RESEARCH ARTICLE:

The Potential of Goat Meat Acceptance by Young Adults in South Africa

Karina Palmer[1], Ashika Naicker[2] and Unathi Kolanisi[3]

Abstract

Recent global meat consumption trends report an increase in goat meat consumption as a protein source; however, consumption is not popular in South Africa. Despite goat meat being a nutritious and sustainable source, the willingness to consume goat meat as an acceptable protein source among young adults is not known. The study aims to explore factors that may prevent goat meat consumption and determine the potential for goat meat consumption among young adults from a rural and urban university in KwaZulu-Natal, South Africa. An online meat consumption survey was developed and disseminated through email to students (n=416). Goat meat consumption by young adults was reported to be mainly due to cultural practices. Although most of the participants consumed goat meat, the frequency of consumption was lower than that of chicken, beef and pork. Key barriers to goat meat consumption included a lack of availability, unappealing aroma and allergies. The findings indicated the potential to promote goat meat availability at retail outlets in South Africa, specifically through value-added convenience products. An integrated approach, including consumer education and the increasing availability of goat meat and value-added products, will improve the consumption of this sustainable and nutritious protein source.

Keywords: *goat meat; meat consumption; sustainable foods; young adults*

Introduction

Domesticated goat meat originated from the wild species of the Quaternary: Capra aegagrus, Capra falconeri, and Capra prisca, from different regions of Asia (Ensminger and Parker, 2002: 430). Goats are widely distributed around the world, totalling more than 850 million and representing about 1,156 different breeds (Devendra, 2010: 127). The largest number of goat breeds are found in Asia and Africa (Ivanović *et al*., 2016: 112). According to a report by the South African Department of Agriculture, Forestry and Fisheries, South Africa produces less than 1% of the world's number of goats (Mogala, 2018: 6). There are three main commercial goat breeds in South Africa: Boer, Savanna and Kalahari Red, that are reared for their meat and skins. In 2012, the Eastern Cape (38%), Limpopo (19%), and KwaZulu-Natal (13%) were reported as the highest producers of goats in the country including indigenous and commercial breeds (Mogala, 2012: 8). Indigenous goats comprise approximately 63% of the goats in South Africa (Mogala, 2012: 6).

Indigenous goats are usually reared under natural veld conditions in developing countries like South Africa and are usually not administered pharmacological agents to improve or boost their health and increase the number of offspring (Mazhangara *et al.*, 2019: 7). Hence, goats reared under these typical conditions may be regarded as 'green produce', which poses an advantage in terms of the marketing of products made from goat meat (Mazhangara *et al.*, 2019: 8). The 'naturalness' of goat meat directly feeds into the consumer shift towards healthier food options that are regarded as 'better for you'. The nutritional benefits coupled with the natural rearing conditions make goat meat an ideal choice for the health-conscious consumer (McMillin and Brock, 2005: E59; Elias and Tischew, 2016: 99; Mazhangara *et al.*, 2019: 9; Rana and Paul, 2017: 159). However, indigenous goat breeds are not favoured for their meat as they have small

[1]University of Zululand, PalmerK@unizulu.ac.za
[2]Durban University of Technology, ashikan@dut.ac.za
[3]University of Zululand, KolanisiU@unizulu.ac.za

carcasses and their milk produced in low quantities. Therefore, Boer goat is the preferred breed for chevon in South Africa.

A report on climate change and its impact on Southern African food systems refers to goats as the second most valued livestock after cattle in rural areas (Ogundeji, 2022: 591). During the 2015-2016 agricultural drought in South Africa, KwaZulu-Natal farmers lost more of their cattle herds (43%) as opposed to goat herd (29%). The number of cattle remained stagnant three years after the drought, whilst goat numbers recovered (Vetter *et al.,* 2020: 95). Goats are known for having low input requirements and being hardy (Soji and Muchenie, 2017: 584 and Mogala, 2018: 9). The resilient nature of goats makes them a profitable enterprise capable of thriving despite climatic challenges and multiple environmental stressors that other livestock like cattle may not be able to recover from (Mataveia *et al.*, 2021: 157; Nair, Sejian *et al*., 2021: 2230).

In terms of nutrition, animal sources of food are rich in high biological value protein and contain other essential nutrients that promote well-being (Stajic and Pisinov, 2021: 2). Nutritionally, goat meat is regarded as being superior to other red meats, due to the lower saturated fat and cholesterol content and it contains more polyunsaturated fatty acids than beef and lamb (Ivanović *et al*., 2016: 112; Van der Weele *et al*., 2019: 506). Goat meat is also reported to be a good source of group B vitamins including vitamin B6 (20% of the daily requirement) and vitamin B12 (70% of the daily requirement), which is comparable to other meat sources (Kazhybayeva *et tal*., 2019: 239). Despite goat meat being a nutritious food source that is low in total fat, cholesterol, and kilojoules (Table 1) (United States Department of Agriculture 2001), consumption of goat meat and retail availability in South Africa still lags behind other countries (Mohlatlole *et al*., 2015: 44). Approximately 63% of the goats in South Africa comprise indigenous veld goats, which contribute to the non- commercialised agricultural sector (Visser *et al*., 2004: 25). Identifying factors that make goat meat a less favourable protein choice is key in addressing ways to improve the consumption of goat meat as a sustainable food source. Hence, the purpose of this study was to explore the factors that may prevent goat meat consumption and determine the potential for goat meat consumption among young adults.

