

(REVIEW ARTICLE)



Description of community behavior regarding the trade mode of babirusa (*Babyrousa babirusa* Celebensis Deniger), a protected endemic animal circulating at the Langowan traditional market, Minahasa Regency, North Sulawesi of Indonesia

Hengki J. Kiroh *, Frits S. Ratulangi, Umar Papatungan and Jein R. Leke

Department of Animal Production, Faculty of Animal Sciences, Sam Ratulangi University, Manado, Indonesia 95115.

Open Access Research Journal of Multidisciplinary Studies, 2024, 07(01), 126–133

Publication history: Received on 31 January 2024; revised on 11 March 2024; accepted on 14 March 2024

Article DOI: <https://doi.org/10.53022/oarjms.2024.7.1.0018>

Abstract

Introduction and aim: The babirusa (*Babyrousa babirusa* Celebensis Deniger) is a genetic resource of immeasurable value, even though it has held protected status for nearly 60 years. Unfortunately, its status remains declared as endangered due to factors such as forest encroachment in the North Sulawesi region. This research aims to investigate the behaviours of community collectors, traders, and consumers concerning their level of interest in babirusa meat, which continues to circulate in the Langowan traditional market, Minahasa Regency. The findings of this study can provide valuable recommendations for the government to formulate new policies and regulations.

Methods: The research employed a survey method, focusing on the community of collectors, traders, and buyers of babirusa meat in the Langowan traditional market, Minahasa Regency, and its surroundings.

Results: The results from the field survey were then juxtaposed with the outcomes of sensory test analyses conducted by several panellists at the Animal Products Technology Laboratory. Until now, babirusa meat remains a sought-after commodity for Minahasa residents in the Langowan area and its surroundings. This indicates that despite the existence of government regulations in the form of Conservation Law No. 5 of 1990, there is still evidence of the covert sale of protected babirusa meat in the Langowan traditional market, Minahasa Regency, North Sulawesi province of Indonesia.

In conclusion: The local individuals in the Langowan traditional market of Minahasa Regency who purchase and consume babirusa meat are predominantly under 50 years old, with a higher representation of males with the majority holds of elementary school education, and their primary occupation of farmers. Public awareness of the endemic babirusa is remarkably high. The sensory test results indicated that babirusa meat is perceived as highly attractive in terms of colour, possesses a distinctive meaty aroma, rough texture, excellent taste, and high tenderness. This positive perception is linked to the understanding that babirusa meat has its own benefits, leading to a genuine liking for this unique meat.

Implications: There exists a notable public awareness of babirusa as an endemic animal. The overall acceptability of babirusa meat was noteworthy, reinforcing its significance as an endemic animal in North Sulawesi. Specifically, the Langowan traditional market has been a focal point for the buying and selling of babirusa meat. This practice, which was more prevalent before 1990, continues to be carefully executed in the Langowan market being protected for the next sustainability of this endemic animals.

Keyword: Endangered babirusa meat trade; Traditional market; North Sulawesi Indonesia; Babirusa meat sensory test; Local community knowledge level; Minahasa North Sulawesi Indonesia.

* Corresponding author: Hengki J. Kiroh

1. Introduction

North Sulawesi province of Indonesia boasts a rich diversity of species, with approximately 70% of the 114 known wildlife species are being rare and endemic status, including the babirusa (*Babyrousa babyrussa Celebensis Deniger*). Despite babirusa having been a protected species for nearly 60 years, its status remains classified as endangered [1].

The exploitation of wild animals by humans has deep historical roots, intertwined with the development of human civilization. Wild animals play a crucial role in fulfilling various human needs, such as providing meat for consumption, skin and fur for clothing, fat for fuel, horns for tool handles, and bones for crafting utensils and musical instruments [1].

Traditional markets serve as pivotal hubs for the buying and selling of wild animals, representing the initial point of interaction for people with these creatures. In Sulawesi Island, several traditional markets engage in the trade of wild animals. The inhabitants of Minahasa Regency exhibit a particular interest in various wild animal meats, including babirusa meat [2]. The demand for such meat surges, especially during significant events like the clove harvest, church thanksgiving activities has been recently regulated by the government on a district/city level as an annual tourism attraction for both local and foreign tourists, village anniversaries, and other celebrations [1].

