

Utilization of Animals as Traditional Medicine in Pangkalpinang City, Bangka Island, Sumatra

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Abstract

Utilizes animals as traditional medicine have been known globally. A study to collect, analyze and evaluate utilization of animals as traditional medicine by indigenous people was carried in September to November 2022 in Pangkal Pinang City, Bangka Island, Sumatra. Data collection was done through surveys and informant selection using snowball sampling. Three selected local people were then interviewed according to the prepared questionnaire. We analysis information by qualitatively (using descriptive statistics) and quantitatively (calculating RFC or Relative Frequency of Citation) and Informant Consensus Factor (ICF). Our study found that the utilization of animals as traditional medicine is still practiced due to various interconnected reasons. The animals utilized as traditional medicine by local people consist of 6 families and 6 species, including Reptilia (3 species with a percentage of 50.0%), as well as Mammalia, Actinopterygii, and Aves (each with 1 species and a percentage of 16.7%). Herpetofauna ranks first based on the percentage of the number of animal species utilized as traditional medicine by the community of Ketapang Subdistrict. There is correlation between the age of informants and the level of knowledge regarding the utilization of animals as traditional medicine indicates that informants aged over 45 have broader knowledge due to their life experiences. Finally, wildlife conservation in traditional medicinal practices is essential to preserve cultural heritage and support ecological sustainability.

Keywords: Bangka Island, ethnozoology, Pangkalpinang, Sumatra, traditional medicine.

Introduction

Traditional medicine refers to treatment and care provided in ways other than conventional medical and/or nursing knowledge, referring to knowledge, experiences, and skills acquired through inheritance, apprenticeship, or training, applied according to prevailing norms in society (Sarkhel 2021). Traditional medicine comprises materials or material ingredients in the form of plant materials, animal materials, mineral materials, concoctions, or mixtures of these materials traditionally used for treatment based on experience (Rizvi 2022). Animals, which have long been used as sources of medicine in dead form, have parts such as meat, horns, bones, tails, feathers, claws, fat, bile, and shells used in traditional medicine, as well as products such as urine, feces, honey, and milk (Costa-Neto 2005).

Bangka Island is the second largest island in Sumatra, Indonesia (Iqbal *et al.* 2011). The Island approximately 11,330 km² and consists of various habitats, including secondary forests, lowlands, and shallow valleys interspersed with hilly paths, and has a highest elevation of 699 m above sea level (Whitten *et al.* 2000). Additionally, Bangka Island has a hot and humid climate, with an average annual rainfall of about 3,000 mm (Syafutra *et al.* 2019). The settlers of Bangka Island generally rely on natural resources to meet their livelihood needs. This is evident from the

livelihoods of the Bangka Island population, which mainly consists of farmers, fishermen, and miners (Ibrahim 2015).

The utilization of natural resources by the inhabitants of Bangka Island is aimed at various needs, including traditional medicine. Research on the utilization of animals as traditional medicine in Bangka Island has been conducted in Bangka Regency (Afriyansyah *et al.* 2016; Nukraheni *et al.* 2019; Saputra *et al.* 2023). Further study has also been conducted in South Bangka Regency and Central Bangka Regency (Priyansah *et al.* 2021; Syafutra *et al.* 2021, 2022; Fitriana *et al.* 2022a). However, many areas in Bangka Island have not documented their community's knowledge of utilizing animals as traditional medicine, such as the Ketapang Subdistrict in Pangkalpinang City. The various term of animals utilization can promote the formation of interaction systems between communities and the surrounding natural environment over time (Sunaryo *et al.* 2019). Therefore, our study is very important to be conducted, to support the conservation of local knowledge in Bangka Island related to ethnomedicine from animals (ethnozooecine). This study is basic information on the utilization of animals as traditional medicine by the community of Pangkalpinang City.

Methods

A study to collect information on the utilization of animals as traditional medicine was conducted in September and November 2022 in Ketapang Subdistrict, Pangkalanbaru District, Pangkalpinang City (Fig. 1). This research collected data through surveys and informant selection using snowball sampling and grouped based on age, namely <31 years, 31-45 years, and >45 years. Snowball sampling is a non-probability data collection technique/method that obtains subsequent informants based on recommendations from previous informants until saturation is reached (Sugiyono 2017).

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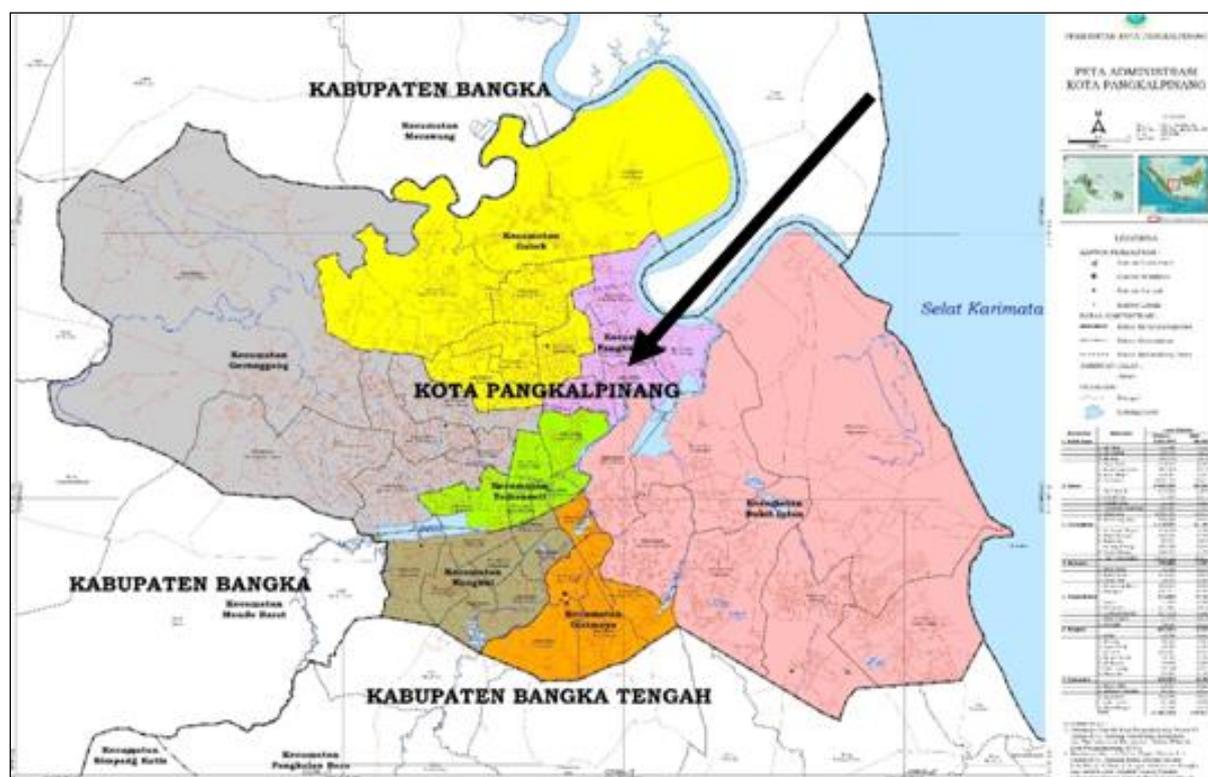


Figure 1. Map of Pangkalpinang City, Bangka Island, Bangka Belitung Province. Black arrow indicate study site.

Table 1. Selected interviewee.

