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The impact of Genetic Polymorphism in the IGF1 Gene on the Weight Gain of the Mother and Offspring in Iraqi Camels

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Abstract

CAMELS are crucial to iraq's ecology, economy, and culture for centuries, providing sustainable development through milk and meat production. they also contribute to biodiversity conservation by eating wild plants. the igf1 gene plays a significant role in camel growth, development, and adaptability, requiring research for improved management practices. this research looked at the igf1 gene's genetic polymorphism in 40 female camels in al-najaf, iraq, and how it related to the weights of the mother camel and her progeny in three age groups (weight at birth, weight after six months, and age after a year).the results were that the genotype aa had more weight than aa and aa (646.78,601.89 and 541.00) respectively.there were significant differences between the genotypes of this gene for weight gain in the mothers' offspring from birth to subsequent weights, so Aa genotype showed superior weight gain from birth to six months of age, achieving 71.00 kg, compared to 61.44 kg for the AA and 63.60 for aa genotype. the variation in genotypes for this gene was also linked to weight gain between birth and one year of age, since the Aa type was the superior one.so the genetic hybrid model weighed 170.3 kg. this makes it evident how closely the igf1 gene in camels is related to the weight gain of both mothers and offspring , Therefore, we suggest that the hybrid genetic model be used in selecting mothers. emphasizing the need for further research on this gene and the selection of genotypes that promote greater weight gain.

Keywords: *Camelus dromedarius*, genetic, weight of body**.**

Introduction

In Iraq, camels have a significant cultural and historical significance, particularly in the country's desert regions. Camels are regarded as a part of traditional history and are utilized for lengthy desert travels as well as a source of milk and meat. They are also employed transportation and livestock breeding. Iraqi desert regions that are conducive to camel husbandry are found in the governorates to the south and west, where the majority of camels are raised [1]. Because of its remarkable adaptability to the harsh desert environment, the camel has been called the "ship of the desert" for a very long time[2]. The camel is not like other domesticated animals for the Arabs; because of its economic value as a food source and its symbolic significance as an animal that embodies qualities of forbearance and strength that have been celebrated by tribes for ages, it is a part of history spanning the cosmos, religions, and modern times[3-4].Given that this creature exhibits genetic diversity and its karyotype instability even within the same species, it is not surprising that it has previously captured the attention of Arab peoples and that geneticists and evolutionists are now interested in studying it. This means that there is a need to raise awareness about this animal's genetic makeup[5].In

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Iraq, there are various types of camels, including the Al-Shakha, known for their use in races as well as for decorative purposes and special occasions. The Wadha is esteemed by Arabs for its elegance and holds significant worth. The Shahba got its name from its crimson hue, which in Arabic means "flame," or radiance. Because of its unique light blond tint, Bedouin tribes prefer the Sahba variety [6-7]. The IGF1 gene is one of the key genes that affects an animal's weight and growth because its expression is correlated with the amount of IGF protein in the blood and tissues [8-9-10].This protein was shown to have a direct impact on blood sugar regulation, which in turn supports cell growth and division as well as the development of bones, muscles, and other organs in animals at all stages of life[11]. Additionally, it was discovered that this gene plays a critical role in the development of the embryo both inside the womb and after delivery since breast milk from animals contains growth factors, such as the protein IGF1, which promotes the newborn's growth[12].The GEF1 gene has four introns and five exons, and it is found on chromosome 11 of the Arabian camel[13]. Few studies have been done on this gene and how it affects Iraqi camels. In the weights of Iraqi female camels (Al-Shakha), as well as the weights of these females' progeny at three different ages, the current study was conducted to examine the phenotypic variety of the fifth exon of the IGF1 gene (at birth, after 3 months, and at one year of age). So This study aims to investigate the genetic polymorphism of the IGF1 gene in Iraqi camels and its association with body weight in mothers and offspring In general, camel breed improvement depends on genetic trait-based selection.

Material and Methods

Source of data and flock details: In the current study forty female Arabi camels from Najaf, Iraq were utilized. Blood was drawn from the jugular vein during the field procedure, and the mother and her children were weighed three times: at birth, six months later, and a year later. The blood was then transported by ice container at 4 C to a lab equipped with a low shaker. The mechanical scales displayed the combined weight of all the animals.

