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IMPROVING FECUNDITY IN BARKI EWES BY USING NUTRITIONAL FLUSHING AND EXOGENOUS GONADOTROPINS

(With 6 Tables and 4 Figures)

By

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تحسين الخصوبة فى النعاج البرقية بأستخدام الدفع الغذائى و الحقن بالهرمونات الحاثة للغدد التناسلية

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أثناء موسم التناسل، تم أستخدام عدد ٦٠ نعجة (سبق لها ان ولدت مرة أو اكتر) لدراسة تاثير ثلاثة عوامل (نظام٣x٢x٢ الاحصائى متعدد العوامل) و هى مستوى الدفع الغذائى (منخفض " ١٣٥٪ من الإحتياجات الحافظة" او مرتفع " ١٩٣ ٪ من الإحتياجات الحافظة") و درجة أكتناز الجسم (نحيف أو متوسط الأمتلاء) بالاضافة الى الحقن الهرمونى (الاسفنجة المهبلية أو الاسفنجة + مصل الأفراس الحوامل أو الاسفنجة + مصل الأفراس الحوامل+ هرمون الاباضة) على كل من استجابة النعاج للشبق و نسبة النعاج الحوامل و عدد الاجنة أو الخلفة بالبطن الواحدة و كذلك انتاجية الحملان الناتجة. و يجدر بالذكر انه تم اثناء التجربة استخدام التصوير بالاشعة التليفزيونية خلال البطن عند اليوم ٢٨ من الحمل لجميع النعاج. أوضحت النتائج انه : لم يتأثر معدل الاستجابة للشياع بالمعاملات المفروضة. كانت نسبة النعاج الحوامل عند الوضع أعلى معنويا (٨٠٪) فى النعاج المعاملة بمستوى دفع غذائى منخفض عنه فى النعاج المعاملة بمستوى مرتفع (٦٣٪). و فىنفس الوقت كانت نسبة النعاج الحوامل فى المجموعة المغذاة بمستوى دفع غذائى مرتفع و درجة أكتناز جسم نحيف (عالى-نحيف) و كذلك تلك المغذاة بمستوى دفع غذائى منخفض و درجة أكتناز جسم متوسط الأمتلاء (منخفض -متوسط الأمتلاء) أعلى معنويا عنه فى المجاميع (منخفض-نحيف) أو (عالى- متوسط الأمتلاء). وفرة النتاج والتى يعبر عنها بعدد الاجنة أو الخلفة / بطن ، وجدت أنها تتاثر معنويا بمستوى الدفع الغذائى ودرجة أكتناز الجسم عند اليوم ٢٨ من الحقن. حيث حققت ألنعاج المغذاة على مستوى منخفض وكذلك تلك التى كانت متوسطة امتلاء الجسم حول التلقيح اعلى عدد من الاجنة (بالاشعة التليفزيونية) عن تلك المغذاة على المستوى المرتفع أو نحيفة. أيضا تم تحقيق أعلى عدد من الخلفة (١,٦٧) مجموعة (منخفض -متوسط الأمتلاء) يليها المجموعتين (عالى- متوسط الأمتلاء) و(عالى-نحيف) و كانت نتائجهما ١,٣٣ ، ١,٤٢ على الترتيب. بينما كانت أقلها المجموعة (منخفض-نحيف) و سجلت ١,٣٣ . و من ناحية أخرى سجلت النعاج المغذاة على مستوى دفع غذائى مرتفع و تلك التى كانت نحيفة أعلى عدد خلفة بالبطن عند حقنها بهرمونى مصل الأفراس

الحوامل+ هرمون الاباضة . بينما تم تسجيل نفس العدد فى النعاج المغذاة على مستوى دفع منخفض و تلك التى كانت متوسطة الأمتلاء عند حقنها بهرمون مصل الأفراس الحوامل فقط. تم الحصول على حملان ذات وزنا عاليا عند كل من الولادة و الفطام من تلك النعاج المغذاة على مستوى دفع غذائى مرتفع فى الفترة الاخيرة من الحمل. أوضحت هذه الدراسة أنه يمكن تحسين كل من الاستجابة للشياع و نسبة الحمل و عدد خلفة البطن الى نسب ٩٥٪ ، ٩٥٪ ، ١,٥ على الترتيب بأستخدام التأثير المتبادل لكل من مستوى الدفع الغذائى ، درجة أكتناز الجسم و الحقن بالهرمونات الحاثة للغدد التناسلية.

