Assessing limb variation across camel types using images from social media

Tasneem Maraqa, Hasan Alhaddad, and Bader H. Alhajeri
Department of Biological Sciences, Kuwait University, Kuwait

Introduction

- The external morphology of Arabian camel (*Camelus dromadarius*) types shows much variation.
- Each type is defined by a number of diagnostic features, including coat color and texture, overall size, as well general neck and limb structure.
- Each camel type is used by breeders for different purposes (e.g. racing camels tend to have a thin body with tall limbs, while milk-producing camels tend to be shorter and stockier).
- Morphological variation in limb shape were assessed across camel types.

Objectives

1. To develop a standardized protocol to collect linear measurements of camel limbs.
2. Use camel images as a source to extract linear measurements of limbs (Figure.1).
3. Build a database of linear measurements for different camel types.
4. To determine if there is considerable variation in limb dimensions across camel types.

Conclusion

Camel limb morphology varies between types. Racing camels (Omani) and Sudani have thinner and taller hind-limbs compared with milk production (Mezayen) camels.

Got 30 Seconds?

Observation

Length, width, and height of camel limbs vary among camel types

What we did?

- Camel images were collected
- Extract measurements by Image.J
- Compare between types..

Conclusion

Racing types have shorter and thinner legs than Mezayen.

Methods and Materials

- Camel images (n = 50) from three types were collected from public camel breeder accounts using a popular image-sharing application (nine Sudani, seven Omani, and 34 Mezayen).
- Linear distances were extracted from the photographs (in pixels) using ImageJ.
- Ratios of different limb regions were quantified in order to provide unitless shape variables that can be used to assess overall shape variation in limb structure across types.
- Limb ratios were then subjected to principal component analysis in order to reduce the dimensionality of the data (the number of retained PCs were determined using the broken-stick criterion).
- The variation in the camel types in each ratio was visualized separately using boxplots, and the overall variation based on the first two principal components were visualized using scatterplots.
- The overall clustering patterns among the average ratios of each camel types were assessed using Unweighted Pair Group Method with Arithmetic Mean (UPGMA) and the results were visualized using a dendrogram.

Results

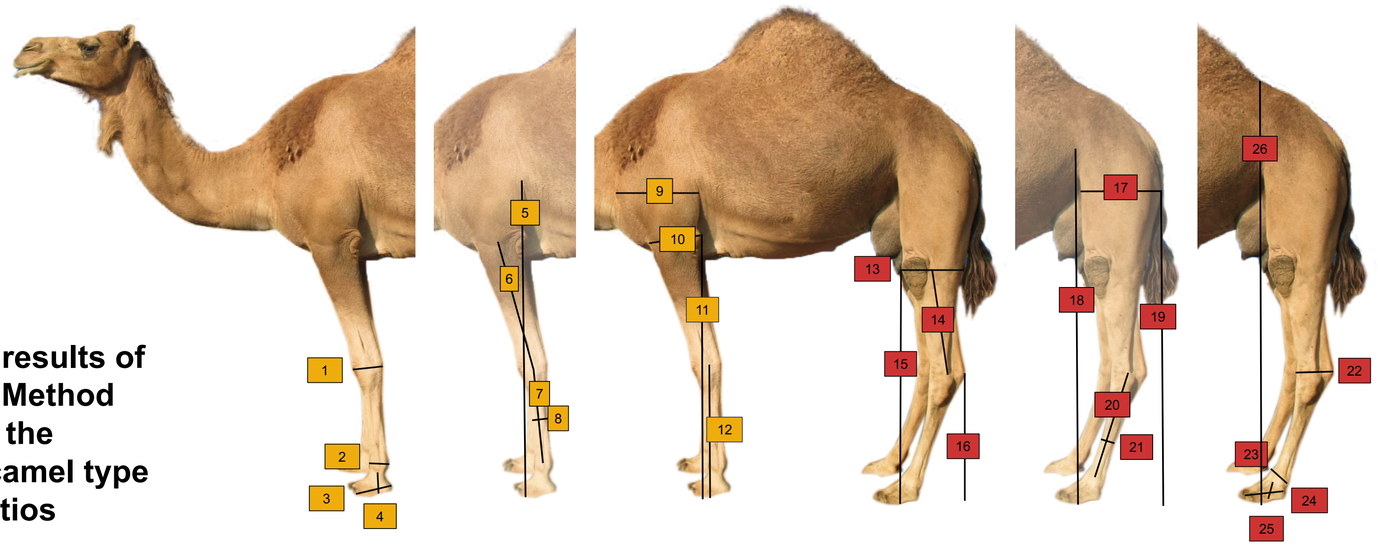
Fig.1:

a. **The linear distance measurements we chose for camel limbs:**
   - **(1-12) Forelimbs**
   - **(13-26) Hindlimbs**

