The Potential of Ethnozoology in Traditional Treatment of Bada Ethnic in Lore Lindu Biosphere Reserve in Central Sulawesi

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Abstract. The relationship between humans and animals has existed since the past. Animals as a natural resource that plays a role in human life. The bada ethnic community that occupies the Bada valley in Lore Lindu biosphere reserve is an indigenous community called To Bada / Tampo Bada which has a local wisdom and acts as a strategy for life activities. One form of local wisdom is traditional medicine. This study aims to inventory and find out perceptions of bada ethnic conceptions about using animals in traditional medicine. This explorative study used semi-structure interview and in-depth interviews with open-ended interview techniques. Based on the results of this study there were 13 species consisting of 5 classes and 10 tribes of animals used as traditional medicine. There are 8 types of diseases that can be treated, namely asthma, liver, heartburn, eczema, itching allergy when cold, ageless, strong / massage oil. Utilization of body parts used includes the entire body, meat, liver, bile, and fat. The use of animals as medicine must be sustainable in order to stabilize the population in nature. The identification of species used as traditional medicines is important in conservation efforts.

1. Introduction

Indonesia is a mega biodiversity and plurality tropical country consisting of 17,500 islands [1]. Indonesia also has 370 ethnic cultures. Therefore Indonesia is a country has highest diversity of culture [2]. Culture product local knowledge reflects character of an ethnic group. The forms of local knowledge an ethnic group vary and reflected in traditional forms such as clothing, arts, home and health [3]. Local knowledge refers to local wisdom in a local community primarily concerns utilization and management of natural resources [4].

Ethnic Bada is one of the indigenous peoples (To Bada / Tampo Bada) who lived in Bada valley buffer zone of the Lore Lindu biosphere reserve in Poso, Central Sulawesi. This area are divided into two sub-districts namely West Lore and South Lore. Bada valley area as a national cultural heritage area with the discovery of artifacts in the form of megalithic statues [5]. Lore Lindu Biosphere Reserve area was declared by UNESCO in 1977 and determined by the Minister of Forestry with SK No. 464 / Kpts-II / 99 area of 217,991.18 hectares as an ecosystem conservation area to promote a balance of relations between humans and nature [6]. This area consists of 3 zones, namely the core zone, buffer zone and transition zone [7].
The relationship between humans and nature, namely plants and animals, has existed since ancient times, namely since the beginning of human history. Evidence of human relations with nature can be seen from ancient paintings in caves. Animal resources have an important role in human life. Ancient paintings described wild animals hunted by humans. Humans as subsistence hunters gather natural resources to meet their needs daily. Catch animals as natural resources to the needs of human life. Traditional societies using animals as traditional medicine also function as magical spirits. The function of animals and their products in human life is for food, clothing, tools, decoration, medicine and spiritual magic [8]. Local knowledge about animals and their use as a human cultural heritage that has been passed down from generation to generation [9]. Nature has provided natural ingredients as traditional medicine. Traditional ingredients in nature include animals, plants and rock minerals. Local knowledge as cultural heritage reflects a long relationship between indigenous peoples and nature [10]. The deep relationship between humans and animals as traditional medicine [11].

One of the human cultures in connection with the use of animals is as traditional medicine. Traditional medicine is a form of human corpus and praxis related to the beliefs and cultural experiences of the local community. The forms of traditional medical practices of each ethnic are different, depend on biodiversity, lifestyle, cultural history, attitude and philosophy [12]. The meaning of traditional medicine according to WHO is health practice with the approach of local knowledge and beliefs using natural ingredients through therapy, exercise, spiritual with the aim of welfare, treating, diagnosing and preventing disease [13].

According to WHO, there are about 75-80% of the world population using traditional medicines [14]. The use of animals for traditional medicinal ingredients with the aim of curing a disease is called zootherapy. Zootherapy is a part of ethnozoology. Ethnozoology is the study of the relationship between humans culture and animals in an environment [12]. Zootherapy phenomenon is strong evidence that nature providing natural ingredients as traditional medicine [14]. Wild animals and their products as important ingredients in traditional medicine [10].

