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Evaluating the Public Knowledge on the Use of Endangered Species in Producing Traditional Medicines

The Endangered Species Traditional Medicines project team

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This study was conducted by project team of students from University of Hong Kong, and Japan Wildlife Conservation Society (JWCS) which is a non-profit organization located in Tokyo, Japan. While the survey in Japan has been completed thanks to all supports by people related Universities, we could not obtain much answers than we expected in Hong Kong and Macau due to the COVID-19. JWCS accomplished a statistical analysis and summary of the results on behalf of the students who graduated without getting this research done satisfactorily because of university closures. The collaboration of this research ended incompletely, we strongly hope, however, that the international cooperation system will be maintained so that they are able to liberally conduct research activities, with concerns about the future of Hong Kong.

[Summary]

A questionnaire survey was conducted to university students in Japan and Hong Kong/Macau (i.e. high educated students) regarding endangered species used in traditional medicines. We found that respondents from both areas considered traditional medicine to be necessary, and indeed had use experience. They had negative thought about the use of endangered species however, at the same time, they did not care about presence/absent of endangered species in traditional medicines they take. In other words, there was little interest and awareness about the ingredients of the traditional medicines used and/or the use of endangered species. Most respondents also supported the use of alternatives to endangered species. On the other hand, even though respondents from Hong Kong/Macau were more aware of the endangered species used in traditional medicine, they were more in favor of the use of endangered species than respondents from Japan. Given this result in terms of reducing the demand for endangered species, it is likely that the respondents of the survey would avoid medicines containing the endangered species if they have information on the presence of endangered species and its alternatives in traditional medicine.

JAPAN WILDLIFE CONSERVATION SOCIETY

Introduction

Since ancient times, various animals and plants have been used as ingredients for traditional medicines. Because these uses have led many species extinction or endangered, change in our behavior is needed. Young people, the next generation of consumers, are said to have strong interest in environmental issues, thus the demand for these traditional medicines may differ across ages. For wildlife conservation aspect, it is essential to follow changes in demand and consumption. In this study, we surveyed and analyzed the awareness of this theme among university students (high educated students) in Japan, Hong Kong/Macau.

Materials and methods

1. Respondents

We created a website for questionnaire including explanation in English, Japanese, and Chinese, which could make it possible for a respondent to send the answer form anonymously. The website could be accessed from a personal computer or mobile phone. The student research group from the University of Hong Kong explained the purpose of the questionnaire to respondents and called for an answer directly at Teikyo University of Science and Kokugakuin University from January 7th, 2020 to January 10th, 2020, and on online at Rakuno Gakuen University. Collecting responses in Japan was conducted from December 19th, 2019 to January 15th, 2020. The respondents were students belonging to Kokugakuin University, Teikyo University of Science, Rikkyo University, Rakuno Gakuen University, and Japan Youth Biodiversity Network. In Hong Kong/Macau, we collected responses in the similar way but online such as email and SNS from November 8th, 2019 to February 29th, 2020.

2. Questionnaire item

Place of origin, age, and sex were given as individual information. So as to know use situation of traditional medicines/endangered species, following questions were asked: 1) Use experience of traditional medicines, 2) use experience of endangered species in traditional medicines, 3) image which age group respondent thinks uses endangered species in traditional medicines the most, 4) species that respondent or family member has used in traditional medicines, 5) species which respondent is aware of used in traditional medicines. Respondents answered the last two questions (i.e. 4 and 5) using species list we provided (see below). As attitude survey, 6) necessity of traditional medicines, 7) necessity of endangered species in traditional medicines, and 8) attitude of alternative use to endangered species in traditional medicines, were on the

questionnaire (see Appendix).

The fourteen species in our list have been registered in Appendix I and also used for traditional medicines. These species were grouped into three: A) species in CITES Appendix II (international trade is allowed only under permission), B) species in CITES Appendix I (international trade is not allowed), C) species being used in specific area as traditional medicines.

A) Appendix II

This group includes bear (*Ursidae spp*.), musk deer (*Moschus spp.*), saiga antelope (*Saiga tatarica*), seahorse (*Hippocampus spp.*), tokay gecko (*Gekko gecko*). All bear species are listed in Appendix II with exception of Asia bear and some population of brown bear listed in Appendix I. An export permit issued by the Management Authorities in the export country is required, with the advice that export will not threaten the species in order to import these species from the Scientific Authorities in the export country.

