant feeding have caused lowered fat and/or protein percent in milk (Kim *et al.*, 1993), interference with ruminal cell wall digestion (especially by fats rich in PUFA (Palmquist and Jenkins, 1980) and depression of feed intake (Cant *et al.*, 1997). Furthermore, biohydrogenation of PUFA by rumen microbes (Doreau and Chilliard, 1997) has been shown to limit quantitative transfer of fatty acids from fish oil into tissue and milk. Also, studies have focused on production of n-3 PUFA-enriched milk (Kitessa *et al.*, 2001a) and meat (Kitessa *et al.*, 2001 b) from ruminants through supplementation of fish oil to lactating or growing ruminants. Improvement in fertility a part from improved energy status suggests that fat supplementation mediates its positive effect through other physiological mechanism such as: progesterone concentrations in plasma are enhanced by fat supplementation and may enhance embryo survival: certain (PUFA) such as linoleic acid may reduce uterine secretion of prostaglandin (William and Charles, 2003).However, little of work have been done on determine the response of suckling ewes fed on diets supplemented with fish oil in Egypt. The main objective of this study was to investigate the influence of fish oil on nutrients digestibility ,feeding values, productive and reproductive performance of ewes during late pregnancy and suckling period and their lambs performance.

MATERIALS AND METHODS

This study was conducted at Sakha Experimental Station, Animal Production Research Institute, Ministry of Agriculture, in cooperation with the Department of Animal Production, Faculty of Agriculture, El-Mansoura University, Egypt, during the period from December, 2005 to May, 2006.

A total number of 42 mature healthy (1/2 Finish Landrace x 1/2 Rahmani ewes 3-6 years of age) were divided into three groups, each of 14 ewes according to their live body weight (53.2+1.95 kg) and reproductive history. The experimental period lasted for 5 months beginning from December and consisted of 3 periods, late pregnancy (45 days), suckling (60 days) and rest or flushing (45 days) and income ewes in mating season (May). Animals were fed to cover the requirements for last 8 weeks of gestation and 8 weeks of lactation suckling ewes according to *NRC (1985).* The first group was fed the control diet consisting of common concentrate feed mixture(CFM),to cover 50% of crude protein (CP) requirements recommended by *NRC (1985)* for lactating suckling ewes. The rest of the requirements was cover for berseem which was given *ad libitum*. The fish oil was added to the control diet at the level of 2% and 4% of DM intake, for G2 and G3, respectively. All groups were offered the CFM allowances in two parts at 9 a.m. and 4 p.m. daily. All animals were kept under equal management conditions and in a semi-open shaded yard. Fresh water was available all times.

For running, the digestion trials, three mature (1/2 Finish Lnadrace x 1/2 Rahmani) rams aged 24 month with 61±1.23 kg live body weight were taken randomly from the herd of the station and placed in metabolic cages for 14 days as a preliminary period followed by 7 days collection period. The animals were weighed before and after running trials. Animals in digestion trials were fed the same diets with approximately the same proportions of CFM and berseem used in feeding ewes. Amounts of CFM was divided into equal meals and given to animals twice daily at 8.0 a.m. and 4 p.m. The 90% of *ad libitum* feeding of fresh berseem (3rd cut) was given to avoid any feed refusals. Samples were taken periodically from tested materials for laboratory analysis. The classical metabolism trial procedures were carried out as described by Schneider and Flatt(1975). Composite feedstuffs and fecal samples were taken and stored for laboratory proximate analysis purpose, which were analyzed according to the methods of the A.O.A.C. (1995).

At the end of the collection period of the digestion trials, rumen liquor samples were taken from the three rams before feeding and at 2, 4, 6 and 8 hours post feeding using a rubber stomach tube. The rumen pH values were measured immediately by HANNA pH meter, model (HI-8424 Sophisticated microprocessor, pH meter) then the fluid was strained through four layers of cheesecloth and used immediately for the estimation of (NH3-N) according to Conway (1957),total volatile fatty acids (TVFA's) as described by Warner (1964). Molar proportion of volatile fatty acids were analyzed according to Erwin *et al.* (1961).

At May mating season, ewes were monitored for sign of estrus using well trained ram two times per day (at 8.0 and 15.0 h) for 30 days (mating season). Data, weight and number of ewes exhibited estrus were recorded. The live weight of sheep was recorded at beginning of the experiment and every biweekly and body weight changes were calculated.

Daily milk yield was determined weekly using milk suckling technique. Milk intake plus milk removed by hand milking represented daily milk yield for that week. Milk samples (0.5% of total milk produced) were taken from 5 ewes from each group during suckling period (8 week) to determine milk composition by Milko-Scann (133 BN. FOSS Electric).

Blood samples were taken from five ewes from the jugular vain at 8.0 a.m. into vacutainer tubes then centrifuged at 2500 rpm for 20 minutes in order to separate blood serum using seriological pipettes, serum was carefully decanted into labeled tubes and stored at -20°C until analysis. Biochemical blood parameters in serum were analyzed using commercial kits by diagnostic system laboratories, INC USA. Total protein (peters,1968) and albumin (Drupt, 1974) were determined. Globulin was calculated by the difference between total protein and albumin. The GOT and GPT concentrations was determined according to Reitman and Frankel (1957). Glucose was determined according to Trinder (1969), total cholesterol (Wastson, 1962), triglycerides (Schalm *et al.*, 1975), total lipids (Zollner and Kirch, 1962),

Statistical analysis for the obtained data of rumen parameters ,digestibility trails, milk yield and composition, reproductive as well as blood constituents were performed by method of analysis of variance for repeated

measurement according to Winer (1971) using the general linear model procedures of SAS (1996). Duncan Multiple Range Test was used to test the differences among means (Duncan, 1955).

RESULTS AND DISCUSSION

Chemical composition:

Data in Table (1) showed chemical composition of ingredients and calculated composition of tested diets from the actual consumed of chemical nutrients of feed ingredients and the individual dry matter intake during the digestion trails. The experimental diets were practically iso-caloric and iso-nitrogenous and had similar chemical nutrients as well as cell wall fractions. However, EE content was gradually increased from 2.39 to 4.27 and 6.12 % for control, diet 2 and diet 3, respectively. This could be due to fatty acids in fish oil addition (Zuta *et al.*, 2003).

