Research Article

PATH ANALYSIS AND PATH COEFFICIENT OF MILK YIELD IN ZAVOT COWS

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ARTICLE INFO	ABSTRACT

The aim of the present study was to determine the relationships between milk yield with some environmental factors and physiological characters of Zavot cows using path analysis. It was carred out in 44 smalholders that existed 36-168 old age cows in north-east Turkey. Milk yield (Y) negative correlated with animal age (X_1) (-0.021). But, it (Y) positively correlated with lactation period length (X_2), number of animals available in enterprise (X_3), number of inhabitants in enterprise (X_4) (r = 0.550, 0.132*, 0.701 respectively). The path analysis showed that animal age, lactation period length, number of animals available in enterprise had high of direct effects on milk yield (88.84%, 77.90% 83.71% respectively). The effect of number of inhabitants in enterprise via lactation period length on milk yield was found 62.37% and path coefficient was found as -0.0547. Besides, the effect of number of inhabitants in enterprise via number of animals available in enterprise on milk yield was found noteworthy (16.88%, P = -0.0148).

INTRODUCTION

Milk yield is under the influence of many environmental and physiological events occurring throughout the lactation. The importance of each one of these factors to milk yield become clear when occurs yield decreasing and low profir margin. Most important subject involved in dairy husbandry concerns correctly prediction of the lactation yield of cows, as the milk yield level largely determines the profitability of production (Yakubu, 2011). As to one of the major problems in terms of dairy husbandry concerns correctly prediction of the lactation yield of cows and its affecting components. Many factors, depending on such as cow, breeder and enterprise conditions, can affect milk yield. Keskin *et al.,* (2005) indicated that are important for selection in a dairy herd such as udder circumference, udder bottom height, udder depth and teat circumference may perform direct and indirect effects on milk yield. The direct effect is a directional relation between independent and dependent variables. On the other hand, the indirect effect is the effect of an independent variable on a dependent variable through one or more intervening or mediating variables (Yakubu, 2011). Simple correlation coefficients may not be sufficient in explaining the complex relationships among these effects. In these cases, path analysis can be exploited. Because, Path analysis is an extension of the multiple regression model which enables the determination of causes that explain mostly the relationship among variables

(Norris *et al.,* 2015). The goal of it is to identify possible causal explanations of the correlations observed between dependent and independent variables (Abbott *et al.,* 2007). It is a local breed of Turkey, Zavot cattles that is combined yield direction. These cattle, which are an important source of income for smallholder enterprises, can make good use of marginal areas and adverse environmental conditions (Yüksel *et al.,* 2011). Also, relationships among milk yield efficient factors have not been examined using a statistical analysis such as direct and indirect effect. In this study aimed determining the direct and indirect effects of some factors affecting the milk yield of Zavot cattle.

MTERIAL AND METHOD

Experimental animals and location

The study was carried out in the rural area of the Ardahan province, Turkey. Ardahan is situated in the eastern part of the Turkey. The climate is cool, mid-moist in winter, summers is cool, dry. Annual rainfalls and temperatures changes 543 mm and from -15.4 °C to 23.9 °C respectivly (Anon, 2018). In this study 44 smallholder enterprise were used. The animals (between the ages of 36 and 168 month old) were subjected to the traditional rearing system which allowed them to graze freely at day time and recall back at night to owner care.

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Data collection

Information on the ages of the animals was provided from the official record. Lactation period, popülation of enterprise and number animal in enterprise were followed by the project team. As to milk controls were carried out by the project team on a basis monthly . Milk yield (Y), animal age (X_1), lactation period length (X_2), number of animals available in enterprise (X_3) and number of inhabitants in enterprise (X_4) are variables measured in each enterprise.