Table 1: The nutrient composition of goat and other meat sources per 85g (United States Department of Agriculture 2001: 85 and Mazhangara *et al*., 2019: 7)

Nutrient	**Goat**	**Chicken**	**Beef**	**Pork**
Kilojoules (kJ)	510	678	749	753
Fat (g)	2.6	6.3	7.9	8.2
Saturated fat (g)	0.79	1.7	3.0	2.9
Protein (g)	23	25	25	25
Cholesterol (mg)	63.8	76.0	73.1	73.1
Iron (mg)	3.1	1.5	2.9	2.7

Despite the nutritional benefits of goat meat depicted in Table 1, in South Africa goats are generally reared and slaughtered for religious or traditional ceremonies in rural communities and not as a preferred meat source nor are they commercially marketed (Erasmus and Hoffman 2017: 72). Goats play an important role in African culture and are used not only for ceremonies but also in marriage negotiations, hence they are an important aspect of rural livelihoods. Even though goats are important in rural communities, the extent of their production and contribution to local economies is underestimated. Due to goat meat being utilized mainly for cultural/religious practices, consumption of goat meat seems to be specific to a select few communities. This niche target group and the sensory properties of goat meat (strong aroma) have impacted both the commercial availability and marketing efforts directed at increasing consumption of goat meat in South Africa (Soji and Muchenje, 2017: 585).

A notable increase in consumption of goat meat has been observed in other countries during the twentieth century as the global demand for all meat types increased from 28.5 kg/capita/year in

1961 to 51 kg/capita/year in 2013 (FAOSTAT 2017; Falchetta *et al*., 2021: 5). The United Nations Food and Agriculture Organization (FAO) predicts that global meat consumption will double by 2050, with meat consumption growing to ± 465 million tons. Consumption of all meat types in sub-Saharan Africa was on average 11.5 kg/capita in 2013 (FAOSTAT 2017). In terms of greenhouse gas (GHG) emissions, beef contributes the most emissions (41%), followed by pig meat (9%), chicken meat and eggs (8%) and lastly, small ruminant meat (6%) (FAO 2013). The low percentage of GHG emissions that small ruminants such as goats contribute, shows the potential for these animals to be part of the solution to sustainable and green food sources. In terms of sustainability, goat and sheep have a lower footprint on gray water (water pollution as a result of livestock production) and blue water (ground or surface water) as opposed to beef, poultry, and pork (Parlasca and Qaim, 2022: 24). Despite the increase in global consumption, in South Africa the formal marketing of chevon is not done by rural and small-scale farmers as goats are often not regarded as being a profitable meat source due to various misconceptions. The term 'chevon' refers to meat from adult goats, whilst 'cabrito' is meat from young goats that are less than two years of age (Mogala, 2012: 5). Hence, the availability of chevon in formal markets is scarce, which directly influences consumption as consumers are not able to eat what is not readily available in the retail sector outside the scope of traditional events where goat meat is consumed (Soji and Muchenje, 2017: 586). However, the composition of goat meat lends itself to the growing demand from consumers for a lean and nutritious meat source.

Even though goats in rural areas are usually not formally marketed for an income, households that rear livestock such as goats and other ruminants are reported to be less likely affected by food insecurity compared to those that do not rear such animals (Ogundeji, 2022: 4). Sub-Saharan Africa is the only region in the world where more than one-third of the population experiences widespread hunger. Despite reports that show more than 80% of the continent's food is produced by the region's smallholder farmers, this region still struggles with caloric and micronutrient deficits and 61% of households in the region, which includes South Africa and Kenya, experience mild, moderate, or severe food insecurity (Xie *et al*., 2021: 4). Whilst other livestock require feed, which is grown, goats are browsers and forage for their feed hence do not compete with humans for food sources (Nair *et al.*, 2021: 2231). In South Africa, the benefits of goat meat are, however, overshadowed by the misconceptions of the sensory properties of the meat that influence consumption and overall acceptability (Pophiwa *et al*., 2017: 795). The literature highlights the nutritional and entrepreneurial benefits of goats globally; however, research surrounding the potential of goat meat in South Africa is limited. Therefore, the purpose of this study was to explore the factors that may inhibit goat meat consumption and determine the opportunities for and acceptance of goat meat consumption among young adults.

Methodology

A cross-sectional study design was used to obtain the data presented in this paper. The target population included students from two universities (University A and University B). University A is situated in an urban setting in Durban, KwaZulu-Natal with food outlets located on the university premises and within proximity to formal food outlets. University B is in a rural setting, in KwaDlangezwa, KwaZulu-Natal with limited access to food outlets, with the nearest formal food outlet situated 16km away. The target population included registered university students, inclusive of all races and genders, aged between 18-30 years. The number of students from both universities at the time of the study was 60 000, hence a minimum sample size was determined at 383 using a 95% confidence level and 5% margin error (Taherdoost, 2017: 238). The sample size was rounded off to 400, to allow 200 participants (50%) from each university.

A goat meat consumption and preference survey was designed and reviewed by the research team. The survey was then piloted by representatives of the sample population (n=10) to ensure the phrasing of the questions was not ambiguous, the sequencing allowed ease of completion and sufficient options were provided for multiple response questions. The survey layout included an introductory paragraph followed by four sections: demographics, general meat consumption,

goat meat and milk consumption, and intent to purchase goat meat using multiple response questions. Gatekeeper permission to conduct the study at both universities was obtained from the Research Directorate of each university. Access to student email addresses was obtained from the Dean of Students for each university. In compliance with the Protection of Personal Information Act (POPIA), details of the study and survey link were sent to students' email addresses via blind carbon copies for both the pilot and final survey. The survey was kept open for four months and during this time 416 participants completed the survey.

Data was checked for correctness and completeness prior to statistical analysis. The Statistical Package for Social Sciences (SPSS®) version 22.0 was used for descriptive statistics including means and standard deviations, where applicable. Frequencies are represented in tables or graphs. Using the Chi-square goodness-of-fit-test, a univariate test was used on a categorical variable to test whether any of the response options were selected significantly more/less often than the others. The binomial test was used to test whether a significant proportion of respondents selected one of a possible two responses. This study was granted approval by the Durban University of Technology Institutional Research Ethics Committee (IREC): IREC number: 071/21. A letter of information was included as a hyperlink to the online questionnaire and informed consent was attained through a checkbox at the start of the survey. Restrictions were applied to the online questionnaire to allow students to answer the survey only once. Participation in the online questionnaire was voluntary and anonymous with the right to withdraw at any time from the survey.

