Advances in Dairy Research

Worku, et al., J Adv Dairy Res 2015, 3:2
http://dx.doi.org/10.4172/2329-888X.1000133

Research Article Open Access

Effect of Different Levels of Dried Sugar Cane Tops Inclusion on the Performance of Washera Sheep Fed Basal Diet of Grass Hay, Ethiopia

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Rec date: Mar 09, 2015; **Acc date:** Apr 04, 2015; **Pub date:** Apr 09, 2015

Abstract

Background: Ruminants feed largely on crop resides as their basal diet. Despite their vast use as a livestock feed, crop residues are naturally of low quality and do not fulfill the nutrient requirement of animals. Thus, the deficit in the basal feed of quantity can be covered with sugar cane tops that are potential feed for better performance of animals. This study aimed with to evaluate the effect of different level of Dried Sugar Can tops inclusion on carcass characteristics and Economic Feasibility of Washera sheep fed a basal diet of grass hay.

Methodology: A study was conducted at Bure Agricultural Technical Vocational Educational Training (ATVET) College using twenty yearling Washera sheep with initial body weight (BW) of 18.15 ± 1.85 (mean ± SD). The experimental design was randomized complete block design, and sheep were blocked into five blocks of four animals based on their initial BW and randomly assigned to one of the treatments within a block. Treatments were hay ad libitum+100 g/head/d CM for T1 and an additional 120 g, 240 g and 360 g SCT per head/day on dry matter basis for T2, T3 and T4, respectively. The experiment consisted 90 days of Growth trials followed by evaluation of carcass components at the end.

Result: Average Daily Gain (ADG) was 21, 46, 56 and 75 g/d for T1, T2, T3 and T4, respectively and was highest for T4 and lowest for T1. Hot carcass weight (HCW) was 6.4, 8.2, 8.7 and 9.1 kg for T1, T2, T3 and T4, respectively and was greater for T4 but similar among the other three treatments. Dressing percentage on slaughter or empty body weight basis also took a similar trend like that of HCW. Net return was 63.01, 105.7, and 204.73 Birr for T2, T3 and T4, respectively.

Conclusion: The supplementation has positive impact on the growth and carcass characteristic. Therefore, it was concluded that sugar cane tops could be used as part of a diet for sheep to improve animal performance where it is available.

Keywords: Body weight; Dressing percentage; Sugar cane top; Inclusion; Sheep

Abbreviations

ADG: Average Daily Gain; FCE: Feed Conversion Efficiency; FCR: Feed Conversion Ratio; GLM: General Liner Modal; RCBD: Randomized Complete Block Designed; TEO: Total Edible Offal's; TNEO: Total Non-edible Offal's, CM: Concentrate Mix; ATVET: Agricultural Technical Vocational Educational Training; SCT: Sugar Cane Tops; WB: Wheat Bran; NSC: Noug Seed Cake; SD: Standard Deviation; BW: Body Weight; HCW: Hot Carcass Weight; ME: Metabolizable Energy; IBW: Initial Body Weights, FBW: Final Body Weight; SW: Slaughter Weight; EBW: Empty Body Weight

Introduction

Expanding urbanization and use of arable land for housing, recreation, and industrial development is diminishing grazing lands, with an increase in human population, more and more land were devoted to crop production only fragments of marginal lands were left for feed production. Consequently, ruminants feed largely on crop resides as their basal diet [1]. Despite their vast use as a livestock feed, crop residues are naturally of low quality and do not fulfill the nutrient requirement of animals. They have low crude protein content in the range of 3-13% of the dry matter [2]. Most crop residues are deficient in fermentable energy and minerals. Crop residues also he low digestibility that leads to poor intake, particularly when fed as the sole roughage [2].

Thus, the deficit in the basal feed of quantity can be covered with other alternatives for better performance of animals. In this regard sugar cane tops can be considered as one of the potential feed. Sugar cane tops are by-product of sugar cane harvesting, comprising of green leaves, the leaf bundle sheath and some immature cane. Sugar cane tops are often conserved as hay during the harvest season and fed to stock during dry seasons and drought conditions. Report of the digestibility of sugar cane tops is 54.3% [3].

