

## Ethnopharmacological applications of the amphibians and reptiles among the people in the vicinity of Margalla Hill National Park, Islamabad, Pakistan

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### SUMMARY

The study of ethnopharmacological application made it feasible to recognize the life dynamics of the societies and the fauna with which they live together. Although there has been an increase of ethnozoological studies over the last five years of this century, little is recognized about human and herpetofauna interactions in Pakistan. In current research, we examined the data about ethnopharmacological applications of the amphibians and reptiles among the people in the vicinity of Margalla Hill National Park, Islamabad, Pakistan. Ethnopharmacological applications of herptiles were collected from local respondent using “semi-structured interviews” and “group discussion”. Informants were chosen based on their ethnopharmacological knowledge on amphibian and reptiles. In present study, 16 species of amphibian and reptiles were used for treatment of backbone pain, bite pains, cancer, infections, eyes infection, joint pain, male impotency and rheumatic pain. The highest value of frequency of citation (FC=30) is noted for Indus-valley spiny-tailed ground lizard (*Saara hardwickii*). The current study showed that many species of amphibian and reptiles are utilized by people in vicinity of Margalla Hill National Park, Islamabad, Pakistan. This society still depends on customary remedy, while the other health-care departments are also present in vicinity of Margalla Hill National Park, Islamabad, Pakistan; however, the medicinal avian species have considerable value for treating the various ailments. High values of indices showed that these species are the most ideal species for sickness. The chosen species of amphibians and reptiles could be used for production of required drugs for various health disorders.

**Keywords:** Amphibian, Reptile, Ethnomedicine, Islamabad

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### INTRODUCTION

Amphibians and reptiles represent one of the most significant groups of fauna. The herptiles and human communities have interacted for kiloannum, wherever both

have been in connection (Alves *et al.*, 2013). Human societies have created a close association with the amphibian and reptile with which they live together, based on utilize and information of herptile (Rojas *et al.*, 2015; Alves *et al.*, 2019). Thus, the ethnoherpetology researches folklore data obtained from associations between human herptile and interactions themselves (Albuquerque *et al.*, 2013).

Pakistan is also one of the diverse country of the earth concerning herptile species; currently, 195 reptiles (Khan, 2006) and 24 amphibians' species (Khan, 2010) have been documented in Pakistan. Knowing herptile diversity, it is significant to know native societies' view about the herptile species with which they share their region to expose data about the significant interaction of these societies with environment in the area. This can be the base for creating plans of conservation regional level, involving politics, academics, and local communities (Pinto *et al.*, 2015).

For few years now, ethnozoological researches have been carried out in Pakistan that focused mostly on species of herptile (herptiles i.e. *Uromastyx hardwickii*, *Aspideretes hurum*, *A. gangeticus*, *Eublepharis macularius*, *Eryx johnii*, *Python molurus*, *Daboia russelii russelii* etc.) with high ethnomedicinal use (Altaf *et al.*, 2017; Altaf *et al.*, 2020). However, there is small data about ethnopharmacological application of herptile (Altaf *et al.*, 2020). Hence, efforts to get data about the animal and its relations within the environment become significant where ethnozoological researches play a basic role in knowing the current ecology dynamics, such as changes in the trees and animals among others (del Diagnóstico, 2016; Alves *et al.*, 2018). Taking this into explanation, our aim is to assess ethnopharmacological information and awareness of the Margalla Hill National Park, Islamabad, Pakistan community about the herptile.

## MATERIALS AND METHODS

The data were collected from April, 2020 to December, 2020 in the vicinity of Margalla Hill National Park, Islamabad, Pakistan (Figure 1).

### STUDY AREA

Margalla Hill National Park situated to the north of the Islamabad. It was declared a national park on 1980. Margalla Hill National Park range is from 456 m to 1580 m in altitude. The topography is steep slopes, limestone being feature of the area. The climate is subtropical semi-arid. Annual average rainfall is 1,000 mm. Temperatures range from 20 to 40 °C during the summer and 1 to 15 °C in winter (HWFI, 2007).

### ETHNO-HERPETOLOGY OBSERVATION AND IDENTIFICATION

Ethnopharmacological applications of herptiles were gathered from local (n=50) respondent using "semi-structured interviews" and "group discussion". Informants were chosen based on their ethnopharmacological knowledge on herpetofauna. The herpetofauna were classified using The Amphibian and Reptiles of Pakistan (Khan, 2006).