SUMMARY

During breeding season a number of 60 multiparous Barki ewes were used in a 2x2x3 factorial experiment to study the effects of 2 nutritional flushing (135xM; L *Vs* 193xM; H), two body condition scores (thin *Vs* moderate) as well as 3 hormonal treatment (Progesterone sponge(S) *Vs* S+PMSG *Vs* S+PMSG+HCG) on estrous response, pregnancy rate, litter size and lamb performance. Real-time transabdominal ultrasonography were performed for all ewes at Day 28 of gestation. Estrous response was not significantly affected by means of treatments. Pregnant ewes/ewes exposed (PEE) at lambing was significantly ($P<0.03$) higher in L (0.80) compared with H (0.63) nutritional level. Moreover, ewes receiving H nutrition and on thin BCS (H-thin) arround mating as well as those in (L-moderate) group had higher ($P<0.05$) PEE than those ewes in (H-moderate) or (L-thin) groups. Prolificacy, defined as the number of feti or lambs present per pregnant ewes (LBP) was significantly affected by each of flushing level or BCS at Day 28. Ewes receiving L-flushing level or on moderate BCS around mating had higher LBP at Day 28 than those receiving H-flushing level or on thin BCS. Meanwhile, the highest ($P<0.05$) LBP at Day 28 was noted in L-moderate group (1.67) followed by those in H-moderate and H-thin groups (1.42 and 1.33, respectively). The least ($P<0.05$) LBP was reported for L-thin group (1.33). Also, ewes received H-nutrition or on thin BCS achieved the highest LBP when treated with PMSG+HCG, while, those received L-nutrition or in moderate BCS achieved the same levels when treated with PMSG only. On the other hand, significant heavier lambs birth and weaning weights were reported in those lambs come from ewes fed on H-nutrition during gestation. It can be concluded that, estrus response, pregnancy rate as well as litter size can be improved in Barki ewes up to 95%, 95% and 1.5, respectively, by using the synergestic effects of flushing (nutrition) level, BCS and exogenous gonadotropins treatments.

Key words: *Barki ewes - Fecundity - Flushing - Gonadotropins*

INTRODUCTION

Barki breed sheep is one of the subtropical breeds that are raised mostly under unfavorable management and environmental conditions including less availability and seasonal fluctuations in feed resources and heat stress which affect their fecundity and productivity (Aboul-Ela and Aboul-Naga, 1987). The improving fecundity (defined as the number of lambs born per time) in subtropical breeds, has two dimensions; increasing the number of lambing per year and the number of lambs per lambing. The latter could be improved by, increasing the ovulation rate, which in turn could be achieved by improving nutrient intake (flushing) before mating (Scaramuzzi and Radford, 1983), by using exogenous gonadotropins (Fraser et al., 1976), by immunization of ewe against sex steroids (Smith, 1985) or by crossbreeding prolific with non-prolific breeds (Hanrahan and Quirke, 1985).

The practice of flushing (i.e. provision of additional feed around breeding) to increase the incidence of multiple ovulations has been used in Europe for many years. However, the practice was not always beneficial (Dunn and Moss, 1992), since there is already evidence of a suppressive effect of high plane-feeding on progesterone concentrations during early pregnancy in the ewe which could chare a detrimental influence on oocyte maturation and ovulation (Williams and Cumming, 1982). Various factors including body weight and body condition score of ewe prior to flushing (Rhind et al., 1984) as well as the length and magnitude of the flushing period (Kleemann et al., 1991) has been affected the benifit of flushing. However, only a few trials have been reported on the use of flushing to improve fecundity in subtropical sheep. It was found that, 25-30% increases in twinning rate appear to be the maximum response expected from any flushing treatment in Awassi and Akkaraman sheep (Younis, 1977 and Askin et al., 1983). In Egypt, no effect on conception, twinning or lambing rate were observed when variable levels of dietary protein were used (El. Shobbokshy et al., 1982 and Sabra et al. 1996). In prolific sheep, gonadotropins has been used to increases ovulation rate and induces a closer synchronization of these ovulations (Congnie et al., 1970), increase lambing and litter size (Robinson, 1983). Howevere, information on hormonal manipulation of the estrus cycle to increase fecundity in subtropical breeds (non-prolific) has been restricted to few trails involving small number of ewes. The use of pregnant mare serum gonadotropins (PMSG) at a relatively high doses (400 - 500 IU/ewe) resulted in an increase of 25% in litter size in Kivircik sheep (Askin et al., 1983) and 42% in Ossimi and Rahmani sheep

(Aboul-Naga and Abdel-Rahman 1981). The higher litter size recorded in the latter trail was mainly due to the increase in the percentage of quadruplets, although management of large litter size is difficult as well as their mortality rates is high (Bradford et al., 1974). Recently, some successful trails were performed to clarify the possibility of using the human chorionic gonadotropins (HCG) hormone to enhance the effect of PMSG as a superovulatory agents to increase the ovulation rate in goat and cattle (Schmidt et al., 1988 Senn and Richardson 1992 and Rowe and East 1996).

