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Morphological characterization for the horses located in Kirkuk city

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Abstract:
The aim of these was to look out for their implications on body dimensions. In total, 150 horses of both sexes and ages 3 to 15 were analyzed. Measurements of body length, body height (withers height), and body girth were also performed in accordance with standards. Horses were grouped according to their body color (black, red dun, blue roan, bay, gray) and face type (star and stripe, star and snip, bald face, lip marking, irregular blaze). Statistical analyses were made on independent samples for each of the dependent controls (SPSS Version 25.0): t-test, one-way ANOVA, and Pearson correlation coefficient. Results indicated statistically significant sexual dimorphism between males and females in body height ($p = 0.009$), with males consistently taller (155.62 cm) than females (149.95 cm). No significant differences were shown between sexes for body length and girth. Coat color significantly influenced body length ($p < 0.05$), with black horses having the longest body length, 161.50 cm, while the shortest body length was most attributed to red dun (143.22 cm); however, coat color did not have a notable effect on body height or girth. There was no significant difference in body height or gender differences between males and females. Face type did not significantly correlate with body dimensions. Limb morphology showed bilateral symmetry, and the association between different limb traits was only moderate. All these points point out the influence of genetic and environmental factors on Equine Morphology and have practical implications for breeding and management strategies, which are often used to support equine. The study emphasizes the need to take phenotypic traits into account in equine research and suggests future studies must delve further into the likely genetic basis for those associations.

Keywords: horses, characterization, morphological

Introduction:

Horses are enormous and elegant animals known for speed, strength, and agility. As a result, the horse has an elongated neck, tough and strong legs, and a deep thorax that is equipped to sustain a strong heart and lungs [1-4]. Their long, muscle-loaded limbs are made to accommodate movement, with strong musculature and tendons. The horse has a long, elongated head and high forehead, and arched, flexible, and swiveling ears for auditory perception [5, 6]. Horses have large expressive eyes that are positioned laterally on their heads to allow for a wide perspective [7]. Horses have elongated, thin limbs that are optimized for velocity and stamina; however, one big foot provides shock absorption and increases traction [6, 12]. They have different coat colors and patterns, including solid hues of bay, black, and chestnut coat colors, as well as Pinto and Appaloosa designs [8-10]. Horses have large expressive eyes, which can give an even wider picture, very mobile ears with varying speeds, and the ability to rotate in order to sense various sounds. Horses have a dorsal mane along each side of their neck and a rear tail that can be stretched or recessed depending on temperament and the horse's skin type, and tend to appear to have a longer, tighter tail or a tail that extends to the back for various uses or aesthetic reasons. They are of different hair colors and characters like bay (reddish brown with a black mane and tail), black and chestnut (reddish orange), gray (ranging from white to dark gray), palomino (golden with a white mane and tail), pinto (large patches of white and color), and appaloosa (spotted coat). Although the body coat typically corresponds to manes and tails, numerous varieties differ significantly in color [11]. Horses might be marked differently, with a star (a white spot on the forehead), a stripe (which is generally a vertical line down the face), and a snip (a slight white mark on the nose). This study attempts to analyze the morphological characteristics of the horses found in Kirkuk city, along with an exploration of their physical traits, the variation of breed, and their adaptability to the local ecology.

Materials and methods:

The study was carried out in Kirkuk city in northern Iraq. The area has a semi-arid climate that affects both breeding and the upkeep of horses. Horses in this study were taken from nearby farms. A total of 150 horse members (male and female) were selected for inclusion in the study to provide a sample of the equine population in this area. Horses were chosen according to their age (usually ranging from 3–15 years) and their breed (local and common in the region). In this data collection, the sex ratio of the horses used was nearly balanced to facilitate comparison. The visual color and face types of the bodies were observed visually and classified accordingly. Dimensions of the body were measured to describe the morphology of the horses. Measurement parameters were body length, body height (frequently called withers height), and body girth. Measurements: All measurements were made using standardized methods:

Body Length: Measured from the position of the shoulder to the buttocks using a measuring tape. Body height: Measured at the withers using a spirit level measuring stick. Body Girth: Around the chest, behind forelimbs, measured with flexible tape. All measurements were taken in centimeters (cm) and done in the morning, to minimize variations from feeding or physical activity. Each measurement was conducted three times for triage, and the average was measured. Horse body color: The color of their body was identified visually and divided into black, red dun, blue roan, bay, and gray categories. Face Markings: Recorded and categorized as star and stripe, star and snip, bald face, lip marking, and irregular blaze. Morphological analyses were performed to assess the impact of sex, body color, and face

type on the measured characteristics. Statistical analysis was performed among means, standard errors (SE), and standard deviations (SD) from SPSS (Version 25.0). Independent Sample t-tests: Used for the comparison of morphological characteristics in male and female horses. A one-way ANOVA was used to examine the relationships between body color, face type, and body dimensions. Correlations between morphological characteristics (body length, height, and body girth) as well as between sex, body color, and face type were tested using Pearson's correlation coefficient.