## QUANTITATIVE ANALYSIS

The ethnoherpetological data was analyzed using different quantitative indices: relative frequency of citation (FC), fidelity level (FL), relative popularity level (RPL), rank order priority (ROP) and similarity index (SI). Each herptile species noted by informants with respect to the local information were calculated as FC.

The contribution of different herpetofauna body part use and ethnopharmacological information were exhibited in chord diagrams using *circulize* package in R software 3.6.1 (Gu *et al.*, 2014).

### Relative frequency of citation

The relative frequency of citation (RFC) presents the value of each Amphibian and Reptiles species in study area (Tardío and Pardo-de-Santayana, 2008; Ilker *et al.*, 2009; Vitalini *et al.*, 2013). RFC was analyzed by the following formula:

$$RFC = FC/N \quad (0 < RFC < 1)$$

FC = Number of local informants

N = Total number of informants in the research

### Fidelity level

The fidelity level (abbreviated as; FL) is the proportion of local informers declaring utilizes of a particular kind of exact numbers of therapeutic application of amphibians and reptiles species by the local informers of Margalla Hill National Park, Islamabad, Pakistan. The fidelity level index was calculated using the following formula by (Friedman *et al.*, 1986; Alexiades and Sheldon, 1996).

$$FL (\%) = N_p/N \times 100$$

Where “ $N_p$ ” is the count of local informers for specific kinds of ethnomedicine application of herptile species and “N” is the total count of local informers that used the herptile species for any application. A high FL index revealed the significance and high rate of application of the herptile species for folklore use by the informers of the Margalla Hill National Park, Islamabad, Pakistan.

### Relative popularity level

The relative popularity level (abbreviated as; RPL) is the ratio of the count of folklore application by a herptile species and the total number of study area informers for any illness. The RPL assumes a value “0 for unpopular” to “1 for popular” (Umair *et al.*, 2017; Umair *et al.*, 2019).

$$RPL = R_U/R_O \quad (0 < RPL < 1)$$

$R_U$  = Maximum number of informants

$R_O$  = specific number of informants for each species

### Rank order priority

The “rank order priority” (abbreviated as; ROP) is utilized to properly rank the herptile with different FL and RPL values utilized as correction factor. The ROP

derived from FL values by multiplying RPL. The ROP value was computed by the following formula by (Friedman *et al.*, 1986; Ali-Shtayeh *et al.*, 2000).

$$ROP = FL \times RPL$$

#### Similarity index

The similarity index (abbreviated as; SI) is analyzed by the following formula;

$$SI = S_a/T_a (0 < RFM < 1)$$

Note:

$S_a$  = Similar documented sickness in “previous and present study”

$T_a$  = Total documented sickness in “present study”

## RESULTS AND DISCUSSION

### DEMOGRAPHY

Data were collected from 50 respondents having age between 20 to 75 years. Out of total, 42 (84%) informants were literate having education of Master (n=2), Graduate (n=8), Intermediate (n=10), Matric (n=7), Primary (n=15) and Illiterate (8). Majority of the respondents (n=27) were from rural area, while other were belong to urban (Figure 1).