No.	Initial	Age	♂/♀	Ethnicity/Religion	Occupation
1.	A.Y.	63	♂	Malay/Islam	Retired Civil Servant /Descendant of Traditional Healers
2.	S.G.	56	♂	Malay/Islam	Merchant/Descendant of Traditional Healers
3.	M.Q.	48	♀	Malay/Islam	Housewife/Descendant of Traditional Healers

Data analysis was conducted qualitatively and quantitatively. Qualitative analysis was performed using descriptive statistics, while quantitative analysis was conducted by calculating RFC and ICF, namely:

1. Relative Frequency of Citation (RFC)

RFC was first initiated by Tardio & Pardo-de-Santayana (2008) to determine the local importance of each species. RFC value is calculated using the equation:

$$RFC = \frac{F_c}{N}$$

where: F_c is the number of informants mentioning the utilization of the species, and N is the total number of informants. RFC has a range of values from 0 to 1 (Pujinisa *et al.* 2023).

2. Informant Consensus Factor (ICF)

ICF was first initiated by Trotter & Logan (1986) to determine the homogeneity of local knowledge. ICF value is calculated using the equation:

$$ICF = \frac{[Nur - N_s]}{[Nur - 1]}$$

where: Nur is the number of reports of utilization for each category, and N_s is the number of species used for a particular category by all informants. ICF has a range of values from 0 to 1 (Pujinisa *et al.*, 2023).

The conservation status of each species is assessed based on international and national categories, namely the International Union for Conservation of Nature and Natural Resources Red List of Threatened Species (IUCN Red List), Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES), and Regulation of the Minister of Environment and Forestry of the Republic of Indonesia Number P.106/MENLHK/SETJEN/KUM.1/12/2018.

Results and Discussion

Indigenous People Knowledge

The results of interviews with three informants indicate that the community of Ketapang Subdistrict still utilizes animals as traditional medicine due to several interrelated reasons. Firstly, limited access to modern healthcare services forces them to rely on traditional knowledge that has become an integral part of their culture. The utilization of animals as traditional medicine has been passed down from generation to generation, instilling belief in its effectiveness in curing various ailments. Additionally, the availability and accessibility of animals or their body parts in nature are easier compared to modern medicines that are difficult to access. The practicality and affordability make the use of traditional medicine more appealing to communities with economic limitations. The cultural and spiritual values associated with certain animal species also influence the selection of traditional medicine, as their use often correlates with cultural and spiritual beliefs within the community. Finally, when modern medical solutions are inadequate, communities often resort to traditional medicine that has proven effective in their daily experiences.

Local people divided into the age group >45 years (3 informants with a percentage of 100%) (Fig. 2). These results indicate that knowledge related to the utilization of animals as traditional

medicine tends to increase with the age of the informants. This increase is attributed to the accumulation of more life experiences in older informants compared to younger informants. Generally, younger informants have limitations in experiences related to the types and functions of animals. Therefore, it can be concluded that there is a good relationship between age and the level of informants' knowledge regarding the utilization of animals as traditional medicine. This finding is consistent with previous study (Kendie *et al.* 2018; Mussarat *et al.* 2021; Faiz *et al.* 2022) who also found that knowledge about the utilization of plants and animals correlates positively with the age of informants.

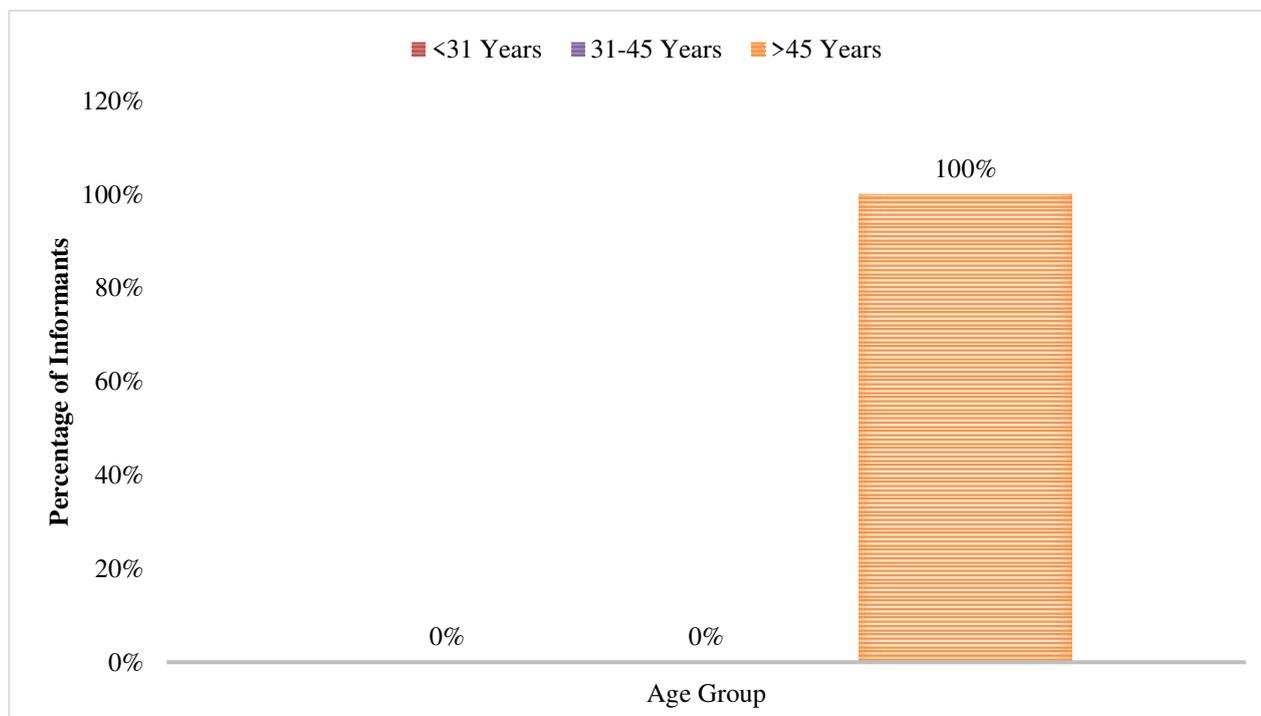


Figure 2. Percentage of informants based on age group.

Animals Utilized as Traditional Medicine

The animals utilized as traditional medicine by the community of Ketapang Subdistrict consist of 6 families and 6 species categorized into 4 classes (Fig. 3), including Reptilia (3 species with a percentage of 50.0%), as well as Mammalia, Actinopterygii, and Aves (each with 1 species and a percentage of 16.7%) (Table 2, Fig. 4). Reptilia ranks first based on the percentage of the number of animal species utilized as traditional medicine by the community of Ketapang Subdistrict.

Based on the calculation of Relative Frequency of Citation (RFC) (Table 3), the Reticulated Python *Malayopython reticulatus* becomes the species most frequently used by the community of Ketapang Subdistrict in treating illnesses, evidenced by the highest RFC value of 1.000. Additionally, this species is also utilized as traditional medicine in other areas of Bangka Island (Fitriana *et al.* 2022b; Syafutra *et al.* 2022, 2024). Previous study also suggest that *M. reticulatus* is most frequent herpetofauna used by local communities in Indonesia (Mardiastuti *et al.* 2021a, 2021b). Furthermore, the Monitor Lizard *Varanus salvator* and Gecko *Hemidactylus frenatus* are two species with the lowest RFC values of 0.333. This indicates that these three animal species are the least utilized by the community of Ketapang Subdistrict in treating illnesses.

