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Cross-regional analysis on usage of Indigenous Technical Knowledge in dairy farming

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ABSTRACT

Farmers in India have been using traditional health care practices in dairy farming since time immemorial. Present paper is an attempt to review the Indigenous Technical Knowledge (ITK) practised and documented across five regions in India *viz.,* North, South, East, West and North East regions to understand the prevalence of ITKs and its dynamics of usage across the country. Cross regional analysis of location specificity of different ITKs, similarities and variation in ingredients usage and researchable issues in ITKs would help in further promoting its widespread usage. Large inter-regional variation in the ITK usage warrants a scope to popularize the validated ITKs among the dairy farmers of other regions where these are not being practised. Concerted research efforts are required in treatment of the important diseases like mastitis which causes heavy economical losses to the farmers, whereas the ITKs may be refined in the form of user friendly package for ultimate solution to the diseases.

Key words: Comparison, Dairy Farming, Diseases, Indigenous Technical Knowledge, Regions.

INTRODUCTION

Indigenous Technical Knowledge (ITK) in crop, livestock and fish farming as well as forestry has been well documented by many researchers across the country during different periods. In many cases, consorted efforts have also been made on validation of ITKs based on judgment of researchers and in a few cases useful products have been developed. In view of cultural compatibility, social acceptability and economic viability, ITKs are bound to play a predominant role in farming dominated by resource poor farm families. While much efforts have been published in peer reviewed journals and popular magazines, evidence on variability of ITK's usage across various regions to solve a particular problem is not available. Cross regional analysis would help to understand the diversity and similarity of different ITKs documented and used by farming community. Since most of the ITK's have a significant bearing on dairy farming, the present study was undertaken with the following specific objectives.

1. To understand the extent of location specificity of different ITKs across different regions of the country
2. To know the variation in ingredients usage, while applying ITKs for animals
3. To understand the similarities and variability of ITKs for the same problem in dairy animals
4. To explore researchable issues in ITKs for further promoting its widespread usage

MATERIALS AND METHODS

The whole country has been divided into five regions in order to compare the ITK's usage in dairy farming which comprise of North, South, East, West and North East regions. Important documented ITKs were identified for making cross regional comparisons. From each region, published articles and research studies and thesis were chosen. Problem wise comparison of ITK's usage was made. ITKs across the country were analysed for their diversity and similarity in terms of its ingredients/ composition of components and location specificity.

RESULTS AND DISCUSSION

Usage of ITK for addressing various breeding related problems

It is very important for the dairy farmers to identify heat detection at right time to make dairy farming profitable by overcoming the loss due to extra feeding and long dry period in animals. It has been estimated through NDRI study that farmer loses Rs.4000 when he misses each heat in dairy animal (Srivastava *et al*., 2013). ITKs can also play a major role in inducing heat in animals at right time. Cross comparison in the Table 1 shows that the plants used for inducing heat in dairy animals vary from region to region indicates the location specificity of ITKs and also emphasises the importance of plant diversity. Thus there should be increased focus on promotion of bio diversity among the farmers rearing dairy animals. It was also found

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Table 1: ITK's for inducing heat in dairy animals

