Scientific Journal of Review (2020) 9(3) 634-643
ISSN 2322-2433
doi: 10.14196/sjr.v9i3.536

Contents lists available at Sjournals
Scientific Journal of **Review**
Journal homepage: www.sjournals.com

Review article

Sex, age of animal and weight at slaughter as explanatory variables for carcass and meat quality properties in goats and sheep production

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ARTICLE INFO

Article history,
Received 12 February 2020
Accepted 13 March 2020
Available online 20 March 2020
iThenticate screening 14 February 2020
English editing 11 March 2020
Quality control 18 March 2020

Keywords,
Sex
Age
Weight
Carcass
Meat
Goat
Sheep

ABSTRACT

Slaughtering kids/lambs at specified age and weight of specialized goat and sheep meat breeds might promote high muscle deposition and a desirable carcass fat cover, culminating into meat with a more adequate nutritional profile and health properties for human consumption. In this case, animal factors such as sex, age and weight at slaughter play a central role as the primary explanatory variables on meat yield and quality of carcass parameters in goat and sheep production. The discussion on determinants of carcass and meat quality properties is complex given that the diversity of goat and sheep meat breeds, both early and late maturing is considerable, over and above exploited as is the practice in non-identical production systems. Of interest goats and sheep in most cases are accordingly slaughtered at different weights and age, and on the other hand, specific markets have preferred sex of animal for slaughter. However, taking cognisance of the above, carcass and meat parameters are influenced by various non-genetic effects, hence the knowledge on these factors and their interactions becomes of paramount importance in order to produce desirable meat quality for specified markets and consumers' preference. A linear relationship between carcass yield with age at slaughter has been reported in goats and sheep, there is a tendency of carcass weight increasing as the age of the animal increases. Sex dependency on carcass and meat parameters has been inconsistent in goats and sheep, however, most studies show that sex greatly influence carcass

and meat quality properties. Compromised dressing percentage in goats and sheep due to higher slaughter weight, could be explained by the lightest animals lacking perfectly developed digestive tracts. Against this background, age at slaughter explicitly influences meat quality, particularly with regards to tenderness of meat derived from young animals. The differential carcass status in young and mature animals is due to increased fat deposition in older animals than in younger ones, while fat tissue increases with increased slaughter weights. Complexity of determination of desirable carcass and meat parameters is ascribable to interaction of many variables, hence it is imperative to appreciate the role of each component by appropriately factoring their influence in any slaughter decision, where animals could be slaughtered at given age and weight to meet specified objectives of a particular market requirements. Producers operating in different production systems might not duplicate factors such as age, weight and sex of slaughter because they utilise different genotypes, and the prescribed nutritional regime in non-identical production systems will weigh heavily on the outcome of carcass and meat parameters. The interaction of all these factors (genotype and non-genetic factors) at different levels as influenced by the market expectations will decide the economics of goat and sheep meat production. This present review will give an insight on some non-genetic effects that influence carcass and meat quality properties namely sex, age and weight at slaughter.

1. Introduction

Desirability of carcass and meat quality properties are dependent on more than one factor such as genotype and other non-genetic factors namely nutrition, sex of animal, age and weight at slaughter, etc. and these can be assessed as specified in various studies by a number of authors (Dhanda et al., 2003; Mourad et al., 2001; Marichal et al., 2003; Santos, 2004). For this reason, the understanding of the carcass and meat parameters, determined by primary factors that influence them, is critical. The effect of sex (Mioč et al., 2013), age (Cifuni et al., 2000) and slaughter weight (Rajkumar et al., 2014) on carcass characteristics and composition has been the subject of a considerable number of studies in small ruminants' meat production. This is on the backdrop that kid/lamb carcasses and meat quality produced in different production conditions differ substantially in different parts of the world as they are exposed to different non-genetic factors. This entails different markets prefer animals of specific sex slaughtered at different age and weight. Moic et al. (2013) reported a sex dependent dressing percentage, where females had a higher dressing percentage than their male counterparts, dressing percentage in goats has been reported to increase with age (Ruvuna et al., 1992). Dressing percentage was eminent with the increase in slaughter weight from 24 to 34 kg in Karagouniko and Serres lambs (Matsoukas et al., 1987). In a similar study, Johnson et al. (1995) observed that sex had a larger influence on carcass parameters than breed, in a comparative study of intact males, castrated males, and females of Florida native, Nubian * Florida native and Spanish * Florida native. On the other hand, well-developed carcasses, with larger carcass fractions have been associated with greater slaughter weight (Marichal et al., 2003; Pen et al., 2005). Elsewhere, low slaughter weight has been preferred by consumers because it is considered that meat of young animals is of better quality (Bernabeu et al., 2005). A previous report by Naude and Hofmeyr (1981) noted that in most cases, goat carcasses have inferior conformation as compared with sheep carcasses, most importantly early in life. Studies of higher slaughter weights in different Italian sheep breeds by different authors exhibited superior hot carcass yields (Sarti et al., 1991; Morbidini et al., 2009; Borghese et al., 1982; Gigli et al., 1982; Verita et al., 2001). Mioč et al. (2013) working with goats observed that slaughter weight was a major determinant of carcass parameters, where higher slaughter