Bear bile is used in medicines for digestive system. Researchers in University of Okayama in Japan identified the principal ingredient of bear bile called ursodeoxycholic acid. This active ingredient has chemically synthesized and sold for over-the-counter drug (OTC, Yoshiyuki 2020). Although Watanabe *et al*. (2009) found cow bile has the same medical effect as bear bile does, 86 medicines containing bear bile were still listed in "Japan pharmaceutical data book: over-the-counter drug" (October 2018 version) by Jiho Inc. Secretion from musk gland of musk deer located at abdomen is called "musk" and used for medical or aroma chemical purpose. All musk deer families are listed as Appendix II and even Appendix I for some population of them. Yamada Pharmaceutical Co., Ltd. (provisional translation) remade a medicine which does not contain musk due to the difficulty to get (Yamada Pharmaceutical Co., Ltd. 2015). Horn from saiga antelope is used in OTCs and one of them are also seen in television commercial. Sea horse is used in commercially available nutritional drink. Tokay gecko was listed as Appendix II on December 26th 2019.

B) Appendix I

Rhinoceros (*Rhinocerotidae spp.*), tiger (*Panthera tigris*), leopard (*Panthera pardus*), lion (*Panthera leo*), elephant (*Elephantidae*), pangolin (*Manis spp.)*, and totoaba (*Totoaba macdonaldi*) are into this group. Since international trade are not generally allowed for species in Appendix I, medicine made out of these species is illegal unless it is from stock before the regulation.

Importation of rhino's horn has been prohibited since Japan joined CITES in 1980. Therefore, some pharmaceutical companies have used saiga's horn as an alternative which is believed to be the same effectiveness (TRAFFIC 2016). Although liquor preserving tiger's bone had used as a tonic medicine, due to the decreased population of tiger, it is considered that demand for other large cat species have increased (EIA 2020, TRAFFIC 2015). Pangolin has been listed as Appendix I since January 2nd, 2017. Finally, totoaba is used as medical luxury food.

C) Species being used in specific area as traditional medicines

This group includes Japanese pond turtle (*Mauremys japonica*) and slow loris (*Nycticebus spp.*). Japanese pond turtle was listed as Appendix II in June 12th 2013 and the exporting has been prohibited because approximately 28,000 individuals were applied for shipping from 2nd August, 2015 to 13th September, 2015 (Ministry of the Environment 2015). Destination for export of the pond turtle is mainly the main land of China and Hong Kong. Slow loris is believed to be effective in postpartum recovery, sexually transmitted diseases, and asthma in Cambodia and Vietnam. But the use is limited in specific areas (JWCS 2010).

We showed these species that are actually used in traditional medicines and asked the survey respondents if they had used them or if they were aware that they are used as traditional medicine ingredients.

Table 1. Example of medicines containing endangered species in our list and its medical effect

Category	Species	Medicine name	Medicinal effect	Body part	Effect of active ingredient	Ref.
A	Bear	ウチダの熊胆, 紀伊国屋ユウタン, 救胆 etc.	digective system	bile	stomachic and choleretic actions	1
A	Bear	永春丸, 延壽麝龍散, 延命一心丸 etc.	circulatory system	bile	stomachic and choleretic actions	1
A	Bear	延寿太陽丸, 奥田胃腸薬L, 丸剤熊膽圓S etc.	digective system	bile	stomachic and choleretic actions	1
A	Musk deer	新大宝心, 心薬, 精改心 etc.	circulatory system	musk gland	overactive cardiac	1, 2
A	Musk deer	特撰金粒樋屋奇応丸	neuropsychiatric	musk gland	hypercardiac, hypotensive, male hormone-like, anti-inflammatory actions	1, 2
A	Musk deer	日野実母散	gynecologic	musk gland	hypercardiac, hypotensive, male hormone-like, anti-inflammatory actions	1, 2
A	Saiga antelope	いけだや牛黄麝龍圓	circulatory system	horn	central nervous system depressive, antipyretic, analgesic actions	1, 2
A	Saiga antelope	宇津救命丸, キンキ奇応丸, 五黄圓 etc.	neuropsychiatric	horn	central nervous system depressive, antipyretic, analgesic actions	1, 2
A	Saiga antelope	日水清心丸, 馬場安寿丸, 能活精 etc.	analeptic	horn	central nervous system depressive, antipyretic, analgesic actions	1, 2
A	Sea horse	春源精, 新ロクジュウオウA, 日水補腎片 etc.	analeptic	whole	male hormone-like action	1, 2
A	Tokay gecko	秦皇元（カプセル）, 新ロクジュウオウA	analeptic	whole	androgenic action	1, 2
B	Rhinoceros	赤井筒薬小児六神丸, 岡平小児感應丸	circulatory system	horn	cardiotonic, vasopressor actions	1, 2
B	Rhinoceros	救寿, 救命散, 済仁, 和平六神丸	circulatory system	horn	cardiotonic, vasopressor actions	1, 2
B	Tiger	腎白金, 硬十天, 速勃延时片 etc.	-	bone	anti-inflammatory, analgesic actions	1, 2
B	Leopard	健歩強身丸	-	bone	-	3
B	Lion	-	-	bone	-	3
B	Elephant	-	-	ivory	-	3
B	Pangolin	七草五毒膏,炮山甲　美国魔根	-	scale	rheumatism, arthralgia, tumour, hypogalactia	2, 3
B	Totoaba	-	-	air bladder	-	-
C	Japanese pond turtle	-	-	lower shell	-	4
C	Slow loris	-	-	whole	postpartum recovery, sexually transmitted disease, asthma	5