Animals are not only used in traditional medicine but are also needed as a basic ingredient in modern pharmaceutical company pharmaceuticals. The important role of traditional medical knowledge in local communities is in the identification of important species and related to conservation regarding the use of these species in nature [15]. In general, animals used as sources of traditional medicine are animals died. The basic ingredients of traditional medicine are commonly used the whole body of animals, body parts and animal products. Animal body parts used as medicine are meat, bones, horns, tails, nails, skin, fur, fat, gall, and shells. Animal products commonly used as traditional medicinal ingredients are urine, feces, honey, and milk [13, 16].

2. Method
This field research was conducted in two sub-districts namely West Lore and South Lore using exploration survey method and interviews as well as documentation. Exploration surveys are used to find out informants knowledge about using animals as traditional medicine. Information obtained in a participatory by using open-ended interview techniques with in-depth interview and semi-structured interviews. The selection of key informants is based on purposive sampling and then to get detailed information snowball sampling is based on key informants [17].

The informants chosen to be interviewed are people who have knowledge about the use of animals as traditional medicine, which includes local experts (Sando, traditional leaders) and local communities. Analysis of research data includes descriptive qualitative and quantitative data. Qualitative data, namely the types of animals used as basic ingredients of medicine in traditional medicine include corpus and praxis in related with social, cultural ethnicity of the Bada people. Quantitative data is the number of species used based on taxon level, animal body parts and types of disease.
For information, there were 29 respondents interviewed (8 men and 21 women). Informant status includes gender, age, education, and social status of the community. Ethnozoological data of traditional medicine includes the local name of the animal, the body part of the animal used, the function of the part used, the type of disease being treated, and how to prepare it for use as traditional medicine.

3. Results and Discussion

3.1 Knowledge and diversity of animal species used as ingredients of traditional medicine

Ethnic Bada is an indigenous community called To Bada / Tampo Bada and lives around the forest in the buffer zone of the Central Sulawesi Lore Lindu biosphere reserve. Indigenous peoples still hold customary law in life. People who live near the forest have a good knowledge of diverse species are potentially important in human life. Local people who live close to forest have a very strong relationship with surrounding nature. They assume nature is a part of the human soul. Without nature, local people cannot feel life because it still depends on nature. The bada ethnic community knows various types of animals around and knows how to use them.

Local knowledge in the form of local wisdom as a form of human culture is implemented in everyday life. One form of Bada ethnic local wisdom is the use of animals as traditional medicinal ingredients. Bada ethnic knowledge about a traditional medicine using natural materials, namely plants and animals, derived from the experience and legacy of parents' narrative. According to BAPPENAS, local wisdom is a culture in the form of a belief in one ethnicity which is passed down from one generation to another [4].

Ethnic bada has a view of the disease, namely medical and non-medical diseases. Medical illness is a disease that can be cured with the help of doctors and local health experts. Non-medical diseases are diseases caused by spirits and can be cured by a sando / physician. Ethnic bada has used animal resources in the surrounding environment. Most use wild animal resources as traditional medicinal ingredients. They take these animal materials from the surrounding environment, namely rivers, yards, rice fields, gardens, and forests. But the knowledge and use of animals as traditional medicine are now reduced. This is because traditional knowledge about the use of animals as traditional medicine is only widely owned by parents. Along with the times, young people with higher education already have health awareness and prefer to go modern medical facilities such as health centers, and hospitals. The availability of health facilities makes it easier for people to seek treatment. Another consideration is the younger generation already has an awareness of the role of the environment and nature conservation efforts.

The results of the study were 72.41% male and 27.59% female informants. Most local experts (sando) are elderly men and have low education. The average age of respondents was less than 25 years 13.79%, between 25-60 years 68.97%, and more than 60 years 17.24%. Generally, the status of education from elementary school to senior high school (86.21%) and no school 13.79%. Social status
of the community is generally ordinary people 75.86%, local experts 17.24%, and community leaders 6.897%.

