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Consumer Knowledge, Attitudes, and Practices towards meat adulteration in Kilosa, Tanzania

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Abstract

Meat adulteration refers to the intentional or unintentional substitution, mislabeling, or contamination of meat products with lower-quality or undeclared animal species, additives, or non-meat substances. This practice can lead to serious consequences, including food safety risks, economic fraud, loss of consumer trust, and potential health hazards such as allergic reactions or exposure to harmful contaminants. The fight against meat adulteration in most developing countries is still hindered by a lack of consumer awareness of the concepts of meat adulteration and a clear description that constitutes a legal case of this fraudulent act. Limited studies on consumer awareness, perception and buying practices regarding meat adulteration in Tanzania made this study particularly interesting. From December 2023 to March 2024, a survey of 384 individuals in Kilosa District revealed that 95.1% of consumers had a low knowledge of meat adulteration (mean score: 4.8 ± 1.4). Multiple linear regression analysis revealed five significant predictors of consumers' knowledge: age (31–45 years), education level (tertiary), occupation (butcher and business), employment status, and residency time (1–10 years). Notably, 65.4% were unaware of legislation addressing meat adulteration in Tanzania, and 87.7% linked the upsurge of adulteration practices to economic incentives. Additionally, consumer meat purchasing decisions were primarily influenced by price (86.2%) and appearance (52.9%) of the meat. This study highlights a critical lack of knowledge and practices of identifying adulterated meat in most of the consumers in Kilosa district. Therefore, the urgent need for targeted consumer education and stricter regulatory enforcement to combat meat adulteration in Tanzania is suggested.

Keywords: *Attitudes; Buying practices; Consumer knowledge; Kilosa District; Meat adulteration*

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Introduction

Meat adulteration involves deliberately adding, substituting, or diluting meat products with inferior, non-meat, or unauthorized substances to mislead consumers and potentially increase profit margin (Asomah and Cheng, 2018; Levi *et al.*, 2020; Liu and Tong, 2024; Nunes *et al.*, 2020). This deceitful act covers various practices including blending, replacing, mislabeling to obscure meat types, vending spoiled or expired

items, and integrating toxic substances (Surendran *et al.,* 2020; Szyłak *et al.,* 2023; Wisniewski and Buschulte, 2019). Additionally, the Administration Assistance and Cooperation System for Food Fraud (AACF) categorizes meat adulteration into mislabeling, product tempering, unapproved processing, falsified documents, and Intellectual Property Rights (IPR) infringement (Fikselová *et al.,* 2020). Meat adulteration is a critical issue in food safety and public health, posing significant challenges to consumers and regulatory authorities worldwide (Anagaw *et al.,* 2024). Adulteration, whether intentional or accidental, compromises the quality, safety, and authenticity of meat products, leading to economic losses and potential health risks (Kushwaha *et al.,* 2021). In addition, meat adulteration violates belief systems that restrict the consumption of certain meat types making adulterated meat unacceptable (Hossain *et al.,* 2021).

Legal loopholes, negligence, and delays in prosecuting offenders contribute to the upsurge of meat adulteration globally (Sawyer and Izah, 2024). These acts have decreased consumer trust in food control systems recently due to various meat adulteration cases worldwide (Polakova *et al.,* 2024). Global efforts to combat meat adulteration are an ongoing race including the establishment of organizations such as the International Food Safety Authority Network (INFOSAN), co-managed by the Food and Agricultural Organization (FAO), and the World Health Organization (WHO), which coordinates food adulteration prevention globally (Savelli and Mateus, 2021). In 2021, 70% of INFOSAN members actively participated in meat adulteration prevention efforts, with 74% addressing incidents and calling for improved best practice guidelines (Spink *et al.,* 2019). Knowledge of meat adulteration is essential for consumers to protect themselves and their families against deceptive buying practices (Kuboka *et al.,* 2024). Previous studies have extensively documented the low levels of consumer knowledge regarding meat adulteration (Polakova *et al.*, 2024). Most meat consumers are price-sensitive and rely on the appearance of the meat, ignoring the origin of the meat and exposing themselves to meat-borne illnesses, including zoonotic infections (Cardona *et al.,* 2023; Rugarabamu *et al.,* 2023). According to Nasreen and Ahmed (2014), consumers consider expiry date and quality or freshness when buying packaged and open food items respectively, with only 12% (n=11) considering approval by regulatory authorities useful for packaged food purchase. In addition, consumer perceptions of meat products are often influenced by intrinsic and extrinsic attributes. Intrinsic attributes include color, appearance, taste/flavor, texture, and odor, while extrinsic attributes involve price, processing, origin, and certified control measures to preserve meat safety and quality (Cardona *et al.,* 2023). In addition, the low level of knowledge on food fraud has remained a major challenge to the international community, for instance, the German official food control authorities revealed a wide gap of knowledge on the concept of food fraud in Germany (Wisniewski and Buschulte, 2019).