Results

From the total of 416 participants, 211 (51%) were from University A and 205 (49%) were from University B. The majority of the participants were African (93%), mainly women (68%) and most participants fell within the 18-20 year (33.9%) and 21-24 year (44.5%) age cohort.

Table 2: Demographic profile of participants (n=416)

Demographics		**Frequency (n)**	**Percentage (%)**
Gender	Men	133	32
	Women	283	68
Race	African	387	93
	Indian	25	6
	White	1	0.2
	Coloured	3	0.7
Age (years)	18-20	141	33.9
	21-24	185	44.5
	25-27	53	12.7
	28-30	37	8.9

The findings from Table 3 indicate that a significant proportion of participants consumed chicken more than four times a month, consumed beef more than three times a month and consumed pork at most twice a month ($p<0.001$).

Table 3: Meat consumption by university students (n=416)

	Frequency	**Chicken**	**Beef**	**Pork**
University A n=211(%)	Not at all	1 (0.5)	23 (10.9)	79 (36.0)
	1-2 times a month	17 (8.1)	58 (27.5)	91 (43.1)
	3-4 times a month	41 (19.4)	65 (30.8)	28 (13.3)
	>4 times a month	152 (72)	65 (30.8)	16 (7.6)
University B n= 205(%)	Not at all	4 (2.0)	8 (3.9)	61 (29.8)
	1-2 times a month	11 (5.4)	52 (25.4)	102(49.8)
	3-4 times a month	31 (15.1)	75 (36.6)	22 (10.8)
	>4 times a month	159 (77.6)	70 (34.1)	20 (9.8)
	Not at all	5 (1.2)	31 (7.5)	137 (32.9)
	1-2 times a month	28 (6.7)	110 (26.4)	193 (46.4)

Combined	3-4 times a month	72 (17.3)	140 (33.7)	50 (12.0)
	>4 times a month	311 (74.8)	135 (32.5)	36 (8.7)
	X^2	571.635	73.288	159.135
	Df	3	3	3
	P value	<.001*	<0.001*	<0.001*

*Indicates significance at the 95% level

Regarding the consumption of processed meat, a significant 76% of participants consumed sausage (p<0.01), whilst a significant 55.8% reported consuming polony (p=.021). Meatballs (ground meat) and biltong (salted dried meat) were not as commonly consumed, with a significant percentage of participants reporting not consuming these items (p<0.01).

Table 4: Processed meat consumption (n=416)

Processed meats	University A n=211 (%)		University B n=205 (%)		Combined n=416 (%)		
	Yes	**No**	**Yes**	**No**	**Yes**	**No**	**p-value**
Biltong	47 (22.3)	164 (77.7)	26 (36.0)	179 (87.3)	73(17.5)	343 (82.5)	<.001*
Burger patties	113 (53.6)	98 (46.4)	88 (42.9)	117 (57.1)	201 (48.3)	215 (51.7)	0.524
Sausage	160 (75.8)	51 (24.2)	156 (76.1)	49 (23.9)	316 (76)	100 (24)	<.001*
Meatballs	35 (16.6)	176 (83.4)	31 (15.1)	174 (84.9)	66 (15.9)	350 (84.1)	<.001*
Polony	113 (53.6)	98 (46.4)	119 (58)	86 (41.9)	232 (55.8)	184 (44.2)	.021*

*Indicates significance at the 95% level

A total of 78.6% of the participants indicated having consumed goat meat before; however, the frequency of consumption was significant for 'once a year' and 'cannot remember when' (p<0.01). Figure 1 reports the reasons for consuming goat meat. A significant 74.3% of participants consumed goat meat due to cultural reasons.

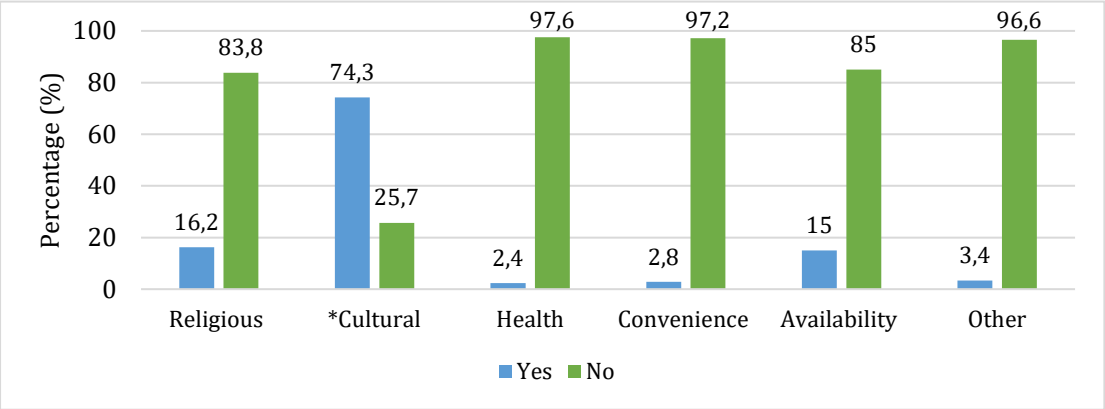

Figure 1: Reasons for consuming goat meat (n=327)

Figure 2 depicts the reasoning for those that do not consume goat meat (n=89). Lack of availability (33.7%), aroma (25.8%) and allergies (24.7%) were the main reported reasons for not consuming goat meat.

Overall, more students from university A, reported not eating goat meat (n=51) as compared to university B (n=38). However, the reasons for not consuming goat meat were similar.

