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Short Research Article

Value Addition of Novel Herbal Livestock Medication *Mastiherb* in Treatment of Mastitis Sustained by Creative Communities from the Regions of Dang, Gujarat

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Abstract

Accessibility for livestock health care has been great challenge in hilly regions and remote areas. Communities across different regions try and find alternative cost effective solutions for livestock welfare. Indigenous Knowledge Research System provided necessary health care, minimize disease incidence and sustain livestock productivity. National Innovation Foundation-India with help of Society for Research and Initiatives for Sustainable Technologies and Institutions had identified, value added an indigenous knowledge practice of Shri. Ukhardiyabhai Sombhai Raot against mastitis among farm animals. The formulation *Mastiherb* was developed, tested and found effective against clinical conditions. Development of socially acceptable product was shared with creative society towards enhancing wider benefit. Globally there was not much successful evidence in emphasizing need to share advancement of documented practice with custodian of knowledge, fundamental ethos of Honey Bee Network. This had helped in formation of network among informal knowledge holders in the regions of Dang, Gujarat State. This had provided intellectual space for creative community to know each other, share and discus their rich experience. The research study tries to articulate generation of social goods from communities' collective action and need for specific strategy to convert them into employment opportunities. The study demonstrated the importance of value addition to novel folkloric medications and an implementation model for technology development, sustaining, sharing, and scaling up of low cost locally available medications. Engagement with creative communities illustrated establishment of knowledge network can be possible through socially relevant action research.

1. Introduction

Significance of agricultural activities towards enhancement of income among farming communities and sustaining food security has been enormous (Surtia et al., 2016). In this system, livestock population plays an important role through mixed crop-livestock farming system (Maass et al., 2012). Livestock sector is socially, economically significant as it provides multifunctional outputs as well as socio-cultural security (Sirohi and Chauhan, 2010). However, this sector is plagued by various ailments, of which mastitis is an important economic ailment affecting ruminant production system (Hillerton and Berry 2005; Ramkumar et al., 2003). Clinical mastitis also affects reproductive function of animal (Hertl et al., 2010), limits udder immunity (Alnakip et al., 2014) and renders total loss of revenue to farmers. Nature of this disease, cost of medication, difficulties in reaching out to needy livestock population and accessibility to diagnostic facilities were main impediments (Devgania et al., 2015). Even after intensive research and prevention measures for decades, the disease remains the biggest economic loss to dairy industry (Pyorala, 2002). Pyorala (2006) also share that inspite of antimicrobial treatment for more than 50 years efficient, safe and economical treatment is lacking. Problems reported by farmers have to prioritize for improved adoption of livestock technologies (Degu, 2012). Availability of labour, highly escalated cost of inputs, seasonal challenges, poor

networking skills in seeking scientific options, physically demanding farming activities and time availability to seek alternative technologies pose distinct challenge for farmers (Kandivendi et al., 2015). In this respect, public system requires necessary information for extent of involvement needed, to support livestock health program and to design suitable disease control strategies (Tisdell et al., 1999).

Evidence was generated for future transformation of society into more creative, compassionate and collaborative through efforts of Honey Bee Network (Gupta, 2013). The need of sustaining creative knowledge, skill and capacities of people from informal sector is paramount for welfare of society (Kumar and Ravikumar, 2016). Folkloric livestock medications offer greater role in remote, hilly areas and majority of rural population depend on it (Kumar and Bharati, 2013; Raziq et al., 2010). Novel practices emerge from this indigenous knowledge system and modern medicine could not replace them completely. However, diffusion research had focused on innovations introduced from outside and provided less attention based on technologies developed by farmers themselves (Roling, 1988). Attributes of innovations have to be considered for effective adoption and diffusion among dairy farmers (Rathod and Chander, 2016).

There were also less scientific understanding to know nature of behavior and suitable model for wider social diffusion of these knowledge systems. Rio-carmenado et al. (2014) argue that skill and competency in terms of technical, behavioral and contextual have to be emphasized while working with people. Limited literature was available wherein innovations developed from trying circumstances had moved beyond their area of origin (Simula et al., 2015, Yadav and Goyal, 2015). In most regions linkage with farmers and market has been weak (Argent et al., 2014), wherein these indigenous knowledge system operate. Learning on-farms is critical for innovation (Ayele et al., 2012) that can engineer path to development of technologies. Swaans et al. (2014) share that innovation platforms may bring different stakeholders to address interest of marginalized society which are rich in knowledge. However, successful realization of it requires suitable implementation through change in institutional arrangements (Schut et al., 2015). In this context efforts were undertaken to identify solutions from indigenous knowledge research system catering towards control of mastitis among farm animals. The research study was executed to understand the nature of social behavior of creative communities while sharing the development of documented knowledge with them.

