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Traditional veterinary practices associated with cattle healthcare in Marwar region of Rajasthan

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ABSTRACT

The aim of the present study was to document ethnoveterinary plants and their formulation techniques in an unexplored region of India and to select candidate medicinal plants with high consensus factor and fidelity value for further *in vitro* investigation. Informants (55) were interviewed using semi-structured questionnaire. A total of 50 plants belonging to 35 families were used to treat cattle ailments in study area. Mostly whole plant and leaves (36 and 30%) were used in recipes formulation mostly in the form of decoction. Almost all plant parts were being used for medicinal purposes but whole plant (36%) was the most frequently used plant part followed by leaves (30%) and roots, fruits, seeds and others (8% each), respectively. Local farmers used these ethnomedicines to treat their cow. Gastrointestinal infections were found more common and majority of the plants were used against cow ailments. Recovery time of majority of the recipes was three to four days. Aged farmers and nomads had more traditional knowledge as compared to younger ones. Plants with high plants values could be further investigated *in vitro* for the search of some novel bioactive compounds and young generation should be educated regarding ethnoveterinary practices.

Key words: Adoption, Cattle, Ethnoveterinary, Herbal plants, Medicinal, Rajasthan, Traditional

Traditional animal healthcare practices, also called ethnoveterinary medicine, provide low cost alternatives in situation where western type drugs and veterinary services are not available or are too expensive. These practices were developed and practiced through trial and error methods and deliberate experimentation and is therefore, least documented and not universally recognized and for these reasons it has no place in mainstream veterinary medicine. Traditional knowledge is a record of human accomplishment in apprehending the complexities of life and survival in often adverse environments. Traditional knowledge may be cultural, social and technical awareness or was obtained as part of great experiments of continuity and advancement (Khadda *et al.* 2018). India is an agriculture country and almost 65% of its population is dependent on agriculture and livestock. India is the world's first largest milk producing country due to its high dependency on agriculture and livestock (NDDB 2017). Resource-poor farmers of India greatly rely on traditional medicine due to their limited access to modern prevention health practices and particularly lack of modern health facilities in their areas (Khandelwal *et al.* 2017). Despite the fact that traditional knowledge is very much important for the cattle health and productivity, the documentation of this knowledge is very much neglected in majority of the remote areas of India.

A zone of foothills lays to the west, through which run the many tributaries of the *Luni* river. Marwar lies in south west part of Rajasthan state between 25°45′ and 26°29′ North latitudes and 73°17′ and 74°18′ East latitudes. The present study was carried out in Pali district of Marwar region of Rajasthan. The present research study was therefore designed to document detailed ethnoveterinary knowledge of cattle in an unexplored Marwar region of Rajasthan, India. The present study was designed to document ethnoveterinary plants of the Marwar region along with the detailed formulation techniques of the reported ethnoveterinary plants, and to select candidate medicinal plants with high consensus factor and fidelity value for further *in vitro* investigation.

MATERIALS AND METHODS

Study area: Present study was conducted in Marwar region Pali district of Rajasthan, India. It is located at 25°80′–26° 72′N, and 73° 17′–27°.52′ E, with an altitude of 489 m, and is the capital of the Pali district. The area is rural in nature and inhabitants are very much dependent on livestock for agricultural, economic, and food purposes. Locals of the Marwar region use a variety of medicinal plants for the treatment of livestock ailments due to expensive veterinary drugs.

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Sampling and data collection: Field work was done from January to May 2017. Initially, local administrative officers and representative (*Sarpanch*) of the study area were visited, who provided information on key resource persons in the field of ethnoveterinary medicinal plants. They suggested 55 informants having strong traditional knowledge regarding cattle treatment. Out of 55 informants, 45 were farmers and 10 were nomadic people. A brief group discussion was held with the informants prior to data collection for explaining to them the main theme of the present study and to get their consent for the publication of their traditional knowledge. This was done in order to acknowledge informants' cooperation in preserving the traditional knowledge of the study area and build their confidence for providing reliable information. Each informant was separately interviewed in their local languages (*Marwari*). Semi-structured questionnaires were designed addressing detailed ethnoveterinary information of cattle. Informants were asked about the number of plants they use to treat their cattle, which part of plant used, recipe formulation, recovery, and other essential questions.