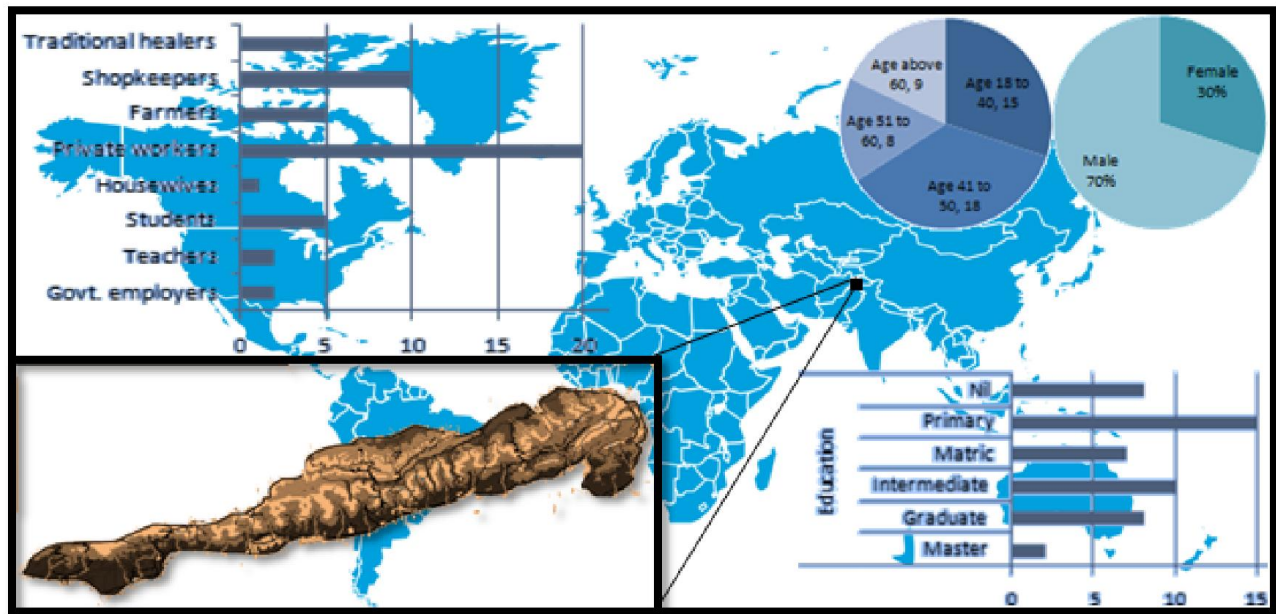


Figure 1: Map of Margalla Hill National Park, Islamabad, Pakistan along with respondents' profile.

### ETHNOMEDICINAL USES OF AMPHIBIAN AND REPTILES

Local people of the study area have important information about ethnomedicine of species of amphibian and reptiles (Table 1). Total 16 amphibian and reptiles' species were applied to heal various sickness i.e. backbone pain, bite pains, cancer,

infections, eyes infection, joint pain, male impotency and rheumatic pain (Figure 2 and 3).