weight permitted considerably more developed carcasses. Age at slaughter influenced meat quality, particularly with regards to tenderness of goat kids (Webb et al., 2005). Slaughtering young animals provide meat which is tenderer since protein synthesis declines with advanced age (Therkildsen et al., 2002; Sazili et al., 2004). The present review gives an insight on the impact of sex, age and slaughter weight on carcass and meat quality properties in goats and sheep.

2. Sex of kid/lamb influencing carcass and meat quality factors in goats and sheep

Reports on sex effect on carcass and meat parameters have been inconsistency, however the majority of studies showed that sex was one of the major sources of variation on carcass and meat parameters in goats and sheep production. Previously, Oman et al. (1999) working with Boer × Spanish than for Spanish males reported a superior hot carcass weight, however was partly influenced high-concentrate diet because the results differed when the same animals were on range. Johnson et al. (1995) observed that sex had a larger influence on carcass parameters than breed, in a comparative study of intact males, castrated males, and females of Florida native, Nubian * Florida native and Spanish * Florida native. Secondary carcass parameters of buttock width and thoracis depth were improved in male lambs (Peña et al., 2005) whereas the same parameters posed no differences in males and females as observed by Santos et al. (2007). Differential slaughter yields of mature adults from males and females of 40.9% and 41.5% respectively, were reported by (Sabbioni et al., 2016). This was in agreement with results for adult sheep of different breeds, reformed and reconditioned through grazing (Pascal et al., 2010). Santos et al. (2000) and Pérez et al. (2000; 2002) reported superior carcass yield in females as compared to their male counterpart. This was in contradiction with results reported by Pen et al. (2007) who observed no significance of sex on carcass traits in Florida suckling lamb. The suspected regular advantage of males over females could be ascribed to more fat deposition and possibly due to the physiology of the male, which take into account a superior growth rate and resulting into a greater elongation of bones (Wylie et al., 1997). Mahgoub et al. (2004) implied that buck kids had superior fraction of lean muscle in the forequarter whereas does and wethers exhibited greater proportion of lean muscle in the hindquarter. Comparative performance between ewes and wethers irrespective of nutrition regime or sire breed effect specify that despite male lambs are naturally larger and leaner, castration depresses male hormonal effects as a result wethers experiencing growth and carcass compositions similar to those of ewes (Zerley, 2010; Warriss, 2009). However, this can be the basis for utilizing either ewes or wether lambs in meat production depending on marketing opportunities for different farmers.

Oman et al. (2000) observed comparable gender dependent dressing percentages among Boer*Spanish, Spanish, and Spanish*Angora where males at 9 months of age, attained a dressing percentage averaging 56.2% of live body weight. Spotted goat kids' females had superior dressing percentage and lower skin with lower legs weight with reference to their males' counterparts (Mioč et al., 2013). Elsewhere, sex dependent dressing percentage although non-significant were observed by Peña et al. (2005) in lambs and Marković et al. (2011) in suckling kids. A comparative evaluation of carcass yield between young and adult animals, it was noted that carcass yield variation does not exist if dressing percentage is based on empty body weight (Marichal et al., 2003). Previously, Allan and Holst (1989) observed that intact males had inferior dressing percentages at 20 kg live weight than wethers and does, but that significant difference was not observed at 26 kg live weight. This was in agreement with the observation by Solaiman et al. (2011) who reported that wethers had superior dressing percent than bucklings. Mioč et al. (2013) reported that hind limb length was greater in males being in opposition to females, whereas other carcass parameters did not vary between sexes. In contradiction, Santos et al. (2007) observed that sex had no influence on dressing proportion and carcass fatness in suckling lambs.