Table (1): The chemical composition on DM basis (%) and fiber fractions (%) of tested ingredients and calculated composition of consumed diets.

Item	CFM*	Berseem	Diet 1	Diet 2	Diet 3
Chemical composition(DM basis %) of ingredients:					
DM	89.25	17.53	56.47	55.68	54.36
OM	91.52	84.99	88.53	87.75	87.82
CP	16.31	14.42	15.43	15.11	14.78
EE	3.42	1.19	2.39	4.27	6.12
CF	11.56	26.25	18.26	18.03	17.81
NFE	60.23	43.13	52.45	50.34	49.11
Ash	8.48	15.01	11.47	12.25	12.18
Fiber fractions (%)					
NDF	46.06	50.32	48.13	47.07	46.18
ADF	22.31	39.04	29.95	29.51	29.06
ADL	11.42	8.12	10.11	9.68	9.45
Hemi cellulose	23.75	11.28	18.05	17.57	17.12
Cellulose	10.89	30.92	19.84	19.82	19.61
*GE MJ / Kg DM***	17.93	16.45	17.23	17.52	17.93

* **The commercial concentrate feed mixture (CFM) used contained: undecorticated cottonseed meal (30%), wheat bran (20%), yellow maize (25%), soybean meal (5%), rice bran (10%), molasses (5%), limestone (3%) and common salt (1%).**

** **Gross energy (GE) calculated according to MAFF (1975) using the following equations: GE MJ/kg DM = 0.0226 cp + 0.0407 EE + 0.0192 CF + 0.0177 NFE.**

Voluntary intake :

The average DM ,TDN and DCP intakes from the experimental diets are presented in Table (2).The results indicated that total DM intake expressed as g/kg $W^{0.75}$ was gradually decreased by increasing the level of fish oil in tested diets, but the differences among the groups were not significant. The reduction in dry matter intake may be a result of the inhibitory effect of supplemental fish oil on microbial growth and efficiency in the rumen and subsequently occurred decreased fiber digestibility (Wachira *et al.*, 2000). Decreasing of fiber digestibility might increase the ruminal retention time and lowered feed intake (Huffman *et al.*, 1992).As for DCP intake expressed as g/kg $W^{0.75}$ it was higher ($p<0.05$) for control diet than tested

diets. These results are in agreement with those obtained by Jones *et al.* (2003).

Table (2): Live body weight, dry matter, nutrient intakes, nutrients digestibility coefficients and nutritive values of the experimental diets.

Item	Experimental groups			± SE
	Control	Group 2 *	Group 3 *	
Mean LBW, kg	60.32	61.13	61.31	1.23
Dry matter intake, g/h/d:				
CFM	853.25^{a}	763.57^{b}	737.68^{b}	13.85
Berseem	885.36	873.15	852.71	11.22
Total	1738.61	1636.72	1590.39	23.47
DMI g/kg $W^{0.75}$	80.55	75.16	72.62	10.73
TDN intake: g/h/d	1181.56	1149.47	1169.00	16.29
g/kg $W^{0.75}$	54.65	52.72	53.38	0.74
DCP intake: g/h/d	191.59^{a}	170.87^{b}	155.98^{c}	1.84
g/kg $W^{0.75}$	8.87^{a}	7.83^{b}	7.12^{c}	0.08
Nutrients digestibility (%)				
DM	73.51^{c}	74.81^{b}	75.73^{a}	0.20
OM	74.35^{b}	75.53^{ab}	76.85^{a}	0.38
CP	71.46^{a}	69.12^{b}	66.33^{c}	0.35
CF	64.36^{a}	60.15^{b}	58.13^{c}	0.46
EE	72.55^{c}	75.33^{b}	79.14^{a}	0.59
NFE	75.14^{c}	75.94^{b}	78.71^{a}	0.68
Cell wall digestibility (%)				
NDF	68.43^{a}	66.47^{ab}	63.35^{b}	1.07
ADF	62.55^{a}	60.31^{ab}	57.61^{b}	0.95
Cellulose	73.45^{a}	71.88^{a}	68.15^{b}	0.86
Hemi cellulose	59.12^{ab}	60.22^{a}	55.35^{b}	1.34
Nutritive values (%)				
TDN	67.96^{c}	70.23^{b}	73.51^{a}	0.32
DCP	11.02^{a}	10.44^{b}	9.81^{c}	0.05

a, b, c Means within the same raw with different superscripts are significantly different at P<0.05.

*** 37.43 and 75.32 g of fish oil was added and was not included in the total DM intake.**

Digestibility coefficients and nutritive values:

Nutrients digestibility coefficients are presented in Table (2).Highest (P<0.05) DM, OM, EE and NFE digestibility coefficients were shown by rams in G3 ,however, the lowest (P<0.05) values were obtained for the control group. On the other hand, highest CP and CF digestibilities (P<0.05) were obtained by the control diet, however, the lowest (P<0.05) CP value was recorded for G3. Such effect may be a result of the inhibitory effect of supplemental fish oil on microbial growth and efficiency in the rumen and subsequently occurred decreased fiber digestibility (Wachira *et al.*, 2000). The digestibilities of NDF, ADF, cellulose and hemi-cellulose were tented to be significantly (P<0.05) the lowest in G3 ,but the highest with control one without significant difference between G2 and G3 for NDF and ADF. These results are in agreement with those found by Szumacher-Strable *et al.* (2002) and Jones *et al.* (2003) with sheep or cows, respectively.

As for the nutritive values of experimental diets, highest (P<0.05)TDN value was shown by rams in G3, however, the lowest (P<0.05)values were obtained for the control group, while values of DCP were lower (P<0.05)with

G2 and G3 than control one. This decrease in DCP content was mainly due to the decrease of protein digestibility in supplemented diets in the present study (Table 2).These results are in agreement with those found by El-Bedawy (1995).