Remarkably, the slaughtering and trading of babirusa meat, despite its protected status, persist in traditional markets within Minahasa Regency [3]. Specifically, the Langowan traditional market has been a focal point for the buying and selling of babirusa meat. This practice, which was more prevalent before 1990, continues to be carefully executed in the Langowan market [4].

This research endeavours to investigate the extent of public interest in the modes and behaviour associated with the trading of babirusa meat in the Langowan traditional market, Minahasa Regency of North Sulawesi province, Indonesia.

2. Material and Methods

2.1. Material object

The material objects utilized in this research encompass the sword community/collectors and buyers/consumers exhibiting interest in babirusa meat at the Langowan traditional market in the Minahasa Regency area of North Sulawesi province, Indonesia.

2.2. Method



Figure 1 The traditional market location selling the babirusa (*Babyrousa babyrussa Celebensis Deniger*) meat and other wild animals visited fully by the local consumers in North Sulawesi province of Indonesia

The research employed direct interview methods with respondents/community members to elucidate their behaviour concerning the trade of protected babirusa animals. Furthermore, the investigation delved into the depth of their understanding of babirusa meat using local consumers showing other wild animals (Figure 1). Subsequently, a sensory analysis was conducted, evaluating the colour, aroma, texture, and taste of babirusa meat [5]. This analysis engaged a panel consisting of 25 students specializing in Animal Products Technology from the Department of Animal Production at the Laboratory of the Faculty of Animal Husbandry, Sam Ratulangi University, Manado.

2.3. Statistical Analysis

The outcomes of direct interviews in the field, conducted through questionnaires with collectors/traders and buyers of babirusa meat at the Langowan traditional market in the Minahasa Regency area, were systematically tabulated. Additionally, the results of the Sensory Test served as a basis for comparing the responses obtained from the respondents. The percentage value for each measured variable was calculated and subsequently discussed in a detailed, descriptive manner. This discussion entails a scientific narrative, providing a thorough account of direct observations in the field and the outcomes of the analysis [6].

3. Result

The results, presented in Table 1, offer a comprehensive breakdown of percentage values across various parameters. These parameters encompass knowledge pertaining to conservation, information sourced by the community, the frequency of babirusa meat marketing days, and community interest regarding the colour, aroma, texture, taste, tenderness, and overall liking of babirusa meat [6].

The detailed analysis provides valuable insights into the community's awareness of conservation efforts, the information flow within the community, and specific factors influencing their preferences in babirusa meat [7]. This information serves as a foundation for a nuanced understanding of the dynamics surrounding the trade and consumption of babirusa meat at the Langowan traditional market in the Minahasa Regency area as reported in other study [7]. The Public knowledges regarding babirusa meat circulating in traditional market in Langowan, Minahasa Regency Region and its surroundings are presented in Table 1.

Until now, babirusa meat remains a sought-after commodity for Minahasa residents in the Langowan area and its surroundings [7]. This indicates that despite the existence of government regulations in the form of Conservation Law No. 5 of 1990 [4], there is still evidence of the covert sale of protected babirusa meat in the Langowan traditional market, Minahasa Regency [7,8], as illustrated in Table 1.

Table 1 Percentage of Trade Value and Purchasing Power of Babirusa Meat

NO	Description	Number of Respondents (person)	Percentage Value
1.	Babirusa meat sales:		
	-Every day	96	96%
	-Certain day	4	4%
2.	Purchase meat for:		
	-Family consumption	84	84%
	-Family events	6	6%
	-For guests	2	2%
	-For sale	8	8%
3.	Amount of meat purchased:		
	-1 Kg or less	20	20%
	-1-2 Kg	64	64%
	-2-3 Kg	2	2%
	-3 Kg or more	14	14%

The research outcomes from the Langowan traditional market regarding information studies reveal that the scientific sensory value of babirusa meat exhibits variability [9]. The comprehensive sensory test was conducted at the Animal Products Technology Laboratory, and the results are presented in Table 2.