2. Materials and Methods

The study was conducted over a period of time during June-July 2007 in the regions of Pondicherry Union Territories and Dang district of Gujarat State, India. The documented indigenous knowledge was value added and tested against Mastitis clinical condition affecting farm animals. This involves selection of livestock owners and sharing the nature of formulation developed based on herbal medication. Clinical animals were examined and requisite consent was taken from livestock owners for undertaking on-farm experimentation. Experimentation was initiated through intra-mammary infusion of formulation and evaluated for its efficacy in terms of minimizing disease condition. Confirmation of etiological agents was carried out through laboratory diagnosis to understand the impact of indigenous medication against specific mastitis condition.

The research study had undertaken an effort to share the development of medication based on knowledge of creative communities. An interactive meeting was organized in a village vanki, Dang district of Gujarat State. This involves extensive village meetings, interacting with creative individuals, personnel interview, field investigations and to have interface among indigenous livestock holders.

2.1. Selection of animals, case history and clinical examination

Ten crossbred cattle with clinical signs of mastitis were chosen for the study to evaluate novel veterinary medication derived based on knowledge of traditional livestock healer Shri Ukhardiyabhai Somabhai Raot. Animals were either identified at their farm station or brought to veterinary dispensary, Villianur, Pondicherry (Table 1). Villages Pozhiyur, GN Palayam, Kottamedu, Melthirukanji, Serhanatham, AV Pet, Kirumbapakkam and Villanur were investigated to ascertain these clinical cases and to have follow-up with livestock owners. It was found that four animals were each in their first and second lactation. Two animals presented for experiment were in their third lactation stages. Among affected animals, two animals were in their later stage of pregnancy and were non-lactating (Dry Cow Therapy-DCT).

Clinical cases were examined for severity, tissue irritation and milk production. Except for one animal, other animal's entire ailment was limited to single quarter. Clinical cases were evaluated on bacterial proliferation, tissue irritation and nature of milk. The impact of the formulation was evaluated by isolating bacterial culture and efficacy testing in affected quarter. Tissue irritation was studied by physical examination and clinical observation by quantifying parameters like swelling, erythema and pain hot^{-1}. The nature of milk was examined by including variables like not normal, apparently normal, hemorrhagic, curdled milk, flakes, serous and thelitis conditions. These observations based on severity of infection were in accordance with Sharma et al. (2007).

2.2. Bacterial culture

The teat orifice was cleaned with 70% ethyl alcohol and 50 ml milk from each cow was collected in sterile vials. The organisms were grown on differential medium to culture and confirm the nature of mastitis causative agent.

2.3. Strengthening of indigenous knowledge system through network meeting

Individual meetings were held with healers in regions viz., Vanki, Shishpanda, Gavdahad, Chinchivihir, Kosabiya, Samhagan, Dunkal and Galkund of Dang district, Gujarat state during the year 2007-2008. National Innovation Foundation-India with help of Society for Research and Initiatives for Sustainable Technologies and Institutions [SRISTI] had conducted network meeting among traditional livestock knowledge holders at Vanki, village of Ahwa Taluk, Dang district, Gujarat state on 4th April 2008 with the aim to share development of their knowledge and to understand nature of interaction among creative communities.

3. Results and Discussion

3.1. Efficacy of indigenous formulation against isolated etiological agent

The research study confirmed mastitis through clinical observation and causative bacterial organism in the study region. The field sample collected from affected quarter had shown bacterial culture indicating Staphylococcus aureus as an etiological agent for mastitis (Table 1). This gram positive bacterial agent pose severe challenge in mastitis control program and cause immune-suppression of mammary system (Hosseinzadeh and Saei., 2014; Barlow et al., 2013; Doymaz et al., 1988). In other field samples the result of bacteriological findings was found to be 'No growth'. This may be due to low concentrations of bacteria or animals may have been treated with antibiotics before sampling. This is in concurrence with White and Kuehn et al., (2013) reported 10-40 percent of clinical cases with negative culture. This in concurrence with Koskinen et al. (2010) who found about 33% of clinical cases bacterial culture diagnosis did not found udder pathogens. Most of the times experience of clinicians can be relied upon because of lack of bacteriological diagnosis that was not immediately available.