According to Girma and Awulachew [4] sugar industries have a total of 26,838 ha sugar cane plantation. However, with the expansion of irrigation and the capacity of the factories the area can be expected to be boosted. According to Amahara National Regional State (ANRS) more than 740,000 ha of fertile land are presently suitable for commercial cash crop production. Studies indicate that approximately 1,020,000 ha of land are fit for irrigation [5]. Ethiopia's cane field produces 540,000 tonnes of cane tops and the factories produce about 476,000 tonnes (235,000 tonnes of dry matter) of bagasse [6]. The objectives of this study were to evaluate the effect of different level of Dried Sugar Can tops inclusion on carcass characteristics and Economic Feasibility of Washera sheep fed a basal diet of grass hay.

Materials and Methods

Description of the study area

The experiment was conducted at Bure ATVET College Farm, which is found in Amhara National Regional State (ANRS) in West Gojjam Zone at Bure Woreda. The Woreda is located 400 km north of Addis Ababa and 148 km south of the regional town Bahir Dar, capital city of the Amhara Region. The Woreda is located at a latitude of 10.17°N-10.49°N and a longitude of 37°E-37.11°E. The mean annual rainfall is 1500 mm and the mean temperature is 22°C.

Feeds and feeding management

The supplements noug seed cake and wheat bran were purchased from oil extractor in the Bure Woreda and flour milling industries in Bahir Dar, respectively. The concentrate mixture containing 67% wheat bran and 33% noug seed cake was formulated. The basal diet of mixed sward hay (grass dominant) was prepared and used for the experiment. Sugar cane tops was purchased from Wan Gedam surrounding farmers. The cane tops was chopped to an approximate size of 5 cm for ease of eating by animals, dried under shade on a plastic sheet, and stored at the experimental site. The animals offered the basal diet, common salt as a mineral licks and water ad libitum. All animals received 100 gram DM of the concentrate mixture. Animals received sugar cane tops according to their treatments. Both the concentrate mixture and sugar cane tops were offered to the animals in two equal halves at 0800 and 1600 hours daily.

Experimental animals and management

Twenty yearling intact male Washera sheep were purchased from the local market of Burie. The mean initial body weight was 18.5+1.85 (mean+SD). The animals were drenched with a broad spectrum anthelmintic (albendazole) drug against internal parasites and sprayed with accaricide against external parasites. They were vaccinated against common diseases (anthrax and pasteurelosis) during the quarantine period of 21 days at the experimental site.

Experimental design and treatments

The experiment was arranged in a randomized complete block design (RCBD), which consisted of four treatments (Table 1). At the end of the quarantine period, the sheep were fasted overnight and initial body weigh were measured. Animal were blocked into five blocks of four animals each on the basis of their initial body weight. Animals within a block were randomly assigned to the four treatments. Experimental diets were individually offered to the animals during the experimental period of both digestibility and growth trial. Treatments were levels of sugar cane top feeding at 0 (T1), 120 (T2), 240 (T3), and 360 g/day (T4) dry matter (Table 1).

Treatment	Feeds		
	Hay	CM (g/head/day)	SCT (g/head/day)
T1	Ad libitum	100	0
T2	Ad libitum	100	120
T3	Ad libitum	100	240
T4	Ad libitum	100	360

Table 1: Experimental treatments CM: Concentrate Mix (67% wheat bran and 33% noug seed cake); SCT: Sugar Cane Tops.

Measurements and Observation

Body weight gain

Body weights of each animal were measured every 10 days after overnight fasting using spring balance. Body weight gain was determined as a difference between the final and initial body weight. Average daily gain was calculated by dividing the weight difference by the number of feeding days. Feed conversion efficiency was also calculated as a proportion of daily body weight gain to daily feed intake.

Carcass characteristics

At the end of the experiment, the all sheep were taken from each treatment, fasted overnight, weighed and slaughtered. Blood was collected in plastic container and weighed. The entire alimentary tract (gut) was removed and weighed with and without gut contents. The empty gut weight was measured individually for each organ and recorded after the content was discarded. The weight of the gut contents was measured by difference. Empty body weight of each animal was determined by subtracting weight of digesta from the slaughter weight. Dressing percentage was calculated as the proportion of hot carcass weight to slaughter and empty body weights. Hot carcass weight was computed by excluding contents of thoracic, abdominal and pelvic cavities, head, skin, feet and tail of the animal.