The present study was designed to examine the effect of flushing levels, body condition score and exogenous gonadotropins and their interactions on reproductive performance of Barki ewes and the growth rate of their litters.

MATERIALS and METHODS

Animals:

Sixty pluriparous Barki ewes reared in ARRI were used in this study. The ewes were run with vasectomzed rams and ascertained to be cyclic before the onset of the experiment.

Experimental design:

The experiment was a 2x2x3 factorial design providing for 2 body condition scores(BCS), 2 nutritional levels and 3 hormonal treatment. At the start of experiment (June, 1996), the ewes were ranked mainly according to their BCS (Russel et al., 1969, Table 1) and allotted to 2 different BSC groups (n=30), thin (BCS ≤ 2.5) and moderate (BCS 2.75-3.5). Each BCS group was randomly divided into 2 similar nutritional subgroups (n=15); low flushing (L) and high flushing (H) received a level of nutrition of 135% (135 x M) and 193% (193 x M) of maintenance requirement, respectively. At early July, 1996, ewes in each nutrition subgroups were further allocated to one of three hormonal treatments (n=5); Group 1 was synchronized by a single progesterone intravaginal sponge (Vermix, upjohn, containing 60 mg medroxy progesterone acetate) which remained in place until withdrawal 13 days latter. Group 2, was synchronized as group 1 and received IM of 250 IU/PMSG (Folligon, Intervet) at sponge removal. Group 3 was treated as Group 2 in addition to IM of 1000 IU of HCG (Profasi, Eipico) at the start of estrus signs. The ewes were then run with fertile rams at a ratio of 1:5 for 4 days after sponge removal.

Table 1: Body condition scoring (BCS) system for sheep

Score	Description
0	Animal is extremely emaciated and at the point of death. It is not possible to detect any muscular or fatty tissue between the skin and the bone.
1	The spinous processes are felt to be prominent and sharp. The transverse processes are also sharp, the fingers pass easily under the ends and it is possible to feel between each process. The eye muscle areas are shallow with no fat cover.
2	The spinous processes still feel prominent but smooth; and individual processes can be felt only as fine corrugations. The transverse processes are smooth and rounded, and it is possible to pass the fingers under the ends with a little pressure. The eye muscle areas are of moderate depth but have little fat cover.
3	The spinous processes are detected only as small elevations; they are smooth and rounded, and individual bones can be felt only with pressure. The transverse processes are smooth and well covered, and firm pressure is required to feel over the ends. The eye muscle areas are full and have a moderate degree of fat cover.
4	The spinous processes can just be detected, with pressure, as a hard line between the fat-covered muscle areas. The ends of the transverse processes cannot be felt. The eye muscle areas are full and have a thick covering of fat.
5	The spinous processes cannot be detected even with firm pressure, and there is a depression between the layers of fat in the position where the spinous processes would normally be felt. The transverse processes cannot be detected. The eye muscle areas are very full with very thick fat cover. there may be large deposits of fat over the rump and tail.

Feeding:

In early June, nutritional treatment were initially imposed by feeding a diet consists of a pelleted concentrate mixture and wheat straw. The pellets contained 16 % crude protein and 2.36 Mega calorie (Mcal) metabolizable energy (ME)/Kg diet. Ewes in two nutritional groups were fed on an allowance of 1 Kg of wheat straw and 0.630 or 1.00 Kg of concentrate mixture/head/day for L and H groups, respectively. These amounts corresponding to a daily intake of 2.85 and 3.68 Mcal ME, respectively and supporting 50 Kg live weight (ARC 1980). At lambing, Bersseem hay were used insteade of straw, where, ewes in both groups were fed according to feeding standard of lactation (ARC, 1980). Water and trace mineral blocks were allaways available for all animals.

Measurement:

BCS and live body weights (LW) were recorded monthly for all ewes. After sponge removal, estrus response (defined as ewes in estrus per ewes exposed; EOE) was recorded. Real-time transabdominal ultrasound scanning using 3.5-5.0 MHS (scanner 480 vet., Pie medical, Meastricht, Netherlands) was performed 28 days after mating where the number of feti were recorded (Fig 1). Pregnant ewes/ewes exposed to breeding (PEE) as well as litter size / pregnant ewes (LBP) at Day 28 of pregnancy and at lambing were also recorded. At twice daily lambing inspection, lambs were tagged and identified with their dams where, type of birth (single or twin), weight and sex were obtained.

Statistical analysis:

The incidence of estrus and pregnancy rate between different groups were compared using chi-square test. Three ways analysis of variance (Factorial design) and Duncan's multiple range test were used between means of litters size, body weight, body condition, lambing birth weight, weaning weight as well as growth rate from birth to weaning,. The data were analysed using COSTAT computer program, version 3.03; copyright 1986 Cottort software.

