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INVESTIGATION OF AVERAGE DAILY WATER CONSUMPTIONAND ITS IMPACT ON WEIGHT GAIN IN CAPTIVE COMMON BUZZARDS (*Buteo buteo*) IN GREECE

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ABSTRACT

This investigation was to find out whether captive common buzzards need additional drinking water to complement the water they obtain from their pre-slaughtered meat meals and to investigate their average daily water requirements. Twenty five (25) common buzzards were studied at the wildlife hospital and rehabilitation centre, Aegina, Greece with weight ranging between 498.4g and 911g. Large quantity of potable water was measured equally into same size ceramic bowls and served each bird under study in separate individual paper boxes. At the end of 24hours, the left over water was carefully brought out and re-measured to determine the quantity the birds have consumed. A control was set with a ceramic bowl with same quantity of water put in a paper box without a bird to determine the quantity of water lost to the atmosphere through evaporation on each day of the experiment. The water lost from the control on a daily basis was corrected in order to determine the quantity the common buzzards consumed daily. The weight of the studied buzzards were carefully taken and recorded 6 times each during the study period with W_1 and W_6 as entry and exit weights respectively. The mean of W_1-W_6 was used for the computation of the average percentage live body weight of the buzzards. The investigation revealed that captive common buzzards took water every day and the average daily water consumption of 724.9g buzzard was 31.4cc or 4.3% of its live body weight. The investigation further shows that the average water lost by evaporation daily (10.7cc) and that consumed by each buzzard daily (31.4cc) add up to 5.8%, equivalent of the average live body weight of the studied captive common buzzards which was 724.9g. The regression coefficient indicated that weight gain/ loss = 0.942 + 1.795 H_2O. This implies that a unit increase in the average quantity of water consumed resulted in a corresponding increase of 1.795 body weight gain by the captive common buzzards.

Keywords: Daily water consumption, Weight Gain, Captive common buzzards.

INTRODUCTION

Water is essential for life and needed for maintenance of homeostasis, intracellular and extracellular fluids, digestion and absorption, transportation of nutrients, elimination of wastes, haemopoiesis, thermoregulation, production of hormones and enzymes. Water is a universal solvent for countless elements, organic and inorganic compounds, chemicals and contaminants (Patrick, 1993; Wobeser, 2002; Paul Duff, 2003). Many birds will eat snow in order to get sufficient water in the winter. When their normal water sources are frozen, only raptors get their moisture from their live prey. Furthermore, consuming water is very important in animals (Anon, 2015). The common buzzard (*Buteo buteo*) is one of the most common birds of prey in Europe. The nominate specie is either nominae or partly migratory (Wuczynski, 2005). They are open habitant hunters which use forests for roosting during winter (Neson *et al*., 2008). Most of them build nest structures

serving thermoregulatory functions which are fundamental to their existence, the nesting sites often vary depending on environmental condition (Hanell, 2000). The availability of food and water dictates the amount of energy available for self-maintenance, growth and reproduction (Robb *et al*., 2008). The relationship between food and water availability is therefore important in wildlife management (Gonzalez *et al*., 2006, Margalida, 2010).

Common buzzards in the wild are known to feed on a variety of food ranging from small rodents to small mammals, birds, reptiles, amphibians, large insects and worms (Bird and Ho, 1976, Amadon and Bull, 1988, Arroyo et al. 2004). This implies that they take their animal preys whole with the entire viscera and the water there in. Since common buzzards are commonly seen in open country, it is possible that they also drink water from brooks, streams, run-off water from rains and left over from human activities (Cooper, 1988; Borrow and Emey, 2001; Paul Duff, 2003).

In captivity, common buzzards are fed with dressed, frozen pre-slaughtered chicken and beef (Patrick, 1993). It is therefore necessary to find out how common buzzards would make up for the short fall in water following captivity, confinement and feeding of food other than what they take in the wild. The determination of the average quantity of water consumed by captive common buzzards per day is a logistic tool for conservationists, teachers of wildlife medicine, researchers, ornithologists and wildlife veterinarians (Aguirre, 2009).

MATERIALS AND METHODS

Twenty five (25) buzzards were randomly picked from those that were brought into the Hellenic wildlife hospital and rehabilitation center Aegina, Greece between January and December, 2009. The birds underwent treatment and good care whilst the investigation lasted. Treatments were administered by the researcher assisted by other staff of the center. At the beginning each common buzzard for study was carefully wrapped with clean cotton cloth and placed on electronic weighing scale to obtain its weight. After reading and recording the weight, the birds were carefully put into perforated paper boxes whose floor was lined with strips of paper. The paper boxes were kept on top of wooden pallets and each paper box had only one buzzard put in it for the study.

