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Effect of Rearing Systems on Growth Performance and Wool Characteristics of Rahmani Sheep Lambs

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ABSTRACT

This study was conducted to evaluate the intensive and rural (non-intensive) rearing conditions effect on growing lambs' performance and wool characteristics of Rahmany sheep. A total of 40 lambs at the age of one year were used from intensive and rural rearing systems (20 lamb each, of equal male and female number). The folk of intensive system was housed at a governmental station located in El-Serw, Damietta city, Egypt. The rural folk was owned by householder located in the same area of the city. The wool sample represents the first shearing harvested from the northern shoulder area of the lambs and used to investigate some wool measurements. The studied rearing systems showed no significant differences found for lambs' birth weights, while, the intensive rearing system enhanced significantly lambs' daily weight gain. Lambs weights at one year aged and the total weight gain in the intensive system were significantly higher than rural system lambs. The rearing system insignificantly affected the lambs' fibre length growth, but affected significantly the clean wool yield, fibre diameter and crimp/cm of lambs. The rearing system affected significantly the lambs' staple strength, point of break and elongation rate, while no effect on staple length was detected.

Keywords: *rearing systems, lamb performance, wool traits, Rahmani sheep*

INTRODUCTION

Rahmani sheep is well known as one of the most important mutton breed among Egyptian sheep breeds that have brown color, large bodies, fatty tail, high relatively twinning rate and produce coarse/carpet wool (Radwan and Shalaby 2017). However, from the farmer side of view sheep as compared to large ruminants are ease management, have short production cycle and are more adaptable to harsh environmental climates. Regarding the economic point of view, sheep have low in investment capital, feed requirements and risk for mortality. Therefore, it could be considered as important activity and ideally suited to production by small and marginal holders in developing countries. Additionally, it serves as employment and a source of income generation to rural people (Offor *et al*., 2018).

Generally, it is difficult for sheep householders to provide the appropriate management conditions during the various stages of sheep production cycle, specially the lamb rearing period until maturity. Certainly that cause direct and indirect force on farmers to rely early marketing of their lambs (Metawi *et al*., 2019).

The evaluating of rearing systems on growing lambs depends mostly on the lambs growth weight and daily gain. Such indicators are not the only sufficient evidences to assess the impact of these systems and more bio-indicators are required. In this respect, Patkowska-Sokoła *et al.* (2009) cleared that the animal hair is considered a good bio-indicator of the state of the environment even better than urine, blood or animal milk. Since wool parameters could reflect the genetic, nutritional, or managemental cumulative effects.

The genetics, environment and management strategies are major factors influencing wool quality and quantity (Khan *et al*., 2012 and Nolan *et al*., 2014). Wool production and quality are also influenced by the sex and age of animals and ewe reproduction state (Khan *et al*., 2012 and Scobie *et al*., 2015). Moreover, the role of proper nutrition reflected in energy-rich and protein supplement are of the main factors affecting the wool production (Nguyen, 2018 and Wyrostek *et al*., 2019).

It is important to mention that studies simultaneously wool traits of lambs as response to rearing systems remain scarce. In the same time the different between intensive and rural rearing systems is needed to more studies. Therefore, the main objective of present study is comparing growth performance and wool traits attributes between intensive and rural production systems of Rahmani sheep lambs.

MATERIALS AND METHODS

A total of 40 Rhmani sheep lambs at age of one year old were used from intensive and rural (non-intensive) rearing systems (20 lamb each, of equal male and female number). The folk of intensive system was housed at a governmental station located in El-Serw, Damietta city, Egypt (31°14'36.0"N 31°47'50.0"E). It should be mentioned that the intensive system refer to accelerated mating system (three mating seasons every two years), while, the rural folk is a once-per year (annual) lambing system. The rural folk was owned by householders located in the same area of the city. The both folks were housed in semi-open sheds.

In the intensive system, animal nutritional requirements were determined and adjusted by animal nutritionist. In winter, animals fed concentrate feed mixture and *ad. Libitum* Berseem hay (*Trifolium alexandrinum*). In summer and autumn seasons, the animals were fed on pelleted concentrate feed mixture, in addition to hay, or by feeding stubble or green fodder if available. Allowances feed were offered twice daily at 7 am and 4 pm. Drinking water was available three times during summer and twice daily during winter. At intensive system, the mineralized salt blocks were available to all animals. Moreover, its animals were subjected to the routine vaccination program against infection diseases.