Result and discussion:

Table 1 presents the mean, standard error, and standard deviation of the horses' bodily dimensions of the male and female (body length, body height, and body girth). The body length and girth between the sexes were not significant, respectively, but body height was significant between the sexes, being higher in the male and female (155.62 in the first pair of measurements and 149.95 in the second).

Table 1: The effect of sex on the body dimensions

Traits (cm)	Male		Female		Sig
	Mean± SE	SD	Mean±	SD	
body Length	148.08±2.45 a	8.82	147.53±1.50 a	6.52	0.840
Body High	155.62±1.58 a	5.68	149.95±1.27 b	5.53	0.009
Body Grith	168.31±1.63 a	5.88	164.74±1.62 a	7.05	0.144

The analysis of horse body dimensions provided fascinating insight into the sexual dimorphism in these traits. However, male body length and female body girth showed no statistical difference compared to non-male body length ($p \geq 0.05$); however, body height differed relatively significantly from the other two ($p = 0.009$), with males being taller than females (155.62 cm vs 149.95 cm on average). This is consistent with the prior reports showing that males commonly show higher body height due to developmental and sex hormone influences [7].

Not significant differences found in body length and girth indicate that these variables could be less influenced by sex and more by environmental aspects or management strategies [12]. These findings underscore the need to account for sex-dependent variation in the assessment of equine body dimensions, as relevant aspects for breeding, performance assessment, and management. Future studies can examine the determinants of these patterns.

A correlation between body length, height, and girth, body dimensions, and Horse Body Color can be seen in Table 2. Body length was significantly correlated with body color. Body length was high in black (161.50) cm and low in red dun (143.22) cm. Blue roan, Bay, and grey were intermediate ones (146.75, 153.25, and 151.00 cm), respectively. The body height and body girth were not found to be significantly correlated with the color of horses' bodies ($P \geq 0.05$). The results showed a significant relationship between body length and coat color in horses ($P \leq 0.05$), with the black horses having the longest body length (161.50 cm) and the red dun their shortest at 143.22 cm. Body length was intermediate in blue roan, bay, and grey horses. However, body height and girth were not correlated with coat color ($P \geq 0.05$). These findings are consistent with other findings showing that genetic contributors to pigmentation may impact growth and design [11]. Additional research is required to determine the underlying genetic and environmental contributors to these associations.

Table 2: The effect of body color on the body dimension

Traits	Body Length		Body High		Body Grith	
	Mean± SE	SD	Mean± SE	SD	Mean± SE	SD
Black	161.50±3.50 a	4.95	150.50±5.50 a	7.78	176.00±1.23 a	5.30
Red dun	143.22±1.57 c	4.71	148.89±2.46 a	7.37	163.00±1.94 a	5.83
Blue roan	146.75±2.36 bc	4.72	153.75±4.52 a	9.03	166.00±4.30 a	8.60
Bay	153.25±4.23 ab	8.46	156.50±2.90 a	5.80	171.50±4.33 a	8.66
Gray	151.00±2.38 bc	5.83	154.67±2.14 a	5.24	167.17±2.37 a	5.81
Sig	0.004		0.365		0.106	

The association between face type and Body dimensions (body length, height, and girth) in animals is provided in Table 3. The analysis, however, shows that the face types differ not significantly from each other for any of the measured traits according to $P \geq 0.05$. Body length ranged from (141.50) cm in "Star and Snip" pattern individuals to (148.75) cm in those with "Lip Marking." Likewise, body height was from (149.50) to (156.00) cm in "Irregular Blaze" to "Star and Stripe." Girth measurements showed the minimum variability - ranging from a maximum of (159.50) cm in "Irregular Blaze" to (169.00) cm in "Star and Snip." A lack of significant correlation indicates that facial markings are not related directly to the dimension of the body, which aligns with the previous research [13, 14]. These findings could be due to the genetic indivisibility of body dimensions to facial phenotypes [15]. It would make sense that larger samples (potentially including more individuals and advanced genetic analysis) would further confirm these findings.