Polymerase chain reaction (PCR): A DNA extraction kit (Promeg) was used to obtain genomic DNA. Using the particular primer, a portion of the IGF1 gene encompassing exon 5 was amplified. The primer sequence as reported by [14]. The primer sequences were (F:5'-ATTACAAAGCTGCCTGCCCC-3') and (R:5'-ACCTTACCCGTATGAAAGGAATATACGT-3') Polymerase Chain Reaction (PCR) was used to amplify 50 ng of genomic DNA in 20 µl reactions. Polymerase Chain Reaction. (PCR) was used to amplify 50 ng of genomic DNA in 20 µl reactions, with 0.7 U of Taq DNA polymerase. The cycling conditions included 30-second cycles at 94°C, 62°C, and 72°C, followed by a 10-minute extension at 72°C.

Single-strand conformational polymorphism analysis (SSCP): Using a Protean II xi cellular electrophoresis system (Bio-Rad, USA), single strand conformational polymorphism (SSCP) analysis was carried out. 8 µl of denaturation dye (98% form amide, 0.025% bromophenol blue, 0.025% xylenecyanol, 10 mM EDTA) was combined with 2 µl of PCR products. After being denatured for six minutes at 105 degrees Celsius, the solutions were quickly cooled on wet ice before being placed onto 16 x 18 cm gels that contained 12% acrylamide: bisacrylamide (37.5: 1; Bio-Rad, USA) and 3% glycerol. For 19 hours, the electrophoresis was conducted at 300 V and 28 C in 0.5 x TBE buffer. The technique of[15]. was used to silver stain the gels.

Statistical analysis

According to a completely randomized design (CRD), the data was analyzed using the statistical program Statistical Analysis System-SAS[16].. The Duncan [17]. multinomial test was used to compare the significant differences between the means in order to examine the impact of genetic structure on the traits under study in camels.

$Yij = \mu + Ti + eij$

Where:

Yij: The value of the observation j.

µ: The general average of the studied trait.

Ti: The effect of genetic structure i.

eij: The random error that is normally distributed with a mean equal to zero and a variance of σ2e

The significance level, often denoted as $p < 0.05$ or $p < 0.01$, represents the probability of obtaining the observed results if the null hypothesis is true, with lower p-values indicating stronger evidence against the null hypothesis.

Results

The camel IGF1 gene's exon 5 genotypic analysis, which was done using the SSCP analysis, revealed three genotypes: AA, Aa, and aa, with frequencies of 6.8, 6.8, and 3.2, respectively. As (Table 1).

We found through the RFLP test that the IGF gene had three genotypes (AA, Aa, and aa) that determine how the gene behaves in accordance with Mendel's rule. We measured the weight of the camels at the age of fertilization and found that the genotypes AA and Aa had larger weights of 6 and 7, respectively, whereas the females with the genotype aa had lower weights, weighing in at 7 kg. (Table 1). Also the weights of camel offspring whose mothers

had these genetic patterns (AA, Aa, aa) were also measured based on the age at birth, six months later, and a year later(Table 2). The results showed that the offspring of mothers with the recessive genetic pattern aa had the lowest weight in these age groups(28.00 , 91.60 and 189.40), whereas the offspring of mothers with the hybrid genetic pattern Aa had the highest weight(28.00 , 91.60 and 189.40). likewise Table 3 illustrates, Through studying the relationship between mothers' IGF1 gene polymorphisms and the weight gain of their offspring at various ages—the first six months following delivery; Phase two, spanning six months to a year; and Phase three, spanning from birth to one year old.The offspring belonging to mothers with the hybrid genotype Aa experienced the highest weight gain throughout the first and third age stages stated above; however, there were no noteworthy variations in the weight gain of other offspring belonging to mothers with the genotypes AA and aa. This suggests a considerable correlation between the variations in mothers' genotypes for this gene and weight increase.