In many developing countries, awareness of meat adulteration is mostly limited due to a lack of meat adulteration education, inadequate public health information, and cultural norms prioritizing affordability over safety (Biswas *et al.,* 2024; Khanafer *et al.,* 2022). In Tanzania, efforts to monitor meat adulteration are being implemented (Rusobya *et al.,* 2024). The Tanzania Meat Board (TMB) oversees the meat industry, ensuring quality standards and combating adulteration, however, unregulated sale of kebabs by vendors creates a loophole for adulteration, particularly if public awareness and oversight remain insufficient (Mushi, 2023). Additionally, the Tanzania Food and Drug Authority (TFDA), Tanzania Food and Nutrition Center (TFNC), and Tanzania Bureau of Standards (TBS) are the regulatory authorities controlling food quality in Tanzania (Balagaye and Pessa, 2022). However, despite their mandate to condemn, seize, and abolish unsafe food products, TFDA, TFNC, and TBS suffer loopholes as unsafe meat is still sold and consumed (Balagaye and Pessa, 2022). The food traceability system currently relies heavily on the quality of documentation provided by processors. In cases where consumers suspect adulteration or have doubts about a particular food product, there are limited standardized methods available to reliably distinguish between genuine and adulterated items (Balagaye and Pessa, 2022).

Furthermore, most research done in Tanzania on the meat supply chain has primarily focused on species authentication, pathogens characterization, hygienic conditions, and microbial contamination (Asati *et al.*, 2024; Dule *et al.*, 2024; Katani *et al.*, 2021; Mushi, 2023; Nonga *et al.*, 2023; Patel *et al.*, 2023; Schilling *et al.*, 2020; Zikankuba *et al.*, 2023). However, information on consumer awareness of meat adulteration is largely lacking in Tanzania. Therefore, the present study aimed to provide baseline information to policymakers and legislative authorities for implementing meat adulteration education interventions in Tanzania.

