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RESEARCH ARTICLE

Genetic control of disease resistance between and within sheep breeds

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Manuscript Info *Abstract*

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This study was conducted to indicate the association among blood potassium with some physiological traits of Iraqi sheep breeds, its included198Awasi , 40 Arabi and 59 Karadi sheep besides fecal egg count for internal parasite were calculated. Blood potassium estimated by using of atomic absorption flame photometer. The results revealed the fallowing :1- Potassium level of Awssi, Arabi and Karadi sheep blood showed a bimodal distribution , the low potassium (LK) and the high potassium (HK) . 2-Arabi sheep recorded significantly more FEC than that in Awasi and Karradi in which 7410, 4313 and 3519 egg/feces respectively .3- Karadi (LK) sheep showed significantly higher FEC than that in LK Karradi sheep in which recorded 6360 and 3255 egg/feces respectively.

Generally this study proved that the FEC increase in the Ewes comparing with Rams in all different breeds, Although without getting a significant differences, the reason for such results because the females undergoing through a period of her life go through different stages of physiological condition such as pregnancy and births, which increasingly influential in the effort to increase the intensity of infection. Older animalshave lower FEC than younger animals, and the young sheep have less resistance to infection compared with the old sheep, as well as the case for females sheep in which they have less resistance when comparing with male sheep.

INTRODUCTION

Many worker has established the adverse effect of ambient temperature on production and reproduction in sheep [1,2,3]. It was also reported that stress is an immune-suppressive factor [4], because stress increases cortisol concentration, which in turn, reduce the response of the immune system [5,6,7,8]. Many studies [9, 10,11] revealed that lymphocytes and neutrophils are affected by different stressors, including diseases and heat; total number of neutrophils increases and that of lymphocytes decreases. Woodard et al. [12] showed that neutrophils deficiency, in sheep, has an adverse effect on the neutrophil activity. The total White Blood Cells (WBCs), and their differential count, is also reportedto be affected by age [9], by nutritional level [13] and by breed [14, 15].

Research results showed that immune response and resistance to stressors, in different animal species, are under the genetic control and that there is a sizable genetic variability for such traits and suggested the use of this trend to establish genetically resistant lines and breeds [16,17].And one of the most important genetic traits that can be studied in sheep is the level potassium concentration in the blood of sheep, which is started and explained by Evans 1954 [18], where Evans indicated the existence of two types of concentra-

tion in the blood of sheep which controlled genetically by a pair of alleles on a single gene, high-potassium level type (HK) homozygous recessive character and low potassium level (LK) and this homozygous dominant character while the heterozygous is form is the (LK).

After that the researches has continued to make sure this phenomenon where all showed the same results which showed by Evans, there are two types of potassium concentration level in the blood of sheep, the first type is a high-potassium and the second type is low potassium. And this trait is hereditary and all controlled by two alleles, the first allele is K^H a recessive allele and controlling the high level of potassium (HK), and the second one K^L which is a dominant allele, the high potassium concentration phenotype be only in homozygous recessive form (HKHK), and the low potassium which is a dominant trait and may be either homozygous (LKLK) or heterozygous (LKHK) form [19][20][21][22][23] , where this research open the door to the study of this trait in different parts of the world over the past half a century, has also been confirmed by Nihat[24] and Al-samarrae[25].

The researches of potassium concentration inheritance took another economic importance dimension and that is the variation in sheep production and reproduction, and also the variation in diseases resistance and some blood values according to potassium level which is genetically control.With regard to the relationship of potassium concentration level with diseases resistance Taneja[26] and Al-Samarrae[27] explained that HK sheep has in their blood more white blood cells than LK sheep, and suggested that this discrepancy shows the animal's ability to resist disease.Vanimisett[28] show the possibility of selective breeding of sheep on the basis of resistance to disease and infection, for example, Haemoncus Contortus.

The fact that one of the most important diseases affecting ruminants are gastrointestinal parasites, Raadsma[29]especially Haemoncus Contortus, and there is a relationship between some biochemical variables and parasitic affections of fourth stomach and intestine in sheep,Gray[30]said that the parasite worm infestation causes heavy uncontrollable losses in sheep production and need administrative procedures as well as the use of anti-worms in large quantities, taking into account the genetic improvement; for raising the self-resistance against began of early since 1970 in the United States and Europe, and particularly in Australia, where as a result of excessive use of antiparasitic drugs the parasites will developed stiff resistance against the drugs used which is one of most proliferation problems,Many studies were carried out to raise cattle and sheep self-resistant and now includes a large portion of livestock researches.

