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Body Weight of Wild and Captive Common Marmosets (*Callithrix jacchus*)

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Captive studies and occasional trappings of wild individuals indicate that callitrichids have small size and body weight and lack sexual dimorphism. We compared body weights of captive and wild Callithrix jacchus obtained by repeatedly weighing subjects from two populations in Brazil. We obtained captive data by routinely weighing 138 individuals from the Universidade Federal do Rio Grande do Norte colony and wild data via regular trapping of 243 individuals in 15 free-ranging groups from IBAMA's field site in Nísia Floresta. We assigned all subjects to one of four age classes—infant, juvenile, subadult, and adult—according to their birth dates or size, reproductive status, and dental development. There is no significant difference between males and females in any of the four age classes, but captive subjects were heavier than wild ones in all age classes but infant. Reproductive and nonreproductive adult females showed no statistical difference in weight. These results accord with previous reports of lack of body size sexual dimorphism in common marmosets and suggest that differences between wild and captive common marmosets are not constitutional, but are instead a consequence of diet and physical activity. The absence of weight difference between reproductive and nonreproductive females suggests that any possible advantage from high rank is outweighed by the costs of reproduction in common marmosets.

KEY WORDS: body weight; callitrichids; age changes; colony-field comparison.

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INTRODUCTION

Callitrichids present several morphological, physiological, and behavioral characteristics that set them apart from other anthropoid primates. Noteworthy among them are the small size and low body weight, which varies from 119 g in *Cebuella* (Soini, 1993) to 750 g in *Leontopithecus* (Fleagle, 1988); the lack of sexual dimorphism (Hershkovitz, 1977; Hearn, 1983; Stevenson and Rylands, 1988); the birth of twins between 10% and 15% of the mother's weight, reaching up to 25% at weaning (Hearn, 1983); a postpartum oestrus; and the absence of physiological mechanisms inhibiting ovulation during lactation, with possible overlap of lactation, pregnancy, and presence of dependent infants (Hearn, 1983; Abbott *et al.,* 1993; Rothe and Darms, 1993).

These characteristics have strong implications for the social and reproductive systems of callitrichids. The small size and body weight, which Leutenegger (1980) and Ford (1980, 1994) consider to evidence phyletic dwarfism, has a direct influence on the cooperative infant care of the relatively heavy newborns (Tardif *et al.,* 1993). Hershkovitz (1977) and Hearn (1983) noted the low body weight and the lack of sexual dimorphism in *Callithrix jacchus.* Many later reports not only confirmed these patterns for *C. jacchus,* but also extended them to other callitrichid genera and species (*Callithrix:* Stevenson and Rylands 1988; Fleagle, 1988; *Leontopithecus:* Dietz *et al.,* 1994; *Saguinus fuscicollis:* Goldizen *et al.,* 1988; *Saguinus imperator imperator:* Bicca-Marques *et al.,* 1997; *contra C. jacchus:* Peters and Guerra, 1998; *S. f. wedelli:* Bicca-Marques *et al.,* 1997).

Most reports concern captive subjects, especially *Callithrix,* and the few field data available are from sporadic trappings. We compare body weight data for captive and wild common marmosets (*C. jacchus*) obtained by repeated weighing of two populations.

METHOD

Subjects, Study Sites, and Procedure

We obtained data from captives in the Núcleo de Primatologia, Universidade Federal do Rio Grande do Norte (UFRN), Natal, Brazil, from 1995 to 1998. This colony had 107–231 common marmosets, which were weighed routinely. A technician retrieved subjects from their cages and weighed them in a plastic box. Immediately after the procedure, they returned to their home cages.

We obtained data from 15 free-ranging marked and habituated groups

at the IBAMA's (Instituto Brasileiro de Meio Ambiente) EFLEX station (Estação Florestal de Experimentação) located (06° 05' S, 35° 12' W) 40 km from Natal, NE-Brazil, in Nísia Floresta. This station covers 170 ha: 70 ha of secondary Atlantic forest, 50 ha of Tabuleiro vegetation, and 50 ha of exotic trees, mainly *Eucalyptus citridora.*

We trapped wild subjects in individual wooden cages to which they were habituated for 3 days before capture via fruits. On the day of capture, one of us stalked the subjects until one entered the trap. At that moment, the door was released and the individual was caught. We covered the cage with a black cloth to calm the subject and took it to a laboratory in the field station, anesthetized it with 0.03 mg/kg of ketamine hydrochloride, and weighed it. We also took other measurements, such as tail-to-head and limb lengths, dental development, and occurrence of prior pregnancy.

