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Short Communications

Relationship between condition score, physical measurements and body fat percentage in mares

D. R. HENNEKE, G. D. POTTER, J. L. KREIDER and B. F. YEATES
Texas Agricultural Experiment Station, Horse Section, Department of Animal Science, Texas A & M University, College Station, Texas, USA

Introduction

DIETARY energy intake has a marked effect on ovarian function in a number of species (Hafez and Jainudeen 1974). Body condition, ie, the amount of stored fat in an animal's body, is positively related to reproductive performance in cattle (Donaldson 1969; Lamond 1969; Whitman 1975; Croxton and Stollard 1976; Dunn and Kaltenbach 1980) and sheep (Polliott and Kilkenny 1976). These studies have shown that improving the body condition of cows and ewes at mating significantly increased pregnancy rates, reduced the interval between parturitions and increased ovarian activity. Recently, Frisch (1980) reported evidence that mammals may require a minimum level of body fat for adequate reproductive performance.

Research into the relationship between body condition and reproduction in the equine is vague and often misconstrued. Recent studies have shown that mares entering the breeding season or foaling in low body condition had prolonged post partum intervals, reduced conception rates and required more cycles per conception than mares entering the breeding season in fatter condition (Henneke 1981).

To date, evaluation of body condition in horses has no consistent basis and comparison of research or management systems concerning body condition and reproductive efficiency cannot be adequately evaluated. This study was conducted to develop a system for accurate comparison of stored body fat in horses, ie, body condition, that could be used to advantage on equine breeding farms.

Materials and methods

Twenty mature Quarterhorse mares of varying body condition were examined to identify areas of the body where fat cover was visible and could be palpated to estimate the amount of stored fat in the mares. The areas selected as being indicative of changes in stored body fat were the lumbar spinous processes, ribs, tailhead, area behind the shoulder, neck and withers (Fig 1).

A condition scoring system was then developed to facilitate the comparison of horses with differing amounts of stored body fat. This system was patterned after the Nebraska system for scoring cattle (Whitman 1975). Condition was evaluated on a scale of 1 to 9, with 1 being extremely emaciated and 9 being extremely fat. A description of this condition score system is given in Table 1.

To compare the condition score system as an indicator of body fat stores, condition scores and other measurements including weight, height at the withers and heart girth circumference were taken from 32 mares of varying body condition at 90 days before expected foaling date, within 12 h after parturition and 90 days after foaling. Also ultrasonic scans of rump fat thickness were taken at a point halfway between the first sacral vertebra and the tailhead, 5 cm lateral to the spinous processes.

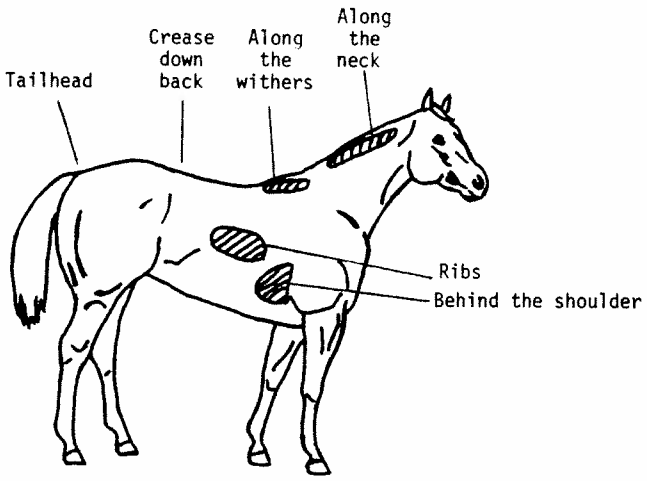

Fig 1. Diagram of areas palpated to estimate body fat and condition score

These scans were used to calculate per cent body fat using the equation of Westervelt, Stouffer, Hintz and Schryver (1976). Simple correlations, r (Anon 1979), calculated between condition score, weight, height, heart girth, weight:height, heart girth:height and per cent body fat are expressed as the coefficient of determination (r^2). ($100 \times r^2$ = percentage of variation in the two characteristics which can be accounted for by their mutual relationship).

Results and discussion

The condition scoring system was based on visual appraisal and palpable fat cover at six areas of the horse's body. During the winter months, the presence of a long, heavy hair coat complicated visual appraisal, and palpation of the animal was conducted to determine body condition more accurately.