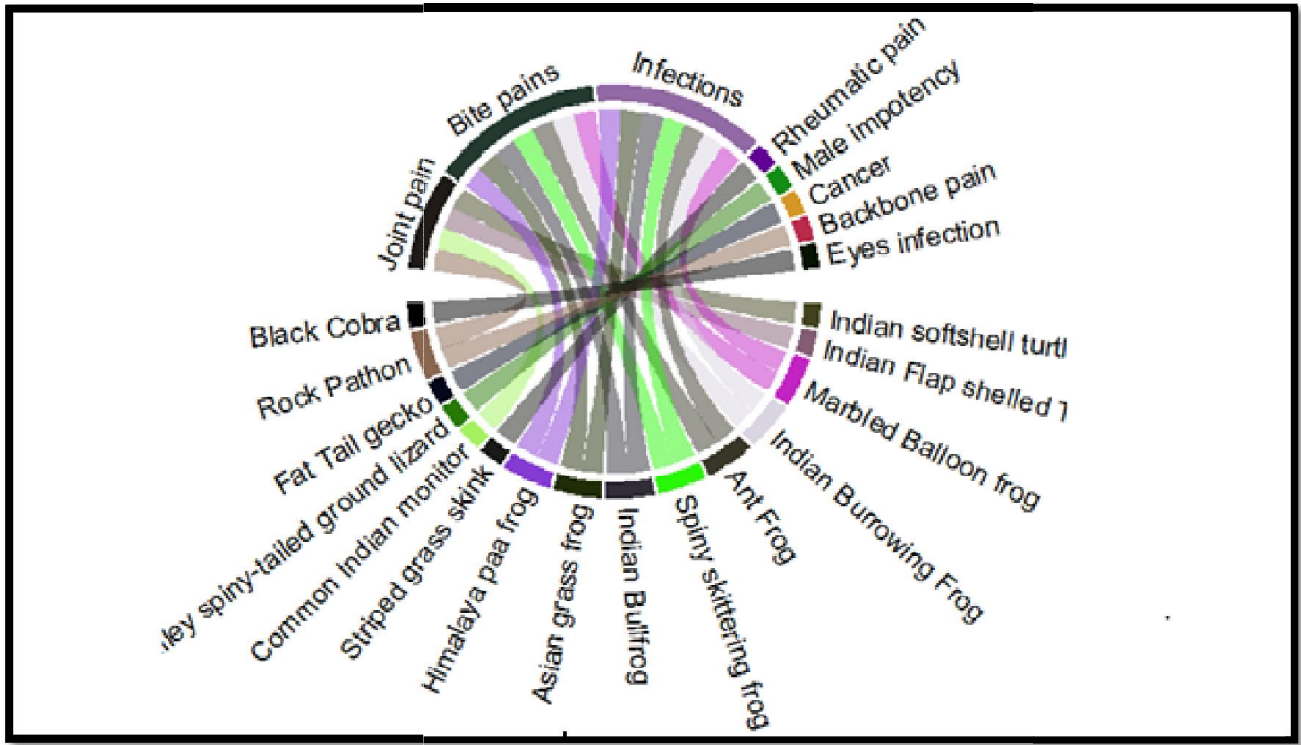


Figure 2: Diseases cured by herpetile species.

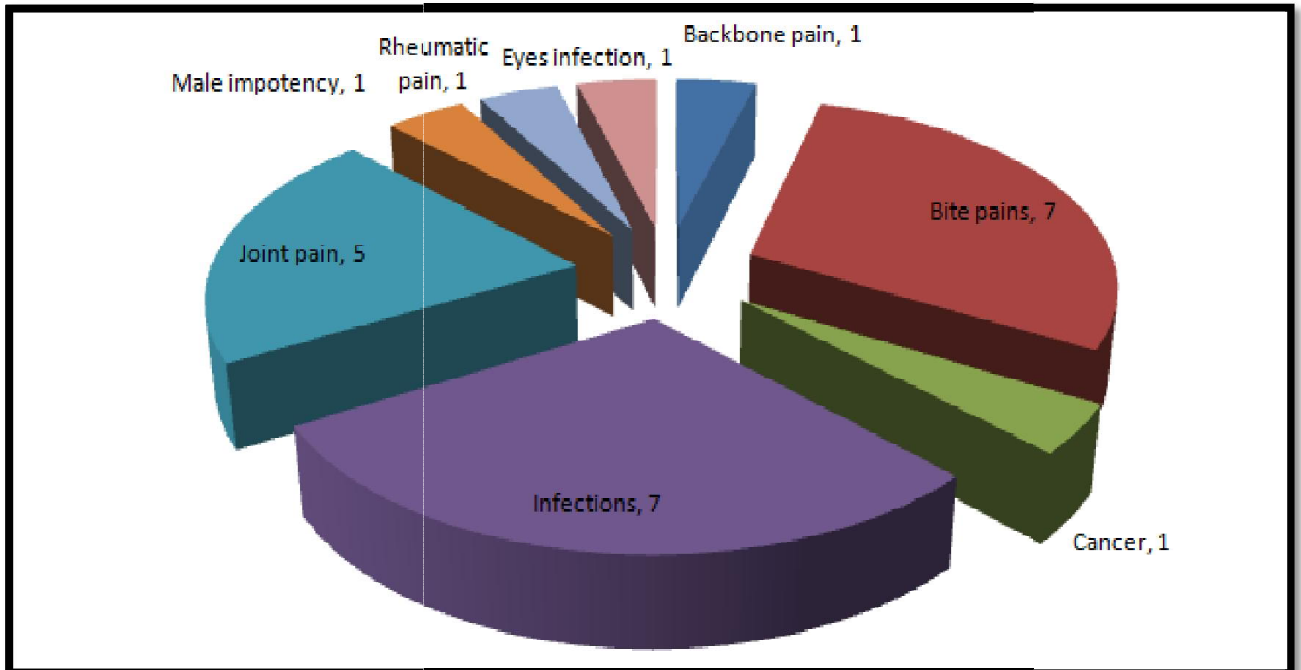


Figure 3: Body parts of herpetiles used in ethnomedicine use in the study area.

