Role of Sex Chromatin on performance in the Arabi sheep

Salim Omar Raoof[1]; Dlpak Birkhader[1]; Sirod Sami Yahya[1] and Younis Ahmad Sheakh Mohamad[2]

[1]Animal Resource, College of Agriculture, Salahaddin University, [2]General Directory of Veterinary and animal wealth, Erbil, Iraq.

E-mail: Salmomarraoof@yahoo.com

Received: 26/1/2016

Accepted: 30/5/2016

Summary

This study was conducted on 122 Arabi sheep belonging to private flock in Erbil plain Kurdistan region- Iraq, from July/ 2014 to August/ 2015 for studying the role of sex chromatin on daily milk production, total milk production, lactation period, fertility rate, prolificacy, birth weight and fertilized estrous sequences. The repeatability for the studied traits were estimated. The ratio of sex chromatin shapes drum stick, sessile nodule, tear drop and small club were 23.37%, 60.22%, 8.54% and 7.87% respectively. The overall means of daily milk production, total milk production, lactation period, birth weight, fertilize estrous sequences, fertility rate, and Prolificacy were 814.65 g 81.49 kg 103.53 day, 78.10%, 1.60, 3.84 kg and 1.50 respectively. Sex chromatin shapes had significant ($P<0.05$) effect on all traits studied. The results revealed that the estimation of the Repeatability coefficient for daily milk production was 0.42. It was concluded from this study that production traits (milk production and birth weight) and reproduction (fertility rate, prolificacy and fertilize estrous sequences) and performance of Arabi sheep were significantly affected by the shapes and percentage of sex chromatin distribution and measurements. The sex chromatin shapes could be used as a tool for early selection of the elite individuals.

Keywords: Arabi sheep, Sex chromatin shapes, Milk production and Repeatability.

Introduction

Arabi sheep are found in the southern of Iraq, and comprise about 18-20 percent of the sheep population. Arabi sheep which is the smallest of the native breeds, has a small fat tail and semi-pendulous ears of medium size. This breed is usually black, pied or white with a black head. The males are horned and the females are hornless (polled). They are also hardy and well adapted to travelling and grazing (1). The animal breeders adopt the programs that raise the animal's productivity through improved genotypes, but a long time is required for these programs in sheep up to 4.5 years. Therefore breeders follow other methods to reach the goal in shortest possible time, and those methods use early selection for the animals at early age to improve the economic traits (2). The discovery of present chromosomal material in some body cells of female and absence in male gave the ability of using such trait in the election which is named as bar body or sex chromatin (3). The presence of sex chromatin in a variety of body cells and neutrophils as drum stick shapes help and explain that the potential application can be given by studying the changes of chromosomal material (4). The changes in shapes and dimension of chromosomal material in nucleus of many body cells for mammal females led the researchers to make relation between these changes and reproductive traits in sheep (5). Sex chromatin can use in diagnosing major x-related reproductive abnormalities and stunted growth in the animal industry which has contributed in the detection of reproductive anomalies and animal growth. Sex chromatin presented in the nucleus of somatic cells and in the nuclei of polymorph nuclear neutrophils, this helped for using the sex chromatin as a tool to detect the physiological and genetic disorders which can cause any defect in all body organs (6). Repeatability estimate is considered as the upper limit of heritability because it contains the permanent environment effects in addition to genetic and phenotypic variances (7).

The purpose of this work is to study the role of sex chromatin shapes in Arabi sheep on the daily milk production, total milk production, lactation period, fertility rate, prolificacy, birth weight (kg), fertilize estrous sequences and repeatability of the daily milk production were studied in Arabi sheep.