Table 3: The effect of face type on the body dimension

Traits	Body Length		Body High		body Grith	
	Mean± SE	SD	Mean± SE	SD	Mean± SE	SD
Star and strip	145.00±5.00 a	7.07	156.00±1.00 a	1.41	168.50±2.50 a	3.54
Star and Snip	141.50±6.50 a	9.19	155.50±0.50 a	0.71	169.00±4.00 a	5.66
Bald Face	147.57±2.57 a	6.80	152.00±2.66 a	7.05	165.29±2.32 a	6.13
Lip marking	148.75±2.79 a	7.89	154.88±2.57 a	7.28	167.25±2.62 a	7.40
Irrgular Blaze	146.50±3.50 a	4.95	149.50±5.50 a	7.78	159.50±3.50 a	4.95
Sig	0.835		0.865		0.685	

The phenotypic correlations between horses' morphological traits are shown in Table 4. Significant negative correlation between coat color and the back left limb trait ($r = -0.457$, $p \leq 0.05$) suggests that the coat color potentially is associated with limb morphology, which hints possibly at some genetic or developmental factor influencing both traits. There were also marked correlations found between back left/back right ($r = 0.716$, $p < 0.001$) and front left/front right limb ($r = 0.821$, $p < 0.001$) that are significant, such as bilateral symmetry (limb morphology). Further, moderate positive correlations between some limb traits, such as front right and back left ($r = 0.516$, $p < 0.05$), indicate that they may have interdependence in how they differ. Of note, face type did not relate to these other traits significantly, demonstrating that it did not show a high dependence on limb morphology or color. Previous research has emphasized genetic links between coat color and morphology [1], as well as symmetry for functional performance [16, 17]. The observed results do provide support for findings regarding morphological traits in equine stock [5] and confirm that phenotypic traits are important for selective breeding methods [8].

Table 4: The correlation among the morphological traits

Traits	Sex	Color	Face Type	Front Left	Front Right	Back Left	Back Right
Sex	1.000						
Color	0.203^{NS}	1.000					
Face Type	0.173^{NS}	0.287^{NS}	1.000				
Front Left	-0.028^{NS}	-0.249^{NS}	0.038^{NS}	1.000			
Front Right	-0.204^{NS}	-0.384^{NS}	-0.193^{NS}	0.821^{***}	1.000		
Back Left	-0.283^{NS}	-0.457^{*}	-0.458^{*}	0.245^{NS}	0.516^{*}	1.000	
Back Right	-0.167^{NS}	-0.183^{NS}	-0.220^{NS}	0.316^{NS}	0.568^{**}	0.716^{***}	1.000

Conclusion:

Equine body measurements and phenotypes are important indicators. Males demonstrated significant sexual dimorphism in body height, demonstrating that males grew taller than females. Coat color was related to body length, and its negative association could not be generalized to other dimensions. No association of face type and limb symmetry with body dimension suggested genetic independence. Results indicate the interaction between genetics, environment, and morphology in equine breeding and management. More studies are indicated to identify genetic and environmental factors.

Conflict of interest statement

There are no disclosed conflicts of interest.

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التوصيف المورفولوجي للخيول الموجودة في مدينة كركوك

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ملخص:
كان الهدف من ذلك هو البحث عن تأثيراتها على أبعاد الجسم. تم تحليل ما مجموعه 150 حصانًا من كلا الجنسين تتراوح أعمارهم بين 3 و 15 عامًا. كما تم إجراء قياسات طول الجسم وارتفاع الجسم (ارتفاع الكتفين) ومحيط الجسم وفقًا للمعايير. تم تجميع الخيول وفقًا للون جسمها (أسود، أحمر داكن، أزرق رمادي، بني، رمادي) ونوع الوجه (نجمة وخطوط، نجمة وقصاصة، وجه أصلع، علامة على الشفة، علامة غير منتظمة). أجريت تحليلات إحصائية على عينات مستقلة لكل من الضوابط التابعة **SPSS)** الإصدار 25.0 **:(**اختبار **t**، **ANOVA**أحادي الاتجاه، ومعامل ارتباط بيرسون. أشارت النتائج إلى وجود تباين جنسي ذي دلالة إحصائية بين الذكور والإناث في ارتفاع الجسم**(p = 0.009)** ، حيث كان الذكور أطول بشكل ثابت (155.62 سم) من الإناث (149.95 سم). لم تظهر فروق ذات دلالة إحصائية بين الجنسين في طول الجسم ومحيطه. أثر لون الفراء بشكل كبير على طول الجسم**(p < 0.05)** ، حيث كان طول الجسم الأطول للخيول السوداء، 161.50 سم، بينما كان طول الجسم الأقصر للخيول الحمراء (143.22 سم)؛ ومع ذلك، لم يكن للون الفراء تأثير ملحوظ على طول الجسم أو محيطه. لم تكن هناك فروق ذات دلالة إحصائية في طول الجسم أو فروق بين الذكور والإناث. لم يكن هناك ارتباط ذو دلالة إحصائية بين شكل الوجه وأبعاد الجسم. أظهرت مورفولوجيا الأطراف تناسقًا ثنائيًا، وكانت العلاقة بين السمات المختلفة للأطراف معتدلة فقط. تشير جميع هذه النقاط إلى تأثير العوامل الوراثية والبيئية.