In reptiles and amphibian, fat was the most frequently used “body parts” and was utilized in the composition of 15 methods to heal lot of sickness, and skin was used in single recipe (Figure 4). The inhabitants of Margalla Hill National Park, Islamabad, Pakistan utilizes fat to backbone pain, bites pains, cancer, infections, joint pain, male impotency and rheumatic pain. The inhabitants of study area use skin of reptile (i.e. *Naja naja*) to heal eyes infection. The presence of “omega-3 fatty acid” in fat and derivatives that heal infection (Wilson, 2015). Omega-3 fatty acid is also productive in various illness as; aging issues, thrombotic, atherosclerosis and neurological problems (Breteler, 2000; Kalmijn, 2000; Haag, 2003).

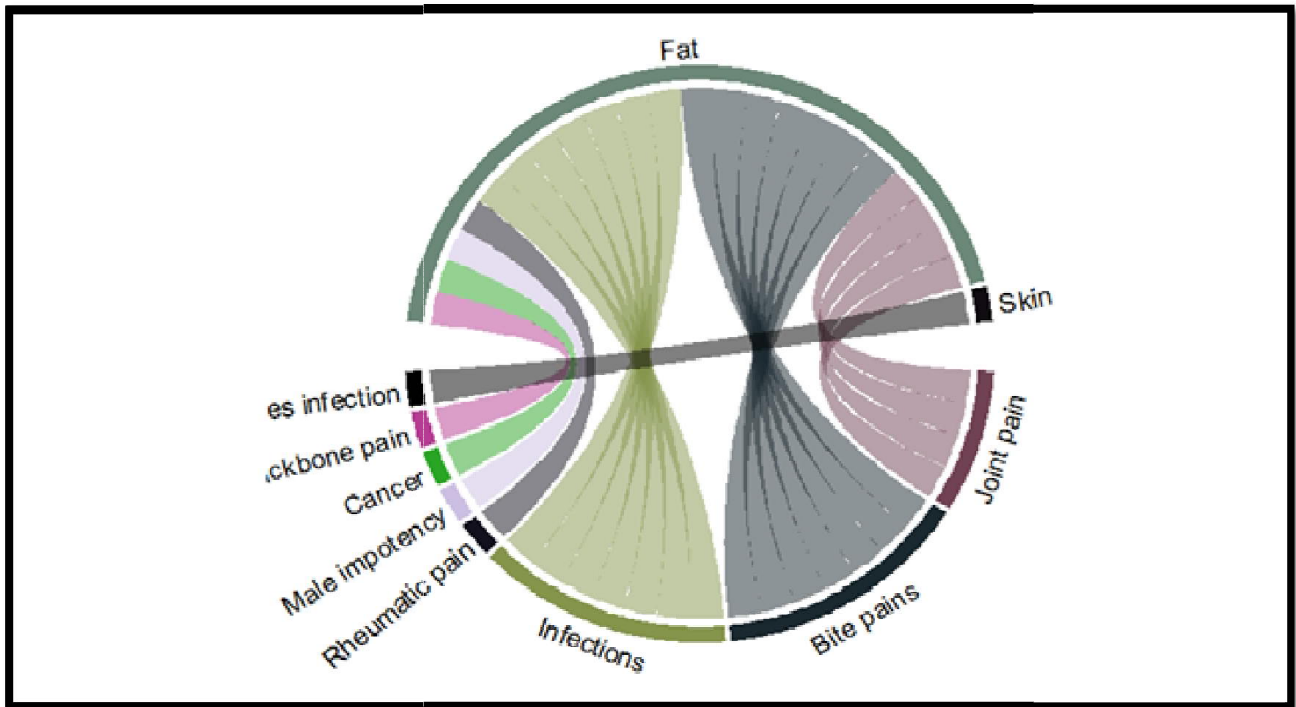


Figure 4: Figure is showing diseases and body parts used interaction.

#### FREQUENCY OF CITATION

The highest value of FC (31) is observed in Indus-valley spiny-tailed ground lizard (*Saara hardwickii*), followed by Indian bullfrog (*Hoplobatrachus tigerinus*) (13), black cobra (*Naja naja*) (7), brown roofed turtle (*Pangshura smithii smithii*), Indian softshell turtle (*Nilssonina gangeticus*), Indian flap shelled turtle (*Lissemys punctata andersoni*), marbled balloon frog (*Uperodon systoma*), and fat tail gecko (*Eublepharis macularius*) (5 each) (Table 1). These FC are directly depends on number of informants. Similar findings are documented by other ethnobiologists (Mahmood *et al.*, 2013).

