

Knowledge and Practices of Bush Meat Consumption among Indigenous People in Belum Forest, Malaysia: An Analytical Cross-Sectional Study

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ABSTRACT

Introduction: Orang Asli are the indigenous people of Peninsular Malaysia, and they consume bush meat as a primary source of protein. Frequent contact with wildlife through bush meat hunting for consumption and trade leaves people at risk of zoonotic infection. This study aims to assess the knowledge and practices of the Jahai tribe on the consumption and handling of bush meat. **Methods:** An analytical cross-sectional study was conducted among Jahai adults aged 18 years and above residing in Belum Forest. Due to their semi-nomadic nature of living, convenience sampling was used to select the participants, who were approached at their homes. A questionnaire was used to assess the knowledge and practices relating to bush meat and hygiene. **Results:** The majority of the participants ate bush meat regularly but had poor knowledge about disease transmission. There was a significant association between sex and occupation with knowledge. A significant association was found between knowledge on disease transmission with the consumption of bush meat. There was no association between practice on cooking, hunting activities and handling carcasses and hand hygiene practice with the consumption of bush meat. **Conclusion:** Most Jahai lacked sufficient knowledge on disease transmission and have poor practices regarding the handling of bush meat and its carcasses, which might put them at a risk of infection. The findings can be used as baseline data to develop effective strategies such as cultural-sensitive educational programs, to deepen the understanding of the community on the risk and prevention of developing diseases.

KEYWORDS: Bush meat, Indigenous people, knowledge, practice, hand hygiene

INTRODUCTION

Zoonotic diseases are infectious diseases that are transmissible from animals to humans via both domestic and wild animals. Zoonotic diseases pose a significant public health threat, especially in some African and Asian countries. Frequent contact with wildlife through bush meat hunting for consumption and trade puts humans at risk of infection [1]. Diseases such as Ebola, Marburg virus disease, monkeypox, Brucellosis, rabies, tuberculosis, leptospirosis [2], Nipah virus infection, toxoplasmosis, and salmonellosis are associated with the consumption of bush meat. These diseases, by way of morbidity, mortality and by increasing the cost of healthcare, burden indigenous communities, an already marginalized population. In

Malaysia, studies reported that zoonotic diseases such as West Nile Virus [3], leptospirosis [4], helminthiasis [5], zoonotic malaria [6] etc. are prevalent among indigenous people.

Indigenous people are often neglected by the country's mainstream population, live in poverty, lack access to social services, and are considered as an economically marginalized population [7]. Besides having unique languages, knowledge and beliefs, the indigenous people also have natural living skills, especially in relation with the land and forest. In certain communities, wild animal meat is not only the main source of protein but may have different roles including medicinal [8], cultural [9-11], religious [10] and superstition [8].



Similarly, among some indigenous people in Malaysia, bush meat is the main source of protein. The indigenous people living in peninsular Malaysia are called Orang Asli. As of 2017, the population of Orang Asli in Malaysia is estimated to be about 178,197 individuals, with the state of Pahang harbouring the largest population of Orang Asli, followed by Perak [12]. For convenience, the colonists of Malaya divided the Orang Asli population into three main groups, namely Negrito, Senoi and Proto-Malays, which are again divided into many subgroups, although these groups have different languages, religions, cultures and social practices [7]. Jahai is one sub-ethnic group of Negrito. Most Jahai are nomadic or semi nomadic and are dispersed in the jungles of Perak and Kelantan, two of the 14 states in Malaysia. They move to a new place if someone fell ill, died, or have a quarrel, or else if their community gained new members or they need to search for a new food source [7].

The Jahai living in the Belum forest are mostly hunter gatherers. Bush meat is the most common source of protein for them. Because eating raw contaminated meat [13], drinking contaminated water, blood, or milk products and handling of contaminated meat or carcasses [13] are modes of transmission of zoonotic diseases such as brucellosis, campylobacteriosis, salmonellosis, *Taenia Saginata*, bird flu, rabies etc [14, 15], the Jahai are at higher risk of being infected. They are especially at higher risk of zoonotic diseases considering they are poor, have lower levels of education, and live far from health care centres [9].

