The Effect of Age on Slaughter and Carcass Characteristics in Male Zavot Cattle*

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Abstract: This study was carried out to determine the effect of age on male Zavot cattle for slaughter and carcass characteristics. For this aim, 18 male Zavot cattle were divided equally into groups 1, 2 and 3 containing animals 6, 18 and 30 months old, respectively. The fattening period lasted 162 days and there was a 14-day adaptation period. Individual ad-libitum feeding was used during the experiment. At the end of the fattening period, the mean liveweight of groups 1, 2 and 3 was 202.9, 327.3 and 348.5 kg; hot carcass weight was 106.3, 190.7 and 197.2 kg; and the dressing percentage was 52.4%, 58.2% and 56.5% respectively. According to slaughter characteristics, there were statistically significant differences among the groups in terms of the rate of the internal fat ($P < 0.05$), of the kidney-kidney fat, of the 10th-12th rib fat and carcass measurements ($P < 0.01$). Moreover, significant correlations among the live weight, slaughter characteristics, and body and carcass measurements were also defined ($P < 0.001$). Finally, it was concluded that 18 months is the most suitable age to start fattening male Zavot cattle.

Key Words: Zavot cattle, age, slaughter characteristics, carcass characteristics

Zavot Irkı Erkek Sığırlarda Yaşın Kesim ve Karkas Özelliklerine Etkisi

Özet: Araştırma, Zavot ırkı erkek sığırların besi, kesim ve karkas özellikleri üzerine yaş faktörünün etkisini incelemek amacıyla yapılmıştır. Araştırmada ortalama olarak 6, 18 ve 30 aylık yaş gruplarında eşit sayıda (6 baş), toplam 18 baş Zavot ırkı erkek sığır kullanılmıştır. Birinci grup 6 aylık, 2. grup 18 aylık ve 3. grup 30 aylık yaştaki hayvanlardan oluşmuştur. Alıştırma dönemiyle birlikte 162 gün süren besi sonunda besi sonu ağırlığı ortalamaları l., 2. ve 3. gruplarda sırasıyla 202,9, 327,3 ve 348,5 kg; sıcak karkas ağırlığı 106,3, 190,7 ve 197,2 kg, sıcak karkas randımanı % 52,40, % 58,23 ve % 56,52 tespit edilmiştir. Kesim özelliklerinden iç yağ oranında ($P < 0,05$); karkas özelliklerinden böbrek, böbrek yağı, 10-12 kaburga yağ oranlarında ve karkas ölçülerinde gruplar arasındaki farklar istatistiksel olarak önemli bulunmuştur ($P < 0,01$). Canlı ağırlık, kesim özellikleri, beden ve karkas ölçüleri, arasında önemli korelasyonlar bulunmuştur ($P < 0,001$). Zavot ırkı erkek sığırları besi başlangıç yaşının 18 ay olmasının uygun olduğu sonucuna varılmıştır.

Anahtar Sözcükler: Sığır, Zavot, yaş, kesim özellikleri, karkas özellikleri

Introduction

Native livestock breeds are of great value for a country, and to define their performance is essential for both the producing and marketing sectors. Although Zavot cattle are bred locally in Kars as one of the most desirable local breeds, there has been insufficient research on production traits related to age (1).

According to data from the Institute of State Statistics, there were 9,804,000 cattle in 2002 in Turkey, and 247,741 of these were reared by traditional methods in Kars (1-3). Zavot cattle became available first by means of a method of mating and then without mating with Simmental, Brown Swiss, Podolya, and Doğu Anadolu Kırmızısı (DAK) breeds. Generally, it is accepted that the Simmental and Brown Swiss genotype played an important role in the creation of the Zavot breed (4).

