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Documentation of Ethnoveterinary Practices for Mastitis in Dairy Animals in Pakistan

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ABSTRACT

This study was aimed to document the ethnoveterinary practices (EVPs) used for the control and treatment of mastitis in cattle and buffaloes in the Sargodha district, Pakistan. The information was collected using rapid and participatory rural appraisal techniques through interviews and focused group discussions with 217 traditional veterinary healers (TVHs) over a period of 16 months from September 2005 to December 2006. Thus, 25 different plant species belonging to 20 different families were documented from the study area for the treatment and prophylaxis of mastitis in bovines (cattle) and bubalines (dairy buffalo, *Bubalus bubalis*). The most frequently reported (≥10 times) plant species were *Capsicum annuum* L. (*n* = 32), *Lepidium sativum* L. (*n* =31), *Allium sativum* L. (*n* = 28), *Sesamum indicum* L. (*n* = 24), *Citrus limon* (L.) Burm. f (*n* = 22), *Zingiber officinale* Roscoe (*n* = 18), *Citrullus colocynthis* (L.) Schrad (n = 18), *Curcuma* longa L. (n = 16), *Cuminum cyminum* L. (n = 14), *Rosa indica* L. (*n* = 13), *Centratherum anthelmisticum* L. (n = 12), *Triticum aestivum* L (*n* = 11), *Nigella sativa* L. (n = 11) and *Peganum harmala* L. (n = 11). All the documented plant species were indigenous to the study area. Materials other than plants used for the treatment of this problem included ammonium chloride. The richness of EVPs in the study area and extensive variation in the doses, methods of preparation, indications, and claims regarding efficacy of plants for mastitis merit controlled studies for their validation.

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INTRODUCTION

Pakistan is one of the major dairying countries in the world with a population of over 29 millions heads of dairy buffalo (*Bubalus bubalis*) and 31.8 million heads of cattle. This huge number of cattle and buffaloes, however, produce only 30 million tons of milk per annum (Economic Survey of Pakistan, 2007-2008), which translates into 2-3 liters of milk production per animal per day. Poor genetic potential and nutritional and managemental practices, especially those affecting the health of milk producing organ (udder) are the major factors for low milk production in these animals (Yousaf, 2009).

Mastitis is the outcome of a complex interaction between host (cows, buffaloes etc.), causative agents (microorganisms) and environment (Muhammad and Firyal, 2008) and is the most costly disease of the dairy industry all over the world (DeGraves and Fetrow, 1993; Allert, 1995). It globally leads to losses of 53 billion dollars annually (Ratafia, 1987). In various surveys, mastitis has been identified as the major livestock problem of Pakistan (Cady *et al*., 1983; Hussain *et al*., 2005; Ali, 2006; Muhammad and Firyal, 2008). Among various microorganisms, bacteria (*Staphylococcus aureus* and *Streptococcus agalactiae*) have been reported to be the most commonly associated etiological agents of mastitis in dairy buffaloes and cows in Pakistan (Shakoor, 2006). The commonly practiced antibiotic treatment for the cure of the clinical mastitis denotes poor results (Sandholm *et al*., 1990). Failure of the antibiotics to reach the site of infection in adequate concentrations, development of resistance to antibiotics, bacterial dormancy, L-form of bacteria (which are not sensitive to the β-lactam type of antibiotics), detrimental nature of some antibiotics to phagocytosis and incompatibility of antibacterial with milk have been implicated for sub optimal results in the therapy of mastitis with antibiotics (Yousaf, 2009).

The use of ethnoveterinary medicine (EVM) may present a cheaper and sustainable alternative to synthetic medicines. These herbal preparations, drawing upon

centuries of traditional belief and use, are in practice over time by pastoralists and farmers for the treatment of different diseases of livestock (Danø and Bøgh, 1999). Natural products may also be an important source for new pharmaceuticals (Abelson, 1990). In Pakistan, Sargodha district is renowned for its high yielding dairy animals and richness of ethnovetrinary practices (Dilshad *et al*., 2008). The present study was carried out to document the use of ethnoveterinary practices for the treatment and control of mastitis of cattle and buffaloes, the two most important dairy animals of Pakistan.