RESULTS

As shown in Table 2, LW and BCS at the start of the experiment were similar in L and H nutritional groups as well as in 1, 2 and 3 hormonal groups. Indeed that did not the case in thin and moderate BCS group. Data analysis revealed that L weight and BCS at lambing were significantly higher ($P<0.05$) in H (54.94 Kg and 3.49) and moderate (56.72 Kg and 3.67) groups than those in L (15.50 Kg and 3.10) and thin (49.78 Kg and 2.0) groups.

Table 2: Effect of nutrition, BCS, exogenous gonadotropins on live weight (LW) and BCS at start of the experiment and at lambing in Barki ewes

Main effects	LW (Kg)		BCS	
	Initial	Lambing	Initial	Lambing
Nutrition:				
H	43.34±0.88 [a]	54.94±0.85 [a]	2.47±0.10 [a]	3.49±0.08 [a]
L	43.21±0.99 [a]	51.55±1.18 [b]	2.56±0.12 [a]	3.10±0.11 [b]
BCS:				
Thin	39.72±0.49 [a]	49.78±0.79 [a]	2.00±0.05 [a]	2.98±0.08 [a]
Moderate	46.84±0.85 [b]	56.72±0.54 [b]	3.03±0.06 [b]	3.67±0.05 [b]
Hormonal treatment:				
Group 1	42.93±1.35 [a]	53.26±1.33 [a]	2.53±0.16 [a]	3.33±0.13 [a]
Group 2	42.50±1.01 [a]	53.83±1.20 [a]	2.51±0.15 [a]	3.38±0.12 [a]
Group 3	42.83±1.59 [a]	53.00±1.47 [a]	2.42±0.16 [a]	3.30±0.14 [a]

Within main effects and columns, means not followed by a common letter differ significantly (P<0.05).

Oestrus response and pregnancy rate:

The effect of nutrition, BCS and exogenous gonadotropins on estrus and pregnancy rate are presented in table 3. The overall mean of EOE,,in the present study, was 0.90. Analysis of data indicated that EOE after synchronization did not significantly (P<0.05) differ among the experimental groups.

Fertility as PEE, (Table 3) tended to be greater in L compared with H nutritional groups, although the difference was significant (P<0.03) only at lambing. On the other hand, neither BCS nor exogenous gonadotropins influenced (P<0.05) pregnancy rate (PEE). However, examination of the significant interaction (table 3) between nutrition and BCS (NxB) at Day 28 and at lambing, indicated that around mating, ewes that receiving high nutrition and on thin BCS (H-thin group) as well as those on (L-moderate) groups had higher (P<0.05) PEE at Day 28 and at lambing than those in H-moderate or L-thin groups.

It is worthy to mentioned that, the overall mean PEE in both nutritional groups tended to decrease, from 0.74 at Day 28 to 0.71 at lambing (untabulated data). Although the difference was not significant, a number of 4 ewes (13.33 %) that fed H-nutrition level had been pregnant initially (as indicated by failure to return service before Day 21and by ultrasonography), had pregnancy failure at lambing.

Litter size:

Prolificacy (LBP), defined as the number of fetuses or lambs present per pregnant ewes are presented in table 4 and 5. ANOVA, revealed that LBP was significantly (P<0.05) affected by nutrition level at Day 28 where, it was greater in L than H groups. However, such difference was not detected at lambing. Similar effects were exerted by BCS on litter size where LBP at Day 28 was significantly (P<0.01) higher in moderate compared with thin BCS. Also, such difference lacked significance at lambing (Table 5). Meanwhile, a significant interaction was reported between nutrition and exogenous gonàdotropins (HxG) on LBP at Day 28 as well as at lambing (Table 4). Another two interactions were recorded between nutrition and BCS (HxB) at Day 28 on one hand and between exogenous gonadotropins and BCS (GxB) on the other hand. Examination the interactions between nutrition and exogenous gonadotropins (Figure 2) revealed that, ewes received H nutrition level achieved the highest (P<0.05) LBP at Day 28 and at lambing when treated with FSH+LH. Similarly, ewes fed on L nutrition level achieved the highest (P<0.05) LBP at Day 28 and at lambing when treated with FSH.

The interaction between nutrition and BCS at Day 28 (figure 3) indicated that, the highest (P<0.05) litter size (LBP) was noted in L-moderate group (1.67) followed by H-moderate and H-thin groups (1.42 and 1.33, respectively). The least number was reported for L-thin group (1.33, P<0.05). On the other hand, examination the interaction between exogenous gonadotropins and BCS at lambing (figure 4) revealed that, ewes in moderate BCS achieved the highest (P<0.05) litter size (1.50) when treated with FSH (Group 2), while, that happened for ewes in thin BCS when treated with FSH+LH(Group 3).