Materials and Methods

One hundred twenty two Arabi ewes were assigned at the private flocks at Erbil plain from period July/ 2014 to August/ 2015. (The ewe's age was between 2-5 years). Two weeks before mating and during the mating period, ewes fed 300 g/day of a 14% crude protein concentrate mixture. The ewes were grazing on natural vegetation, green barley, residual wheat and barley after the harvest. Four weeks prior to the lambing and during lambing season ewes received 750 g/day of concentrate and 500 g/day of straw plus grazing. The ewes were weighted within 24 hours of lambing. The lambs were ear tagged and weighed at birth. Lambs were sucked their mothers until weaned at approximately 90 days of age, during sucking period the lambs were supplemented by increasing daily amounts of a concentrate mixture, by weaning milk production measurements commenced in the 4^{th} week after lambing. Blood samples were collected by using heparinized tube to avoid blood clotting, then blood smear prepared and examined for proper identification. A drop of the whole blood was dropped in a clean glass slide by using a Pasteur pipette and a smear made. Two slides were made from each sample and allowed to dry. The slides were stained with leishman stain for (3-5) minute after that washed with distilled water and then air dried. The slides were examined under the microscope at magnification of 100 x objectives by using oil immersion. The polymorph nuclear neutrophils were examined; four sex chromatin shapes were noticed of different shapes (drum stick, sessile nodule, tear drop and small club shapes). They were counted in (100) polymorph nuclear leucocytes.

Fertility: Is the percent ewes lambing of ewes available for matting period.

Fertility= No. of ewes lambing/ No. of ewes exposed to rams×100.

Prolificacy= No. of lambs born/ No. of ewes lambing ×100.

Repeatability estimate was obtained as follows = $\sigma^2 d$ / $\sigma^2 d + \sigma^2 e$

Repeatability was estimated for daily milk yield.

$\sigma^2 d$= Variance component of dam

$\sigma^2 e$ = Residual error term.

A (General Linear Model) GLM used for the statistical analysis of the data. Duncan multiple range test (8) was performed for the mean differences comparisons. A procedure of the statistical analysis system (9) was used according to the following linear additive model:

Yijk = μ +Si + eijk

yijklm is the value of any observation in the study.

μ: Overall mean

Si: Effect of i^{th} Sex chromatin shapes

i =drum stick, sessile nodule, tear drop and small club.

eijk: Random error associated with the ijk the observation assumed to be NID.(0,$\sigma^2 e$).

Chi-square test was used to significant compare between percentages in this study.

Results and Discussion

Table (1) shows the presence of four different shapes of sex chromatin in Arabi sheep. The overall mean of sex chromatin shapes are drum stick, sessile nodule, tear drops and small club were 23.37%, 60.22%, 8.54% and 7.87% respectively. The highest number of sex chromatin shapes appeared as sessile nodule and the lowest number was as small club shape. This result is in agreement with other (4) in native ewes and in local Awassi sheep (10) and in contrast with other studies (11) in local sheep. In human and other animal species it was observed that drum stick take the highest number of sex chromatin. This result may be due to the different species, health, type of breeding and mating (12 and 13). (Table, 2) explains the overall mean of DMP, TMP and LP were about 814.65 g, 81.49 kg and 103.53 days, respectively.

The significant highest amount ($P<0.01$) of daily milk production appeared in sheep with drum stick shape of sex chromatin to about 911.67g/day. This result is in agreement with other finding in local sheep (11), in Awassi Turkish sheep (14), in native ewes (10) and in black goat (15) while the lowest amount of daily milk production was seen in animals with small club shape in about 734.38 g/day. This result is in agreement with the results of others in local sheep (11), in Awassi Turkish sheep (14) and in black goat (15) and disagrees with (10) who proved that the lowest amount of daily milk production is appeared in animals with tear drops sex chromatin shape in Awassi ewes. For total milk production, the highest level was seen in sheep with drum stick sex chromatin 94.76 kg. This result is in agreement with the results obtained by (10) in native ewes, (4) who indicated that drum stick