1) Japanese Pharmaceuticals DB , 2) Institute of Natural Medicine ETHMEDmmm, 3) Japan Customs, 4) the Ministry of the Environment 2015, 5) JWCS 2010, "-" means no infromarion available

Results

1. Respondent attributes

798 valid responses were collected, which of 44 were from people from main land of China, 176 were from Hong Kong/Macau, 533 were from Japan and 45 were from other areas. We used data only of people from Hong Kong/Macau and Japan since we did not have enough data from main land of China and other areas to analyze. The mean ages of respondents were 21.6 from Hong Kong/Macau, 20.4 from Japan. Ratio of male to female were 38:61 from Hong Kong/Macau, 51:49 from Japan (Fig. 1).

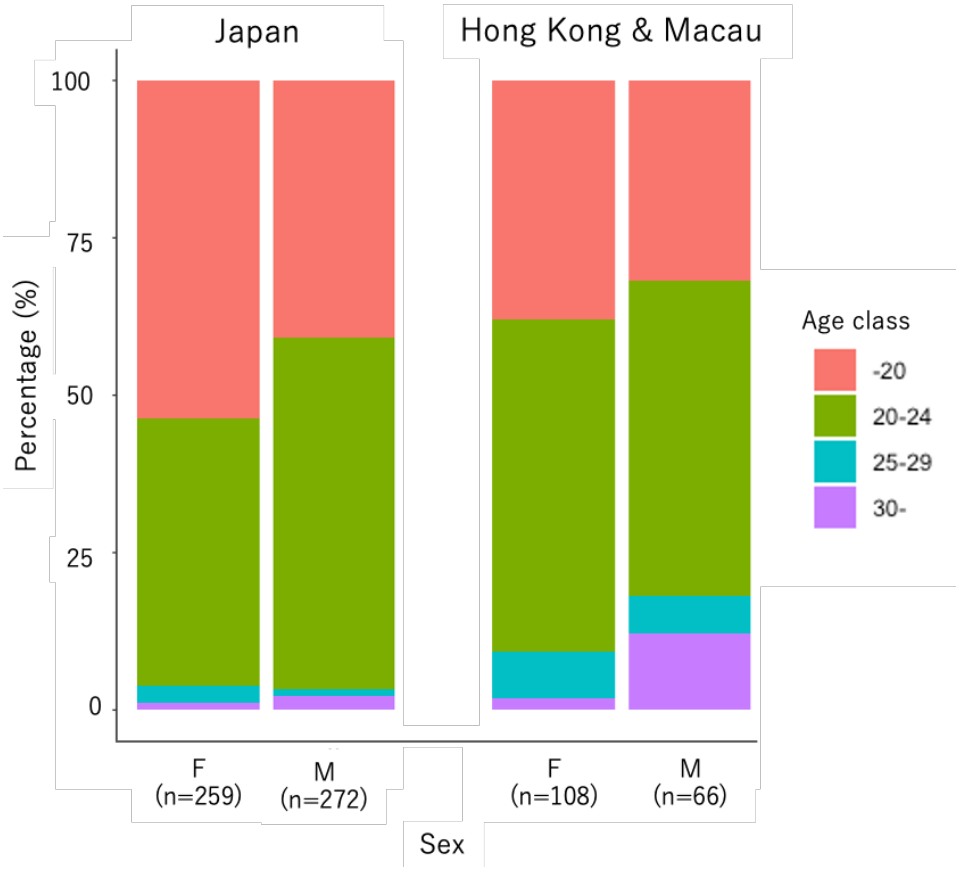

Figure1. Respondent attributes

2. Use experience of traditional medicines

There were 485 responses as “I have used traditional medicines”, 224 responses as “Never used or do not remember” in total. We found significant difference only between sex from Hong Kong/Macau which responded as “Never used or do not remember” ($p<0.01$, $X=10.9$). In other word, women respondents had not used traditional medicines more than men respondents had (Fig. 2).

Note: we pooled “Yes, within the past year”, “Yes, before the past year” and “Yes, more than once”, and “Never used” and “do not remember” due to mistranslation in the question about use frequency (i.e. we divided them into use experience; whether they have used traditional medicines before, see appendix).