According to many studies, the age of initial fattening, slaughter, sex, breed and feeding situation affect the

carcass composition (5-9). Research conducted in Italy showed that 25 young feedlot Chianina bulls were slaughtered when they were 13, 20 or 26 months old. According to this research, the desirable carcass quality was obtained at a younger age (20 months). In another study, the slaughter age did not affect significantly the cut-composition or meat quality (10,11). It was also found that the initial fattening weight of male Holstein calves did not affect significantly slaughter and carcass characteristics (12). However, the effect of the initial fattening age on 12- and 18-month old Brown Swiss cattle was well demonstrated on both fattening and carcass performance (13).

It was found in fattening research performed in Erzurum on 7- and 10-month-old Brown Swiss cattle that the older group had a significantly (P < 0.05) greater pelvic fat proportion than the young group (14). In addition, it was reported that DAK and Zavot bulls in a fattening period that lasted 6 months had mean slaughter weights of 182.8 and 267.0 kg, average cold carcass weights of 99.7 and 152.7 kg and average cold dressing percentages of 54.5% and 56.9%, respectively (15).

Zavot cattle at various ages are used as a fattening material in Kars by many breeders. Thus, the aim of this research was to determine the most suitable fattening age as well as slaughter and carcass characteristics of male Zavot cattle.

Materials and Methods

Eighteen male Zavot cattle were used in this study. These cattle, which were bought in Kars, were divided into groups of ages of 6, 18 and 30 months. Most of them were the Simmental genotype (pale cinnamon in color). Group 1 included 6-month-old calves, group 2 included 18-month-old bulls and group 3 included 30-month-old bulls. After the adaptation period, which lasted 14 days, the cattle were fattened for 148 days in barns of the Kafkas University Education Research and Application Farm.

After the fattening period, the animals which were left hungry every morning and were weighed in the evening. Then the animals were slaughtered at the Kars Çelikler slaughterhouse to both determine their slaughter and carcass characteristics and to find out their final fattening and slaughter weights. The weight of slaughtered animals' skin, head, feet, lungs, heart, liver,

spleen, internal fat, stomach (empty), small and large intestine (empty) and hot carcass weight were determined. Carcass measurements (carcass length I, carcass length II, body depth, rump length I and rump circumference) on the hot carcass and carcass characteristics (front half weight, back half weight, kidney weight, kidney fat weight as well as bone, muscle and fat weight of cut between the 10th and 12th ribs) on the cold carcass and eye muscle area between the 10th and 12th ribs as demonstrated by Alpan and Sezgin were determined as well (16). Eye muscle area was measured with the help of millimeter paper.

Analysis of variance was used to evaluate variations among groups. The importance of variations between 2 groups was analyzed with Duncan's test. Differences between slaughter and carcass characteristics given in percentages were analyzed by the chi-square test. Correlations between slaughter and carcass characteristics were also calculated.

Results

The mean slaughter characteristics and standard errors of 18 male Zavot cattle at different ages are given in Table 1. In the groups, the average final fattening weights were 202.9, 327.3 and 348.5 kg; hot carcass weights were 106.3, 190.7 and 197.2 kg; and hot dressing percentages were 52.40%, 52.40% and 52.40%.

The means of carcass characteristics and standard errors of 18 male Zavot cattle at different ages are given in Table 2. Differences between groups were statistically significant in the kidney, kidney fat and 10th-12th rib cut fat percentages in terms of carcass characteristics (P < 0.01).

Carcass measurements with the mean and standard errors of 18 male Zavot cattle at different ages are given in Table 3. As age increases, carcass measurement values increase as well.

Correlations for weight, body measurements, slaughter characteristics and carcass measurements of the 18 male Zavot cattle at different ages are given in Tables 4 and 5. In general, correlations for weight, body measurements, slaughter characteristics and carcass measurements were high and significant.

Table 1. The average slaughter characteristics and standard errors of Zavot 18 male cattle at different ages.