Lamb performance:

The effect of maternal nutrition, birth type (single vs twin) and sex on lamb performance are presented in table 6. ANOVA revealed that, significant (P<0.01) heavier lamb birth and weaning weights were reported in lambs came from ewes fed on H diet compared with those fed on L diet during gestation. Also, growth rate (g/day) until weaning tended to be higher in H, although the difference lacked significantly. Similar results were reported for twin lambs vs single lambs, where the latter had significant (P<0.01) higher birth and weaning weights as well as higher (P<0.01) growth rate. Meanwhile, birth weight was not affected (P<0.05) by sex in these trail.

Table 3: Effect of nutrition, BCS and exogenous gonadotropins on estrus and pregnancy rate in Barki ewes:

Main effect	EOE	PEE	
		Day 28	Lambing
Nutrition (N)			
H	(26/30) 0.87 [a]	(23/30) 0.77 [a]	(19/30) 0.63 [a]
L	(28/30) 0.93 [a]	(24/30) 0.80 [a]	(24/30) 0.80 [b]
BCS (B)			
Thin	(26/30) 0.87 [a]	(24/30) 0.80 [a]	(23/30) 0.77 [a]
Moderate	(28/30) 0.93 [a]	(23/30) 0.77 [a]	(20/30) 0.67 [a]
Exogenous gonadotropins			
Group 1	(18/20) 0.90 [a]	(15/20) 0.75 [a]	(14/20) 0.70 [a]
Group 2	(18/20) 0.90 [a]	(16/20) 0.80 [a]	(15/20) 0.75 [a]
Group 3	(18/20) 0.90 [a]	(16/20) 0.80 [a]	(15/20) 0.75 [a]
Interaction			
NxB			
H-Thin	(14/15) 0.93 [a]	(14/15) 0.93 [a]	(13/15) 0.87 [a]
H-Moderat	(14/15) 0.93 [a]	(9/15) 0.60 [b]	(6/15) 0.40 [b]
L-Thin	(12/15) 0.80 [a]	(10/15) 0.67 [b]	(10/15) 0.67 [b]
L-Moderate	(14/15) 0.93 [a]	(14/15) 0.93 [a]	(14/15) 0.93 [a]

EOE: Ewes in estrus per ewes exposed. PEE: Pregnant ewes per ewes exposed Within main effects and columns, means not followed by a common letter differ significantly ($P<0.05$)

Table 4: Analysis of variance (ANOVA) of litter size/pregnant ewes (LBP) at Day 28 and at lambing in Barki ewes:

Source	df	LBP at Day 28		LBP at lambing	
		MS	P	MS	P
Nutrition (N)	1	0.1875	0.09	0.187	0.1881
BCS (B)	1	0.5208	0.006	0.0208	0.657
Exogenous gonadotropins (G)	2	1.3125	0.001	0.3958	0.03
Interactions:-					
NxB	1	0.1875	0.06	0.020	0.65
NxG	2	2.6875	0.001	0.562	0.008
BxG	2	0.145	0.115	0.645	0.005
NxBxG	2	0.1875	0.0625	0.645	0.004
Error		0.0625		0.1041	
Error df ( )		(36)		(31)	

However, growth rate (g/day) tended to be faster (P<0.07) in male than female although, difference at weaning lacked significantly.

The reported overall mean LBP at lambing (1.229) was decreased significantly (P<0.03) from that reported at lambing (1.43). Such difference may attributed to the presence of ewes that had been diagnosed initially, as had twin lambs at Day 28 by ultrasonography, but born single lamb at birth.

Table 5: Effect of nutrition, BCS and exogenous gonadotropins on litter size per pregnant ewes (LBP) at Day 28 and at lambing in Barki ewes:-

Main effects	LBP at Day 28	LBP at lambing
Nutrition:		
H	1.38±0.10 [a]	1.17±0.079 [a]
L	1.50±0.10 [b]	1.29±0.095 [a]
BCS:		
Thin	1.33±0.098 [a]	1.25±0.09 [a]
Moderate	1.54±0.104 [b]	1.21±0.085 [a]
Exogenous gonadotropins: Group 1	1.13±0.085 [a]	1.06±0.063 [a]
Group 2	1.50±0.129 [b]	1.25±0.112 [ab]
Group 3	1.68±0.119 [c]	1.38±0.123 [c]

Within main effects and columns, means not followed by a common letter differ significantly (P<0.05).