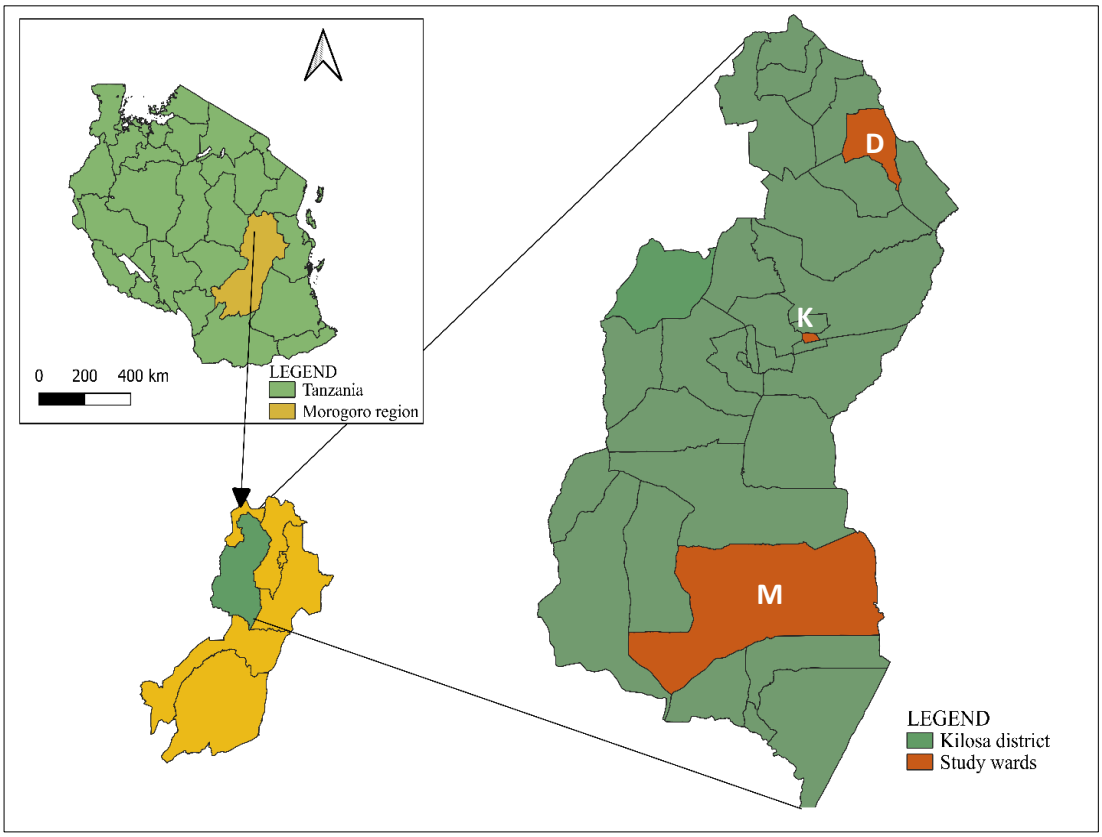
Materials and methods

Study area

The study was conducted in Kilosa district, at geolocation 6^0 49′49″ S and 36^0 59′15″ E in Tanzania (Figure 1). Kilosa district is home to Mikumi National Park, covering 14,918 square kilometers (5,760 sq. mi). The district has a total human population of 617,032 (NBS, 2022). Livestock farming, particularly pastoral and agropastoral systems, forms the backbone of the district. Kilosa district is among the top districts in the Morogoro region for cattle production, primarily for beef (Batamuzi *et al.* 2013). The study wards, namely, Dumila, Kimamba, and Mikumi in the Kilosa district, were purposefully selected by considering their proximity to Mikumi National Park and closeness to highways that increase concerns for bushmeat-based meat adulteration through illegal hunting and fast food preparation along the road to evade detection.

Figure 1

Map of the study area (Kilosa district) showing data collection sites (Wards) for meat adulteration. Location of Morogoro region (golden yellow background) on the map of Tanzania. Location of Kilosa district (green background) on the map of Morogoro region. Enlarged map of Kilosa district showing sampling sites (Wards) marked brown; ***D****, Dumila,* ***K****, Kimamba and* ***M****, Mikumi.*



Study design and sampling

A cross-sectional study design based on a structured questionnaire was conducted between December 2023 and March 2024 among 384 individuals residing in three wards; Dumila, Kimamba and Mikumi) of Kilosa district, Tanzania. The sample size was calculated by using the Lemeshow method (Tosepu *et al.*, 2023). The selection of the respondents was made using probability sampling through a proportional stratified random sampling method. The proportions of respondents in each ward were calculated based on the population density of the respective ward; Dumila (n=210), Kimamba (n=36), Mikumi (n=138). The inclusion criteria of the respondents were as follows: being a permanent resident of the respective ward, and of at least 18 years of age. The exclusion criteria were as follows: not a permanent resident, unwilling to participate as a respondent, and aged below 18 years.

Data collection tool and procedures

A pretested structured questionnaire was designed for data collection regarding consumer knowledge, attitudes, and practices towards meat adulteration at the household level. The survey comprised four sections. Section A consisted of seven questions on gathering sociodemographic information such as age, gender, education level, residency duration, employment status, occupation, and monthly income. Section B comprised four questions about the respondent's knowledge of meat adulteration. Section C comprised four questions about participants' attitudes toward meat adulteration. Section D investigated consumer buying practices through four questions, assessing meat purchasing behavior.

A knowledge score was created by summing up the number of correct responses from the participants. Responses of the participant to the following questions were included in the computed score: "How is meat adulterated?" (0–5 points), where choosing rotten meat would be the wrong answer, "Common meat adulterants" (0–5 points), and "Which meat products are more prone to adulteration?" (0-5 points). Then, participants' total knowledge scores were calculated, ranging from 0 to 15. Participants' knowledge scores were then used to classify participants with low knowledge scores (0–7) and high scores (8–15). To ensure voluntary participation, respondents were given consent forms to read and complete once they agreed to participate in the study. The questionnaires were translated into Swahili and efficiently delivered and collected, with the researcher assistants physically taking them to the participants and administering them one-on-one, interpreting the meaning of the questions for those who could not read or comprehend.

