STABILITY OF PIGEON BODY WEIGHT UNDER FREE-FEEDING CONDITIONS

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Increases in regulatory oversight of animal research require verification of effects of standard practices. There are no formal guidelines for establishing free-feeding weights in adult pigeons. In the present study, pigeons were obtained from a commercial supplier, weighed upon arrival, and then held in quarantine for 7 days with free access to food. Subsequently, still with continuous access to food, they were weighed daily for 30 days. No significant changes in weights occurred over the 30-day period for male pigeons, indicating that seven days is sufficient for establishing a baseline body weight. A secondary finding of higher day-to-day variability in the weights of female pigeons may serve as a method of sexing pigeons.

Key words: body weight, free-feeding, food deprivation, pigeons

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When used in experiments on learning and conditioning, pigeons often are kept at a reduced body weight, usually in the range from 80% (as recommended by the Canadian Council on Animal Care [1984]) to 85% of free-feeding weight. The standard method for maintaining a pigeon at a particular reduced weight is clearly outlined (Ator, 1991; Morrison, Evans, Ator, & Nakamura, 2002), but to our knowledge, guidelines for establishing a 100% weight have not been promulgated. When guidelines are not available, Institutional Animal Care and Use Committees (IACUCs) often rely on veterinary opinion in establishing requirements. In the absence of data, veterinarians are likely to err on the side of more restrictive criteria. For example, current veterinary opinion at our institution about how long it should take to determine a free-feeding weight in a pigeon is that 30 days of continuous access to food are necessary to provide a safe and reliable estimate of free-feeding weight.

The purpose of the present study was to assess if and how much a pigeon's body weight changes over a relatively extended period of free access to food. Given that per-diem charges add significantly to the cost of research, it is important to know how long a pigeon's weight needs to be tracked to establish a firm 100% weight.

METHOD

Subjects

Twenty-seven White Carneau (*Columba livia*) pigeons were obtained from Double-T Farms, Glenwood, Iowa. Five of the 27 were subsequently determined to be females. All pigeons were approximately 1 year old.

Procedure

After the supplier received the order, the requested pigeons were isolated from large room-sized pens containing 100 – 350 pigeons and housed, 3 to a cage, in cages 76 cm long, 61 cm wide, and 61 cm high. They remained at the farm for 14 days before shipment with continuous access to water, a custom mixed grain (consisting of safflower, red and white milo, and popcorn), and health grit. After 14 days, the farm shipped the pigeons individually housed in small cardboard crates via an overnight air carrier. The pigeons had no access to food or water during shipment.

Upon receipt, all pigeons were weighed and then placed in quarantine for 7 days at the University of Florida Animal Care Services unit. During the quarantine, the pigeons were individually housed in cages 79 cm long, 71 cm wide, and 42 cm high, and kept on a 16 hr/8 hr light-dark cycle, with continuous access to water, Purina® Pro Grains for Pigeons, and health grit. On the 8th day, they

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Table 1

Pigeon weights at time of arrival (i.e., the first day of quarantine period), the 1st day of weighing (i.e., the first day in the Psychology Department), the 30th day of weighing, and the coefficient of variation.

	Arrival	Day 1	Day 30	CV
Males				
2	615	690	705	0.013
23	722	719	687	0.017
63	514	525	529	0.006
72	530	564	589	0.017
674	603	629	636	0.007
711	612	597	577	0.012
719	611	623	628	0.007
740	570	586	573	0.016
808	640	634	670	0.019
809	629	623	559	0.034
878	786	778	802	0.014
945	583	573	604	0.019
947	570	595	560	0.021
959	590	644	608	0.013
965	648	658	620	0.017
977	586	601	626	0.016
992	560	563	561	0.008
994	640	634	628	0.008
998	567	546	540	0.006
4506	586	578	606	0.014
4667	525	555	568	0.010
7370	589	593	604	0.009
Females				
65	536	539	538	0.026
737	714	711	766	0.039
898	535	545	528	0.048
934	702	723	658	0.028
7110	528	567	554	0.028

were transferred to the vivarium in the Psychology Department. There, they were housed individually in cages 38 cm long, 28 cm wide, and 31 cm high, and kept on a 16hr/8hr light-dark cycle, with continuous access to water, Purina® Pro Grains for Pigeons, and health grit. From the 8th through the 37th day they were weighed at approximately the same time each day.

