Journal of Animal and Veterinary Advances 11 (14): 2429-2431, 2012
ISSN: 1680-5593

Compare of Different Formulas of Estimating the Weight of Horses by the Iranian Arab Horse Data

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Abstract: It is vital that horse owners, managers and veterinarians can accurately establish the weight of the horses in their care. The factors influenced by a horse's weight include drug dosage, ration formulation, racing performance and transportation. The most accurate method of assessing the weight of a horse is a weighbridge. However, since the cost of this is prohibitive to most horse enterprises other methods usually are employed. Different method is available to estimate the weight of horses. After the weighbridge the best methods is weight formulas. In this study 4 formulas was compared by the Iranian Arab horse data. Measurements of girth, height and length were recorded on 244 horses. Effect of birth year and origin on different formulas was very significant ($p<0.01$). Effect of sex on different formulas was not significant ($p>0.05$). About 4 formulas that used in this study with Duncan test was classified to three classes.

Key words: Body weight, Arab horse, formula and estimation, veterinarians

INTRODUCTION

It is critical for horse owners, veterinarians, trainers and others involved in the care and management of the horse to accurately establish equine weight. An accurate weight is required for medication dosing, nutrition requirements, training purposes and general health monitoring of the horse. Accurate equine weight is vital for administration of anthelmintics and anesthesia as well as other medications. Under dosing of anthelmintics may possibly result in parasite resistance and chronic equine health problems while under dosing of anesthesia results in unnecessary surgical complications. The most accurate method for determining equine weight is a digital scale.

Due to the high cost of large animal scales, the average horse owner or trainer is not likely to own or have access to a scale. Furthermore, many equine veterinarians respond to calls in the field and do not have access to a scale when assessing, treating and administering medications to horses in their care as opposed to a clinical setting where availability of scales would be more likely. The most commonly used method for determining equine weight is visual estimation. Due to the lack of availability or access to equine scales and the general unreliability of visual estimation, the need for an accurate and effective equine weight estimation method or model exists. Over the past four decades, several weight estimation methods have been developed and tested with varying degrees of accuracy.

MATERIALS AND METHODS

The most difficult and time-consuming portion of this study has been gathering data on a sufficient number of horses. The very problem that generated the interest in this project also created a problem with the data gathering phase that was finding a facility with an equine scale that could be utilized. Data was gathered on 244 Iranian Arab horses. Measurements of girth, height and length were recorded (Gharahveysi *et al*., 2008).

The Girth1 (heart girth) measurement was obtained by taking a measurement in centimeters around the heart girth of the horse with the measuring tape snug against the horse following respiratory expiration. The tape was placed directly behind the elbows, the ends of the tape were overlapped and the indicated heart girth measurement was recorded. The Girth 2 (umbilical girth) measurement was obtained by taking a measurement in centimeters around the umbilical girth of the horse with the measuring tape snug against the horse following respiratory expiration.

Once the tape was properly placed, the ends of the tape were overlapped and the indicated umbilical girth measurement was recorded. The height measurement was obtained by taking the distance in inches from the ground to the top of the withers. The length measurement was obtained by taking the distance in centimeters from the olecranon to the tuber ischium in a straight line (Gharahveysi *et al*., 2008, 2010). A non-stretch fiberglass measuring tape was utilized during the

research project. Formulas of weight estimation in this study to consist of Marcenac and Aublet (1964):

$$\text{Weight (kg)} = (\text{Girth (meter)})^3 \times 80$$

Ensminger (1977):

$$\text{Weight (kg)} = \frac{(\text{Girth 1 (ins.)})^2 \times (\text{Length (ins.)}) + 22.7}{660}$$

Jones *et al.* (1989):

$$\text{Weight (kg)} = \frac{(\text{Girth 2 (cm)})^{1.78} \times (\text{Length 2(cm)})^{0.97})}{3011}$$

Hapgood (2002) New Method 2:

$$\text{Weight (lbs.)} = \frac{(\text{Girth 2 (ins.)})^{0.947} \times (\text{Height (ins.)})^{1.189} \times (\text{Length (ins.)})^{0.930}}{301}$$

Origin is the province of horse rearing: The horses in this study were selected randomly from the 4 main provinces. The main centers of Iranian Arab horses are in the four provinces. Statistical Model for analysis consist of sex birth year and origin as fixed effect:

$$y_{ijklm} = M + BWF_i + S_j + By_k + O_l + e_{ijklm}$$

Where:

y_{ijklm} = Value of each observation
M = Mean
BWF_i = The effect of ith body weight estimation formulas
S_j = The effect of jth sex
By_k = The effect of kth birth year
O_l = The effect of lth origin
e_{ijklm} = The experimental error

Analysis of variance was performed by applying Generalized Linear Model (GLM) procedure of the SAS Software. Comparison of the mean was done by Duncan's multiple range tests.

RESULTS AND DISCUSSION

The research hypothesis that a more accurate equine weight estimation model could be developed through statistical analysis was proven. Not only was the phase one model proven to be more accurate than all other equine weight estimation methods tested with the increased sample size.

Table 1: Analysis of variance for body weight estimation formulas

Source	df	Mean square	p-value
Body weight formulas	3	4799777.366	0.000
Birth year	24	44197.508	0.000
Sex	1	5292.875	0.301
Origin	15	31430.497	0.000
Error	932	4936.132	-

Table 2: Compare means of body weight estimation formulas with Duncan test

Body weight formulas	Mean (kg)
Ensminger (1977)	379.151[a]
Marcenac and Aublet (1964)	390.611[a]
Hapgood (2002)	437.608[b]
Jones *et al.* (1989)	609.520[c]
SEM	4.498
N	244.000

Means in each column followed by the same letters are not significantly different at 0.05

Analysis of variance and compare means for body weight formula was shown in Table 1 and 2. Effect of birth year and origin on body weight formulas very significant ($p<0.01$). There was no significante effect of age on the formulas ($p>0.05$). So, they can be used to estimate the body weight of males and female horses.

Different between body weight formulas very significant ($p<0.01$). Table 2 shows the difference between Ensminger (1977) and Marcenac and Aublet (1964) formuls was not significant ($p>0.05$). Difference between formula of Hapgood (2002) and Jones *et al.* (1989) were very significant ($p<0.01$).

CONCLUSION

The result of this study was shown that with data of Iranian Arab horse's accuracy of Ensminger (1977) and Marcenac and Aublet (1964) formulas were unique. Hapgood (2002) and Jones *et al.* (1989) formulas were with different accuracy. About 4 formulas that used in this study with Duncan test was classified to three classes. On the result of this study, accuracy of Ensminger (1977) and Marcenac and Aublet (1964) methods is unique.

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