The total edible offal components were taken as the sum of blood, kidney, heart, liver, tongue, reticulo-rumen, omasum-abomasum, tail, and total fat. The total non-edible offal components were taken as the sum of skin and feet, penis, testicle, spleen, lung trachea and esophagus, and gut fill. The rib-eye muscle area of each animal was determined by tracing the cross sectional area between 12th and 13th ribs after cutting perpendicular to the back bone.

Partial budget analysis

Partial budget analysis was used to determine the profitability of the feeding regime by the method of Upton [7]. It only involved the calculation of major cost of sheep feed (variable cost) and benefit gains from sell price of sheep without considering other cost like labor, housing and veterinary service which was common for all treatments. The calculation was done by using the formulae; Net return=Total return − Total variable cost; Marginal rate of revenue=Δ Net return/Δ Total variable cost.

Citation: Worku A, Animut G, Urge M, Gebeyew K (2015) Effect of Different Levels of Dried Sugar Cane Tops Inclusion on the Performance of Washera Sheep Fed Basal Diet of Grass Hay, Ethiopia. J Adv Dairy Res 3: 133. doi:10.4172/2329-888X.1000133

Statistical analysis

The data obtained from the experiment were analysed using analysis of variance (ANOVA) by the General Linear Model (GLM) Procedure of SAS. The treatment means of all parameters were separated using Tukey HSD (Tukey Honestly Significant Difference Test). The ANOVA model used for analysis of experimental data was: Yij=μ+Ti+Bj+Eij, Where; Yij=the response variable; μ=the overall mean; Ti=the treatment effect; Bj=the block effect; Eij=the random error.

Results and Discussion

Body weight change and feed conversion efficiency

The initial body weights (IBW), final body weight (FBW), average daily body weight gain (ADG) and feed conversion efficiency (FCE) are given in Table 2. In the current study, T1 showed significantly lower (P<0.01) FBW values as compared to the rest of the treatments, and values for treatments that received sugar cane tops were similar (P>0.05). ADG appeared to increase as the level of sugar cane top supplementation increased, and ADG for T4 was greater than that of T1 while the values for T3 was similar with T2 and T4. FCE values took a similar trend like that of FBW, and as such was lower (P<0.05) for T1, but similar (P>0.05) among the other three treatments. The greater FBW and ADG values observed for T4 could be associated with the higher amount of dry mater and ME intakes recorded in this treatment.

Dietary inclusion of SCT improved daily body weight gain of sheep in the study signifying the valuable feeding value of SCT for sheep. Thus, up to 360 g/day inclusion of SCT to hay based diets had a positive impact on the performance of animals when concentrate mixture (67% wheat bran and 33% noug seed cake) was added at 100 g/day. The level of ADG noted in this study was higher than 55.6 g/day noted for sheep fed hay and supplemented with up to 300 gram concentrate mixture [8]. Thus, according to the observation in the current study part of the expensive concentrate mixture can be substituted with SCT with comparable performance results (Figure 1).

	Treatment					
Parameters	T1	T2	T3	T4	SEM	SL
IBW (kg)	17.7	17.9	18.3	18.5	0.33	ns
FBW (kg)	19.8^{b}	22.7^{a}	23.4^{a}	24.5^{a}	0.57	**
ADG (g/day)	21.4^{c}	45.8^{b}	56.1^{ab}	75.1^{a}	0.12	**
FCE (g ADG/g DMI)	0.04^{b}	0.08^{a}	0.10^{a}	0.11^{a}	0.01	**

Table 2: Live weight parameters and feed conversion efficiency of washera sheep fed grass hay basal diet, concentrate mixtures, and graded level of sugar cane tops.

^{a,b}In a row not bearing a common superscript are significantly different; ***P<0.001; **P<0.01; *P<0.05; IBW: Initial Body Weight; FBW: Final Body Weight; ADG: Average Daily Gain; FEC: Feed Conversion Efficiency; DMI: Dry Mater Intake; SEM: Standard Error Mean; SL: Significant Level.

