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Impact of Pre-pubertal Growth Rate on Pubertal Characteristics of Sohagi Ewe Lambs

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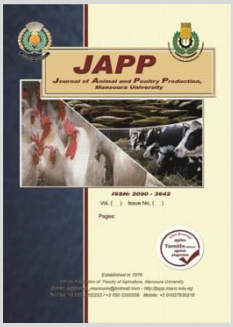

ABSTRACT

This study aimed to investigate the impact of pre-pubertal growth rate on pubertal characteristics of Sohagi ewe lambs. Thirty of Sohagi ewes lambs at 6-7 months of age were divided into three equal groups (n=10 per each group) according to its previous growth rate from birth to 6 months of age, groups marked as fast, medium and low growing. All groups were housed in closed barns with access to an open area and got their nutritional requirements depending on their growth stage. Results show that the pubertal characteristics of Sohagi ewe lambs at puberty were significantly affected (P<0.05) by the pre-pubertal growth rate. Ewe lambs in the fast-growing group were achieved to onset puberty firstly at 235 days on average then ewe lambs in the medium and low-growing group (242.6 and 269.4 days, respectively). Ewe lambs in the fast-growing group were the heaviest at puberty than ewe lambs in the medium and low-growing group (26.4 vs. 23.7 and 22.4 kg, respectively). Blood progesterone concentration was not significantly different among ewe lambs groups (1.419± 0.04 ng/ml on average, ranged from 1.203 to 1.737 ng/ml). In conclusion, results showed that the pre-pubertal growth rate of ewe lambs is one of the most influential factors affecting the development of puberty characteristics.

Keyswords: Sohagi ewe lambs, age and weight at puberty, pre-pubertal growth rate, progesterone concentration.

INTRODUCTION

Small landowners or landless farmers in rural areas of Egypt are unable to invest in large ruminants such as buffaloes or cattle, so they invested more in small ruminants to cover family needs (Alary *et al.* 2015). Many factors play a key role in estimating reproductive efficiency (El-Moghazy *et al*., 2018). Sheep reproduction is affected by climatic factors such as ambient temperature and humidity which may impose stress on sheep reproductive performance traits. Sexual activity of sheep in tropical and subtropical areas may be restricted, to a certain extent, during months with high temperatures and lack of feed (Marai *et al*., 2008). Moreover, ewe lambs with high scores for early puberty can improve flock fertility during breeding and indirectly improve genetics (Ibarra *et al*., 2000). Otherwise, characterization of puberty and early sexual development is a valuable tool for selection within the breed (El-Shahat *et al*., 2014). The early age at puberty is associated with birth time and the nutritional planes (Khalifa *et al*., 2013). Under tropical and sub-tropical conditions, ewe lambs tend to reach puberty at approximately 60 to 65 % of the adult weight (Maijala, 1996). While, Kenyon *et al*., (2014) found that Romney ewe lambs attained the onset puberty at 40–60% of mature live weight. Zarkawi and Al-Daker (2018) reported that fast-growing ewe lambs achieved onset puberty faster than low-growing ewe lambs. Chelikani *et al*. (2003) revealed that about 96% of the variation in attaining puberty is due to pre-pubertal body weight and average daily gain. Sohagi sheep is one of the prevalent native breeds in Upper Egypt, whose reproductive characteristics have not been previously described. The present study was conducted to investigate the impact of pre-pubertal growth rate on pubertal characteristics of Sohagi ewe lambs.

MATERIALS AND METHODS

The present study was conducted at the experimental sheep farm of the animal production department, Faculty of Agriculture, Sohag University, El-kawthar city which is located in the western arid regions of Sohag governorate, Egypt. The provisions of the Federation of Animal Science Societies guidelines "Care and Use of Agricultural Animals in Research and Teaching" - 3rd edition, Champaign, IL were taken into consideration during the experiment.

Animal and management conditions

Thirty of Sohagi ewes lambs at 6-7 months of age were divided into three equal groups (n=10 per each group) according to its previous growth rate from birth to 6 months of age, groups marked as fast, medium and low-growing. All groups were housed in closed barns with access to an open area and fed according to NRC (2007) recommendations depending on their growth stage, freshwater is available all time of day from a fixed drinking through.

Progesterone hormone analysis

Blood samples were collected from all ewe lambs via jugular vein puncture at 10:00 am once biweekly until the end of the experiment (11 months of age). Plasma was separated by centrifugation at 3000 rpm for 15 min within an hour of collection, after that the obtained plasma was transferred into clean eppendorf tube and stored until hormone analysis at -20ºC to estimate the concentration of plasma progesterone hormones. Progesterone was estimated using radioimmunoassay kits (Immunotech, Belgium).