Rumen parameters:

Data in Table (3) showed that ruminal pH values, ropionate,Valerate and Iso-valeric proportions were tended to be gradually increased ($P<0.05$) with increasing fish oil level in G2 and G3, while the reverse trend was true in case of NH_3-N, TVFA's, acetate and butyrate concentrations and A/P ratio. Similar results were reported by Fievez *et al.* (2003) who found that increasing level of fish oil in diets of sheep induced reducer in TVFA's concentration and higher rumen propionate concentrations and decreased methane production might be due to lower cellulose digestibility. Also, Jones *et al.* (2003) reported that a reduction in TVFA's could also be related to the reduced feed intake. The A/P ratio was generally declined when fish oil added as a result of inhibit fiber digestion (Szumacher-Strable *et al.*, 2002 and Jones *et al.*, 2003) which are in accordance of findings in the present study, since digestibility of CF and cell wall constituents were lower with fish oil diets than the control one (Table 2). The main effect of sampling time showed that TVFA's , NH_3-N, propionate, iso-butyrate and valerate concentrations were the lowest ($P<0.05$) before feeding and the highest ($P<0.05$) at 2,4 hours post-feeding then tended to back decreased. While, the lowest ($P<0.05$) ruminal pH value, acetate proportion, A/P ratio and iso-valeric were recorded at 4 hrs post-feeding, while the highest ($P<0.05$) acetate proportion was obtained at before feeding, thereafter they tended to gradually increased with time advancement. The higher TVFA's production (at 2 hrs) would explain the lower pH values recorded herein (Shafie and Ashour, 1997) at that time. Similar results were recorded by Khattab *et al.* (2001).

Body weight during different physiological stages of ewes:

At late pregnancy, body weight value was increased gradually with the progress of pregnancy from 53.2, 53.6 and 53.1 kg at start of experiment with control, G2 and G3, respectively to reach 58.7, 61.1 and 63.6 kg (Table 4) before lambing, respectively. Similar trends were reported by Marinova *et al.* (2005) .

After lambing during suckling period, there were no significant effects of dietary treatments on body weights of ewes at lambing , while body weight at final suckling period was significantly different. Decreasing in body weight during suckling period was more of ewes in control group (4.1 kg) compared with ewes given fish oil supplemented diets, but the differences were not significant (Table 4). This is normal physiological response due to higher feed intake for G3 as well as higher milk yield (Table 5) than control one. During the physiological stress of milk production particularly during the peak of lactation, ewes tended to have no increase or may loss of body weight (Zambom *et al.* 2003).

Table (3): Effect of treatment and time of sampling on ruminal parameters in rumen liquor of rams fed the experimental diets.

Item	pH value	NH3-N (mg/100 ml RL)	TVFA's (meq/100 ml RL)	Acetic acid (%)	Propionic acid (%)	A/P ratio	Butyric acid (%)	Valeric acid (%)	Iso-But. Acid (%)	Iso-Val. acid (%)
Treatment:										
Control	6.68^{c}	24.64^{a}	11.86^{a}	56.22^{a}	25.91^{b}	2.17^{a}	12.61^{a}	1.81^{c}	1.47	1.64^{b}
Group 2	6.92^{a}	22.26^{b}	10.71^{b}	54.36^{b}	28.33^{a}	1.92^{b}	11.76^{b}	2.14^{b}	1.31	1.71^{ab}
Group 3	6.97^{a}	21.31^{b}	10.27^{b}	53.08^{c}	29.11^{a}	1.82^{c}	11.63^{b}	2.31^{a}	1.25	1.81^{a}
±SE	0.07	0.54	0.22	0.33	0.27	0.02	0.22	0.05	0.06	0.04
Time:										
Before feeding	6.95^{a}	20.39^{c}	9.17^{c}	55.94^{a}	27.11^{b}	2.06^{a}	11.58	1.85^{c}	1.21^{b}	1.94^{a}
2 h After feeding	6.52^{c}	25.11^{b}	13.95^{a}	55.21^{a}	27.14^{b}	2.04^{a}	12.11	2.08^{b}	1.43^{ab}	1.69^{b}
4 h After feeding	6.68^{b}	27.44^{a}	11.01^{b}	52.98^{c}	28.59^{a}	1.86^{b}	12.05	2.52^{a}	1.49^{a}	1.71^{b}
6 h After feeding	6.99^{a}	20.98^{c}	10.76^{b}	53.84^{bc}	28.73^{a}	1.88^{b}	11.88	2.17^{b}	1.44^{ab}	1.58^{b}
8 h After feeding	7.10^{a}	19.78^{c}	9.83^{c}	54.81^{ab}	27.44^{b}	2.09^{a}	12.37	1.81^{c}	1.24^{ab}	1.71^{b}
±SE	0.06	0.69	0.29	0.43	0.35	0.03	0.29	0.06	0.08	0.05

a, b, c Means within the same column with different superscripts are significantly different at P<0.05.

At mating period, body weight of ewes was increased (P<0.05) gradually from 47.3, 50.7 and 54.2 for control, G2 and G3, respectively (Table 4) to reach 50.6, 54.9 and 58.8, respectively at the end of experiment. However, rate of increase in body weight was higher (P<0.05) in G3 and G2 by about 8.5% and 8.2% respectively, than control 6.8%.These results are in accordance with those reported by Marinova *et al.* (2005).

Table (4): Body weight (kg) and body weight change (g/day) of ewes during different physiological stages.

Physiological stages	Experimental groups			±SE
	Control	Group 2	Group 3	
Late-pregnancy:				
Duration (day)	30	30	30	---
Initial body weight (kg)	53.2	53.6	53.1	2.02
Final body weight (kg)	58.7	61.1	63.6	2.08
Change (kg)	5.5^{b}	7.5^{b}	10.5^{a}	0.85
Daily change (g/d)	183^{b}	250^{b}	350^{a}	0.02
Feed intake (g/d)	1753	1823	1854	---
After-lambing:				
a- Suckling period:				
Duration (day)	60	60	60	---
Initial body weight (kg)	49.6	52.1	54.1	1.92
Final body weight (kg)	45.5^{b}	48.2^{b}	51.4^{a}	1.83
Change (kg)	-4.1	-3.9	-2.7	1.27
Daily change (g/d)	-68	-65	-45	0.02
Feed intake (g/d)	2154	2216	2257	---
b- Mating period:				
Duration (day)	45	45	45	---
Initial body weight (kg)	47.3^{b}	50.7^{ab}	54.2^{a}	1.91
Final body weight (kg)	50.6^{b}	54.9^{ab}	58.8^{a}	1.91
Change (kg)	3.3^{b}	4.2^{a}	4.6^{a}	0.31
Daily change (g/d)	73^{b}	93^{a}	102^{a}	0.01
Feed intake (g/d)	1314	1375	1425	---

a, b Means within the same raw with different superscripts are significantly different at P<0.05.