Discussion

Three genotypes were identified by the SSCP analysis of the camel IGF1 gene's exon 5 genotypic analysis: AA, Aa, and aa, with frequencies of 6.8, 6.8, and 3.2, respectively (Table 1). This polymorphism follows Mendelian inheritance principles due to the IGF1 gene's activity [18]. When camels were weighted at the time of fertilization the females with genotypes AA and Aa weighed 601.89 and 646.78 kg, respectively, but the genotype AA's weight was smaller at 541.00 kg. (Table 1).These results are accordance [19]. The various genetic variations of this gene in Arabian camels can alter the type of protein that the gene produces, which may have an impact on the weight of the animal. Also, the weights of camel children whose mothers possessed these genetic patterns (AA, Aa, aa) were also measured based on the age at birth, six months later, and a year later, (Table 2). According to the findings, children born to mothers with the recessive genetic pattern aa had the lowest average weight in these age groups, whereas calve born to mothers with the hybrid genetic pattern Aa had the highest average weight. The impact of the IGF1 gene on the mother and fetus is fundamental to understanding its function [20]. The weight of mothers and offspring was correlated with IGF1 polymorphisms, [21]. This is because IGF1 is necessary for the skeletal muscle's myoblast development and stimulation of mitogenic proliferation.[22-23-24].So these results demonstrate how genetic markers can be used in cow and camel breeding programs to choose animals with better growth characteristics[25]. Similarly, Table 3 shows the relationship between mothers' IGF1 gene polymorphisms and the weight gain of their offspring at different ages: Phase one (the first six months after birth), Phase two (six months to one year), and Phase three (birth to one year old).During the first and third age phases mentioned above, the offspring of mothers who had the hybrid genotype Aa gained the most weight; other offspring of mothers who had the genotypes AA and aa did not differ significantly in terms of weight gain. This implies a strong relationship between weight gain and the differences in mothers' genotypes for this gene. The amount of protein in a mother's milk may change if the GFI1 gene influences how she reacts to her nutrition[26-27-28-29]..Research has indicated that the majority of dietary proteins, including dairy proteins, can enter breast milk .This implies that particular protein levels may be transferred to the progeny through the milk if there are mutations or variations in the GFI1 gene that impact those levels .Also, Heterosis, a biological phenomenon that happens when the offspring of the cross of two or more different strains have stronger features than both parents, could be the cause of hybrid persons' superiority. These characteristics could include greater productivity, disease resistance, quick growth, and size[30].

Conclusion

The study examined the IGF1 gene's genetic polymorphism in 40 female camels in AL-Najaf, Iraq, and its relationship with mother and offspring weights. Results showed that the Aa genotype had more weight than the AA and aa genotypes. The Aa genotype showed superior weight gain from birth to six months, and a 170.3 kg increase in weight compared to alternative models. These findings indicate that IGF1 gene polymorphisms could be used as a genetic marker in selective breeding programs for improved weight gain in camels. We also suggest that the sample size be larger in future studies.

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Ethical of approval

This study was approved by the Ethics Committee of the College of Veterinary Medicine, University of Baghdad. The study was conducted in accordance with the relevant ethical guidelines and standards.

TABLE 1. Relationship of the genotype of IGF1gene to the body weight of camels at fertilization

Genotype	Number	Percentage %	Mean ± SE For the body weight of camels at fertilization (kgm)
AA	17	6.8	17.95± 601.89a
Aa	17	6.8	13.67± 646.78a
aa.	8	3.2	10.54± 541.00b
Level of Sig.	---		**

A mean with different letters are significantly different from each ot.
** (P≤0.01).

TABLE 2. Relationship of the genetic polymorphism of IGF1gene to body weight at birth, at 6 months of age and annual weight of camels

Products	Min. (log10 CFU/g)	Max. (log10 CFU/g)	Mean ± S.E* (log10 CFU/g)	P value*
Thigh	2.71	3.48	3.21 ± 0.16^{a}	0.02
Breast	1.60	2.31	2.02 ± 0.11^{b}	

*Mean values of logarithmic count for different products with different superscript letters in the same rows are significantly different at (P<0.05).