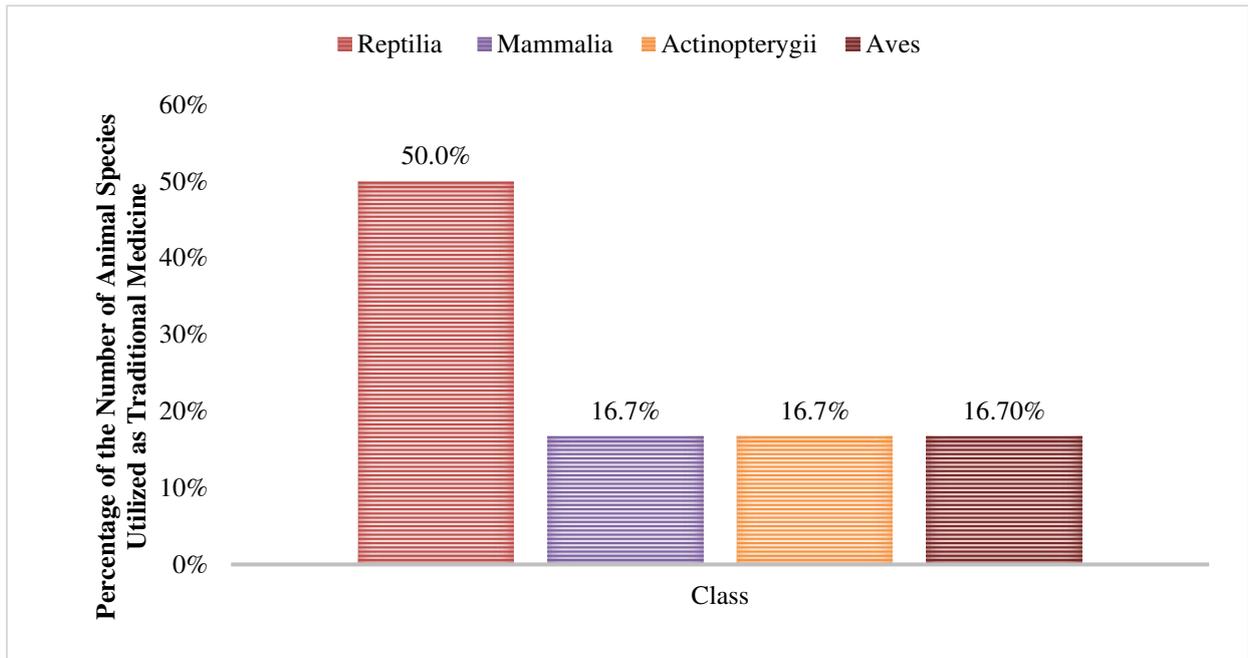


Figure 3. Percentage of the number of animal species per class utilized as traditional medicine by the community of Ketapang Subdistrict.

Table 2. Utilized animals as traditional medicine by the community of Ketapang Subdistrict.

No.	Utilized Animal		Part/Product of Utilized Animal	Method and Form of Processing Part/Product of Utilized Animal	Category of Animal Utilization
	Family/Species	Local/National/International Name			
Subphylum/Class: Vertebrata/Actinopterygii					
1.	Channidae/ <i>Channa striata</i>	Snakehead Fish	Meat	Fried meat, then consumed.	Internal Wounds
Subfilum/Kelas: Vertebrata/Reptilia					
2.	Gekkonidae/ <i>Hemidactylus frenatus</i>	Gecko	Whole Body	The dried put into hot water, soaked and drink	Medicine for Typhoid Fever
			Whole Body	The gecko is burned and pounded into powder. The powder is put the wound.	Medicine for Burn Wounds
3.	Varanidae/ <i>Varanus salvator</i>	Monitor Lizard	Meat	The meat is grilled and then consumed.	Medicine for Itchy Skin
3.	Pythonidae/ <i>Malayopython reticulatus</i>	Reticulated Python	Bile	The bile is consumed raw without processing.	Medicine for Skin Diseases
Subphylum/Class: Vertebrata/Aves					
4.	Apodidae/ <i>Aerodramus fuciphagus</i>	Swiftlet	Nest	The dried nest and frankincense stone put in hot water. The soaked water is consumed.	Medicine for Fever
Subphylum/Class: Vertebrata/Mammalia					
6.	Bovidae/ <i>Capra hircus</i>	Goat	Meat	The meat is grilled and then consumed.	Medicine for Fatigue

Table 3. RFC calculation for animals utilized as traditional medicine by the community of Ketapang Subdistrict.

Family/Species of Animal Utilized	Fc	N	RFC
Pythonidae/ <i>Malayopython reticulatus</i>	3	3	1.000
Channidae/ <i>Channa striata</i>	2	3	0.667
Bovidae/ <i>Capra hircus</i>	2	3	0.667
Apodidae/ <i>Aerodramus fuciphagus</i>	2	3	0.667
Varanidae/ <i>Varanus salvator</i>	1	3	0.333
Gekkonidae/ <i>Hemidactylus frenatus</i>	1	3	0.333

Note: Fc = Number of informants mentioning the utilization of the species; N = Total number of informants; RFC = Relative Frequency of Citation.

Animal Parts Utilized as Traditional Medicine

Meat is the animal part/product most commonly utilized as traditional medicine by the community of Ketapang Subdistrict (Fig. 4). The meat from Snakehead fish *Channa striata*, Monitor Lizard *Varanus salvator* and Goat *Capra hircus* are utilized by the community of Ketapang Subdistrict as traditional medicine for internal wounds, itching, and fatigue. Meat is also known to be the most commonly utilized animal part/product as traditional medicine in various countries (Kendie *et al.* 2018; Husain & Wahidah 2019).