Potable water was measured with sterile syringes and put into clean ceramic bowls of equal capacity and dimension. The birds were served the same quantity of water every day. Their weights were taken and recorded every 4 hours, 6 times daily throughout the period of the study. The relative quantity of water consumed by each bird per day was obtained by deducting the quantity of water left in the ceramic bowls from what was served 24 hours earlier (Aguirre, 2009).

In order to correct the water lost due to the atmosphere through evaporation the same quantity of water served each bird each day was put in a clean ceramic bowl of the same dimension and put into a paper box in the same room without a common buzzard to serve as a control. The quantity of water left in the control bowl was measured with syringe the next day and subtracted from what was served a day before to obtain the quantity of water lost to the atmosphere through evaporation. The statistical analysis was done using ANOVA.

RESULTS AND DISCUSSION

Weights (W_1-W_6) of the Studied Common Buzzards (B_1-B_{25}) taken at Regular Intervals, their Average Weight (g), and their average daily water consumption (cc) as shown in table 1 indicates that three common buzzards, B_1, B_5, B_{11} lost weight while the other twenty two gained weight. The average daily water consumed is as shown in the table, ranging between 21.0 and 40.5cc. These were also reflected in Figures 1 and 2. The average daily water consumption for Captive common buzzard is 31.4cc.

Table1: Interval weight,average weight gain/loss,daily water Consumption

Buzzard	**W_1(g)**	**W_2(g)**	**W_3(g)**	**W_4(g)**	**W_5(g)**	**W_6(g)**	**Average weight (g)**	**Wt. gained/ lost(g)**	**Average qty H_{2O} Consumed Per day**
B_1	911	847.5	847.5	838	829.7	829.7	855.0	-56	26.1
B_2	845	839	867	858.5	853.5	853.9	852.8	7.8	33.9
B_3	614.2	623	652.2	681.6	723.4	724.1	669.8	55.6	39.5
B_4	568	636.9	721	689.3	677.2	678	661.8	93.8	33.5
B_5	823	789.5	786	780.2	777	777.3	788.8	-34.2	26.0
B_6	567.4	602	664.5	679	705	705.2	653.9	86.5	26.0
B_7	498.4	523	513	521	534	536	520.9	22.5	27.3
B_8	619	658.1	705	708.4	713.4	713.4	686.2	67.2	36.2
B_9	731	788.5	833	845	857	856	818.4	87.4	40.5
B_{10}	565	641.2	663	671.3	680.1	679.8	650.1	85.1	40.5
B_{11}	831	819.8	784.5	789.1	795	797.1	802.8	-28.2	33.5
B_{12}	568.8	573	579.1	578.5	578.1	582	576.6	7.8	30.7
B_{13}	673.2	679	693.4	693.8	695	696.7	688.5	15.3	32.2
B_{14}	601.5	619	630	635.2	638	643.7	627.9	26.4	33.4
B_{15}	550	630.2	639	641.9	644.8	646	625.3	75.3	28.7
B_{16}	669	720.5	727	759	801.2	803.1	746.6	77.6	29.0
B_{17}	731.8	720	709	797	688.5	689	705.9	25.9	28.6
B_{18}	767.5	811	835.5	843	850	852.4	826.6	59.1	34.7
B_{19}	637.8	621	603	598	597.1	597.5	784.1	146.3	29.5
B_{20}	694	759.1	803.3	849	885	885.9	812.7	118.7	34.7
B_{21}	790.4	941.3	948.5	946	939	943	918	127.6	29.9
B_{22}	568	579.5	603.2	627.5	647	646.1	611.9	43.9	29.7
B_{23}	695.8	763	875	861.5	865.4	865.7	818.0	122.2	21.0
B_{24}	598.5	629.8	658.1	662.7	667	668	647.3	48.8	25,6
B_{25}	620	721.4	818	819.8	823.4	829.4	772.0	152.0	35.4
Average	669.5	702.5	725.6	731	738.6	740.0	724.9	57.4	31.4