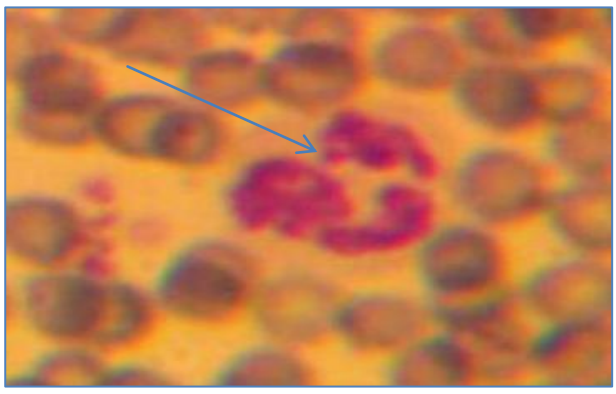
induced significant highly amount of total milk production in local Awassi ewes and (15) in black goat. While the lowest total milk production was seen in small club shapes 74.94 kg. The same result obtained by (4) in local Awaasi sheep and (15) in black goat and the opposite result obtained by (10) who indicated that the lowest amount of total milk production is seen in ewes with tear drops of sex chromatin shape, also in other study by (14) indicated that sex chromatin shapes did not cause any significant changes in total milk production and lactation period in Awassi Turkish sheep. In the same table the longest period of lactation appeared in sheep with sessile nodule shape of sex chromatin reached to about 113.89 days and significantly difference (P<0.05) from the other shapes, and the shorter lactation period was in ewes with small club shape (98.75 days), this result is not in compatible with the result of (4) who indicated that lactation period was significantly (P<0.05) increase in animals with drum stick shape (126.46 days) and decreased in small club shape (103.26 days).

Table, 1. Distribution of sample study according to Sex chromatin shapes

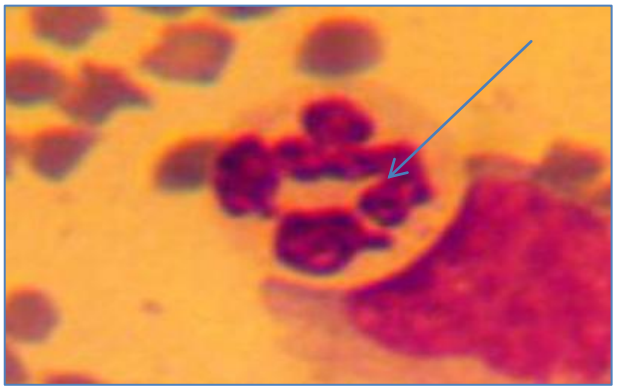
	Sex chromatin shapes	No. Observation	%
1	Drum stick	104	23.37
2	Sessile nodule	268	60.22
3	Tear drop	38	8.54
4	Small club	35	7.87
Total	----------	445	%100
----	Chi-square -χ^2	___	12.407 **

**(P<0.01).

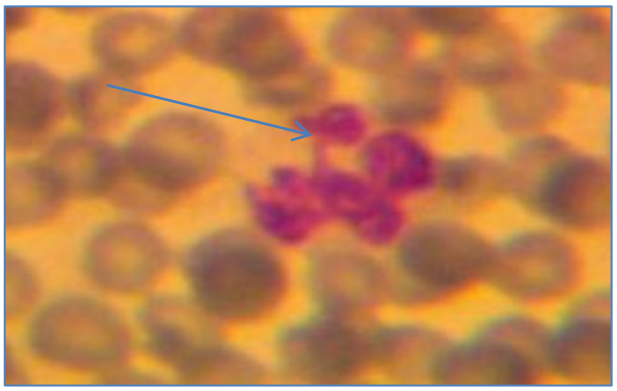
Figure (1-4) Show the sex-chromatin shapes in polymorph nuclear leucocyte of sheep.



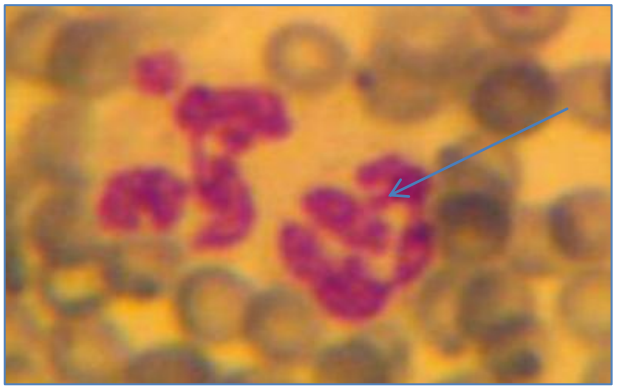
Figure, 1: Drum stick (1000x).