Although the Jahai are at higher risk of zoonotic infection due to improper handling of bush meat and poor personal hygiene, no published study was found in relation to bush meat and zoonotic infection among these communities. This study is of interest to policy makers who seek to track and halt the spread of zoonotic diseases before they could mutate into highly infectious strains that could emerge as a pandemic, in the same fashion as SARS, MERS-COV and Ebola in other countries. This study aimed to assess the knowledge of disease transmission and the practice on hand hygiene, hunting and handling of carcasses among the Jahai people. This information will be used to formulate measures to reduce the risk of zoonotic infection among this population.

MATERIALS AND METHODS

Study design and study area

An analytical cross-sectional study was conducted among Jahai adults aged 18 years and above residing in Belum Forest in Malaysia in August 2017. The Jahai are a semi nomadic sub-ethnic Negrito group of the Peninsular Malaysia aborigines termed Orang Asli. The study was conducted in the forest reserve of Belum located in Perak, Malaysia. These communities are dispersed along the man-made Temenggor lake, which supplies water and electricity to nearby communities in Perak. There are approximately 2,000 Jahai living along the lake. A village called Pos Kejar, which is only accessible by an hour's boat ride from the Pulau Banding jetty, was selected as the study location.

Data collection

Due to the arrangement of the Jahai settlements, which are scattered along the lake shore, and their nature of nomadic living, convenience sampling was used to select the participants. First, the Pos Kejar village across Sungai Kejar, Belum Forest was identified. Discussion between a local liaison person who is fluent in both the Jahai and Malay language and the village chieftain was made. Thereafter, the participants were approached at their respective houses. The community were introduced to our team and the purpose of our visit were explained. Good rapport was built and conversation on bush meat was started. Data was collected among the consenting Jahai adults aged 18 years and above using a self-developed questionnaire. The participants were interviewed using the questionnaire. The interviewing process was done systematically and promptly, in the way of storytelling, which made the participants feel comfortable while answering the questions. They were also told to think carefully and answer as honestly as they could.

The self-developed questionnaire was divided into three sections. Section 1 contained items on socio-demographic characteristics. Section 2 contained items related to knowledge, of which a few questions were adapted from Subramaniam et al 2012 [16]. Section 3 contained questions on practice, of which a few questions were adapted from Friant et al 2015 [9]. The



outcome variables were knowledge and practice regarding bush meat and hand hygiene while the independent variables were the socio-demographic variables. In this study, variables on bush meat consumption were defined regularly if the participants consume bush meat for more than three days in a week. Face validity was conducted among few Jahai people to ensure whether they understand the questions, phrases and terminologies that were used. Content validity of the questionnaire was evaluated by a multidisciplinary team of experts in human health, animal health and environment health.

Sample size calculation

The sample size was calculated based on the two proportions. Based on the 55% of awareness on zoonotic infections [9], estimated of 35% awareness in the current study, and power of 80%, the appropriate sample size was 124 participants. Taking into consideration that the non-response rate is estimated to be 20%, the total sample size required was 150 participants.

Statistical analysis

Data were entered in Excel and imported into SPSS Version 21 for analysis. Due to irregularities in the number of missing data, data was analysed based on the complete information for a particular variable. Descriptive statistics was used to describe the participants. For numerical variables such as age, mean and standard deviation were displayed. For categorical variables, frequency and percentages were displayed. The mean score of the total items of knowledge was used as the cut-off point for categorization into good and poor knowledge [17]. Similarly, the mean was used for categorization into good and poor practice.

Chi-square and Fisher Exact Test was used to determine the associations between the independent variables with knowledge and practice status, and between knowledge and practice with the consumption of bush meat. P-values of less than 0.05 were considered as statistically significant.

Ethical approval

Ethical approval was obtained from the Joint Penang Ethics Committee (JPEC No. 17-0041) and the Department of Orang Asli Development (JAKOA). Consent was obtained from all participants of the study. The study was conducted according to the standards of ethics and Declaration of Helsinki.