North	South	East	West	North-east
Use of Jaggary, common salt, pigeon faeces, sprouted wheat, masur dal (*Lens esculenta*), hen's egg mixed with oil cake, Arabi tubers (*Colocasia esculenta*), sprouted *chhole* (*Cicer ariestinum*) and sprouted *Methi* seed (*Trigonelle foenum-graecum*), crushed soybean (*Glycine max*) in the feed (Sah, 1999). Use of *chapatti* made from mixture of 250 gm jaggary (*Saccharum officinale*), 150 gm *ghee* and wheat flour (*Triticum aestivum*) to feed animal once a day One kg boiled grains of *Methi* (*Trigonella foenum-graecum*) feed empty stomach to animals for 5 days (Bhanothra, 2012., Kavita Rani, 2014).	Two coconuts (*Cocus nucifera Linn*.) and 70 gm *Toon* (*Cedrela toona Roxb*.) made as gum and feed animal along with ¾ glass of *neem* oil for 3 days Give *Kattralai (Agave sisalana Perr)* juice for 1 week and then, water soaked Bengal gram (*Cicer arietinum Linn*.) for 10 to15 days Feed *Nerinji* (*Tribulus terrestris* Linn.), Moringa flowers, *Adalsa* (*Adhatoda vasica Nees*.) with 300ml neem oil in the night and next morning 250 gm mixture of leaves of *Banyan* tree, (*Ficus bengalensis* Linn.), *Peepul* tree *(Ficus religiosa* Linn), Mango (*Mangifera indica* Linn.), *Neem* (*Azadirachta indicaA.Juss*.) give for 5 days (Ponnusamy *et al.,* 2009). Feeding of droppings of pigeon by the Toda tribes (Karthikeyan and Chandrakandan, 1996).	Feeding of *Hing* (*Ferula assafoetida)* and mustard cake (*Brassica spp*.) (Jha, 1998). Feeding of *Kalajeera* (*Cuminum cyminum)* along with oil cake to animal (De e*t al*., 2004). Feeding of Mustard oil cakes (*Brassica campestris* L.) for few days Feeding of germinated wheat/Gram @ 250-500 g daily with other feeds for one week Feeding of one nutmeg (*Myristica fragrans* Houtt) dust three times a day (Saha, 2014).	Feeding of 3-4 seeds of (*Semecarus anacardium)* for 3-4 days Feeding of Bajra (*Pennisetum typhoides*) and ½ kg/day jaggery for 10-15 days (Chand, 2011). Feeding of sprouted wheat (*Triticum aestivam*)and maize (*Zea Mays*) grain or *villama* seeds of *dadun* or faeces of pigeon were used by tribes (Khatik, 1994). Feeding of three to four seeds of *Bhilawa* (*Semeracarpus anacardium)* for 3 to 4 days (Gupta and Patel, 1992).	Feeding of roots of S*hatavari* (*Asparagus racesmosus*) @ 500gm / day to cow for 10 to 15 days Feed 250 gm of dried powdered wild yam tuber (*Dioscorea villosa*) is mixed with rice gruel twice daily for 3-4 days (Singh, 2013).

that pigeon dropping had significant application in inducing heat in dairy animals across the country as the droppings are said to contain estrogen required to create heat in animals. Mineral composition of pigeon droppings is almost similar to commercially available mineral supplements and also rich in iron, zinc and fluorine. Sprouted seeds of legumes and cereals had significant effect on inducing heat in the animals as their rich sources of protein are found to induce heat in animals. The rich protein content 30-35 per cent in mustard cakes helps to induce heat as mustard cake protein has a well balanced amino acid composition, methionine, and lysine. Molasses or jaggery is added to increase palatability of mixture. A plant like methi (*Trigonella foenugraceum*) was found to be used in all regions while region specific plant like *Agave sisalana Perr.* was used only in the south. It was observed that certain ingredients were boiled in one region while sprouted seeds of the same were used in other regions. Even though bajra and maize are the important crops in south Indian states, the use of these crop seeds were not well documented or noticed in inducing heat although as it was commonly observed in east and west regions. In the north-eastern states a peculiar characteristic of using wild forest species were noticed rather than using common cereals or normal plant species.

Table 2: ITK's for dystocia control in dairy animals

North	South	East	West	North-east
Allowing animals to swim in pond (Meena, 2000).	-	Feeding of boiled paddy, *bamboo* leaves, jack fruit leaves, tie jasmine roots on neck and apply lime paste on horn of animal (Mohanty, 1999) Drenching the animal with 50 ml castor oil (Eqbal, 2011).	Force animal to move on uneven ground or roll the animals (Chand, 2011).	Deposit paste made from fresh root of *Shatavari* (*Asparagus racesmosus*) inside the vagina and also apply topically on abdomen for expulsion of foetus Deposit fresh pulp of tuber of wild yam (*Dioscorea villosa*) in vagina (Singh, 2013)