Woolaston[31] explained that the gastrointestinal parasites in general it cannot be classified significantly in their reproductive ability or in other words, cannotdecided that the animal affected or healthy depending on (FEC) Fecal Eggs Count,while in contrast to what Woolastonsaid;Nieuwoudt[32]didn't agree this opinion and explained that he could dependence on the number of parasite eggs in feces (FEC) and considered as an indicator of self-resistance against parasitic diseases, particularly Hemonchus worms.And to illustrate the difference in the number of eggs in the feces when inducing artificial infection among different sheep breed Vanimisetti[33]show that the nFEC in (DP) sheep breed was higher compared with the (KT) breed.And in a continuous work Vanimisetti[34] and through inducing artificial infection by a Hemonchus parasite in crossbred of sheep, they show that there is no fixed effect for the year or for the season of births on(FEC), and PCV rates, were ewes of one year old was less resistance than adult ewe but with a decrease of PCV ($p < 0.05$) and higher rates in t FEC ($p < 0.05$). During the time of infection PCV was inversely proportional comparing with FEC in ewes and lambs, the genetic equivalent ratetfor PCV was 0.39 ($p < 0.01$) and for EFC was 0.10 ($p < 0.05$) in lambs during the duration of the experiment . In ewes the genetic equivalent rate for PCV was 0.15 ($p < 0.05$) and for FEC was 0.31 ($p < 0.01$).While Carta and Scale[35] showed in their studies in New Zealand and Australia, that the resistance against gastrointestinal parasite hereditary controlled by a high genetic equivalent rate and this trait

be at the expense of the other higher productive traits where drops animals productivity with high parasite genetic resistance.

Material and Method:

Estimation of potassium in sheep bloodhad done by the method of direct analysis[36],[37]using of Atomic absorption flame photometer 10AL.FEC counting,done by use of Coles method[38].Animal's distribution was done according to the level of potassium" as expected" each one ofthe three breeds under study were divided to two groups, the first one was the high potassium group (HK), and the second one was the low potassium group (LK), as shown in table1.

Table 1:K level distribution within and between the breeds

Breed	Group according to K level	Mean±SE m.eq/L
Awasi	HK	34.16±0.48 A
	LK	11.08±0.71 B
Arrabi	HK	33.27±0.69 A
	LK	10.05±0.88 B
Karradi	HK	34.12±0.70 A
	LK	11.98±1.19 B

Different Capital letters indicate significant difference ($p<0.01$)

In addition, potassium concentrations within the analog levels varied between the three strains, as well as potassium concentration in whole blood differed between these strains as shown in the table above and some of these variations ere significantly different.

Statistical Analysis:

Each breed of sheep were divided according to the level of potassium separately, and adopted the minimum level at a 99% confidence interval between HK and LK sheep, as indicated by Al-Murani[39]in the statistical design. Analysis of variance used for the incomplete random design , and used Least significant differences to compare averages between different groups as well as finding correlation coefficients between the variables as indicated by Steel and Torrie[40].

Results:

The number of parasite eggs per gram of feces FEC/gm was convergent within readings which obtained from Awasi and krrade breeds (Table 2) 4313 and 3519 eggs/g, respectively, where the differences did not reach significance level, and the difference was significant ($p <0.05$) when comparing the FEC in Arrabi breed(7410) with Awasi and Karradi breeds. FEC in HK sheep was 4168/gm in comparing with 4978/gm for LK sheep and the difference didn't reach significant result (table 3). The results of Arrabi sheep were taken the same path of Awasi data, where the FEC in HK sheep was 7590/gm, while it was 6870 in LK Arrabi sheep and the result was not significant, (table 4). while the FEC in HK Karradi sheep (Table 5) was 3256 eggs/g, compared with 6360 in LK Karradisheep and the difference was significant ($p <0.05$).

It has been observed that the FEC inAwasi ewe reached 4617/gm, where outperformed mathematically on the FEC of Awasi Ram where it was 3620/gm, but the differences did not reach significance level (Table 2). While the numbers on the eggs in the feces (FEC) of Arrabi male sheep were little more than females FEC but did not reach the level of significance (Table 3).The Correlation coefficients (r) of the level of concentration of potassium in the blood of sheep with FEC traits under study as follow: In Karradi sheep

there were significant negative relationship (-0.26) between potassium level with the number of parasite eggs in feces (FEC) table (6).