RESULTS

A total of 102 out of 150 adults that were approached participated in the study, giving a response rate of 68%. Most of the participants were males, married, had informal education, and were working. The mean age of the participants was 29.9 (SD=11.7). The characteristics of the participants are displayed in Table 1.

Most of the participants (81.4%) ate bush meat regularly. Monkeys (77.1%), porcupines (62.6%) and squirrels (46.9%) were the most common meat that the participants consumed. In addition, they also consumed boars, bats, and deer.

Figure 1 shows the knowledge of the participants on modes of transmission and body systems affected due to zoonotic diseases. Most of the participants were unaware that diseases could be transmitted by wild animals. They were also unaware of the modes of transmission of zoonotic diseases and the body systems affected by it. Overall, 74.3% of the participants had poor knowledge of zoonotic disease transmission.

Table 1 Socio-demographic characteristics of the participants (N= 102)

Variables	Frequency (n)	Percentage (%)
<u>Sex</u>		
Men	60	60.0
Women	40	40.0
<u>Marital status</u>		
Single	8	9.0
Married	73	82.0



Separated	1	1.1
Widowed	7	7.9
Education level		
Informal	74	73.3
Primary	20	19.8
Lower secondary	6	5.9
Upper secondary	1	1.0
Employment status		
Working	51	50.0
Not working	21	20.6
Housewife	29	49.0
Occupation		
Hunter	24	24.0
Fishermen	18	18.0
Village work	11	11.0
Boat handlers	2	2.0
Age (Mean ± SD)	29.9 ± 11.7	
Household monthly income, Median (IQR)	100 (IQR: 35-400)	
No. adults in a house, Median (IQR)	2 (IQR: 2-3)	
No. children in a house, Median (IQR)	2 (IQR: 1-4)	