RESULTS

Table 1 shows individual data from all 27 pigeons including the arrival weight, weight on both the 1st and 30th day in the Psychology Department, along with the coefficient of variation to serve as a measure of day-to-day variability. Several analyses were conducted to test for changes in body weights over time. The first set of analyses was conducted on the results from the 22 male pigeons. First,

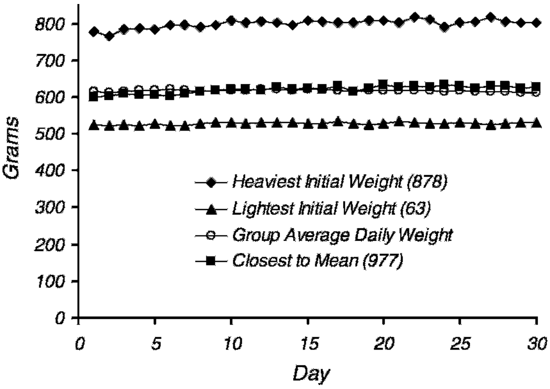

Fig. 1. Daily weight (in g) for the male pigeon with the highest (filled diamonds) and lowest (filled triangles) initial weight, the group average daily weight (open circles), and the pigeon whose weight was closest to that average (filled squares). Pigeon identification numbers appear in parentheses.

a comparison of weights was made between the arrival weights and weights when the pigeons were received in the Psychology Department 7 days later. Specifically, a paired *t*-test was conducted. Group mean arrival weight was 603.45 g and mean weight upon receipt in the Psychology Department was 614.00 g. That difference, although representing a mean change of only 1.8%, was statistically significant (t [21] = 2.129, $p < .045$). Out of the 22 individuals, 13 increased their weight over the 7-day span, with the largest gain being 75 g. Nine pigeons lost weight, the largest loss being 21 g.

Figure 1 summarizes weight changes over the 30 subsequent days. Shown are daily weight records for the pigeon with the heaviest initial weight (filled diamonds), and the pigeon with the lightest initial weight (filled triangles). Also presented are the group-average daily weight (open circles) and the pigeon whose weight was closest to that group mean (filled squares). Weights tended to be very consistent from day to day across the entire 30-day period.

A one-way repeated measures analysis of variance (ANOVA) was conducted with days as the independent variable. That analysis revealed no statistically significant effect of days (F [2,124] = 1.388, $p < .26$). That is, the analysis confirmed the visual impression from Figure 1 that body weight did not change in any important way over the 30-day period.

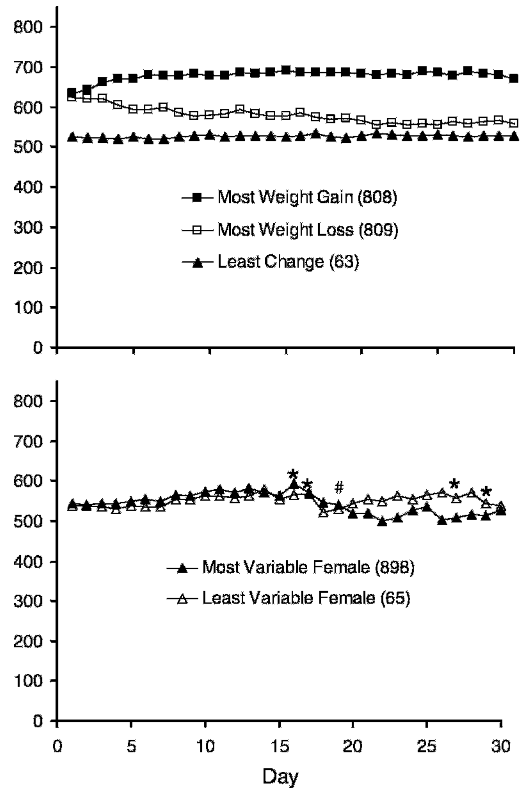

Fig. 2. Upper panel displays daily weight (in g) for the male pigeon with the most weight gain (filled squares), the most weight loss (open squares), and the least weight change (filled triangles) over the 30-day weighing period. Pigeon identification numbers appear in parentheses. Lower panel displays daily weight (in g) for the female pigeon with the most day-to-day variability (filled triangles) and least day-to-day variability (open triangles). Pound signs (#) denote the day an egg was found in the home cage of Pigeon 898; asterisks (*) denote the days an egg was found in the home cage of Pigeon 65. Pigeon identification numbers appear in parentheses.