Sex influenced carcass composition and males had enhanced bone, while intermuscular fat, kidney knob, channel fat proportion were depressed as compared with females (Teixeira et al., 2011). Males exhibited improved carcass compactness by virtue of a higher hot carcass weight/carcass length ratio. Sabbion et al. (2016) working on Cornigliese sheep breed to ascertain the influence of sex*age on carcass parameters, the fat content of loin meat improved with age in females and was depressed in males. In addition, the poly-unsaturated fatty acids content of loin meat was elevated in males as compared with females, with saturated and mono-unsaturated fatty acids exhibiting an important interaction between age-class and sex. Gender has been a primary determinant of the amount of fat in goat carcasses, this has been shown by the extent of fat growth and deposition in females, castrated and uncastrated males. Previously, Allan and Holst (1989) observed that females grow at a slower rate, succeeded by castrated males and intact male goats, respectively. As a result of their growth pace females have

more carcass fat than male goats (Mahgoub and Lu, 1998). The same author in a different study observed that buck kids had a lower fraction of fat against does and wethers of the same breed and nutritional plane (Mahgoub et al., 2004). In addition to that castration promoted fat accumulation, consequently wethers displaying superior fat content against buck kids. Zvonko Antunovic et al. (2010) observed that gender was an important determinant of neck yield, suggesting that males had superior values than females, irrespective of age. In addition, female heavy lambs exhibited a higher fraction of bone and, consequently, a lower muscle/bone and (muscle/fat)/bone ratios than male weight categories.

3. Age at slaughter influencing carcass and meat quality factors in goats and sheep

Age-class dependent factor was important on overall carcass parameters suggesting a delayed development in animals (Sabbioni et al., 2016). Consumer satisfaction from fresh meat is based on tenderness, where generally ideal tenderness has been associated with reduced age at slaughter due to softened myofibrillar proteins and cross bridge formation in muscles (Madruga et al., 2000), because the muscles gets tougher as the age progresses. Slaughtering young animals provide meat which is tenderer since protein synthesis declines with advanced age (Therkildsen et al., 2002; Sazili et al., 2004). Age at slaughter can profoundly influence meat quality, particularly with regards to tenderness of goat kids (Webb et al., 2005). Therefore, as expected young kid/lambs will produce tender meat. In goats' carcass weights, dressing percentage, loin eye area and fat thickness improved as chronological age advanced (Dhanda et al., 1999). There is a linear relationship between hot carcass and cold carcass weight and age at slaughter, where the weights increases as age increases. Working with crossbred, mixed sex goats slaughtered at 5 different ages (116, 172, 228, 284, and 340 d of age), Cameron et al. (2001) observed that heavier hot carcass weights were attained as age advanced. In agreement with this result, Solaiman et al. (2012) confirmed that hot carcass and cold carcass weight ranked heavier as age progressed over 4 slaughter ages of 141, 169, 196, and 225 d of age. Akpa et al. (2017) observed that hind quarter carcass weight and legs weight from young goats were superior than those from adult goats, while the adults were a better source for edible portion. The proportional yield of tender loin and hind leg chump to the whole carcass, which are much sort retail cut, declined as age progressed (Sultana et al., 2010). The important age dependent on goat's edible offals, hind quarter and legs weights reported were in agreement with the earlier reports by Mayi et al. (2010) that showed an increase in goat carcass parameters as slaughter age progresses. Issakowicz et al. (2018) observed that the depressed fraction of prime cuts for instance leg, shoulder, rump cap and mignon and an enhanced inferior cuts, by way of the neck, in addition to inguinal, visceral and kidney fats was a result of advanced age at slaughter, mostly accounting for overall inferior carcass value.

Dressing percentage is both yielding and value influencing parameter and is therefore, is of paramount importance in evaluation of performance of meat producing animals. As reported by Gökdal (2013), variation in dressing percentage may be credited to disparity of age and production environment. On the other hand, proportions of head weight (presence of horns) skin weight (presence and weight of hair), and other variables (slaughter method and practice, relative to hot carcass weight, cold carcass weight, full body weight, empty body weight or slaughter weight) as part of dressing percentage might influence its calculation. This is upon the notion that higher slaughter weight, increased fat cover, high dietary energy density as well unexceptionally accompany higher dressing percentage. Skapetas et al. (2006) working with the mountain Greek sheep breeds observed lambs of different age groups did not vary in dressing percentage significantly. Slaughtering lambs at the age of 60 days the dressing percentage had a propensity to diminish, and tend to ascend at the age of 75 and 90 days. In a similar study, Cifuni et al. (2000) working with Apulian lambs observed that superior dressing percentage was attained at the slaughter age of 45 days versus that of 90 days. In Serres lambs slaughtered at 42 days (weaning) had the highest dressing percentage with reference to those slaughtered at an advanced age at a slaughter weight of 25 and 30 kg (Tzalis et al., 1994). In a similar study by Asenjo et al. (2005) who reported that slaughter weight influenced dressing percentage, however, suggesting that this parameter can have a different effect ascribable to breed effect. Dressing percentage was higher (55.5%) in the older group of ages between 12 to 15 months than others three group of less than 6 months, 6 to 9 months and 10 to 12 months of age, which attained dressing percentages of 48.5%, 49.0% and 51.4%, respectively. The trend perfectly supportive of the notion that dressing percentage was increased with increasing of age.