Data analysis: Informant consensus and fidelity level were used to verify the importance of medicinal plants.

Informant consensus (*Fic*)*:* Fic on the reported cures of a given group of ailments was calculated as an informant consensus factor. Fic within a community designates the widely used plants and thus helps in the selection of plants for phytochemical and pharmacological studies (Punjani and Pandey 2015). Reported veterinary problems were grouped into 8 major ailments. Fic values are high when one or few plants are reported by the large number of respondents to treat a specific ailment, while low Fic value given an indication that informants do not agree over which plant to use (Khateeb *et al.* 2015 and Singh *et al.* 2014).

The Fic was calculated using the formula as follows:

$$\text{Fic} = \frac{\text{nur–nt}}{\text{nur–1}}$$

where Fic, informants consensus factor; nur, number of used citation in each category; nt, number of species used.

Fidelity level (*FL*)*:* FL is useful for recognizing the most preferred plants used for curing certain ailments by the respondents. Highly preferred plants have always greater FL values than those that are less preferred. FL is always calculated in terms of percentage of informants claiming the use of a certain plants species for the same major purpose. The main purpose of FL is to calculate the importance of plants species for a specific purpose. Prior to the calculation of FL values all of the ailments that were reported are a grouped into major classes [10]. FL value was estimated using the formula FL= Ip/Iu × 100, where Ip is the number of respondents who reported the utilization of medicinal plants for a specific main ailment and Iu is the total number of respondents who mentioned the same plants for any ailments (Tariq *et al.* 2014).

RESULTS AND DISCUSSION

The study revealed that local farmers of Marwar region utilize 50 medicinal plants belonging to 35 families for the treatment of cow ailments (Table 1). Among all the families, Asteraceae was found to be dominant (4 species) in the study area being in use in ethnoveterinary practices in the region. Traditional farmers mostly used herbs (50%) for the preparation of ethnomedicines (Table 2) followed by shrubs (38%) and trees (10%). Almost all plant parts were being used for medicinal purposes but whole plant (36%) were found to be the most frequently used plant part followed by leaves (30%) and roots (8%), fruits (8%), seeds (8%) and others (8%), respectively (Table 2) Fig. 3. Local farmers used these ethnomedicines to treat their cows. A total of 50 plants (25 herbs, 19 shrubs, 5 trees and 1

Table 1. Ethnoveterinary plants used for the treatment of cattle ailments in Marwar region

Plant name/family name	Habit	Part used	Ailment treated	Recipe	Vehicle	Route
Acacia modesta (Fabaceae)	Tree	Leaves, seeds	Delivery	Decoction	Water	Oral
Achyranthes aspera (Amaranthaceae)	Herb	Whole plant	Anthelmintic and delivery	Powder	Sugar	Oral
Allium cepa (Amaryllidaceae)	Herb	Whole plant	Febrifuge, tonic	Decoction	Flour	Oral
Aloe barbadensis (Liliaceae)	shrub	Root	Gastrointestinal	Powder	Milk	Oral
Artemisia brevifolia (Asteraceae)	Herb	Leaves	Removal of placenta	Decoction	Sugar	Oral
Allium sativum (Liliaceae)	Herb	Bulb	Impaction and lumbago	Concoction	Milk	Oral
Brassica campestris (Brassicaceae)	Herb	Whole plant	External lice	Paste	Rub	Dermal
Calotropis procera (Apocynaceae)	Shrub	Fruit, leaves	Intestinal worms and skin infections	Paste, concoction	Sugar	Oral, dermal
Cannabis sativa (Cannabaceae)	Shrub	Leaves	External parasites, appetizer	Poulitice, powder	Rub	Dermal, oral
Chenopodium album (Amaranthaceae)	Herb	Whole plant	Wound healing	Paste	Rub	Dermal
Chrysanthemum leucanthemum (Asteraceae)	Herb	Whole plant	Increase milk	Powder production	Flour	Oral

(*Table 1 Contd...*)