Milk yield and composition during suckling period:

Milk yield expressed as actual milk yield and 4% fat corrected milk (Table 5) were higher (P<0.05) for G2 and G3 than the control group. These results could be attributed to increasing energy content of the experimental diets with fish oil addition and may be to improve nutritive values of tested diets as well. These results are in agreement with those recorded by Alba *et al.* (1997).

The highest (P<0.05) milk fat, protein, total solids (%) were obtained by control group, while the lowest values were recorded in G3 (Table, 5). These results are in agreement with those obtained by Sullivan *et al.* (2004). Also, Cant *et al.*(1993) indicated that decreasing in milk protein (%) resulting from addition of fat could

Fat corrected milk (FCM) and Energy (Mj) of milk calculated according to Kirchegessner (1982) as follow: Fat corrected milk(FCM) = (15 x Fat% x milk yield) /100 + 0.4 milk yield and Energy of milk (Mj) = milk yield (0.37 x fat + 0.21 x milk protein % + 0.95) + milk yield x 0.07 .

be due to an energy-dependent reduction in mammary gland blood flow that result in a reduction in the availability of amino acids at the mammary gland. The highest (P<0.05) milk lactose (%)and milk energy (MJ/kg) were shown in G3, being the lowest in control group. Similar trend was obtained by Kitessa *et al.* (2003) and Benson *et al.* (2001). The yields of fat, protein, lactose, total solids and solids not fat were the highest (P<0.05) in G3 and the lowest (p<0.05) in control group. This may be attributed to the higher milk yield for ewes fed fish oil addition.

Table (5): Effect of feeding the experimental diets on milk yield and its composition of ewes during (8 weeks) suckling period.

Item	Experimental groups			±SE
	Control	Group 2	Group 3	
Milk yield (g/d)	465.2^{c}	542.3^{b}	580.5^{a}	0.22
Fat corrected milk (g/d)	501.2^{c}	535.3^{b}	573.3^{a}	0.17
Milk fat (%)	4.64^{a}	4.35^{b}	4.09^{b}	0.11
Milk fat yield (g/d)	21.11^{b}	21.71^{ab}	22.73^{a}	0.56
Milk protein (%)	4.22^{a}	4.06^{a}	3.85^{b}	0.05
Milk protein yield (g/d)	19.33^{b}	20.89^{a}	21.93^{a}	0.67
Milk lactose (%)	4.91^{b}	4.97^{b}	5.14^{a}	0.06
Milk lactose yield (g/d)	22.61^{c}	25.72^{b}	30.14^{a}	0.78
Milk total solids (%)	14.57^{a}	14.15^{ab}	13.83^{b}	0.15
Milk total solids yield (g/d)	66.41^{c}	72.24^{b}	79.18^{a}	1.98
Milk solids not fat (%)	9.87	9.78	9.74	0.12
Milk solids not fat yield (g/d)	45.45^{c}	50.38^{b}	56.36^{a}	1.52
Milk energy (MJ \ kg)	1.65^{c}	1.77^{b}	1.89^{a}	0.04

a, b Means within the same raw with different superscripts are significantly different at P<0.05.

Efficiency of milk production:

Data in Table (6) showed that average of live body weight of ewes during 60 day suckling period was tended to be gradually increased with increasing level of fish oil in diets (G2 and G3) compared with those in control group. The reason for high live body weight in the present study might be attributed to higher total DM and TDN intakes expressed as g/h/d or g/kg $W^{0.75}$. Similar trend was reported by Marinova *et al.* (2005).

The data of average total DM and TDN intake expressed as g/h/d or kg $W^{0.75}$ by experimental groups cleared that daily intake from previous nutrients by G2 and G3 group was nearly similar, being somewhat the lowest in control group which recoded the lowest milk production as mentioned before.

Also, it was noticed that, ewes in G2 and G3 had higher milk yield g/h/day by about 13.2% and 25.2%, FCM g/h/d by about 3.4% and 8.8% and fat g/h/d by about 2.7% and 8.7% over the control group, respectively, in spite of the absent of significant differences among treatments. These results are in accordance with those reported by Jones *et al.* (2003).Feed efficiency calculated as milk yield / DMI and milk yield / TDNI was higher in G2 and G3 than control group. But, feed efficiency calculated as 4% FCM/DMI and 4% FCM/TDNI was approximately similar among all the experimental groups Table (6).Feed conversion values calculated as kg DMI/kg milk and kg

TDNI/kg milk was tended to be lower (the best) with increasing level of fish oil in G2 and G3 than control group.

Table (6): Effect of feeding the experimental diets on productive performance of ewes during (60 day) suckling period.

Item	Experimental groups			± SE
	Control	Group 2	Group 3	
Av. BW (kg)	46.7	48.8	51.6	1.83
Total dry matter intake (g/h/d)	1788	1811	1836	---
Total dry matter intake (g/$w^{0.75}$)	100.1	98.1	95.3	---
Total digestible nutrients intake (g/h/d)	1215	1272	1349	---
Total digestible nutrients intake (g/$w^{0.75}$)	68.1	68.8	70.1	---
Milk yield (kg/h)	27.8	31.4	34.8	0.73
Milk (g/h/d)	463	524	580	22.51
Fat corrected milk (g/h/d)	513	533	558	18.53
Fat (g/h/d)	21.8	22.4	23.7	0.79
Feed efficiency:				
Kg milk /kg TDMI	0.26	0.29	0.31	---
Kg FCM/kg TDMI	0.28	0.29	0.30	---
Kg milk /kg TDNI	0.38	0.41	0.43	---
Kg FCM/kg TDNI	0.42	0.42	0.41	---
Feed conversion:				
Kg TDMI/kg milk	3.86	3.46	3.17	---
Kg TDNI/kg milk	2.62	2.42	2.32	---

Blood constituents:

Data in Table (7) showed that the concentration of total.protein in serum of ewes in G3 was higher ($P<0.05$) than ewes fed control diet. Also, the same trend was observed for albumin but, without significant differences. While, the concentration of globulin in G2 was higher than in G3 and control group but, without significant differences. This mean that the addition of fish oil for ewes diets did not damage or affect the liver function (GOT and GPT), whereas several studies cleared that the normal ratio between albumin and globulin ranged from 0.8 to 1.3 in serum blood (Salem *et al.* 2000) which are more close to the ratios obtained herein (from 1.05 to 1.13). These results are in accordance with those recorded by Abo-Donia (2003), who found that albumin to globulin ratio was not significantly affected by fat supplementation in sheep rations.

