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AN EVALUATİON OF SOME BODY SIZES OF KANGAL DOGS EFFECTING LIVE WEIGHT WITH PATH ANALYSIS

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ABSTRACT

The direct and indirect effects of sizes of withers height, rump height, body length, chest peripheral, head length and leg length on live weight of dogs were investigated by path analysis. In this study, the body sizes of dogs between 1 and 6 aged were used. According to the results of analysis, it was determined that the relationships between all body sizes effecting live weight of dog were positive and significant($P<0.05$ and $P<0.01$). The highest correlations at 5 aged dogs were determined between live weight and respectively rump height and withers height ($r = 0.799$ and $r = 0.796$). The direct effects of withers height, rump height, body length, chest peripheral, head length and leg length on live weight at 6 aged dogs were determined, respectively as 51.250, 17.748, 34.823, 15.197, 16.934% and 24.155%. The indirect effects of withers height, rump height, body length, chest peripheral, head length and leg on live weight were determined respectively as 14.333, 8.875%, 8.400, 6.833 and 10.275%.

Keywords: Dog, live weight, body measurement, path analysis.

INTRODUCTION

Turkey has a function like a bridge between Asia and Europe in terms of geographical and cultural aspects. It acted as a passage throughout thousands of years of human history and had traces of a wide variety of civilizations. With this aspect, Turkey is extremely rich in terms of domestic animal genetic resources. It is possible to find various domestic animal types in a narrow geography. Breeding of some domestic dog breeds, such as, Kangal (Karabaş) Çoban, Akbaş Çoban, Kars (Kafkas) Çoban, Koyun, Karaman, Türk Tazısı, Tarsus Çatalburun, Dikkulak, Scout Dog Zağar, Zerdava (Kapı) and Tonya Finosu (Kobi) have been carried out in Turkey (Yılmaz, 2007a, b; Yılmaz, 2008; Wilson *et al*., 2011; Yılmaz and Ertuğrul, 2011a-e; Yılmaz, 2011a, b; Yılmaz and Ertuğrul, 2012a-f; Yılmaz *et al*., 2012).

There are more than 400 dog breeds in the world (Pugnetti, 2001). There are about 10 domestic dog breed in Turkey (Yılmaz, 2007a). Kangal is the most common in all Turkish dog breeds. The rest ones are local or regional dogs. Hound is used as a huntingdog and Çatalburun is used as the dog for finding the place of a hunt animal and fetching a shot hunt animal (retriever). Dikkulak and Zerdava are used as hunting dogs as well (Pugnetti, 2001; Anonymous, 2005; Yılmaz, 2007b; Yılmaz and Ertuğrul, 2011b; Yılmaz and Ertuğrul, 2011c; Yılmaz and Ertuğrul, 2011d; Yılmaz and Ertuğrul, 2012c).

The body sizes that have been considered to affect the live weight of dog are listed below. Withers height, which is vertical distance from withers to the ground, was measured by using a measure stick or a special tape measure (Kırmızı, 1991; Gönül, 1996; Tepeli, 1996; Altıner, 1998). Rump height, which is vertical distance from the highest point of sakrum to the ground, was measured by using a measure stick. Head length is the distance extending to crista occipitalisten, incisivum and was measured by using a special tape measure (Tepeli, 1996). The length of the body, which is distance between front face of caput humerin and tuber ishiadicum, was measured by a measure stick (Kırmızı, 1991; Gönül, 1996; Tepeli, 1996; Altıner, 1998). Chest peripheral, which is a peripheral measure taken beginning from immediate back of scapula, was measured by using a special tape measure (Gönül 1996, Tepeli 1996). Leg length, which is the vertical distance from Sternum to the ground, was measured by using a special tape measure.

Relating to the kangal breed between 1 and 8 aged, live weight was reported as 31.8 to 68.0 kg; withers height was reported between 62.4 and 75.69 cm; body length was reported between 67.4 and 75.67 cm; the chest peripheral was reported between 73.3 and 85.0 cm; chest

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width was reported between 18.51 and 23.20 cm; chest depth was reported as 23.87 cm; front shin peripheral was reported between 12.12and 14.0 cm; rear shin peripheral was reported as13.37 cm; head length was reported between 26 and 29 cm; face length was reported between 11.81and 14 cm (Kırmızı, 1991; Özbeyaz, 1994; Gönül, 1996; Tepeli ve Çetin, 2000; Atasoy ve Kanlı, 2005). Live weight and body sizes of dogs could be considered as necessary criteria required for the separation of stud. The aim of this study is to analyse the direct and indirect effects of withers height, rump height, body length, chest peripheral, head length and leg length on live weight of dogs through path analysis.

MATERIALS AND METHODS

Animal material of this study was consisted of total of 574 grizzly skin dog,with one aged of 135, two aged of 129, three aged of 133, four aged of 80, five aged of 57, six aged of 40. The body sizes of dogs, such as live weight (Y), withers height (X_1), rump height (X_2), body length (X_3), chest peripheral (X_4), head length (X_5) and leg length (X_6) were measured on cm basis.

The path coefficient suggested by Sewall Wright in 1921 was defined as part of standard deviation of the dependent variable resulting from independent variable while independent variables are fixed except for variable, of which effect could be determined (Pedhazur, 1997). Path analysis has been used in various science areas especially in agriculture for purpose of determination the interactions between efficiency and efficiency elements.

Since the self effects of variables and mutual effects with other variables (indirect effects) are existed within the calculated correlation coefficient between two variables,path analysis is used when the separate effects and mutual effects of variables are needed to be determined (Singh *et al*., 1988). Since the effect level of each independent variable (reason) is explained in path analysis, It is important the selection of independent variables that can take place in model (Sokal and Rohlf, 1995). For this reason, analysis should be carried out after the cause and effect relationships between the variables have been determined by researcher (Pek, 1999). In path analysis, each dependent variable is analyzed with each independent variable, and multiple regression analysis are performed for this analysis. In fact, path analysis is a extended form of multiple regression analysis. The path coefficients must be known to make path analysis. A path coefficient is a standardized regression coefficientrevealing the direct effect of the independent variable on a dependent variable of path model (Alpar, 2011). Regression analysis and correlation analysis are insufficient to determine the direct and indirect relations between variables together. In this case, through path analysis, importance and size of the direct and indirect causal relations between variables can be estimated (Bal and Doğan, 2000). The equation series in equality(1) consisting of path and correlation coefficients are formed (Li, 1975; Düzgüneş and Akman, 1995). The direct and indirect effects are estimated through the solution of these equation. The equation system consisted of path and correlation coefficients to estimate these effects is given in equation (2).

$$
\begin{aligned}
r_{X_1,Y} &= P_{YX_1} + r_{12}P_{YX_2} + r_{13}P_{YX_3} + r_{14}P_{YX_4} + r_{15}P_{YX_5} + r_{16}P_{YX_6} \\
r_{X_2,Y} &= P_{YX_2} + r_{21}P_{YX_1} + r_{23}P_{YX_3} + r_{24}P_{YX_4} + r_{25}P_{YX_5} + r_{26}P_{YX_6} \\
r_{X_3,Y} &= P_{YX_3} + r_{31}P_{YX_1} + r_{32}P_{YX_2} + r_{34}P_{YX_4} + r_{35}P_{YX_5} + r_{36}P_{YX_6} \\
r_{X_4,Y} &= P_{YX_4} + r_{41}P_{YX_1} + r_{42}P_{YX_2} + r_{43}P_{YX_3} + r_{45}P_{YX_5} + r_{46}P_{YX_6} \\
r_{X_5,Y} &= P_{YX_5} + r_{51}P_{YX_1} + r_{52}P_{YX_2} + r_{53}P_{YX_3} + r_{54}P_{YX_5} + r_{56}P_{YX_6} \\
r_{X_6,Y} &= P_{YX_6} + r_{61}P_{YX_1} + r_{62}P_{YX_2} + r_{63}P_{YX_3} + r_{64}P_{YX_5} + r_{65}P_{YX_6} \\
r_{X_e,Y} &= h \qquad (1)
\end{aligned}
$$

Table 1. The identifier statistics related with various body sizes at dogs.