Some conformation differences made certain criteria within each score difficult to apply to specific animals. Some mares had more prominent withers and were flatter across the back than others. Therefore, more emphasis was placed on fat cover over the ribs, behind the shoulder and around the tailhead

TABLE 1: Description of individual condition scores

Score	Description
1 Poor	Animal extremely emaciated. Spinous processes, ribs, tailhead, tuber coxae and ischii projecting prominently. Bone structure of withers, shoulders and neck easily noticeable. No fatty tissue can be felt
2 Very thin	Animal emaciated. Slight fat covering over base of spinous processes, transverse processes of lumbar vertebrae feel rounded. Spinous processes, ribs, tailhead, tuber coxae and ischii prominent. Withers, shoulders and neck structures faintly discernable
3 Thin	Fat build up about halfway on spinous processes, transverse processes cannot be felt. Slight fat cover over ribs. Spinous processes and ribs easily discernable. Tailhead prominent, but individual vertebrae cannot be visually identified. Tuber coxae appear rounded, but easily discernable. Tuber ischii not distinguishable. Withers, shoulders and neck accentuated
4 Moderately thin	Negative crease along back. Faint outline of ribs discernable. Tailhead prominence depends on conformation, fat can be felt around it. Tuber coxae not discernable. Withers, shoulders and neck not obviously thin
5 Moderate	Back level. Ribs cannot be visually distinguished but can be easily felt. Fat around tailhead beginning to feel spongy. Withers appear rounded over spinous processes. Shoulders and neck blend smoothly into body
6 Moderately fleshy	May have slight crease down back. Fat over ribs feels spongy. Fat around tailhead feels soft. Fat beginning to be deposited along the side of the withers, behind the shoulders and along the sides of the neck
7 Fleshy	May have crease down back. Individual ribs can be felt, but noticeable filling between ribs with fat. Fat around tailhead is soft. Fat deposited along withers, behind shoulders and along the neck
8 Fat	Crease down back. Difficult to feel ribs. Fat around tailhead very soft. Area along withers filled with fat. Area behind shoulder filled with fat. Noticeable thickening of neck. Fat deposited along inner thighs
9 Extremely fat	Obvious crease down back. Patchy fat appearing over ribs. Bulging fat around tailhead, along withers, behind shoulders and along neck. Fat along inner thighs may rub together. Flank filled with fat

when evaluating mares with high withers and flat backs. However, when properly applied, the scoring system was independent of size or conformation of the horse.

Conformation changes also occurred in pregnant mares as they approached parturition. The weight of the conceptus stretched the skin and musculature of the back, ribs and tailhead. Fat cover appeared to be diminished in these areas. To compensate for this condition, more emphasis was placed on fat deposition behind the shoulder and along the withers when evaluating pregnant mares near term. In addition, maiden mares seemed to have more fat cover over their ribs than older mares of the same body condition. Therefore, the apparent fat cover over the ribs was not used extensively when evaluating maiden mares.

Simple correlations were determined between condition score, weight, height, heart girth, weight:height, heart girth: height and per cent body fat (Table 2). The condition score was positively related (r^2 = 0.65, $P<0.001$) to body fat percentage, but there were no significant correlations between

TABLE 2: Correlations (r^2) between condition score, physical measurements and body fat percentage in mares

	Weight	Height	Heart girth	Weight: height	Heart girth: height	Fat percentage
Condition score	0.50**	-0.21	0.40*	0.58**	0.51**	0.65***
Weight		0.21	0.90***	0.92***	0.59***	0.30
Height			0.29	-0.17	-0.57**	-0.34
Heart girth				0.79***	0.62***	0.19
Weight: height					0.83***	0.43*
Heart girth: height						0.44*

* $P<0.05$; ** $P<0.01$; *** $P<0.001$

weight, height or heart girth to body fat percentage. Thus, the condition score was more closely related to body fat content than other single physical measurements. Because the scoring system is independent of conformation, length and height, it seems reasonable that it should be a more accurate indicator of stored body fat than any individual measurement taken.

Weight:height and heart girth:height were significantly related (r^2 = 0.43, $P<0.05$; r^2 = 0.44, $P<0.05$; respectively) to per cent body fat. These ratios account for more than one physical dimension and are therefore more reflective than any single physical measurement in comparing stored fat reserves. However, the condition score system uses the total animal as a basis for estimating body fat content and, therefore was likely to be more highly related to body fat content than other measures.

This scoring system is easy to apply and could be useful in experiments on the effects of nutrition on reproductive performance. Further, the system can be a very useful communication tool in managing mares to achieve maximum performance.

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