Table (7): Effect of feeding the experimental diets on blood constituents of ewes.

Item	Experimental groups			±SE
	Control	Group 2	Group 3	
Total protein (g / dl)	6.37^{b}	6.65^{ab}	6.71^{a}	0.81
Albumin (g / dl)	3.79	3.41	3.55	0.73
Globulin (g / dl)	2.58	3.24	3.16	0.66
Al / Gl ratio	1.13	1.05	1.12	0.36
GOT (IU / dl)	32.97^{b}	33.77^{ab}	34.72^{a}	1.03
GPT (IU / dl)	15.51	16.26	16.51	0.32
GOT / GPT ratio	2.12	2.06	2.09	0.29
Glucose (mg / dl)	50.01^{b}	52.01^{ab}	53.89^{a}	1.35
Total lipids (mg / dl)	469.2^{c}	499.4^{b}	528.5^{a}	3.98
Triglyceride (mg / dl)	32.81	36.16	40.43	0.46
Total Cholesterol (mg / dl)	123.1^{c}	136.1^{b}	146.9^{a}	0.86

a, b Means within the same raw with different superscripts are significantly different at $P<0.05$.

The glutamate oxalocactate transaminases (GOT) concentration was higher (P<0.05) in serum of G3 than ewes fed control diet. Also, the glutamate pyruvate transaminases (GPT) concentration was in the same trend of GOT, without significant differences. Moreover, the ratio of GOT/GPT in G2 was lower than ewes fed control diet. Generally, although an increase in these enzymes in ewes treated with fish oil but, their values were within the normal ranges given by Abo-Donia (2003) for GPT (17.36 to 17.97) and GOT (36.63 to 36.93). These results agreed with those obtained by Moallem *et al.* (1997), who found the activity GOT enzyme was higher in cows fed fat as compared to cows fed ration without any additives. The ewes in G3 had higher (P<0.05) concentration of serum glucose, total lipids and total cholesterol followed by ewes in G2, while ewes fed control diet had the lowest values. Also, the same trend was recorded with triglycride concentration without significant differences among the experimental groups. These results are in agreement with those obtained by Avila *et al.* (2000);El-Bedawy (1995) and Petit *et al.* (2001),they found that fat supplementation in ration of dairy cows and sheep resulted in an increase in the concentration of blood glucose and total lipids. The inclusion of lipid supplement in the diet of ruminants normally increases both cholesterol and triglycride (Cant *et al.*, 1993).Generally, physiological levels of blood parameters studied in this study were within the normal ranges for blood constituents (mg/dl) of glucose (51 to 58), total lipids (503 to 537), triglyceride (31.21 to 61.22) and total cholesterol (117 to 151) of sheep (Salem *et al.*, 2000).

Performance of suckling lambs:

Ewes in G2 and G3 showed higher values of birth weight as compared with control group (Table 8) but the differences were not significant. This was in consistent with the results of Toteda *et al.* (2004) who pointed that lambs born from ewes offered diets supplemented with fish oil had higher (P<0.05) birth weight than control diet.

Table (8): Effect of feeding the experimental diets on productive performance of suckling lambs during suckling period (60 days).

Item	Experimental groups			±SE
	Control	Group 2	Group 3	
Birth weight (kg)	3.36	3.41	3.56	0.11
Weaning weight (kg)	11.85	12.31	14.04	0.71
Total gain (kg)	8.49	8.90	10.48	0.57
Daily gain (g/day)	142	148	174	0.01
Milk intake (g/day)	465.2[b]	454.3[a]	580.5[a]	30.2

a, b Means within the same raw with different superscripts are significantly different at P<0.05.

Similarly, weaning weight was higher in treated groups being 12.31 and 14.04 kg for G2 and G3, respectively than that of control group (11.85 kg). These results are in accordance with those reported by Dawson and Edar (2005) who found that addition fish oil for diets ewes during nursing resulted in improving its feed utilization and resulted in satisfactory ewe live weight and lamb growth rate.

Ewe's reproductive performance in mating season:

Average body weight at mating of ewes was highest (P<0.05) (60.4 kg) with G3, while the lowest (P<0.05) with control group (48.8 kg) (Table 9). This effect of fish oil addition on body weight may be due to the higher (P<0.05) feed intake as compared with control diet (Table 4).The improvement could be due to increasing the energy status and adequate time to recover body condition (Bocquier *et al.*, 1993), thus improving the fertility of ewes. This was in consistent with the results of Thomas and Williams (1996).

Table (9): Reproductive performance of ewes in mating season (May) as affected by the experimental diets.

Item	Experimental groups			±SE
	Control	Group 2	Group 3	
No. of ewes	14	14	14	-
Body weight at mating (kg)	48.8^{b}	55.7^{ab}	60.4^{a}	2.07
No. of ewes exhibited estrus	5	9	10	-
Ewes exhibited estrus (%)	35.7	64.3	71.4	0.12
No. of ewes lambed	3	8	9	-
Fertility as (%) from mated ewes	60	88.8	90	0.13
Fertility as (%) from total ewes	21.4^{b}	57.1^{ab}	64.3^{a}	0.12
No. of lambs born alive	4	11	13	-
Litter size	1.33	1.37	1.44	0.14
Duration from lambing to 1st estrus	139.2	117.3	132.9	10.32

a, b Means within the same raw with different superscripts are significantly different at P<0.05.

Ewes exhibited estrus (%) in (G3) were higher (71.4%) than those in control and G2 (35.7% and 64.3%, respectively),without significant differences among tested groups. These results are in agreement with those obtained by William and Charles (2003).

