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Full Length Research Article

PREVALENCE OF OVERWEIGHT IN HORSES: A COMPARISON OF OWNER AND PROFESSIONAL ASSESSMENTS OF BODY CONDITION AND WEIGHT ESTIMATION

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ABSTRACT
This study aimed to compare the owners' perception of horse body condition and body weight with professional assessment to determine the prevalence of overweight in horses within the Sokoto metropolis. A questionnaire was administered to assess owner perception of body condition and weight (BW) of 79 horses. Body condition scores and morphometric measurements such as Heart Girth (HG), neck circumference (NC), neck length (NL), body length (BL), and height at withers (HW) were carried out by an experienced equine veterinarian. The BW, body mass index (BMI), NC: HW, and HG: HW ratios were calculated. The majority of the horses were male, Nigerian local breed, and engaged in racing. Owners' perception of the horses' body condition was often inaccurate when compared with the assessment made by the professional, with 27.6% of the horses either underscored or overscored by the owners. The BCS of the horses varied between 2.8 to 7.5. The prevalence of overweight horses in this study is 25% and 17.1% based on professional and owner assessments, respectively. The BW, BMI, cresty neck scores (CNS), NC, HG: HW, and NC: HW ratio significantly increased with BCS. In conclusion, 25% of the horses in Sokoto metropolis are overweight, and the owners misperceive the body condition and weight of their horses, with underestimation being the common misperception.

Keywords: Body condition score, horses, owner perception, overweight, weight estimation

INTRODUCTION

Obesity is a condition in which excessive body fat accumulates to an extent that it may adversely affect the health of an individual. It may be generalized or localized (i.e., regional), internal (accumulation of adipose tissue around and within muscles and organs), or external (palpable subcutaneous fat) (Rendle *et al.,* 2018). In the modern domestic horse, it can be caused by excessive caloric intake of high-energy pasture grass and long periods spent grazing relative to the amount of energy expended in daily activities (Johnson *et al*., 2009). In horses, overweight (or overconditioning has been defined as a body condition score (BCS) ≥6 based on the modified 9-point Henneke scale (Kohnke, 1992). The accumulation of excess fat tissue is a major health concern in animals because of its high prevalence and association with insulin resistance or dysregulation, laminitis, cardiovascular disease, and other chronic inflammatory disorders (Durham *et al*., 2019). There is an increasing sentiment that the prevalence of overweight or obesity in horses has also become high, and it either directly or indirectly negatively affects the health and performance of affected animals (Tavanaeimanesh *et al.,* 2022). Obesity is considered to be a primary component of equine metabolic syndrome, a condition that is characterized by insulin dysregulation and a predisposition to laminitis (Frank, 2011; Fitzgerald et al., 2019; Tavanaeimanesh *et al.,* 2022).

Understanding horse owners' perception of body condition and estimation of body weight of horses is essential for monitoring nutritional impacts of diets as well as early recognition of the obesity prone horses and/or disease conditions such as chronic inflammation, laminitis, and insulin dysregulation as a result of obesity (Durham et al 2019; Zak *et al.,* 2020). Morphometric measurement in horses has been a significant tool, especially for weight estimation and assessment of the body condition, because the technique is rapid, non-invasive, inexpensive, and relatively simple to perform. This study aims to compare horse owners' and professionals' assessment of body condition and weight estimation in determining the prevalence of overweight in horses in Sokoto State.

MATERIALS AND METHODS

Study Area

The study was carried out in the Sokoto metropolis of Sokoto State, Nigeria. The state is located at the extreme northwest of the country and lies on the latitude 13^{o}N and longitudes 4.8^{o}E to 6.54^{o}E. The state shares boundaries with Niger Republic to the North and West, and the state of Zamfara to the East, and Kebbi to the Southwest. Sokoto state is in the dry Sahel, surrounded by sandy savannah and isolated hills. The main occupations of the people are farming, fishing, husbandry practice, and trading. Sokoto state ranked second in livestock production in the country with an estimated population of 3 million cattle, 4 million goats, 3.85 million sheep, 0.8 million camels, and 1 million poultry (SSIPC, 2008).

Study Animals

A cross-sectional study was conducted during the cold dry season (September to December 2023) using 76 horses from different stables around Sokoto metropolis, comprising both sexes, different ages, and breeds. Age of the horses were determined based on the owners' records and/or dentition (Wayne and Melvin, 2000). Horses below 3years old were excluded. They were all managed intensively, with some stabled while the majority tethered on an open field using sand as bedding, with provision for a shed or not. They were mainly fed on bean hay, groundnut hay, grasses, wheat bran or millet, and water was provided ad libitum. The inclusion of the horses was based on the availability and willingness of horse owners to participate in the study.