4. Discussion

The results of the research highlight a correlation between the trade of protected babirusa meat [10] and the education and livelihood levels of the community, encompassing both sellers and buyers at the Langowan traditional market [11]. The prevailing education level among the community, primarily elementary school (SD), suggests a potential lack of awareness regarding the protected status of babirusa as an endangered species. Individuals with this educational background often engage in seeking or hunting babirusa meat for culinary purposes in Minahasa. Notably, farmers constitute a significant portion of those involved in hunting babirusa meat, driven by the belief that its consumption enhances vitality [12].

Examining the varied levels of education among frequent users of the Langowan traditional market, including middle school (32%) and high school (18%), and a minimal representation of university education (6%), raises concerns about their understanding of endemic Sulawesi animals, especially the critically endangered babirusa [7]. Moreover, the research reveals a lack of awareness among the community about legal sanctions and fines associated with the capture, killing, and trade of protected animals classified as endangered. This knowledge gap contributes to the ongoing trade of babirusa meat [8].

Table 2 Sensory test results for babirusa deer meat at the Animal Products Technology Laboratory

NO	Description	Number of Respondents (people)	Percentage Value
1.	Babirusa meat color:		
	-Very uninteresting	-	-
	-Not attractive	-	-
	-Somewhat interesting	4	16%
	-Interesting	16	64%
	-Very interesting	5	20%
2.	Meat texture:		
	-Very unsubtle	-	-
	-Not subtle	3	12%
	-A bit subtle	6	24%
	-Fine	15	60%
	-Very smooth	1	4%
3.	Meat aroma:		
	-No meat flavor	-	-
	-Slightly meaty aroma	1	4%
	-Meat-flavored	14	54%
	-Very flavorful of meat	10	40%
4.	Meat taste:		
	-Very unpleasant	-	-
	-Not good	-	-
	-It's kind of delicious	3	3%
	-Nice	19	19%

	-Very delicious	3	3%
5.	Meat tenderness:		
	-Tendinous	-	-
	-Not soft	2	8%
	-A bit soft	6	24%
	-Soft	16	64%
	-Very soft	1	4%
6.	Oil based:		
	-Very non-greasy	-	-
	-Not greasy	1	4%
	-A bit oily	15	60%
	-Greasy	9	36%
	-Very oily	-	-
7.	Acceptability :		
	-Very dislike	-	-
	-Do not like	-	-
	-Kinda like it	1	4%
	-Like	20	80%
	-Really like	4	16%

Active visitors to the Langowan traditional market, regardless of employment status, include private employees (14%), Military/Police (3%), craftsmen (12%), drivers (8%), and retirees (13%). These individuals, representing diverse professions, share a commonality in their role as buyers of babirusa meat. This practice, deeply ingrained in the cultural habits of the Minahasa community and its surrounding areas, persists across generations.

Babirusa meat, with its positive sensory attributes in terms of colour, smell, elasticity, and overall quality, stands out when compared to local pork meat. The physical characteristics of meat, such as colour, firmness, structure, texture, and blood spots, play a crucial role in consumer perception [12]. Although challenging to measure objectively, these properties are subjectively evaluated by consumers based on visual observation, touch, and personal preferences, as documented in literature [13, 14]. Understanding these subjective evaluations is crucial for addressing consumer perceptions and implementing effective conservation strategies for the endangered babirusa population.

The community's knowledge, as evidenced by the field survey, indicates that 88% are aware of the existence of babirusa, with only 12% lacking this knowledge. Various information was gathered, revealing that 50% of people have directly observed the circulation of babirusa meat in traditional markets, particularly in the Langowan market. Only a small number of individuals received information about babirusa from newspapers (16%), TV media (20%), and school/college (12%). This suggests that Minahasa people, especially babirusa meat buyers, have acquired firsthand knowledge over generations regarding the presence of this unique culinary ingredient [15].