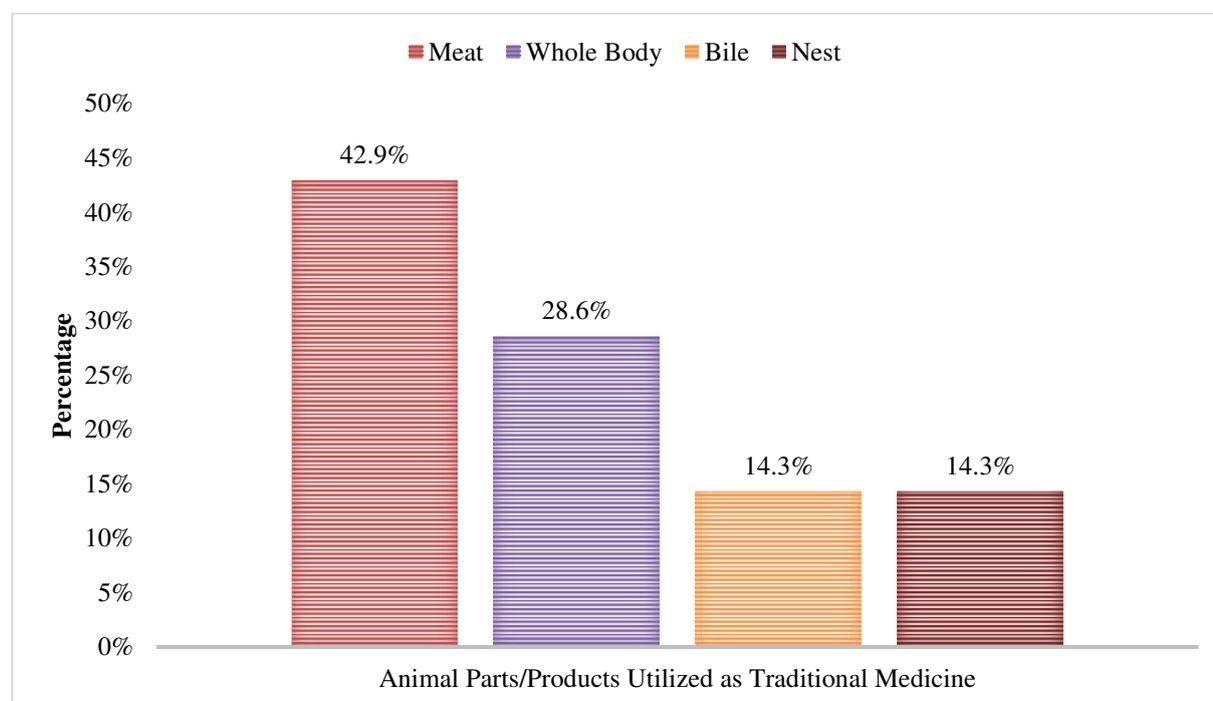


Figure 4. Percentage of animal parts/products utilized as traditional medicine by the community of Ketapang Subdistrict.

Adhikari *et al.* (2020) found that the community of Chitwan-Annapurna, central Nepal utilizes meat from various animals as medicine for paralysis, asthma, rheumatism, arthritis, poor eyesight, and tuberculosis. This according with a previous study from Pakistan that utilizes meat from goats *Capra hircus*, Rhesus Monkeys *Macaca mulatta*, Indian Hedgehogs *Paraechinus micropus*, European Rabbits *Oryctolagus cuniculus*, Indian Palm Squirrels *Funambulus palmarum*, Mallard Ducks *Anas platyrhynchos* and Jungle Fowl *Gallus gallus* as medicine for hepatitis, cough, cancer, asthma, epilepsy, anemia, weakness, and kidney problems (Mussarat *et al.* 2021). Additionally, Faiz *et al.* (2022) stated that the community of Azad Kashmir, Pakistan utilizes meat from various animals as medicine for various diseases, both minor (such as fever, cough, stomach ailments, *etc.*) and major (such as diabetes, lung diseases, heart diseases, liver diseases, kidney diseases, respiratory tract problems, *etc.*).

Meat is defined as the flesh of an animal consumed as food, whether fresh, minced, or frozen (Giromini & Givens 2022). Meat consists of two types, namely red meat and white meat. In nutritional

studies, white meat includes poultry and fish but excludes all mammalian meats considered as red meat (Lupoli *et al.* 2021). Processed meat is defined as meat preserved by methods other than freezing, such as smoking, heating, and salting, or with the addition of chemical preservatives (IARC 2018). During meat processing, additional meat and animal fats can be added along with various non-meat substances and additives resulting in more complex products (Giromini & Givens 2022). Meat provides a high-quality protein source and a variety of essential nutrients crucial for optimal health. The nutrients in meat can contribute beneficially to key nutrient intake that is typically lacking in the diet of some population groups (Wyness 2016).

Processing Methods of Animal Parts Utilized as Traditional Medicine

Regarding the processing methods of animal parts/products utilized as traditional medicine, the community of Ketapang Subdistrict is more dominant in using burnt and boiled methods rather than fried and uncooked methods (Fig. 5). These results are similar to the findings of Adhikari *et al.* (2020), which showed that cooking by frying and boiling is the most commonly used method by local community in Chitwan-Annapurna, central Nepal. In Ethiopia, the local people mostly uses unprocessed or uncooked or eaten raw methods in utilizing animal parts as traditional medicine (Kendie *et al.* 2018).

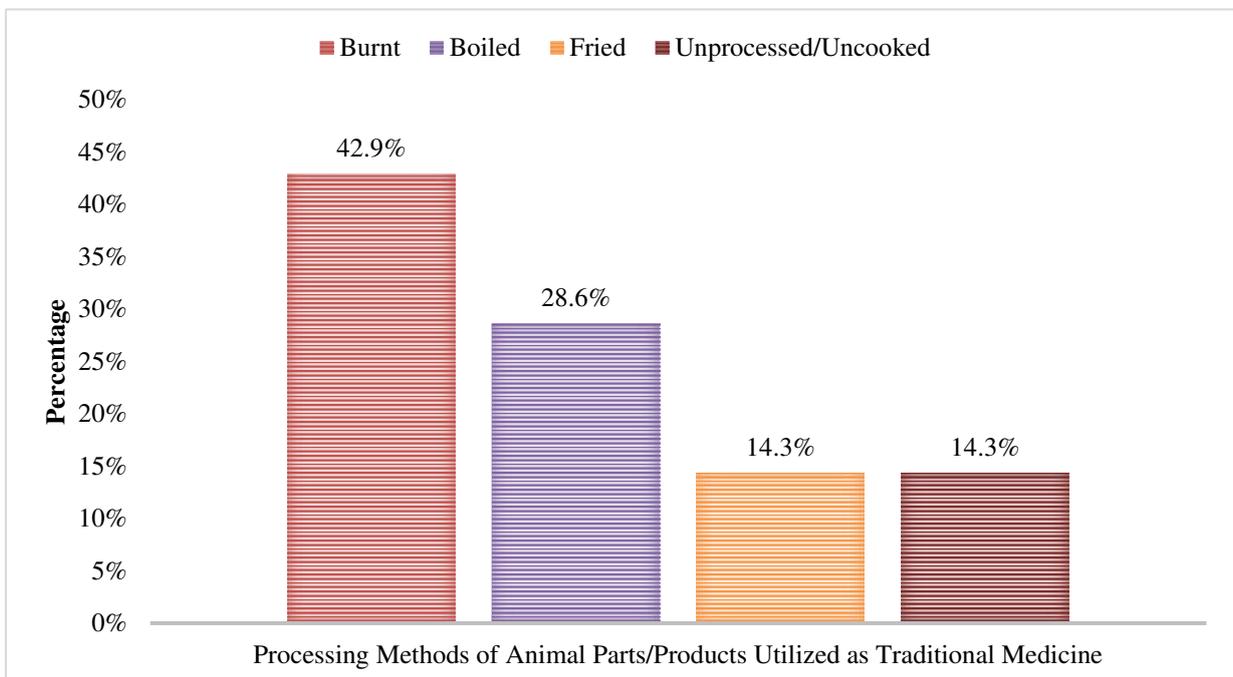


Figure 6. Percentage of processing methods of animal parts/products utilized as traditional medicine by the community of Ketapang Subdistrict.

Consuming uncooked raw food has certain impacts on human health, which can be either beneficial or detrimental. Currently, some people prefer raw food diets because they believe that raw food diets have positive impacts on health. Additionally, raw foods are known to have fewer processing steps and fewer additives, which is advantageous for those who choose raw foods as their diet. Furthermore, another benefit of consuming raw food is the preservation of enzymes contained within them. The cooking process is believed to destroy these enzymes. Many people believe that consuming foods with preserved enzymes provides health benefits, such as helping to reduce the risk of certain types of cancers including mouth, throat, and breast cancer. However, some people believe that raw foods can have negative impacts on their health. They prefer cooking these foods rather than consuming them raw. A previous study in 2009 found that cooking raw foods can kill harmful bacteria within them, making them safe to consume (Mas'ad & Hisham 2018).