We assigned all subjects to one of four age classes (Yamamoto, 1993): infants (0–5 months), juveniles (6–10 months), subadults (11–15 months), and adults (>15 months). However, we excluded data from subjects between 0 and 2 months of age in order to keep the captive and wild samples balanced because captures of wild young infants were rare. We classified captive-born subjects and those whose birth was registered in the field according to their birth dates. We classified other subjects according to size, reproductive status, and dental development. We use broad age classes to allow for error in age estimation of wild subjects.

We assigned adult females to two broad categories: reproductive and nonreproductive. In the first category are all the females that had a reproductive status in their groups, regardless of their reproductive situation at the moment of the weighing. Nonreproductive females are ones that had never bred.

Table I presents the total number of subjects both for captive and wild

Table I. Mean weights and standard deviations for captive and wild animals in the various age/sex classes[a]

Age/sex classes		Setting	
		Captive	Wild
Infant	Male	144.9 ± 38.5 (49)	125.3 ± 34.4 (10)
	Female	133.7 ± 32.2 (47)	141.6 ± 27.4 (14)
Juvenile	Male	238.1 ± 45.6 (64)	164.5 ± 41.7 (31)
	Female	244.8 ± 37.6 (53)	179.8 ± 39.5 (30)
Subadult	Male	302.2 ± 42.5 (48)	244.9 ± 42.8 (31)
	Female	318.2 ± 45.6 (46)	251.4 ± 32.4 (29)
Adult	Male	347.6 ± 30.5 (46)	317.9 ± 34.1 (69)
	Female	359.7 ± 50.4 (38)	322.0 ± 40.4 (86)

[a]Sample sizes are shown in parenthesis.

settings for all eight age/sex classes. We weighed 138 captive and 243 wild individuals. Thus, we had a minimum of 14 and a maximum of 86 individuals for any age/sex class. In the case of repeated weighing of the same individual in any age class, we considered the mean of all the weights during that period. As a result, we had only one value for each individual for any of the age classes.

RESULTS

The mean weight of captive subjects ranges from 133.7 g (infant females) to 359.7 g (adult females), and from 125.3 g (infant males) to 322.0 g (adult females) in the field (Table I). There is no significant difference between males and females in any age class. Captive subjects are heavier than wild animals in all age classes, with the exception of infants (MANOVA, factors: age and setting. $F_{2, 675} = 14.7573$, $p = 0.0000$, Tukey test, $p = 0.00003$ for adults, subadults, and juveniles) (Fig. 1).

We also compared the weights of adult reproductive and nonreproductive females because reproductive status is a major influence on weight. There is no difference between the four status/site categories for females (ANOVA, factors: status and site: $F_{2, 120} = 0.4309$, $p = 0.5128$). The major difference is between captive and wild nonreproductive females (captive females, mean weight 370.7 g; wild females, mean weight 344.6 g) but it is not statistically significant.

DISCUSSION

In accordance with two previous reports (Hearn *et al.,* 1978; Abbott, 1978) but different from a third (Peters and Guerra, 1998), we found no evidence of sexual dimorphism in marmosets in terms of body weight. Peters and Guerra (1998) compared subjects of exactly the same age, whereas we worked with broad age classes. Nevertheless, ours is a highly consistent result because the absence of difference in weight was clear in very large samples for all age classes and for both captive and wild subjects. This result is not surprising because marmosets show lack of sexual dimorphism in many other aspects (Kleiman, 1977).

There is a clear difference in weight between captive and wild subjects, with the latter showing consistently lower weight than their same-age counterparts. The only exception is infants, which showed similar weights both in the colony and in the field, suggesting that differences in weight between