Birth difficulty or dystocia is a major periparturient disorder in animals. Farmers allowed the animals to swim in the pond as water availability is not a major constraint in the north region. But in western part of the country animals were forced to move on an uneven ground (Table 2).The application of this technique was found to be similar across both the northern and western regions to facilitate animal to exercise which need further scientific validation. While parts of different plant species were used for dystocia control in East and north-east regions. *Bamboo* leaves, *Shatavari* (*Asparagus racesmosus*), wild yam (*Dioscorea villosa*) are the important plant species used in the treatment of dystocia. *Asparagus racemosus* root powder supplementation during different stages of lactation improved the reproductive performance and nutritional status of dairy cows. Thus, it could serve as a potential management tool to improve reproductive performance (including inducing heat) in crossbred dairy cows which will help to overcome the periparturient disorder, such as dystocia (Kumar *et al.,* 2010). *Asparagus racemosus* has antioxidant and antibacterial effects, and might improve the immune system. Root and leaf of *Shatavari* contains aspergin, mucilage and saccharine matter which is used as a refrigerant, demulcent, aphrodisiac, antidirrhoeal, anti spasmodic and dewormer. Bamboo contains choline, betaine, nuclease, urease, cyanogenic glucosides. When the animals are allowed to swim in the pond, the excess body heat of the animals gets subsided. It was found that there is a lack of documentation of ITKs for dystocia in southern region. Dissimilar practices were observed for control of dystocia in dairy animals across various regions.

Perusal of (Table 3) shows that in the northern region paddy (*Oryza sativa*) cultivation is predominant and paddy is also called as a "heated substance" which means that heat of the paddy would help to break down the uterine lining that helps in easy expulsion of placenta (Lans *et al.,* 2003). Other plants like *Banana, Jack fruit, Bamboo*, caster tree, tea leaves were used for the treatment. Jack fruit contains high value of organic matter digestibility as well as metabolisable energy. In the southern region *toon*, mango nuts, Indian liquorice, brinjal, *jamun*, cotton seeds, horse gram, bengal gram were used. In the eastern region mango leaves, fenugreek, jackfruit, *bamboo*, jasmine, castor oil were used. Fenugreek seeds act as emollient of the intestinal tract. The aqueous extract of the seeds shows antibiotic activity. In the west *akada* shrub, *Cinnamomum zeylanicum*, cloves, *Arbus precautarius*, bark of *jamun* are given in various combinations or separately. In North east *Takki (Bahunia viriegata*) was used. Cotton contains resin, phenols, glucosides, gossypetin which helps in dropping of placenta. Mango contains vitamin A, B and C, tannin, gallic acid, fat sugar and gum which help to act as laxative, diuretic, diaphoretic, astringent, antiscorbutic and stops bleeding and prolapse of uterus. It is noticed from the different documented ITKs that decoction prepared by boiling of plant parts as a treatment is practised commonly in all the regions instead of feeding whole plant or parts of it as a solution for retention of placenta.

Mastitis is an important disease which causes heavy economic losses and also affects the quality of milk, but the ITK documented for mastitis treatment are very limited. Application of the *Chenopodium* paste reduces the swelling and pain in the inflamed udder, the herbal paste also cures blood in milk indicating its anti-inflammatory potential (Table 4). This plant has antiscorbutic, diuretic and nutritive properties. The studies in this direction are very limited and restricted to northern region whereas in the western region the medicinal plants like turmeric, *gugal*, *babul* and other ingredients such as salt, honey and alum are used for treating the mastitis. Turmeric contains curcumin, and terpenoids which work as cooling agent, astringent, anti-inflammatory and antibacterial effect. These ITKs are not so effective in curing mastitis but only aids in reducing swelling and pain in affected udders. Thus, it is imperative to test more ITKs from different parts of the world so that an effective alternative to antibiotics commonly used in mastitis is developed (Mukherjee, 2004). To prevent economic loss of farmers, prevention is better than cure; hence, efforts should be made to prevent mastitis by following hygienic practices in the dairy farms.

Diarrhoea is most common in dairy animals. Diarrhoea results in loss of fluids which in turn results in dehydration and the loss of certain body salts. Possible causes of diarrhoea include bacterial and viral infections, certain chemicals, intestinal parasites, poor diet, overfeeding on milk or lush grass, poisonous plants and other toxins, food allergies and even stress. The problem is more acute in calves where it leads to death if proper measures not taken at right time. So, to overcome the problem of diarrhoea, farmers tend to follow different ITKs across the country. The cross analysis of different regions showed that there are vast differences in plant species as well as parts of the plants used. In the north, mainly leaves, fruits and flowers were used. While in southern region seeds and leaves were used. In east, fruits, pulp and bark were commonly used and in west, use of bark was documented. In north east, leaves were commonly used. The paste prepared with different combination of plant parts for feeding to the animal was followed for control of diarrhoea in all regions of the country (Table 5). The study on plants belonging to different plant families such as Anathaceae, Anacardiaceae, Ceasalpinniaceae, Clusiaceae, Punnicaceae and Verbenaceae indicated anti-diarrheal activity (Panda *et al*., 2012) against pathogens causing diarrhoea in human being was tested successfully. Other plants like *Mangifera indica, Punica granatum and Cassia Absus etc.,* were also used to treat in animals in northern and southern regions. Bael fruit might have antidiarrhoea ingredients such as alkaloids, tannins,