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Statistical analysis

Data were analyzed using the PROC MIXED for repeated measurements of SAS (SAS, 9.3) and the results presented as Least Squares Means (LSM). The statistical model included the fixed effects of the lambs group (fast, medium and low growing), and sample time (biweekly sample from the beginning until the end of the experiment). Differences between LSM were determined with the PDIFF option of SAS. Statistical model used for analyze all obtained data was:

$$Y_{ijk} = \mu + G_i + T_j + \varepsilon_{ijk}$$

Where

Y_{ijk} is the dependent variable (Age and weight at puberty, progesterone level in ewe lambs, μ is the overall mean, G_i is the fixed effect of ewe lambs group, T_j the fixed effect of sample time and ε_{ijk} is the random residual error.

RESULTS AND DISCUSSION

The effect of pre-pubertal growth rate on pubertal characteristics of Sohagi ewe lambs were shown in Table (1). The upper part of the table displays growth performance during the first 6 months of age for the experimental groups of ewe lambs (fast, medium and low-growing). Average daily gain (g) and total weight gain (kg) were significant differences ($P<0.05$) in these groups while birth weight did not differ significantly ($P<0.05$) in the three groups. The fast-growing group had the highest average daily gain and total weight gain (112.2 g and 20.3 kg) then the medium-growing group (91.7 g and 16.5 kg) while the low-growing group had the lowest average daily gain and total weight gain (79.4 g and 14.3 kg).

The pubertal characteristics of ewe lambs in the three groups are displayed in the lower part of Table (1). Age and weight of ewe lambs at puberty were significantly affected ($P<0.05$) by growth performance of ewe lambs from birth to 6 month of age. Ewe lambs in fast-growing group were achieved to onset puberty firstly at 235 days on average than ewe lambs in medium and low-growing group (242.6 and 269.4 days, respectively). The same trend were obtained for weight at puberty, ewe lambs in fast-growing group were the heaviest at puberty than ewe lambs in medium and low-growing group (26.4 vs. 23.7 and 22.4 kg, respectively).

Table 1. Effect of pre-pubertal growth rate on pubertal characteristics of Sohagi ewe lambs.

	Ewe lambs groups			Overall
	Fast growing	Medium growing	Low growing	
Birth weight (kg)	3.12 ± 0.06	2.93 ± 0.05	2.81 ± 0.08	2.95 ±0.04
Weight at 6 month (kg)	23.9^{a} ± 0.19	19.3^{b} ± 0.31	17.2^{c} ± 0.13	20.13 ± 0.53
Total weight gain (kg)	20.3^{a} ± 0.13	16.5^{b} ± 0.37	14.3^{c} ±0.13	17.03 ± 0.48
Average daily gain (g)	112.2^{a} ±0.74	91.7^{b} ± 2.03	79.4^{c} ± 0.74	94.4 ± 2.62
Pubertal characteristics				
Age at puberty (day)	235.00^{a} ± 3.60	242.60^{a} ± 7.08	269.40^{b} ± 5.58	249.00 ± 4.15
Weight at puberty (kg)	26.4^{a} ± 0.19	23.7^{b} ± 0.17	22.4^{b} ± 0.62	24.2 ± 0.38
Progesterone concentration at puberty (ng/ml)				
– Average	1.440± 0.06	1.444± 0.04	1.372± 0.04	1.419± 0.03
– Minimum	1.203	1.283	1.226	-----
– Maximum	1.737	1.667	1.585	-----

^{abc} mean values with a different superscript in the same row indicate significant difference ($P<0.05$).

Table (1) and Fig (1) illustrates that the concentration of blood progesterone was not significantly differ among ewe lambs groups and concentration of blood progesterone at puberty was 1.419± 0.04 ng/ml on average (ranged from 1.203 to 1.737 ng/ml). This result confirmed that pre-pubertal growth rate of animals hasn't significant effect on concentration of blood progesterone at puberty, but ewe lambs with rapid growth reach puberty earlier than those have slow growth (Fig 1).

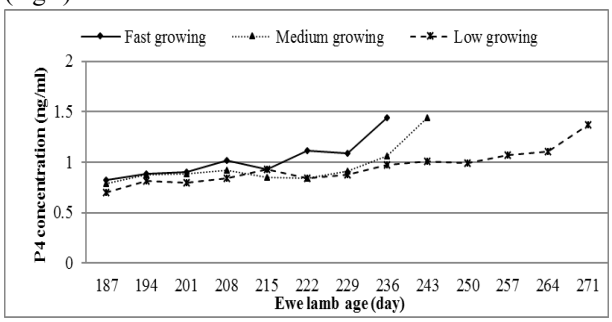

Fig 1. Blood progesterone concentration of Sohagi ewe lambs from 6 month of age until puberty according to growth performance (fast, medium and low growing)

From the present results, it's clear that Sohagi ewe lambs were reached to pubertal characteristics between 235 – 269 days (8-9 month of age) with range average body weight 22 – 26 kg and with blood progesterone concentration above 1.2 ng/ml. Furthermore, growth performance of Sohagi ewe lambs from birth to 6 month of age had significant effect on age and weight at puberty, ewe lams with higher average daily gain and body weight were reached to puberty at early age than those with medium or low average daily gain and body weight.