Table (2):Average distribution of FEC on three breeds of sheep

Breed	Awasi	Arrabi	Karraedi
Number of eggs/ gm	4313±280 b (198)	7410±552 a (40)	3519±409 b (59)

Different Small letters indicate significant difference ($p<0.05$)
Figures within the parentheses represent the sheep numbers

Table (3): Potassium level relationship with FEC in Awasi sheep

Awasi sheep			Awasi Rams			Awasi ewes		
Overall blood K	HK	LK	Overall	HK	LK	Overall	HK	LK
4313 ±280 (198)	4168 ±308 (163)	4978 ±674 (35)	3628 ±494 (62)	3667 ±541 (52)	3420 ±1264 (10)	4617 ±338 (136)	4400 ±373 (111)	5556 ±781 (25)

Figures within the parentheses represent the sheep numbers

Table (4): Potassium level relationship with FEC in Arrabi sheep

Arrabi sheep			Arrabi Rams			Arrabi ewes		
Overall blood K	HK	LK	Overall	HK	LK	Overall	HK	LK
7410 ±552 (40)	7590 ±619 (30)	6870 ±1238 (10)	2592 ±1222 (13)	8963 ±1589 (8)	5400 ±1616 (5)	7322 ±586 (127)	7091 ±608 (22)	8340 ±1791 (5)

Figures within the parentheses represent the sheep numbers

Table(5):Potassium level relationship with FEC in Karradi sheep

Arrabi sheep			Arrabi Rams			Arrabi ewes		
Overall blood K	HK	LK	Overall	HK	LK	Overall	HK	LK
3519 ±409 (59)	3256 ±393 b (54)	6360 ±2086 a (10)	2155 ±818 (11)	2133 ±996 (9)	X	3831 ±458 (48)	3840 ±424 (45)	9100 ±218 (3)

Different Small letters indicate significant difference ($p<0.05$)
Figures within the parentheses represent the sheep numbers

Table(6):Correlation between K level and FEC

Breed	Awasi	Arrabi	Karradi
No. of sheep	198	40	59
Correlation	0.003	0.019	- 0.264 x

X = 5% significant

Discussion:

There were a differences between the number of eggs per gram of feces (FEC) between the three breeds, where the number of eggs in the Arrabi breed was 7810/gm and this result is more than what exists in Awasi sheep (4313/gm), and karradi (3519/gm), were the differences was significant ($p <0.05$), and the differences in FEC between Awasi and Karradi breeds didn't get a significant differ-

ence.Thisconfirms what referred to Vanimisett[33] when he obtained a significant difference in the number of eggs in the feces (FEC) between different breeds of sheep, and he proposed that the genetics play an important role in the severity of affection, in other words; there are genetically control resistance to intestinal parasitic infection between different breeds.

Despite the disparity the in numbers of eggs in the stool (FEC) between high potassium sheep (HK) and low potassium sheep (LK), but the only significant difference was in karradi sheep breed, where the LK sheep contain parasite eggs in the feces more than that which found in HK sheep breed which indicates that there is a relationship between the level of potassium in the blood and the number of eggs in the feces (FEC). This confirms that the HK sheep breed have the ability to adapt to the harsh environment and resist stress condition more than LK sheep breed, This underscores what referred to Taneja[26]that the HK sheep are more resistant against diseases. In other words the increase in potassium concentration in the blood gives an electoral advantage for the animals to resist parasitic diseases, Dally[41] showed that the number of eggs in the feces (FEC) significantly affected by hemoglobin types of sheep and explained that the sheep with hemoglobin AA have lowest number of eggs of parasites stomach and intestines in the stool (FEC), while the sheep with hemoglobin AB and BB showed equal numbers of (FEC), which confirms the existence of genetic factors controlled to some extent the severity of infection.

Generally its observed that the FEC increase in the Ewes comparing with Rams in all different breeds, Although without getting a significant differences, the reason for such results because the females undergoing through a period of her life go through different stages of physiological condition such as pregnancy and births, which increasingly influential in the effort to increase the intensity of infection, and it was observed that older animals their FEC was lower than what found in younger animals, and this confirms what referred to Vanmisetti[33] and Nieuwoudt[32]; that the young sheep have less resistance to infection compared with the old sheep, as well as the case for females sheep in which they have less resistance when comparing with male sheep.

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