Statistical analysis

The correlations among milk yield and enterprise conditions were calculated. Standardized partial regression coefficients called path coefficients (beta weights) were calculated. The correlation values determined were divided direct and indirect affect (Topal and Esenbuga, 2000).

$$r_{Y1} = P_{Y1} + r_{12}P_{Y2} + r_{13}P_{Y3} + r_{14}P_{Y4}$$
$$r_{Y2} = r_{21}P_{Y1} + P_{Y2} + r_{23}P_{Y3} + r_{24}P_{Y4}$$
$$r_{Y3} = r_{31}P_{Y1} + r_{32}P_{Y2} + P_{Y3} + r_{34}P_{Y4}$$
$$r_{Y4} = r_{41}P_{Y1} + r_{42}P_{Y2} + r_{43}P_{Y3} + P_{Y4}$$

P_{Yi}; path coefficient that indicates the direct effect of i th independent variable on Y dependent variable, $r_{ij}P_{Yi}$; = the indirect effect of ith independent variable via j^{th} independent variable on Y dependent variable, r_{Yi}; is correlation coefficient between Y dependent variable and i. independent variable, r_{ij}; is correlation coefficient between independent variables.

Path coefficients are calculated by replacing in the formula showing partial effect rates the simple correlation coefficients between variables. Thus, the formula showing partial effect rate becomes a matrix notation form. SPSS, (2001) package program was used in the calculations.

P_{Y1}		r_{11}	r_{12}	r_{13}	r_{14}	$^{-1}$	r_{Y1}
P_{Y2}	=	r_{21}	r_{22}	r_{23}	r_{24}	*	r_{Y2}
P_{Y3}		r_{31}	r_{32}	r_{33}	r_{34}		r_{Y3}
P_{Y4}		r_{41}	r_{42}	r_{43}	r_{44}		r_{Y4}

RESULTS AND DISCUSSION

In the Zavot cattle, correlation coefficients between Y and other independent variables have shown in Table 1. While milk yield had positive and significant association with X_3 (r = 0.132; P < 0.05), correlated with X_1 negatively (r = -0.021). The present results relevent with age are consistent with the findings of Javed *et al.,* (2004) where advanced age had positive and significant correlation lowly with milk yield of cows. Similarly, Ahmad *et al.,* (2001) reported a negative (-0.26) phenotypic correlation between age at first calving and lactation milk yield on Pakistani Sahiwals and their crosses. The highest correlation was found between milk yield and X_4 while high correlation was found between milk yield and X_2. The present results belonging to lactation length are consistent with the findings of Jadhav and Shinde, (2017) where lactation length had positive and significant correlation with milk yield of cows. In a related study, Javed *et al.,* (2004) reported association between milk yield and first lactation length of cows of Sahiwal breed. In the study, it was finded significant corelation between X_2 with X_3 (0.196) and X2 with X4 (0.328) variables. The present estimate of phenotypic correlation between these variables is correspond with our investigations in those areas. Because, it is made farming by taken into

consideration environmental conditions, feed sources and human resources in the area.

Table 1 Coefficients of Correlation Between Milk Yield and Some Characteristics of Zavot Cows

Variables[1]	Y	X_1	X_2	X_3
X_1	-0.021			
X_2	0.550	0.023		
X_3	0.132[*]	0.010	0.196[**]	
X_4	0.701	0.026	0.328[**]	0.079

[1]**Variables** : Milk yield (Y), animal age (X1), lactation period length (X2), number of animals available in enterprise (X3), number of inhabitants in enterprise (X4), **: P< 0.01, *: P<0.05