	1 age (n=135)		2 age (n=129)		3 age (n=133)		4 age (n=80)		5 age (n=57)		6 age (n=40)	
Vari.	$\bar{X}$	$s_{\bar{x}}$	$\bar{X}$	$s_{\bar{x}}$	$\bar{X}$	$s_{\bar{x}}$	$\bar{X}$	$s_{\bar{x}}$	$\bar{X}$	$s_{\bar{x}}$	$\bar{X}$	$s_{\bar{x}}$
CA	44.58	0.59	44.78	0.66	46.82	0.68	47.71	0.86	47.44	9.28	47.78	1.20
CY	74.10	0.43	74.26	0.49	75.31	0.51	75.71	0.66	75.51	6.07	76.25	0.71
SY	73.27	0.45	73.10	0.48	74.26	0.51	74.85	0.71	74.39	5.96	75.00	0.69
VU	80.67	0.72	83.43	0.80	86.13	0.72	86.84	1.20	87.12	8.94	84.45	1.35
GÇ	84.41	0.55	85.99	0.57	86.89	0.60	87.81	0.70	87.96	6.99	87.20	0.85
BŞU	30.13	0.20	30.91	0.20	30.89	0.20	30.70	0.20	30.80	2.67	30.69	0.21
BAU	35.59	0.36	35.21	0.35	35.80	0.34	35.56	0.42	35.35	4.00	36.93	0.60

Vari.: Variables, $\bar{X}$: Average, $s_{\bar{x}}$: Standard error, n: Number of animals, CA: Live weight, CY: Withers height, SY: Rump height, VU: Body length , GÇ: Chest peripheral, BŞU: Head length, BAU: Leg length.

Here, while P_{YX_1} , P_{YX_2} , P_{YX_3} , P_{YX_4} , P_{YX_5} and P_{YX_6} parameters indicate direct effects of Xs on Ys, $r_{12}P_{YX_2}$ indicates the indirect effect of X_1 on X_2 (Wright, 1968).

In equation system (1), the correlations between independent variables and the correlations between independent variables and dependent variable was known. The path coefficients can be calculated depending on these correlations. To do this, multiple equation system is written in matrix form. While correlation matrix related to independent variables is indicated by A, vector consisting of the correlations between independent variables and dependent variable is indicated by B, and path coefficient is indicated by P, then the matrix form is stated as in equation (2) (Bal and Doğan, 2000).

$$\begin{bmatrix} P_{YX_1} \\ P_{YX_2} \\ \vdots \\ P_{YX_6} \end{bmatrix} = \begin{bmatrix} 1 & r_{12} & \cdots & r_{16} \\ r_{21} & 1 & \cdots & r_{26} \\ \vdots & \vdots & \vdots & \vdots \\ r_{61} & r_{62} & \cdots & 1 \end{bmatrix}^{-1} * \begin{bmatrix} r_{X_1,Y} \\ r_{X_2,Y} \\ \vdots \\ r_{X_6,Y} \end{bmatrix}$$

$$\Rightarrow P = A^{-1}B \qquad (2)$$

Here, A^{-1} is the inverse of A matrix.

By taking into account the direct effects of independent variables, the indirect effects of these variables on the dependent variable can be calculated. To do this, the path coefficients produced by benefiting from multiple equation system stated in equation (1) are multiplied by the correlation matrix consisted of diagonal matrix and independent variables and accordingly, matrix given in equation (3), consisting of indirect effects, is created.

$$\begin{bmatrix} P_{Y1} & P_{Y1}r_{12} & \cdots & P_{Y1}r_{16} \\ P_2r_{21} & P_{Y2} & \cdots & P_{Y2}r_{26} \\ \vdots & \vdots & \vdots & \vdots \\ P_6r_{61} & P_{Y6}r_{62} & \cdots & P_{Y6} \end{bmatrix} = \begin{bmatrix} P_{Y1} & 0 & \cdots & 0 \\ 0 & P_{Y2} & \cdots & 0 \\ \vdots & \vdots & \vdots & \vdots \\ 0 & 0 & 0 & P_{Y6} \end{bmatrix} \begin{bmatrix} 1 & r_{12} & r_{13} & r_{16} \\ r_{21} & 1 & r_{23} & r_{26} \\ \vdots & \vdots & \vdots & \vdots \\ r_{61} & r_{62} & \cdots & 1 \end{bmatrix} \qquad (3)$$

The diyagonal values in the matrix on the left of equation (3) indicate path coefficients, in other words, the direct effects; the values other than the diagonal argument indicate indirect effects interaction of independent values.

RESULTS AND DISCUSSION

The identifier statistics about the live weight of dogs according to ages(Y), live weight (Y), withers height (X_1), rump height(X_2), body length(X_3), chest peripheral (X_4), head length (X_5) and leg length (X_6) are given in table 1. Karakaş *et al*. (2002) informed that live weight, withers height, rump height, body length, chest peripheral, head length was calculated higher than the others. The measures of live weight and head lengthwere determined in approximate values that were reported by Atasoy *et al*. (2011). While withers height, rump height, chest peripheralwere determined in approximate values that were reported by Atasoy (2011), the body length values calculated in this study were determined a little higher.

Standardized multiple regression models relating to the body sizes of dogs, such as live weight (Y), withers height (X_1), rump height(X_2), body length (X_3), chest peripheral (X_4), head length (X_5) and leg length (X_6) were respectively determined as given below. The number of these regression models are six, including seperately from 1 to six ages.

$$Y_1 = -0.157X_1 + 0.686X_2 - 0.087X_3 + 0.331X_4 - 0.009X_5 - 0.002X_6$$
$$Y_2 = -0.382X_1 + 0.826X_2 - 0.085X_3 + 0.303X_4 + 0.136X_5 - 0.062X_6$$
$$Y_3 = 0.149X_1 + 0.206X_2 + 0.028X_3 + 0.425X_4 - 0.031X_5 + 0.106X_6$$
$$Y_4 = -0.297X_1 + 0.512X_2 + 0.015X_3 + 0.399X_4 - 0.081X_5 + 0.321X_6$$
$$Y_5 = -0.181X_1 + 0.635X_2 - 0.020X_3 + 0.193X_4 - 0.060X_5 + 0.351X_6$$
$$Y_6 = 0.615X_1 - 0.199X_2 + 0.265X_3 + 0.143X_4 - 0.136X_5 + 0.193X_6$$

Here, since the coefficients were standardized, constant term yielded as zero. The partial regression coefficients in this equation indicate the direct effects of each variable, such as withers height, rump height, body length, chest peripheral, head length and leg length, on live weight, which is the result variable. Standardized and normal regression coefficients, standard error, t statistics and significance levels are given in table 2 separately for every age group from 1 to six ages.

The correlation coefficients and significance levels belonging to the variables examined at dogs are given in table 3. Thecorrelation coefficients between live weight and withers height, rump height, body length, chest peripheral, head length and leg length were determined as significant statistically at one aged dogs ($P<0.01$ ve $P<0.05$). The correlation coefficients between live weight and withers height, rump height, body length, chest peripheral, head length and leg length were determined as significant statistically at 2,3,4,5 aged dogs ($P<0.01$). The correlation coefficients between live weight and withers height, rump height, body length, chest peripheral, head length and leg length were determined as significant statistically at 6 aged dogs ($P<0.01$ ve $P<0.05$). The correlation coefficients were different from the ones that were determined by Dirlik (2008) between the body sizes of 9, 12 and 15 months dogs.

So as to determine the direct and indirect effects of body size affecting the live weight, equation system given in equation (2) is solved with the help of path and correlation coefficients defined in equation (1). In the equation system, the inverse of the correlation matrix

Table 2. The results of the regression analysis of body size in dogs.