Data analysis

Data were analyzed using Statistical Product for Service Solution (SPSS) version 25 (SPSS Inc., Chicago, IL, USA). Descriptive statistics, such as frequencies and percentages, were used for data summarization. Multiple linear regression analyses were used to assess associations between sociodemographic features and the participant's knowledge score, where associations with $p<0.05$ were considered statistically significant.

Results

Sociodemographic characteristics of the participants

Over half (57.3%) of the study population were males while 42.7% were females. Most (41.9%) respondents were in the age range of 31–45 years. More than half (59.4%) of the participants had primary education, followed by secondary education (27.1%), tertiary (8.9%), and no formal education (4.7%). Nearly half (44%) of participants were residents of the area for over 10 years, and most of them were self-employed (77.6%). Most (49.7%) respondents were peasants, followed by business (34.1%), public service (9.1%), day workers (4.9%), and butchers (2.1%)

Consumer knowledge of meat adulteration

Majority (95.1%) of respondents had low level of knowledge on meat adulteration, with a mean total knowledge score of 4.8 ± 1.4. Most (70.6%) respondents were aware that adulteration could affect the health of individuals. When asked about how meat could be adulterated, less than half (27.1%) of the participants chose "blending lower-cost meat with higher-cost meat", "misrepresenting the type or the origin of meat"

(24.7%), "adding non-meat substances" (10.7%), and "adding water to increase weight" (49.5%). However, most respondents (74.7%) wrongly chose "rotten meat." Concerning meat adulterants, consumer responses were: "water" (47.7%), "chemical preservatives" (45.3%), "coloring agents" (21.1%), "fillers" (19%), and "inferior quality meat" (14.6%). More than half (58.1%) of the respondents identified "kebabs" as meat products prone to adulteration, while lesser proportions of the respondents chose "sausages (27.1%), fresh cuts (25.8%), burgers (24.7%), and meatballs (14.3%).

Table 1

Sociodemographic characteristics of the study population in Kilosa, Tanzania

Characteristics	Samples, n (%)
Age	
31-45 years	161 (41.9)
18-30 years	97 (25.9)
>60 years	38 (9.9)
46-60 years	88 (22.9)
Gender	
Male	164 (42.7)
Female	220 (57.3)
Education Level	
Primary education	228 (59.4)
Secondary education	104 (27.1)
Tertiary education	34 (8.9)
No formal education	18 (4.7)
Residency Time	
<1 year	38 (9.9)
1-5 years	121 (31.5)
6-10 years	56 (14.6)
>10 years	169 (44.0)
Employment Status	
Employed	59 (15.4)
Self-employed	298 (77.6)
Students	27 (7.0)
Occupation	
Public servant	35 (9.1)
Peasant	191 (49.7)
Butcher	8 (2.1)
Business	131 (34.1)
Day worker	19 (4.9)
Monthly Income*	
<100,000 TShs	213 (55.5)
100,000-300,000 TShs	129 (33.6)
300,000-500,000 TShs	16 (4.2)
>500,000TShs	26 (6.8)

**1USD = 2,585 Tanzania Shillings (TShs), was applicable during the time of study* (BOT, 2023)

Table 2

Knowledge of meat adulteration among participants in Kilosa, Tanzania

Knowledge	Samples, n (%)
How meat is adulterated*	
Blending lower-cost meat with higher-cost meat	104 (27.1)
Adding non-meat substances	41 (10.7)
Misrepresenting the type or the origin of meat	95 (24.7)
Adding water to increase weight	190 (49.5)
Rotten meat	287 (74.7)
Common meat adulterants*	
Fillers	73 (19)
Water	183 (47.7)
Coloring agents	81 (21.1)
Chemical preservatives	174 (45.3)
Inferior quality meat	56 (14.6)
Meat products that can be adulterated*	
Kebabs	223 (58.1)
Sausages	104 (27.1)
Burger	95 (24.7)
Meatballs	55 (14.3)
Fresh cuts	99 (25.8)
Can adulteration affect your health?	
Yes	271 (70.6)
No	98 (25.5)
Not sure	15 (3.9)
Total knowledge score (Mean ± SD)	4.8 ± 1.4