Plant name/family name	Habit	Part used	Ailment treated	Recipe	Vehicle	Route
Citrullus colocynthis (Cucurbitaceae)	Herb	Fruit, root	Abdomen pain, bloat, skin infection	Juice, powder	Water	Oral
Ocimum sanctum (Limiaceae)	Tulsi	Leaves	Cencer and skin	Crushed	Honey/milk	Oral/ dermal
Citrus medica (Rutaceae)	Shrub	Fruit	Induce lactation	Juice	Water	Oral
Convolvulaus arvensis (Convolvulaceae)	Herb	Whole plant	Constipation	Crushed	Sugar	Oral
Coriandrum sativum (Apiaceae)	Herb	Leaves, root	Antidiurentic	Decoction water	Water	Oral
Curcuma longa (Zingiberaceae)	Herb	Leaves, root	Antidiuretic	Decoction water	Water	Oral
Cynodone dactylon (Poaceae)	Herb	Whole plant	Wound healing, analgesic	Concoction	Milk	Oral
Capparis deciduas (Cappaaceae)	Shrub	Stem	Fractured bone	Paste	Milk	Oral
Cordia dichotoma (Ehretiaceae)	Shrub	Stem	Swelling during fracture	Liquid	Water	Oral
Cynoglossum lanceolant (Boraginaceae)	Herb	Root	Common cold	Crushed	Water	Oral
Calligonum polygonoides (Polygonaceae)	Shrub	Whole plant	Common cold, stomach worms, joint pains	Crushed	Water	Oral
Calotropis process (Asclepiadaceae)	Shrub	Latex	Antidote to scorpion bite	Latex	Hyderochloride acid	Dermal
Datura inoxia (Solanaceae)	Herb	Whole plant	Antilice	Paste	Milk	Dermal
Desmostachya bipinnata (Poaceae)	Herb	Whole plant	Flatulence	Crushed	Water	Oral
Ephedera ciliate Fish (Gnetaceae)	Herb	Whole plant	Cure constipation	Decoction	Water	Oral
Crotolaria Buch (Fabaceae)	Herb	Whole plans	Cure constipation	Juice of this plant	Water	Oral
Hedera nepalensis (Araliaceae)	Shrub	Leaves	To remove leeches	Infusion	Water	Nasal
Letadenia pyrotechnica (Alcepiadaceae)	Shrub	Tender roots	Ouster	Small cuts induction	Nil	Oral
Euphorbia triculii (Euphoerbiaceae)	Shrub	Latex	Skin disease	Latex	NA	Dermal
Melia azedarach (Meliaceae)	Tree	Leaves	Stomach flatulence	Powder	Sugar	Oral
Mentha arvensis (Lamiaceae)	Herb	Leaves	External parasite	Paste	Rub	Oral
Morus alba (Moraceae)	Tree	Leaves, fruit	Laxative	Crushed	Milk	Oral
Nerium oleander (Apocynaceae)	Shrubs	Whole plant	Stomach ache	Concoction	Water	Oral
Ocimum basilicum (Lamiaceae)	Shrub	Leaves	Gastrointestinal	Decoction	water	Oral
Punica granatum (Lythraceae)	Shrub	Fruit, leaves	Anthelmintic	Decoction	Milk	Oral
Ricinus communis (Euphorbiaceae)	Shrub	Leaves, stem	Common cold	Powder	Flour	Oral
Rumex hastatus (Polygounaceae)	Shrub	Root and leaves	Wound healing	Powder	Flour	Oral
Solanum surrattense (Solanaceae)	Herb	Whole plant	Whole plant	Fever, cough, intestinal infections	Crushed Flour	Oral
Sonchus asper (Asteraceae)	Herb	Whole plant	Milk production	Decoction	Flour	Oral
Sonchus asper (Asteraceae)	Herb	Whole plant	Milk production	Decoction	Flour	Oral
Tagetes minuta (Asteravceae)	Herb	Leaves	Skin infections	Juice	Water	Oral
Tamarix aphylla	Tree	Leaves	Kill worms of wounds	Paste	Rubbed	Dermal
Tinospora cordiflolia (Menispermaceae)	Climber	Whole plant	Skin infections	Poultice	Paste	Dermal
Tribulus terrestris (Zygophyllaceae)	Herb	Whole plant	Chronic cough	Crushed	Sugar	Oral
Trifolium repens (Papilionaceae)	Shrub	Root	Tonic, laxative	Powder	Flour	Oral
Triticum aestivum (Poaceae)	Herb	Seeds	Common cold, dysentery	Powder	Flour	Oral
Verbena officinalis (*Verbenaceae*)	Herb	Stem, leaves	Wound healing	Decoction	Milk	Oral
Vitex negundo (Verbenaceae)	Shrub	Stem	Mange, fever, stomach	Crushed decoction	Sugar	Oral
Zizyphus nummularia (Rhamnaceae)	Tree	Leaves	Wound healing	Decoction	Sugar	Oral