MATERIALS AND METHODS

Study area

District Sargodha is located at latitude of 32.08^0N and 72.67^0E of Punjab, Pakistan. The area under study comprises 5854 Km^2 and is divided into 845 villages. Average rainfall in the area is 526 mm/annum and mean temperature oscillates between 16.6^0C in January and 48^0C in June (Pakistan Meteorological Department, 2007). Sargodha is a canal irrigated plain agricultural district with wheat, rice and sugarcane being its main crops. The human population of district Sargodha is 2.8 million (Population Census Organization, 1998) with a population density of 455 Km^{-2}. The population of cattle and buffaloes in the area has been estimated at 574,887 and 687,685 heads, respectively (Economic Survey of Pakistan, 2007-2008). The female animals are mainly used for milk production, while males are reared for draught and meat purposes. Agriculture is the main source for income of most of the people, who have a rich history of traditional livestock farming. There are 60 government veterinary hospitals and/or dispensaries in the study area with a technical staff of 35 veterinary officers and 102 veterinary assistants (Livestock and Dairy Development Department, 2007).

Data collection

The study comprised of three main steps. An initial survey, rapid rural appraisal (RRA; Catley and Mohammed, 1996; Lans and Brown, 1998a) was conducted from September 2005 to December 2006 to identify the well-known traditional veterinary healers (TVHs). Survey team comprised a Veterinarian who was well versed with the diseases of livestock and local language, a Veterinary Assistant from nearby Veterinary Hospital and a community leader from the local village. A purposive sampling of TVHs was made (Lans and Brown, 1998b). Initial survey led to the identification of 217 TVHs, which were the key respondents for collection of subsequent information. The age of these TVHs ranged from 40 to 90 years and they enjoyed a respectable status in the community. They had gained ethnoveterinary knowledge through verbal transmission from their ancestors, by exchange of views during the treatment of animals with their coexisting practitioners or through hands-on experience. Moreover, 35 veterinary officers and 102 veterinary assistants were also included in discussion.

Interviews, focused group discussions and field visits were used as the tools of participatory rural appraisal (PRA). The information regarding the treatment and control of mastitis in cows and buffaloes using plants or other materials was collected using a well-structured questionnaire, open-ended interviews and guided dialogue techniques. Focused group discussions were arranged for verifying the information provided by the TVHs to reach more accurate results. TVHs were asked to tell how they acquired the knowledge related to the disease diagnosis and treatment. They were also asked to show the plant species or other materials, if any, described for the treatment of mastitis in cows and buffaloes.

All plants and other materials commonly used by TVHs for the treatment and control of mastitis were procured/ purchased from the area by the survey team. Medicinal plants used by the TVHs were identified by the Botany Department, University of Agriculture, Faisalabad (Pakistan) and the voucher specimens were preserved in Ethnoveterinary Research and Development Center, Faculty of Veterinary Science, University of Agriculture, Faisalabad, Pakistan.

RESULTS AND DISCUSSION

Detailed discussion with TVHs, qualified veterinary officers (35) and veterinary assistants (102) resulted in the documentation of 25 different plant species belonging to 20 families (Table 1) and one other-than-plant material (ammonium chloride) being used for the treatment and control of mastitis in cows and buffaloes in the study area. Maximum number of plant species belonged to the family Poaceae and Zingiberaceae (n = 3 each), followed by Brassicaceae (n = 2). The most frequently reported (≥10 times) plant species were *Capsicum annuum* L. (n = 32), *Lepidium sativum* L. (n =31), *Allium sativum* L. (n = 28), *Sesamum indicum* L. (n = 24), *Citrus limon* (L.) Burm.f (n = 22), *Zingiber officinale* Roscoe (n = 18), *Citrullus colocynthis* (L) Schrad (n = 18), *Curcuma* longa L. (n = 16), *Cuminum cyminum* L. (n = 14), *Rosa indica* L. (n = 13), *Centratherum anthelmisticum* L. (n = 12), *Triticum aestivum* L (n = 11), *Nigella sativa* L. (n = 11) and *Peganum harmala* L. (n = 11). Most of the plant species documented in this survey were locally cultivated which is in accordance to the argument of Johns *et al*. (1990) that more common a plant in the area, the more often it would be used.

The ethnoveterinary practices (EVPs) recorded in this survey were being used as prophylactic and treatment measures by the TVHs. The third most frequently used plant for the treatment of mastitis was *Allium sativum* L. Two major objectives in the control of mastitis i.e. the prevention of new infection and reduction in the duration of existing infection (Muhammad and Firyal, 2008) may have been achieved by the antiseptic and vermifuge properties of the *Allium sativum* (Bullitta *et al*., 2007). *Brassica campestris* L. oil recorded for the treatment of mastitis is in accordance with the report of Karreman (2007), who documented its use in treating mastitis along with the other plant materials. *Citrullus colocynthis* (L.) Schrad, reported to be used for controlling mastitis in this study, has been used as galactagogue in India (Takhar, 2004). The documentation of the usage of *Curcuma longa* for treating mastitis in this study is supported by the earlier report of its use in treating subclinical mastitis (Saxena *et al.,* 1995). *Linum usitatissimum* L. has been