Table 3: Addressing the problems of retention of placenta

North	South	East	West	North-east
Feeding of *paddy (Oryza sativa), Banana (Musa paradisiaca)* and *Soanf (Foeniculum vulgare)* boiled in water and then filtrate given to animal (Sah, 1996). Feeding of Jackfruit *(Artocarpus heterophyllus)* leaves or boiled *paddy* along with *bamboo* (*Bambuseae*) leaves (Pandey,1996). Feeding of liquid abstract of half kg of boiled tea leaves (*Camellia sinensis*) Feeding of half kg boiled Paddy *(Oryza sativa)* One kg stem of simbal (*Bombex ceiba*) tree leaves and 100 gm of jaggery (*Saccharum officinarium)* was boiled in ½ lit of water and fed Cold water was fed to animals until full stomach ½ kg gulkand and 4 unboiled eggs Baans leaves (*Bambusa arundinaceae*) were fed to animal 200 gm wheat flour (*Triticum aestivum*) boiled in water and mixed in 100 gm ghee and 100 gm jaggery (*Saccharum officinarium)* apply to animal body (Bhanothra, 2012). Feeding of boiled bark of castor tree (*Ricinus communis*) mixed with jiggery (Das, 2003). Extract obtained from tea leaves *(Camellia sinensis)* on boiling after sieving was fed to animals Extract obtained after boiling rice was also fed to animals (Kavita Rani, 2014).	Powdered *Toon* (*Cedrela toona Roxb*.) and mango nuts are given to affected animals twice a day 3 to 4 seeds of Indian liquorice *(Abrus precatorius Linn*.) mixed with boiled brinjals and made as a paste and given to animals for 2 to 3 days 10 gm of bark of Jamoon tree (*Syzygium jambos L.Alston*) boiled in water and is given to animals for two days After parturition, 1 kg non-parboiled rice gruel and 250 gm of palm gur is given to the cows for 2 days Four kg cotton seeds, 2 kg horse gram and 2 kg Bengal gram soaked in water and are fed to the animals (Ponnusamy *et al*., 2009)	Feeding of mango leaves to expel the placenta 50 gm of fenugreek and 100 gm of sugar mixing with milk for a week (Saha, 2014). Feeding of 20-25 number of jack fruit leaves with oil immediately after parturition (De, 1994). Feeding of boiled paddy, bamboo, jackfruit leaves, tie jasmine root on the neck and apply lime paste on horn in case of retained placenta (Mohanty, 1999). Drenching the affected animal with castor oil (50 ml) is fallowed (Eqbal, 2011).	Edge shrub flower or stem of Aakada Shrub (*Calotropis procera*) used for retention of placenta (Patel *et al*., 2014) *Cinnamomum zeylanicum* Taj Bl. Dry stem bark powder mixed with clove is fed to animals to help expel the placenta after delivery (Jadeja *et al*., 2006) Two or three seeds of *Abrus precatorius* are given with boiled bajra to the animal immediately after calving for easy and early dropping of the placenta and the bark of jambu *(Syzygium cumini)* tree is boiled in the water filtered and given to the animal just after calving (Gupta and Patel, 1992)	Two cups of root decoction of *Takki* (*Bauhinia variegata L*) is given twice a daily (Sharma, 2010).