** multiple responses*

The multiple linear regression analysis revealed five predictors of the participants knowledge scores: Age (30–45 years) (β = -0.167, p = 0.018), an education level (tertiary education) (β = 0.190, p = 0.020), residency duration; 1–5 years (β = 0.203, p = 0.000) and 6–10 years (β = 0.149, p = 0.007), employment status; employed (β = -0.221, p = 0.025), occupation, with individuals in business (β = 0.332, p = 0.005) and butchers (β = 0.216, p = 0.000) demonstrating positive associations with knowledge scores. However, gender and monthly income had no significant association with the knowledge score (p > 0.05).

Table 3

Multiple linear regression analyses for the association between Sociodemographic profiles with the knowledge score in Kilosa, Tanzania

Predictors	*β* Coefficient, (95% CI)	*p*-Value
Age		
31-45 years	-0.167 (-0.879, -0.082)	0.018*
18-30 years	0.016 (-0.430, 0.537)	0.828
>60 years	-0.038 (-0.744, 0.382)	0.527
46-60 years (Ref.)	0	

Gender	0.035 (-0.211, 0.413)	0.525
Education Level		
Primary education	0.055 (-0.492, 0.811)	0.630
Secondary education	0.075 (-0.449, 0.932)	0.492
Tertiary education	0.190 (0.151, 1.751)	0.020*
No formal education (Ref.)	0	
Residency Time		
<1 year	-0.090 (-0.943, 0.084)	0.101
1-5 years	0.203 (0.285, 0.961)	0.000*
6-10 years	0.149 (0.165, 1.037)	0.007*
>10 years (Ref.)	0	
Employment Status		
Employed	-0.221(-1.632, -0.111)	0.025*
Self-employed	-0.143 (-1.089, 0.109)	0.109
Students (Ref.)	0	
Occupation		
Public servant	0.167 (-0.119, 1.767)	0.087
Peasant	0.148 (-0.269, 1.109)	0.231
Butcher	0.216 (1.001, 3.301)	0.000*
Business	0.332 (0.300, 1.693)	0.005*
Day worker (Ref.)	0	
Monthly Income		
<100,000 TShs	-0.011 (-0.616, 0.553)	0.916
100,000-300,000 TShs	0.087 (-0.330, 0.855)	0.384
300,000-500,000 TShs	0.068 (-0.354, 1.318)	0.258
>500,000TShs (Ref.)	0	

** statistically significant associations at $p < 0.05$*

Attitudes toward meat adulteration

More than half (53.9%) of the participants had preferences towards processed meat, while others (46.1%) opts for unprocessed meat. When asked about whether Tanzania has a law against meat adulteration, most (65.4%) consumers were not sure if such a law exists. Only 31% of the respondents claimed such a law exists, although is inadequately enforced as declared by 58.8% of the respondents. Regarding the main drivers of meat adulteration, a majority (87.8%) of the respondents chose "economic incentives" and "weak regulatory enforcement" (71.4%). Other proportions of the respondents claimed that "lack of knowledge" (33.9%) and "demand exceeding supply" (4.2%) were also push factors for meat adulteration. Only 20% of the respondents didn't know the reason for meat adulteration.

Consumer Buying Practices

The majority (83.3%) of study participants had a habit of asking about the meat origin before making a purchase, where nearly half (48.9%) of them focused on "livestock meat" and "poultry meat" (42.5%). Only a few (8.6%) of the respondents focused on "game meat" and "seafood" (2.8%). The meat purchasing decisions of most (86.2%) of the respondents were influenced by "price," "appearance" (52.9%), and "meat animal species" (32.6%). Only a small proportion (19.3%) of the participants said the location of meat vendors or meat retailers influenced their purchasing decisions. Out of 384 participants, 355 (92.4%) and 344 (89.6%)

reported that "pet meats" and "working animals," respectively, are the most prohibited in the area. When asked about the meat types that were prohibited in their areas, the majority (92.4%) of the study participants chose "pets," "beast of burdens" (89.6%), and "wildlife meat" (53.4%). Other proportions claimed that, "wildlife" (53.4%), "sea food" (14.8%), and "livestock" (14.1%) were prohibited in the area.