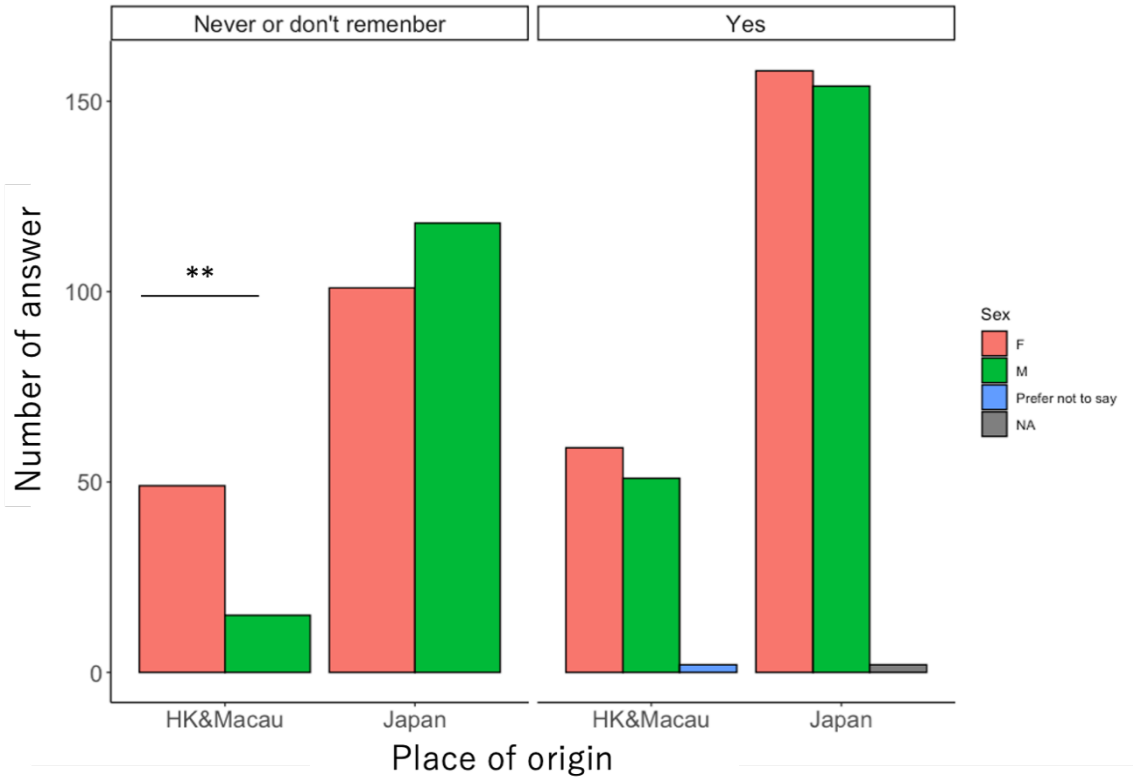

Figure 2. Use experience of traditional medicines according to sex and place of origin

3. Use of endangered species in traditional medicines

We collected the most responses “Unsure” to the question whether they had ever taken endangered species in traditional medicines. However, responses “Yes I have” were rare (Fig. 3). It seems they do not care about the presence of endangered species in traditional medicines. Surprisingly, All Japanese respondents answered that they had never taken endangered species in traditional medicines.