TABLE 3. Relationship of the genetic polymorphism of IGF1gene to body weight at birth, at 6 months of age and annual weight of camels

Genotype	Mean ± SE (kgm)		
	Body weight at birth	Body weight at 6 months	Body weight after 12 months
AA	1.35± 32.44b	1.34± 93.89b	1.32± 195.11b
Aa	1.17± 37.89a	3.22± 108.89ab	5.29± 208.22a
aa.	0.83± 28.00c	1.07± 91.60b	0.50± 189.40b
P	**	**	**

** (P≤0.01).
A mean with different letters are significantly different from each other.

TABLE 4. The relationship between the genetic polymorphism of IGF1gene and the rate of weight gain between the studied ages of camels

Genotype	Mean ± SE (kgm)		
	Weight gain between birth and 6 months	Weight gain between 6 months and one year old	Weight gain between birth and yearling weight
AA	1.34± 61.44b	1.19± 101.22	1.30± 162.67ab
Aa	3.29± 71.00a	4.96± 99.33	5.14± 170.33a
aa.	1.07± 63.60ab	1.20± 97.80	0.81± 161.40b
Level of Sig.	*	NS	*

* (P≤0.05) A mean with different letters are significantly different from each other

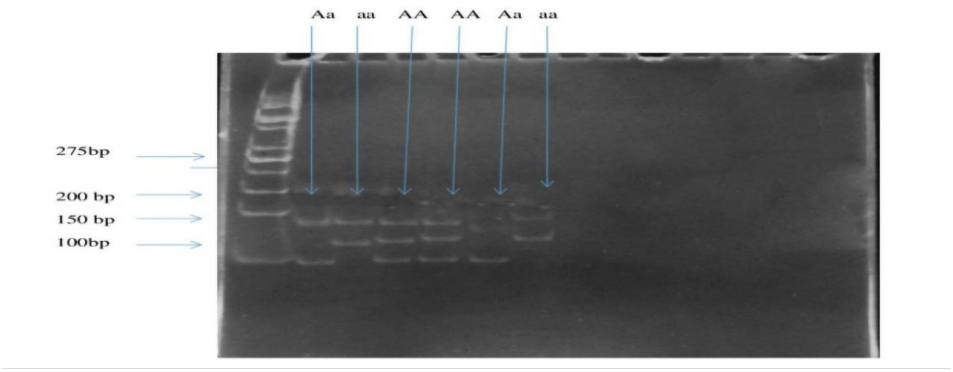

Fig. 1. PCR-SSCP gel electrophoresis of IGF1 (exon 5) gene representing three genotypes (AA, Aa, aa)

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تأثير التعدد الشكلي الوراثي في جين IGF1 على الزيادة الوزنية للأمهات والصغار في الإبل العراقية

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الملخص

الإبل ذات أهمية حيوية للبيئة والاقتصاد والثقافة في العراق منذ قرون، حيث توفر تنمية مستدامة من خلال إنتاج الحليب واللحوم. كما أنها تساهم في الحفاظ على التنوع البيولوجي عن طريق تناول النباتات البرية. يلعب جين IGF1 دورًا هامًا في نمو الإبل وتطورها وقدرتها على التكيف، مما يستدعي إجراء أبحاث لتحسين ممارسات الإدارة. بحثت هذه الدراسة في تعدد الأشكال الجينية لجين IGF1 في 40 ناقة في النجف، العراق، وكيف يرتبط بأوزان الناقة الأم ونسلها في ثلاث فئات عمرية (الوزن عند الولادة، والوزن بعد ستة أشهر، والوزن بعد عام). وأظهرت النتائج أن النمط الجيني Aa كان لديه وزن أكبر من AA و 646.78) aa، 601.89، 541.00 كجم على التوالي). كما كانت هناك اختلافات كبيرة بين الأنماط الجينية لهذا الجين لزيادة الوزن في نسل الأمهات من الولادة إلى الأوزان اللاحقة، حيث أظهر النمط الجيني Aa زيادة وزن فائقة من الولادة إلى ستة أشهر من العمر، حيث حقق 71.00 كجم، مقارنة بـ 61.44 كجم للنمط الجيني AA. كما ارتبط الاختلاف في الأنماط الجينية لهذا الجين بزيادة الوزن بين الولادة وسنة واحدة من العمر، حيث كان النمط Aa هو الأفضل. فيما يتعلق بالنماذج البديلة، كانت هناك زيادة في الوزن قدرها 170.3 كجم. هذا يدل بوضوح على مدى ارتباط جين IGF1 في الإبل بزيادة وزن كل من الأمهات والنسل، فضلاً عن الحاجة إلى مزيد من البحث حول هذا الجين واختيار النمط الجيني الذي يؤدي إلى زيادة أعلى.

الكلمات الدالة: الابل ذات السنام الواحد،وراثة ،الاوزان الجسمية.