Table 4

Participants' attitudes toward meat adulteration in Kilosa, Tanzania

Characteristics	Samples, n (%)
Do you buy/consume processed or unprocessed meat?	
Processed	207 (53.9)
Unprocessed	177 (46.1)
Does Tanzania have a law against meat adulteration?	
Yes	119 (31.0)
No	14 (3.6)
Not sure	251(65.4)
Do you believe it is adequately enforced? (n =119)	
Yes	31 (26.1)
No	70 (58.8)
Somehow	18 (18)
Why do you think meat adulteration occurs*	
Economic incentives	337 (87.8)
Demand exceeding supply	16 (4.2)
Weak regulatory enforcement	274 (71.4)
Lack of knowledge	130 (33.9)
I do not know	80 (20.8)

* *multiple responses*

Table 5

Buying practices of the consumers in Kilosa, Tanzania

Buying practices	Sample, n (%)
Do you ask for the species of animal before buying meat?	
Yes	320 (83.3)
No	64 (16.7)
What is your focus?* (n = 320)	
Game meat	19 (8.6)
Livestock meat	156 (48.9)
Poultry meat	136 (42.5)
Seafood	9 (2.8)
Factors influencing purchasing decision*	
Price	331 (86.2)
Appearance	203 (52.9)
Meat animal species	125 (32.6)
Location	74 (19.3)
Type of meat prohibited in your area*	
Pets	355 (92.4)

Livestock	54 (14.1)
Beasts of burden (camel, donkey, horse, etc.)	344 (89.6)
Seafood	57 (14.8)
Wildlife	205 (53.4)

* *multiple responses*

Table 6

Distribution of the restricted meat types across the wards

	Wards		
Restricted Meat Type	**Mikumi, n(%)**	**Dumila, n(%)**	**Kimamba, n(%)**
Pets	137 (38.6)	187 (52.7)	31 (8.7)
Livestock	32 (59.3)	11 (20.4)	11 (20.4)
Beasts of burden (camel, donkey, horse, etc.)	132 (38.4)	182 (52.9)	30 (8.7)
Seafood	32 (56.1)	15 (26.3)	10 (17.5)
Wildlife	132 (64.4)	66 (32.2)	7 (3.4)

Discussion

The fight against meat adulteration in most developing countries is still hindered by a lack of consumer awareness of the concepts of meat adulteration and a clear description that constitutes a legal case of this fraudulent act. Moreover, limited studies on consumer awareness of meat adulteration in Tanzania made this study particularly interesting. This study was conducted in Kilosa district of Morogoro, Tanzania to assess consumers' knowledge, attitudes, and practices (KAPs) towards meat adulteration.

The low level of knowledge about meat adulteration observed in this study aligns with findings by Khanafer *et al.,* (2022), who reported limited awareness among 73.1% of Lebanese participants. However, Gautam (2019) found higher consumer awareness on meat adulteration (80%), possibly due to differences in sociodemographic profiles. The respondents' adulteration knowledge scores were significantly associated with age, education, residency duration, employment status, and occupation ($p < 0.05$). This aligns with findings by Khanafer *et al.,* (2022), who also reported a significant relationship between participants' knowledge scores and sociodemographic factors. However, our results contradict those of Gautam (2019), who found no significant influence of sociodemographic profiles on consumer knowledge of meat adulteration. Notably, Gautam's study had a gender bias and a relatively small sample size (n = 300) compared to our study, which may explain the differing findings. The misconception that rotten meat constitutes adulteration highlights a gap in consumer understanding, as spoilage results from natural microbial activity rather than intentional contamination (Akinsemolu and Onyeaka, 2024). However, the awareness of meat adulteration's health risks suggests a general recognition of its potential harm. Similarly, Amoah *et al.* (2023) have also reported widespread consumers' concern about the health implications of meat adulteration. Moreover, the reported use of carcinogenic chemical preservatives to make expired or spoiled meat appear fresh justifies consumers' concerns about the health risks of adulterated meat products (Sudharsan *et al.,* 2025).