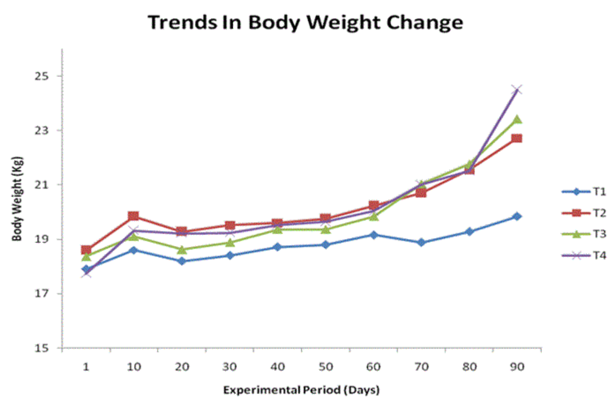

Figure 1: Trends of body weight change across the feeding period for Washera sheep fed grass hay basal diet, concentrate mixtures, and graded level of sugar cane tops.

Carcass component

Slaughter weight (SW), empty body weight (EBW), hot carcass weight and dressing percentage on SW and EBW basis, and rib eye muscle area of Washera sheep fed grass hay and graded levels of sugar cane tops are shown in Table 3. Slaughter weight, EBW and HCW were lower (P<0.05) for T1 than all other treatments which did not significantly differ among each other (P>0.05), which is in line with [9]. Dressing percentage also took a similar trend like that of HCW. This observation is consistent with the final body weight of sheep noted in the current study. The dressing percentage (EBW) of many tropical sheep breeds is low and within the range of 40-50% [10], which is in line with the results of the current study. The experimental animals in this study had equal rib eye area (P>0.05) among each other.

Parameters	Treatment					
	T1	T2	T3	T4	SEM	SL
SW (Kg)	19.72^{b}	22.64^{a}	23.3^{a}	24.3^{a}	7.5	**
EBW (Kg)	14.5^{b}	16.4^{ab}	17.18^{a}	17.35^{a}	0.92	**
HCW (kg)	6.4^{b}	8.2^{a}	8.7^{a}	9.14^{a}	0.29	***
Dressing percentage (% SW)	32.6^{b}	36.6^{a}	37.7^{a}	37.9^{a}	1.74	**
Dressing percentage (% EBW)	44.7^{b}	50.5^{a}	52.0^{a}	52.7^{a}	0.22	*
Rib eye area (cm^{2})	5.77	6.67	6.28	7.03	0.54	ns

Table 3: Main carcass characteristics of washera sheep fed grass hay basal diet, concentrate mixtures, and graded level of sugar cane tops.

^{a,b}Same row with different superscript differ significantly; ***p<0.0001; **p<0.01; *P<0.05; SEM: Standard Error of Mean; SL: Significance Level; SW: Slaughter Weight; EBW: Empty Body Weight; HCW: Hot Carcass Weight.

Non-carcass components

Edible carcass offal components of Washera sheep fed a basal diet of grass hay and graded level of sugar cane tops are shown in Table 4. Liver weight was significantly higher in T4 ($P<0.001$) while the rest treatments did not differ significantly ($P>0.05$) from each other. The increase in liver weight with STC inclusion might be related to the storage of reserve substances such as glycogen as described by Lawrence and Fowler [11]. Similarly, reticulo-rumen was higher in T4 ($P<0.01$) and equal for other treatments ($P>0.05$). This might be due to higher intake feed associated with greater intake of SCT in T4, which might have increased the reticulo-rumen size because of the fibrous nature of SCT. All the remaining edible carcass offal's were statistically equal among all treatment feeds ($P>0.05$). Lack of significant differences among the treatments in these edible offal components in the current study might be due to the fact that organ weight is more dependent on other factors such as sex, breed and age of the animal than plane of nutrition [12]. The heavier weight of TEOC in T4 indicated that SCT has a positive effect on the weight of such non-carcass components, although the variation may also arise due to individual differences.

	Treatment					
Edible offal	T1	T2	T3	T4	SEM	SL
Blood (g)	577.9	770	774	624	70.3	ns
Heart (g)	95.2	85.3	102.6	93.4	6.32	ns
Liver (g)	217.3^{b}	230.7^{b}	219.9^{b}	360.4^{a}	11.4	***
Kidney (g)	37.2	46.3	49	47	4.38	ns
Tongue (g)	55.8	58.6	58.2	55.2	2.68	ns
Reticulo-rumen (g)	380^{c}	410b	430^{b}	590^{a}	30.1	**
Omaso abomasum (g)	140	150	162	562	18.3	ns
Kidney fat (g)	30.3	26.12	27.9	30.4	7.28	ns
Omental fat (g)	26.1	22.34	26.02	48.1	11.91	ns
Intestine (g)	560	580	594	580	42.0	ns
Tail (g)	580	520	614	398	74.6	ns
TEOC (g)	2699.9^{c}	2899.9^{b}	3057.8^{a}	3389.4^{a}	211.2	***

Table 4: Edible offal component of Washera sheep fed grass hay basal diet, concentrate mixtures, and graded level of sugar cane tops.