	Sabit	CY	SY	VU	GÇ	BŞU	BAU
1 year old dogs							
Coefficient	-28.331	-0.214	0.894	-0.071	0.354	-0.028	-0.003
Standard error	6.656	0.298	0.244	0.054	0.089	0.238	0.129
t	-4.256	-0.716	3.662	-1.306	3.961	-0.119	-0.02
P	0.000	0.475	0.000	0.194	0.000	0.905	0.984
Beta		-0.157	0.686	-0.087	0.331	-0.009	-0.002
2 year old dogs							
Coefficient	-33.294	-0.517	1.121	-0.069	0.352	0.457	-0.116
Standard error	7.728	0.325	0.291	0.063	0.122	0.296	0.189
t	-4.308	-1.593	3.847	-1.094	2.883	1.545	-0.615
P	0.000	0.114	0.000	0.276	0.005	0.125	0.540
Beta		-0.382	0.826	-0.085	0.303	0.136	-0.062
3 year old dogs							
Coefficient	-36.326	0.197	0.273	0.027	0.479	-0.106	0.208
Standard error	6.663	0.312	0.29	0.064	0.098	0.235	0.170
t	-5.452	0.63	0.941	0.415	4.871	-0.453	1.226
P	0.000	0.530	0.349	0.679	0.000	0.651	0.223
Beta		0.149	0.206	0.028	0.425	-0.031	0.106
4 year old dogs							
Coefficient	-26.451	-0.385	0.62	0.011	0.492	-0.35	0.661
Standard error	10.255	0.361	0.334	0.071	0.148	0.409	0.235
t	-2.579	-1.067	1.855	0.156	3.316	-0.856	2.81
P	0.012	0.290	0.068	0.876	0.001	0.395	0.006
Beta		-0.297	0.512	0.015	0.399	-0.081	0.321
5 year old dogs							
Coefficient	-48.377	-0.277	0.99	-0.021	0.256	-0.207	0.814
Standard error	10.359	0.632	0.585	0.102	0.158	0.356	0.334
t	-4.670	-0.438	1.693	-0.206	1.621	-0.581	2.440
P	0.000	0.663	0.097	0.838	0.111	0.564	0.018
Beta		-0.181	0.635	-0.02	0.193	-0.06	0.351
6 year old dogs							
Coefficient	-33.857	1.04	-0.344	0.236	0.201	-0.772	0.389
Standard error	23.598	0.647	0.489	0.152	0.247	0.906	0.384
t	-1.435	1.608	-0.705	1.557	0.813	-0.853	1.011
P	0.161	0.117	0.486	0.129	0.422	0.400	0.319
Beta		0.615	-0.199	0.265	0.143	-0.136	0.193

between the independent variables is multiplied with dependent variable and vector consisting of correlation coefficients between independent variables, and accordingly, path coefficients vector, in other words, direct effect quantities belonging to related independent variables are produced. In order to establish the matrix consisting of the direct and indirect effects, path coefficients vector is multiplied with correlation matrix formed by correlation between independent variables. In the resulting 4 * 4 dimensional matrix, the diagonal values are path coefficients creating effect directly. The values other than diyagonal are the interacted indirect effects of independent variables. The correlation coefficients given in table 3 were replaced in equation (1) and consequently, the equations given below were created. Firstly, the equations were given for all dogs.

$$0.680 = P_{YX_1} + 0.949P_{YX_2} + 0.350P_{YX_3} + 0.677P_{YX4} + 0.640P_{YX_5} + 0.646P_{YX6}$$
$$0.710 = 0.949P_{YX_1} + P_{YX_2} + 0.309P_{YX_3} + 0.623P_{YX4} + 0.579P_{YX_5} + 0.612P_{YX6}$$
$$0.193 = 0.350P_{YX_1} + 0.309P_{YX_2} + P_{YX_3} + 0.378P_{YX4} + 0.159P_{YX_5} + 0.041P_{YX6}$$
$$0.613 = 0.677P_{YX_1} + 0.623P_{YX_2} + 0.378P_{YX_3} + P_{YX4} + 0.547P_{YX_5} + 0.372P_{YX6}$$
$$0.454 = 0.640P_{YX_1} + 0.579P_{YX_2} + 0.159P_{YX_3} + 0.547P_{YX4} + P_{YX_5} + 0.373P_{YX6}$$
$$0.646 = 0.612P_{YX_1} + 0.041P_{YX_2} + 0.372P_{YX_3} + 0.547P_{YX4} + 0.373P_{YX_5} + P_{YX6}$$

By converting this equation system into the matrix form specified in equation(2), path coefficients were calculated as follows:

$$P = A^{-1}B = \begin{bmatrix} P_{YX_1} \\ P_{YX_2} \\ P_{YX_3} \\ P_{YX_4} \\ P_{YX_5} \\ P_{YX_6} \end{bmatrix} = \begin{bmatrix} 1 & 0.949 & 0.350 & 0.677 & 0.640 & 0.646 \\ 0.949 & 1 & 0.309 & 0.623 & 0.579 & 0.612 \\ 0.350 & 0.309 & 1 & 0.378 & 0.159 & 0.041 \\ 0.677 & 0.623 & 0.378 & 1 & 0.547 & 0.372 \\ 0.640 & 0.579 & 0.159 & 0.547 & 1 & 0.373 \\ 0.646 & 0.612 & 0.041 & 0.372 & 0.373 & 1 \end{bmatrix}^{-1} * \begin{bmatrix} 0.680 \\ 0.710 \\ 0.193 \\ 0.613 \\ 0.454 \\ 0.432 \end{bmatrix} = \begin{bmatrix} -0.164 \\ 0.693 \\ -0.087 \\ 0.331 \\ -0.008 \\ -0.003 \end{bmatrix}$$

The indirect effects affecting live weight at 1 aged dogs,

$$\begin{bmatrix} -0.164 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0.693 & 0 & 0 & 0 & 0 \\ 0 & 0 & -0.087 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0.331 & 0 & 0 \\ 0 & 0 & 0 & 0 & -0.008 & 0 \\ 0 & 0 & 0 & 0 & 0 & -0.003 \end{bmatrix} * \begin{bmatrix} 1 & 0.949 & 0.350 & 0.677 & 0.640 & 0.646 \\ 0.949 & 1 & 0.309 & 0.623 & 0.579 & 0.612 \\ 0.350 & 0.309 & 1 & 0.378 & 0.159 & 0.041 \\ 0.677 & 0.623 & 0.378 & 1 & 0.547 & 0.372 \\ 0.640 & 0.579 & 0.159 & 0.547 & 1 & 0.373 \\ 0.646 & 0.612 & 0.041 & 0.372 & 0.373 & 1 \end{bmatrix} = \begin{bmatrix} -0.164 & -0.156 & -0.057 & -0.111 & -0.105 & -0.106 \\ 0.658 & 0.693 & 0.214 & 0.432 & 0.401 & 0.424 \\ -0.030 & -0.027 & -0.087 & -0.033 & -0.014 & -0.004 \\ 0.224 & 0.206 & 0.125 & 0.331 & 0.181 & 0.123 \\ -0.005 & -0.005 & -0.001 & -0.004 & -0.008 & -0.003 \\ -0.002 & -0.002 & -0.0001 & -0.001 & 0.001 & -0.003 \end{bmatrix}$$

Similarly, path coefficients for 2 aged dogs,

$$0.630 = P_{YX_1} + 0.953P_{YX_2} + 0.483P_{YX_3} + 0.749P_{YX4} + 0.608P_{YX_5} + 0.707P_{YX6}$$
$$0.682 = 0.953P_{YX_1} + P_{YX_2} + 0.473P_{YX_3} + 0.744P_{YX4} + 0.545P_{YX_5} + 0.640P_{YX6}$$
$$0.249 = 0.483P_{YX_1} + 0.473P_{YX_2} + P_{YX_3} + 0.402P_{YX4} + 0.112P_{YX_5} + 0.154P_{YX6}$$
$$0.638 = 0.749P_{YX_1} + 0.744P_{YX_2} + 0.402P_{YX_3} + P_{YX4} + 0.602P_{YX_5} + 0.663P_{YX6}$$
$$0.488 = 0.608P_{YX_1} + 0.545P_{YX_2} + 0.112P_{YX_3} + 0.602P_{YX4} + P_{YX_5} + 0.621P_{YX6}$$
$$0.469 = 0.707P_{YX_1} + 0.640P_{YX_2} + 0.154P_{YX_3} + 0.663P_{YX4} + 0.621P_{YX_5} + P_{YX6}$$

$$\begin{bmatrix} P_{YX_1} \\ P_{YX_2} \\ P_{YX_3} \\ P_{YX_4} \\ P_{YX_5} \\ P_{YX_6} \end{bmatrix} = \begin{bmatrix} 1 & 0.953 & 0.483 & 0.749 & 0.608 & 0.707 \\ 0.953 & 1 & 0.473 & 0.744 & 0.545 & 0.640 \\ 0.483 & 0.473 & 1 & 0.402 & 0.112 & 0.154 \\ 0.749 & 0.744 & 0.402 & 1 & 0.602 & 0.663 \\ 0.608 & 0.545 & 0.112 & 0.602 & 1 & 0.621 \\ 0.707 & 0.640 & 0.154 & 0.663 & 0.621 & 1 \end{bmatrix}^{-1} * \begin{bmatrix} 0.630 \\ 0.682 \\ 0.249 \\ 0.638 \\ 0.488 \\ 0.469 \end{bmatrix} = \begin{bmatrix} -0.386 \\ 0.830 \\ -0.085 \\ 0.302 \\ 0.136 \\ -0.061 \end{bmatrix}$$