Table 4: ITK's for mastitis control in dairy animals

North	South	East	West	North-east
Application of 15 gm black salt was on the teats once a day (Bhanothra, 2012). 100 gm turmeric (*Curcuma longa*) 10 gm alum or *phitkari* and 10 gm black pepper grind and massage on teats once a day (Subrahmanyeshwari and Chander 2013). Honey and turmeric alternative treatment using the case of an herb locally known as bathua (*Chenopodium album*) in India. Use of aqueous extract of *Ocimum sanctum* (*O. tenuiflorum*), alcoholic extract of *Tinospora cordifolia* and cell wall fraction of M. pheli were found to be effective against SCM (Mukherjee, 2004). Application of common salt on teats or combination of turmeric *(Curcuma longa),* alum and black pepper grind and apply on teats or application of only alum or *phitkari* on teats (Kavita Rani, 2014).	-	-	Bhandari Gugal (*Commiphora wightii Arn.*) Tree used to treat Mastitis (Patel and Patel, 2014) *Deshi baval* (*Acacia nilotica* L. Del.) gum is used to cure mastitis (Jadeja *et al*., 2006).	-

Table 5: ITK's for managing diarrhoea in dairy animals

North	South	East	West	North-east
Linseed plant *(Linum usitatissimum)* or soaked gram *(Cicer arietinum)* or arhar *(Cajanus cajan*) wood mixed with ash, salt and water and feed to animal (Gupta and Gupta, 1989). 100gm of banana leaf (*Musa paradisiaca*) and 100 gm of jaggery (*Saccharum officinarium*) grind and mix with 100gm of *Ajwain* (*Trachyspermum ammi)* and feed to animal per day for 2 days Flowers of tobacco (*Nicotina tobaccum*) were mixed in wheat flour and feed to animal once a day 10-12 leaves of *katori (Xylosona longifolium*) feed to animal Fruits of *bael* (*Aegle marmelos*) feed to animal (Bhanothra, 2012). Powder of half ripe *bael* (*Aegle marmelous*) fruit +powder of *shisam* (*Dalbergia sissu)* leaves give to animal (Subrahmanyeshwari and Chander, 2013) 10-12 leaves of *Katori (Xylosona longifolium)* plant feed to animal Fruits of *bael* (*Aegle marmelos*) feed to animals (Kavita Rani, 2014).	3 gm Thorn apple (*Datura stramonium* Linn.) seeds, 20 gm areca nut (*Areca catechu*) and 500 gm white clay mix with rice gruel and is give twice a day Leaves of *kolinji* (*Tephrosia purpurea* Linn.) mixed with carved coconut, cumin *(Cuminum cyminum)* and dried chillies are given to animal Cotton (*Gossypium hirsutum*) seeds and 4-5 leaves of the Portia tree (*Thespesia populnia* Linn.) mix and boil in water and give to animals 250 gm pomegranate leaves (*Punica granatum* Linn.) or tender sapota (*Manilkara zapota*) give to cattle Mixture of *(Hybanthus enneaspermus* (L.) F.Muell. *Orilai thamarai* and cumin (Ponnusamy *et al.,* 2009).	Dissolve salt and sugar in 1:2 ratio in water and drench the animal 2-3 times a day Pulp of 100 gm old ripened *Tentul* (*Tamarindus indica*) feed to the animal for two to three days. Fifty ml sap of *Peyara (Psidium guajava)* leaves feed especially for goat One hundred and fifty gram *Pelakacha's* fruit smoked and then feed to the cattle (De, 2004.; Mohanthy, 1999). *Neem* (*Azadirachta indica*) leaves and bark of *Daniaa* (*Bougainvillea glabra*) are mixed and sap is extracted from the mixture and then 100 ml is drenched everyday for 3-4 days Decoction of barks of *Kendu* (*Diospyros Melanoxylon*) and *Bankulthi*(*Cassia Absus*) + Methi (*Trigonella foenum-graecum*)+ *Saunf* (*Foeniculum vulgare*) + *Sonth* (*Zingiber officinalis*) and rock salt with molasses (Kumar, 2011).	Decoction of stem bark powder of Mango (*Mangifera indica* Linn.) given orally (Jadeja *et al*., 2006).	Feeding fresh leaves of *Kumarika* (*Smilax ovalifolia*) chopped and sprinkled with salt solution 250 gm fresh or 100 gm dried leaves of *Ganja* (*Cannabis sativa*) and Banana (*Musa paradisiaca)* stem is boiled along with feed prepared for a day (Singh, 2013).