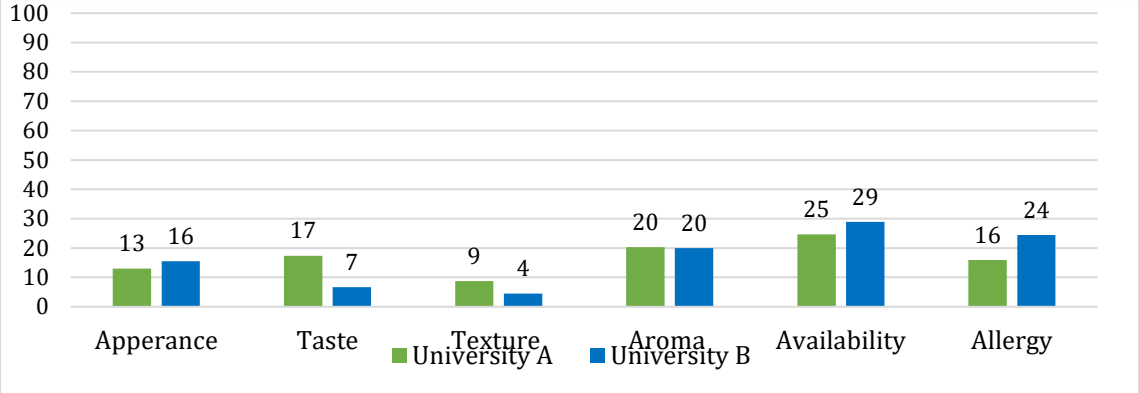

Figure 2: Reasons for not consuming goat meat (n=89)

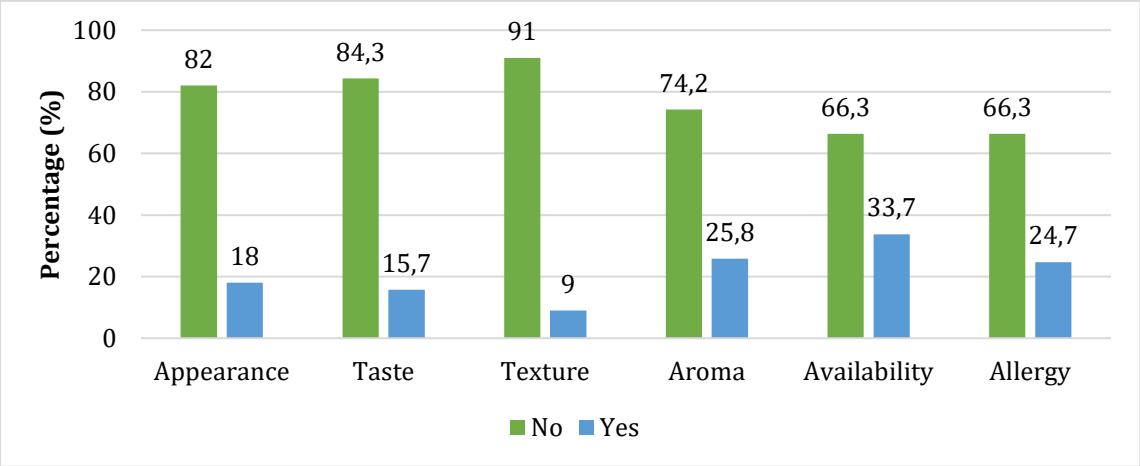

Figure 3: Reasons for not consuming goat meat stratified by university (n=89)

The intent to purchase goat meat and milk products is depicted in figure 4. Most participants reported having not consumed goat milk products before (74.8%); however, there was interest in tasting these items (72.1%) and other processed goat meat products (68.8%).

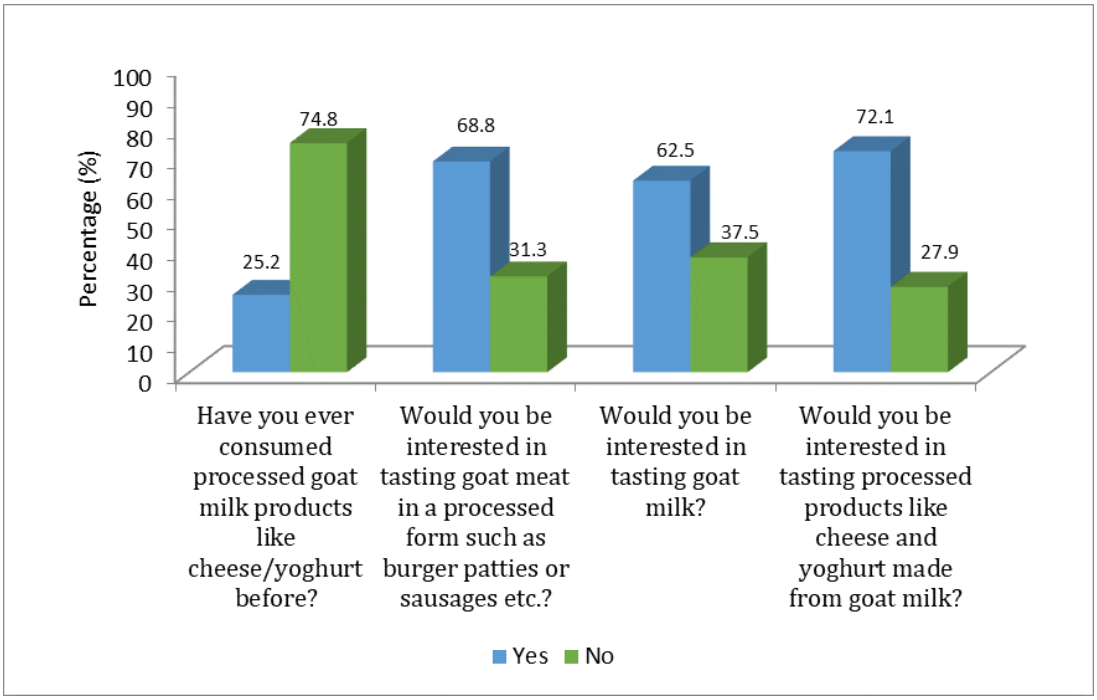

Figure 4: Willingness to purchase goat meat and milk products (n=416)

Participants' interest in consuming goat meat in a formal setting (figure 5) revealed that if price was not a factor, some would be interested in purchasing goat meat from their local shop (58.9%), and some would purchase goat meat products in a restaurant setting (58.7%).