Table 1: Frequency of use of medicinal plants for the treatment and control of mastitis in district Sargodha, Pakistan

Plant family	Plant species	Vernacular name	Frequency (n = 217)
Alliaceae	*Allium sativum* L.	Lehson/thoom	28
Apiaceae	*Foeniculum vulgare* Mill.	Saunf	08
Asteraceae	*Cuminum cyminum* L.	Sufaid zeera	14
Brassicaceae	*Lepidium sativum* L.	Halia	31
Brassicaceae	*Brassica campestris* L.	Sarsson	04
Capparidaceae	*Capparis deciduas* (Forssk.) Edgew.	Karir or Dillay	01
Compositae	*Centratherum anthelmisticum* L.	Kali Zeeri	12
Cucurbitaceae	*Citrullus colocynthis* (L.) Schrad.	Indryan/Kor tuma	18
Linaceae	*Linum usitatissimum* L.	Alsi	05
Malvaceae	*Gossypium hirsutum* L.	Paiway/waraiwain	09
Papilionaceae	*Trigonella foenumgraceum* L	Matheray	07
Pedaliaceae	*Sesamum indicum* L.	Meetha tael	24
Poaceae	*Triticum aestivum* L.	Gandam/kanak	11
Poaceae	*Oryza sativa* L.	Chawal/Moonji	10
Poaceae	*Saccharum officinarum* L.	Kamad	08
Polygonaceae	*Polygonum bistorta* L.	Anjbar	04
Ranunculaceae	*Nigella sativa* L.	Kaoolnji	11
Rosaceae	*Rosa indica* L.	Gulab	13
Rubiaceae	*Galium aparine*L.	Banafsha	01
Rutaceae	*Citrus limon* (L.) Burm.f	Khatian	22
Solanaceae	*Capsicum annuum* L.	Lal mirch	32
Zingiberaceae	*Zingiber officinale* Roscoe	Sund	18
Zingiberaceae	*Curcuma longa* L.	Haldi	16
Zingiberaceae	*Amomum subulatum* Roxb.	Baree Ilaichee	03
Zygophyllaceae	*Peganum harmala* L.	Harmal	11

reported to be used as galactagogue in Bangladesh (Islam and Kashem, 1999). *Trigonella foenumgraceum* L. documented in the present study was also reported to be used in Southern region of Italy as remedy in various conditions related to the production of dairy products from dairy animals (Pieroni *et al*., 2004).

Use of different parts of the plants (seeds, leaves, pulp from the stem, flowers, bark, oil extract, fruit, roots, petals, vine and rhizome) for the treatment and control of mastitis in cows and buffaloes has been depicted in Table 2. In some cases, whole plant was used as a remedy. Some prescriptions documented in this study were based on a combination of different plants with the understanding that synergistic effect of different species of plants improved the cure rates. This argument was strengthened by the previous report of Bonet and Valles (2007). Variation in the effects of various plants was attributed to the qualitative and quantitative differences in biochemical constituents of the plants like phenolics, polyphenols, terpenoids, essential oils, alkaloids, lectins and polypeptides (Cowan, 1999). The plant genotype (Scalzo *et al*., 2005) and agronomic practices (Hakkinen and Torronen, 2000) have been reported to affect the total phenolic and flavonoid contents in the fruit. Moreover, the degree of maturity at harvest, environmental conditions, development stages of the plant at harvesting, drying process and storage technique (Croom, 1983; Zadernowski *et al*., 2005) can also trigger variations in the active compounds of plants.

Commonly used vehicles for administration of plant material included water, jaggery, wheat flour, milk whey, butter as such or in refined form (*desi ghee*), sugar, vegetable oil, common and black salt. Sometimes milk (preferably cow milk) was used as a vehicle for the administration of fruit of *Amomum subulatum* Roxb and leaves of *Rosa indica* L. Similarly, saltish milk whey was mixed in oil extract of *Sesamum indicum* in treating mastitis. It has been suggested that the use of such vehicles may dilute or reduce the relative potency of the drug (Jabbar *et al.,* 2006).

