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## Determination of Body Measurements, Live Weights and Manure Production of Dairy Anatolian Water Buffaloes in the Istanbul Region

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**Abstract** This study was carried out in order to characterise live weights and morphometric properties of the Anatolian water buffaloes, and determine to their manure productions depending on live weights which compose basic data for waste management in the water buffalo enterprises according to different seasons. Morphometric properties such as withers height, rump height, body length, chest width and chest circumference were measured by measuring rod, compass and measuring tape in order to determine body measurements. Electronic weighing scale was used to measure live weight of the Anatolian water buffaloes. The cell method were implemented to determine manure production of the Anatolian water buffaloes.

At the result of this study, withers height, rump height and chest circumference of the Anatolian water buffaloes were measured between 130–148 cm, 134–159 cm and 192–223 cm respectively. Also, the average of withers height, withers height and chest circumference of the Anatolian water buffaloes were found as 137.1 cm, 146.1 cm and 207.3 cm respectively. The live weights varied between 427 and 596 kg. The manure production as a percentage of live weight varied between 7.4 and 8.6 % depending on seasons.

**Keywords** Anatolian water buffaloes, Live weights, Body measurements, Manure production

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### Introduction

Water buffalo is a member of the *Bovidae* family and it belongs to the subfamily of *Bovinae*. Water buffalo is generally located in South and South East Asia. Domestic water buffaloes are basically divided into two groups as swamp and river buffaloes. There are differences in terms of morphological and efficiency properties between these two groups. Swamp buffaloes are generally used for business purposes and have low milk and meat yields. They are particularly located in China and South East Asia. River buffaloes are bred with the objects of milk and meat yields and originated in India [1]. Water buffaloes are structurally and behaviorally heavy, low-rumped, black or gray haired. Hairs are thin on the skin. Their developments are late and it goes on until 5 - 6 years [2]. It is accepted that there are 74 different breeds of water buffaloes on the earth [3].

The Anatolian water buffalo which has place in the group of river buffaloes and is originated from Mediterranean water buffaloes are bred in Turkey [4]. Anatolian water buffalo are registered as a breed by Ministry of Food, Agriculture and Livestock, General Directorate of Agricultural Research and Policies in 2004 [5]. According to Turkish Statistical Institute's data [6], while the water buffalo existence of Turkey was 97 632 in 2011, it had 45.5% increasing between 2011-2016 years and reached up to 142 073 with subsidies.

The morphometric definition of the Anatolian water buffalo is necessary for comparison of our water buffaloes with other breeds. Anatolian water buffalo has great value for richness of Turkey and there is also that the development and extensification of Anatolian water buffalo breeding has importance with regard to biological diversity.



On the other hand, water buffalo enterprises are small or medium sized and located in or near settlement areas, so these situations may cause some environmental problems. Especially, manure has great pollutant risk for animal, human and environmental welfare due to enterprises have not any manure management and store manure uncontrolled. Thus, manure production of water buffalo should be known in order to ensure effective manure management.

This study was carried out in order to characterize live weights and morphometric properties of the Anatolian water buffaloes, and determine to their manure productions depending on live weights in Istanbul Province where has 10% of Turkey water buffalo existence.

### Material and Method

This study was performed in water buffalo enterprises which are located in Thrace Part of Istanbul Province and affiliated to Water Buffalo Breeder Association. Measured water buffaloes were randomly selected among dairy water buffaloes at same age.

Live weight and morphometric properties such as withers height, back height, rump height, tailhead height, body length, pin bone height, hook bone width and chest circumference were measured. Body measurements and live weights of the water buffaloes were measured in the direction of the principles indicated in Kok [7]. Measuring rod, compass and measuring tape were used for body measurement and live weight measurements were obtained through electronic weighing scale.

The SPSS package software was used for significance tests, correlation analysis and descriptor statistics belong to morphometric properties (cm) and live weight (kg) of dairy water buffalo [8].

