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Wet and Dry Weight Relationships of Mallard (*Anas platyrhynchos*) Tissues

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Much data in the literature on environmental contaminants in animals are presented on the basis of wet weight of tissues. Equally, considerable data are presented on a dry weight basis. Comparison of residues in tissues between wet weight and dry weight based reports cause considerable difficulties in interpretation due to the lack of dry weight percentages. Considerable problems in recovering accurate samples from dead and dying individuals under field conditions prompt questions as to the value of wet weight determinations of contaminants in such animals. The work of ADRIAN & STEVENS (1979) with duck livers indicates that difficulties in ensuring valid wet weights are very real. The present work was undertaken to provide data on wet weight vs dry weight of mallard (Anas platyrhynchos) tissues in order that comparisons of data already reported on wet and dry weight basis may be facilitated.

MATERIALS AND METHODS

Forty adult (2 years old) male mallards were assigned to the experiment. These were fasted overnight and killed by exsanguination in groups of five at 14-day intervals (12 February through 21 May 1982). The following tissues were recovered from each animal: blood, bone, (tarso-metatarsus), brain, gizzard, heart, intestine, kidney, liver, muscle, (skeletal-Musculus complexus major) proventriculus, and testis. Samples of each tissue (<10g) were placed in tared containers, weighed, and wet weights were obtained. Following weighing tissues were lyophilized in a freeze dryer over 48 hours at -50C and 50-100 µtorr. Following the freeze drying, tissues were stored in dessicators and weighed to determine dry weights. Differences between wet weights and dry weights were determined by calculation and expressed as percentages. Means and standard errors (SE) of dry weight percentages of all tissue were calculated. Data were analysed by Analysis of Variance to determine whether days of sampling influenced dry-weight percentages.

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RESULTS AND DISCUSSION

Day of sampling did not affect dry-weight percentages of tissues indicating that day-to-day handling procedures did not affect results and that percentage dry weight of tissues was not subject to seasonal variations during the study (February through May). Mean dry weight percentages of tissues varied from 14.5% for testis to 81.7% for bone (Table 1). The dry matter percentage of most tissues (blood, brain, gizzard, heart, kidney, liver, and testis) did not vary substantially. Bone, skeletal muscle, and 2 components of the gastrointestinal tract (proventriculus and intestine) varied considerably.

Of particular interest is the fact that neither testis nor liver dry matter percentage varied with time as considerable growth of testes occurred in the mallards during the study period. OSBORN (1979) has suggested that seasonal changes in liver content of fat and protein are substantial in the starling (Sturnus vulgaris) and such changes may influence concentrations of heavy metals in bird livers. If fat content of the liver varies the dry matter content should also vary and would be reflected in a seasonal variation in dry matter content of liver. Change over time in liver dry matter percent was not seen in the present experiment though substantial changes in preparation for breeding took place and mallards were starting to molt towards the last sacrifice date. On the other hand they were maintained on a constant diet during the course of the experiment and minimal changes due to diet could be expected. ADRIAN & STEVENS (1979) found the mean dry matter of mallard liver varied from 25.7 percent to 35.4 percent in frozen and fresh liver, respectively, dried by oven drying. Freeze-drying in the present report resulted in a mean of 32.7 percent dry matter with less variation than reported by ADRIAN & STEVENS (1979). Method of euthanasia may also have contributed to differences depending on the degree of exsanguination which resulted.

The data reported herein should help facilitate comparisons between reports of contaminant concentrations of tissues based on wet weights and dry weights in a species (mallard) which has been the subject of extensive study.

Table 1. Dry weight as a percentage (mean ±S.E.) of wet weight of 11 tissues of mallard ducks.

Tissue	N	Mean % Dry Weight, ±S.E.
Blood	40	21.70±0.21
Bone	40	81.66±0.99
Brain	40	20.43±0.13
Gizzard	40	25.44±0.17
Heart	40	24.30±0.21
Intestine	40	20.83±0.39
Kidney	40	23.44±0.28
Liver	39	32.67±0.26
Muscle, Skeletal[1]	40	23.46±0.48
Proventriculus	40	22.56±0.50
Testis	40	14.51±0.24

1: Musculus complexus major.

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