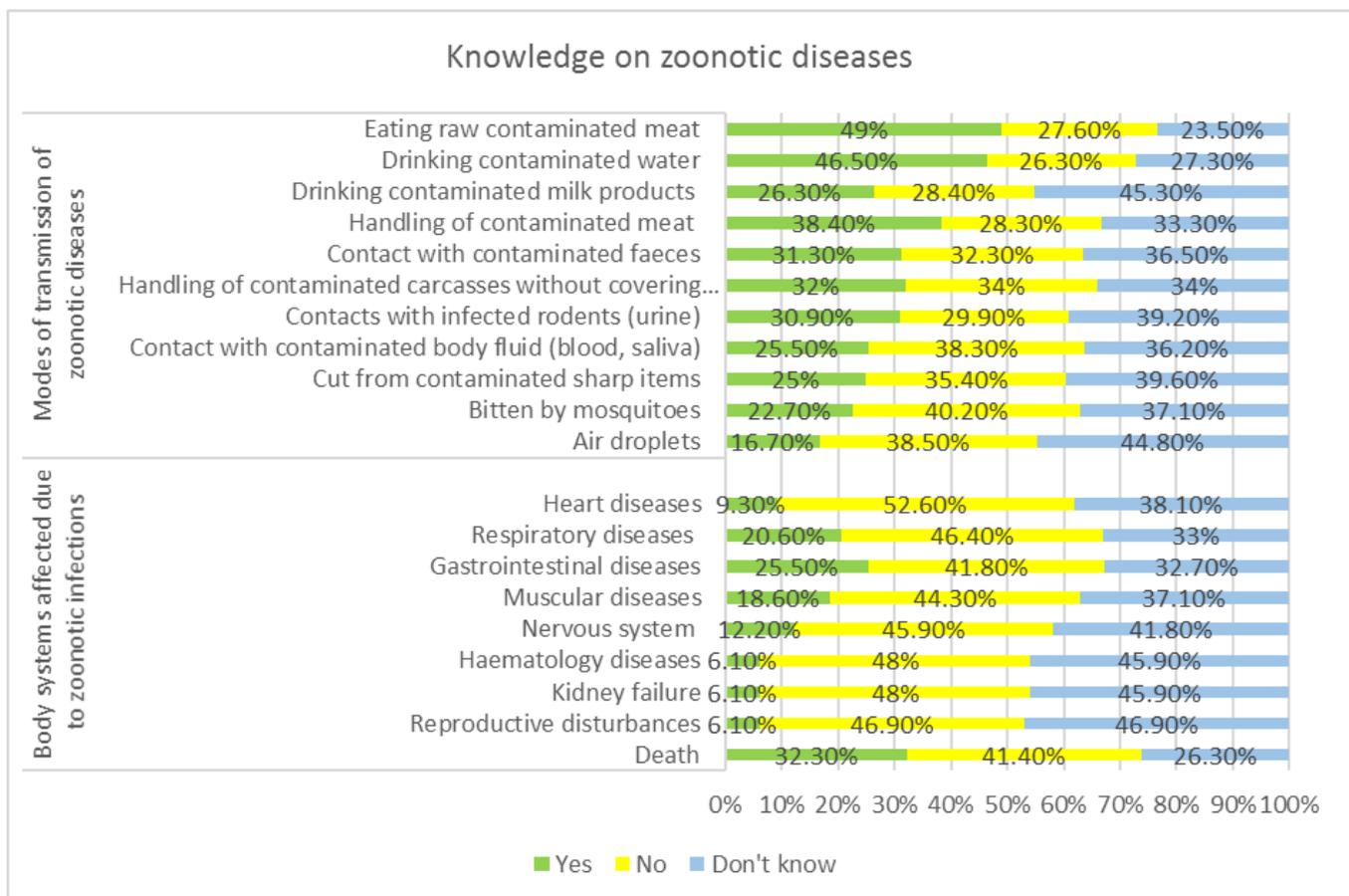


Figure 1 Knowledge of the participants on modes of transmission and body systems affected due to zoonotic diseases



Table 2 shows the practices on hunting activities, handling carcasses and cooking. Although more than half of the participants hunt wild animals for food, most of them do not skin or slaughter any suspected infected animals. Nevertheless, most of them do not use any protective equipment when hunting and handling carcasses. Only a few of them use a barrier when handling the carcasses. Most of the participants cook meat thoroughly and immediately after hunting.

As for hand hygiene practices, most of the participants wash their hands with soap before eating, after using the latrine (70.9%), before preparing a meal and before serving food (Table 3).

Table 4 shows the associations between socio-demographic characteristics with knowledge; practices on cooking, hunting activities and handling carcasses; and hand hygiene practices. There were significant associations between sex and employment status with knowledge on disease transmission. Men were two times more likely to have good knowledge of disease transmission compared to women (OR: 2.41, 95% CI: 1.034-5.63, $p=0.039$). Working adults were three times more likely to have good knowledge compared to those who were not working (OR: 3.13, 95% CI: 1.37-7.16, $p=0.006$). There were also no statistically significant association between socio-demographic characteristics and practice on cooking, hunting activities & handling carcasses and with hand hygiene practices.

Table 2 Practice on hunting activities, handling of carcasses and cooking

Variables	Frequency (n)	Percentage (%)
<u>Hunting activities</u>		
Hunt wild animals		
Yes	59	59.0
No	41	41.0
Injured while butchering		
Yes	8	11.0
No	65	89.0
Skinning of suspected infected animals		
Yes	15	20.5
No	58	79.5
Slaughter any suspected infected animals		
Yes	4	5.5
No	69	94.5
Wearing protective equipment (gloves, boots) when hunting		
Yes	9	13.0
No	60	87.0
<u>Handling of carcasses</u>		
Methods handling animals' carcasses		
Using plastic to cover hands		
Yes	3	4.7
No	61	95.3
Using gloves		
Yes	1	1.6
No	63	98.4
Using stick to move the carcasses		
Yes	25	39.1
No	39	60.9
Using bare hand		
Yes	18	28.6
No	45	71.4
Do with the carcasses		
Bury		
Yes	31	44.3
No	39	55.7