Presentation Forms of Animal Parts Utilized as Traditional Medicine

The local community of Ketapang Subdistrict predominantly utilizes animal parts/products as traditional medicine in the form of food and drink rather than in other forms (Fig. 6). Consistent with

these findings, the communities of Khyber Pakhtunkhwa, Pakistan and Metema Woreda, North-Western Ethiopia, are also known to predominantly utilize animal parts/products as traditional medicine in the form of drinks and food rather than in the form of massage media, amulets, etc. (Mussarat *et al.*, 2021; Kendie *et al.*, 2018).

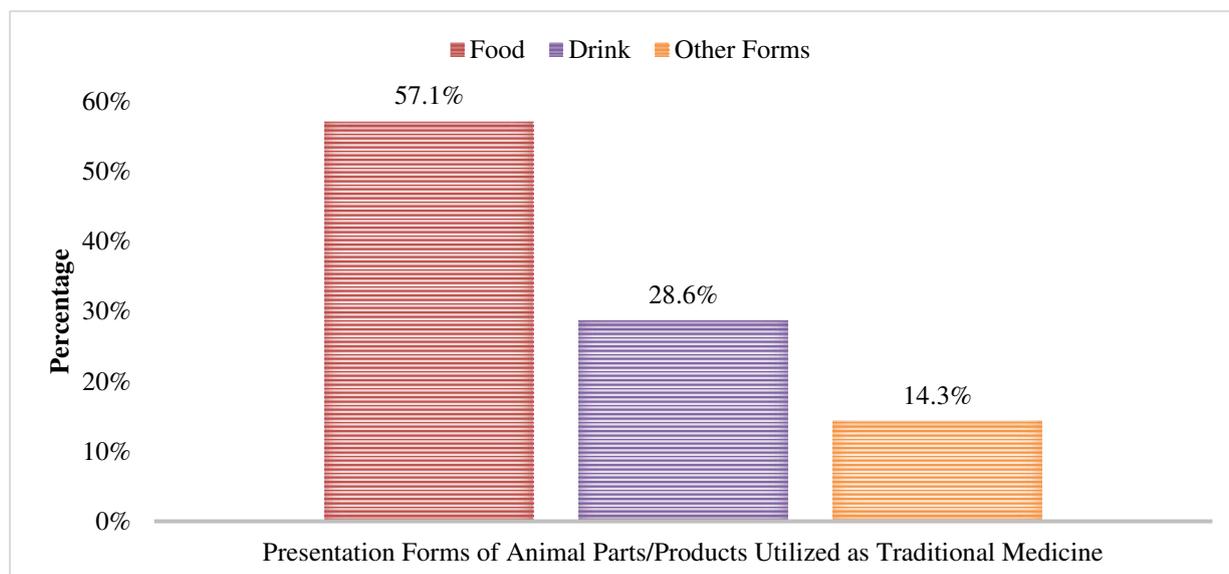


Figure 6. Percentage of presentation forms of animal parts/products utilized as traditional medicine by the community of Ketapang Subdistrict.

Healthy food and drinks play a crucial role in shaping health and well-being. Nutrient-rich foods provide energy to the body, support the functions of vital organs, and aid in tissue growth and repair. A balanced diet strengthens the immune system, reduces the risk of chronic diseases, and enhances energy and stamina. Additionally, adequate hydration supports bodily functions, aids in detoxification, and maintains overall health. The combination of both not only influences physical health but also mental health, improving mood, focus, and sleep quality. The quality of food and drinks affects overall quality of life, thus serving as a vital foundation in maintaining optimal health and well-being [Ratmawati, *pers.comm.*, 2023].

Utilization Categories of Animals as Traditional Medicine

Calculation of the Informant Consensus Factor (ICF) reveals a diverse range of values (Table 4). The varied ICF values provide insights into the level of consensus or variation in the utilization of animals as traditional medicine. This variation highlights the importance of further understanding how the information and beliefs of local communities influence the practice of utilizing animals as traditional medicine.

Table 4. Calculation of ICF for the categories of animal utilization as traditional medicine by the community of Ketapang Subdistrict.

Utilization Category of Animals as Traditional Medicine	Number of Utilization Reports	Utilized Animal		ICF
		Total	Species	
Medicine for Skin Diseases	3	1	<i>Malayopython reticulatus</i>	1
Medicine for Internal Wounds	2	1	<i>Channa striata</i>	1
Medicine for Fever	2	1	<i>Aerodramus fuciphagus</i>	1
Medicine for Fatigue	2	1	<i>Capra hircus</i>	1
Medicine for Typhoid Fever	1	1	<i>Hemidactylus frenatus</i>	0
Medicine for Burn Wounds	1	1	<i>Hemidactylus frenatus</i>	0
Medicine for Itchy Skin	1	1	<i>Varanus salvator</i>	0

Few categories of animal utilization as traditional medicine show a high level of agreement among the informants, as indicated by the maximum ICF value (ICF value of 1). An ICF value of 1 indicates that the informants strongly and consistently recognize and agree that skin diseases, internal wounds,

fever, and fatigue can be treated by utilizing the parts/products of *Malayopython reticulatus*, *Channa striata*, *Aerodramus fuciphagus*, and *Capra hircus*. On the other hand, typhoid fever, burn wounds, and itch medicine are three categories of animal utilization as traditional medicine with low agreement among the informants, with a minimum ICF value (ICF value of 0). An ICF value of 0 indicates that the informants tend not to recognize and agree that typhoid fever, burn wounds, and itch can be treated by utilizing the parts/products of *Hemidactylus frenatus* and *Varanus salvator*. Previous study suggest the highest yielded ICF value (ICF value of 0.974), indicating that the informants strongly recognize and agree that cardiovascular diseases can be treated by utilizing the parts/products of various animals; and toothache can be treated by utilizing the parts/products of *Vanellus indicus*, *Pavo cristatus*, and *Bubulcus ibis* (Adhikari et al. 2020).

Conservation Status of Animals Utilized in Traditional Medicine

In the context of the Ketapang Subdistrict community, limited access to modern healthcare services and a strong belief in traditional knowledge drive them to continue utilizing animals as traditional medicine. This phenomenon, although rich in cultural value, poses serious consequences for the survival of both protected and unprotected wildlife. This situation emphasizes the urgency of evaluating the conservation status of each species of animals utilized in traditional medicine, both from an international perspective and within Indonesian national regulations.

Table 5. Conservation status of animals utilized in traditional medicine by the community of Ketapang Subdistrict.

No.	Family/Species of Animals Utilized in Traditional Medicine	Conservation Status of Animals Utilized in Traditional Medicine		
		IUCN Red List	CITES	Permen LHK RI P.106
Subfilum/Kelas: Vertebrata/Actinopterygii				
1.	Channidae/ <i>Channa striata</i>	LC	Non-App.	TD
Subfilum/Kelas: Vertebrata/Reptilia				
2.	Gekkonidae/ <i>Hemidactylus frenatus</i>	LC	Non-App.	TD
3.	Varanidae/ <i>Varanus salvator</i>	LC	App.II	TD
4.	Pythonidae/ <i>Malayopython reticulatus</i>	LC	App.II	TD
Subfilum/Kelas: Vertebrata/Aves				
5.	Apodidae/ <i>Aerodramus fuciphagus</i>	LC	Non-App.	TD
Subfilum/Kelas: Vertebrata/Mammalia				
6.	Bovidae/ <i>Capra hircus</i>	NA	Non-App.	TD

Note:

- [IUCN Red List] International Union for Conservation of Nature and Natural Resources (IUCN) Red List of Threatened Species: Not Applicable (NA) = Species not listed on the IUCN Red List; Data Deficient (DD) = Species with insufficient data; Least Concern (LC) = Species with low risk of extinction; Near Threatened (NT) = Species close to being vulnerable to extinction; Vulnerable (VU) = Species vulnerable to extinction; Endangered (EN) = Species endangered with extinction; Critically Endangered (CR) = Species critically endangered with extinction.
- [CITES] Convention on International Trade in Endangered Species of Wild Fauna and Flora: Non-Appendix (Non-App.) = Species currently not threatened with extinction and its trade is not controlled/free; Appendix III (App.III) = Species protected in certain countries within its habitat range, and its status may be elevated to Appendix II or I in the future; Appendix II (App.II) = Species currently not threatened with extinction but may become so if its trade is not strictly controlled; Appendix I (App.I) = Species currently threatened with extinction, thus prohibited from all forms of trade.
- Ministerial Regulations (Peraturan Menteri or PERMEN LHK RI P.106) Regulation of the Ministry of Environment and Forestry of the Republic of Indonesia No. P.106/MENLHK/SETJEN/KUM.1/12/2018: Not Protected (TD); Protected (D).

Utilization of Animals a Traditional

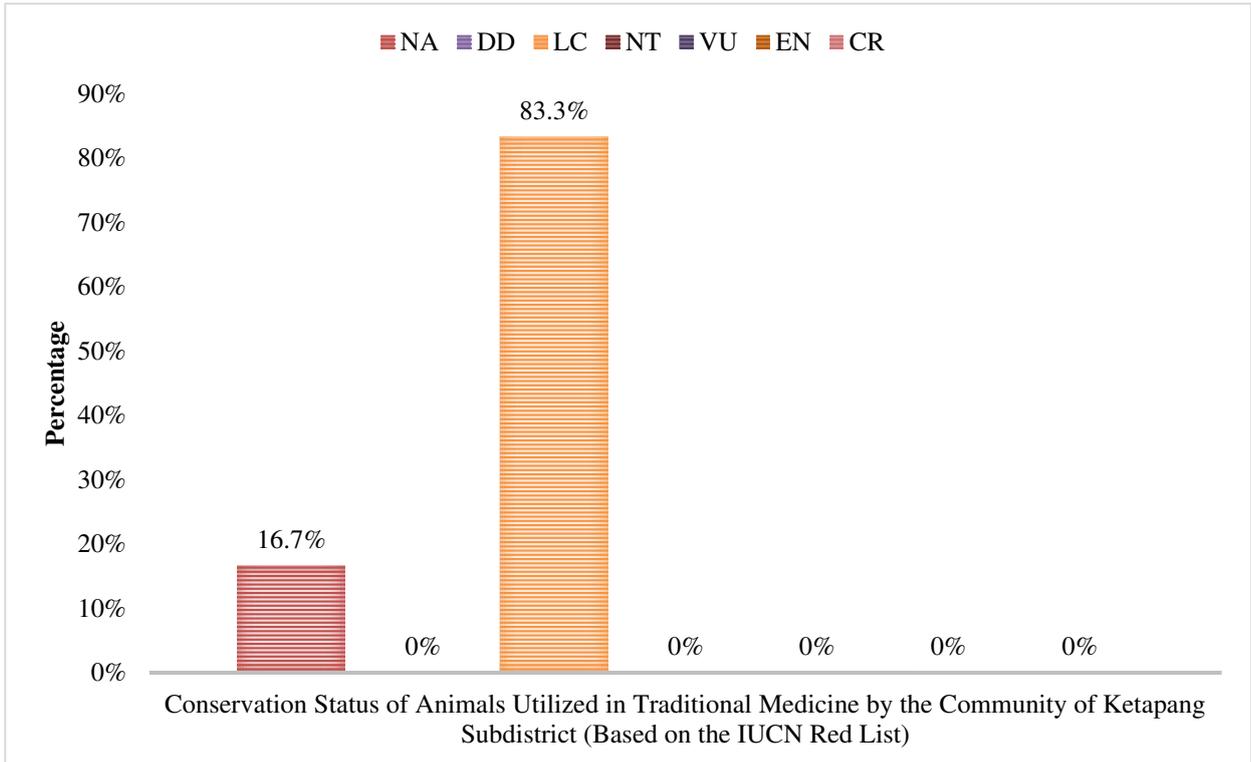


Figure 7. Percentage of the conservation status of animals utilized in traditional medicine by the community of Ketapang Subdistrict (based on the IUCN Red List).

The conservation status of each species of animal is evaluated through three references: the IUCN Red List, CITES, and Permen LHK RI P.106 (Table 5, Fig. 7-9). Data generated from these three references provide a comprehensive overview of the threat level faced by each species toward extinction and how they are threatened by human activities, including their utilization in traditional medicine.

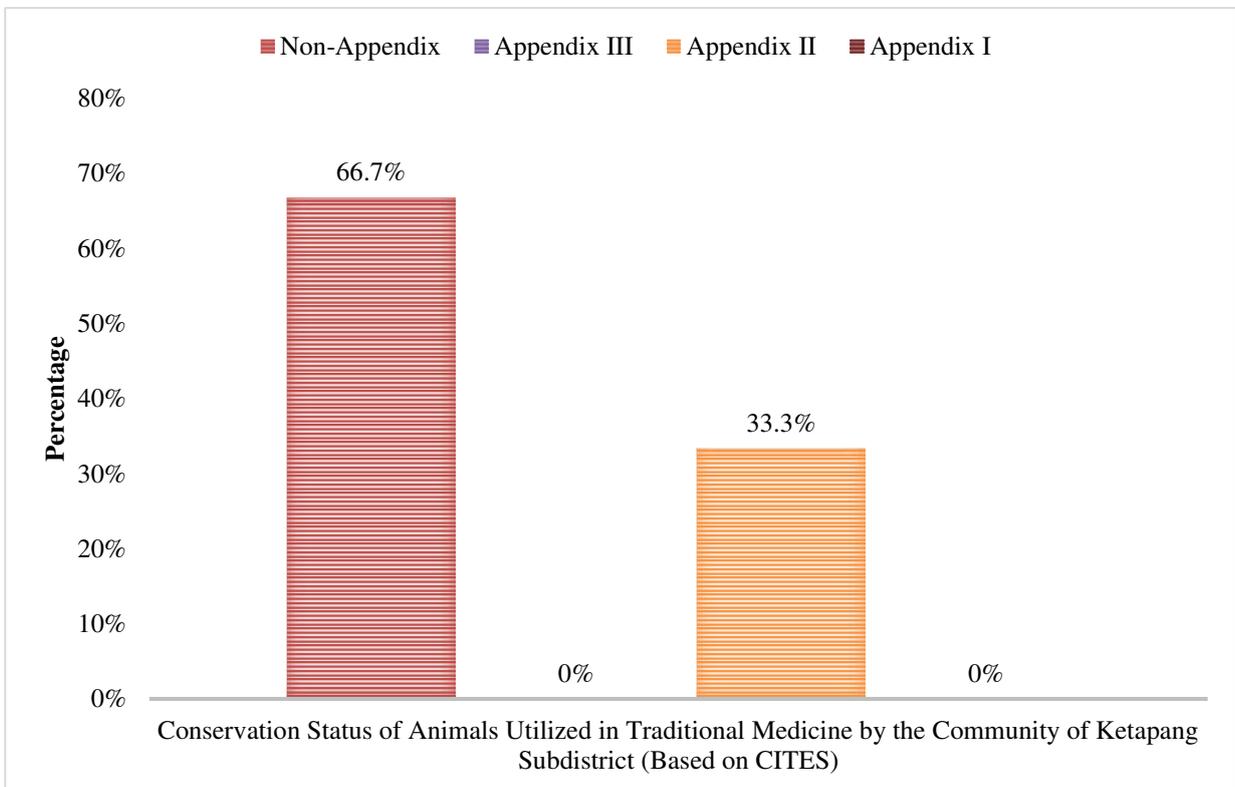


Figure 8. Percentage of the conservation status of animals utilized in traditional medicine by the community of Ketapang Subdistrict (based on CITES).