Characteristics	Group 1		Group 2		Group 3	
	Weight (kg)	%	Weight (kg)	%	Weight (kg)	%
Final fattening	202.9 ± 4.5		327.3 ± 8.9		348.5 ± 8.5	
Hot carcass	106.3± 3.0		190.7 ± 6.2		197.2 ± 6.5	
Hot DrePer		52.40 ±0.98		58.23± 0.46		56.5± 0.60
Skin	19.7 ± 0.9 [b]	9.71 ± 0.44	28.9 ± 1.1	8.83 ± 0.34	31.2 ± 0.7	8.95 ± 0.20
Head	9.0 ± 0.3	4.44 ± 0.14	12.0 ± 0.3	3.76 ± 0.09	12.9 ± 0.2	3.70 ± 0.06
Feet	4.1 ± 0.1	2.02 ± 0.05	5.5 ± 0.2	1.68 ± 0.09	6.1 ± 0.3	1.75 ± 0.09
Spleen	0.52 ± 0.04	0.26 ± 0.02	0.63 ± 0.03	0.19 ± 0.01	0.70 ± 0.05	0.20 ± 0.01
Lungs	2.5 ± 0.2	1.23 ± 0.10	3.3 ± 0.2	1.01 ± 0.06	3.8 ± 0.2	1.09 ± 0.06
Heart	0.85 ± 0.05	0.42 ± 0.02	1.13 ± 0.07	0.35 ± 0.02	1.33 ± 0.04	0.38 ± 0.01
Liver	3.2 ± 0.1	1.58 ± 0.05	4.6 ± 0.1	1.41 ± 0.03	4.5 ± 0.2	1.29 ± 0.06
Internal fat	1.2 ± 0.4	0.59 ± 0.20 [b]	2.8 ± 0.6	0.86 ± 0.18 [ab]	4.6 ± 0.8	1.32 ± 0.23 [a*]
Stomach (empty)	6.4 ± 0.2	3.15 ± 0.10	9.5 ± 0.3	2.90 ± 0.09	10.2 ± 0.3	2.89 ± 0.09
Intestines (empty)	5.7 ± 0.4 b	2.81 ± 0.20	7.9 ± 0.6	2.41 ± 0.18	8.7 ± 0.5	2.50 ± 0.14

* $P < 0.05$. Differences between average values on the same line are shown by different letters.
%: Every characteristic was found by dividing final fattening weight.
DrePer = Dressing percentage.

Table 2. The average carcass characteristics and standard errors of Zavot 18 male cattle at different ages.

Characteristics	Group 1		Group 2		Group 3	
	Weight (kg,g)	%	Weight (kg,g)	%	Weight (kg,g)	%
Cold carcass	101.4 ± 3.2		183.2 ± 7.5		191.2 ± 6.5	
Cold DrePer		50.00 ± 1.17		55.86 ± 0.84		54.79 ± 0.62
Front half	53.4 ± 1.6	52.7 ± 1.6	97.0 ± 3.6	52.9 ± 2.0	0.60 ± 0.04	53.0 ± 1.9
Back half	48.0 ± 1.7	47.3 ± 1.7	86.2 ± 4.3	47.1 ± 2.3	89.9 ± 3.0	47.0 ± 1.6
Kidney	605 ± 36	0.60 ± 0.04[a]	875 ± 48	0.48 ± 0.03[c]	1025 ± 25	0.53 ± 0.04[b**]
Kidney fat	1176 ± 172	1.16 ± 017[c]	5158 ± 511	2.82 ± 028[a]	4400 ± 192	2.30 ± 0.10[b***]
10th-12th rib, bone	198 ± 8	0.20 ± 0.01	318 ± 12	0.17± 0.01	377 ± 8	0.20 ± 0.004
10th-12th rib, M	702 ± 22	0.69 ± 0.02	1250 ± 53	0.68 ± 0.03	1392 ± 61	0.73 ± 0.03
10th-12th rib, fat	115 ± 11	0.11 ± 0.01[b]	298 ± 21	0.16 ± 0.01[b]	360 ± 14	0.19 ± 0.01[a**]

$P < 0.05$, *$P < 0.01$. Differences between average values are shown by different letters on the same line.
%: Every characteristic was found by dividing cold carcass weight. M = Muscle.