Burn		
Yes	14	20.0
No	56	80.0
Throw in a secured packed plastic		
Yes	1	1.4
No	69	98.6
Throw randomly		
Yes	2	2.9
No	68	97.1
Leave it as it is		
Yes	28	40.0
No	42	60.0
Substance when bury/burn/throw the carcasses		
Salt	3	3.0
Leaves	7	7.0
None	51	51.0
Wear protective clothing (gloves, boots) when handling carcasses		
Yes	7	10.6
No	59	89.4
Cooking		
Cook bush meat thoroughly		
Yes	80	96.4
No	3	3.6
Time cooking the meat after hunting		
Immediately	64	76.2
Within less than 3 hours	11	13.1
Between 3 hours to 8 hours	7	8.3
Keep overnight	1	2.4
Ways of preservation of bush meat		
Keep as it is	65	78.3
Smoking	11	13.3
Salting	1	1.2
Others	6	7.2

Table 3 Practices on hand hygiene

Variables	Frequency (n)	Percentage (%)
Wash hands		
Yes	78	78.8
No	21	21.2
Wash hands with soap before eating		
Yes	54	65.9
No	28	34.1
Wash hands with soap after using toilet/latrine		
Yes	56	70.9
No	23	29.1
Wash hands with soap before preparing a meal		
Yes	59	72.8
No	22	27.2
Wash hands with soap before serving the meal		
Yes	55	67.9
No	26	32.1
Wash hands after contact with a pet		
Yes	48	48.5
No	51	51.5



Table 4 Associations between socio-demographic characteristics with knowledge; practices on cooking, hunting activities and handling carcasses; and hand hygiene practices

Socio-demographic characteristics	Knowledge				Practices on cooking, hunting & handling carcasses				Practices on hand hygiene			
	Good	Poor	OR	P-value	Good	Poor	OR	P-value	Good	Poor	OR	P-value
	n(%)	n(%)	(95% CI)		n(%)	n(%)	(95% CI)		n(%)	n(%)	(95% CI)	
<u>Sex</u>												
Male	30 (71.4)	29 (50.9)	2.41 (1.04-5.63)	0.039*	33 (75.0)	12 (66.7)	1.13 (0.77-1.68)	0.541	25 (56.8)	15 (60.0)	0.88 (0.32-2.38)	0.807
Female	12 (28.6)	28 (49.1)			11 (25.0)	6 (33.3)			19 (43.2)	10 (40.0)		
<u>Education level</u>												
Informal	29 (69.0)	45 (77.6)	0.64 (0.26-1.58)	0.337	35 (79.5)	12 (70.6)	1.16 (0.76-1.77)	0.506	30 (66.7)	18 (72.0)	0.78 (0.27-2.27)	0.790
Others	13 (31.0)	13 (22.4)			9 (20.5)	5 (29.4)			15 (33.3)	7 (28.0)		
<u>Marital status</u>												
Married	30 (81.1)	42 (95.5)	0.20 (0.04-1.05)	0.072	32 (88.9)	12 (85.7)	1.09 (0.60-1.98)	1.000	37 (94.9)	12 (75.0)	6.17 (1.00-37.98)	0.053
Others	7 (18.9)	2 (4.5)			4 (11.1)	2 (14.3)			5 (5.1)	4 (25.0)		
<u>Employment status</u>												
Working	28 (66.7)	23 (39.0)	3.13 (1.37-7.16)	0.006**	28 (63.6)	9 (50.0)	1.18 (0.84-1.67)	0.397	24 (53.3)	12 (48.0)	1.24 (0.47-3.29)	0.804
Others	14 (33.3)	36 (61.0)			16 (36.4)	9 (50.0)			21 (46.7)	13 (52.0)		

* Significant at p<0.05

** Significant at p<0.001



There was a statistically significant association between knowledge of disease transmission and consumption of bush meat. The participants who had poor knowledge of zoonotic diseases were more likely to consume bush meat than those who had good knowledge (OR: 3.44, 95% CI: 1.23-9.67, $p=0.024$).

There was no significant association between practice on hunting and handling carcasses (OR: 1.11, 95% CI: 0.26-4.77, $p=1.000$) and hand hygiene practice (OR: 0.421, 95% CI: 0.106-1.683, $p=0.350$) with the consumption of bush meat (Table 5).