Fertility as (%) of mated ewes was 60, 88.8 and 90 and 21.4, 57.1 and 64.3 (as a percent of ewes subjected to be mated) in control, G2 and G3, respectively (Table 9). These results may suggest that fish oil addition had positive effect on fertility of ewes may be attributed to (1) an amelioration of negative energy states thus leading to an earlier return to estrus postpartum and therefore improved fertility (Mattos *et al.*, 2000), (2) an increase in progesterone production/secretion favorable to improved fertility and (3) a stimulation or inhibition of $PGF_{2}\alpha$ production/resale which influence the persistence of the corpus luteaum (Mattos *et al.*, 2000 and Yoel-Zeron *et al*;. 2002). This was in consistent with the results of William and Charles (2003) who found that fat addition had positive effect through other physiological mechanism such as progesterone concentrations in plasma which are enhanced by fat and may enhance embryo survival ; certain (PUFA), such as linoleic acid may reduce uterine secretion of prostaglandin William and Charles (2003).

Litter size calculated as number of lambs produced per ewes lambed is shown in Table (9). Values tended to be gradually increased with increased fish oil level without significant differences among groups. This was in consistent with those reported Yoel-Zeron *et al.* (2002) who found that ewes which fed a diet supplemented with fish oil increased number of follicles and

oocytes were found in the ovaries of ewes supplemented with PUFA more than in control ewes.

Duration from lambing to first estrus was shorted in G2 (117 days) followed by G3 (132 day) and control group (139 day). This improvement could be due to that ewes gained 1 kg of body during first month after lambing had the shortest anovulatory period than similar lipid gain (Bocquier *et al.*, 1993) thus leading to an earlier return to estrus postpartum and therefore improved fertility . These results are in agreement with those obtained by Grummer and Carroll, 1991) who found that fatty acids increase pregnancy rate and reduce open days by increasing the energy status of animal or by other processes independent of energy intake led to changes in serum concentrations of metabolites and metabolic hormones that may act at the hypothalamic-pituitary-ovarian axis.

In conclusion, the findings of this study revealed that, addition of fish oil at both levels (2% or 4%) to diets of lactating ewes had positive and beneficial effects on enhance nutrients digestibilities, nutritive values,ruminal fermentation, consequently ewes productive and reproductive performance.

REFERENCES

A.O.A.C. (1995). Official Methods of Analysis (13th Ed). Association Official Analytical Chemists. Washington DC. USA.

Abo-Donia, F. M. A. (2003). Using different sources of soap-stock as non-conventional source of energy in sheep rations. Egypt.J. of Nutr. and Feeds 6(Special Issue): 1381.

Alba, L. M. ; Cavalcanti, S. ; Hernandez, M. ; Marin, A. and Marin, G. (1997). Calcium soaps of olive fatty acids in the diets of Mancheg dairy ewes: effect on digestibility and production. J. Dairy Sci. 80: 3316.

Avila, C. D. ; Depeters, E. J. ; Perez-Montl, H. ; Taylor, S. J. and Zinn, R. A. (2000). Influences of saturation ratio of supplemental dietary fat on digestion and milk yield in dairy cows. J. dairy Sci., 83: 1505.

Benson, J. A. ; Reyolds, C. K. ; Humphries, D. J. ; Rutter, S. M. and Beever, D. E. (2001). Effects of abomasal infusion of long-chain fatty acids on intake, feeding behaviour and milk production in dairy cows. J. Dairy Sci. 84: 1182.

Bocquier, F. ; Kann, G. and Thimonler, J. (1993). Effect of body composition variations on the duration of the postpartum an ovulatory period in milked ewes submitted to different photoperiods. Reprod. Nutr. Develop. 33(4): 395.

Cant, J. P. ; DePeters, E. and Baldwin, R. L. (1993). Mammary uptake of energy metabolites in dairy cows fed fat and its relationship to milk protein depression. J. Dairy Sci. 76(8): 2254.

Cant, J. P. ; Fredeen, A. H. ; MacIntyre, T. ; Gunn, J. and Crowe, N. (1997). Effect of fish oil and monensin on milk composition in dairy cows. Can. J. Anim. Sci. 77: 125.

Conway, E. G. (1957). Microdiffusion analysis and volumetric error. 4th Ed. O. Grasphy-lock wood and sons Ltd., London.

Dawson, L. E. R. and Edgar, H. (2005). Effect of source and level of fish oil for ewes in late pregnancy on subsequent performance Proceeding of the British Soc. of Anim. Sci. Annual Conf. 2005, York, UK 4th – 6th April, 141.

Doreau, M. and Chilliard, Y. (1997). Effect of ruminal or postruminal fish oil supplementation on intake and digestion in dairy cows. Reprod. Nutr. Dev., 37: 113.

Drupt, F. (1974). Determination of serum albumin. Pharm. Biol. 9: 777.

Duncan, D. B. (1955). Multiple Range and Multiple F-test Biomatrics 11:10.

El-Bedawy, T. M. (1995). Preparation of sunflower oil calcium soap as a protected fat and its use in ruminant nutrition. J. Agric. Sci. Mansoura Univ. 20: 231.

Erwin, E. S. ; Marco, G. T. and Emery, E. M. (1961). Volatile fatty acid, blood and rumen fluid by analysis gas chromatography.

Fievez, V. ; Dohme, F. ; Danneels, M. ; Raes, K. and Demeyer, D. (2003). Fish oils as potent rumen methane inhibitors and associated effects on rumen fermentation in vitro and in vivo. J. Anim. Feed Sci. Technology 104(1/4): 41.

Grummer, R. R. and Carroll, D. J. (1991). Effect of dietary fat on metabolic disorders and reproductive performance of dairy cattle. J. Anima. Sci. 69: 3838.

Huffman, R. P. ; Stock, R. A. ; Sindt, M. H. and Shain, D. H..(1992). Effect of fat type and forage level on performance of finishing cattle. J. Anim. Sci. 70: 3889.

Jones, D. F. ; Weiss, W. P. and Jenkins, T. C. (2003). Dietary fish oil for dairy cows: 2-effects on neutrophil function and digestibility. Res. and Rev. Dairy 163:99.