This understanding is further supported by the public's perception of babirusa meat colour, with 88% finding it very attractive and 12% stating it is attractive [15]. This implies that individuals possess skills or extensive experience in observing babirusa meat, forming the basis for their informational contributions. The research explores the self-taught understanding of the aroma of babirusa meat, revealing that 94% perceive it as strongly meaty, while only 6% think it smells of meat. This suggests that those buying or hunting babirusa meat in the Langowan traditional market have developed their own abilities to provide information about its aroma.

Regarding texture, 68% of respondents described babirusa meat as having a rough texture, 22% somewhat rough, and 10% smooth. This field information serves as a reference for subsequent sensory tests in the Animal Products

Technology laboratory. Interviews with people at the Langowan traditional market showed that 90% considered babirusa meat very tasty, 76% found it tender, and 84% had a strong liking for babirusa meat. These attitudes vary, with only 16% expressing a liking for babirusa meat.

The survey delves into reasons for consuming babirusa meat, revealing that 55% consume it for its properties, 40% to increase stamina, and only 5% due to its cost compared to local pork. The results emphasize the need for a comprehensive scientific study, particularly concerning the community's belief that babirusa meat can increase stamina and possesses unique efficacy compared to other animal meats.

Field survey results indicate that 96% of babirusa meat in the Langowan market is available every day, often sold covertly to avoid authorities. Approximately 4% of sales occur on specific market days. This underscores the need for serious efforts from the government, police, NGOs, and higher education institutions involved in the scientific field to find appropriate and firm solutions for saving the endemic animals of North Sulawesi, including the babirusa.

Regarding the distribution of purchased babirusa meat, 84% is intended for daily family needs, 6% for family events, 8% for processing into culinary food sold in Minahasa restaurants, and 2% for guest needs. Purchase amounts per day vary, with 64% buying 1-2 kg, 20% less than 1 kg, 14% more than 3 kg, and approximately 2% purchasing 2-3 kg.

The varying distribution levels indicate an existing problem in the conservation of endemic endangered animals in North Sulawesi, especially in Minahasa Regency. This suggests uneven legal understanding among catchers/hunters, collectors/sellers, and buyers/consumers. Legal measures, including counselling and sanctions, could potentially reduce hunting, catching, and trade in babirusa meat.

Sensory tests with 25 semi-trained panellists in the Animal Products Technology laboratory showed differences in perception compared to the public. Regarding meat colour, 64% of panellists found babirusa meat attractive, 20% very attractive, and 16% somewhat interesting. This contrasts with direct interviews in the Langowan market, where 88% perceived the colour as very attractive. The difference highlights the subjective nature of colour perception, influenced by various factors such as blood and muscle pigments.

Therefore, this comprehensive discussion highlights the intricate dynamics surrounding the community's knowledge, perception, and behaviour related to babirusa meat in the Langowan traditional market. The findings underscore the necessity for collaborative efforts between government bodies, law enforcement, NGOs, and scientific institutions to address conservation challenges effectively [16]. On the other hand, the central test results with 25 semi-trained panellists regarding the texture of babirusa meat revealed that 60% of panellists found the texture smooth, 24% somewhat smooth, and 4% very smooth. This variation among panellists in assessing the texture of babirusa meat at the Langowan traditional market suggests differences in individual perceptions. Two key factors influencing meat quality are categorized as before and after slaughter. Pre-slaughter factors include genetics, species, breed, livestock type, gender, age, feed (including additives), and stress. Post-slaughter factors encompass withering methods, electrical stimulation, heating/cooking methods, carcass pH, intermit fat or marbling, storage methods, and various muscle types [17].

The sensory test results also indicated diverse perceptions among panellists regarding the aroma of babirusa meat. Approximately 56% of panellists described it as having a meaty aroma, 40% as very meaty, and 4% as slightly meaty. This diversity underscores the subjective nature of evaluating the aroma of babirusa meat, influenced by individual olfactory sensitivity [18].

Moving on to taste, around 76% of panellists perceived babirusa meat as quite tasty, while 12% found it very delicious. The varying levels of preference among panellists, coupled with differences in their duration of consuming babirusa meat, contribute to diverse interpretations and preferences. The age and gender of babirusa meat samples taken from the Langowan traditional market were not known, raising the possibility that these factors influenced the differing taste values among panellists.