Table 6: Effect of nutrition, birth type and sex on birth weight, weaning weight and growth rate* of lambs from Barki ewes:-

Main effects	Birth weight (Kg)	Weaning weight (Kg)	Growth rate (g/day)
Nutrition:			
H	3.90±0.16 [a]	25.10±0.86 [a]	225.35±7.33 [a]
L	3.40±0.17 [b]	22.87±0.76 [b]	216.14±7.70 [a]
Birth type:			
Single	4.12±0.15 [a]	26.10±0.66 [a]	240.90±6.27 [a]
twin	3.23±0.07 [b]	21.88±0.74 [b]	200.70±8.30 [b]
Sex:			
Male	3.70±0.17 [a]	24.33±0.77 [a]	228.52±7.33 [a**]
Female	3.60±0.13 [a]	23.60±0.91 [a]	213.17±7.64 [a]

Within mean and columns, means not followed by a common letter differ significantly (P<0.05).* From birth to weaning (at 10 week old). ** Differ at (P<0.07).

DISCUSSION

It is worthy to mention that, BCS is a simple but useful procedure that can help producers to monitor sheep flocks and determine whether their nutritional status is adequate or not and also, help him to make management decision about the amount of fed required by an ewe flock to optimize performance (Millard, 1991). However, scale used in our experiment could be more suitable for non fat-tail (Barki breed sheep) than fat tail breed (Rahmani and Ossimi), because this scale depend mainly on measuring the amount of fat deposits mostly over the ribs, around the tail base, lumber and pelvic area. Moreovere, the reported overall mean (0.90) of estrus activity (EOE) after synchronization was greater than (0.80) previously reported by EL-Nour (1996) by the same group of ewes. Such difference may be attributed to improve the nutrition in our study.

The overall mean of pregnancy rate reported in the current study was 71.0%, it was equal to those achieved by Ezzo (1989) in the same breed (Barki ewes) by natural breeding (70.83%). Moreover, there are no significant differences in pregnancy rate among hormonal treatments. On the contrary, Hawk et al. (1987) obtained low fertility by using superovulatory agents, this did not seen to be true in our study, probably due to the low dosage of PMSG (250 IU). High dose of PMSG induce a secondry post ovulatory rise in circulating estradiol and estrone which may resulted from the rescue of follicles in early atresia (Monnioux et al, 1984) or the growth and maturation of small follicles (Wise et al., 1986) or both (Monnioux et al., 1984). This increase in the circulating estrogen is responsible for hormonal inbalance which interfers with mechanism of ovulation (Kummer et al., 1980). Such hormonal inbalance may also, reduce gametes transport and embryonic survival (Booth et al., 1975; Bettridage, 1977). The high concentrations in the hormonal milieu exert an unfavourable effect on the fertilization of the ova and initial stages of embryo development (Drost et al., 1986), as well as the uterine environment of superovulated animals was found to be harmful to embryos (Boland, 1984). Also, it has been reported that estrus synchronization, whether on its own or in combination with superovulation reduce sperm transport within reproductive tract, consequently, low sperm numbers are available at the fertilization site and this lower fertility (Hawk et al., 1987).

The observation reported in our study indicated that, the high feeding level (195xM) during premating and gestation period had a detrimental effect on the form of low pregnancy at Day 28, in addition, to the reported failure in pregnancy rate in 13.3% of ewes in this group at lambing may indicate either early ova wastage or late pregnancy failure or both. Gunn et al. (1979) and Gunn (1983) suggested that, most induced wastage which could be influenced by nutritional factors occur during the first 30-40 days of pregnancy. This may be the case in the present study taking into account that ultrasonography cannot determine fetus viability before day 35 of gestation (Garcia et al., 1993). similar results were previously reported by EL-Sheikh et al. (1955), Cumming et al. (1975) and Gunn et al. (1979) who found that very high plane of nutrition (2xM) reduce embryo survival up to day 40 of gestation. The mechanisms involving the reduction of embryo survival by high plane of nutrition in early pregnancy may include the stimulatory effects of high nutrition on the metabolic clearance rate of progesterone hormone (Parr et al., 1993 and Prime and Symonds, 1993) and the concomitant reduction in progesterone circulation at the time when the embryo is extremely sensitive to low concentration in the peripheral circulation (Parr, 1992). Sabro et al. (1996) found that, in Barki ewes, during early pregnancy, plasma progesterone was significantly higher ($P<0.05$) in non supplemented (maintenance) than those supplemented with high protein level. Moreover, low level of progesterone before mating are accompanied by reduced LH surge which inturn reduce fertility (Thompson et al., 1992).