Based on the results of animal studies used by Bada ethnic groups as traditional medicinal ingredients there are 13 species, 5 classes and 10 tribes (Table 1). These animals live more wild in nature. The class of mammals has the most amount used as a traditional medicinal ingredient. This is because mammals as large animals are easily seen and easily obtained. Local people believe in animals, in addition to being a healer, it also means spiritual magic. Body parts of animals can be used as amulets [19]. Etnis Bada believes using of animals other than as medicines as well as spiritual magic. *Gallus gallus domesticus* and *Macaca tonkeana* animals are also believed to have spiritual magical meaning. *Gallus gallus domesticus* is often used in various rituals such as weddings and welcoming great guests. The white *Gallus gallus domesticus* egg means safety and joy with a clean, pure heart to welcome a great guest. *Macaca tonkeana* for ethnic Bada is believed to bring trouble when they meet while doing activities in the forest and gardens.

The use of animals as a traditional medicinal ingredients in two forms namely still in the raw and processed through the process of cooking or burning. Ethnic bada using animals as medicine through food that has been processed into food. They trust animals as a source of protein that is beneficial to human health.

Bada ethnic community does not understand zoonosis. Zoonosis is a disease that affects humans from animals [20]. Animals around can transmit disease to humans. The use of animals for human needs such as food and medicine must be cooked to be sterile from microorganisms that cause disease. They still used raw animal parts as traditional medicine. The raw animal used has been washed thoroughly. They used raw body parts of the liver and bile as medicine. Raw use of animal body parts namely from the liver and bile from the animals *Anguilla celebesensis*, *Malayopython reticulatus*, and *Macaca tonkeana*. Animal believed a drug for its bile is *Anguilla celebesensis* for treating allergic itchiness when it is cold. The use of liver from animals *Sus scrofa*, *Babyrousa babyrussa*, *Sus celebensis* as an asthma remedy is half cooked. Whereas the use of animals as medicine without being processed cook endangers human health. Wild vertebrates in nature that can be eaten to function as traditional medicine. The use of wild vertebrate meat consumption is motivated by local culture [21].

| No  | Class          | Family      | Local name | Species                   | Part used | Disease treated              |
|-----|----------------|-------------|------------|---------------------------|-----------|------------------------------|
| 1   | Actinopterygii | Anguillidae | Mahapi     | *Anguilla celebesensis*   | Bile      | Allergy itching when cold   |
| 2   | Aves           | Phasianidae | Manu       | *Gallus gallus*           | Egg Yolk  | Heartburn                    |
3.2. Types of Diseases and Traditional Treatment Methods

Based on the results of the study there are 8 types of diseases that can be cured with traditional medicines made from animals (Figure 4). Asthma can be cured using animals *Sus scrofa, Babyrousa babyrussa, Sus celebensis, Macaca tonkeana, Pteropus alecto, and Malayopython reticulatus*. Wild vertebrates in nature that can be eaten to function as traditional medicine. The use of wild vertebrate meat consumption is motivated by local culture [21].

Based on the results of the study there are 6 animal body parts and animal products that can be used as ingredients of traditional medicine. Ethnic Bada uses the whole body, body parts, and animal products as traditional medicinal ingredients such as eggs, liver, bile, fat, and meat. Utilization of body parts based on the type of disease.

| 3 | Clitellata | Megascoleidae | Kalindohi | Pheretima sp | Whole-body | Liver, heartburn, typhus |
|---|---|---|---|---|---|---|
|   | Suidae | Boe | Sus scrofa | Liver | Asthma |
|   | Suidae | Boe | Babyrousa babyrussa | Liver | Asthma |
|   | Suidae | Boe Kakau | Sus celebensis | Liver | Asthma |
| 4 | Mammalia | Viverridae | Hulaku | Viverra tangalunga | Fat | Massage oil, strong medicine |
|   | Mammalia | Cercopithecidae | Oba | Macaca tonkeana | Bile, Liver, Fat | Asthma, Massage oil strong medicine |
|   | Mammalia | Pteropodidae | Paniki | Pteropus alecto | Liver | Asthma |
|   | Mammalia | Phytonidae | Nakonda | Malayopython reticulatus | Bile, Fat | Asthma, Massage oil strong medicine |
| 5 | Reptilia | Gekkonidae | Asa-asar | Hemidactylus frenatus | Whole-body | Heartburn in children |
|   | Reptilia | Varanidae | Kalia | Varanus salvator | Meat | Ageless |

![Figure 4. Number of animal species at the taxon class level](image)

In actinopterygii class, there are *Anguilla celebesensis* that live in the river, the body of the bile eaten raw is believed to be an allergy remedy for itching when cold. In the class of aves, egg yolk *Gallus gallus domesticus* is eaten raw and as a medicine for heartburn. *Gallus gallus domesticus* eggs are also a digestive drug [22] and asthma [23]. *Gallus gallus domesticus* is believed to treat fever [19].