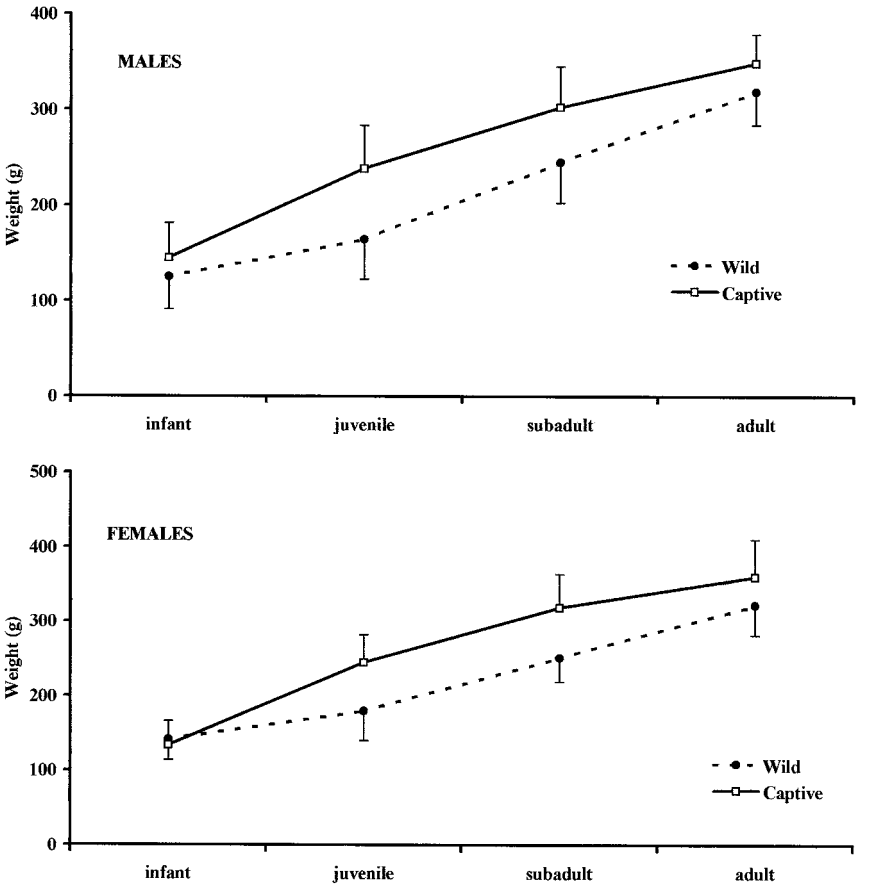

Fig. 1. Mean body weight and standard deviations of captive and wild male and female *Callithrix jacchus* of four different age classes.

wild and captive subjects are not constitutional, but instead are a consequence of diet and physical activity.

The lack of weight difference between captive and wild infants raises another point: They were born from mothers of different weights. The fact that they did not differ in weight supports our hypothesis that differences between subjects of other age classes are not genetic and also suggests that in marmosets, as in other species, including humans (Knobil and Neill, 1994), infants are born of normal weight regardless of mother weight.

Finally, reproductive and nonreproductive adult females evidenced no significant weight difference. One might expect that reproductive females,

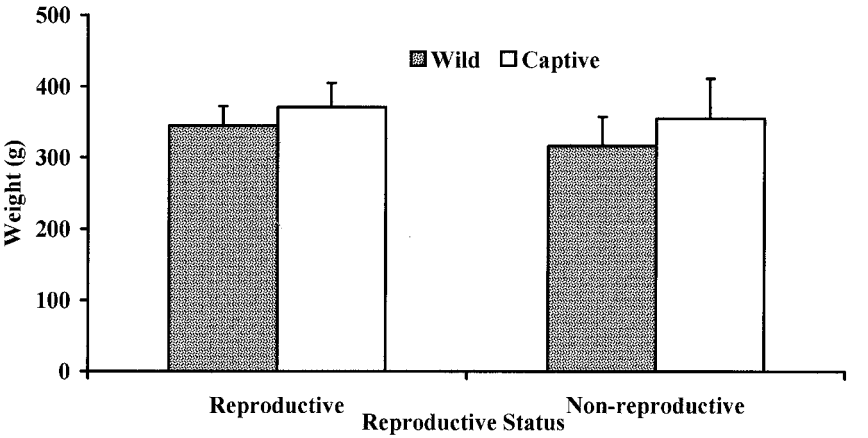

Fig. 2. Mean body weight and standard deviations of captive and wild reproductive and nonreproductive female *Callithrix jacchus.*

which are usually dominant over the other females, should be larger than nonreproductive females and also that reproductive activity itself would lead to an increase in mean female weight. Nevertheless, none of this seems to occur. Tardif *et al.* (1993), Price (1992), and Goldizen (1987, 1989) suggested that reproduction has a high energetic cost for marmosets. We believe that the present data reflect the costs of reproduction because, even considering that pregnancy brings an increase in body weight, this is apparently outweighed by the loss of weight after birth and during lactation.

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