In the scope of study, manure production of water buffalo depending on live weight were determined by cell method at each season with two repetition. For this purpose, a special environment was built in the barn and the floor was covered with double-layer PVC to provide impermeability. One of selected water buffaloes was kept in the cell for 24 hours. It was ensured that the same feed ration which was used for other water buffaloes was given to water buffalo in the cell. According to obtained data the manure production of water buffaloes were calculated as a percentage of live weight.

### Results and Discussion

#### Some Morphometric Properties of Dairy Anatolian Water Buffalo Breeding

Recent studies on animal morphological evaluations have shown that morphological properties apart from aesthetic appearance can be used for a indicator for average flock life, lifetime yield and determination of breeding properties. Also, breeding animals which show good characters of its own breed have buyers at high price [9].

**Table 1:** The body measurements and live weights of Anatolian water buffaloes in the study

Morphometric properties (cm) and live weights (kg) belonged to dairy water buffalo breed											
Number of enterprise	Number of water buffalo	Withers height	Back height	Rump height	Tailhead height	Pin bone height	Body length	Pin bone width	Hook bone width	Chest circumference	Live weight
I	1	135	134	134	119	115	134	20	59	221	542
	2	130	126	137	122	117	142	21	61	210	524
II	1	139	136	144	129	120	150	20	58	203	525
	2	140	134	141	126	121	149	19	58	204	575
III	1	138	135	140	124	118	147	20	59	205	560
	2	135	126	128	116	114	155	20	53	200	475
IV	1	133	132	139	122	116	149	21	53	207	573
	2	132	125	130	115	110	130	19	49	192	427
V	1	148	141	145	130	121	159	28	69	223	596
	2	141	136	142	125	119	146	21	54	208	575

Some body measurements such as wither height, rump height, body length, chest width and circumference show heredity level of animal [10]. These properties give information about the development of the animal.



Appearance characteristics are used as an important selection criterion in breeding programs. One of the main tasks of animal breeding is to evaluate appearance of animals [11].

The Anatolian water buffalo is one of the native gene sources in Turkey. A limited number of surveys have been published on breeding yield characteristics and body measurements. Anatolian water buffaloes which are bred in a large area of Turkey should be examined based on yield characteristics and body measurements to contribute identification and improvement of breeding studies. In this context, body measurements and live weights of randomly selected dairy water buffaloes at the same age were measured in the direction of the principles stated in Kok [7] and the obtained data are given in Table 1.

Table 1 has showed that the withers height, body length and chest circumference of the dairy Anatolian water buffaloes were measured between 130-148 cm, 134-159 cm and 192-223 cm respectively in this study. The average of withers height, body length and chest circumference of the dairy Anatolian water buffaloes were found as 137.1 cm, 146.1 cm and 207.3 cm respectively. The live weights varied between 427 and 596 kg and the average of live weights were found as 537.5 kg. Descriptive statistics for the morphometric characteristics (cm) and the live weights (kg) of the dairy water buffalo were given in Table 2, the correlation coefficients between the measured values and the significance test results were given in Table 3.

**Table 2:** Descriptive statistics of morphometric characteristics (cm) and live weights (kg) of dairy water buffalo in the study

Character	N	Average	Standard error	Coefficient of variation	Minimum	Maximum
Withers height	10	137.10	1.66	3.84	130.00	148.00
Back height	10	132.50	1.66	3.97	125.00	141.00
Rump height	10	138.00	1.81	4.16	128.00	145.00
Tailhead height	10	122.80	1.60	4.11	115.00	130.00
Pin bone height	10	117.10	1.10	2.97	110.00	121.00
Body length	10	146.10	2.79	6.04	130.00	159.00
Pin bone width	10	20.900	0.82	12.45	19.00	28.00
Hook bone width	10	57.30	1.75	9.63	49.00	69.00
Chest circumference	10	207.30	2.91	4.44	192.00	223.00
Live weight	10	537.2	16.5	9.71	427.0	596.00

The highest coefficient of variation among the body measurements of water buffaloes was obtained in the pin bone width with 12.45%.