While, in the rural (non-intensive) system, the animals feeding regime varies around the year depends on the availability of green fodder. During the summer, concentrate feeding is common due to that green feed is scarce. Farmers supplement the late pregnancy and lactation ewes with small amount of pelleted concentrate mixture. Drinking water was available *ad. Libitum*. In both rearing systems, new born lambs were identified and their type of birth, sex and pedigree were recorded. Lambs were weaned at approximately eight weeks of age.

The wool sample (about 200 g) represents the first shearing harvested from the northern shoulder area of the lambs at age of year of both rearing systems. The studied lambs growth performance traits were birth weight (BW), daily gain (DG), year weight (YW) and total gain (TG). While the studied wool quality traits described in details by Holman and Malau-Aduli (2012). The studied wool traits

were; 1) clean wool yield (WY); 2) fibre characteristics (fibre length (FL), fibre dimeter (FD) and crimp/cm (Cr/cm)), and 3) saple characteristics (staple length (SL), staple strength (SS), point of staple break (POB) and elongation rate of staple (ELR)).

Statistical analysis was performed by the least squares method using the T-test of the statistical analysis system computational program SAS (2014) to test the differences of studied growth and wool traits between the two rearing systems.

RESULTS AND DISCUSSION

Results

Data accentuate in Table (1) showed that no significant differences were found for lambs birth weight between the studied rearing systems. While, results cleared that the intensive rearing system enhanced significantly ($p<0.05$) lambs' daily weight gain compared with rural (non-intensive) system (100 g/d and 96.38 g/d, respectively). Consequently, lambs weights at age of year in the intensive system were significantly higher (40.16 kg) than rural system lambs (38.78 kg). Dependably, at the end of the first year of lambs' age, the lambs in intensive system gained significantly higher weight than rural system lambs (36.50 kg and 35.18 kg, respectively). However, despite of the significant effect of the intensive system on the yearly lambs' weight the rural system did not adversely affect the lambs' growth performance.

Table 1. Effect of intensive and rural (non-intensive) rearing systems on growth performance of growing Rahmani sheep lambs.

	Intensive system	Rural system	±SEM
BW, kg	3.660	3.595	0.032
DG, g/d	100.0^{a}	96.38^{b}	0.683
YW, kg	40.16^{a}	38.78^{b}	0.252
TG, kg	36.50^{a}	35.18^{b}	0.249

Birth weight (BW), daily gain (DG), year weight (YW) and total gain (TG)
a-b: Means in the same row with different superscripts are significantly different at p<0.05.

The effects of examined two rearing systems on the clean wool yield and fibre characteristics are presented in Table (2). Results observed that the clean wool yield of intensive system was significantly ($p<0.05$) higher than the rural system by about 15.85% (Fig. 1). Whereas, insignificant difference was observed in the fibre length between the studied rearing systems (13.74 cm and 13.73 cm for intensive and rural systems, respectively). On the other hand, the fibre diameters of the rural system were significantly ($p<0.05$) higher than the intensive system by about 25.93% (Fig. 1). Conversely, the crimp/cm of the intensive system was significantly higher by about 23.47% than the rural system lambs. Generally, results showed that the rural system insignificantly affected the lambs' fibre length growth, but affected significantly the clean wool yield, fibre diameter and crimp/cm.

Table (3) showed the effect of the two rearing systems on staple characteristics. No significant differences were found for staple length between the studied rearing systems Table (3). While, staple strength of intensive system was significantly higher than rural system by about 42.60 % (Fig. 2). Moreover, the point of staple break positioned significantly closer ($p<0.05$) to middle of the staple in intensive system than rural system by about 18.41 %. Clearly, the staple elongation rate was also significantly ($p<0.05$) increased in intensive system by about 31.25 % (Fig. 2). So the rearing system affected significantly the most lambs' staple characteristics except the staple length.

Table 2. Effect of intensive and rural (non-intensive) rearing systems on clean wool yield and fibre characteristics of growing Rahmani sheep lambs.

	Intensive system	Rural system	±SEM
WY, %	62.27^{a}	52.40^{b}	0.759
FL, cm	13.74	13.73	0.116
FD, µm	17.00^{b}	22.95^{a}	0.102
Cr/cm	0.916^{a}	0.701^{b}	0.010

Clean wool yield (WY), fibre length (FL), fibre dimeter (FD) and crimp/cm (Cr/cm)
a-b: Means in the same row with different superscripts are significantly different at p<0.05.