climbers) were found to be used for treatment of cow ailments in study area by *Raikas*' community. Different types of cow ailments were treated which were categorized into 8 major categories. Gastrointestinal infections were found to be most common in cattle and a total of 16 plants were used against them followed by 11 plants which are used as antipyretic while 7 are used for wounds treatment (Table 3). Local farmers prepare different types of ethnomedicines but the most preferred techniques were decoction and powder (12 plants each) followed by crushing (9 plants) in the studied region. Monotherapy was most common in the study area; only few plants were found to be used in concoction form (Table 1). For example, stem of *Allium sativum* is mixed with flower of *Punica granatum* and milk with used against gastrointestinal infection; roots of *Asparagus gracilis* are mixed with leaves of *Coriandrum sativum* to make fine concoction and given with water to cattle for delivery purposes. The most common route of administration was oral (68%) followed by dermal (16%) and only single species is administered through nasal pathway (Table 1). Recovery time of majority of the recipes was 3 to 4 days. Informant consensus (Fic) results have shown a high degree of consensus for gastrointestinal, respiratory, and reproductive (0.95 each) ailments, which were followed by parasitic infection and wound healing (0.90 each) (Table 3). The highest plants use citation was for gastrointestinal (195) followed by wound healing (53) and reproductive (47) ailments. The present study revealed 10 medicinal plants having high FL value (Table 4). FL values in this study varied from 1.0% to 100%. *Asaragus gracilis* ranked first with the highest FL value (93%) followed by *Rumex hastatus* ranked second (90%), *Tinospora cordifolia* ranked third (90%), and *Aloe barbadensis* ranked fourth (85%). The entire informants interviewed were aged people ranging between 40 and 70 years old.

Table 2. Habit and parts used of ethnoveterinary plants for cattle

General attribute	Total plants	Percentage
Habits		
Herbs	25	50
Shrubs	19	38
Trees	5	10
Climber	1	02
Total	50	100
Parts used		
Whole plants	18	36
Leaves	15	30
Root	01	02
Stem	04	08
Fruit	04	08
Seed	04	08
Others	04	08
Total	50	100

Table 3. Informants consensus factor

Disease categories	Nur	Nt	Fic
Gastrointestinal	195	16	0.94
Respiratory	18	02	0.94
Reproductive	38	03	0.91
Dermatological	11	04	0.90
Wounds	47	07	0.91
Antipyretic	13	11	0.91
Parasitic	43	05	0.90
General body tonic	07	02	0.83

Table 4. Fidelity level of highly utilized species

Plant species	Diseases category	Ip	Iu	FL (%)
Asparagus gracilis	Reproductive	31	33	93
Rumex hastatus	Wound healing	34	38	89
Tinospora cordifolia	Dermatological	26	29	90
Alove barbadensis	Gastrointestinal	25	28	89
Convolvulus arvensis	Gastrointestinal	23	26	88
Tribulus terrestris	Respiratory	14	19	73
Zizypus nummularia	Wound healing	17	20	85
Chenopodium allum	Wound healing	16	27	59
Artemisia brevifolia	Reproductive	21	31	67
Cannabis sativa	Parasitic	18	30	60

Livestock keeping is one of the most important economic sources of rural community of study area of Marwar. The farmers and nomadic people of the area not only depend on plants to get fodder for their animals but also use different medicinal plants to treat various cattle diseases. The majority of the people interviewed using ethnoveterinary plants have got this knowledge from their forefathers while some have learned from the other people. The majority of the farmers and nomadic pastoralists were not very well off and heavily dependent on medicinal plants due to their unaffordable potential of using modern veterinary drugs for their cattle treatment. Our study revealed that people of the region use 41 medicinal plants for their cattle health care. Similar studies have also been documented in other parts of India (Dudi and Meena 2015, Khandelwal 2017, Khadda *et al.* 2018). Traditional healers of the region mostly use herbs for the treatment of their animals that might be due to the fact that herbs are available everywhere and easy to collect as compared with other growth forms.