Ponnampalam et al. (2007) observed that at the age of 8 months carcases lambs had inferior lean meat and those from Merino lambs were comparable to Poll Dorset x Merino lambs. The fractions of muscles revealed an

inclination of increasing with the increasing slaughter age although the scenario was not significant. Fat deposition varies not simply in total amount, among others is its distribution between the various deposits which changes considerably in the course of active growth period (Negussie et al., 2003) hence this affect the proportion of fat existence in young and mature animals. In males age-class had no influence on tissue composition, however, in females the muscle and fat percentages increased with age whereas the bone fraction decreased. The differential carcass status in young and mature animals is due to the fact that fat deposition is prominent in older animals than in younger ones (Kaić et al., 2012). Gaili et al. (1972) previously reported that goats showed an increase in fat with increase in mature animals over the young ones due to peak of growth and development in adult body. In younger animals, adipocytes are depressed, resulting in a higher association between the cell membrane which is fortified with PUFA particularly omega-3 and omega-6 (Brand et al., 2010) as a result the fraction of unsaturated fatty acids increases. This was given as a justification of enhanced content of omega-3 and omega-6 in crossbreds (Issakowicz et al., 2018). This pointed to the fact that deposition of some fatty acids depend on the age apart from genotype of the animal, where fat deposition is dependent on genotype. Superiority of adult sheep in supplying live weight, carcass weight, dressing percentage, head weight, skin weight, legs weight and edible offals was necessitated by the increased carcass parameters with increase in age at slaughter (Akpa et al., 2017). Skapetas et al. (2006) observed that between age groups of 30 and 90 days, the total fat increased from 20.84 to 23.59%, which tend to show that total fat was increasing directly proportion to slaughter weight. In a similar trend subcutaneous, intermuscular, perinephric and pelvic fats increased with the slaughter age, exclusively the subcutaneous fat was affected substantially. Quite the opposite, as the age at slaughter increased, the fraction of bones declined. Fat tend to grow at a lower rate in the early stage of an animal life, but afterwards the growth rate of this tissue escalates with respect to body weight increase. In this regard, the age at slaughter or the maturity stage of animals is one of the most important factors that determine the carcass composition. Skapetas et al. (2006) observed that total fat fraction was enhanced consistently with the increase of slaughter age from 30 to 90 days, while a decline was experienced in this factor for lambs' slaughtered at the age of 60 days, possibly due to weaning stress. It was shown clearly that as the age at slaughter increased, the meat-to-bone ratio tended to be improved. The bone fraction as a proportion of the entire carcass decline with the increase of age at slaughter. This relationship was observed in sheep breeds indicating that bones tissue experience earlier growth with reference to muscles and fat (Kemster et al., 1987; Papadimitriou et al., 1989). A further explanation was that there is alteration of priority on blood nutrient utilised by various body tissues during the different stages of animals' life. Sultana et al. (2010) recommended that the optimum market/slaughter age for castrated native sheep maintained under a prescribed nutritional regime and management would be at around eight months of age. This might be a problem for other scenarios were grazing is the mode of nutritional source. On the other hand, castration of animal might also influence the carcass measurements.