#### FIDELITY LEVEL

We documented that FL) of amphibian and reptiles species during the research which varies from 33% to 67%. More than 40% FL was calculated for three species of amphibian and reptiles i.e. Asian grass frog (*Fejervarya limnocharis*) (FL = 67%),



Indus-valley spiny-tailed ground lizard (*Saara hardwickii*) (FL = 45%) and Black Cobra (*Naja naja*) (FL = 43%) (Table 1). This current ethnoherpetological investigation showed that peoples of Margalla Hill National Park, Islamabad, Pakistan have information to cure sickness; and customary pharmacological applications have not removed from local culture. Primarily, high FL value confirmed that these species of amphibian and reptiles are used more and low FL value means that less used of species of amphibian and reptiles (Srithi *et al.*, 2009; Bibi *et al.*, 2014).

#### RELATIVE POPULARITY LEVEL

Total, 16 species are used in folklore medicine of amphibian and reptiles (Figure 5), out of total, only one species of amphibian and reptiles i.e. Indus-valley spiny-tailed ground lizard (*Saara hardwickii*) give more attention by local respondents and have the highest “Relative popularity level” (abbreviated as; RPL value (RPL=1.00) (Table 1). And Indian Bullfrog (*Hoplobatrachus tigerinus*) RPL values is 0.42. High popularity of species of amphibian and reptiles might be documented to its higher understanding and familiarity of people of Margalla Hill National Park, Islamabad, Pakistan which specify utilize in folklore medicine. Similar findings are documented by other ethnobiologists (Friedman *et al.*, 1986; Ali-Shtayeh *et al.*, 2000).