The results indicate the abundance of herbs in the study area and their high usage might also be due to the strong efficacy of herbaceous plants against cattle ailments. The same findings were also reported from other studies conducted at different parts of the world (Barbosa *et al.* 2018). The wider utilization of this Asteraceae family might be due to its higher abundance in the study area or mightbe due to high bioactivity. Similar studies have also been reported from other parts of world (Janackovic *et al*. 2019) and from India (Khadda *et al.* 2018) where traditional healers mostly use the member of Asteraceae family for the preparation of traditional medicines for the treatment of cattle and human ailments. This observation is however different from that of Singh *et al.* (2014) who in an

ethnoveterinary survey reported Fabaceae family as the highest. The difference among studies might be related to the different dominant vegetation of the areas or might be associated with traditional beliefs of different cultures in using specific plants traditionally. Most of the ethnoveterinary recipes in the study region are prepared using leaves of plants. The highest use of leaves in large number of ethnomedicinal and ethnoveterinary studies has also been documented from different parts of the world (Banotra and Gupta 2016). Preferred use of leaves might be associated with ease of collection as compared to other plant parts. Leaves are the main site of photosynthetic apparatus and are involved in a variety of physiological processes of plants and produce numerous secondary metabolites that could be a possible reason for their effectiveness and efficacy against cattle diseases.

Local people also use whole plants after leaves for herbal formulation that could be a very destructive type of harvesting for rare and slowly growing plants from conservation point of view. Harvesting of leaves does not pose any serious impact on the life cycle of plants and is considered a sustainable type of harvesting. The present results are in contradiction with other studies where roots are the most widely used plant part in ethnoveterinary practices (Meena *et al.* 2015). Cows were the most commonly treated animals followed by goats and sheep in the studied region of Marwar. Similar results have also been conducted by Dudi and Meena (2015). Production animals are also more important because of their socio-economic importance in the local inhabitant life. The majority of the plants in the region are used to treat different types of gastrointestinal problems of the cattle like diarrhea, expulsion of worms, constipation, and so forth. It has already been found that stomach infections are more common in lactating cows which might be due to poor quality of fodder and drinking water (Khandelwal 2017). Informant consensus results also showed the highest informant citation for gastrointestinal, respiratory, and gynaecological problems. The highest informant citation against these infections gives an indication of high prevalence of these diseases in the region. According to Khateeb *et al.* (2015), high medicinal values are very useful in the selection of specific plants for further search of bioactive compounds. Widely used medicinal plants for species ailments always score the highest fidelity level. The present study determined different plants like *Asparagus gracilis, Rumex hastatus, Tinospora cordifolia, Aloe barbadensis,* and so forth, scored highest fidelity values and should be further subjected to phytochemical and pharmacological investigation to prove their medicinal efficacy. The method of drug preparation in many cases varied from individual to individual. The same plant material for the same ailment was prepared in different ways by different traditional veterinary healers. Traditional healers prepare ethnoveterinary recipes mostly in the form of powder and decoction in the study area. Powdering or boiling is the most common method of drugs extraction (Khandelwal 2017). These findings are in line with a study conducted in the ethnoveterinary practices in India (Rautray *et al.* 2015, Punjani and Pandey 2015, Khateeb *et al*. 2015 and Sikarwar *et al.* 2015).

Most of the recipes are prepared using single plant mixture while some of the recipes are also prepared in the form of concoction and it is generally believed that potency of the drugs can be enhanced when used in concoction form (Banotra and Gupta 2016). These recipes are given to the cattle with their feed along with different types of ingredients like sugar, flour, milk, and so forth, in the region. Similar findings are also reported from other regions of the world (Barbosa *et al*. 2016) and Khadda *et al.* (2018). The use of these vehicles might be due to their enhancing potential of taste and medicinal properties of certain plant remedies. Uniformity was lacking regarding amount of medicines to be used among informants during the interview. Informants only provided the knowledge of observed time of recovery of cattle in response to given recipes. Full recovery is confirmed when the cattle restart proper feeding and activities. Similar findings are also reported by other ethnoveterinary studies conducted elsewhere (Bhanotra and Gupta 2016, Khandelwal 2017, Khadda *et al.* 2018 and Singh *et al*. 2014). It was confirmed from the present study that men had better knowledge regarding ethnoveterinary practices as compared to women. The reason might be due to the fact that men are mostly favoured in shift of knowledge while women in the majority of the cultures are considered for family's care.