Most consumers in the present study identified kebabs as meat products susceptible to adulteration, a concern supported by previous research reporting high incidences of species substitution in these products (Dule *et al.,* 2024; Szyłak *et al.,* 2023). This susceptibility may be due to the use of small meat pieces, which obscure morphological identification and make it difficult to verify the specific species used. Consumers' preference for processed meat over unprocessed options aligns with previous studies, which indicate that processed animal protein is favored due to its enhanced stability and flavor (Muzayyanah *et al.,* 2022; Török *et al.,* 2023). This

preference reflects the convenience and sensory qualities that processed meats offer. Economic incentives were identified by most participants as a major driver of meat adulteration, which is justified by Levi *et al.,* (2020), who found that financial motives often lead to intentional meat adulteration.

This study highlights a significant gap in the enforcement of regulations against meat fraud in Tanzania. The mere existence of legal provisions is insufficient without effective implementation. Similarly, Manning *et al.* (2016) found that regulatory gaps contribute to the persistence of adulterated meat in the supply chain. Previous studies have also noted that regulatory bodies such as TFDA, TFNC, and TBS face legal loopholes that limit their ability to fully enforce their mandates (Balagaye and Pessa, 2022). The findings suggest that consumers in this study are more proactive in verifying meat species before purchase compared to previous reports, where time constraints often prevented such considerations (Khanafer *et al.,* 2022; Parida and Gadekar, 2023). This difference may be attributed to specific cultural and market dynamics influencing consumer behavior in the study area. Price emerged as a major factor shaping purchasing decisions, aligning with existing literature that highlights its strong influence on consumer attitudes toward meat products (Cardona *et al.,* 2023; Charlebois *et al.,* 2016; du Plessis and du Rand, 2012; Hati *et al.,* 2021; Lee *et al.,* 2012). Consumers' sensitivity to price variations might reflect broader economic factors or income levels within the surveyed population. Additionally, the reliance on external cues such as packaging suggests a preference for visual indicators in assessing meat quality, a behavior commonly observed in markets with limited access to detailed product information (Cardona *et al.,* 2023; Underwood and Klein, 2002). Interestingly, the emphasis on price and appearance contrasts with findings from Svetlíková *et al*., (2018), where quality and meat origin were more influential. This discrepancy could stem from differences in consumer demographics, as their study involved a more educated and financially stable population, potentially making them less price-sensitive. These variations highlight the role of socioeconomic factors in shaping purchasing behaviors and underline the need for tailored consumer education and marketing strategies based on target demographics.

Wildlife meat was more restricted in Mikumi ward than in other wards, as identified by the majority of participants. This is likely due to the ward's proximity to Mikumi National Park, which hosts diverse wildlife crucial to the tourism industry. The identification of wildlife as a restricted meat type reflects the strong enforcement of the Wildlife Conservation Act [Cap. 283 R.E.2022], a comprehensive legislation dedicated to conserving, protecting, and managing Tanzania's wildlife resources. Similarly, the restriction of pets and beasts of burden in Dumila ward suggests that cultural values and the functional roles of animal influence meat consumption patterns. In some societies, certain animals are traditionally considered food sources, while in others, they serve primarily as companions or labor assets. The evolving perceptions of pets globally, as observed in South Korea, demonstrate the dynamic nature of cultural norms, where economic development and increased pet ownership contribute to shifting attitudes (Choi *et al.,* 2024). Religious beliefs have shown to have influence in shaping dietary restrictions. As seen in studies on Islamic dietary laws (Hossain *et al.,* 2021), prohibitions against specific meat types reflect deeply ingrained religious principles. This underscores the intersection of law, culture, and religion in determining acceptable food sources, with some restrictions driven by ethical and spiritual considerations rather than ecological or economic factors.

Despite its limitations in design, and the use of a structured questionnaire, which may introduce biases and hinder the capture of temporal changes, the current study presents considerable insights into the status of meat adulteration, knowledge, attitudes, and meat-purchasing habits among consumers in Kilosa district. Nevertheless, the findings of this study might be extrapolated to other areas with similar settings.

Conclusion

The results of this study indicate that knowledge and practices for identifying adulterated meat

were lacking among most consumers in Kilosa district. Increasing consumer knowledge, awareness, and motivation to identify adulterated meat products during food shopping is crucial for empowering individuals to make better purchasing decisions, particularly among those with lower levels of education. Intensive public education campaigns should be implemented to raise awareness and enhance food safety knowledge across the population, helping to mitigate the widespread use of meat adulterants.

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