The indirect effects affecting live weight at 2 aged dogs,

$$\begin{bmatrix} -0.386 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0.830 & 0 & 0 & 0 & 0 \\ 0 & 0 & -0.085 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0.302 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0.136 & 0 \\ 0 & 0 & 0 & 0 & 0 & -0.061 \end{bmatrix} * \begin{bmatrix} 1 & 0.953 & 0.483 & 0.749 & 0.608 & 0.707 \\ 0.953 & 1 & 0.473 & 0.744 & 0.545 & 0.640 \\ 0.483 & 0.473 & 1 & 0.402 & 0.112 & 0.154 \\ 0.749 & 0.744 & 0.402 & 1 & 0.602 & 0.663 \\ 0.608 & 0.545 & 0.112 & 0.602 & 1 & 0.621 \\ 0.707 & 0.640 & 0.154 & 0.663 & 0.621 & 1 \end{bmatrix} = \begin{bmatrix} -0.386 & -0.368 & -0.186 & -0.289 & -0.235 & -0.273 \\ 0.791 & 0.830 & 0.393 & 0.618 & 0.452 & 0.531 \\ -0.041 & -0.040 & -0.085 & -0.034 & -0.010 & -0.013 \\ 0.226 & 0.225 & 0.121 & 0.302 & 0.182 & 0.200 \\ 0.083 & 0.074 & 0.015 & 0.082 & 0.136 & 0.085 \\ -0.043 & -0.039 & -0.009 & -0.040 & -0.038 & -0.061 \end{bmatrix}$$

Path coefficients for 3 aged dogs,

$$0.749 = P_{YX_1} + 0.969P_{YX_2} + 0.475P_{YX_3} + 0.779P_{YX4} + 0.520P_{YX_5} + 0.676P_{YX6}$$

$$0.741 = 0.969P_{YX_1} + P_{YX_2} + 0.481P_{YX_3} + 0.767P_{YX4} + 0.487P_{YX_5} + 0.627P_{YX6}$$

$$0.379 = 0.475P_{YX_1} + 0.48P1_{YX_2} + P_{YX_3} + 0.433P_{YX4} + 0.306P_{YX_5} + 0.063P_{YX6}$$

$$0.757 = 0.779P_{YX_1} + 0.767P_{YX_2} + 0.433P_{YX_3} + P_{YX4} + 0.487P_{YX_5} + 0.571P_{YX6}$$

$$0.421 = 0.520P_{YX_1} + 0.487P_{YX_2} + 0.306P_{YX_3} + 0.487P_{YX4} + P_{YX_5} + 0.549P_{YX6}$$

$$0.563 = 0.676P_{YX_1} + 0.627P_{YX_2} + 0.063P_{YX_3} + 0.571P_{YX4} + 0.549P_{YX_5} + P_{YX6}$$

$$\begin{bmatrix} P_{YX_1} \\ P_{YX_2} \\ P_{YX_3} \\ P_{YX_4} \\ P_{YX_5} \\ P_{YX_6} \end{bmatrix} = \begin{bmatrix} 1 & 0.969 & 0.475 & 0.779 & 0.520 & 0.676 \\ 0.969 & 1 & 0.481 & 0.767 & 0.487 & 0.627 \\ 0.475 & 0.481 & 1 & 0.433 & 0.306 & 0.063 \\ 0.779 & 0.767 & 0.433 & 1 & 0.487 & 0.571 \\ 0.520 & 0.487 & 0.306 & 0.487 & 1 & 0.549 \\ 0.676 & 0.627 & 0.063 & 0.571 & 0.549 & 1 \end{bmatrix}^{-1} * \begin{bmatrix} 0.749 \\ 0.741 \\ 0.379 \\ 0.757 \\ 0.421 \\ 0.563 \end{bmatrix} = \begin{bmatrix} 0.162 \\ 0.195 \\ 0.027 \\ 0.426 \\ -0.030 \\ 0.103 \end{bmatrix}$$

The indirect effects affecting live weight at 3 aged dogs,

$$\begin{bmatrix} 0.162 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0.195 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0.027 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0.426 & 0 & 0 \\ 0 & 0 & 0 & 0 & -0.030 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0.103 \end{bmatrix} * \begin{bmatrix} 1 & 0.9690 & 0.475 & 0.779 & 0.520 & 0.676 \\ 0.969 & 1 & 0.481 & 0.767 & 0.487 & 0.627 \\ 0.475 & 0.481 & 1 & 0.433 & 0.306 & 0.063 \\ 0.779 & 0.767 & 0.433 & 1 & 0.487 & 0.571 \\ 0.520 & 0.487 & 0.306 & 0.487 & 1 & 0.549 \\ 0.676 & 0.627 & 0.063 & 0.571 & 0.549 & 1 \end{bmatrix} = \begin{bmatrix} 0.162 & 0.157 & 0.077 & 0.126 & 0.084 & 0.110 \\ 0.189 & 0.195 & 0.094 & 0.150 & 0.095 & 0.122 \\ 0.013 & 0.013 & 0.027 & 0.012 & 0.008 & 0.002 \\ 0.332 & 0.327 & 0.185 & 0.426 & 0.208 & 0.243 \\ -0.016 & -0.015 & -0.009 & -0.015 & -0.030 & -0.017 \\ 0.070 & 0.065 & 0.007 & 0.059 & 0.057 & 0.103 \end{bmatrix}$$

Path coefficients for 4 aged dogs,

$$0.772 = P_{YX_1} + 0.965P_{YX_2} + 0.630P_{YX_3} + 0.806P_{YX4} + 0.622P_{YX_5} + 0.762P_{YX6}$$

$$0.752 = 0.965P_{YX_1} + P_{YX_2} + 0.636P_{YX_3} + 0.797P_{YX4} + 0.583P_{YX_5} + 0.768P_{YX6}$$

$$0.490 = 0.630P_{YX_1} + 0.636P1_{YX_2} + P_{YX_3} + 0.632P_{YX4} + 0.542P_{YX_5} + 0.397P_{YX6}$$

$$0.738 = 0.806P_{YX_1} + 0.797P_{YX_2} + 0.632P_{YX_3} + P_{YX4} + 0.517P_{YX_5} + 0.631P_{YX6}$$

$$0.430 = 0.622P_{YX_1} + 0.583P_{YX_2} + 0.542P_{YX_3} + 0.517P_{YX4} + P_{YX_5} + 0.569P_{YX6}$$

$$0.699 = 0.762P_{YX_1} + 0.768P_{YX_2} + 0.397P_{YX_3} + 0.631P_{YX4} + 0.569P_{YX_5} + P_{YX6}$$

$$\begin{bmatrix} P_{YX_1} \\ P_{YX_2} \\ P_{YX_3} \\ P_{YX_4} \\ P_{YX_5} \\ P_{YX_6} \end{bmatrix} = \begin{bmatrix} 1 & 0.965 & 0.630 & 0.806 & 0.622 & 0.762 \\ 0.965 & 1 & 0.636 & 0.797 & 0.583 & 0.768 \\ 0.630 & 0.636 & 1 & 0.632 & 0.542 & 0.397 \\ 0.806 & 0.797 & 0.632 & 1 & 0.517 & 0.631 \\ 0.622 & 0.583 & 0.542 & 0.517 & 1 & 0.569 \\ 0.762 & 0.768 & 0.397 & 0.631 & 0.569 & 1 \end{bmatrix}^{-1} * \begin{bmatrix} 0.772 \\ 0.752 \\ 0.490 \\ 0.738 \\ 0.430 \\ 0.699 \end{bmatrix} = \begin{bmatrix} -0.300 \\ 0.513 \\ 0.016 \\ 0.400 \\ -0.081 \\ 0.320 \end{bmatrix}$$