On the other hand, the recorded significant interaction between nutrition and BCS in the present study was previously reported by Rhind et al. (1984) and Williams and Cumming (1982) who suggested that the differences in condition score before mating compared differences in food intake in postmating period may have quite different consequences for reproductive performance. They added, feeding of good condition ewes at a high levels of nutrition achieved an even higher level of BCS may be counter reproductive due to detrimental effects on both estrus activity and ova or embryo wastage. Meanwhile, Gunn (1983) concluded that, embryos of ewes that were in poor condition and low nutrition at mating are most at risk and appear to be detrimental to embryo survival.

The results of this study indicated that, litter size of Barki ewes can be improved up to 1.32-1.5 per ewe pregnant at lambing which equal to 1.25-1.42 reported in Kivirick, Ossimi and Rahmani breed sheep (Aboul-Naga Abdel-Rahman, 1981 and Askin et al., 1983) although non of the ewes in this study produced triplets.

The observation that, higher litter size recorded in moderate compared with thin BCS at Day 28 was in line with Gunn et al. (1984) who clarified that, mean ovulation rate of ewes in high score was significantly higher than those of low BCS. Rhind and McNeilly (1986) suggested that BCS had a large effect on FSH concentrations during luteal and follicular phase of the estrous cycle. Meanwhile, lower litter size associated with very high nutrition in these experiment may attributed to the higher progesterone level and its metabolic clearance rate which associated with ovum viability as discussed earlier.

The recorded decrease in litter size (LBP) from 1.438 at Day 28 to 1.22 at lambing in both nutritional levels may attributed to the use of same feeding levels during whole gestation period, as some authors recommended to use low level (100-120xM) after mating up to 8 weeks before lambing (Millard, 1991and NRC, 1985). Such increase may have a detrimental effect on embryo survival (Gunn and Dony, 1979 and Gunn et al., 1979).

Concerning the effect of exogenous gonadotropins on litter size, it was found that, compared to control, PMSG increased litter size in both Day 28 and at lambing. Similar results were reported in tropics by Mutiga and Mukas-Mugerwa (1992) and by using low dose (200-300 IU/PMSG). Moreover, the significant improvement in litter size caused by administration of HCG (LH) was previously reported in goat and cattle by (Schmidt et al., 1988, Senn and Richardson, 1992 and Rowe and East, 1996). This may be attributed to early LH surge, which in turn, accelerates the process of ovulations (developed follicles formed as resulted from PMSG injection) to be synchronized and so the fertilization become better than a synchronized ovulated animals.

The present study demonstrated an interaction between BCS and nutrition at Day 28 on LBP. Similar interactions were reported by Gunn et al., (1991) and Rhind et al., (1984) who suggested that level of intake may mediate its effect through changes in LH plus frequency in the 2 or 3 days before mating which affect the proportion of large follicles induced to undergo the final stage of development. On the other side, BCS may affect ovulation rate through changes in FSH concentration and the number of large follicles present (Rhined and McNeilly, 1986). Meanwhile, the significant interactions recorded between nutrition and exogenous gonadotropins in one hand and between BCS and exogenous gonadotropins on the other hand may indicate that HCG may require beside PMSG in induction of twinning when the state of nutrition (very high) or body condition (thin) have a detrimental effect on the hormonal balance responsible for multiple ovulation.

The result of this study revealed that, significant heavier birth and weaning weight were reported in lambs come from ewes fed on H diet during gestation compared with L diet. Similar results were reported by Alliston and Lucas (1979) and Lanza et al. (1987). It seem that, birth weight was the function of late pregnancy feeding, since the gain mass of the fetus in last 8, 4 and 2 weeks of gestation is equivalent to 85, 50 and 25 % of its birth weight(Robinson, 1983). So, it is reasonable to expect a relationship between plane of nutrition in late pregnancy and lamb birth weight. Moreover, the reported heavier weaning weight may indicate that ewes in this group (H) had higher body reserves and feed efficiency to support lactation.

It can be concluded that, estrus response, pregnancy rate as well as litter size can be improved in Barki ewes up to 95%, 95% and 1.5, respectively, by using the synergestic effects of flushing (nutrition) level, BCS and exogenous gonadotropins treatments.