flavonoids, saponins and triterpenes which may be responsible for ameliorative potential of bael. *Shisam* (*Dalbergia sissu)* leaves contains alkaloids, tannins and saponins. Ajwain contains searoptin, thymine, thymol which has antihelminthic, antiseptic, carminative and antispasmodic properties. Pomegranate has astringent, antihelminthic and cooling properties. Salt is used in certain combinations as it restores electrolytic imbalance. Banana possesses astringent action. Guava contains essential oils, eugenol, resin, cellulose and volatile oil. A peculiar regional specific plant like *Aegle marmelos* was found exclusively in the northern region. Even though the plants like *Punica granatum, Mangifera indica,Trigonella foenum-graecum and Zingiber officinalis* were grown across all regions of the country, but the use of these plants was noticed in certain regions only which might be mainly due to lack of awareness among farmers and traditional healers.

Among the various ectoparasites such as mosquitoes, flies, triatomines, fleas, bees, ticks are the common causing severe health problems to the dairy animals. Especially to control ectoparasites, use of chemicals like kerosene and petrol also known as tickicides are well known methods of local practice followed by all the regions in India. *Annona squamosa* contains amorphous alkaloid which has anti-ecto-parasitical property. *Mimosa pudica* contains alkaloids, mimosine, tannin, which helps as antiseptic. It is a good researchable issue to observe that different plants like *Brassica campestris, Artemisia nilagirica, Prunus persica* in the north, *Nicotiana rustica, Millettia pinnata* in east*, Milletia extensa, Azadirachta indica, Mimosa pudica, Mikania micrantha* and *Melia azedarach* in north-east used to control ectoparasites which were belong to the clad of *Eudicotidae or eudicotyledons* plants. The use of plant herbaceous perennial *Aristolochia bracteata,* that plant pipevines contain a disinfectant which assists in wound healing. It is colloquially known as "Worm Killer" due to

Table 6: ITK's for ectoparasites control in dairy animals

North	South	East	West	North-east
50 gm common salt (sodium chloride) add to 250 gm of *sarsoon* oil (*Brassica compestris*) and apply all over the body of animal (Bhanothra, 2012). *Aaru* leaves (*Prunus persica*) were grounded to form a paste, which was applied on the animal to remove the external parasites 10 g of kerosene oil or petrol was applied all over the body of animal Neem leaves were applied all over the body of animal Cow urine and black ash; cloth dipped in petrol; camphor application; red soil on legs (Subrahmanyeshwari and Chander, 2013). Salt added to mustard oil *(Brassica campestris)* was applied all over the body for control of ectoparasites *Shambar* leaves *(Artemisia nilagirica)* were fed to animals for removing internal as well as external parasites (Kavita Rani, 2014).	Powder of sweet flag (*Acorus calamus*) and Tulsi (*Ocimum Sanctum*) leaf juice is smeared over the body Powdered Napthaline balls were applied all over the body and washed with water (Ponnusamy *et al.,* 2009).	Tobacco (*Nicotiana rustica*) shoot with kerosene oil Leaves or oil of *Karanj (Millettia pinnata*) Dung ash with leaves of *Saritha* (*Annona squamosa)* (Kumar,2011) .	Paste of green leaves of *Kid amar (Aristolochi a bracteata Retz.) apply* to kill ticks & maggots (Jadeja *et al*., 2006).	The shed dried root of *Milletia extensa* is worn on animal neck as collar ring Bath the animals with boiled leaves of Neem (*Azadirachta indica*) and water *Mimosa pudica* rubbed on affected part to cure scabies Hang leaves of *Mikania micrantha* and *Melia azedarach* Linn. inside the animal shed as insect repellent (Singh, 2013).