4. Weight at slaughter influencing carcass and meat quality factors in goats and sheep

Quite a number of studies reported a significant influence of slaughter weight on carcass traits and meat composition (Mioč et al., 2013; Teixeira et al., 2005). Studies of higher slaughter weights in different Italian sheep breeds by different authors exhibited superior hot carcass yields (Sarti et al., 1991; Morbidini et al., 2009; Borghese et al., 1982; Gigli et al., 1982; Verita et al., 2001). Mioč et al. (2013) working with goats observed that slaughter weight was a major determinant of carcass parameters, where higher slaughter weight permitted considerably more developed carcasses, while hind weight of carcasses increased with increase slaughter weight. Santos et al. (2007) found that carcass parameters and compactness index increased with increased live weight at the same time slaughter weight category. Superior hot carcass yields were attained in higher slaughter weights (Sabbioni et al., 2016). Omanetal (1999) working with Boer × Spanish than for Spanish males reported a superior hot carcass weight, however was partly influenced high-concentrate diet because the results differed when the same animals were on range. Mioč et al. (2013) working with Croatian Spotted goat kids observed that slaughter weight had a significant influence on carcass weight and the weight of skin with lower legs and all internal organs, except the spleen. Gablilides et al. (1993) and Papadopoulos et al. (1993) concurrently working with Chios and Kimis lambs, respectively, ideal carcass yields were reported at the slaughter weight of 26 and 30 kg in comparison with that at the slaughter age of 50 days.

Oman et al. (2000) observed comparable gender dependent dressing percentages among Boer*Spanish, Spanish, and Spanish*Angora where males at 9 months of age, attained a dressing percentage averaging 56.2% of

live body weight. Dressing percentage is value determinant considering carcass yield parameters and can be calculated as final live weight divided by HCW multiplied by 100. Vergara et al. (1999) observed that slaughter weight influence carcass weight while dressing percentage, predicted on slaughter weight and empty body weight, was unaffected. Mioč et al. (2013) the effect of slaughter weight on dressing percentage was not important in goats, was attributable to lower weights at slaughter and the comparison of these in a compressed weight ranges. Beriain et al. (2000) observed a decline in dressing percentage with higher slaughter weight, explained by the lightest animals lacked perfectly developed digestive tracts. Dressing percentage was eminent with the increase in slaughter weight from 24 to 34 kg in Karagouniko and Serres lambs (Matsoukas et al., 1987).

Slaughter weight was a determinant of scored carcass fatness, which was advanced in higher slaughter weights, while meat colour lightness and water capacity was low with the lower slaughter weight lambs (Cañeque et al., 2001). Cameron et al. (2001) observed that weight at slaughter influence the rates of protein and fat deposition. Fat is the highly inconsistent tissue in an animal's body. Its growth, deposition and distribution vary in accordance with different physiological state (Mohapatra and Shinde, 2018). Fat content influence meat quality especially as it responds to slaughter weights. Santos et al. (2007) subcutaneous tissue distribution was mainly modified by slaughter weight and increase in slaughter weight resulted in a high proportion of subcutaneous fat. In a similar study, Russo et al. (2003) and Díaz et al. (2005) reported an increase in fat fraction in carcass which was directly proportional to increase in slaughter weight. Rajkumar et al. (2014) studying Muzaffarnagari lambs slaughtered at higher live weight reported carcasses with high lean and visceral fat content and depressed bone content. Intramuscular fat fraction of L. dorsi increased and moisture percentage declined with higher slaughter weight.

Meat/bone proportion of the carcass improved as slaughter weight increased. These results were in agreement with the observation by Santos-Silva and Portugal (2001) and Diaz et al. (2003) who reported an increase in muscle/bone fraction as concomitant to increases with slaughter weight. In a similar study, Rodrigues et al. (2006) reported that lean meat in carcass did not vary between different carcass weight classes but fat increased considerably. Sabbioni et al. (2016) compactness index was compromised in heavy lambs than in mature animals and the lowest index was exhibited in heavy female lambs. These results are inconformity with report in dairy goats by Koyuncu et al. (2007) that as carcasses become heavier compactness index increased. Teixeira et al. (2011) working with goat kids of Cabrito Transmontano breed in Spain reported carcass weight influencing carcass joint proportion. A host of carcass parameters improved where the increase carcass weight there was a proportionally linear increase in carcass compactness, chump and breast fraction, fat depots and tissues parameters. However, experienced a decline leg, shoulder, fore ribs and bone proportion. In addition, the influence of slaughter weight was exerted in longissimus dorsi muscle determinants and muscle area were elevated over and above the subcutaneous fat thickness. Muscle proportion was depressed in Karagouniko and Kimis lambs as a result of higher slaughter weights especially from 26 to 30 kg (Matsoukas et al., 1991; Papadopoulos et al., 1993). The explanation was that biological maturity is attained earlier as compared to the body weight of lambs. This partly was in agreement with previous reports by Taylor et al. (1989) and Zygoyiannis et al. (1990) who noted that a decrease in the lean fraction by the time the slaughter weight attained 40-76% of the mature weight of sheep. However, this was in contrary to reports by Assan (2012) and Bonvillani et al. (2010) who observed that the fraction of visceral organs and fat depots as the percentages of empty body weight were not influenced by slaughter weight in indigenous Matebele and Criollo Cordobés kids' goat, respectively. Cañeque et al. (2001) working with Talaverana breed lambs reported that unweaned lambs slaughtered at weights of 24 and 28 kg exhibited a low total collagen levels, while the intramuscular fat showed an enhanced fraction of saturated fatty acids and a lower n-6/n-3 fatty acid ratio. Intramuscular fat of the longissimus dorsi muscle of heavier lambs attained higher levels of monounsaturated and lower levels of polyunsaturated fatty acids, in addition to lower soluble collagen. In contrary, higher slaughter weight partly influenced meat quality properties (Santos-Silva et al., 2002). Sinha (1991) observed that Muzaffarnagari lamb carcasses from high slaughter weights had more kidney and omental fat. Rajkumar et al. (2014) observed that slaughter weight had no bearing on meat chemical composition, pH, cooking loss, water holding capacity and shear force. Even the tenderness, flavour and juiciness were not influenced by slaughter weight whereas juiciness scores were comparatively elevated for heavier carcasses.