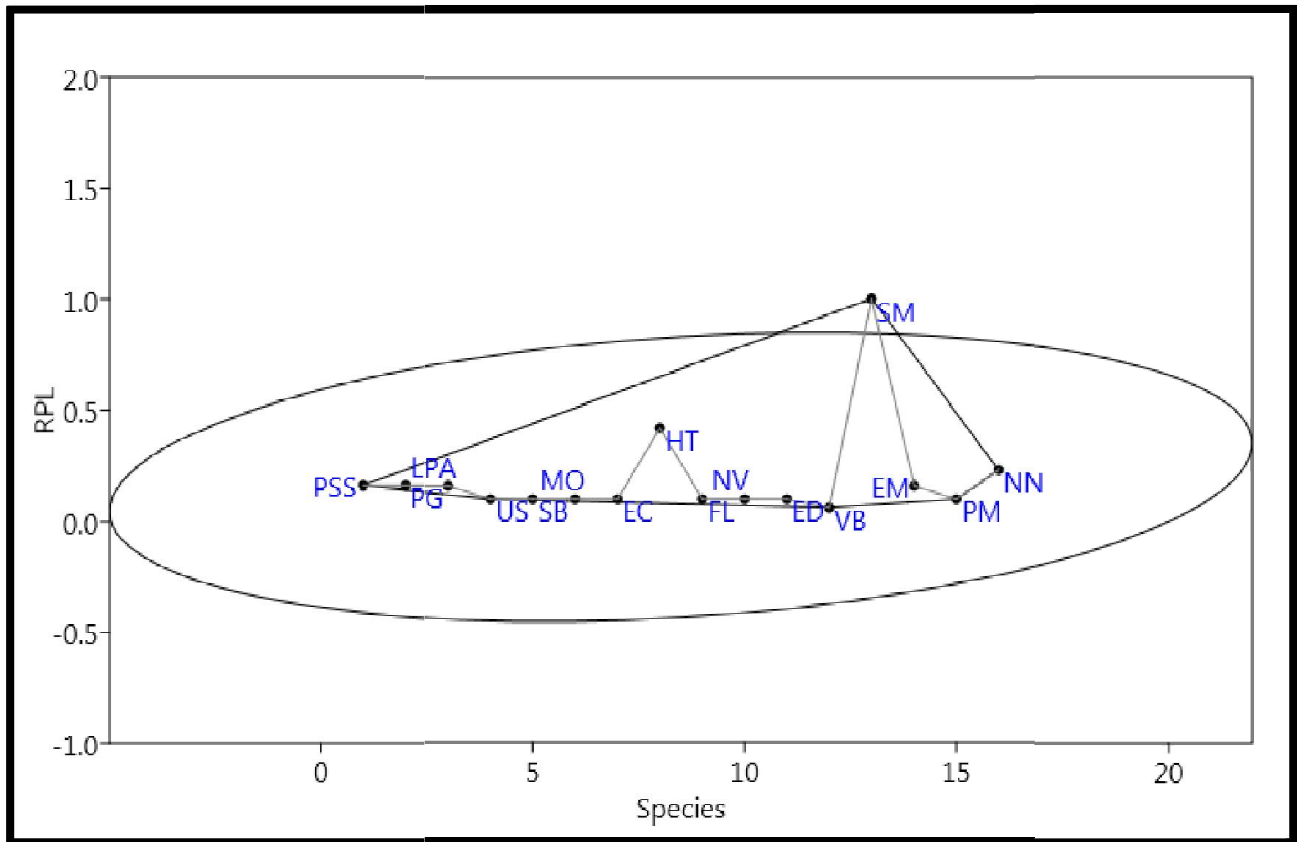


Figure 5: RPL is showing interaction with each species.

#### RANK ORDER PRIORITY

ROP is an important index to analysis the ethnopharmacological values (Table 1). Out of total, only six species of amphibian and reptiles get above 10 values of ROP. These species of amphibian and reptiles are brown roofed turtle (*Pangshura smithii smithii*) (13), Black Cobra (*Naja naja*) (9.7), Indian bullfrog (*Hoplobatrachus tigerinus*) (6.5), Asian grass frog (*Fejervarya limnocharis*) (6.5), and fat tail gecko (*Eublepharis macularius*) (6.5).

#### SIMILARITY INDEX

It is documented that out of total, 2 species of amphibian and reptiles have 1.00 SI i.e. skin of black cobra (*Naja naja*) is used to treat eyes infection, while in previous documentation of this species is used to treat eye sight, cancer, leprosy, arthritis, sciatica, sexual weakness, snakebite and muscular pain (Bagde and Jain, 2013; Arshad *et al.*, 2014; Bagde and Jain, 2015) and fat of Indus-valley spiny-tailed ground lizard (*Saara hardwickii*) is applied to cure male impotency, while in previous record of this species is used to treat impotency, earache, headache, backbone pain, joint pain (Arshad *et al.*, 2014; Altaf *et al.*, 2018). Two species (i.e. *Lissemys punctata andersoni* and *Varanus bengalensis*) are documented before, but both these species have no similar ailment treatment in previous documentation. Indian flap shelled turtle (*Lissemys punctata andersoni*) is used to treat joint pain in present study, while previously reported document this species is used to treat Allergy, asthma, dermatitis, diabetes, backbone pain, lung diseases, fever, indigestion, skin infection, TB and impotency (Mishra *et al.*, 2011; Vijayakumar *et al.*, 2015a; Vijayakumar *et al.*, 2015b; Altaf *et al.*, 2018). Common Indian monitor (*Varanus bengalensis*) is used to treat joint pain in present study, while previously reported document this species is used to treat Immune enhance (Chellappandian *et al.*, 2014). While out of 16 species, 14 species have zero SI i.e. *Pangshura smithii smithii*, *Nilssonina gangeticus*, *Lissemys punctata andersoni*, *Uperodon systoma*, *Sphaerotheca breviceps*, *Microhyla ornate*, *Euphlyctis cyanophlyctis*, *Hoplobatrachus tigerinus*, *Fejervarya limnocharis*, *Nanorana vicina*, *Eutropis dissimilis*, *Varanus bengalensis*, *Eublepharis macularius* and *Python molurus*.

#### NOVELTY OF THE STUDY

Current research is the first list of all accessible data on ethnomedicinal species of amphibian and reptiles in capital of Pakistan, Islamabad, provides first records of species of reptiles and amphibian, and customary medicinal appliances of species. Current ethnoherptile research is vital manuscript that gives data about customary therapeutics appliances. The collected data are unique because out of total, 14 species of amphibian and reptiles have “0.00” similarity index.