Figure, 2: Sessile nodule (1000 x)



Figure, 3: Small club shape (1000 x)



Figure, 4: Tear drop shape (1000 x).

Table (3) showed that sex chromatin shapes affected significantly (P<0.05) on fertility rate and prolificacy in Arabi sheep with overall mean about 78.10% and 1.60 respectively. The fertility rate is significantly (P<0.05) raised in sheep with both sessile nodule and drum stick shapes of sex chromatin 81.93 and 81.11 respectively. While the fertility rate is decreased in both fertility rate and prolificacy in Arabi sheep with overall mean about 78.10 and 1.60, respectively. The fertility rate is significantly (P<0.05) raised in sheep with both sessile nodule and drum stick shapes of sex chromatin 81.93 and 81.11, respectively. While the fertility rate is decreased in both sex chromatin shapes tear drop 75.95 and small club 74.09.

This result is agree with the result obtained by (15) in black goat and not agree with (4) and (14) who stated that sessile nodule sex chromatin increased significantly the fertility rate as compared with other three shapes (drum stick, tear drop and small club) which did not caused significant change in fertility rate in local Awassi sheep and Turkish Awassi sheep, respectively. In the same table, prolificacy significantly (P<0.05) elevated in sheep with drum stick and sessile nodule to about 1.94 and 1.93 respectively, but the lowest Prolificacy level founded in sheep with sex chromatin shapes of tear drop 1.34 and small club 1.21.The same result obtained by (15) in black goat, while (4) Indicated that sessile nodule sex chromatin shape raised the prolificacy ratio significantly in Turkish Awassi sheep while the other three shapes drum stick, tear drop and small club were not caused significant changes. Table (4) indicated that sex chromatin shape caused significant effect (P<0.05) in birth weight and fertilizes estrous sequences with overall mean 3.84 (kg) and 1.50 (Times/season) respectively. Drum stick and sessile nodule sex chromatin gave a significant positive birth weight about 4.06 and 4.04 kg respectively, conversely tear drop and small club caused negative birth weight in sheep with 3.65 and 3.63 kg, respectively.

Table, 2: Effect of Sex chromatin shapes in milk production.

Source of variation	No. Observation	Daily milk production (g)	Total milk production (kg)	Lactation period (day)
Overall mean	445	814.65±1.21	81.49±0.96	103.53±0.49
Sex chromatin shapes		**	*	*
Drum stick	104	911.67±1.42a	94.767 ±0.67a	104.67±0.40b
Sessile nodule	268	855.56±1.33ab	77.06±1.02b	113.89±0.80a
Tear drop	38	757.89 ±1.05b	75.79± 1.14b	100.00±0.38b
Small club	35	734.38 ±1.03b	74.94± 1.02b	98.75± 0.39b

All means within a particular subclass differ significant except those follow by the same letter. *(P<0.05) ** (P<0.01)

Table, 3: Effect of sex chromatin shapes on fertility and prolificacy.

Source of variation	No. observation	Fertility %	Prolificacy
Overall mean	445	78.10±0.18	1.60±0.13
Sex chromatin shapes		*	*
Drum stick	104	81.11± 0.19a	1.94 ± 0.15a
Sessile nodule	268	81.93± 0.19a	1.93 ± 0.15a
Tear drop	38	75.95± 0.17b	1.34 ± 0.11b
Small club	35	74.09± 0.17b	1.21 ±0.12b

All means within a particular subclass differ significant except those follow by the same letter. * (P<0.05)

The same result appeared in black goat by (15). Other result obtained by (11) proved that sex chromatin shapes did not cause any significant changes in birth weight of Turkish Awassi sheep but animals with small club sex chromatin recorded the highest birth weigh 4.44 kg. In the same table, the fertilizes estrous sequences trait was studied, the significant positive results appeared in sheep with drum stick and sessile nodule sex chromatin by (2.00) fertilize estrous Sequences, while the negative effect appeared in sheep with tear drop and small club sex chromatin shapes (1.0) fertilize estrous sequence. This result is in the opposite of the results obtained by (15) in black goat whom indicated that the significant highest fertilize estrous sequences times appeared in goat with tear drop and small club sex chromatin shapes and the lowest estrous fertilize sequences times appeared in drum stick and sessile nodule sex chromatin shapes.