The indirect effects affecting live weight at 4 aged dogs,

$$\begin{bmatrix} -0.300 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0.513 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0.016 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0.400 & 0 & 0 \\ 0 & 0 & 0 & 0 & -0.081 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0.320 \end{bmatrix} * \begin{bmatrix} 1 & 0.965 & 0.630 & 0.806 & 0.622 & 0.762 \\ 0.965 & 1 & 0.636 & 0.797 & 0.583 & 0.768 \\ 0.630 & 0.636 & 1 & 0.632 & 0.542 & 0.397 \\ 0.806 & 0.797 & 0.632 & 1 & 0.517 & 0.631 \\ 0.622 & 0.583 & 0.542 & 0.517 & 1 & 0.569 \\ 0.762 & 0.768 & 0.397 & 0.631 & 0.569 & 1 \end{bmatrix} = \begin{bmatrix} -0.300 & -0.290 & -0.189 & -0.242 & -0.187 & -0.229 \\ 0.495 & 0.513 & 0.326 & 0.409 & 0.299 & 0.394 \\ 0.010 & 0.010 & 0.016 & 0.010 & 0.009 & 0.006 \\ 0.322 & 0.319 & 0.253 & 0.400 & 0.207 & 0.252 \\ -0.050 & -0.047 & -0.044 & -0.042 & -0.081 & -0.046 \\ 0.244 & 0.246 & 0.127 & 0.202 & 0.182 & 0.320 \end{bmatrix}$$

Path coefficients for 5 aged dogs,

$$0.796 = P_{YX_1} + 0.974P_{YX_2} + 0.560P_{YX_3} + 0.720P_{YX4} + 0.626P_{YX_5} + 0.765P_{YX6}$$
$$0.799 = 0.974P_{YX_1} + P_{YX_2} + 0.561P_{YX_3} + 0.743P_{YX4} + 0.594P_{YX_5} + 0.696P_{YX6}$$
$$0.360 = 0.560P_{YX_1} + 0.561P1_{YX_2} + P_{YX_3} + 0.321P_{YX4} + 0.276P_{YX_5} + 0.226P_{YX6}$$
$$0.719 = 0.720P_{YX_1} + 0.743P_{YX_2} + 0.321P_{YX_3} + P_{YX4} + 0.550P_{YX_5} + 0.646P_{YX6}$$
$$0.531 = 0.626P_{YX_1} + 0.594P_{YX_2} + 0.276P_{YX_3} + 0.550P_{YX4} + P_{YX_5} + 0.646P_{YX6}$$
$$0.735 = 0.765P_{YX_1} + 0.696P_{YX_2} + 0.226P_{YX_3} + 0.640P_{YX4} + 0.646P_{YX_5} + P_{YX6}$$

$$\begin{bmatrix} P_{YX_1} \\ P_{YX_2} \\ P_{YX_3} \\ P_{YX_4} \\ P_{YX_5} \\ P_{YX_6} \end{bmatrix} = \begin{bmatrix} 1 & 0.974 & 0.560 & 0.720 & 0.626 & 0.765 \\ 0.974 & 1 & 0.561 & 0.743 & 0.594 & 0.696 \\ 0.560 & 0.561 & 1 & 0.321 & 0.276 & 0.226 \\ 0.720 & 0.743 & 0.321 & 1 & 0.550 & 0.640 \\ 0.626 & 0.594 & 0.276 & 0.550 & 1 & 0.646 \\ 0.765 & 0.696 & 0.226 & 0.640 & 0.646 & 1 \end{bmatrix}^{-1} * \begin{bmatrix} 0.796 \\ 0.799 \\ 0.360 \\ 0.719 \\ 0.531 \\ 0.735 \end{bmatrix} = \begin{bmatrix} -0.177 \\ 0.630 \\ -0.019 \\ 0.192 \\ -0.061 \\ 0.352 \end{bmatrix}$$

The indirect effects affecting live weight at 5 aged dogs,

$$\begin{bmatrix} -0.177 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0.630 & 0 & 0 & 0 & 0 \\ 0 & 0 & -0.019 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0.192 & 0 & 0 \\ 0 & 0 & 0 & 0 & -0.061 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0.352 \end{bmatrix} * \begin{bmatrix} 1 & 0.974 & 0.630 & 0.806 & 0.622 & 0.762 \\ 0.974 & 1 & 0.561 & 0.743 & 0.594 & 0.696 \\ 0.560 & 0.561 & 1 & 0.321 & 0.276 & 0.226 \\ 0.720 & 0.743 & 0.321 & 1 & 0.550 & 0.640 \\ 0.626 & 0.594 & 0.276 & 0.550 & 1 & 0.646 \\ 0.765 & 0.696 & 0.226 & 0.640 & 0.646 & 1 \end{bmatrix} = \begin{bmatrix} -0.177 & -0.172 & -0.099 & -0.127 & -0.111 & -0.135 \\ 0.614 & 0.630 & 0.353 & 0.468 & 0.374 & 0.439 \\ -0.011 & -0.011 & -0.019 & -0.006 & -0.005 & -0.004 \\ 0.138 & 0.143 & 0.062 & 0.192 & 0.106 & 0.123 \\ -0.038 & -0.036 & -0.017 & -0.034 & -0.061 & -0.039 \\ 0.269 & 0.245 & 0.080 & 0.225 & 0.227 & 0.352 \end{bmatrix}$$

Path coefficients for 6 aged dogs,

$$0.691 = P_{YX_1} + 0.873P_{YX_2} + 0.402P_{YX_3} + 0.705P_{YX4} + 0.596P_{YX_5} + 0.639P_{YX6}$$
$$0.591 = 0.873P_{YX_1} + P_{YX_2} + 0.527P_{YX_3} + 0.654P_{YX4} + 0.449P_{YX_5} + 0.417P_{YX6}$$
$$0.392 = 0.402P_{YX_1} + 0.527P_{YX_2} + P_{YX_3} + 0.450P_{YX4} + 0.385P_{YX_5} - 0.141P_{YX6}$$
$$0.582 = 0.705P_{YX_1} + 0.654P_{YX_2} + 0.450P_{YX_3} + P_{YX4} + 0.362P_{YX_5} + 0.340P_{YX6}$$
$$0.357 = 0.596P_{YX_1} + 0.449P_{YX_2} + 0.385P_{YX_3} + 0.362P_{YX4} + P_{YX_5} + 0.325P_{YX6}$$
$$0.470 = 0.639P_{YX_1} + 0.417P_{YX_2} - 0.141P_{YX_3} + 0.340P_{YX4} + 0.325P_{YX_5} + P_{YX6}$$

$$\begin{bmatrix} P_{YX_1} \\ P_{YX_2} \\ P_{YX_3} \\ P_{YX_4} \\ P_{YX_5} \\ P_{YX_6} \end{bmatrix} = \begin{bmatrix} 1 & 0.873 & 0.402 & 0.705 & 0.596 & 0.639 \\ 0.873 & 1 & 0.527 & 0.654 & 0.449 & 0.417 \\ 0.402 & 0.527 & 1 & 0.450 & 0.385 & -0.141 \\ 0.705 & 0.654 & 0.450 & 1 & 0.362 & 0.340 \\ 0.596 & 0.449 & 0.385 & 0.362 & 1 & 0.325 \\ 0.639 & 0.417 & -0.141 & 0.340 & 0.325 & 1 \end{bmatrix}^{-1} * \begin{bmatrix} 0.691 \\ 0.591 \\ 0.392 \\ 0.582 \\ 0.357 \\ 0.470 \end{bmatrix} = \begin{bmatrix} 0.615 \\ -0.197 \\ 0.265 \\ 0.143 \\ -0.137 \\ 0.193 \end{bmatrix}$$