Table 3. The average carcass measurements and standard errors of Zavot 18 male cattle at different ages.

Characteristics	Group 1	Group 2	Group 3
Carcass length I (cm)	160.5 ± 1.7[c]	181.2 ± 2.5[b]	189.0 ± 0.9[a**]
Carcass length II (cm)	98.5 ± 1.4[b]	111.0 ± 2.6[a]	115.5 ± 1.2[a**]
Body depth (cm)	52.0 ± 1.0[b]	62.2 ± 0.9[a]	63.0 ± 1.5[a**]
Rump length I (cm)	63.8 ± 0.8[b]	71.5 ± 0.9[a]	73.5 ± 0.6[a**]
Rump circumference (cm)	82.5 ± 1.2[b]	95.5 ± 2.1[a]	99.3 ± 1.0[a**]
Eye muscle area (cm^2)	41.2 ± 1.1[b]	66.8 ± 3.4[a]	67.6 ± 2.0[a**]
Eye muscle width (cm)	10.6 ± 0.1[b]	12.7 ± 0.3[a]	12.8 ± 0.2[a**]
Eye muscle depth (cm)	5.0 ± 0.1[b]	6.9 ± 0.2[a]	7.0 ± 0.[a**]
Eye muscle area of per 100 kg carcass (cm^2)	38.8 ± 0.4[b]	35.0 ± 0.5[a]	34.3 ± 0.3[a**]

*$P < 0.05$, ** $P < 0.01$. Differences between average values are shown by different letters on the same line.

Table 4. Correlations for weight, body measurements, slaughter characteristics and carcass measurements of Zavot 18 male cattle at different ages.

Character.	IFW	FFW	HCarW	HDrePer	Skin W	Head W	Feet W	Lungs W
FFW	0.960***							
HcarW	0.933***	0.994***						
HdrePer	0.673**	0.793***	0.853***					
Skin W	0.908***	0.944***	0.924***	0.672**				
Head W	0.936***	0.938***	0.922***	0.713***	0.922***			
Feet W	0.903***	0.845***	0.833***	0.642**	0.832***	0.878***		
Lungs W	0.701***	0.720***	0.687**	0.418 -	0.684**	0.772***	0.564*	
Heart W	0.883***	0.846***	0.822***	0.569*	0.791***	0.844***	0.735***	0.625**
Liver W	0.839***	0.922***	0.914***	0.709***	0.849***	0.840***	0.672**	0.668**
Stoma W	0.943***	0.965***	0.962***	0.777***	0.873***	0.896***	0.813***	0.734***
Intest W	0.721***	0.735***	0.739***	0.595**	0.626**	0.735***	0.660**	0.791***
CarLenl	0.944***	0,.931***	0.914***	0.708***	0.895***	0.906***	0.863***	0.661**
BoDep	0.880***	0.927***	0.924***	0.754***	0.891***	0.907***	0.829***	0.564*
IFBoLe	0.989***	0.950***	0.924***	0.682**	0.893***	0.927***	0.866***	0.698***
IFWitH	0.989***	0.953***	0.927***	0.685**	0.896***	0.939***	0.878***	0.703**
IFChG	0.979***	0.963***	0.950***	0.729***	0.914***	0.952***	0.895***	0.697***
FFBoLe	0.939***	0.962***	0.950***	0.756***	0.919***	0.922***	0.858***	0.715***
FFWitH	0.964***	0.943***	0.917***	0.685**	0.900***	0.939***	0.926***	0.705***
FFChG	0.945***	0.978***	0.969***	0.780***	0.938***	0.923***	0.849***	0.660**

*** P < 0.001, ** P < 0.01, * P < 0.05. - Nonsignificant.
W = Weight, IF = Initial fattening, FF = Final fattening, H = Hot, Car = Carcass, Stoma. = Stomach, Le = Length, Dep = Depth, Bo = Body, WitH = Withers height, ChG = Chest girth.