Table, 4: Effect of sex chromatin shapes on birth weight (kg) and fertilizes estrous sequences.

Source of variation	No. Observation	Birth weight (kg)	Fertilize estrous sequences Times/season
Overall mean	445	3.84±0.42	1.50±0.20
Sex chromatin shapes		*	*
Drum stick	104	4.06±0.45a	2.00±0.22 a
Sessile nodule	268	4.04±0.42a	2.00±0.21 a
Tear drop	38	3.65±0.38b	1.00±0.18b
Small club	35	3.633±0.38b	1.00±0.18 b

All means within a particular subclass differ significant except those follow by the same letter. *(P<0.05)

Repeatability trait is the proportion of the phenotypic variance due to all genetic effects

and permanent environmental effects. It is an indicator of effectiveness of selection on early lactations. Repeatability estimates for daily milk production 0.42. (15) reported a repeatability of 0.38 for daily milk production in black goat; also (16) reported a repeatability of 0.46 for daily milk production in Improved Awassi. While a high repeatability coefficient does not mean that the animal will demonstrate the same performance in the next productive seasons; it can predict the subsequent performance of the animal under stable environmental conditions (17). In conclusion, the Sex chromatin shapes had significant effect on all of the traits studied. The results of this study indicated that sex chromatin shapes in blood of sheep are not the same, and have a great role and statistical effect on some of blood characters and fertility rate. The high estimates of repeatability in this study means that one can cull poor producing individuals on the basis of their first record. It was concluded from this study that prediction of production (milk production and BW) and reproduction (fertility rate, prolificacy and fertilize estrous sequences) performance for Arabi sheep from shapes and percentage of sex chromatin distribution and measurements. The sex chromatin shapes helped in early selection of the elite Arabi sheep on the linkage between sex chromatin shapes and performance production.

Acknowledgments: We would like to thanks Mr. Snjawi Arab and Mr. Dana Makdeed Internal laboratory Erbil teaching hospital-Kurdistan region/ Iraq.