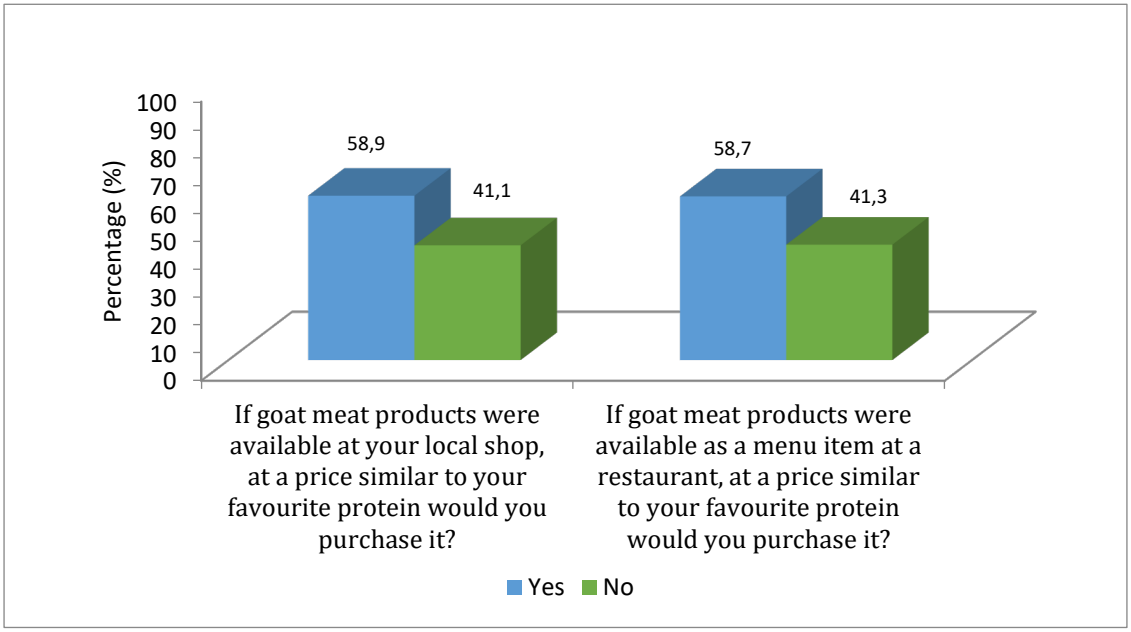

Figure 5: Interest in consuming goat meat in a formal setting (n=416)

Discussion

The overall findings in this study report that there were no significant differences in the consumption frequency between the rural and urban universities, hence data was combined and reported as such. The demographic results in terms of race were representative of the student population at both sites.

Goat meat consumption

Most of the participants (78,6%) reported consuming goat meat; however, the frequency of consumption was much lower in comparison to chicken, beef, and pork. The present findings from Table 3 indicate that a significant proportion of participants consumed chicken more than four times a month. This is consistent with results from a previous study on food consumption in South Africa which reported a significant increase in meat consumption with chicken being the most consumed protein (Ronquest-Ross *et al.*, 2015: 3). Chicken is also widely available, easily accessible and a relatively cheap protein source. Meat is a core component of the South African diet as shown in the significant consumption of chicken (more than four times a month) and beef (more than three times a month). However, chicken consumption precedes that of beef, mainly due to affordability (Schonfeldt and Hall, 2013: S67; Erasmus and Hoffman, 2017: 73).

Processed meat consumption

Processed meats are commonly consumed in South Africa; these are usually cheaper than unprocessed meat options and generally high in sodium, flavourings, and preservatives to increase the product shelf-life and acceptability (Cluff *et al.*, 2017: 144; Peters *et al.*, 2017: 405). Processed foods contain high amounts of sugar, fat and salt which contribute to lifestyle diseases such as obesity, hypertension and cardiovascular disease, thus high consumption of these foods compromises an individual's health status (Popkin and Ng, 2021: 5). A study in a rural community in South Africa reported processed meat as being the most popular lunch option for teenagers (Abrahams *et al.,* 2011: 1754). In the current study, a significant 76% of the participants consumed sausage, whilst a significant 56% reported consuming polony, which is a cured and cooked meat that contains meat trimmings and off-cuts. Meatballs (ground meat) and biltong

(salted dried meat) were not as commonly consumed, with a significant percentage of participants reporting not consuming these items. This is possibly due to the cost factor as these products do not have added meat extenders in the product formulation and seemingly, are not a common food choice among students (Abrahams *et al*., 2011: 1755; Cluff *et al*., 2017: 145; Jones *et al*., 2017: 746).

Justification of goat meat consumption

The main reason for consuming goat meat was due to cultural practices, which requires the slaughtering of goats ceremoniously. A significant percentage of participants reported eating goat meat for cultural purposes, which was also observed in a study conducted in rural communities (Mazhangara *et al.,* 2019: 7; Erasmus and Hoffman, 2017: 8). Results indicated that young university students frequently consumed chicken and beef which were readily available and accessible in formal markets. In terms of processed meats, participants reported a preference for sausage, which highlights the potential for developing processed goat meat value-added convenience products to increase consumption directed at the youth consumer segment. However, certain questions revealed that the participants' intent to purchase processed goat meat were not entirely convincing, reflecting that product development alone would be insufficient in promoting consumption and other strategies would need to be used concurrently.