Table 5. Correlations for weight, body measurements, slaughter characteristics and carcass measurements of Zavot 18 male cattle at different ages.

Characters	Heart W	Liver W	StomaW	Intest W	CarLI	BoDep	IFBoLe	IFWitH
Liver W	0.754***							
Stoma W	0.796***	0.895***						
Intest W	0.618**	0.662**	0.824***					
CarLe	0.789***	0.806***	0.889***	0.605**				
BoDep	0.809***	0.865***	0.872***	0.640**	0.860***			
IFBoLe	0.901***	0.818***	0.929***	0.669**	0.935***	0.864***		
IFWitH	0.897***	0.828***	0.928***	0.672**	0.941***	0.879***	0.998***	
IFCheG	0.856***	0.856***	0.945***	0.702***	0.937***	0.917***	0.977***	0.983***
FFBoLe	0.804***	0.868***	0.925***	0.677**	0.938***	0.855***	0.936***	0.942***
FFWitH	0.845***	0.834***	0.898***	0.659**	0.931***	0.875***	0.960***	0.969***
FFCheG	0.792***	0.875***	0.944***	0.671**	0.927***	0.946***	0.944***	0.949***
Characters	IFCheG	FFBoLe	FFWitH					
FFBoLe	0.940***							
FFWitH	0.963***	0.965***						
FFCheG	0.971***	0.943***	0.934***					

*** P < 0.001, ** P < 0.01, * P < 0.05. – Nonsignificant.

Discussion

Because of their uncommon use and the limited numbers of animals, there have been insufficient studies on Zavot cattle. Therefore, the obtained data and presented results are of particular importance for describing the Zavot breed in terms of the evaluated performances. Additionally, this study provided an opportunity to compare the Zavot breed with other cattle breeds for the evaluated characteristics.

As seen in Table 1, values for slaughter characteristics, except hot dressing percentages, increased with increasing age. In terms of slaughter characteristics, significant differences were found between groups 2 and 3 (P < 0.01). Differences in head and heart weight were significant in all the groups (P < 0.01). Dressing percentages were similar to those reported in most previous studies (15,17-19), but the corresponding results were lower than those of the d'Aquitaine breed (20), and higher than those of Brown Swiss (13). With the support of the literature, the Zavot cattle in this study showed a noteworthy performance in terms of dressing percentage.

Although animal age was an important factor on weight of carcass parts, the most significant differences between the groups were in kidney fat and 10th-12th rib weight (P < 0.01). Most of the evaluated carcass characteristics showed similarity with the results of previous studies (10,11,21-23).

Generally, there were no significant differences between groups 2 and 3, but, in terms of carcass length I, differences were significant between these groups (P < 0.01). The longest carcass length I measurements were in group 3. This difference might be due to age. Although they were for different cattle breeds, carcass measurements similar to those in the literature were found in the present study (13,14,24,25). These literature-supported comparisons created a defined position for the Zavot breed.

Statistically significant correlations between weight, body measurements, slaughter characteristics and carcass measurements were determined and are demonstrated in Tables 4 and 5 (P < 0.05-0.001). Only correlations between hot dressing percentages with lung weight were not significant. These correlations help in the determination of the Zavot breed and might also be used for further studies and in weight estimation formulae.

There are a very limited number of studies on the Zavot breed, and it might be suggested that this number should be increased. This study might be regarded as a pilot research for this breed. The results obtained show that the Zavot breed is more similar to the breeds of European origin than to native Turkish breeds. In particular, in terms of fattening performance and meat production the Zavot breed can be chosen one of the best among the native cattle breeds. This study determined that, in order to obtain better slaughter and carcass traits from male Zavot cattle, fattening should start at the age of 18 months and this fattening period should continue for 162 days. This suitable starting age and fattening period can be recommended for the Zavot breeders in northeast Turkey.

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