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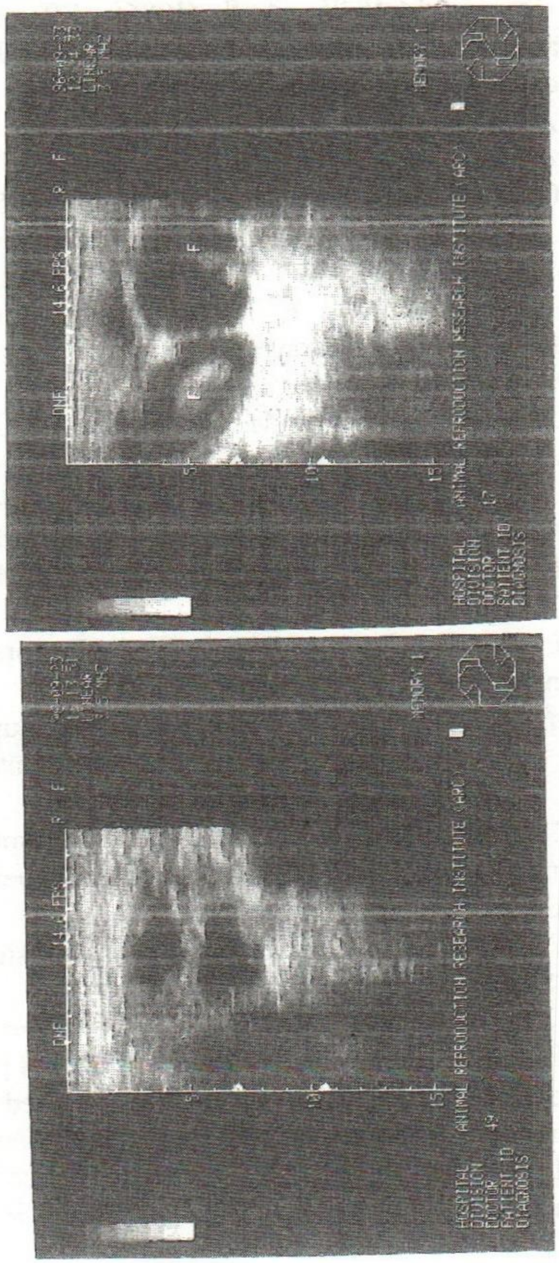
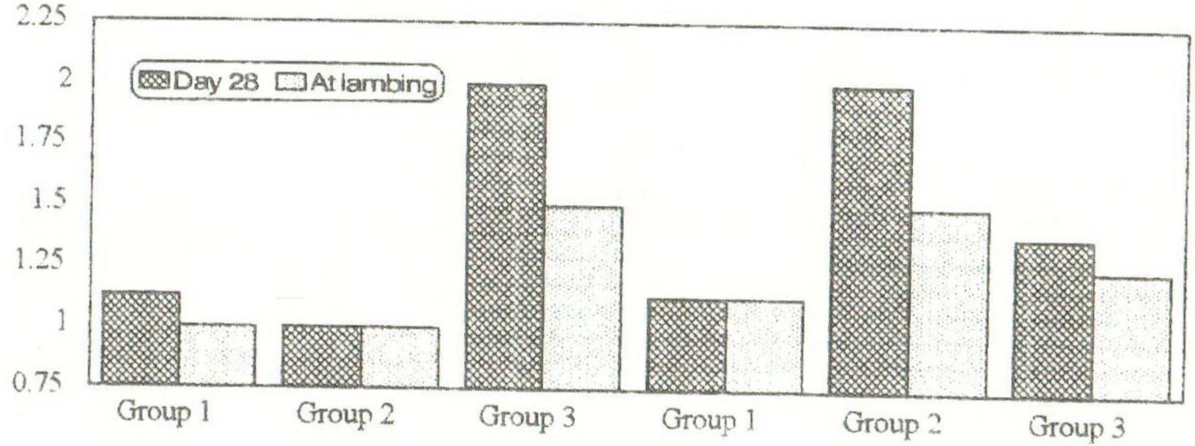


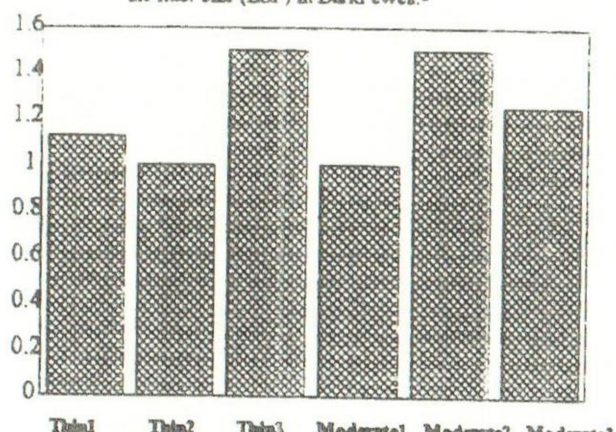
Fig. 1: Ultrasonography for two pregnant ewes (Day 28 of pregnancy showing twins).

Figure 2: Effect of the interaction between nutrition and exogenous gonadotropins on the litter size (LBP) in Barki ewes:-



H (193xM)

Figure 3: Effect of the interaction between nutrition and BCS on the litter size (LBP) in Barki ewes:-



L (135xM)

Figure4: Effect of the interaction between BCS and exogenous gonadotropins on litter size at lambing in Barki ewes:-