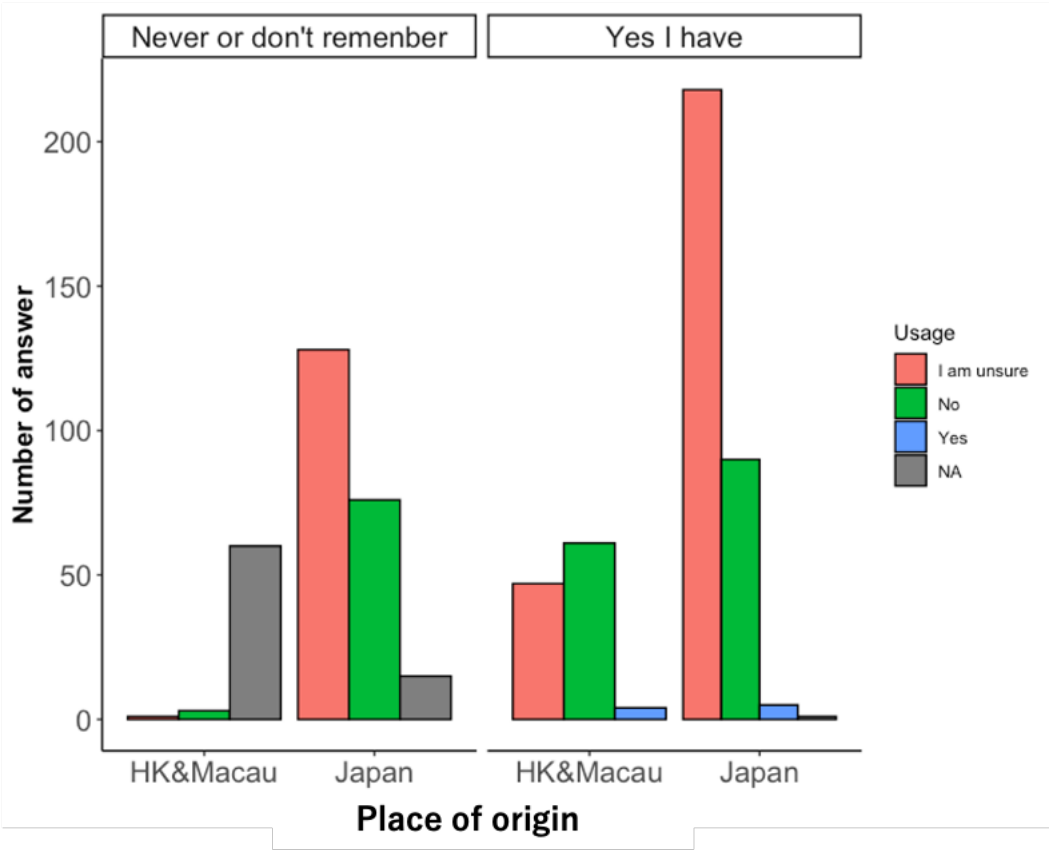

Figure 3. Use experience of endangered species according to place of origin and use experience of traditional medicines

4. Recognition of endangered species in traditional medicines

We showed the species list to respondents and asked whether they had taken any of them. Seahorse was the one they had taken the most then followed by bear, musk deer, rhino and tokay gecko. However, no one had taken lion, leopard and totoaba in traditional medicines (Table 2). We could find a slight difference in the percentages among areas. For example, bear is the most consumed species for Japanese, but seahorse is for Hong Kong/Macau with much larger occupancy.

Table 2. Percentage of species which the respondents had taken in traditional

Rank	All		Japan		Hong Kong/Macau	
	Species	%	Species	%	Species	%
1	Seahorse	4.9	Bear	4.7	Seahorse	14.8
2	Bear	4.8	Rhino	1.7	Bear	5.1
3	Musk deer	1.7	Seahorse	1.7	Musk deer	4.0
4	Rhino	1.4	Tokey gecko	1.3	Pangolin	1.7
5	Tokay gecko	1.1	Musk deer	0.9	Rhino	0.6
6	Elephant	0.6	Elephant	0.8	Japanese pond turtle	0.6
7	Japanese pond turtle	0.6	Japanese pond turtle	0.6	Tokay gecko	0.6
8	Pangolin	0.4	Tiger	0.4	Slowloris	0.6
9	Tiger	0.3	Slowloris	0.2	Saiga antelope	0.6
10	Slowloris	0.3	Saiga antelope	0.2	Tiger	0.0
11	Saiga antelope	0.3	Pangolin	0.0	Elephant	0.0
12	Totoaba	0.0	Totoaba	0.0	Totoaba	0.0
13	Leopard	0.0	Leopard	0.0	Leopard	0.0
14	Lion	0.0	Lion	0.0	Lion	0.0

We also showed the same list and asked species they know as used in traditional species. 162 respondents did not have any recognition of all species in the list. Rhino had the most recognition at 36.8%, followed by bear, seahorse and elephant. To the contrary, totoaba had the least recognition, followed by slow Loris, lion and leopard (Fig. 4). Species with a high percentage of respondents who answered they had used them in traditional medicines were relatively well-known. Compared the recognition proportions of endangered species generally used in traditional medicines by region of origins, all recognitions were higher in Hong Kong /Macau (Fig. 4). The endangered species used as traditional medicine ingredients were more well known by people from Hong Kong/Macau than in Japan.