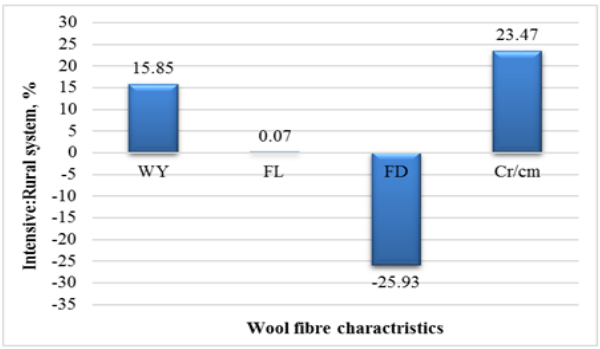

Figure 1. The percentages of differences in clean wool yield (WY), fibre length (FL), fibre diameter (FD) and crimp/cm (Cr/cm) of growing Rahmani lambs under the intensive and rural (non-intensive) rearing systems.

Table 3. Effect of intensive and rural (non-intensive) rearing system on staple characteristics of growing Rahmani sheep.

	Intensive system	Rural system	±SEM
SL, cm	13.16	13.08	0.107
SS, (N/Ktex)	56.74^{a}	32.57^{b}	0.857
POB, (%)	49.93^{b}	59.12^{a}	0.240
ELR, (%)	24.99^{a}	17.18^{b}	0.277

Staple length (SL), staple strength (SS), point of staple break (POB) and elongation rate of staple (ELR)
a-b: Means in the same row with different superscripts are significantly different at p<0.05.

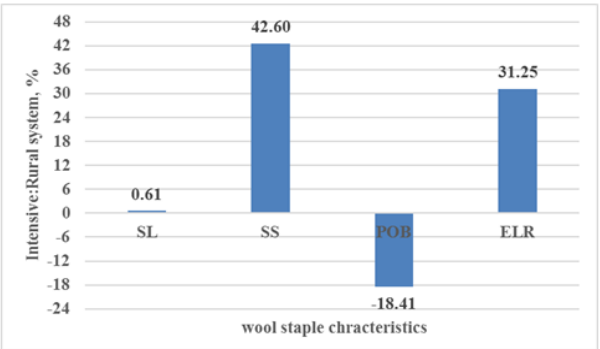

Figure 2. The percentages of differences in staple length (SL), staple strength (SS), point of staple break (POB) and elongation rate of staple (ELR) of growing Rahmani lambs under the intensive and rural (non-intensive) rearing systems.

Discussion

It is well known that the effects of production systems on lambs start from the effect on dams during pregnancy, then on dams with lambs during suckling period and on the lambs after weaning. Therefore, the effect of different production systems reflected on the birth weights and daily weight gain of the growing period. This means that live weight plays an important role in determining several characteristics of the farm animals (Sarikonda *et al*., 2019), as well the average daily weight gain effect the production systems and then the profitability (Mohammadi *et al*., 2013). This fact could be observed from the results obtained herein, since revealed that the rearing systems affected significantly the growth performance of lambs. The lambs' weights of the intensive system were significantly higher than the rural system at similar ages. These differences in yearly final live weights might be explained by the available nutrient sources depending on the rearing system. Supporting the current results, various studies on sheep production systems (Ekiz *et al*., 2013 and Yalcintan *et al*., 2017) reported that the feeding system and husbandry conditions may affect lamb growth performance. Likewise, Sarikonda *et al*. (2019) showed that the differences in the sheep body weight and measurement may be due to variation in feeding, environment and management conditions.

Thus, the improvements obtained herein in the lambs' growth performances of intensive system than rural system are expected to be reflected on the further better productive and reproductive traits of these animals. In addition, the higher growth performance of lambs is a desirable trait of economic importance in sheep, and helps in early selection of lambs. In this aspect, Gabr *et al*. (2016) cleared that the lambs' growth rate affected significantly its further productivity and reproductively traits. Moreover, Csizmar *et al* (2013) illustrated that lambs birth weights are an early measurable trait which has a positive genetic correlation with further live weights.

Results obtained indicate that intensive management strategies resulted in high significant clean wool yield and fines fibres of examined lambs. Normally, the clean fleece weight refers to the fibrous content of wool and attracts high price premiums (Holman and Malau-Aduli 2012). Wool fibres are primarily composed of proteins (Plowman, 2003), hence it is possible that with increasing of protein-rich sources, there was a corresponding increase in nutrient partitioning towards wool fibre synthesis, hence the observed increase in clean fleece weight (Holman and Malau-Aduli 2014). Moreover, current differences detected in clean wool yield between the rearing systems, could be due to that lambs were not exposed to wool contaminants (such as vegetable matter and dust) which are known to decrease clean fleece weight (Holman and Malau-Aduli, 2012).