The indirect effects affecting live weight at 6 aged dogs,

$$\begin{bmatrix} 0.615 & 0 & 0 & 0 & 0 & 0 \\ 0 & -0.197 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0.265 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0.143 & 0 & 0 \\ 0 & 0 & 0 & 0 & -0.137 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0.193 \end{bmatrix} * \begin{bmatrix} 1 & 0.873 & 0.402 & 0.705 & 0.596 & 0.639 \\ 0.873 & 1 & 0.527 & 0.654 & 0.449 & 0.417 \\ 0.402 & 0.527 & 1 & 0.450 & 0.385 & -0.141 \\ 0.705 & 0.654 & 0.450 & 1 & 0.362 & 0.340 \\ 0.596 & 0.449 & 0.385 & 0.362 & 1 & 0.325 \\ 0.639 & 0.417 & -0.141 & 0.340 & 0.325 & 1 \end{bmatrix} = \begin{bmatrix} 0.615 & 0.537 & 0.247 & 0.434 & 0.366 & 0.393 \\ -0.172 & -0.197 & -0.104 & -0.129 & -0.089 & -0.082 \\ 0.107 & 0.140 & 0.265 & 0.119 & 0.102 & -0.037 \\ 0.101 & 0.094 & 0.064 & 0.143 & 0.052 & 0.049 \\ -0.082 & -0.062 & -0.053 & -0.050 & -0.137 & -0.045 \\ 0.123 & 0.081 & -0.027 & 0.066 & 0.063 & 0.193 \end{bmatrix}$$

Table 3. The correlation coefficients between the variables examined in dogs.

1 age	Y	X_1	X_2	X_3	X_4	X_5	2 age	Y	X_1	X_2	X_3	X_4	X_5
X_1	0.680^{**}						X_1	0.630^{**}					
X_2	0.710^{**}	0.949^{**}					X_2	0.682^{**}	0.953^{**}				
X_3	0.193^{*}	0.350^{**}	0.309^{**}				X_3	0.249^{**}	0.483^{**}	0.473^{**}			
X_4	0.613^{**}	0.677^{**}	0.623^{**}	0.378^{**}			X_4	0.638^{**}	0.749^{**}	0.744^{**}	0.402^{**}		
X_5	0.454^{**}	0.640^{**}	0.579^{**}	0.159	0.547^{**}		X_5	0.488^{**}	0.608^{**}	0.545^{**}	0.112	0.602^{**}	
X_6	0.432^{**}	0.646^{**}	0.612^{**}	0.041	0.372^{**}	0.373^{**}	X_6	0.469^{**}	0.707^{**}	0.640^{**}	0.154	0.663^{**}	0.621^{**}
3 age	Y	X_1	X_2	X_3	X_4	X_5	4 age	Y	X_1	X_2	X_3	X_4	X_5
X_1	0.749^{**}						X_1	0.722^{**}					
X_2	0.741^{**}	0.969^{**}					X_2	0.752^{**}	0.965^{**}				
X_3	0.379^{**}	0.475^{**}	0.481^{**}				X_3	0.490^{**}	0.630^{**}	$.636^{**}$			
X_4	0.757^{**}	0.779^{**}	0.767^{**}	0.433^{**}			X_4	0.738^{**}	0.806^{**}	$.797^{**}$	0.632^{**}		
X_5	0.421^{**}	0.520^{**}	0.487^{**}	0.306^{**}	0.487^{**}		X_5	0.430^{**}	0.622^{**}	$.583^{**}$	0.542^{**}	0.517^{**}	
X_6	0.563^{**}	0.676^{**}	0.627^{**}	0.063	0.571^{**}	0.549^{**}	X_6	0.699^{**}	0.762^{**}	$.768^{**}$	0.397^{**}	0.631^{**}	0.569^{**}
5 age	Y	X_1	X_2	X_3	X_4	X_5	6 age	Y	X_1	X_2	X_3	X_4	X_5
X_1	0.796^{**}						X_1	0.691^{**}					
X_2	0.799^{**}	0.974^{**}					X_2	0.591^{**}	0.873^{**}				
X_3	0.360^{**}	0.560^{**}	0.561^{**}				X_3	0.392^{*}	0.402^{*}	0.527^{**}			
X_4	0.719^{**}	0.720^{**}	0.743^{**}	0.321^{*}			X_4	0.582^{**}	0.705^{**}	0.654^{**}	0.450^{**}		
X_5	0.531^{**}	0.626^{**}	0.594^{**}	0.276^{*}	0.550^{**}		X_5	0.357^{*}	0.596^{**}	0.449^{**}	0.385^{*}	0.362^{*}	
X_6	0.735^{**}	0.765^{**}	0.696^{**}	0.226	0.640^{**}	0.646^{**}	X_6	0.470^{**}	0.639^{**}	0.417^{**}	-0.141	0.340^{*}	0.325^{*}

* $P<0.05$, ** $P<0.01$

The resulting path coefficients are the regression coefficients belonging to standardized data given in table 2. Therefore, they have a direct effect on the dependent variable. The values of these resulting effects belonging to age range between 1 and 6 are given in table 4.

When Model parameters are examined it will seen that, when withers height is changed one unit, live weight will change -0.164 unit, when rump height, body length, chest peripheral, head length, leg length are changed one unit, live weight will change respectively 0.693, -0.087, 0.331, -0.008 and -0.003 unit at 1 aged dogs. When withers height rump height, body length, chest peripheral, head length, leg length are changed one unit, live weight will change respectively -0.386, 0.830, -0.085, 0.302, 0.136 and -0.061 unit at 2 aged dogs. When withers height rump height, body length, chest peripheral, head length, leg length are changed one unit, live weight will change respectively 0.162, 0.195, 0.027, 0.426, -0.030 and 0.103 unit at 3 aged dogs. When withers height rump height, body length, chest peripheral, head length, leg length are changed one unit, live weight will change respectively -0.300, 0.513, 0.016, 0.400, -0.081 and 0.320 unit at 4 aged dogs. Whenwithers height rump height, body length, chest peripheral, head length, leg length are changed one unit, live weight will change respectively -0.177, 0.630, 0.245, 0.192, -0.061 and 0.352 unit at 5 aged dogs. When withers height rump height, body length, chest peripheral, head length, leg length are changed one unit, live weight will change respectively 0.615, -0.197, 0.081, 0.143, 0.137 and 0.193 at 6 aged dogs. These changes are direct effects.

The correlation description shares are given as effect share (%). The correlation coefficient between live weight and withers height was determined as 0.680 at 1 aged dogs. When this correlation was separated into the elements, the indirect effectsof withersheight on body sizeswere determined as follows: on rump height is 0.658 with 60.757% ratio; on body height is -0.030 with 2.77%

Table 4. Direct and indirect effects of body sizes at dogs.

		1 age			2 age			3 age		
Doğ. E.	Dol. E.	r	P	E. P. (%)	r	P	E. P. (%)	r	P	E. P. (%)
X_1		0.680**	-0.164	15.143	0.630**	-0.386	24.586	0.749**	0.162	20.716
	X_2		0.658	60.757		0.791	50.382		0.189	24.169
	X_3		-0.030	2.770		-0.041	2.611		0.013	1.662
	X_4		0.224	20.683		0.226	14.395		0.332	42.455
	X_5		-0.005	0.462		0.083	5.268		-0.02	2.046
	X_6		-0.002	0.185		-0.043	2.739		0.07	8.951
X_2		0.710**	0.693	63.636	0.682**	0.830	52.665	0.741**	0.195	25.259
	X_1		-0.156	14.325		-0.368	23.350		0.157	20.337
	X_3		-0.027	2.479		-0.04	2.538		0.013	1.684
	X_4		0.206	18.916		0.225	14.277		0.327	42.358
	X_5		-0.005	0.459		0.074	4.695		-0.015	1.943
	X_6		-0.002	0.184		-0.039	2.475		0.065	8.420
X_3		0.193*	-0.087	17.971	0.249**	-0.085	10.507	0.379**	0.027	6.767
	X_1		-0.057	11.774		-0.186	22.991		0.077	19.298
	X_2		0.214	44.206		0.393	48.578		0.094	23.559
	X_4		0.125	25.821		0.121	14.957		0.185	46.366
	X_5		-0.001	0.207		0.015	1.854		-0.01	2.256
	X_6		-0.0001	0.021		-0.009	1.112		0.007	1.754
X_4		0.613**	0.331	36.294	0.638**	0.302	22.125	0.757**	0.426	54.061
	X_1		-0.111	12.171		-0.289	21.172		0.126	15.990
	X_2		0.432	47.368		0.618	45.275		0.15	19.036
	X_3		-0.033	3.618		-0.034	2.491		0.012	1.523
	X_5		-0.004	0.439		0.082	6.007		-0.02	1.904
	X_6		-0.001	0.110		-0.040	2.930		0.059	7.487
X_5		0.454**	-0.008	1.127	0.488**	0.136	12.915	0.421**	-0.03	6.224
	X_1		-0.105	14.789		-0.235	22.317		0.084	17.427
	X_2		0.401	56.479		0.452	42.925		0.095	19.710
	X_3		-0.014	1.972		-0.010	0.950		0.008	1.660
	X_5		0.181	25.493		0.182	17.284		0.208	43.154
	X_6		0.001	0.141		-0.038	3.609		0.057	11.826

Continued...