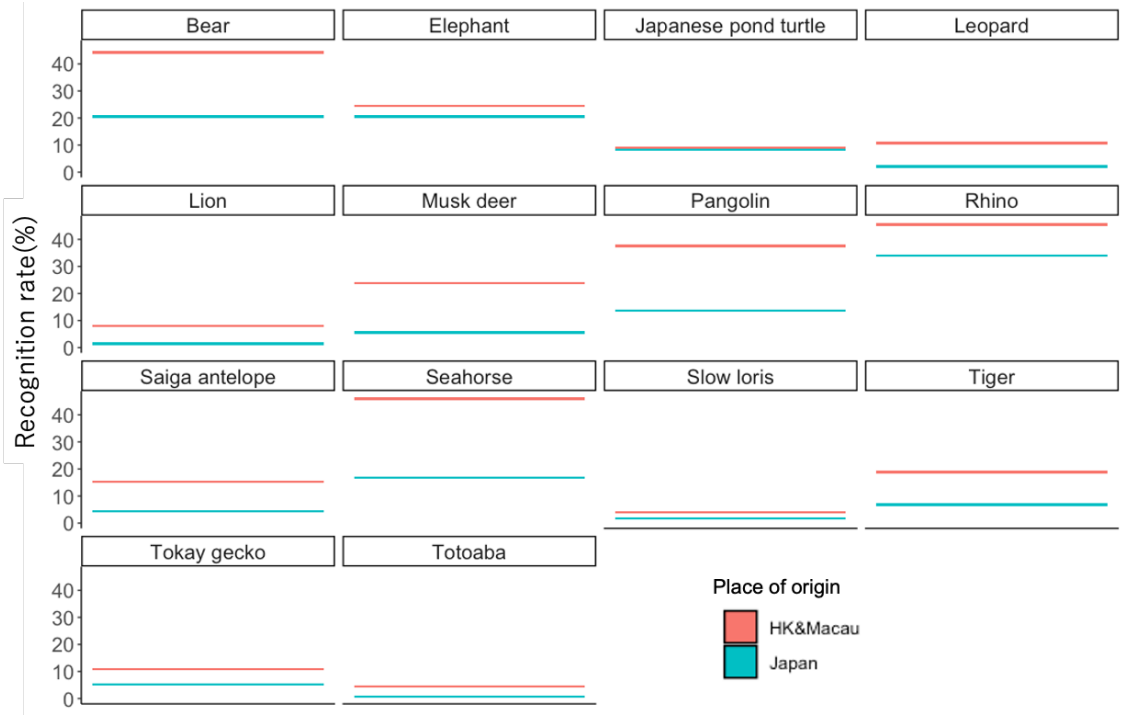

Figure 4. Recognition rates per endangered species in traditional medicines according to regions of origin

5. Image toward people using traditional medicines

The age group that respondents assume they use traditional medicines is those over 60 years old in both countries. Many respondents had the image that they would be used by elderly (Fig. 5).

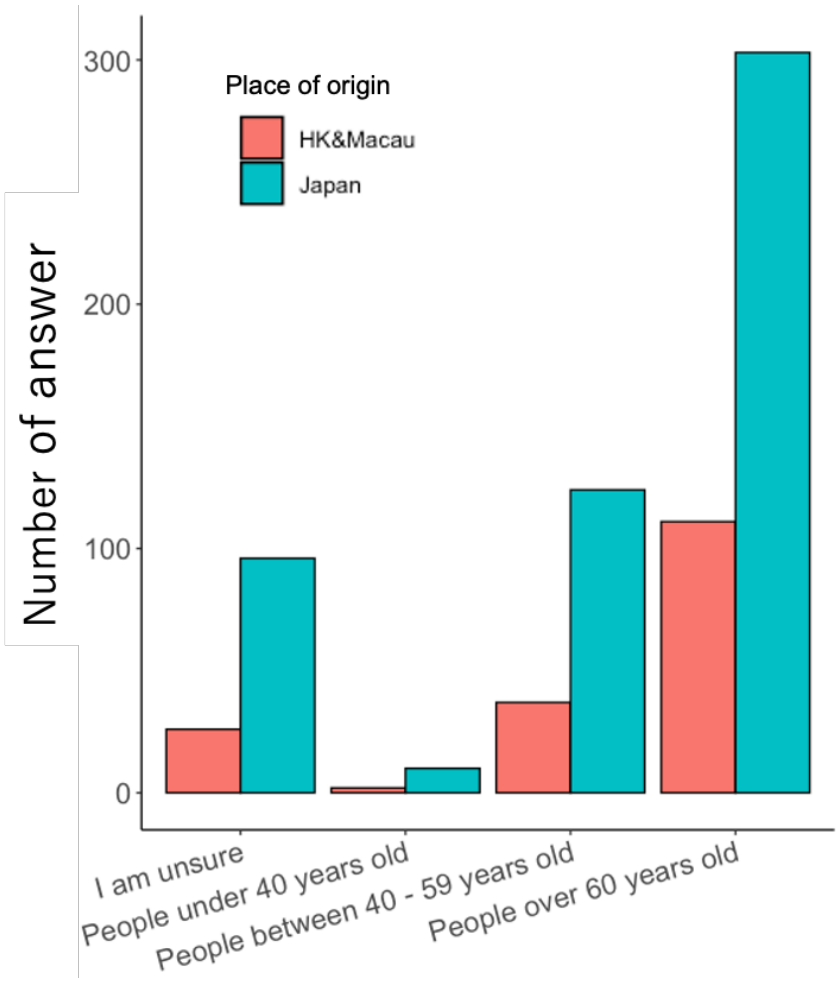

Figure 5. Image of age group who uses traditional medicines

6. Attitudes toward traditional medicines

We took three questionnaires on attitudes toward traditional medicines/endangered species uses. First, we asked unnecessity of the medicines. Most of them disagreed to "traditional medicines are unnecessary" and we did not find difference between the countries (Fig. 6a). But Japanese responses which disagreed to "endangered species are vital to traditional medicines" were the majority more than Hong Kong/Macau's (Fig. 6b). Finally, a lot of respondents answered that chemical alternatives to endangered species should be used in both regions (Fig. 6c).