Significant phenotypic corelations between these variables found in our study indicated that the variables are appled by the same environmental and in steady milk yield will not appled of other models that is not advantageous for economical dairy production. In the study direct and indirect effects of some enterprise condition and physiological characters on milk yield (Y) are shown in Table 2. Although low negative correlation was found between animal age (X_1) and milk yield (-0.021), the direct effect of X_1 on milk yield was quite high (88.84%, P=0.319). The present finding is in consonance with the report of Gorgulu, (2011) where the direct effect of animal age on milk yield of Jersey cow was highest. In the study, indirect effect of X_1 via X_2 were negative and lower than direct effect of X_1. Jadav and Shinde, (2017) and Naskar and Banik (2006) observed negative contribution of age first calving to lactation milk yield for different lactations in Sahiwal cattle. The direct effect of X_2 on milk yield finded high (77.90%, P= - 0.167). On the other hand, indirect effect of X_2 via X_3, X_4 on milk yield finded lower and negative than direct effect of X_2. Jadhav and Shinde, (2017); Gorgulu, (2011) reported that lactation length positively correlated with high productiv based on milk yield. In the present findings the direct effect of X_3 on milk yield was high (83.71%, P= - 0.188). This situation is an indication that number of animals available in enterprise is an important trait to be considered while selecting method for milk yield purposes. In researchs, factors that affect direct and indirect to milk yield have concentrated on physiological characters such as first calving age, service period, lactation order (Gorgulu, 2011; Jadhav and Shinde, 2017) and anatomic characters such as breast structure, body measurements (Yakubu, 2011; Keskin, (2012); Norris *et al.,* 2015). However, there are also many other environmental and socio-cultural factors that are very effective in this matter. But, there are no studies on this subject. Because, depending on environmental potentials and anthropic conditions, increasing the number of animals rather than increasing the yield per animal is preferred in many enterprises. The high level of animal number in such style enterprises triggers some basic dynamics. Applications such as milking, feeding and animal management are carried out more carefully. As a matter of fact, in this study, indirect effect of the number of animals available in enterprise via lactation period length on milk yield was found the ratio notably (14.56%, P = - 0.0327). On the other hand, as the height in the number of animals is seen as an assurance in such enterprises, care is further increased. The direct effect portion and path coefficient the X4 on milk yield was 11.40%, -0.010, respectively. The effect of X_4 via X_2 on milk yield was found 62.37% and path coefficient

was found as -0.0547. The indirect effect was found to be high due to environmental factors, social life principles and enterprise structure. Especially female labor support comes to the forefront. Due to the important contributions of the female labor force, milking is carried out in a sensitive and efficient manner. Thus, an increase in the number of animals and an pickup in the amount of milk is observed for milk. The effect of X_4 via X_3 on milk yield was found noteworthy (16.88%, P = - 0.0148). The number of people in the enterprise encourages the increase in the number of animals in the enterprise and thus the milk yield is affected positively (16.88%, P = -0.0148).

Table 2 Investigation of Direct and Indirect Effects of Some Factors Affecting Milk Yields of Zavot Cows

Direct Effect	Indirect Effect	r	P	Effect Portion (%)
		-0.021	0.319	88.84
X_1	X_2		-0.038	10.58
	X_3		-0.0018	0.55
	X_4		-0.00026	0.08
		0.550	-0.167	77.90
X_2	X_1		0.0073	3.41
	X_3		-0.0368	17.17
	X_4		-0.00328	1.53
		0.132	-0.188	83.71
X_3	X_1		0.0031	1.38
	X_2		-0.0327	14.56
	X_4		-0.00079	0.35
		0.701	-0.010	11.40
X_4	X_1		0.0082	9.35
	X_2		-0.0547	62.37
	X_3		-0.0148	16.88

Milk yield (Y), animal age (X_1), lactation period length (X_2), number of animals available in enterprise (X_3), number of inhabitants in enterprise (X_4), r: corelation coefficient, P: Path coefficient

CONCLUSIONS

Simple phenotypic correlations have shown that milk yield was positively and highly correlated with lactation period length, number of animals available in enterprise and number of inhabitants in enterprise. Path analysis revealed that animal age had the highest significant direct effect on milk yield of Zavot cows, followed by number of animals available in enterprise, lactation period length and number of inhabitants in enterprise, respectively. Number of animals available in enterprise and number of inhabitants in enterprise may be approach as determine efficient factors to milk yield.

Recommendation

More resources should be allocated to all indigenous animal breeds in the world and more research should be done. The way for these animals to serve to humanity in the world more must be opened.

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