It may be concluded that local farmers and nomads of the region utilize different medicinal plants for the treatment of cattle due to their low income status and high expenses of western drugs. From the present study, 50 indigenous technical knowledge practices and 35 plants families ingredients used for treatment of different ailments were identified and documented. The traditional healers and pastoralist of Marwar region Pali district *Raikas*' depends on ethnoveterinary practices in order to treat their cattle due to the unavailability of modern veterinary health care practices. Gastrointestinal infections were most common in the studied region; therefore attention should be given to provide good quality fodder and water to the cattle. Young generation should be mobilized to take interest in ethnoveterinary practices in order to conserve this knowledge.

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REFERENCES

Barbosa, Aguiar J A A, Alves J O and Nobrega R R D. 2018. Medicinal use of animals by hunters in North eastern Brazil. *Indian Journal of Traditional Knowledge* **17**: 485–93.

Bhanotra A and Gupta J. 2016. Mapping of indigenous technical knowledge (ITK) on animal healthcare and validation of ITK used for treatment of pneumonia in dairy animals. *Indian Journal of Traditional Knowledge* **15**: 297–303.

Dudi A and Meena M L. 2015. Ethnoveterinary medicine used by goat keepers in Marwar region of Rajasthan. *Indian Journal of Traditional Knowledge* **14**: 454–60.

Janackovic P, Gavrilovic M, Savic J, Marin P D and Stevanovic Z D. 2019. Traditional knowledge on plants use from Negotin Krajina (Eastern Serbia): An ethnobotanical study. *Indian Journal of Traditional Knowledge* **18**: 25–33.

Khadda B S, Singh B, Singh D V, Singh S K and Singh C B. 2018. Economics of goat farming under traditional system of management in Uttarakhand. *Indian Journal of Traditional Knowledge* **17**: 808–06.

Khadda B S, Singh S K, Singh C and Singh C B. 2018. Inventory of traditional ethno-veterinary practices followed by goat keepers, Uttarakhand. *Indian Journal of Traditional Knowledge* **17**: 155–61.

Khandelwal N. 2017. Ethnoveterinary practices among women of Banaskantha district, Gujarat. *Indian Journal of Traditional Knowledge***16**: 614–25.

Khateeb A M, Khandi S A, Kumar P, Bhadwal M and Jeelani R. 2015. Ethnoveterinary practices used for the treatment of animal diseases in Doda district, Jammu and Kashmir. *Indian Journal of Traditional Knowledge* **14**: 306–12.

Meena M L, Sharma N K and Singh D. 2015. Ethnoveterinary treatment of sheep in Marwar region of Rajasthan, India. *Indian Journal of Animal Research* **49**: 662–70.

NDDB. 2017. Annual Progress Report, National Dairy Development Board (NDDB). pp. 67–78.

Punjani B and Pandey V. 2015. Ethnoveterinary practices used by tribes in Bhiloda forest range, Gujarat. *Indian Journal of Traditional Knowledge* **14**: 313–18.

Rautray A K, Sahoo R, Sardar K K, Patra R C and Sahoo A. 2015. Ethnoveterinary practices for small ruminants followed by rural folks in southern Odisha. *Indian Journal of Traditional Knowledge* **14**: 614–25.

Singh D, Kachhawaha S, Chaudhary M K, Meena M L and Tomar P. 2014. Ethnoveterinary knowledge of *Raika's* of Marwar for nomadic pastoralism. *Indian Journal of Traditional Knowledge* **13**: 123–31.

Tariq A, Mussarat S, Adnan M, Abdeesalam N M, Ullah R and Khan A L. 2014. Ethnoveterinary study of medicinal plants in a tribal society of Sulaiman range. *Scientific World Journal* **14**: 7526–36.