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Questionnaire Survey

A questionnaire aimed at determining the owners' perception of the horse body condition and weight estimation was administered to 20 horse owners within Sokoto metropolis. Questions were grouped into the following categories: Owners' details, horse information, and perception of horse body condition and weight estimation. The questionnaire was designed to minimize any form of bias as the format of the questionnaire was categorical presented with different options. The questionnaire was written in English; however, the native language was used where necessary for better owner understanding of the questions.

Professional Assessment of Horse Body Condition and Morphometric Measurements

Each horse was assigned a BCS by an experienced equine veterinarian using the modified Henneke scoring system from 1 to 9 (Kohnke, 1992). In the modified Henneke scoring system, the six body areas were scored separately, and the average score obtained by dividing the total score of the six body areas by six is recorded as the BCS. The nuchal crest adiposity was also measured using the Cresty Neck Score (CNS) as described by Carter *et al.* (2009). This was done by visually assessing the neck and palpation of the nuchal crest area. The body length (BL), heart girth (HG), neck length (NL), and neck circumference (NC) were measured in centimetres using the non-elastic measuring tape, after each horse was properly restrained using a halter. The height at withers (HW) was taken using the 2.0-meter-long calibrated measuring stick. The measurements were taken from the left side of the horse while standing on a horizontal surface in standard position. All measurements were taken by the same person (AMM). The body weight (BW) was estimated using the formula (Carroll and Huntington, 1988):

$$BW\ (kg) = \frac{HG^2 \times BL}{11{,}900}$$

Statistical Analysis

Data obtained on individual horses, including the BCS, CNS, BW, CN, HW, and questionnaire responses, were entered into Microsoft Excel to create a database, and all morphometric data were expressed as mean±Standard deviation. Descriptive statistical tools, such as frequency and percentage, charts were used to describe the data and results presented using figures and tables. The morphometric data were analyzed using Kruskal-Wallis with Dunn's test to determine the difference between the categories of BCS. All statistical analyses were performed using GraphPad Prism version 10.1.0 (GraphPad Software, San Diego, USA). Statistical significance was set at $p < 0.05$.

RESULTS

Horses and Owners demographic characteristics

A total of 76 questionnaires were completed for 76 horses by 20 horse owners within Sokoto Metropolis. All the horse owners were male, and their age ranged between 18 and 70 years old (41.2±14.3 years). The majority of the owners had different levels of education, with 65.0 % being Bachelor's degree holders (Table 1). The age range of the horses was between 3 to 12 years, with an average age of 6.9 years. The sex, breeds, and activities of the horses are shown in Table 2. Male horses (72.4 %) were more abundant than female horses (27.6 %), and 52.6 % of the horses were Nigerian local breed (Arewa). The majority (71.0 %) of the horses were used for racing.

Table 1: Horse owners' demographic information

Demographic information		No. of horse owners	% of horse owners
Sex	Male	20	100.0
Age (years)	< 20	2	10.0
	20 – 40	7	35.0
	> 40	11	55.0
Level of Education	No formal education	1	5.0
	SSCE	3	15.0
	Diploma	3	15.0
	Degree	13	65.0

Table 2: The sex, breed, and activities distributions of the horses

Horse information's		No. of horses	% of horses
Sex	Stallion	55	72.4
	Mare	21	27.6
Breeds	Arewa*	40	52.6
	Sudanese	14	18.4
	Talon	12	15.8
	Thoroughbred	2	2.6
	Cross breed†	8	10.5
Activities	Racing	54	71.0
	Pleasure Riding	8	11.0
	Companion/Royalty	10	13.0
	Breeding	4	5.0

Arewa* is Nigeria's local breed, †cross between Thoroughbred and Arewa/Sudanese

Owner perception of horse body condition and weight

None of the horse owners knew their horses' height, and only two (10 %) owners monitored the horses' body weight using visual estimation. Owners regarded 90.7% of their horses as having ideal weight, 0.9 % as obese, 2.8 % as slightly overweight, 4.6 % as slightly underweight, and 0.9 % as very thin. When given a pictorial chart of a 0 to 5 scale system, the percentage of horses regarded as ideal weight reduced to 40.8% as shown in Table 3. Thirteen horses (17.1 %) were scored overweight or obese (BCS >4). The majority (98.1 %) of the horses were reported to have the same weight year-round, and only 2 % of the horses were reported to have been previously overweight.

Table 3: The body condition scores of the horses assigned by the horse owners using a pictorial chart of a 0 to 5 scale system

BCS	Category	No. of horses	% of horses
0	Emaciated	1	1.3
1	Thin	10	13.2
2	Moderate	21	27.6
3	Ideal	31	40.8
4	Fat	9	11.8
5	Obese	4	5.3

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Professional assessment of horse body condition, weight and morphometric

The BCS of the horses assessed by the professional using modified Henneke scale varied from 2.8 to 7.5. The horses were categorized into four classes: 11 (14.5 %) underweight, 46 (60.5 %) optimal weight, 18 (23.7 %) overweight and 1 (1.3%) obese. All morphometric data, body weight, BMI, and NC:HW ratio were significantly increased with BCS (Table 4). Similarly, the CNS also significantly increased with BCS with obese horse having the highest score of 4. The Age and HG:HW ratio has no effect on the BCS of the horses.