Table 7: ITK's for Endoparasites control in dairy animals

North	South	East	West	North-east
Feed rhizome of baryaan herb (*Acorus calamus*) to animal Feed *Shambar* (*Artemisia nilagirica*) leaves to animal Feed leaves of *Neem* (*Azadirachta indica*) to animal (Bhanothra, 2012). Forest leaves; stem peelings; fermented mixture of butter milk and *neem* leaves (Subrahmanyeshwari and Chander, 2013)	Grinded 50-100 seeds of *Subabul (Leucaena leucocephala)* given with 200 ml of water to goats Leaves, flowers and bark of *neem* along with 100 gm cucumber seeds (*Cucumis sativus* Linn.) ground and give for 3 days (Ponnusamy *et al.,* 2009.; Seeralan, 2004).	Extract of *neem* leaves mixed with sugar and fed to animals (Mandal, 1999). Leaves and bark of *Arhar (Cajanus indicus)* with molasses/ Blood of duck / Fruit of *Baibidang (Embellia robusta)* with molasses (Kumar, 2011).	Drenching of *kalijiri* (*Cuminum cyminum*) mixed with sour whey to kill intestinal worms (Khatik, 1994).	The decoction of the leaves @ 1 kg *Alangianceae alangium* mixed with 5 lit of drinking water and feed to animal after fasting over night The leaves of *Meyna Laxiflora* and *Musa paradisiaca* chopped together and feed to animal adlib (Singh, 2013).

supposed antihelminthic activity which is found to be used in western region of India.

The region wise comparison showed that for the control of endoparasites in animals, the ITKs in northern, southern and eastern regions show that the use of Neem (*Azadirachta indica*) helps in effective control of both ectoparasite and endoparasites. It is mainly because of presence of Azadirachtin and other compounds in neem products which exhibit various modes of action against insects such as antifeedancy, growth regulation, fecundity suppression and sterilization, oviposition repellence changes in biological fitness and blocking development of vector-borne pathogens (Tipu *et al*., 2006). A. Beside this in north, baryan herb (*Acorus calamus*), *Shambar* (*Artemisia nilagirica*) were used. In south, *Subabul* (*Leucaena leucocephala*) and cucumber (*Cucumis sativus* Linn.), in the east, Arhar (*Cajanus indicus*), *Baibidan* (*Embellia robusta*).in west *kalijiri* (*Cuminum cyminum*), In north-east *Alangiance aealangium, Meyna laxiflora* and *Musa paradisiacal* were used.

Many of the indigenous traditional knowledge-based crude polyherbal preparation containing *Withania*

somnifera,Ocimum sanctum, Tinospora cordifolia, Emblica officinalis, Nigella sativa, Tribulus terrestris, and Asparagus racemosus supplementation possess antioxidant properties.

RESEARCHABLE ISSUES

The comparison of different ITKs across five regions of the country reveals the following researchable issues.

1. Documentation on mastitis control in dairy animals needs to be further explored in different regions of the country
2. The wide variation in formulation of ITK practice for same problem warrants preparation of unique product based on the role of active ingredients in plant parts.
3. A ready to use (RTU) product prepared from well validated ITK would enhance the adoption, profitability and sustainability.
4. Efforts should be to validate the use of plants such as pearl millet and sorghum in South India also as they are widely used in East and West regions.
5. For controlling diarrhoea in dairy animals, plant parts used for treatment vary from region to region and it is vital to find the best plant part for effective use.
6. There is a need to develop appropriate extension mix for disseminating the locally relevant ITK through vernacular language targeting the resource poor farm families.
7. Higher focus is required on local innovators to be developed as role models and training centers for outscaling the adoption of ITKs relevant to particular region.
8. Many research projects have been carried out in the domain of ITKs but a result framework for monitoring ITKs and its impact on the communities or people need to be developed.
9. Like Intellectual property right a legal protocol for validation and protection of ITKs should be developed to encourage traditional practitioner, researchers and associated communities.
10. Conservation of useful plants, local resources should be encouraged through cultivation of medicinal plants collectively like in ITK medicare parks or gardens and its use and method of ITK use should be described on boards for visitors.

CONCLUSION

The ITKs used for treating animals in India are wealthy traditions of animal husbandry. These traditions are being maintained from generation to generation; but with the trend of modernization, knowledge of ITKs are depleting at a very high rate. From this study, it is revealed that there is vast variation in the ITKs usage for treating animals, though few are common. It also shows that the ingredients used in the ITKs for treating animals are easily available in the locality. Cross regional analysis has helped to understand the diversity and similarity of different ITKs which were documented and used by farming community. It would help to popularize these ITKs in the other regions where they are not known or prevalent. It will help to conserve tradition and make use of our local biodiversity for treating animals at low cost. The use of these ITKs for ayurvedic medicines need to be promoted. There is need to explore ITKs on the disease like Mastitis which causes heavy losses to farmers. The traditional healers should be encouraged to spread this knowledge to future generations, in order to conserve these rich traditions of animal care.

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