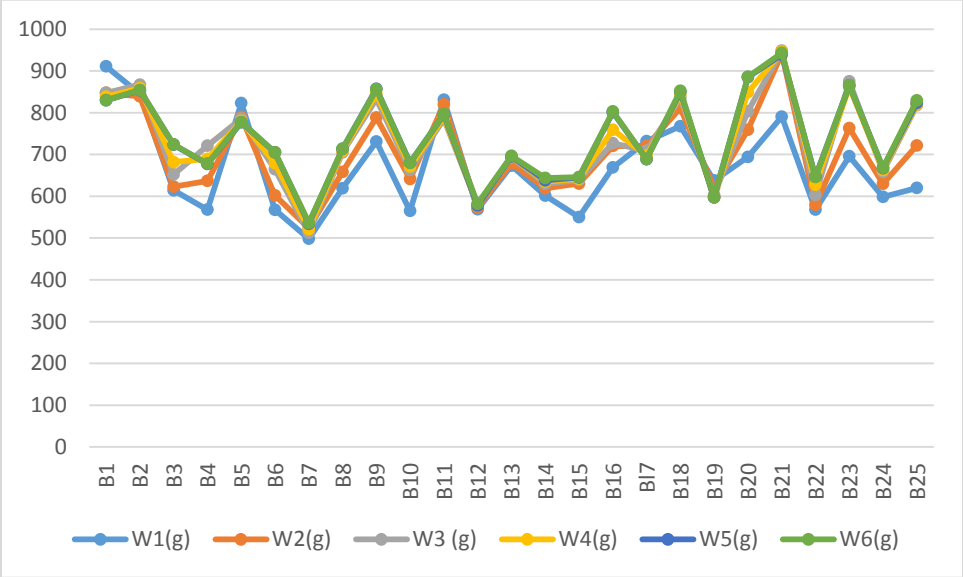

Figure 1: Graph of common buzzard and their weekly interval weights (g)

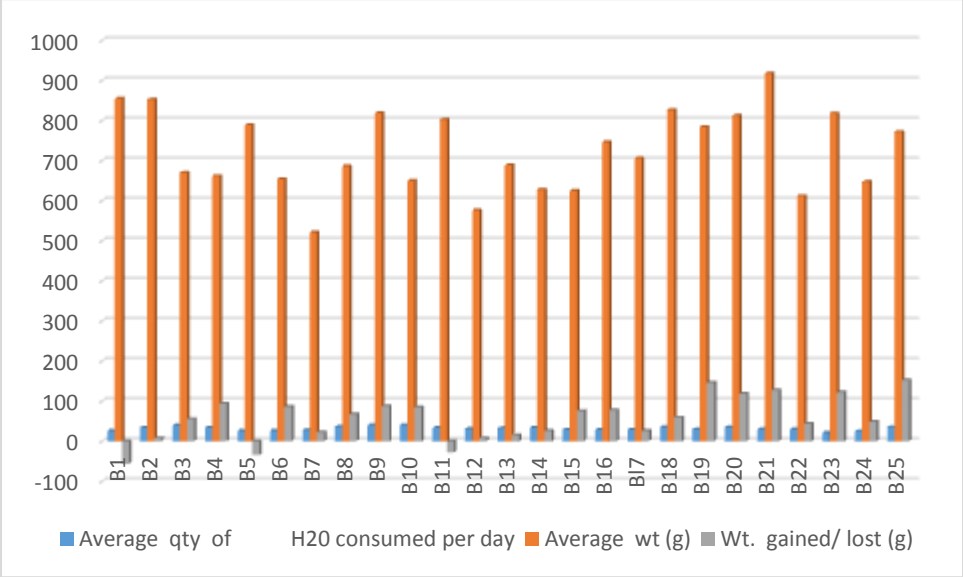

Figure 2: Graph of average weight (g), average quantity of H_20 consumed per day and weight gained/lost (g)

Table 2: ANOVA Table of the Weight (g) of Common Buzzards

Source	Type III Sum of Squares	df	Mean Square	F	Sig.	
Corrected Model	1612598.018[a]	29	55606.828	48.006	0.000	
Intercept	77289115.042	1	77289115.042	66724.526	0.000	
Weight	94080.164	5	18816.033	16.244	0.000	
Buzzards	1518517.853	24	63271.577	54.623	0.000	
Error	138999.771	120	1158.331			
Total	79040712.830	150				
Corrected Total	1751597.788	149				

a. R Squared = 0.921 (Adjusted R Squared = 0.901)

There is significant difference between the weights (g) at 0.05 level of significance

Table 3: Duncan Multiple Range Test Table

Weight	N	Subset		
		1	2	3
weight1	25	669.5720		
weight2	25		701.4520	
weight3	25			726.3520
weight4	25			730.9720
weight5	25			738.5920
weight6	25			739.9600
Sig.		1.000	1.000	0.203

Means for groups in homogeneous subsets are displayed based on observed means.
The error term is Mean Square(Error) = 1158.331.
a. Uses Harmonic Mean Sample Size = 25.000.
b. Alpha = 0 .05. From the Duncan multiple range test weight 1 and weight 2 are significantly different from every other weight at 0.05 level of significance.