^{a,b,c}In the same row with different superscript differ significantly; ***$p<0.0001$; **$p<0.01$; SEM: Standard Error of Mean; SL: Significance Level; ns: Not Significant Level; TEOC: Total Edible Offal Component.

Non-edible offal

In the present study, T4 had the highest weight of gut content followed by T3, while T1 and T2 had the lowest ($P<0.01$) (Table 5). The weights of feet, skin and spleen differed significantly ($P<0.05$), but without much apparent trend. The total non-edible offal components (TNEO) were similar among treatments [13]. Noted that weight of some visceral organs is affected by the level of nutrition. On the contrary, Emebet [14] reported that sheep fed haricot bean haulms supplemented with wheat bran and brewery dried gain did not significantly differ in these organs between supplemented and control sheep, consistent to what is noted in this study, which is supported by Pena et al. [15] who noted that relative proportion of non-carcass components significantly decrease relative to increment in the size of live weight.

	Treatment					
Non-Edible offal	T1	T2	T3	T4	SEM	SL
Gut content (g)	5172^{c}	5175^{c}	6198^{b}	7028^{a}	136.2	**
Feet (g)	396^{b}	340^{b}	580^{a}	400^{b}	74.6	**
Penis (g)	33.6	36.6	30.4	30.7	2.53	ns
Skin (g)	3059^{c}	3728^{b}	3450^{b}	4646^{a}	1.75	***
Spleen (g)	22.9c	28.5^{ab}	24.9^{bc}	32.3^{a}	1.7	**
Testicles (g)	201.8	195.3	177.7	180.2	13.2	ns
Lung with trachea (g)	291.8	296.6	290.8	288	14.53	ns
Head (g)	784	905	790	834	2.53	ns
TNEOC (g)	10630.1	11623	11541.8	11852.2	482.7	ns

Table 5: Non-Edible offal component of Washera sheep fed grass hay basal diet, concentrate mixtures, and graded level of sugar cane tops.

^{a,bc}Same row with different superscript differ significantly; **$p<0.01$; *$p<0.05$; SEM: Standard Error of Mean; SL: Significance Level; ns: Not Significant level; TEOC= Total Edible Offal Component.

Variables	Treatment			
	T1	T2	T3	T4
Purchasing price of sheep (Birr/head)	700	700	700	700
Total hay consumed (kg/head)	35.0	31.21	26.1	26.3
Total concentrate consumed (kg/head)	9	9	9	9
Total sugar cane consumed (kg/head)	-	9	13.8	23.5
Cost for hay (Birr/sheep)	52.50	46.81	39.15	39.45
Cost for concentrate (Birr/sheep)	29.97	29.97	29.97	29.97
Cost for sugar cane tops (Birr/sheep)	-	9.9	15.18	25.85
Total variable cost (Birr) (TVC)	82.47	86.99	84.3	95..27
Selling price of sheep (Birr)	800	850	890	1000
Gross income (Birr)	100	150	190	300
Net return (Birr/sheep) (NI)	17.53	63.01	105.7	204.73
Change in net income (∆NI)	_	45.48	88.17	187.2
Change in total variable cost (∆TVC)	_	4.52	1.83	12.8
MRR (∆NI/∆TVC)	_	106.0	481.8	146.2

Table 6: Partial budget analyses for Washera sheep fed grass hay basal diet, concentrate mixtures, and graded level of sugar cane tops.

Partial budget analysis

Partial budget measures profit or loss, which is the net benefits or difference between gains and losses for the proposed change. Gain includes added return and reduced costs, losses include added costs and reduced returns. The results of the partial budget analysis are given in Table 6. The net return of T4 was the highest followed by T3, T2 and T1 in that order. The difference in the net return among treatments was mainly due to the difference in selling price of the animals and variable cost in each treatment. The changes in net income of different proportions of dried sugar cane tops, wheat bran, noug seed cake and their mixture ,was 63.01, 105.7, and 204.73 Birr for T2, T3 and T4, respectively. And the marginal rate of returns was higher for T3 and followed by T4. Therefore, for better animal performance and economic profitability, inclusion of 360 g SCT is recommended for Washera Sheep fed grass hay and concentrate mix. It was also concluded that sugar cane tops could be used as part of a diet for sheep to improve animal performance where it is available.