References

1. Juma, K.H. and Alkass, J.E. (2000). Sheep in Iraq. The Arab center for the studies of arid zones and dry lands. Syrian Arab Republic.
2. Jalal, S. and Karam, H. (2003). Animal Breeding. 6th Ed., Anglo library, Cairo, Egypt.
3. Reddy, P. L. (2009). Human physiology for dental student. 1st Ed. Pp:47.
4. Al-Issawi A. H.; Al-Rabiye, H.M.A. and Al-Anbari, N. N. (2013). Study of sex chromatin traits and it's relation with production and reproduction performance in local Awassi sheep. J. Babylon Uni., 21(4). (Arabic)
5. Pillary, V. V. (2010). Textbook of Forensic Medicine and Toxicology. 5th Ed. Published by Divyesharviind Kothary for Paras Medical Publisher. Pp:57.
6. Geetha, N. (2009). Text book of physiology for dental student. 1st Ed. Published by Divyesharvind Kothary for paras medical publisher. Pp:45-260.
7. Lush, J.L. (1945). Animal Breeding plans, low a state college press, Ames, Lowa.
8. Duncan, D. B. (1955). Multiple Range Test. Biometrics. 11:1-42.
9. SAS (2012). Statistical Analysis System. Users Guide for Personal Computers, Version 8.2, SAS. Institute Inc, Cary, NC. USA.
10. Kadhim, A. F. and Al –Dabbagh, F. A. (2014). Study some of growth traits and productive milk in the native ewes dependent on sex chromatin. Tikrit J. Agr. Sci., 14(3): 141-147. (Arabic)
11. Ameen, N.A. and Raoof, S.O. (2015). The effect of sex chromatin on some reproductive traits of local sheep in Erbil. Journal of Biotechnology Research Center. Al Nahrain. Baghdad. Univ. Iraq. 2(9):6-10.(Arabic)
12. Zakko, R. B. (1997). The shapes of sex chromatin in ewes and local sheep. Msc. thesis. College of Veterinary Medicine, Baghdad. University (Arabic).
13. Al Ghazi, M. K.A. (1999). The shapes of sex chromatin in some species of Iraqi chickens. Msc. thesis, Veterinary Medicine College, Baghdad University. (Arabic).
14. Al Anbari, N.N. and Al Khazragi, W. J. M. (2012). The Role of Sex Chromatin in performance of Turkish Awassi sheep. J. Vet. Sci., 5(1). (Arabic).
15. Raoof, S. O.; Yahya, S. S.; Birkhader, D. and Mohamad, Y. A. (2016). Role of sex chromatinon performance in the local (black) goats. J. Biotechnol. Res. Center. Al Nahrain. Baghdad Univ. Iraq. 10(1):53-57.
16. Gootwine, E.; Zenu, A.; Bor, A.; Yossafi, S.; Rosov, A. and Pollott, G. E. (2001). Genetic and economic analysis of introgressing the B allele of the FecB (Booroola) gene into Awassi and Assaf dairy breeds. Livest. Prod. Sci., 71:49-58.
17. Mourad, M. (2001). Estimation of repeatability of milk yield and reproductive traits of Alpine goats under an intensive system of production in Egypt. Small Rumin. Res., 42:1-4.

دور الكروماتين الجنسي على الأداء الأنتاجي للأغنام العرابية

سالم عمر رؤوف[1] و دلباك بيرخدر[1] و سرود سامي يحيى[1] و يونس احمد شيخ محمد[2]

[1]قسم الثروة الحيوانية، كلية الزراعة، جامعة صلاح الدين، [2] المديرية العامة للبيطرة والثروة الحيوانية، أربيل، العراق.

E-mail: Salmomarraoof@yahoo.com

الخلاصة

أجريت هذه الدراسة على الأغنام العرابية في سهل أربيل- أقليم كوردستان العراق من تموز، 2014 لغاية آب، 2015. تضمنت التجربة 122 نعجة بهدف دراسة دور الكروماتين الجنسي في إنتاج الحليب اليومي والكلي وطول موسم الحليب ونسبة الخصوبة والخصب ووزن الميلاد وتسلسل دورة الشبق في الأغنام العرابية. وقد قُدر المعامل التكراري للصفات المدروسة. بلغت النسب المئوية لعصا الطبال وبروز بدون ساق ودمعة العين والشكل الهراوي 23.37 و60.22 و8.54 و7.87% على التوالي، أما قيمها لإنتاج الحليب اليومي والكلي وطول موسم الحليب ونسبة الخصوبة والخصب ووزن الميلاد وتسلسل دورة الشبق فقد بلغت 814.65 غم و 81.49 كغم و 103.53 يوم و 78.10 % و 1.60 و3.84 كغم و 1.50على التوالي. تبين أن هنالك تأثير معنوي ($P<0.05$) لأشكال الكروماتين الجنسي في جميع الصفات المدروسة. وقد قُدرالمعامل التكراري لأنتاج الحليب اليومي 0.42. من خلال هذه الدراسة أستُنتج بأن الصفات الإنتاجية (انتاج الحليب ووزن الميلاد) والأداء التناسلي (نسبة الخصوبة والخصب وتسلسل دورة الشبق) للأغنام العرابية تأثرت وبشكل معنوي بإختلاف اشكال ونسب توزيع الكروماتين الجنسي. ومن الممكن استخدام اشكال الكروماتين الجنسي كأداة للإنتخاب المبكر للأفراد المتميزة.

الكلمات المفتاحية: الأغنام العرابية، أشكال الكروماتين الجنسي، انتاج الحليب والمعامل التكراري.