The percentage distribution of babirusa meat in Minahasa Regency suggests a continued popularity of consuming meat from protected animals, including babirusa, among the public. This popularity is evidenced by its consistent availability, with 96% of babirusa meat in the market being sold every day, often covertly. Only about 4% of sales occur on specific market days. This highlights the need for serious efforts from government agencies, law enforcement, NGOs, and scientific institutions to develop effective solutions for the conservation of other endemic animals in North Sulawesi [19, 20, 21].

Sensory tests on tenderness conducted with 25 panellists at the Animal Products Technology Laboratory indicated that approximately 64% of panellists considered babirusa meat tender, 24% somewhat tender, 8% not tender, and 4% very tender. The varying percentage levels suggest the absence of a standardized value for babirusa meat tenderness, likely influenced by factors before slaughter, including genetics, gender, age, food, and stress during slaughter.

Scientific studies using sensory tests at the Animal Products Technology Laboratory on the percentage of oil found that 60% of panellists stated that babirusa meat was slightly oily, 36% found it oily, and 4% found it not oily. This observation aligns with the natural habitat and lifestyle of babirusa, a wild animal residing in wet environments, swamps, and bushes, often foraging in untouched forests and coconut plantations. Intramuscular fat accumulation varies due to factors such as species, age, and muscle, with heritability playing a significant role.

The results of the central test on babirusa meat acceptability showed that 80% of panellists liked it, 16% really liked it, and 4% somewhat liked it. This suggests a high level of community acceptance and satisfaction with babirusa meat in the Langowan traditional market, despite varying percentage differences. The key factors influencing meat deliciousness—tenderness, oil essence (juiciness), aroma, and taste (flavour)—highlight the multifaceted nature of consumer satisfaction. The public's high acceptance of babirusa meat underscores its value as a rare and almost extinct endemic animal in Sulawesi.

5. Conclusion

The demographic profile of individuals utilizing the Langowan traditional market in Minagawa Regency and its adjacent areas, engaged in purchasing and consuming babirusa meat, predominantly comprises individuals under 50 years old, with a higher representation of males. The majority holds an elementary school education, and their primary occupation is in farming. There exists a notable public awareness of babirusa as an endemic animal. Respondents, on average, obtained information firsthand from direct observations in the field. The sensory test results of babirusa meat revealed that panellists perceived it as highly attractive in terms of colour, possessing a distinctive meaty aroma, rough texture, excellent taste, and high tenderness. This positive perception contributes to the genuine liking of babirusa meat, driven by the perceived benefits associated with its consumption. The sensory tests conducted at the Animal Products Technology Laboratory for babirusa meat, serving as a comparative analysis, indicated favourable attributes. The meat's colour was found to be attractive, texture smooth, aroma distinctively meaty, taste delicious, tenderness level high, and with a slight oily essence. The overall acceptability of babirusa meat was noteworthy, reinforcing its significance as an endemic animal in North Sulawesi.

Compliance with ethical standards

Acknowledgment

The financial support of the Ministry of Research, Technology and Higher Education of the Republic of Indonesia through their Partnership Research Finance Program at the Research Center of Sam Ratulangi University (LPPM-Unsrat) is gratefully acknowledged.

Disclosure of conflict of interest

I declare that I have no conflicts of interest, financial or otherwise.

Statement of informed consent

Informed consent was obtained from all individual participants included in the study.

References

- [1] Alikodra, HS 2010. Wild Animal Management Techniques in the Context of Maintaining Indonesia's Biodiversity. IPB, Bogor.
- [2] Arikunto, S. 1989. Research Procedures A Practical Approach. Building Literacy. Jakarta.
- [3] Kiroh, HJ, I. Wahyuni, FS Ratulangi, SC Rimbing, 2017. Study of slaughtering Babirusa (*Babirusa babirusa*) as an endemic animal in North Sulawesi. Report. Faculty of Animal Science.