Barriers to the consumption of goat meat and lamb were reported in a qualitative study in Europe, which highlighted that the reason for goat and lamb consumption was due to perceived health benefits and lower environmental impact (Mandolesi *et al*., 2020: 11). These results are quite different in comparison to this study, where a very low percentage acknowledged consumption of goat meat due to its health benefits. The marketing and promotion of goat meat needs to be addressed both in South Africa and internationally as the mixed perceptions about the benefits and limited availability of goat meat in retail stores are both challenges that restrict consumption (Kaur 2010: 42 and Mandolesi *et al.,* 2020: 14). A recent study conducted in South Africa among university students supports results from international studies that found the intrinsic attributes of goat meat to be a means of promoting its consumption and market development (Ngomane *et al*., 2022 :2). The study also suggests a possible solution for increasing the marketing of goat meat through highlighting its product value and social impact for improving livelihoods and food security as the collective benefits of goat meat. Other strategies towards increasing acceptance include that the use of technologically advanced processing methods, alternative fats such as pork and beef fat, and the use of enzymes and brines to tenderise the meat can be explored to improve the sensory attributes of goat meat (Kazhybayeva *et al.,* 2019: 240; Stajic and Pisinov, 2021: 2).

The main reasons for not consuming goat meat were due to unavailability and undesirable aroma. Goat meat has similar aroma compounds to those present in beef and lamb, except for glycine and fructose which are reported to be present in higher concentrations which could be responsible for the distinct aroma (Teixeira *et al*., 2020: 12). These factors that influence consumption can be addressed by creating awareness and improving accessibility through supply chains in conjunction with product development to mask the undesirable sensory characteristics (Hartmann and Siegrist 2017: 13; Idamokoro *et al*., 2019: 2; and Hegde, 2020: 31).

Potential for goat meat value added products

When posed with a question on interest in consuming processed goat meat products (68,8%) and goat meat if it were available as a restaurant item (58,7%), there was no clear indication that participants would choose goat meat as the preferred protein if they were given an option in a formal market setting. Moreover, even though the majority had eaten goat meat before, the willingness or choice to eat it may have been influenced by cultural and traditional practices as opposed to preference. A systematic review on consumer perceptions and behaviour regarding sustainable protein consumption revealed consumer reluctance to change to alternative meat consumption in terms of reducing or substituting meat (insects) was low (Navarrete-Molina *et al*., 2020: 3). This drives the case for goat meat, which has been reported as having several

benefits in terms of sustainability, including the animal's feeding practices (it does not compete with vegetation that can be used for human consumption), maintenance of biodiversity as goats are browsers rather than grazers and require low use of non-renewable resources (Peacock and Sherman, 2010: 71; Griggs *et al*., 2013: 306).

Young adults may be willing to explore eating goat meat from a sustainable point of view but value addition, as denoted by the results in figure 4, clearly highlights that processing goat meat would have the potential to be well received by young adults more so than emphasising the health benefits whereas an international study involving seven countries in Europe, emphasised two important themes, 'health benefits and the pleasure of eating'. In the study goat and sheep meat were perceived as 'natural and healthy' due to their lower environmental impact and nutritional benefit (Mandolesi *et al.*, 2020: 12). Cultural and traditional considerations differ vastly among countries and hence a customised strategy needs to be developed for specific audiences. A study in the US conducted a goat meat survey on the prospects of enhancing goat meat. The researcher reported that marketing efforts and promotions should be directed to the primary shopper, which is the younger generation (<33 years old), in line with changes in consumer trends and with younger generations being more adventurous and willing to try different foods. This supports the results of our study which indicate young adults would be willing to try goat meat/milk and value-added products (Light, 2020: 34).

Even though there is good growth potential for goat meat markets, efforts need to be channelled towards quality assurance and uniformity, data collection on consumer preferences, and determining the type of meat products and processing methods that should be used to promote consumption (Madruga and Bressan, 2011: 40). Unlike other commonly consumed meats, goat meat is not widely exported but rather consumed locally within communities of developing countries. The market structure for goat meat is also not well developed to promote the consumption of this meat (Skapetas and Bampidis, 2016: 2). The value and acceptability of goat meat may be increased through production practices and meat processing (McMillin and Brock, 2005: E59). Stajic and other authors have reiterated that goat meat could be used to develop meat products that are acceptable to consumers. This includes potential products such as dry fermented sausages and cured meats made by substituting goat fatty tissue (undesirable sensory attributes) with alternative fat sources. The use of spices and seasoning could also improve the sensory acceptability by masking the undesirable sensory attributes of goat meat (Stajic and Pisinov, 2021: 2; Ivanovic *et al*., 2016: 53; Leite *et al*., 2015: 115; Teixeira *et al.*, 2021: 2). Special consideration needs to be taken when developing innovative food products using goat meat, as the composition of the meat will influence the modifications that can be made to meet consumers' needs and be sensory acceptable (Hathwar *et al*., 2012: 654; Ivanović *et al*., 2020: 221).

Conclusion

The study shows the potential for the emergence of goat meat and value-added products in the South African market. An integrated approach such as consumer education, increasing availability and visibility of goat meat, and value-added product development needs to be incorporated as a holistic strategy to improve the consumption of this sustainable and nutritious source of protein. Understanding the youth as an emerging consumer market segment can assist in the marketing and promotion of goat meat as a favourable meat source.

There are several opportunities to increase both the acceptability and consumption of this sustainable meat source. The three main approaches that can be explored by researchers are to improve the awareness, consumption, and acceptability of goat meat. Improving consumer awareness on the sustainability and nutritional benefits through workshops, road shows and other marketing activities is essential in improving the acceptance of goat meat. As much as increasing the awareness of goat meat is important, availability is also a crucial component that will influence the acceptance and willingness to consume goat meat. Sourcing of goat meat from small holder farmers will not only improve farmers' livelihoods but also contribute to the

sustainable supply of goat meat as the demand increases. Product development and value addition is another opportunity to increase the acceptability of goat meat. Much like in this study, where students were identified to be frequent consumers of processed meats, value addition can mask certain undesirable characteristics and extend the product range, providing more choices to the consumer. Consumers response to the sensory evaluation of products developed with goat meat will provide information on the approach needed to improve acceptance.