**Table 3:** Correlation coefficient and significance test of morphometric characteristics (cm) and live weights (kg) of dairy water buffalo in the study

	WH	BH	RH	TH	PBH	BL	PBW	HBW	CC
BH	0.87**								
RH	0.68*	0.84**							
TH	0.75*	0.84**	0.97**						
PBH	0.72*	0.78**	0.89**	0.94**					
BL	0.62*	0.47	0.48	0.59	0.66*				
PBW	0.66*	0.57	0.48	0.53	0.43	0.55			
HBW	0.60	0.63*	0.60	0.69*	0.68*	0.46	0.75**		
CC	0.46	0.63*	0.44	0.45	0.47	0.24	0.68*	0.79**	
LW	0.62*	0.81*	0.81**	0.77**	0.83**	0.52	0.49	0.63*	0.69*

Note: Withers Height=WH, Back Height=BH, Rump Height=RH, Tailhead Height=TH, Pin Bone Height=PBH, Body Length=BL, Pin Bone Width=PBW, Hook Bone Width=HW, Chest Circumference=CC, Live Weight=LW and \*\*=P<0,01 , \*=P<0,05



When Table 3 was examined, the correlation coefficient between live weight and chest circumference was found as 0.69 ( $P < 0.05$ ). The highest correlation coefficients were found as 0.97 ( $P < 0.01$ ) between tailhead height and rump height. The correlation coefficient between withers height and ridge height was 0.87 ( $P < 0.01$ ).

Body measurements of animal are not only used as criterion in defining the breed characteristics, but also they can be utilized as indicators to determine requirement space per animal in the different type of barns based on animal welfare. Indeed, Hegab and Mohammed [12] conducted a study in Egypt to develop equations for determining stall dimensions in tie-stall and free-stall water buffalo barns by using the body measurements and live weights of water buffaloes and, they planned proper stalls by these equations.

#### Manure Production of Anatolian Water Buffalo

In order to plan and project manure storages within the economic boundaries, reliable data is required about manure yields of animals. Obtaining reliable data is only possible with repeated measurements at different seasons.

Feed ration of water buffaloes may varied according to season and manure production is variable with this reason. In this study, manure production of water buffaloes was determined at four seasons. Measurements were made totally eight times at each season with two repetitions. Daily manure productions of water buffaloes depending on live weight at different seasons were given in Table 4.

**Table 4:** Manure productions of Anatolian water buffaloes depending on live weight

Cell season	Number of water buffalo	Live weight of water buffalo (kg)	Manure production of water buffalo (kg)	Manure production as percentage of live weight (%)	Average of manure production (%)
Winter season	1	575	49.60	8.6	
	2	542	46.45	8.5	8.6
Spring season	3	525	42.30	8.1	
	4	511	37.95	7.4	7.8
Summer season	5	527	39.95	7.5	
	6	573	43.54	7.6	7.6
Fall season	7	597	48.35	8.1	
	8	575	47.73	8.3	8.2

When Table 4 was examined, it was seen that manure productions of water buffaloes varied between 7.6 and 8.6% according to different seasons. The annual average value was calculated as 8.1%.

It is necessary to store animal manure which are very important for crop production with right way that does not cause odor and sight pollution in the farms. Also, proper storage dimensions should be determined and functional storage plan and projects should developed taking the discharging times from the enterprises into account.

#### Conclusion

Determination of the body dimensions of the Anatolian water buffaloes and extensification of the studies in this subject are important for defining the breed characteristics. In addition, morphometric characteristics are used as a criterion to determine the requirement area and lay out barn planning in the transition from traditional water buffalo farming to modern water buffalo farming.

Manure which is exposed in water buffalo enterprises should be accumulated in imperable storages to prevent environmental pollution at the hold stages for using of agricultural lands or other process. In order to plan and project the manure storages within the economic boundaries, proper data about manure production of the animals are required.

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