- [4] Department of Forestry, 1990. Law of the Republic of Indonesia Number 5 of 1990 concerning Conservation of Biological Natural Resources and Their Ecosystems, Jakarta.
- [5] Forrest, JC, ED, Aberle, HB Hedrick and RA Markel. 1975. Principles of Meat Science. WH Freeman and Co. San Francisco.
- [6] Kiroh, HJ, JH Manopo, FS Ratulangi, SC Rimbing, 2014. Study of the Potential for Ecotourism Development Based on Endemic Fauna on Mount Tumpa, Manado City. Unsrat, Manado.
- [7] Kiroh, HJ, FS, Ratulangi., RM, Keintjem.2022. Community Acceptability of Babirusa Meat (*Babyrousa babyrousa* Celebensis Deninger) in the Langowan Traditional Market, Minahasa Regency. Research Report, DIPA Sam Ratulangi University, Manado.
- [8] Bell, J. 1987. Nutritional and Reproductive Biology. Edinburgh School of Agriculture, . Edinburgh
- [9] Lawrie , RA 2003. Meat Science. Fifth edition . Parakasi Translation. University of Indonesia. Jakarta.
- [10] Mackinon, J. 1979. The structure and function of the tusk of babirusa. Mammal Review 11:37- 40.
- [11] Matur, HP 1990. Babirusa Breeding and Conservation Efforts (*Babyrousa babyrousa*) at the Surabaya Zoo. pp. 85 – 93 In: Indonesian Animal Nuftah Plasma. National Nuftah Plasma Conservation Commission, Bogor.
- [12] Macdonald, AA 1991. Monographie des Hirschebers (*Babyrousa babyrousa*). Fradrich Jubilaumsband Seite : 69 – 84.
- [13] Preston, TR and MB Willis. 1982. Intensive Beef Production. Second Ed. Pergamon Press, Sydney.
- [14] Patry , M. and J. Capoid, 1989. Pour la premier foils le Babirusa a l'etat naturel. Connaissance de la Chasse 156 : 45 – 46.
- [15] Setyaningsih, D., A. Apriyantono, MP Sari. 2010. Sensory Analysis for the Food and Agro Industry. IPB Press. Bogor.
- [16] Siregar, AP, P. Sitorus, BPA Rajagukguk, Santosa, M. Sabrani, S. Sudiman, T. Iskandar, E. Kalsid, LEP Batubara, H. Sihotang, A. Syarifuddin and Wiluto. 1984. Possibilities of Civilizing Wild Animals, pp. 1 – 34. In: proceedings of the Wildlife Seminar, Livestock Research and Development Center. Agricultural Research and Development Agency, Department of Agriculture, Bogor.
- [17] Soeparno , 2005. Meat Science and Technology. Print IV. Gadjah Mada University Press. Yogyakarta.
- [18] Soeparno , 2007. Processing of Animal Products. Basic material book. Edition 2. Open University. Jakarta.
- [19] Agus S. S, U. Paputungan, H. Paputungan and H. Pasambuna. 2023. The existence of black macaque (*Macaca nigra*) population in Bogani Nani Wartabone National Park, Bolaang Mongondow, North Sulawesi of Indonesia: The valuable economical investment of the endemic fauna in the forest environmental sustainability. Open Access Research Journal of Life Sciences, 05(01), 010–018. <https://doi.org/10.53022/oarjls.2023.5.1.0011>
- [20] Tandj, N., U. Paputungan and Walangitan, H. Dj. 2023. Strategi Mitigasi Konflik Manusia Dan Monyet Yaki (*Macaca nigra*) Di Cagar Alam Dwasudara Dan Taman Wisata Alam Batuputih Kota Bitung. Agri-sosiekonomi, Vol. 19 (1):645 – 656 . <https://ejournal.unsrat.ac.id/v3/index.php/jisep/article/view/46891>
- [21] Poli Z., Polii B. and U. Paputungan. 2016. Egg Laying Behavior of Maleo Bird (*Macrocephalon maleo*) at Muara Pusian Natural Conser-Vation in Bogani Nani Warta-Bone National Park, East Dumo-Ga District Of Bolaang Mongon-Dow Regency. Zootec, 36 (2):289 – 301. <https://ejournal.unsrat.ac.id/v3/index.php/zootek/article/view/12394/11969>