Table 4 continued..

		1 age	2 age	3 age						
Doğ. E.	Dol. E.	r	P	E. P. (%)	r	P	E. P. (%)	r	P	E. P. (%)
X_6		0.432**	-0.003	0.452	0.469**	-0.061	5.245	0.563**	0.103	17.253
	X_1		-0.106	15.988		-0.273	23.474		0.11	18.425
	X_2		0.424	63.952		0.531	45.658		0.122	20.436
	X_3		-0.004	0.603		-0.013	1.118		0.002	0.335
	X_5		0.123	18.552		0.200	17.197		0.243	40.704
	X_6		-0.003	0.452		0.085	7.309		-0.02	2.848
				4 age			5 age			6 age
Doğ. E.	Dol. E.	r	P	E. P. (%)	r	P	E. P. (%)	r	P	E. P. (%)
X_1		0,722*	-0.300	21.112	0.796**	-0.177	14.194	0.691**	0.615	51.250
	X_2		0.495	34.835		0.614	49.238		-0.172	14.333
	X_3		0.010	0.704		-0.011	0.882		0.107	8.875
	X_4		0.322	22.660		0.138	11.067		0.101	8.400
	X_5		-0.050	3.519		-0.038	3.047		-0.082	6.833
	X_6		0.244	17.171		0.269	21.572		0.123	10.275
X_2		0,752**	0.513	36.000	0.799**	0.630	50.930	0.591**	-0.197	17.748
	X_1		-0.290	20.351		-0.172	13.937		0.537	48.369
	X_3		0.010	0.702		-0.011	0.865		0.140	12.586
	X_4		0.319	22.386		0.143	11.536		0.094	8.423
	X_5		-0.047	3.298		-0.036	2.926		-0.062	5.586
	X_6		0.246	17.263		0.245	19.806		0.081	7.252
X_3		0,490**	0.016	1.675	0.360**	-0.019	3.016	0.392*	0.265	34.823
	X_1		-0.189	19.791		-0.099	15.730		0.247	32.484
	X_2		0.326	34.136		0.353	56.095		-0.1	13.666
	X_4		0.253	26.492		0.062	9.778		0.064	8.449
	X_5		-0.044	4.607		-0.017	2.667		-0.05	6.965
	X_6		0.127	13.298		0.080	12.635		-0.027	3.574
X_4		0,738**	0.400	30.651	0.719**	0.192	18.234	0.582**	0.143	15.197
	X_1		-0.242	18.544		-0.127	12.099		0.434	46.079
	X_2		0.409	31.341		0.468	44.454		-0.129	13.709
	X_3		0.010	0.766		-0.006	0.579		0.119	12.678
	X_5		-0.042	3.218		-0.034	3.191		-0.050	5.313
	X_6		0.202	15.479		0.225	21.396		0.066	6.971
X_5		0,430**	-0.081	8.394	0.531**	-0.061	6.900	0.357**	0.137	16.934
	X_1		-0.187	19.378		-0.111	12.534		0.367	45.303

Continued...

Table 4 continued..

		1 age	2 age	3 age						
Doğ. E.	Dol. E.	r	P	E. P. (%)	r	P	E. P. (%)	r	P	E. P. (%)
X_5	X_2		0.299	30.984		0.374	42.330		0.089	11.001
	X_3		0.009	0.933		-0.005	0.588		0.102	12.608
	X_5		0.207	21.451		0.106	11.946		0.052	6.403
	X_6		0.182	18.860		0.227	25.724		0.063	7.750
X_6		0,699**	0.320	25.662	0.735**	0.352	32.234	0.470**	0.193	24.155
	X_1		-0.229	18.364		-0.135	12.363		0.393	49.186
	X_2		0.394	31.596		0.439	40.201		-0.082	10.263
	X_3		0.006	0.481		-0.004	0.366		-0.037	4.681
	X_5		0.252	20.209		0.123	11.264		0.049	6.083
	X_6		-0.046	3.689		-0.039	3.571		-0.045	5.632

* $P<0.05$, ** $P<0.01$; Dir. E. : Direct effect, Ind. E. : Indirect effect, r:Correlation coefficient, P: Path coefficient, E. S. (%): Effect share, X_1: Withers height, X_2: Rump height, X_3: Body length, X_4: Chest peripheral, X_5: Head length, X_6: Leg length.

head length is -0.005 with 0.462 % ratio; on leg length is -0.005 with 0.462% ratio; on leg length is -0.002 with 0.185 ratio. The correlation coefficient between live weight and rump height was calculated as 0,710. When this correlation was separated into the elements, the indirect effects of rump height on body sizes were determined as follows: on withers height is -0,156 with 14.325% ratio; on body length is-0.027 with 2.479% ratio; on chest peripheral is 0.206 with 18.916% ratio;on head length is -0.005 with 0.459% ratio; on leg length is -0.002 with 0.184% ratio. The correlation coefficient between live weight and body length was calculated as 0.193. When this correlation was separated into the elements, the indirect effects of body length on body sizes, such as, withers height, rumpheight, chest peripheral, head length, leg length were determined respectively as 11.774, 44.206, 25.821, 0.207 and 0.021 on percent basis. The correlation coefficient between live weight and chest peripheral was calculated as 0.613. When this correlation was separated into the elements, the indirect effects of chest peripheral on body sizes, such as, withers height, rump height, body length, head length, leg length were determined respectively as 12.171, 47.368, 3.618, 0.439 and 0.11 on percent basis. The correlation coefficient between live weight and head length was calculated as 0.454. When this correlation was separated into the elements, the indirect effects head length on body sizes, such as, withers height, rump height, chest peripheral body length, leg length were determined respectively as 14.789, 56.479, 1.972, 25.493 and 0.141 on percent basis. The correlation coefficient between live weight and leg length was calculated as 0.432. When this correlation was separated into the elements, the indirect effects leg lengthon body sizes, such as, withers height, rump height, chest peripheral body length, head length were determined respectively as 15.988, 63.952, 0.603, 18.552 ve 0.452 on percent basis.

The correlation coefficient between live weight and withers height was determined as 0.630 at 2 aged dogs. The indirect effects of withers height on body sizes, such as rump height, chest peripheral, body length, head length and leg lengthwere determinedrespectively as 50.382, 2.611, 14.395, 5.268, 2.739 on percent basis. The correlation coefficient between live weight and rumpheight was determined as 0.682. The indirect effects of rump height on body sizes, such as withers height, chest peripheral, body length, head length and leg lengthwere determined respectively as 23.35, 2.538, 14.277, 4.695 and 2.475 on percent basis. The correlation coefficient between live weight and body length was determined as 0.249. The indirect effects of body length on body size, such as withers height, rump height, chest peripheral, head length and leg length were determined respectively as 22.991, 48.578, 14.957, 1.854 and 1.112 on percent basis. The correlation coefficient between live weight and chest peripheral was determined as 0.638. The indirect effects of chest peripheral on body size, such as withers height, rump height, body length, head length and leg length were determined respectively as 21.172, 45.275, 2.491, 6.007 and 2.93 on percent basis. The correlation coefficient between live weight and head length was determined as 0.488. The indirect effects of head length on body sizes, such as withers height, rump height, body length, chest peripheral and leg lengthwere determined respectively as 22.317, 42.925, 0.95, 17.284

and 3.609 on percent basis. The correlation coefficient between live weight and leg length was determined as 0.469. The indirect effects of leg lengthon body sizes, such as withers height, rump height, body length, chest peripheral and head length were determined respectively as 23.474, 45.658, 1.118, 17.197 ve 7.309 on percent basis.