The result of this study revealed that growth rate of Sohagi ewe lambs in early age stages have a significant effect on age and weight at puberty. Ewe lambs in fast-growing group reached firstly to puberty followed by those in medium-growing group but ewe lambs in low-growing group were the latest. Similar results were previously conducted by Zarkawi and Al-Daker (2018). They investigated the effect of pre-weaning growing rate of Syrian Awassi ewe lambs on some productive and reproductive performance. They found that average body weight at puberty was higher in fast-growing ewe lambs than weak-growing ewe lambs. Moreover, fast-growing ewe lambs were reaching to puberty earlier than weak-growing ewe lambs. Also, Johnson (1987) found that the higher post-weaning average daily gain leads to reach puberty earlier as well as first parturition. In addition, Simpson et al. (1991) stated that there is a complementary relationship between average daily gain and puberty. Animals had great average daily gain reach puberty faster than those with low average daily gain. Moreover, Chelikani et al. (2003) revealed that about 96% of the variation in attaining puberty is due to pre-pubertal body weight and average daily gain. Shirley et al. (2001) reported that heavier ewes produce more growth hormone (GH) which attained puberty earlier than ewes with lighter weight. EI-Saidy et al. (2008) suggested that ewe lambs with fast growing rates exhibited their first estrus and the most

likely to conceive at a younger age than ewe lambs with slow growing rates.

The concentration of blood progesterone in the current study was not significantly different among ewe lambs growing groups. In contrast, Khalifa et al. (2013) studied the productive and reproductive performance of Rahmani ewe lambs fed two different rations, the progesterone levels showed significant ($P<0.05$) difference in their mean (1.53 and 1.89 ng/ml). The ewe lambs with a high progesterone level had a high energy ration, which improved the average daily gain and reached puberty faster. Generally, Minton et al. (1991) and Chagas e Silva et al. (2003) observed that ewe lambs are considered pubertal upon the sustained rise in progesterone concentration above 1.0 ng/ml over two sequential blood collections. They suggested that progesterone level >1.0 ng/ml is indicative of luteal function.

CONCLUSION

Therefor from the present results it could be concluded that the pre-pubertal growth rate of ewe lambs is one of the most influential factors affecting the development of puberty characteristics. So, sheep breeders must select ewe lambs that have fast growth rates which are eligible to reach puberty at an early age, and then start the production stage early and improve reproductive efficiency to achieve the economic return of ewes.

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تأثير معدل النمو قبل البلوغ على خصائص البلوغ للحوليات السوهاجى

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أجرى هذا البحث بهدف دراسة تأثير معدل النمو قبل البلوغ على خصائص البلوغ للحوليات السوهاجي. تم تقسيم عدد ثلاثين حولية سوهاجي بعمر 6-7 أشهر إلى ثلاث مجموعات متساوية (10 لكل مجموعة) تبعاً لمعدل نموها السابق منذ الولادة وحتى عمر 6 أشهر ، وتم تمييز المجموعات بأنها سريعة ومتوسطة ومنخفضة النمو. تم إيواء جميع المجموعات في حظائر مغلقة مع إمكانية الوصول إلى منطقة مفتوحة وحصلت على متطلباتها الغذائية اعتمادًا على مرحلة نموها. أظهرت النتائج أن خصائص البلوغ للحوليات السوهاجي عند البلوغ تأثرت معنويا ($P<0.05$)بمعدل النمو قبل البلوغ. وصلت الحوليات إلى سن البلوغ في المجموعة سريعة النمو عند عمر 235 يوم في المتوسط تلاها الحوليات في مجموعة النمو المتوسطة والمنخفضة (242,6 و 269,4 يوم على التوالي). كما كانت الحوليات في المجموعة سريعة النمو هى الأثقل وزناً عند البلوغ عن الحوليات في المجموعة المتوسطة والمنخفضة النمو (26,4 مقابل 23,7 و 22,4 كجم على التوالي). لم يكن هناك اختلاف معنوية في تركيز هرمون البروجسترون في الدم بين مجموعات الحوليات (1,419 ± 0.04 نانوغرام / مل في المتوسط ، تراوحت من 1,203 إلى 1,737 نانوغرام / مل) ، ولكن الحوليات ذات النمو السريع قبل البلوغ تصل إلى سن البلوغ في وقت مبكر عن تلك التي لديها نمو بطيء . في الختام ، أظهرت نتائج الدراسة المقدمة أن معدل نمو الحوليات قبل البلوغ من أكثر العوامل المؤثرة في تطور خصائص البلوغ.