The target audience selected was young adults due to this age cohort being more willing to be experimental or adventurous with food options. It is perceived that young adults are also keen on driving the sustainability agenda which is pivotal to meeting the sustainable development goals set by the United Nations. Although the study was conducted in a specific province in South Africa, the demographic profile and food environment were representative of the rest of the country. However, the results cannot be generalised to the rest of Africa as consumption and preferences may differ.

References

Abrahams, Z., De Villiers, A., Steyn, N. P., Fourie, J., Dalais, L., Hill, J., Draper, C. E. and Lambert, E. V. 2011. What's in the lunchbox? Dietary behaviour of learners from disadvantaged schools in the Western Cape, South Africa. *Public Health Nutrition*, 14(10): 1752-1758.

Cluff, M., Kobane, I., Bothma, C., Hugo, C. and Hugo, A. 2017. Intermediate added salt levels as sodium reduction strategy: Effects on chemical, microbial, textural, and sensory quality of polony. *Meat Science*, 133: 143-150.

Devendra, C. 2010. Concluding synthesis and the future for sustainable goat production. *Small Ruminant Research,* 89(2-3): 125-130.

Elias, D. and Tischew, S. 2016. Goat pasturing—A biological solution to counteract shrub encroachment on abandoned dry grasslands in Central Europe? *Agriculture, Ecosystems and Environment*, 234: 98-106.

Ensminger, M. E. and Parker, R. O. 2002. *Sheep and Goat Science: Reproduction in Sheep and Goats*. 6th edition. Danville, IL: Interstate Printers and Publishers Inc.

Erasmus, S. W. and Hoffman, L. C. 2017. What is meat in South Africa? *Animal Frontiers*, 7(4): 71-75.

Falchetta, G., Golinucci, N., Noussan, M. and Rocco, M. V. 2021. Environmental and energy implications of meat consumption pathways in sub-Saharan Africa. *Sustainability*, 13(13): 1-22.

FAO. 2013. Major cuts of greenhouse gas emissions from livestock within reach. Available: https://www.fao.org/news/story/en/item/197623/icode/ (Accessed 14 March 2022).

FAOSTAT. 2017. Food balance sheet. Available: https://www.fao.org/faostat/en/#data/FBS (Accessed 14 March 2022).

Griggs, D., Stafford-Smith, M., Gaffney, O., Rockström, J., Öhman, M. C., Shyamsundar, P., Steffen, W., Glaser, G., Kanie, N. and Noble, I. 2013. Sustainable Development Goals for people and planet. *Nature*, 495: 305-307.

Hartmann, C. and Siegrist, M. 2017. Consumer perception and behaviour regarding sustainable protein consumption: A systematic review. *Trends in Food Science and Technology*, 61: 11-25.

Hathwar, S. C., Rai, A. K., Modi, V. K. and Narayan, B. 2012. Characteristics and consumer acceptance of healthier meat and meat product formulations — A review. *Journal of Food Science and Technology*, 49(6): 653-664.

Hegde, N. G. 2020. Goat development: An opportunity to strengthen rural economy in Asia and Africa. *Asian Journal of Research in Animal and Veterinary Sciences*, 5(4): 30-47.

Idamokoro, E. M., Gunya, B. and Aliber, M. 2019. Farmers' perception and willingness to consume goat milk and goat milk products: A case study of the central Eastern Cape, South Africa. *Pastoralism*, 9(1): 1-8.

Ivanović, S., Pavlović, I. and Pisinov, B. 2016. The quality of goat meat and its impact on human health. *Biotechnology in Animal Husbandry*, 32(2): 111-122.

Ivanović, S., Pavlović, M., Pavlović, I., Tasić, A., Janjić, J. and Baltić, M. Ž. 2020. Influence of breed on selected quality parameters of fresh goat meat. *Archives Animal Breeding*, 63(2): 219-229.

Jones, M., Arnaud, E., Gouws, P. and Hoffman, L. C. 2017. Processing of South African biltong – A review. *South African Journal of Animal Science*, 47(6): 743-757.

Kaur, B. 2010. Consumer preference for goat meat in Malaysia: Market opportunities and potential. *Journal of Agribusiness Marketing*, 3: 40-55.

Kazhybayeva, G., Agibayeva, A., Kuderinova, N., Harlap, S., Fedoseeva, N., Usov, V., Zhumanova, G. and Bakirova, L. 2019. Development of technology and assessment of nutritional value of a delicacy goat meat product. *International Journal of Innovative Technology and Exploring Engineering*, 8(5): 239-242.

Leite, A., Rodrigues, S., Pereira, E., Paulos, K., Oliveira, A. F., Lorenzo, J. M. and Teixeira, A. 2015. Physicochemical properties, fatty acid profile and sensory characteristics of sheep and goat meat sausages manufactured with different pork fat levels. *Meat Science*, 105: 114-120.

Light, A. M. 2020. Prospects for enhancing the market for goat meat products: Analysis of the 2019 goat meat survey. Master's thesis, Missouri State University.

Madruga, M. and Bressan, M. 2011. Goat meats: Description, rational use, certification, processing, and technological developments. *Small Ruminant Research*, 98(1-3): 39-45.

Mandolesi, S., Naspetti, S., Arsenos, G., Caramelle-Holtz, E., Latvala, T., Martin-Collado, D., Orsini, S., Ozturk, E. and Zanoli, R. 2020. Motivations and barriers for sheep and goat meat consumption in Europe: A means-end chain study. *Animals*, 10(6): 1-16.

Mataveia, G. A., Visser, C. and Sitoe, A. 2021. Smallholder Goat Production in Southern Africa: A Review. Available: https://www.intechopen.com/chapters/76608 (Accessed 12 March 2022).