Conclusion

Supplementation of dried sugar can top has positive impact on the body weight gain and carcass characteristics of to Washera Sheep even with better economic feasibility. Therefore, for better animal performance and economic profitability, inclusion of 360 g SCT is recommended for Washera Sheep fed grass hay and concentrate mix. It was also concluded that sugar cane tops could be used as part of a diet for sheep to improve animal performance where it is available.

Acknowledgements

The author's heart fully appreciation is to Federal ATVET for sponsoring the study and the research work. The author also wishes to express gratitude to Burie ATVET College teaching and administrative staffs for giving moral support and for facilitating different supports required during the conduct of the thesis research project.

References

1. Fekede F, Agajie T, Angaw T (2011) Producing and using Alternative Feeds to Crop Residues Efficient use of Crop Residues: Animal Feed Vs Conservation Agriculture Research Project. EIAR, Addis Ababa, Ethiopia
2. Alemu Y (2008) Nutrition and Feeding of Sheep and Goats. ESGPIP (Ethiopia Sheep and Goat Productivity Improvement Program), Sheep and Goat production Hand book for Ethiopia. Alemu Yami and R.C.Merkel (eds), pp. 103-159.
3. Kevelenge JEE, Said AN, Kiflewahid B (1983) The nutritive value of four arable farms by products commonly fed to dairy cattle by small scale farmers in Kenya III Nitrogen and mineral retentions by weather. Tropical Animal production 8: 180–186.
4. Girma MM, Awulachew SB (2007) Irrigation practices in Ethiopia Colombo, Sri Lanka: International Water Management Institute, pp. 80.
5. ANRS (Amhara National Regional State) (2005) Rural household socio-economic survey of 56 Woredas in Amhara Region. Volume VIII. Livestock production February 2003. Bahir Dar, pp. 46.
6. Hiwot M (1986) Molasses as a drought feed. FAO Corporate Document Repository.
7. Upton M (1979) Farm Management in Africa: The Principle of Production and Planning. Oxford University Press, Great Britain, pp. 28-298.
8. Simachew G (2009) Effects of supplementation with maize bran, noug seed (Guizotiaabyssinica) cake and their mixtures on feed utilization and carcass characteristics of Washera sheep fed hay. MSc Thesis Presented to the School of Graduated Studies of Haramaya University, Haramaya, Ethiopia.
9. Gebeyew K, Animut G, Urge M, Feyera T (2015) the effect of feeding dried tomato pomace concentrate feed on body weight, carcass parameter and Economic Feasibility on Harareghe Highland Sheep, Eastern Ethiopia. J Veterinar Sci Technol 6: 217.
10. Payne WJA, Wilson RT (1999) An Introduction to animal husbandry in the tropics. 5th ed. Blackwell Science Ltd, London, UK, pp. 815.
11. Lawrence TCJ, Fowler VR (1998) Growth of farm animals. CABI publishing, London, pp. 271-273 .
12. Archhimede H, Pelloned P, Despois P, Etienne T, Alexander G (2008) Growth performance and carcass trials of ovin Martinitik lambes fed various ratios of tropical forage to concentrate under intensives conditions. Small Ruminant Research 75: 163-170.
13. Fluharty FL, McClure KE (1997) Effects of dietary energy intake and protein concentration on performance and visceral organ mass in lambs. Journal of Animal Production 75: 604-610.
14. Emebet L (2008) Supplementation of Blackhead Ogaden sheep fed haricot bean (phaseolus vulgaris) haulms with mixtures of wheat bran and brewery dried grain: Effect on feed utilization, live weight gain and carcass parameters. An MSc Thesis Presented to School of Graduate Studies of Haramaya University, Haramaya, Ethiopia.
15. Pena F, Cano T, Domenech V, Alcalde MJ, Martos J, et al. (2005) Insluence of sex, slaughter weight and carcass weigh on non-carcass and carcass quality in segurena lambs. Small Ruminant Research 60: 247-254.