#### CONCLUSION

The current study showed that a lot of medicinal species of amphibian and reptiles are utilized by people of Margalla Hill National Park, Islamabad, Pakistan. This society still depends on customary remedy, while the other health-care departments are also present in vicinity of Margalla Hill National Park, Islamabad, Pakistan; thus, the medicinal avian species have considerable value for treating of ailments. Indices



RFC, FL, RPL and ROP values showed that species of amphibian and reptiles are the most preferred species for sickness. The selected species of amphibian and reptiles could be used for synthesis of new drugs for various sicknesses.

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Table 1: Ethnopharmacological applications of herptiles in the vicinity of Margalla Hill National Park, Islamabad, Pakistan.

Sr.	Names	Code	Mode of uses	MOA	FC	RFC	FAC	RPL	FL	ROP	Reported use	SI
1	<i>Pangshura smithii smithii</i> Brown roofed Turtle	PSS	Fat used to treat joint pain	Topical	5	6.49	2	0.16	40	6.5		0
2	<i>Nilssononia gangeticus</i> Indian softshell turtle	PG	Fat used to treat joint pain	Topical	5	6.49	1	0.16	20	3.2		0
3	<i>Lissemys punctata andersoni</i> Indian Flap shelled Turtle	LPA	Fat used to treat joint pain	Topical	5	6.49	2	0.16	40	6.5	Allergy, asthma, dermatitis, diabetes, backbone pain, lung diseases, fever, indigestion, skin infection, TB, impotency (Mishra <i>et al.</i> , 2011; Vijayakumar <i>et al.</i> , 2015a; Vijayakumar <i>et al.</i> , 2015b; Altaf <i>et al.</i> , 2018)	0
4	<i>Uperodon systoma</i> Marbled Balloon frog	US	Fat used to treat bite pains and infections	Topical	3	3.90	1	0.10	33	3.2		0
5	<i>Sphaerotheca breviceps</i> Indian Burrowing Frog	SB	Fat used to treat bite pains and infections	Topical	3	3.90	1	0.10	33	3.2		0
6	<i>Microhyla ornate</i> Ant Frog	MO	Fat used to treat bite pains and infections	Topical	3	3.90	1	0.10	33	3.2		0
7	<i>Euphlyctis cyanophlyctis</i> Spiny skittering frog	EC	Fat used to treat bite pains and infections	Topical	3	3.90	1	0.10	33	3.2		0
8	<i>Hoplobatrachus tigerinus</i>	HT	Fat used to treat bite pains	Topical	13	16.88	2	0.42	15	6.5		0

9	Indian Bullfrog <i>Fejervarya limnocharis</i>	FL	and infections Fat used to treat bite pains	Topical	3	3.90	2	0.10	67	6.5		0
10	Asian grass frog <i>Nanorana vicina</i>	NV	and infections Fat used to treat bite pains	Topical	3	3.90	1	0.10	33	3.2		0
11	Murree frog/ Himalaya paa frog <i>Eutropis dissimilis</i>	ED	and infections Fat used to treat rheumatic pain	Topical	3	3.90	1	0.10	33	3.2		0
12	Striped grass skink <i>Varanus bengalensis</i>	VB	Fat used to treat joint pain	Topical	2	2.60	1	0.06	50	3.2	Immune enhance (Chellappandian <i>et al.</i> , 2014)	0
13	Common Indian monitor <i>Saara hardwickii</i>	SM	Fat used to treat male impotency	Topical	31	40.26	14	<b>1.00</b>	45	45	Impotency, earache, headache, backbone pain, joint pain (Arshad <i>et al.</i> , 2014; Altaf <i>et al.</i> , 2018)	1
14	Indus-valley spiny-tailed ground lizard <i>Eublepharis macularius</i>	EM	Fat used to treat cancer	Topical	5	6.49	2	0.16	40	6.5		0
15	Fat Tail gecko <i>Python molurus</i>	PM	Fat used to treat joint pain, backbone pain	Topical	3	3.90	1	0.10	33	3.2		0
16	Rock Pathon <i>Naja naja</i>	NN	Skin used to treat eyes infection	Topical	7	9.09	3	0.23	43	9.7	Eye sight, cancer, leprosy, arthritis, sciatica, sexual weakness, muscular pain, snakebite (Bagde and Jain, 2013; Arshad <i>et al.</i> , 2014; Bagde and Jain, 2015; Altaf <i>et al.</i> , 2018)	1