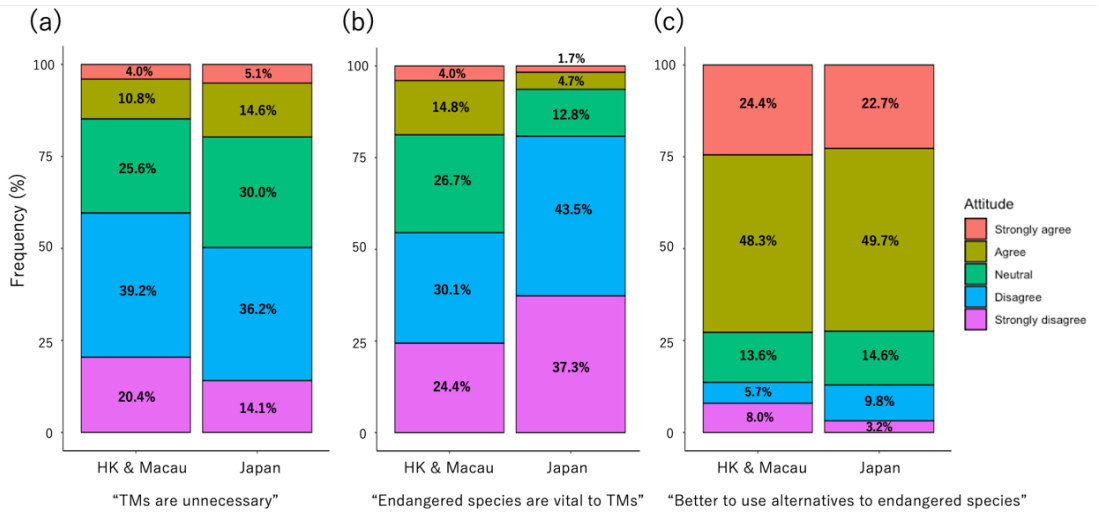

Figure 6. Attitudes toward traditional medicines by place of origin. Attitudes toward "TMs are unnecessary" (a), "Endangered species are vital to TMs" (b), "Better to use alternatives to endangered species"

We also analyzed how differ the attitudes by the use experiences because we predicted the experience could affect the attitude toward necessity of traditional medicines and the alternative use to endangered species. First, there was significantly different in the attitude to the necessity by the experience (GLM, disagree: $p<0.01$, Strongly disagree: $p<0.001$, Fig. 7a). Most of the respondents who had used traditional medicines agreed to necessity of traditional medicines. However, the respondents who had never used were mostly neutral. Second, regarding the need for endangered species in traditional medicine there was no statistical difference between the experiences, with much disagreement with the need for endangered species (Fig. 7b). Lastly, regarding the alternative use to endangered species, "it is better to use alternatives to endangered species" was answers the most but people who had never used significantly agreed (GLM, $p <0.05$, Figure 7c).