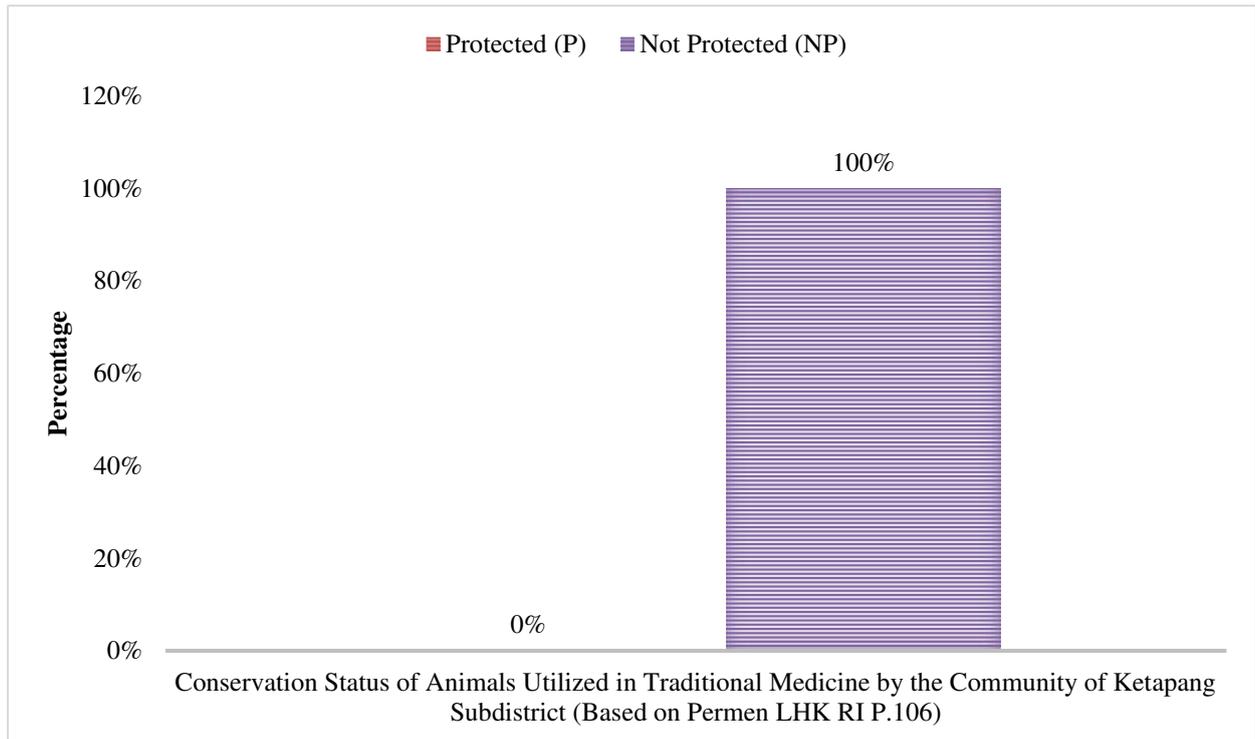


Figure 9. Percentage of the conservation status of animals utilized in traditional medicine by the community of Ketapang Subdistrict (based on Permen LHK RI P.106).

Most species of animals used by local community for traditional medicine are considered as unthreatened by IUCN Red List and listed as Non-Appendix status by CITES. This suggests a low risk of extinction and no trade restrictions. Additionally, species such as *Varanus salvator* and *Malayopython reticulatus* are listed under Appendix II on CITES, indicating their potential vulnerability to extinction if their trade is not strictly regulated. Furthermore, all species of animals are categorized as Not Protected according to Permen LHK RI P.106. These threatened species require more intensive protection, including monitoring of trade and habitat restoration efforts. Collaboration between the government, conservation agencies, and local communities is key to addressing these conservation challenges, involving various efforts such as public education and law enforcement. Strong cooperation and collaborative actions will play a crucial role in protecting the survival of species threatened by traditional medical practices.

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References

- Adhikari, J.N., Bhattarai, B.P., Rokaya, M.B., & Thapa, T.B. 2020. Ethno-medicinal uses of vertebrates in the Chitwan-Annapurna Landscape, central Nepal. *PLOS ONE* 15(10): e0240555. <https://doi.org/10.1371/journal.pone.0240555>
- Afriyansyah, B., Hidayati, N.A. & Afrizan, H. 2016. Pemanfaatan hewan sebagai obat tradisional oleh Etnik Lom di Bangka. *Jurnal Penelitian Sains* 18(2): 66–74. <http://ejurnal.mipa.unsri.ac.id/index.php/jps/article/download/26/22>
- Costa-Neto, E.M. 2005. Animal-based medicines: Biological prospecting and the sustainable use of zootherapeutic resources. *Anais da Academia Brasileira de Ciências* 77(1): 33–43. <https://doi.org/10.1590/S0001-37652005000100004>
- Faiz, M., Altaf, M., Umair, M., Almarry, K.S., Elbadawi, Y.B. & Abbasi, A.M. 2022. Traditional uses of animals in the Himalayan Region of Azad Jammu and Kashmir. *Frontiers in Pharmacology* 13. <https://doi.org/10.3389/fphar.2022.807831>
- Fitriana, F., Syafutra, R., Fatmawati, F., Sakti, M.Y.G., Karsina, L. & Kurbiyanto, A. 2022a.