The surrounding climatic conditions, as previously identified, were found to affect some wool traits of growing lambs. No doubt that the differences between the two examined rearing systems in housing, management and feeding conditions explain obtained results. In this respect, Abdel Aal (2018) and Taha *et al*. (2018) stated those fibre diameters were affected significantly by the surrounded temperature that Barki sheep were exposed to. Additionally, the forage to concentrate ratio, protein sources and dry mater intake among the dietary treatments reported to cause significant differences in wool quality traits (Nguyen *et al*., 2018).

The intensive rearing system could be shifted to control lamb wool staple strength, point of break and elongation rate. Generally, Holman and Malau-Aduli (2012) revealed that the staple break point is mainly depending on staple strength. Additionally, the majority of variations in staple strength were thought to be based on differences in fibres stretching ability, moreover, the finer fibres have more flexibility than the coarser fibres (Holman and Malau-Aduli, 2012). On the other hand, Taha *et al*. (2018) showed that in Barki sheep the staple elongation rate increased significantly when the point of break was closer to the middle of staple. Moreover, Abdel Aal (2018) reported that the almost central staple point of break and the higher elongation rate may be attributed to the fibre diameter and higher crimps frequency recorded. However, moderate to high correlations between fibre diameter and other wool quality traits were detected (Malau-Aduli *et al*., 2019).

CONCLUSION

It is clear that the rearing system affected significantly the growth performance and some wool characteristics of sheep lambs from the starting point of their life. Some stations related to the Animal Production Research Institute distributed in different places to be as effective extensions for traditional livestock householders. It is important to examine the performance of these stations as intensive rearing system with the surrounding rural (non-intensive) systems. The present results showed that intensive production system reflected significant enhancement in lambs' growth and some wool traits. Generally, the present study revealed that lamb wool traits besides growth performance could be considered as very important bio-indicator to determine the impact of rearing systems.

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تأثير نظم التنشئة على أداء النمو وخصائص الصوف في حملان الأغنام الرحماني

فايق حسني فراج ، عمرو أحمد عبد الرازق جبر و سارة عبد الحميد مصطفى سعد

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قد تمت هذه الدراسة لتقييم أثر النظام المكثف والنظام القروي في تنشئة الحملان النامية من خلال معدلات النمو وخصائص الصوف في سلالة الاغنام الرحماني. تمت الدراسة على عدد 40 حمل عمر عام (20 حمل من كل نظام يشمل عدد متساوي من الذكور والاناث). كان القطيع تحت نظام التنشئة المكثف هو قطيع تابع لمحطة بحوث الانتاج الحيواني بالسرو ، مدينة دمياط ، مصر. وكان القطيع تحت نظام التنشئة القروي تابع لأحد صغار المربين في المنطقة المحيطة بقطيع محطة البحوث. وكانت عينات الصوف المستخدمة في الدارسة تمثل الجزة الاولى في حياة الحملان وتم تجميعها من أعلى الكتف الأيسر في جميع الحملان. أوضحت نتائج الدارسة عدم وجود فارق معنوي بين حملان كلاً من نظامي التنشئة في الوزن عند الميلاد، بينما أدى نظام التنشئة المكثف لتحسن معنوي في معدل النمو اليومي للحملان. كما أظهرت النتائج أن نظام التنشئة المكثف أدى لحدوث زيادة معنوية في الوزن النهائي للحملان عند عمر عام وكذلك وزن الجسم الكلي المكتسب. اما بالنسبة للتأثر على صفات الصوف، اظهرت الدراسة انه لم يؤثر نظام التنشئة بشكل معنوي على طول الياف الصوف ولكن أثر معنوياً على وزن الصوف النظيف وقطر الالياف والتواءات الألياف في صوف الحملان عند عمر عام. كما أشارت النتائج إلى أن نظام التنشئة أثر معنوياً على قوة شد خصلة الياف الصوف ونقطة القطع ومعدل الاستطالة ، ولكن لم يؤثر نظام التنشئة على طول خصلة الصوف في الحملان. وكان النظام المكثف في تنشئة الحملان أظهر تحسناً ملحوظاً في خصائص الصوف قيد الدراسة في حملان الاغنام الرحماني. بشكل عام يمكن أن يستخلص أنه من الأهمية دراسة ومقارنة اداء النظام القروي في تنشئة الحملان بالمناطق المحيطة بمحطات بحوث الانتاج الحيواني والتي تعد نماذج إرشادية لتحسين نظم التنشئة ومستويات الإنتاج. بالاضافة إلى أنه دراسة صفات الصوف للحملان عند عمر عام يمكن أن تعد مؤشراً بيولوجي هاماً في تقييم اثر نظام التنشئة على الحملان النامية ، إلى جانب صفات النمو والزيادة في وزن الحملان.