Mazhangara, I. R., Chivandi, E., Mupangwa, J. F. and Muchenje, V. 2019. The potential of goat meat in the red meat industry. *Sustainability*, 11(13): 1-12.

McMillin, K. and Brock, A. 2005. Production practices and processing for value-added goat meat. *Journal of Animal Science*, 83(13): 57-68.

Mogala, M. 2012. *A Profile of the South African Goat Market Value Chain 2012*. South Africa: Department of Agriculture, Forestry and Fisheries.

Mogala, M. 2018. *A Profile of the South African Goat Market Value Chain 2018*. South Africa: Department of Agriculture, Forestry and Fisheries.

Mohlatlole, R. P., Dzomba, E. F. and Muchadeyi, F. C. 2015. Addressing production challenges in goat production systems of South Africa: The genomics approach. *Small Ruminant Research*, 131: 43-49.

Nair, M., Sejian, V., Silpa, M., Fonsêca, V., de Melo Costa, C., Devaraj, C., Krishnan, G., Bagath, M., Nameer, P. and Bhatta, R. 2021. Goat as the ideal climate-resilient animal model in tropical

environment: Revisiting advantages over other livestock species. *International Journal of Biometeorology*, 65(12): 2229-2240.

Navarrete-Molina, C., Meza-Herrera, C., Herrera-Machuca, M., Macias-Cruz, U. and Véliz-Deras, F. 2020. Not all ruminants were created equal: Environmental and socio-economic sustainability of goats under a marginal-extensive production system. *Journal of Cleaner Production*, 255: 1-12.

Ngomane, M., Tsvakirai, C. and Mlambo, V. 2022. Improving the marketing of goat meat to youths in South Africa. *Small Ruminant Research*, 214: 1-6.

Ogundeji, A. A. 2022. Adaptation to climate change and impact on smallholder farmers' food security in South Africa. *Agriculture*, 12(5): 1-16.

Parlasca, M.C. and Qaim, M. 2022. Meat consumption and sustainability. *Annual Review of Resource Economics*, 14: 17-41.

Peacock, C. and Sherman, D. 2010. Sustainable goat production—Some global perspectives. *Small Ruminant Research*, 89(2-3): 70-80.

Peters, S. A., Dunford, E., Ware, L. J., Harris, T., Walker, A., Wicks, M., Van Zyl, T., Swanepoel, B., Charlton, K. E. and Woodward, M., Webster, J. and Neal, B. 2017. The sodium content of processed foods in South Africa during the introduction of mandatory sodium limits. *Nutrients*, 9(4): 1-15.

Pophiwa, P., Webb, E. C. and Frylinck, L. 2017. Carcass and meat quality of Boer and indigenous goats of South Africa under delayed chilling conditions. *South African Journal of Animal Science*, 47(6): 794-803.

Popkin, B. M. and Ng, S. W. 2021. The nutrition transition to a stage of high obesity and noncommunicable disease prevalence dominated by ultra-processed foods is not inevitable. *Obesity Reviews*, 23(1): 1-18.

Rana, J. and Paul, J. 2017. Consumer behaviour and purchase intention for organic food: A review and research agenda. *Journal of Retailing and Consumer Services*, 38: 157-165.

Ronquest-Ross, L.C., Vink, N. and Sigge, G. O. 2015. Food consumption changes in South Africa since 1994. *South African Journal of Science*, 111(9-10): 1-12.

Stajic, S. and Pisinov, B. 2021. Goat meat products. In: *61st International Meat Industry Conference 2021*. Available: https://vet-erinar.vet.bg.ac.rs/bitstream/handle/123456789/2293/Stajic_2021_IOP (Accessed 13 March 2022).

Schonfeldt, H. C. and Hall, N. 2013. "Fish, chicken, lean meat and eggs can be eaten daily": A food-based dietary guideline for South Africa. *South African Journal of Clinical Nutrition*, 26(3): 66-76.

Skapetas, B. and Bampidis, V. 2016. Goat production in the World: Present situation and trends. *Livestock Research for Rural Development*, 28(11): 1-6.

Soji, Z. and Muchenje, V. 2017. Should the South African red meat classification system be revised or maintained? A review. *South African Journal of Animal Science*, 47(5): 583-594.

Taherdoost, H. 2017. Determining sample size: How to calculate survey sample size. *International Journal of Economics and Management Systems*, 2: 237-239.

Teixeira, A., Silva, S., Guedes, C. and Rodrigues, S. 2020. Sheep and goat meat processed products quality: A review. *Foods*, 9(7): 1-22.

Teixeira, A., Ferreira, I., Pereira, E., Vasconcelos, L., Leite, A. and Rodrigues, S. 2021. Physicochemical composition and sensory quality of goat meat burgers. Effect of fat source. *Foods*, 10(8): 1-11.

United States Department of Agriculture. Composition of foods raw, processed, prepared USDA Nutrient Database for Standard Reference. Available: https://www.ars.usda.gov/ARSUserFiles/80400535/DATA/sr14/sr14_doc.pdf (Accessed 02 February 2022).

Van der Weele, C., Feindt, P., Van der Goot, A. J., Van Mierlo, B. and Van Boekel, M. 2019. Meat alternatives: An integrative comparison. *Trends in Food Science and Technology*, 88: 505-512.

Vetter, S., Goodall, V. and Alcock, R. 2020. Effect of drought on communal livestock farmers in KwaZulu-Natal, South Africa. *African Journal of Range and Forage Science*, 37(1): 93-106.

Visser, C., Hefer, C., Van Marle-Koster, E. and Kotze, A. 2004. Genetic variation of three commercial and three indigenous goat populations in South Africa. *South African Journal of Animal Science*, 34(5): 24-27.

Xie, H., Wen, Y., Choi, Y. and Zhang, X. 2021. Global trends on food security research: A bibliometric analysis. *Land*, 10(2): 1-21.