Table 4: Regression Model Coefficientse

Model	Unstandardized Coefficients		Standardized Coefficients	t	Sig.
	B	Std. Error	Beta		
(Constant)	0.942	73.078		0.013	0.990
H20	1.795	2.297	0.161	0.781	0.443

Dependent Variable: weight gain/lost
Regression model: Weight gain/lost = 0.942 + $1.795H_{20}$ i.e. a unit increase in the average quantity of water will result in corresponding increase of 1.795 weight gain in common buzzards. The computation from the control shows that the average quantity of water lost to the atmosphere daily during the study period was 10.7cc.

The study indicated clearly that the birds require additional water supply apart from what they get from their meat meals. This was proven by the fact that all the studied buzzards took some quantity of water every day of the study even after correcting for the water lost to the atmosphere through evaporation. This was particularly so while they were in captivity without access to whole live animal preys, which obviously would supply them with more water than frozen pre-slaughtered meat rations. There is no doubt that disease conditions may cause reduced food consumption by captive birds, but sick birds are known to take more water (Wobeser, 2002). A falconet was reported dead due to impaction of the gizzard and subsequent obstruction of the intestinal tract (Hamerton, 1998; Cooper, 2002; Gombobaatar *et al.,* 2004) such condition was very unlikely if the moisture content of the diet were adequate (Cooper, 1988). Deprivation of water has been incriminated as the cause of visceral gout in reptiles which is also possible in birds (Cooper, 1968; Cooper, 1988).

After taking cognizance of invisible water lost to the atmosphere through evaporation, an average buzzard of 723,9g from the studied sample population consumed averagely 31.4cc of water per day which is 4.3% of its live body weight. The analysis of water consumed against weight gained by the buzzards for the first l0days and another 15days gave regression coefficients of 0.332 and 0.302 respectively. The difference in the coefficient could be as a result of the buzzard adjustment to their new environment, recovery from ailments, effects of the medicaments and stress of handling and captivity.

The allometric equation to estimate the daily water consumption of birds generally as updated in 2011

(Bird and Ho, 1976; Woberser, 2002) is; bird drinking rate = 0.059 x (w) 0.67. Where w is the weight of the birds. Using the above equation a common buzzard of 724.9g will consume 0.059 x 724.9 x 0.67 = 28.7cc of water per day.

This compares very closely with the figure 31.4cc obtained from this investigation which is barely 9.4% more than the estimate obtained using the allometric equation for water consumption in birds. Captive common buzzards do not only need additional drinking water, they need it ad libitum because of the enormous role water plays in raptor diet and health (Aguirre, 2009). Captive common buzzards may abstain from food for a whole day but would not abstain from drinking water. There is significant difference between the weights of the buzzards at 0.05 level of significance. Duncan multiple range test shows that W_1 and W_2 are significantly different from every other weight at 0.05 level of significance.

Captive common buzzards should be provided with clean drinking water ad libitum as long as they are not fed with whole live preys as in free wild living. The water will augment what they get from their pre-slaughtered meat meals, reduce the stress of confinement and help them in recovery from diseases, bio-metabolism of drugs, excretion, homeostasis and digestion. The average daily water consumption of studied common buzzards was equivalent of 4.3% of their live body weight after correcting for the water lost to the atmosphere through evaporation. This implies that captive common buzzards should be served water equivalent to 15% of their live body weight so that even after loss by evaporation, they will still have enough water to drink, From this investigation the average water lost by evaporation daily (10.7cc) and that consumed by each buzzard daily (31.4cc) add up to 5.8% equivalent of the live body weight of the studied captive common buzzard which was 724.9g. This value is in agreement with the 10% live body weight of water suggested by Patrick (1993) for raptors.

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Author's Contribution

Okoli C. P. sourced for samples and funding of the work. Aiyedun J. O. was involved in the analysis and funding of the work. Oludairo O. O. was involved in the write up of the work.

Conflict of interest

The authors declare that there is no conflict of interest.

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