Table 4: Morphometric measurements, body weight and cresty neck score in relation to horse body condition score in Sokoto metropolis

Variables	Underweight (BCS <4.5) n = 11	Optimal weight (BCS 4.5 – 6) n = 46	Overweight (6 >BCS ≤7) n = 18	Obese (BCS >7) n = 1	P value
Age (years)	7.6 ±2.3	7.2±2.6	5.9±2.0	5	0.1278
HW (cm)	145.7±7.9	147.2±7.9^{a}	153.1±6.6^{b}	142	0.021
HG (cm)	148.9±8.1^{ac}	143.9±11.5^{c}	166.0±8.4^{b}	158	0.0003
NC (cm)	72.9±4.6^{a}	80.3±7.3^{b}	87.5±6.3^{c}	93	<0.0001
HG : HW	1.02±0.03^{ac}	1.05±0.05^{c}	1.09±0.03^{b}	1.1	0.0003
NC : HW	0.5±0.01^{a}	0.55±0.04^{bc}	0.57±0.04^{c}	0.65	0.0007
Weight (kg)	266.7±44.7^{ac}	297.1±57.3^{b}	349.6±56.6^{c}	298.9	0.0027
BMI (kgm^{-2})	182.2±22.9^{ac}	200.9±33.02^{b}	227.3±28.5^{c}	210.5	0.002
CNS	1.6±0.5^{a}	2.5±0.5^{b}	2.9±0.4^{c}	4	<0.0001

HW- height at withers, HG - heart girth, NC - neck circumference, BMI -Body mass index, and CNS - Cresty Neck Score

Comparison between professional and owner assessment of body condition and horse weight

The overall prevalence of overweight or overconditioning (BCS >6-9) horses observed by the professional is 25.0 %, as against the 17.1 % reported for overweight by horse owners (Figure 1). Generally, 27.6 % of the horses were either underscored or overscored by horse owners. The estimated body weight of the horses by professionals, when compared with horse owners, showed that the weights of 38.0 % of the horses were overestimated and 32.9 % were underestimated by the owners.

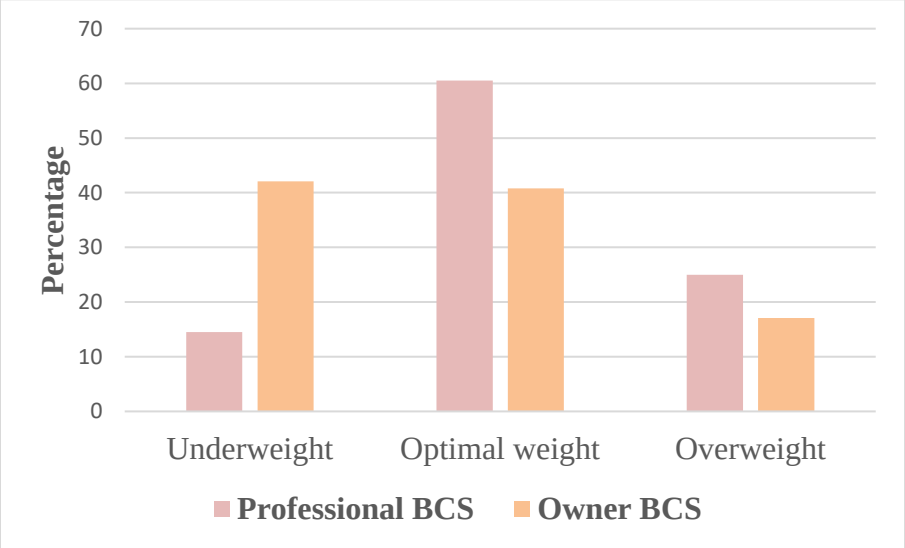

Figure 1: The distribution of body condition score categories determined by the professional and owners for horses sampled from Sokoto metropolis

DISCUSSION

The threat of relative health implications of obesity and/or overweight among horses is a great concern in society, because it relatively predisposes horses to a lot of clinical complications, such

as hyperglycemia and hyperinsulinemia, among others (Geor, 2008). The ability of the horse owners to recognize overweight in their horses is therefore paramount for the overall well-being of the horses.