The survey identified a range of doses of the same plant used for same condition by different TVHs. Non-standardized dosages (Longuefosse and Nossin, 1996) are subjected to criticism by the veterinarians (Niwa *et al*., 1991). 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 TVHs. The commonly used methods for preparation of plants and other materials to be used in EVM were, grinding, crushing, mixing, grinding with sugar and preparation of a decoction in water, milk or some vegetable oil (preferably *Brassica campestris* oil). Sometimes, the fruit was cut in to pieces, common salt was poured on these cut pieces and they were put in open air for whole of the night, so that they became condensed with dew drops and then these were orally fed to cattle and buffaloes for solving the problem of mastitis. The material in this end was the fruit of *Citrus limon.*

The commonly used modes of administration were feeding and drenching. Sometimes the plant material was put on the fired hay to produce fumigations. These fumigations were applied to the affected quarters of the animal. The plant material in this end included *Peganum harmala* and stem crushing of *Triticum sativum.* Similar types of practices with different plant species have already been reported for treating mastitis in camels in Saudi

Table 2: Ethnoveterinary practices for the treatment and control of mastitis in district Sargodha, Pakistan

Plants	Part of the plant used	Administration / dosage for cows/buffaloes
Allium sativum L.	Rhizome	250g, grinded with butter and administered orally for 7 days.
Amomum subulatum Roxb.	Fruit	25g, given orally for 3 days.
Brassica compestress	Seed oil	500ml, given orally for 10 days.
Brassica compestres+ *Curcuma longa*	Seeds + root	250g seeds are grinded with 50g root and administered orally for 5 days.
Capparis deciduas (Forssk.) Edgew.	Fruit	50g, administered orally for 3 days.
Capsicum annuum	Fruit/whole plant	50g, given orally for 8 days.
Centratherum anthelmisticum L.	Seeds	50g, mixed in wheat flour and given orally for 5 days.
Citrullus colocynthis (L.) Schrad.	Fruit	2-3 pieces given orally daily for 5 days.
Citrus limon	Fruit	250g, cut and placed in dew drops for whole night, common salt is dusted and administered orally for 5 days.
Cuminum cyminum L.	Seeds	1 Kg, administered orally in divided doses for 6 days.
Curcuma longa L.	Roots	25g, grinded with sugar and given orally for 7 days.
Foeniculum vulgare Mill.	Seeds	50g, seeds roasted on the hot plate, mixed in 125ml vegetable oil and drenched for 4 days.
Galium aparine L.	Vine	500g, given as decoction drench for 3 days
Gossypium hirsutum L.	Flowers	250g, boiled in 1L water to 250 ml, then drenched for 3 days.
Lepidium sativum	Seeds	500g, boiled in 2L of milk and given orally for 8 days.
Linum usitatissimum L. + *Citrus limon*	Seeds + Fruit extract	25g, seeds are mixed with the extract from 3-4 *Citrus limon,* added with raw sugar and given orally for 5 days.
Nigella sativa L.	Seeds	50g seeds boiled in 2L water to 250 ml and drenched for three alternate days only in winter season.
Oryza sativa	Seeds	500g boiled in 2L milk + sugar 500g and administered orally for 8 days.
Peganum harmala + *Triticum sativum*	Fruit + Stem crushing (Hay)	50g + 2 Kg, fumigation of harmal by putting it on fired hay under the affected udder for 4 days.
Polygonum bistorta L.	Bark	125g, boiled in 1L water to 250 ml, given orally for 4 days.
Rosa indica L.	Petals	750g, boil in 1L of cow milk, drenched daily for 7 days.
Saccharum officinarum L.	Extract	2 L, drenched daily for 7 days.
Sesamum indicum	Seed oil	250 ml, mixed oil in 1.5L of milk whey, and given orally for 7 days.
Zingiber officinale	Rhizome	125g, grinded finely with sugar, given orally for 5 days.
Trigonella foenumgraceum L	Seeds	25g, paste is made with handful of wheat flour and vegetable oil and given orally for 5 days.
Ammonium Chloride	Powder	30g, mixed in wheat flour and given orally for 3 days.

Arabia (Abbas *et al*., 2002).

No specific procedure for preparation and administration of EVM existed in the study area. It varied from person to person, depending on how the TVH acquired that knowledge and how they got good results. Ethnoveterinary knowledge (EVK) was usually transmitted orally from generation to generation. There is, however, danger of its extinction as most of the TVHs showed their concern that EVPs are gradually being replaced with modern allopathic medicine. The wide variations of documented plants and other materials indicate the unexplored dimension of this knowledge which is limited to a few persons who gained it from their forefathers. Validation and transferring of this knowledge to the livestock raising farmers everywhere to know the best plant material around themselves for a particular disease would not only serve the people of developing countries but also in the developed world.

Documentation of EVPs provides the data that serves as a base for validation of these practices and plant materials used to cure various ailments in livestock (Muhammad *et al.*, 2005). The validation of EVPs for the treatment of other diseases is the need of the hour to have better understanding for the promotion of their use on scientific basis.

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