Khattab, H. M. ; El-Sayed, H. M. ; El-Ashry, M. A. ; Gomaa, I. M. and Omar, F. M. (2001). Performance of fattening lambs fed rations containing different levels of soylecithin and sunflower soap stock as non conventional fats. 1- Effect of nutrients digestibility, nitrogen and water balance. Egyptian J. Nutr. and Feeds 4: 667.

Kim, Y. K. ; Schingoethe, D. J. ; Casper, D. P. and Ludens, F. C. (1993). Supplemental dietary fat from extruded soybean and calcium soaps of fatty acids for lactating dairy cows. J. Dairy Sci. 76: 197.

Kitessa, S. M. ; Gulati, S. K. ; Ashes, J. R. ; Fleck, E. ; Scott, T. W. and Nichols, P. D. (2001a). Utilization of fish oil in ruminants. II. Transfer of fish oil fatty acids into goats milk. Anim. Feed Sci. Technol. 89: 201.

Kitessa, S. M. ; Gulati, S. K. ; Ashes, J. R. ; Scott, T. W. and Fleck, E. (2001b). Effect of feeding tuna oil supplement protected against hydrogenation in the rumen on growth and n-3 fatty acid content of lamb fat and muscle. Aust. J. Agric. Res. 52: 433.

Kitessa, S. M. ; Peake, D. ; Bencini, R. and Williams, A. J. (2003). Fish oil metabolism in ruminants. III. Transfer of n-3 polyunsaturated fatty acids from tuna oil into sheep's milk. J. Anim. Feed Sci. Technology 108(114): 1.

Kirchgessner, M. (1982). Tierernahrung, DLG-Varlags-GmbH Frankfunt (Main). ISBN, 8-12 Sept. S: 150.

MAFF (1975). Ministry of Agriculture, Fisheries and Foods. Energy allowances and feeding systems for ruminants. Tech. Bulletin 33: London HM50.

Marinova, P. Banskalieva, V. and Tzvetkova, V. (2005). Body and carcass composition and meat quality of kids fed fish oil supplemented diet. Options. Med. Serie-A, Seminaries, Mediterraneens. 67: 151.

Mattos, R. ; Staples, C. R. and Thatcher, W. W. (2000). Effect of dietary fatty acids on reproduction in ruminants. Rev. Prod. 5: 38.

Moallem, U. ; Kaim, M. ; Folman, Y. and Sklan, D. (1997). Effect of calcium soap of fatty acids and administration of somatotropin in early lactation on productive and reproductive performance of high producing dairy cows. J. Dairy Sci. 80: 2127.

NRC (1985). Nutrient Requirement of sheep. 6th revised edition. The National Research Council, Washington D.C. National Academy of Science.

Palmquist, D. L. and Jenkins, T. C. (1980). Fat in lactation rations, review. J. Dairy Sci. 63:1.

Peters, T. (1968). Determination of serum total protein. Clin. Chem. 14: 1147.

Petit, H. V. ; Dewhurst, R. J. ; Proulx, J. G. ; Khalid, M. ; Haresign, W. and Twagiramungu, H. (2001). Milk production, milk composition and reproduction function of dairy cows fed different sources of fats. Can. J. Anim. Sci. 81: 263.

Reitman, S. and Frankel, S. (1957). A colorimetric method for glutamic pyruvic transminase. Am. J. Clin. Path. 26: 26.

Salem, F. A. ; Soliman, A. S. ; El-Mahdy, M. R. M. and Abdel-Mawla, S. M. (2000). Effect of some feed additives to diets of growing sheep on growing performance, rumen fermentation, blood constituents and carcass characteristics. Annals of Agric. Sci., Moshtohor, 38: 1733.

SAS (1996). SAS User's Guide: Statistics SAS Inst. Inc., Cary, NC.

Schneider, B. H. and Flatt, W. P. (1975). The Evaluating of Feeds Through Digestibility Experiments. The Univ. Of Grorgia Press. Athens.

Schalm, O.W. ; Jain, N.C. and Corroll, E.J.(1975). Veterinary Hematology. 3rd Ed., Lea and Febiger, Philadelphia,USA.

Shafie, M. M. and Ashour, G. (1997). Anticipated role of the rumen in complementary adaptation to environment. Egypt. J. of Nutr. & Feeds 1:21.

Sullivan, H. M. : Bernard, J. K. ; Amos, H. E. and Jenkins, T. C. (2004). Performance of lactating dairy cows fed whole cottonseed with elevated concentrations of free fatty acids in the oil. J. Dairy Sci. 87: 665.

Szumacher-Strabel, M. ; Potkanski, A. ; Kowalczk, J. ; Cieslak, A. ; Czauderna, M. ; Gubaa, A. and Jedroszkowiak, P. (2002). The influence of supplemental fat on rumen volatile fatty acid profile, ammonia and pH levels in sheep fed a standard diet. J. Anim. Feed Sci. 11(4): 577.

Thomes, M. G. and Williams, G. L. (1996). Metabolic hormone secretion and FSH induced superovulatory responses of beef heifers fed dietary fat supplemented containing prodomintly saturated or polyunsaturated fatty acids. Theriogenology 45: 451.

Toteda, F. ; Facciolongo, A. M. ;Vicenti, A. Melodia, L. and Bozzo, F. (2004). Effect of type of suckling and polyunsaturated fatty acid used on lamb production. 1. Productive performance and quanti-qualitative characteristics of the carcass. J. Italian Anim. Sci. 3(1): 71.

Trinder, P. (1969). Determination of blood serum glucose. Ann. Cl. Biochem., 6: 24.

Wachira, A. M. ; Sinclair, L. A. ; Wilkinson, R. G. ; Hallett, K. ; Enser, M. and Wood, J. D. (2000). Rumen biohydrogenation of n-3 polyunsaturated fatty acids and their effects on microbial efficiency and nutrient digestibility in sheep. J. Agric. Sci. 135: 419.

Warner, A. C. I. (1964). Production of volatile fatty acids in the rumen. Methods of Measurements. Nut. Abst. Rev. 34: 339.

Wastson, D. (1962). Method of determination of blood serum cholesterols. Clin. Chem. Acta, 5: 637.

William, W. T. and Charles, R. S. (2003). Effects of dietary fat supplementation on reproduction in lactating dairy cows. J. Anim. Sci. 67: 785.