In the class of fat reptiles *Malayopython reticulatus* is used as an oil to treat fatigue to be strong. According to Lopez et.al. (2017) snakes are animals that are commonly used as traditional medicines,
supernatural and can be eaten at the same time [24]. Oil from reptiles is widely sold by traditional medicine traders. The use of *Gekko gecko* is burned and eaten as an eczema medicine. Asa-asa (*Hemidactylus frenatus*) parts of the body are burned, pounded and mixed with water to drink for the purpose of treating internal diseases. The whole body of Asa-asa (*Hemidactylus frenatus*) can also treat coughs [23]. Kalia (*Varanus salvator*) cooked meat and used as a drug for youth. Bada ethnic community consumes Kalia as food and traditional medicine. Reptiles are spiritual animals that are most often used as traditional medicine and are widely traded [19]. Kalia (*Varanus salvator*) and Nakonda (*Malayopython reticulatus*) are used as medicine by Kanayant Dayaks in Kalimantan. The Kanayant Dayak tribe uses wild animals as traditional medicine. Nakonda fat (*Malayopython reticulatus*) is used as a massage oil to treat body aches due to collisions and fatigue. Kalia (*Varanus salvator*) part of the bile is used as a drug for asthma, flu and the bite of poisonous insect animals [25].

![Figure 5. Parts of the body and animal products used as basic ingredients of traditional medicine](image5.png)

![Figure 6. Types of diseases that can be cured using animals](image6.png)

Kalindohi (*Pheretima* sp) the whole body is burned, pounded mixed with water to drink aimed at treating liver pain and heartburn. The use of liver is burned half cooked from animals *Sus scrofa*, *Babyrussa babyrussa*, *Sus celebensis* as an asthma medicine. *Sus scrofa* is used as a leg pain medication due to burns [22]. Oba (*Macaca tonkeana*) bile and raw liver as an asthma medicine. The fat is burned as a massage oil to treat fatigue so that the body is strong. Hulaku (*Viverra tangalunga*) fat is burned and used as massage oil. Paniki (*Pteropus alecto*) part of boiled liver eaten for asthma medication. Paniki is widely sold in the free market for consumption and as traditional medicine. Paniki (*Pteropus alecto*) can treat asthma and hepatitis because it contains steroid compounds (estrone and androsterone), and pyridin-piperidine and also imidazole-framed alkaloids [25]. Animal fat is used for massage oil not only from reptile class animals, but also mammals, namely oba (*Macaca tonkeana*). Burned fat does not use oil by putting it in a cooking pan. Bada ethnic community using raw animal liver and bile as a traditional medicine from *Anguilla celebesensis*, *Malayopython reticulatus* and *Macaca tonkeana*.

### 3.3. Conservation Status

In general, Bada ethnic use animals as traditional medicine are wild animals caught in nature. If exploitation is not controlled it will affect the stability of the existence of these species in nature. Based on the research results, Bada ethnic uses animals as traditional medicine both body parts, products and the whole body of animals included in the list of the protection status of IUCN, Appendix CITES I and II, and Government Regulation (PP) No. P. 106 / MENLHK / SETJEN / KUM.1 / 12/2018 (Table 2). Wild animals in nature are used as traditional medicines and are traded so that they play an important role in the economy [26]. Overuse and trade will damage the stability of the animal population in nature.

| No | Class | Family | Local Species | Conservation status |
|----|-------|--------|----------------|---------------------|