Table 5 Association between knowledge of disease transmission, hand hygiene practice and practice on hunting and handling carcasses with the consumption of bush meat

	Consumption of bush meat		Total	OR (95% CI)	P-value
	Yes n (%)	No n (%)			
<u>Knowledge</u>					
Poor	62 (75.6)	9 (47.4)	71	3.44	0.024*
Good	20 (24.4)	10 (52.6)	30	(1.23-9.67)	
<u>Practice on cooking, hunting activities & handling of carcasses</u>					
Poor	15 (29.4)	3 (27.3)	18	1.11	1.000
Good	36 (76.0)	8 (72.7)	44	(0.26-4.77)	
<u>Hand hygiene practice</u>					
Poor	22 (39.3)	3 (21.4)	25	1.16	0.350
Good	34 (60.7)	11 (78.6)	45	(0.93-1.45)	

DISCUSSION

This study assessed the consumption of bush meat among the Jahai, Orang Asli living in the Belum Forest in Malaysia. The findings of this study showed that most of the participants ate bush meat regularly but had poor knowledge of disease transmission. There were significant associations between sex and occupation with knowledge. Significant association was also found between knowledge of disease transmission with consumption of bush meat.

In general, the consumption of bush meat is associated with hunting, which is a pivotal activity in the life of aboriginal communities worldwide, and the Orang Asli in Malaysia are no different. Bush meat serves as the main source of food for this population, especially when livestock is limited due to inaccessibility and high cost. Trading in bush meat also supplements the meagre income of these communities. The majority of the participants in this study consumed bush meat as a staple. The result of this study is in line with studies carried out by Bolton JM [18], Lebreton M [19] and Subramaniam M [16]. In a latter study, most of

the participants reported that hunting bush meat was for consumption and trade. In one study [20], it was reported that the reasons for hunting wild animals were for food, in particular as a source of protein; protecting crops, supplementing their income, medicinal purpose, ceremonial and cultural purposes and as a social activity to demonstrate the skills that the hunter has attained. The similarities are because the Jahai community still relies largely on bush meat as one of their primary sources of food because their very low income means that conventional grocery is unaffordable to them.

This study found that monkey was the most common bush meat consumed by this community. This preference may be because monkeys are large bodied animals or because they are abundant and could be easily hunted. Similar observations were found in a study conducted in a Philippine forest reserve [21] which also reported that animals with large amount of meat and high monetary value were preferred. Nevertheless, the community also preferred eating small-bodied animals such as porcupines and squirrels.



This is in line with the findings of another study conducted in the same population in Belum forest [22]. The similarities could be because these animals could easily be hunted using just blowpipes compared to other animals that may require heavier or more advanced tools.

The majority of the participants in this study lacked knowledge on transmission of diseases from animals to humans. Similar results were also reported by studies conducted elsewhere [23, 24]. Nevertheless, men and working adults were found to have better knowledge of transmission of disease compared to women and non-working adults. Similarly, in another study, it was reported that the pattern of consumption of bush meat was affected by the knowledge that one has of disease transmission [25]. Supporting our findings, a study done in Southwest region of Cameroon also reported a correlation between gender and awareness on zoonotic diseases [10]. Men have better knowledge compared to women probably because of their direct involvement in the hunting and the knowledge that they gained while observing their surroundings in the hunt. Studies also showed that communities that reside in a zoonotic disease hotspot were more aware that animals can transmit diseases to human [26].

Some communities expressed more concern towards the preparation and consumption of bush meat out of respect of their cultural beliefs [13]. As an example, pregnant women are advised not to eat certain types of bush meat such as porcupines, gibbons and flying squirrel because they may cause illness [22].

The finding of this study does not agree with that of Subramaniam which did not find any significant association between gender and knowledge of disease transmission, which may be explained by their small sample size. In one study that assessed the traditional knowledge of forest amongst the Orang Asli in Peninsular Malaysia, the community was found to have the highest score of knowledge relating to forest, lakes and rivers [27] but only a quarter of them were reported to have knowledge of wild life.