The correlation coefficient between live weight and withers height was determined as 0.749 at 3 aged dogs. The indirect effects of withers height on body sizes, such as rumpheight, chest peripheral, body length, head length and leg length were determined respectively as 24.169, 1.662, 42.455, 2.046 and 8.951 on percent basis. The correlation coefficient between live weight and rump height, was determined as 0.741. The indirect effects rump height on body sizes, such as withers height, chest peripheral, body length, head length and leg length were determined respectively as 20.337, 1.684, 42.358, 1.943 and 8.42 on percent basis. The correlation coefficient between live weight and body length was determined as 0.379. The indirect effects of body length on body size, such as withers height, rump height, chest peripheral, head length and leg lengthwere determined respectively as 19.298, 23.559, 46.366, 2.256 ve 1.754 on percent basis. The correlation coefficient between live weight and chestperipheral was determined as 0.757. The indirect effects of chest peripheral on body size, such as withers height, rump height, body length, head length and leg lengthwere determined respectively as 15.99, 19.036, 1.523, 1.904 ve 7.487 on percent basis. The correlation coefficient between live weight and head length was determined as 0.421. The indirect effects of head length on body sizes, such as withers height, rump height, body length, chest peripheral and leg length were determined respectively as 17.427, 19.71, 1.66, 43.154 and 11.826 on percent basis. The correlation coefficient between live weight and leg length was determined as 0.563. The indirect effects of leg lengthon body sizes, such as withers height, rump height, body length, chest peripheral and head length were determined respectively as 18.425, 20.436, 0.335, 40.704 and 2.848 on percent basis.

The correlation coefficient between live weight and withers height was determined as 0.722 at 4 aged dogs. The indirect effects of withers height on body sizes, such as rump height, chest peripheral, body length, head length and leg length were determined respectively as 34.835, 0.704, 22.66, 3.519 ve 17.171 on percent basis. The correlation coefficient between live weight and rump height, was determined as 0.752. The indirect effects of rump height on body sizes, such as withers height, chest peripheral, body length, head length and leg lengthwere determined respectively as 20.351, 0.702, 22.386, 3.298 and 17.263 on percent basis. The correlation coefficient between live weight and body length was determined as 0.490. The indirect effects of body length on body size, such as withers height, rump height, chest peripheral, head length and leg length were determined respectively as 19.791, 34.136, 26.492, 4.607 and 13.298 on percent basis. The correlation coefficient between live weight and chest peripheral was determined as 0.738. The indirect effects of chest peripheral on body size, such as withers height, rump height, body length, head length and leg lengthwere determined respectively as 18.544, 31.341, 0.766, 3.218 and 15.479 on percent basis. The correlation coefficient between live weight and head length was determined as 0.430. The indirect effects of head length on body sizes, such as withers height, rump height, body length, chest peripheral and leg length were determined respectively as 19.378, 30.984, 0.933, 21.451 ve 18.86 on percent basis. The correlation coefficient between live weight and leg length was determined as 0.699. The indirect effects of leg length on body sizes, such as withers height, rump height, body length, chest peripheral and head length were determined respectively as 18.364, 31.596, 0.481, 20.209 and 3.689 on percent basis.

The correlation coefficient between live weight and withers height was determined as 0.796 at 5 aged dogs. The indirect effects of withers height on body sizes, such as rump height, chest peripheral, body length, head length and leg lengthwere determined respectively as 49.238, 0.882, 11.067, 3.047 and 21.572 on percent basis. The correlation coefficient between live weight and rump height, was determined as 0.799.The indirect effects of rump height on body sizes, such as withers height, chest peripheral, body length, head length and leg length were determined respectively as 13.937, 0.865, 11.536, 2.926 and 19.806 on percent basis. The correlation coefficient between live weight and body length was determined respectively as 0.360. The indirect effects of body length on body size, such as withers height, rump height, chest peripheral, head length and leg length were determined respectively as 15.73, 56.095, 9.778, 2.667 and 12.635 on percent basis. The correlation coefficient between live weight and chest peripheral was determined as 0.719. Theindirect effects of chest peripheral on body size, such as withers height, rump height, body length, head length and leg length were determined respectively as 12.099, 44.454, 0.579, 3.191 and 21.396 on percent basis. The correlation coefficient between live weight and head length was determined as 0.531. The indirect effects of head length on body sizes, such as withers height, rump height, body length, chest peripheral and leg length were determined respectively as 12.534, 42.33, 0.588, 11.946 and 25.724 on percent basis. The correlation coefficient between live weight and leg length was determined as 0.735.The indirect effects of leg lengthon body sizes, such as withers height, rump height, body length, chest peripheral and head length were determined respectively as 12.363, 40.201, 0.366, 11.264 and 3.571 on percent basis.

The correlation coefficient between live weight and withers height was determined as 0.691 at 6 aged dogs. The indirect effects of withers height on body sizes, such as rump height, chest peripheral, body length, head length and leg length were determined respectively as 14.333, 8.875, 8.4, 6.833 and 10.275 on percent basis. The correlation coefficient between live weight and rump height, was determinedas 0.591. The indirect effects of rump height on body sizes, such as withers height, chest peripheral, body length, head length and leg lengthwere determined respectively as 48.369, 12.586, 8.423, 5.576 and 7.252 on percent basis. The correlation coefficient between live weight and body length was determined respectively as 0.392. The indirect effects of body length on body size, such as withers height, rump height, chest peripheral, head length and leg lengthwere determined respectively as 32.484, 13.666, 8.449, 6.965 and 3.574 on percent basis. The correlation coefficient between live weight and chest peripheral was determined as 0.357 The indirect effects of chest peripheral on body size, such as withers height, rump height, body length, head length and leg length were determined respectively as 45.303, 11.001, 12.608, 6.403 and 7.75 on percent basis. The correlation coefficient between live weight and head length was determined as 0.531. The indirect effects of head length on body sizes, such as withers height, rump height, body length, chest peripheral and leg lengthwere determined respectively as 12.534, 42.33, 0.588, 11.946 and 25.724 on percent basis. The correlation coefficient between live weight and leg length was determined as 0.470.The indirect effects of leg lengthon body sizes, such as withers height, rump height, body length, chest peripheral and head length were determined respectively as 49.186, 10.263, 4.681, 6.083 and 5.632 on percent basis.

CONCLUSION

In this study, the direct and indirect effects of withers height, rump height, body length, chest peripheral, head length, leg length, which are considered to have an effect on live weight of dogs were estimated through path analysis. The results of the analysis revealed that rump height and chest peripheral at 1 and 2 aged dogs; chest peripheral at 3 and 4 aged dogs; leg length at 5 and 6 aged dogs have statistically significant effects on live weight. According to research results, the relationship between live weight and withers height is negative at 1, 2, 4 and 5 aged dogs, positive at 3 and 6 aged dogs. In the light of these facts, an increase at withers height will lead to a decrease in the live weight at 1, 2, 4 and 5 aged dogs and an increase in the live weight at 3 and 6 aged dogs. The relationship between live weight and rump height is positive. An increase at rump height will lead to a increase in the live weight. The relationship between live weight and body length is negative at 1, 2, and 5 aged dogs, positive at 3, 4 and 6 aged dogs. The relationship between live weight and chest peripheral is positive. An increase at chest peripheral will lead to a increase in the live weight. The relationship between live weight and head length is negative at 1, 3, 4 and 5 aged dogs, positive at 2 and 6 aged dogs. While an increase at head length leads to a decrease in live weight at 1, 3, 4 and 5 aged dogs, leads to an increase at 2 and 6 aged dogs.

The relationship between live weight and leg length is negative at 1 and 2 aged dogs, positive at 3,4,5 and 6 aged dogs. While an increase at leg length leads to a decrease in live weight at 1 and 2 aged dogs, leads to an increase at 3, 4, 5 and 6 aged dogs. As a result, it was determined that in general, rump height and chest peripheral at 1 to 5 aged dogs; withers height at 6 aged dogs have more direct effect on live weight than other body sizes.

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