b. **Dendrogram shows the results of Unweighted Pair Group Method with Arithmetic Mean of the average ratios of each camel type**

c. **Boxplots for forelimb ratios measurements**

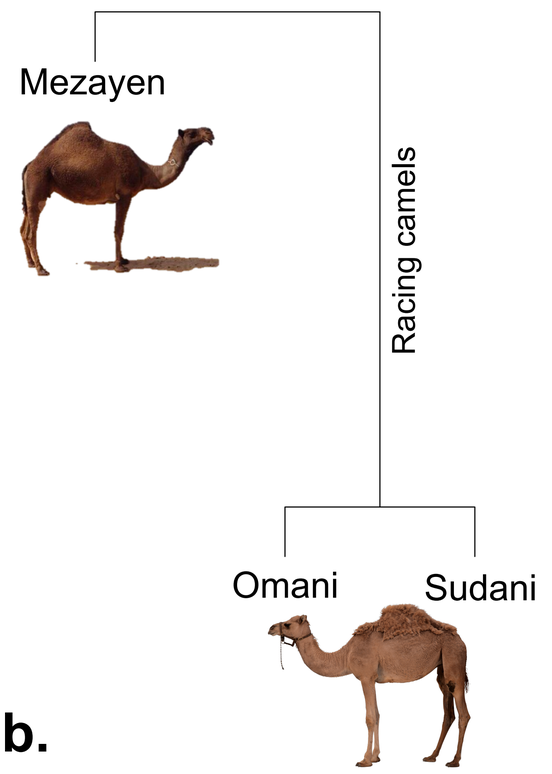
d. **Boxplots for hindlimb ratios measurements**



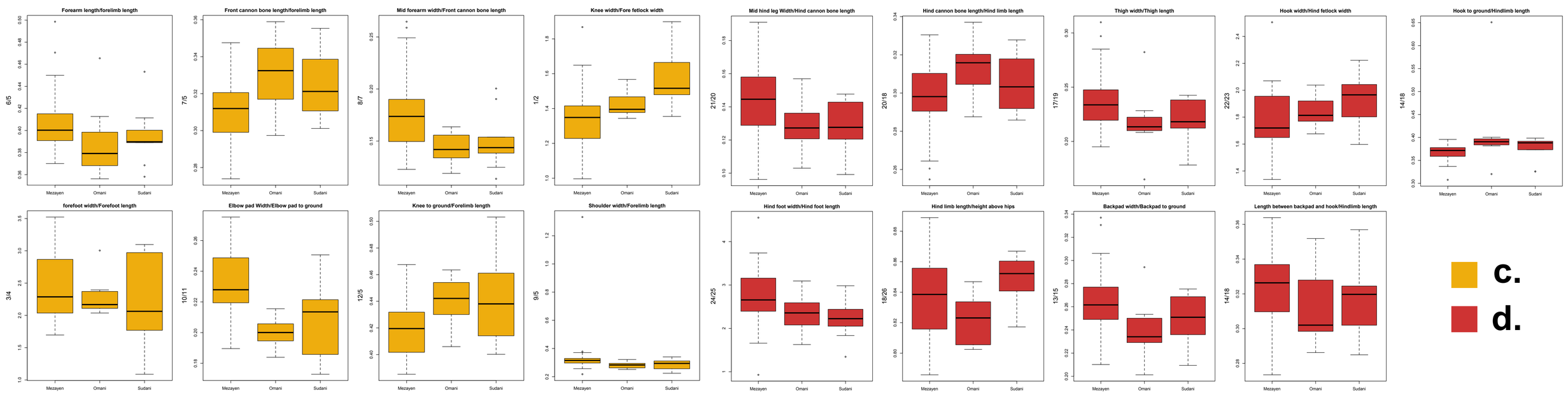
a.

1. Knee width
2. Fore-fetlock width
3. Forefoot width
4. Forefoot length
5. Forelimb length
6. Forearm length
7. Front cannon bone length
8. Mid-forearm width
9. Shoulder width
10. Elbow pad width
11. Elbow pad to ground
12. Knee to ground

13. Backpad width
14. Length between stifle and hock
15. Back pad to ground
16. Hock to ground
17. Thigh width
18. Hindlimb length
19. Thigh length
20. Hind cannon bone length
21. Mid-hind leg width
22. Hock width
23. Hind-fetlock width
24. Hind-foot width
25. Hind-foot length
26. Height above hip



b.



c.

d.

Acknowledgments: This project would not have been possible without images posted by camel breeders on their social media accounts, including: ime1111, hjn_uae, alotaibi_654, smsrbywshr, djekv493hf, rashed1209, ahmedreshidi, aljhaam, 3lag_al7lal, camel.kw, theking2050, al_nahab, alsultan38, nsas669, zmool_alarab, o.77_, osaamah23, _a_qatar_9033, shr2222, swaihaan).

@jamalidreport @jamalid_report jamalidreport@gmail.com