Table 2. Conservation status of animal species used as a traditional medicine
| Name | IUCN | CITES | PERMEN KLHK |
|------|------|-------|-------------|
| Actinopterygii | Mahapi | Anguilla celebesensis | NT | - | - |
| Aves | Phasianidae | Manu | Gallus gallus domesticus | - | - | - |
| Clitellata | Megascoleidae | Kalindohi | Pheretima sp | - | - | - |
| Suidae | Boe | Sus scrofa | LC | - | - |
| | Boe | Babyrousa babyrussa | VU | I | V |
| | Boe | Sus celebensis | NT | - | - |
| Mamalia | Viverridae | Hulaku | Vivera tangalunga | LC | - | - |
| | Cercopithecidae | Oba | Macaca tonkeana | VI | II | V |
| | Pteropodidae | Paniki | Pteropus alecto | LC | II | - |
| | Phytonidae | Nakonda | Malayopython reticulatus | LC | II | - |
| Reptilia | Gekkonidae | Asa-asa | Hemidactylus frenatus | LC | - | - |
| | Toke | Gekko gecko | LC | - | - |
| | Varanidae | Kalia | Varaus salvator | LC | II | - |

Note: Vulnerable (VU), Near Threatened (NT), Least Concern (LC), Appendix I and II.

Ethnic Bada utilize were 5 species included in the CITES I and II appendix list, namely Babyrousa babyrussa, Macaca tonkeana, Pteropus alecto, Malayopython reticulatus, and Varanus salvator [27]. There are 11 species included in the IUCN conservation status list, namely Anguilla celebesensis, Sus scrofa, Babyrousa babyrussa, Sus celebensis, Vivera tangalunga, Macaca tonkeana, Pteropus alecto, Malayopython reticulatus, Hemidactylus frenatus, Gekko gecko, and Varanus salvator [28]. In Government Regulation (PP) No. P. 106 / MENLHK / SETJEN / KUM.1 /12/2018 there are 2 protected species used as a traditional medicinal ingredients namely Babyrousa babyrussa, and Macaca tonkeana [29].

The use of natural resources must be guide by the IUCN, which is according to need and sustainable in accordance with a well-managed local culture [30]. The status of animal protection must be known by the Bada ethnic community through education socialization conducted by the adat leader with the relevant agencies. The ultimate goal is expected that the Bada ethnic community will not over-exploit wild animals so that they will be aware of restrictions on the use and cultivation of animals that will be used as traditional medicine.

4. Conclusions

Based on the results of research, Bada ethnic community still uses animals in traditional medicine. Relationship between animals and bada ethnic community occurs deeply which is influenced by local culture. Traditional medicine is a form of culture. There are 13 species of animals used in traditional medicine. The use of animals includes the entire body, body parts, and products from animals. Parts of the body used are liver, bile, fat, and meat. The animal product used is egg yolk. The use of animals as traditional medicine can be done by giving in the form of food. Utilization of animals as medicine can be done by direct administration (eaten raw) and indirectly (cooked first).

Utilization of animals as traditional medicine can cure eight types of diseases namely asthma, typhus, itching when cold/allergic, eczema and as a massage oil to be strong. Generally, Bada ethnic gets animals as medicine derived from wild animals caught in nature. The use of wild animals in nature as medicine must be restricted in use and prohibited. The status of animal protection must be
delivered through education socialization with the aim that Bada ethnic community be aware of protected species and restrictions on used and conduct of cultivation of the species used.