A study on the consumption of bush meat during the Ebola crisis found that household income and health risk influence bush meat consumption [25]; with increased perceived risk to health and increased price of

the meat reduce said consumption. Similar findings were observed among rural African villagers [19]. The study suggested that high risk activities such as butchering are avoided when the community perceived that there was risk of getting infected. Communities believed that zoonotic diseases can be avoided by cautious preparation and thorough cooking of bush meat [28].

It was reported that the consumption of and preference for bush meat were influenced by economic and cultural factors [29] including cultural identity. Cultural factors remain one of the main reasons of bush meat consumption, in reference to a rite of passage for men, the transition from adolescence to adulthood. The older generations are also more bounded with cultural factors than the younger ones and are more inclined to participate in the hunting and consumption of bush meat.

In a recent review on the risk of zoonotic infection and wild meat trade, 51 zoonotic pathogen which may pose a public health threat was identified. These pathogens could affect the health of individuals who were involved in the hunting, butchering and consumption of bush meat [30]. It was noted that those handling the carcasses of animal were especially at risk due to the direct contact with blood and secretions while those involved in hunting activity posed medium risk of infection. It was noted that those involved in the slaughtering of the bush meat have the highest risk of contracting zoonotic disease [31]. The current study demonstrated that most members of a hunting community do not hunt, nor skin animals deemed to be sick; instead, the sick animal and carcasses are left untouched. This demonstrates that the community was aware that sick animals may pose a risk of infection to human.

No study had evaluated the association between the practice of hunting and handling meat with the consumption of bush meat. In the current study, the majority of the community had good practice of hunting and handling meat, but no association was found with the consumption of bush meat.

It is equally important to note that most of the participants in this study was found to have good hand hygiene. Similar findings were observed in one study



conducted in Hong Kong where most members of the community were reported to practice good hand hygiene [32]. Good hand hygiene is essential to mitigate the risk of zoonotic disease transmission. Nevertheless, most of the participants do not wash using soap due to socio-economic barrier which hinders them from purchasing soaps. Similar observations were reported in a study that evaluated handwashing programme in remote aboriginal communities in Australia [33].

Since bush meat is the main source of protein for these communities, they should be educated on the dangers of zoonotic infections and on measures to prevent these infections. As the community of the Orang Asli are highly dependent on animals and the environment, this study highlights the need of using interdisciplinary approach to better understand the situation of Orang Asli. The data and observations collected could be used as a baseline to develop effective strategies such as culturally sensitive educational programmes to deepen the understanding in the community of the mode of transmission and risk of developing diseases, as well as collaboratively engaging the community in future social programmes.

Strength & limitations

This study is unique in being the only one to investigate the association between knowledge and practice of the Orang Asli with regards to the consumption and handling of bush meat in Malaysia. Nevertheless, the study also has limitations. The data obtained in this study was self-reported, although since the variables were meant to assess the participants' knowledge and practice, this factor may not have incurred any bias. Moreover, the participants were instructed to answer each question as honestly as possible. While it is best to select the study participants using a probabilistic sampling, a convenience sampling was chosen due to the seminomadic nature of Orang Asli and the absence of a sampling frame for this population. The findings can only be generalized for aboriginal communities living in the forest. Thus, the findings of this study should be interpreted with caution.

CONCLUSION

This study aimed to assess the knowledge and practices of the Jahai tribe on the consumption and handling of bush meat. Significant associations were observed between sex and occupation with knowledge of disease transmission, and subsequently with consumption of bush meat. Even though the majority of the Jahai eat bush meat as a staple, most of them still lack knowledge of disease transmission and have poor practices regarding the handling of bush meat and its carcasses. Since bush meat is the main source of protein among this marginalized community, it is highly imperative that the community be educated on the risk of contracting zoonotic diseases and preventive measures to reduce the risk of infection, such as safe hunting, butchering, handling, and preparation of bush meat.

Recommendations

Health promotion programmes should be conducted periodically, preferably every six months, to reinforce the participants' knowledge of disease transmission and improve their practices toward reducing their risk of contracting diseases. Audio-visual elements and hands-on sessions should be incorporated into the programme to promote engagement in the activity and improve their level of understanding.

Conflict of interest

Authors declare none.

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