- Etnozoologi masyarakat Desa Beruas dan Desa Puput Kabupaten Bangka Tengah. *Agriprimatech* 5(2): 70–75. <https://doi.org/10.34012/agriprimatech.v5i2.2644>
- Fitriana, F., Syafutra, R., Handayani, H., Arohman, R., Saputra, F. D. & Piryandani, A. 2022b. Kajian etnozologi masyarakat di Desa Air Mesu Barat dan Cambai Induk, Kabupaten Bangka Tengah. *Agroprimatech* 5(2): 58–67. <https://doi.org/10.34012/agroprimatech.v5i2.2634>
- Giromini, C. & Givens, D. I. 2022. Benefits and risks associated with meat consumption during key life processes and in relation to the risk of chronic diseases. *Foods* 11(14): 2063. <https://doi.org/10.3390/foods11142063>
- Husain, F. & Wahidah, B.F. 2019. Identification of medicinal animals in traditional medicine in Rural Central Java (a preliminary result of ethno-zootherapeutical study). *Proceedings of the International Conference on Rural Studies in Asia (ICoRSIA 2018)*. <https://doi.org/10.2991/icorsia-18.2019.29>
- IARC. 2018. *IARC monographs on the evaluation of carcinogenic risks to humans: red meat and processed meat* (Vol. 114). International Agency for Research on Cancer (IARC). <https://publications.iarc.fr/publications/media/download/5659/5d7454aa8257a735c59b78233317f1b0c12b9d50.pdf>
- Ibrahim, I. 2015. Dampak penambangan timah ilegal yang merusak ekosistem di Bangka Belitung. *Selisik* 1(1): 77–90. <http://journal.univpancasila.ac.id/index.php/selisik/article/view/626>
- Iqbal, M., Febrianto, I. & Zulkifli, H. 2011. The occurrence of the Javan Plover *Charadrius javanicus* in Sumatra, Indonesia. *Wader Study Group Bulletin* 118(2): 49–51.
- Kendie, F.A., Mekuriaw, S.A. & Dagneu, M.A. 2018. Ethnobiological study of traditional medicinal appreciation of animals and their products among the indigenous people of Metema Woreda, North-Western Ethiopia. *Journal of Ethnobiology and Ethnomedicine* 14(1): 37. <https://doi.org/10.1186/s13002-018-0234-7>
- Lupoli, R., Vitale, M., Calabrese, I., Giosuè, A., Riccardi, G. & Vaccaro, O. 2021. White meat consumption, all-cause mortality, and cardiovascular events: a meta-analysis of prospective cohort studies. *Nutrients* 13(2): 676.
- Mardiastuti, A., Masy'ud, B., Ginoga, L.N., Sastranegara, H. & Sutopo. 2021a. Short communication: Wildlife species used as traditional medicine by local people in Indonesia. *Biodiversitas* 22(1): 329–337. <https://doi.org/10.13057/biodiv/d220140>
- Mardiastuti, A., Masy'ud, B., Ginoga, L. N., Sastranegara, H., & Sutopo. 2021b. Traditional uses of herpetofauna practiced by local people in the island of Sumatra, Indonesia: Implications for conservation. *IOP Conference Series: Earth and Environmental Science* 762(1): 012003. <https://doi.org/10.1088/1755-1315/762/1/012003>
- Mas'ad, M. A., & Hisham, M. Z. F. 2018. Raw food consumption and its effects on human health: an analysis of halalantoyyiban concept. *UMRAN - International Journal of Islamic and Civilizational Studies*, 5(2–1). <https://doi.org/10.11113/umran2018.5n2-1.312>
- Mussarat, S., Ali, R., Ali, S., Mothana, R. A., Ullah, R., & Adnan, M. 2021. Medicinal animals and plants as alternative and complementary medicine in southern regions of Khyber Pakhtunkhwa, Pakistan. *Frontiers in Pharmacology*, 12. <https://doi.org/10.3389/fphar.2021.649046>
- Nukraheni, Y. N., Afriansyah, B., & Ihsan, M. 2019. The ethnozoology of Jering Ethnic Society in utilizing the animals for halal traditional medicine. *Journal of Halal Product and Research* 2(2), 60–67. <https://doi.org/10.20473/jhpr.vol.2-issue.2.60-67>
- Priyansah, S., Syafutra, R., Fitriana, F., Apriyani, R., Mahatir, E. H., Safitri, M., & Husin, T. D. 2021. Pemanfaatan satwa liar sebagai obat tradisional di Desa Air Mesu Timur dan Cambai Selatan, Kabupaten Bangka Tengah. *Ekotonia: Jurnal Penelitian Biologi, Botani, Zoologi dan Mikrobiologi* 6(2): 35–41. <https://doi.org/10.33019/ekotonia.v6i2.2812>
- Pujinisa, W., Henri, H. & Romdhoni, E. 2023. Etnobotani tumbuhan bahan pangan di Taman Wisata Alam Gunung Permisan, Kabupaten Bangka Selatan. *Jurnal Ilmu Lingkungan* 21(3): 453–462. <https://doi.org/10.14710/jil.21.3.453-462>
- Rizvi, S.A.A., Einstein, G.P., Tulp, O.L., Sainvil, F. & Branly, R. 2022. Introduction to traditional medicine and their role in prevention and treatment of emerging and re-emerging diseases. *Biomolecules* 12(10): 1-29.
- Saputra, F. D., Syafutra, R., Dalimunthe, N. P. & Priyansah, S. 2023. Pemanfaatan satwa liar sebagai obat tradisional di Desa Parit Padang, Kabupaten Bangka. *Conserva* 1(1): 14–22. <https://doi.org/10.35438/conserva.v1i1.190>
- Sarkhel, S. 2021. *Traditional Medicine in Health and Diseases*. In: Sharangi, A.B. Peter, K. V. (Eds)

- Medicinal Plant-Bioprospecting and pharmacognosy. CRC Press, Florida, USA, pp. 29-38.
- Sugiyono. 2017. *Metode Penelitian Bisnis: Pendekatan Kuantitatif, Kualitatif, Kombinasi dan R&D*. Penerbit Alfabeta, Bandung, 832 pp.
- Sunaryo, E., Anwari, M. S., & Yani, A. 2019. Etnozoologi masyarakat Dayak Jelai Hulu Embulu Lima di Desa Mekar Utama Kecamatan Kendawangan Kabupaten Ketapang. *Jurnal Hutan Lestari* 7(3): 1100–1110. <https://jurnal.untan.ac.id/index.php/jmfkh/article/view/36436>.
- Syafutra, R., Alikodra, H. S., & Iskandar, E. 2019. Mentilin *Cephalopachus bancanus bancanus* (Horsfield, 1821) habitat in Bangka Regency, Indonesia. *Asian Primates Journal* 8(1): 13–24. http://www.primate-sg.org/storage/asian-primates-journal/volume-81/2019Sep18_Article_2.pdf.
- Syafutra, R., Fitriana, F., Heri, H., Ahka, R., Febriyani, R., & Mubinan, M. F. 2022. Pemanfaatan satwa liar sebagai obat tradisional oleh masyarakat Desa Pedindang, Kabupaten Bangka Tengah. *Jurnal Biogenesis* 18(1): 33–41. <https://doi.org/10.31258/biogenesis.18.1.33-41>.
- Syafutra, R., Fitriana, F., Kamal, A., Wulandari, F., Wulan, N. A. N. & Alamsyah, Z. 2021. Pemanfaatan satwa liar sebagai obat tradisional di Desa Terak dan Teru, Kabupaten Bangka Tengah. *Ekotonia* 6(2): 42–50. <https://doi.org/10.33019/ekotonia.v6i2.2813>.
- Syafutra, R., Sonya, T., Irandi, Z., Almira, A., Kirana, S., Ersya, A. & Saputra, A. 2024. Satwa yang dimanfaatkan sebagai obat tradisional di Desa Tempilang dan Rangas, Provinsi Kepulauan Bangka Belitung. *Spizaetus* 5(1): 92. <https://doi.org/10.55241/spibio.v5i1.347>.
- Tardío, J. & Santayana, M.P. 2008. Cultural Importance Indices: A Comparative Analysis Based on the Useful Wild Plants of Southern Cantabria (Northern Spain). *Economic Botany* 62(1): 24-39.
- Trotter, R.T. & Logan, M.H. 1986. *Informant Consensus: A New Approach for Identifying potentially Effective Medicinal Plants*. In: Etkin, N.L. (Ed.) *Plants in Indigenous medicine and Diet*. Redgrave Publishing Company, New York, pp. 91- 112.
- Whitten, T., Damanik, S.J., Anwar, J. & Hisyam, N. 2000. *The Ecology of Sumatra*. Periplus, Singapore, 478 pp.
- Wyness, L. 2016. The role of red meat in the diet: nutrition and health benefits. *Proceedings of the Nutrition Society* 75(3): 227–232. <https://doi.org/10.1017/S0029665115004267>