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References

[1] Sukara E and Tobing I S L 2008 Vis. Vitalis. 1 1-11.
[2] Rintelen K V, Arida E and Hauser C 2017 Res. Ideas Outcomes 3 e20860.
[3] Pusat Data dan Statistik Pendidikan dan Kebudayaan. 2016. Analisis Kearifan Lokal ditinjau Dari Keragaman Budaya. (KEMENDIKBUD R1 : Jakarta).
[4] BAPPENAS 2012 Laporan Akhir Kajian Tahun 2012 Peran Masyarakat Adat Dalam Perumusan Kebijakan Publik (Jakarta: BAPENNANAS)
[5] Mashuri 2011 MEKTEK XIII 1 23-30.
[6] Balai Besar Taman Nasional Lore Lindu 2011. Statistik Balai Besar Taman Nasional Lore Lindu tahun 2010 (Kementerian Kehutanan : Palu).
[7] Munawaroh E, Purwanto Y, Prasetyo H S, Suryanto J and Aijingrum P S 2013 Aspek Biofisik dan Potensi Cagar Biosfer Lore Lindu. Strategi Adaptasi Pengelolaan Sumber Daya Alam Hayati Masyarakat Lokal Di Cagar Biosfer Lore Lindu ed Purwanto Y, Walujo EB, Suryanto J, and Munawaroh E (Bogor : LIPI).
[8] Alves R R N 2012 Ethnobiol. Conserv 1 1-69.
[9] Alves R R N and Souto W M S 2015 Ethnobiol. Conserv. 4 1-13.
[10] Alves R R N, Pinto L C L, Barboza R R D, Souto W M S, Oliveira R E M C C and Vieira W L S 2013 A Global Overview of Carnivores Used in Traditional Medicines. Animal in Traditional Folk Medicine Implications For Conservation ed Alves RRN and Rosa IL (Berlin : Springer).
[11] Pandey A 2015 J Environ. Sci. Toxicol. Food Technol. IOSR-JESTFT 3 48-52.
[12] Magige F J 2015 Tanz. J. Sci. 41 64-71.
[13] Alves R R N, Olivera M G G, Barboza R R D and Lopez L C S 2010 Human. Ecol. Rev. 17 (1) 11-17.
[14] Costa-Neto EM 2005 An. Acad. Bras. Cienc. 77 33-43
[15] Yirga G, Teferi M and Gebresiasse Y 2011 Int. J. Med. Med. Sci. 10 316-320.
[16] Permen LHK RI 2018 Daftar jenis Tumbukan dan Satwa Yang Dilindungi ( Jakarta: Menteri Lingkungan Hidup dan Kehutanan RI).
[17] Tongeo M D 2007 Ethnobot. Res. App. 5 147-158.
[18] Google Earth. 2019. https://www.google.com/earth/ (24 Agustus 2019)
[19] Alves R R N, Vieira W L D S and Santana G G 2008 Biodivers. Conserv. 17 2037-2049.
[20] Alves R R N, Olivera M G G, Barboza R R D, Singh R and Lopez L C S 2009 Forsch. Komplementmed. 16 305-12.
[21] Alves R R N, Olivera T P R, Mediros M F T 2017 Hindawi Evidence-Based Complementary and Alternative Medicine. 17 1-22.
[22] Alves R R N, Barbosa J A A, Santos S L D X, Souto W M S and Barboza R R D 2011 Hind. Pub. 2011 1-15.
[23] Alade GO, Frank A and Ajibesin KK 2018 J. Pharm Pharma Res 6 483-502.
[24] Lopez R G, Villegas A, Coronel N P and Alvarez G G 2017 J Ethnobiol. Ethnomed 13 1-10.
[25] Pilatus, Kartikawati S M and Anwari M S 2017 Jurnal Hutan Lestari 5 858-867.
[26] Soewu DA 2013 Zootheraphy AndBiodiversity Conservation In Nigeria, Animal in Traditio
Folk Medicine Implications For Conservation ed Alves RRn and Rosa IL (Berlin : Springer).

[27] CITES (Convention on International Trade in Endangered Species). 2019. Checklist of CITES Species. http://checklist.cites.org/ (24 Agustus 2019)

[28] IUCN (International Union For Conservation of Nature And Natural Resources). 2019. The IUCN Red List of Threatened Species. http://www.iucnredlist.org (24 Agustus 2019)

[29] Permen LHK RI 2018 Daftar jenis Tumbuhan dan Satwa Yang Dilindungi ( Jakarta: Menteri Lingkungan Hidup dan Kehutanan RI). Alves R R N, Lima H N, Tavares M C, Souto W M S, Barboza R R D and Vasconcellos A. 2008 Biomed. Central. 8 1-9.

[30] Verma A K, Prasad S B, Rongpi T and Arjun J 2014 Int. J. Pharm. Pharm. Sci. 6 593-600.