5. Implications

In the framework of different production conditions body weight at different ages greatly differ between meat breeds and their crosses, consequently influencing the outcome on growth performance, carcass and meat properties. This is exactly why, one size fits all approach on kid/lamb slaughter decisions, on when and what sex to slaughter and at what slaughter weight becomes problematic in goat and sheep production considering the diversity of commercial mutton and chevon meat market demands and consumer perception of quality meat in different regions of the world, which are characteristically utilising various breeds and their crosses in non-identical production environments. This is despite that slaughtering kids/lambs at given age and weight of specific goat and sheep meat breeds may promote high muscle deposition and desirable carcass fat cover, resulting in meat of favourable nutritional profile and health properties for human consumption. Goat and sheep meat production world over take place in an array of production conditions, posed by differed marketing context and consumer meat perceptions, as a result factors of sex of animal, age and weight has explanatory variables on carcass and meat parameters can be combined at different levels to conform to requirements of specific markets in terms of carcass and meat quality properties. The combination of factors of age, weight and sex of animal should take cognisance of body weight and growth patterns with reference to early against late maturing goats and sheep breeds and their crosses, because body development of these two categories of breeds in relation to muscle and fat development vary as regards to biological age and weight. For the purpose of enhancing meat production efficiency early and late maturing breeds may need to be considered differently in the context of their slaughter weights and age in order to attain ideal dressing percentage, carcasses and desirable meat properties. Genetically meat breeds differ in muscle development and fat deposition, others tend to grow more rapidly and efficiently under intensified nutrition which might be desirable to slaughter animals at specific ages and weights ranges. It is interesting to note that there is a strong interaction of age*sex*slaughter weight which cannot be ignored when a slaughter decision is going to be made on desirability of dressing percentage, carcass and meat quality for specific production environments and market expectations. There is a tendency of higher slaughter weight contributing to well-developed carcasses that are associated with higher carcass yield, then technically larger carcasses can be produced to meet the more meat for increased demand in the market without detrimentally affecting meat tenderness. With defined slaughter age end-points, producers have the ability to alter production practices to produce desirable carcass and meat by deciding on tested age and weight at slaughter for specific market. An alternative option in attaining lean meat with high nutritional value for health human consumption is the exploitation of breed complementarity that reduces animal slaughter age as a result promoting tender meat. In Africa there is need to evaluate the potential of various local goat and sheep genotypes through ascertaining slaughter weight and age end points for ideal carcass and meat parameters so that these can be properly exploited in the mainstream commercial meat markets. The meat yield parameters of many local goats and sheep breeds are usually lower than those of exotic or improved breeds and this has limited the use of indigenous breeds in intensive meat production systems. In this regard, most smallholder producers have opted for crossbreeding of goat and sheep local genetic resources with terminal sire breeds in order to improve carcass and meat parameters. Growth, slaughter and meat traits of local goats and sheep as compared with introduced exotic breeds have not been thoroughly evaluated despite this information being useful to achieve optimal meat production desired by commercial meat markets.

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How to cite this article: Assan, N., 2020. Sex, age of animal and weight at slaughter as explanatory variables for carcass and meat quality properties in goats and sheep production. Scientific Journal of Review, 9(3), 634-643.