Winer, B. J. (1971). Multifactor Experiments Having Statistical Principles in Experimental Design. New York Mc Graw-Hill.

Yoel-Zeron, A.s. ; Sklan, D. and Amir-Arav (2002). Effect of polyunsaturated fatty acid supplementation on biophysical parameters and chilling sensitivity of ewe oocytes. Molecular Reprod. And Dev. 61(2): 271.

Zambom, M. A. ; Alcalde, C. R. ; Macedo, F. A. F. ; Gavcia, J. ; Silva, K. T. ; Martins, E. N. and Sontos, G. T. (2003). Performance and quality of milk of Saanen goats feeding with different roughage concentrations, in the prepartum and lactation. From World Conference on Animal Production., Oct. 26-31, 2003, Porto Alegre ,Rio Grande Do Sul, Brazil.

Zollner, N. and Kirch, K. (1962). Determination of total lipids. Ges. Exp. Med. 135: 545.

Zuta, C. P. ; Simpson, B. K. ; Chan, H. M. and Phillips, L. (2003). Concentrating polyunsaturated fatty acids from mackerel processing wastes. J. A. O.C. S. (80): 90: 933.

تأثير إضافة زيت السمك علي معاملات الهضم والقيم الغذائية وبعض مقاييس الكرش ومكونات الدم و الأداء الإنتاجي والتناسلي للنعاج

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اجريت هذه الدراسة في محطة بحوث الإنتاج الحيواني بسخا التابعة لمعهد بحوث الإنتاج الحيواني – وزارة الزراعة بالتعاون مع قسم إنتاج الحيوان – كلية الزراعة جامعة المنصورة خلال الفترة من ديسمبر ٢٠٠٥ حتى مايو ٢٠٠٦ ، ولقد استهدفت هذه الدراسة معرفة تأثير إضافة زيت السمك بمستوى ٢&٤% على معاملات الهضم والقيم الغذائية ومكونات الدم و الأداء الإنتاجي والتناسلي للنعاج الخليطة في مراحلها الفسيولوجية المختلفة . أستخدم في هذه الدراسة ٤٢ نعجة عشار خليط (٢/١ رحماني + ٢/١ فنلندي) عمرها من ٣-٦ سنوات قسمت إلى ثلاث مجموعات على أساس الوزن والمرحلة الفسيولوجية

بمتوسط وزن ٥٣,٢ كجم وغذيت على حسب المرحلة الإنتاجية طبقا للمقررات الغذائية لـ NRC (1985). وكان يضاف زيت السمك في المجموعتين الثانية والثالثة بمعدل ٢&٤% على أساس المادة الجافة مقارنة بمجموعة المقارنة وقد كانت العليقة تقدم يوميا (العلف المركز) بمعدل ٥٠% من الاحتياجات البروتينية وكان البرسيم يغذى حتى الشبع . كما اجريت ثلاث تجارب هضم لتقدير معاملات الهضم والقيم الغذائية للعلائق التجريبية.

لقد أشارت النتائج المتحصل عليها إلى:

- أدى إضافة زيت السمك فى العلائق ٢ ، ٣ إلي تحسن معنوي فى معاملات هضم(DM, OM, NFE, EE) مقارنة بالمقارنة وعلى الجانب الأخر انخفاض معاملات الهضم(CP, CF, ADF, NDF,) معنويا للمعاملتين ٢ ، ٣ عن المقارنة.اما بالنسبة للقيم الغذائية لعلائق التجربة فى صورة TDN(%) فلقد كانت أعلى معنويا للمعاملتين ٢ ، ٣ عن المقارنة بينما DCP(%) انخفض معنويا بإضافة زيت السمك فى المعاملتين ٢ ، ٣ عن المقارنة.
- أظهرت نعاج المجموعة الثالثة ارتفاعا معنويا فى وزن الجسم عند الفطام وخلال فترة التلقيح عن المجموعتين الثانية و المقارنة .
- أظهرت نعاج المجموعة الثالثة انخفاضا معنويا فى نسب مكونات اللبن ماعدا اللاكتوز وأيضا ارتفعت طاقة اللبن (Mj/kg) للمجموعة الثالثة عن المجموعتين الثانية و المقارنة وعلى الرغم من ذلك ارتفع محصول جميع مكونات اللبن وهذا راجع لارتفاع كمية اللبن للمجموعة الثالثة عن المجموعتين الثانية و المقارنة.
- كانت أعلى قيم للكفاءة التحويلية معبرا عنها بالمادة الجافة أو مجموع المركبات الغذائية المهضومة (كجم /كجم لبن) للمجموعة الثالثة ويليها المجموعة الثانية واقل القيم كانت للمجموعة المقارنة.
- أظهرت المجموعة الثالثة ارتفاعا معنويا في تركيز كل من البروتين الكلى وGOT والجلوكوز والليبيدات الكلية والكولسترول عن المجموعتين الثانية والمقارنة.
- أظهرت قيم كل من وزن الميلاد ووزن الفطام ومعدل النمو اليومي خلال فترة الرضاعة تفوق المجموعة الثالثة عن المجموعتين الثانية والمقارنة بدون فروق معنوية, واللبن المتناول خلال فترة الرضاعة كان أعلي معنويا للمجموعة الثالثة عن المجموعتين الثانية والمقارنة.
- أظهرت المجموعة الثالثة ارتفاعا معنويا في وزن الجسم عند التلقيح و نسبة الخصوبة كنسبة من النعاج الكلية و أيضا معدل التوائم عن المجموعتين الثانية والكنترول و لكن بدون اختلافات معنوية وكانت الفترة من الولادة حتى أول شياع اقصر في المجموعة الثانية (١١٧ يوما) ويليها المجموعة الثالثة (١٣٢ يوما) والمقارنة (١٣٩ يوما).

-ونستنتج من هذه الدراسة أن إضافة زيت السمك بمعدل ٢&٤% لعلائق النعاج الناضجة كان له تأثير جيد على الأداء الإنتاجي في صورة إنتاج اللبن وكفاءة التحويل الغذائي و أداء الحملان الرضيعة والأداء التناسلي في موسم التناسل لهذه النعاج مع عدم وجود أي تأثيرات سلبية على مقاييس مكونات الدم أو الصحة العامة للحيوانات.