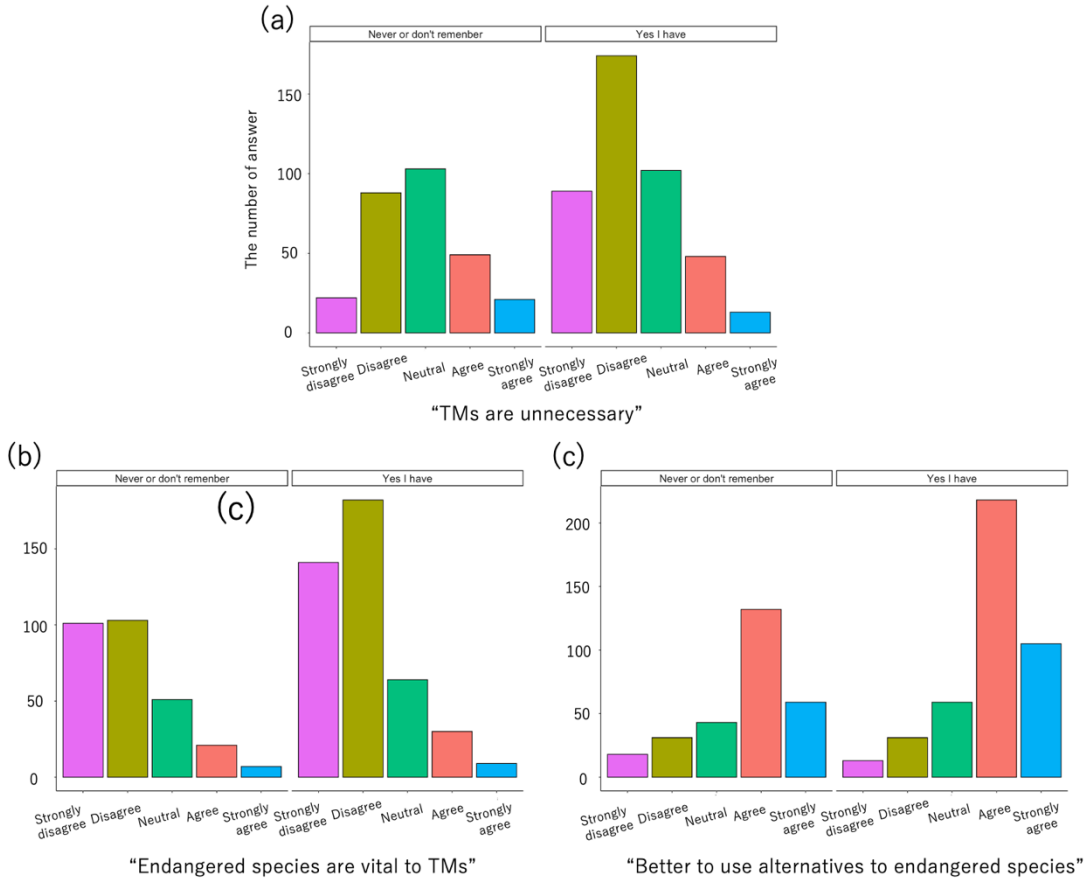

Figure 6. Attitudes toward traditional medicines by use experience. Attitudes toward "TMs are unnecessary" (a), "Endangered species are vital to TMs" (b), "Better to use alternatives to endangered species" (c).

Discussions

Majority of respondents had used traditional medicines and needed traditional medicines. Although the student respondents had image that elderly uses traditional medicines, traditional medicines were also used by young people in both regions.

Many respondents were uncertain about the presence/absence of endangered species in the traditional medicines actually used. 23% of the respondents answered that they did not know all 14 species in the list as species used for traditional medicine. It is considered that they do not care about ingredients containing in traditional medicines or have no knowledge of the use of endangered species in traditional medicines. There was a regional difference in the awareness of the endangered species used in traditional medicines. Respondents from Hong Kong/Macau were more aware of the species in traditional medicines than those from Japan. There was no significant difference in the use experience in the region of origin, suggesting that there was no correlation between the awareness of the species and the experience. Furthermore, although there were many agreements in both countries regarding the use of alternatives, the respondents in Hong Kong/Macau were more in favor of the use of endangered species in traditional medicines than in Japan. Given that, it is possible that the high awareness of endangered species in the medicines does not necessarily lead to the restraint of purchasing traditional medicines containing endangered species. In term of conservation of endangered species, it is necessary to raise awareness of the ingredients in a country like Japan, where there is little interest in the ingredients containing in traditional medicines and many respondents said that there is no need for endangered species. In addition to the improvement of the awareness, since the majority of the opinions in both countries were in favor of the use of alternatives, it is recommended to actively promote the use of alternatives.

The species that respondents often used in traditional medicines was roughly proportional to the species that was highly recognized as being used in traditional medicines. For example, bears, rhinos and seahorses ranked high in both. However, as an exception, although recognition of traditional elephants was high, the use rate was actually low. Since elephants has been often reported in the media for illegal trade in ivory, it is considered that elephants were highly recognized not only for traditional medicine but also for illegal trade. Therefore, media can be effective in raising awareness of wildlife use.

In conclusion, it is expected that the consumption of endangered species in traditional medicines will be reduced by raising awareness of the species through the media and development and promotion of alternatives.

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Appendix. Evaluating the Public Knowledge on the Use of Endangered Species in Producing TM Questionnaire in English

1. Place of origin, age, sex

2. Have you ever taken traditional medicines?
   A: Yes, within the past year; Yes, before last year; Never; I do not remember

3. Did the traditional medicines you consumed include medicines made from endangered species?
   A: Yes; No; I am unsure

4. Which age group you think use traditional medicines made out of endangered species the most?
   A: people under 40 years old; people between 40- 59 years old; people over 60 years old; I am unsure

5. Which of the following species were present in traditional species that you/your family members have used?
   A (multiple choices allowed): Bear; rhinoceros; pangolin; Japanese pond turtle; tiger; elephant; tokay gecko; lion; slow loris; leopard; totoaba; musk deer; saiga antelope; seahorse

6. Which of the following species are you aware of – with regard to usage in manufacturing traditional medicines?
   A (multiple choices allowed): Bear; rhinoceros; pangolin; Japanese pond turtle; tiger; elephant; tokay gecko; lion; slow loris; leopard; totoaba; musk deer; saiga antelope; seahorse

7. Endangered species are vital to the making of traditional medicines.
   A: Strongly agree; agree; neutral; disagree; strongly disagree

8. It is better to use other chemical synthesis or poultry which have the same composition as endangered species to make traditional medicines.
   A: Strongly agree; agree; neutral; disagree; strongly disagree

9. Traditional medicines are unnecessary.
   A: Strongly agree; agree; neutral; disagree; strongly disagree