Other more focused analyses also support that description. For example, a paired *t*-test comparing the weights on Day 30 with those on the first day in the Psychology Department showed that the mean weight loss of 1.27 g was not statistically significant (t [21] = 0.222, $p <$ .83). Group mean values over the 30 days ranged from 612 to 622 g, with the highest value occurring on Day 12. Thus the range for the group mean spanned 1.6%.

The top panel of Figure 2 shows data from 3 pigeons—the one that gained the most weight (filled squares), the one that lost the most weight (open squares), and the one with the least change in weight (filled triangles) over the 30-day period. The pigeon with the most weight gain, gained 36 g (a 5.4% change), and the pigeon with the most weight loss, lost 64 g (a 10.3% change) over the 30 days. However, upon visual inspection, it appears that almost all of the gain and loss in these 2 pigeons occurred within the first 9 days.

The data from female pigeons are treated separately because they were distinctive in an interesting way. All the pigeons ordered were presumably males, but 5, as evidenced by egg-laying, were females. Feather-tissue DNA tests (Avian Biotech International, Tallahassee, FL) were conducted on all 27 pigeons and confirmed the 5 egg-laying pigeons as females and the other 22 pigeons as males. The females and males differed noticeably in day-to-day variation in weight. The bottom panel of Figure 2 shows daily weights from 2 females, the one showing the most day-to-day variability (filled triangles), and the one showing the least day-to-day variability (open triangles). Those functions may be compared to similar functions for males in Figure 1. To provide statistical confirmation of the apparent difference between males and females, a coefficient of variation across the 30 days of weighing was calculated for each subject. The mean for males was 0.014, whereas that for females was 0.034. A *t*-test for independent samples revealed that difference to be statistically significant (t [4.912] = 4.579, $p <$ .006).

The sex difference in day-to-day variability was noticeable, albeit less so, even before egg laying. A *t*-test for independent samples was conducted using the female coefficient of variation of the first day of weighing until 2 days before laying their first egg. The females' mean coefficient of variation was smaller (0.028), but still statistically significantly higher than the males' even before egg laying (t [4.811] = 3.130, $p <$ .027). The symbols above the data series in the bottom panel of Figure 2 note the days on which an egg was found in the pigeon's home cage. The degree of variation between female pigeons did not appear to be a function of the number of eggs laid. For example, as shown in the bottom panel of Figure 2, the pigeon with the highest variability (as measured by its coefficient of variation) laid one egg during the 30-day weighing period, whereas the pigeon with the lowest variability laid four eggs.

DISCUSSION

The present data reveal clearly that male pigeon body weights become stable in no more than 7 days of free access to food. We cannot determine, given that we did not have access to the pigeons during the quarantine period, if a shorter period also would suffice. It is informative to note, however, that the weights upon arrival from the shipper were on average less that 2% lower than the final weights obtained 37 days later. Thus, even if the arrival weight were used as the estimate of free-feeding weight, there would have been only a 1.7% (i.e., 8 g) ''error'' in an 80% target weight. These data make it evident that assessment of free-feeding body weights of male pigeons can be accomplished relatively rapidly with no danger of misestimating.

An interesting side result of the current investigation is that monitoring free-feeding body weight might provide a method for sexing pigeons, something that is difficult to do by sight. The female pigeons showed consistently greater day-to-day variation in weight than did males even before egg laying. Pigeon breeders, including the supplier of the birds in the present study, often rely on behavioral assessments to sex pigeons. That is, observed gender-specific coos, struts and other courting behavior are used to differentiate the cocks from hens (see Levi, 1963 for more details). However, as the present study illustrates, behavioral sexing is not an infallible practice. For studies in which a pigeon's gender serves as a critical independent variable, monitoring day-to-day weight variability may serve as a less intrusive alternative to surgical examination of internal sex organs, and a less expensive alternative to DNA tests of feather-tissue, eggshell, or blood.

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