This study reports, for the first time the prevalence of overweight among horses in Sokoto metropolis using body condition score, weight, and morphometric measurements. The BCS of the horses ranged from 2.8 to 7.5 out of 9 using the modified Henneke scoring system (Kohnke, 1992), with most of the horses (60.5 %) having optimal BCS. The prevalence of overweight horses by professionals is 25 %, much higher than the 17.1 % prevalence reported by the owners. Furthermore, horse owner considerably underscored 27.6 % of their horses' condition as either overweight (7.9 %) or optimal condition (19.7 %). This suggests that about 20 % of the overweight horses were wrongly classified as horses with optimal condition. Additionally, 27.6 % of underweight horses were overscored. Furthermore, neither of the horse owners knew their horse's height nor monitored the horse's weight using a standardized method. Hence, about 70 % of the horses were assigned a wrong weight, with 32.9 % underestimated and 38 % overestimated. This observation is not different from previous studies where horse owner perception of body condition was regarded to be low, with most underestimating their animal's actual body condition (Stephenson *et al.,* 2011; Jensen *et al*., 2016; Potter *et al.,* 2016; Morrison *et al.,* 2017). Similar reports have been documented in other companion animals such as dogs and cats, where owners misperceived the body shape and/or weight of their dogs, with underestimation being the common misperception reported and a possible risk factor for obesity (Courcier *et al*., 2011; Eastland-Jones *et al*., 2014).

The poor perception of BCS could have been due to a lack of experience and bias when categorizing their horses. Similarly, the non-use of a standardized weighing method like a calibrated weighing scale or weight tape is a major factor that contributed to the error in weight estimation. The difference in body weight or condition of horses perceived as ideal for certain equestrian events may also influence the owner's judgement, notwithstanding the effect of breed characteristics on the horse's conformation (Kacem *et al.,* 2024). Morrison *et al.* (2017) also reported that owner perceptions of body weight or condition depend on the activity the horse or pony is intended for, with increased body weight or condition deemed to be more appropriate for certain equestrian disciplines like horse showing events.

Although there have been variations in the overweight or obesity (23.1% to 72%) reported in horses. These have largely been influenced by the type of scoring system used to classify overweight or obese, which includes BCS >5/9 (Harker *et al.,* 2011), or > 6/9 (Pratt-Phillips *et al.,* 2010), or BCS 7-9 (Thatcher *et al*., 2012; Jensen *et al*., 2016; Potter *et al.,* 2016; Kosolofski *et al*., 2017; Menzies-Gow *et al*., 2017; Golding *et al.,* 2023; Al Ansari *et al.,* 2024; Garland *et al.,* 2025). The prevalence of overweight horses in this study is 25 % based on BCS > 6 out of 9.

This prevalence may be within the range reported by previous studies; however, it is lower when compared with recent similar studies that considered BCS > 6 or 7 - 9 as overweight (Menzies-Gow *et al.,* 2017; Golding *et al.,* 2023; Al Ansari *et al.,* 2024). The reason for this could be attributed to the type of management system employed in Sokoto. Horses are kept tethered with access to feed that is controlled while they engage in regular exercise to meet the demand of their main activity, which is racing. Importantly, exercise performance is affected negatively by adiposity (Pratt-Phillips and Munjizun, 2023). Previous reports have also documented a higher prevalence of overweight or obesity in low work level horses, like pleasure riding, than horses used in competitive events (Robin *et al*., 2015; Harris *et al*., 2020). More so, the study was conducted during the early dry season, where the availability of fresh forages is not adequate.

The morphometric measurements, such as neck circumference, heart girth, neck circumference to height at wither ratio, and cresty neck score, increased significantly with BCS, with obese horses having the highest values for CNS and NC: HW. These findings are in agreement with previous studies where CNS and NC: HW were considered suitable predictors for overall adiposity and, by extension, assessment of overweight and obesity (Thatcher *et al*., 2012; Jensen *et al.,* 2016; Al Ansari *et al.,* 2024).

The main limitation of this study was the fact that the horses used for this study were from Sokoto metropolis comprises of four local government areas. Hence, a true prevalence of overweight among horses in Sokoto state would require a larger sample size of randomly selected horse owners covering all local government areas in the state. Nevertheless, this study reported a high prevalence of overweight among horses in Sokoto, and future research is therefore needed to establish the prevalence and the factors associated with overweight or obesity in horses in Sokoto state.

Conclusion

This study demonstrates that 25 % of horses in the Sokoto Metropolis are overweight or obese based on professional assessment, whereas horse owners frequently underestimate the body condition of their animals. Misperception of both body condition and weight was common, with underestimation being the predominant trend. Improving horse owners' ability to accurately evaluate body condition is therefore essential, as early recognition of overweight status can help reduce the risk of metabolic and musculoskeletal disorders associated with excess adiposity. Strengthened owner education and routine use of objective assessment tools would contribute meaningfully to better equine health and management outcomes.

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The authors declared no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

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