Introduction

Practical, rapid, and non-invasive methods for assessing health status and well-being are valuable when studying rats used in research studies where weight and health are powerful confounds. Weight loss, measured as a percent decline from initial weight or weight of age-matched controls, is a commonly used criterion for euthanasia. Depending on the study, weight loss may not be a sensitive indicator of animal health. Studies which create physiological changes such as intraperitoneal fluid retention or tumor growth may mask the weight loss by interfering with the interpretation of body condition scores. In satellite studies of weight loss, body condition scores were found to not vary according to factors such as sex and age. Interpretation of collected weights can also be biased due to factors such as equipment error, observer variation, and time of day. The body condition scoring technique is performed by observing and palpating the flesh over the bony protuberances of the hips and lumbar spine. Similar techniques have been shown to more accurately reflect the body condition and nutritional state of the patient in a number of species, including dairy cows, beef cows, dogs, cats, sheep, and mice. The body condition scoring techniques have also been shown to be insensitive to interobserver variation.

Materials & Methods

Rats. Rats were retired heterozygous breeders obtained from a local breeding colony of rats that develop polycystic kidney disease (Han:SPRD). Retired heterozygous breeders are between 12 and 18 months of age and have an increased chance of death caused by renal failure. Housing. Rats were housed in ventilated autoclaved shoebox caging on hard wood bedding. Food and water were provided ad lib. The light cycle was a 12:12 and temperature and humidity were maintained at 72°F and 30-70%, respectively. Experimental procedure. Male and female Han:SPRD heterozygous rats and Sprague Dawley rats, aged 12 to 18 months, were selected from the breeding colony according to body condition score to ensure that an even distribution of body condition scores was represented in the male and female parental groups. Two observers recorded the weight of each rat at least once per week. At the time of weighing, each observer palpated each rat and recorded a body condition score. The observers performed their evaluations independently. The weights and body condition scores were reviewed by the PI who requested euthanasia as an alternative should the condition score trend. Body condition score was determined by palpation of the hips (illustrated).

Body Condition Score

Description

1. Underconditioned with segmentation of the vertebral column and the dorsal pelvic bones remaining distinct with a highly sculpted surface.

2. Underconditioned with segmentation of the vertebral column and the dorsal pelvic bones remaining distinct with a highly sculpted surface.

3. Consistent normal variation, with the segmented vertebral column nearly indistinguishable. Only the edges of two to three sacral vertebrae should be visible.

4. Well fleshed with rounding of the subcutaneous tissues over the dorsal pelvic protuberances. The pelvic bones are palpable with slight pressure, and the spinous processes are still easily visible. Segmental variation of the vertebral column is still visible.

5. Well fleshed with rounding of the subcutaneous tissue over the dorsal pelvic protuberances. The pelvic bones are palpable with slight pressure. The segmentation of the vertebral column is still palpable with slight pressure, but the segmentation is not visible.

Rats were housed in ventilated autoclaved shoebox caging on hard wood bedding. Food and water were provided ad lib. The light cycle was a 12:12 and temperature and humidity were maintained at 72°F and 30-70%, respectively. Experimental procedure. Male and female Han:SPRD heterozygous rats and Sprague Dawley rats, aged 12 to 18 months, were selected from the breeding colony according to body condition score to ensure that an even distribution of body condition scores was represented in the male and female parental groups. Two observers recorded the weight of each rat at least once per week. At the time of weighing, each observer palpated each rat and recorded a body condition score. The observers performed their evaluations independently. The weights and body condition scores were reviewed by the PI who requested euthanasia as an alternative should the condition score trend. Body condition score was determined by palpation of the hips (illustrated).

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Results

The results of this study show that the body condition scoring technique described here was an accurate measure of the degree of renal failure in the polycystic kidney disease rat model. Body condition score reliably decreased as serum chemistry indicators of renal function increased and kidney size increased (due to the development of renal cysts). The loss of body mass could not be reliably assessed using body weight as the increasing size of the kidneys masked the loss of muscle mass.

Although mice and rats share many similarities, they are still different species with differences in their anatomy and physiology. Our hypothesis had been that it would be possible to utilize the murine body scoring technique to noninvasively, and inexpensively, and consistently evaluate the muscle mass of rats. However, we discovered that minor modifications to the murine scale were required when evaluating rats because rats did not develop significant fat deposits nor did they develop the prominent vertebral changes as they became obese. With these minor modifications, the rat body condition scoring technique can be valuable for assessing the health of rats.

Our study also reaffirmed that body weights have high interobserver variability and should be used with caution, especially in rodents (data not shown). We have previously suggested that this variation can be due to time of day, scale used to weigh the animals, and the technique of personnel performing the weighing procedure. Another limitation of the use of body weight to assess rodent health is that a baseline weight or age-matched control animal weight is required to be able to adequately determine if the case or subject rodent has lost weight. The body condition scoring technique has no significant interobserver variability (data not shown) and does not require a baseline or age-match control to be able to interpret the health status of the case or subject rodent. For these reasons, we encourage personnel working with rodents to incorporate the use of body condition scoring to influence when evaluating mice and rats clinically or as part of a research experiment.

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Figure 1: To obtain the body condition score, the rat is allowed to rest on the wire top. The vertebræ are assessed by palpation of the lumbar spine. The pelvic bones are assessed by palpation of the hips (illustrated).

Figure 2: This graph illustrates the mean BUN values for the male rats, at each body condition score level. The confidence bars (not shown) are a standard of distribution. "Single factor ANOVA analysis showed significant between group variation for both BUN and creatinine (p<0.001)." Data for the female rats was similar (not shown).

Table 1: Description of the palpation criteria used to assess the body condition scores.

Figure 3: This graph illustrates the mean body weights of each rat live weight, the kidney weight, and the adjusted body weight of the cadaver after removal of the kidney (cadaver weight) for the male rats at each body condition score level. "Single factor ANOVA analysis showed significant between group variation for both BUN and creatinine (p<0.05)." Data for the female rats was similar (not shown).

Characterizing a Body Condition Scoring Technique and Scale for Rats

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