Table 1: Nature of clinical cases and bacterial culture

Sl. no.	Quarter	Stage of lactation	Prt–TI		Prt-MP			Bc
			Swelling	Erythema	Pain/ heat	Daily milk yield (litre)	Nature of milk from affected quarter	
1.	RF	I	Nil	Nil	Nil	9	Not normal	No culture
2.	LH	I	Moderate	Mild	Mild	8	Apparently normal	No culture
3.	RH	II	High	High	Hot	6	Curdled milk; highly fibrosed	Treated with AB
4.	RH	II	Moderate	Mild	Mild	DCT	Thelitis; Flakes	No culture
5.	LH & LF	III	High	High	Hot	9	Curdled milk	Treated with AB
6..	RF	II	High	High	Hot	8	Curdled milk	S aureus
7.	RF	II	Mild	Mild	Nil	8	Apparently normal	No culture
8.	LH	I	Mild	Nil	Nil	8	Blood in milk	Hemorrgahic milk
9.	RF	I	Mild	Nil	Nil	9	Apparently normal	No culture
10.	RH	III	Moderate	Mild	Mild	DCT	Serous	Treated with AB

TI : Tissue Irritation; MP : Milk production; Prt : Pre treatment; Bc : Bacterial culture (Each teat prior to milking); DCT : Dry cow therapy

Clinically confirmed animals were treated with 3 ml intra-mammary infusion day^{-1} for a minimum period of 3 days. The observation was carried out for a total period of five days. Among these cases, one animal was given liver tonic since animal was found with in appetite, mild fever. Further, animal affected with two teats was given Non-steroidal anti-inflammatory drug for one day only. Remaining 8 animals did not receive any supplements during the course of trial period. Livestock owners were advised to strip the milk after 8-10 hrs of administration of *Mastiherb* for 3 days.

The observation of udder and nature of milk from clinical cases had revealed immediate relief on next day (2nd Day) (Table 2). Nature of milk was observed on third day was found completely recovered and disappearance of clinical signs for 7 animals with history of blood in milk, flakes, curdled milk, serous milk and inflammation of udder earlier. Upon 5th day of observation, remaining 3 animals were completely cured. Affected quarters on continuous examination for next 5 days did not show reoccurrence pattern. Visual examination of milk was found completely normal and animals regained milk

Table 2: Observation of efficacy of herbal medication Mastiherb over clinical cases on Day II, III

S. no.	Tr–TI & MP Day II				Tr–TI & MP Day III			
	Swelling	Erythema	Pain heat^{-1}	Nature of milk from affected quarter	Swelling	Erythema	Pain heat^{-1}	Nature of milk from affected quarter
1.	Normal	Normal	Normal	Apparently normal	Normal	Normal	Normal	Normal
2.	Normal	Normal	Normal	Normal	Normal	Normal	Normal	Normal
3.	Moderate	Moderate	Moderate	No curdling	Reduced	Reduced	Animal allows to handle	Apparently normal
4.	Moderate	Mild	Mild	Normal	Reduced	Reduced	Animal allows to handle	Normal
5.	Moderate	Moderate	Moderate	Apparently normal	Reduced	Reduced	Animal allows to handle	Normal
6.	Reduced	Reduced	Reduced	Normal	Normal	Normal	Normal	Normal
7.	Reduced	Reduced	Reduced	Normal	Normal	Normal	Normal	Normal
8.	Normal	Normal	Normal	Normal	Normal	Normal	Normal	Normal
9.	Normal	Normal	Normal	Normal	Normal	Normal	Normal	Normal
10.	Normal	Normal	Normal	Apparently normal	Normal	Normal	Normal	Normal

Tr : Treatment; TI : Tissue Irritation; MP : Milk production

production from affected quarter. The indigenous formulation had cured mastitis clinical condition and confirmed against specific etiological agent. The formulation had shown complete allying of inflamed quarters affected with mastitis.

Scientific studies revealed that mastitis therapy is common unsuccessful due to inflammatory reaction which causes pathological changes in udder parenchyma (Du Preez, 2000). This is pertinent as herbal formulation had dual role in terms of control of bacterial proliferation as well as minimizing impact of inflamed tissue. Hence indigenous medications can help in sustaining udder health as well as to protect against mastitis causing organism. The efficacy of intra-mammary infusion may be due to availability of active ingredients at therapeutic level. The evidence of on-farm written protocols in treatment of mastitis helps judicious administration of antimicrobials (Pyorala, 2009). Farmer's were readily adopting these technological initiatives derived from indigenous knowledge in clinical conditions. These evidence need to be highlighted as value of milking animal depends on milk production and willingness of farmer's to experiment with investigator's demonstrate need for research in control of mastitis. This may be due to widespread antimicrobial resistance of mastitis causative organism beyond cost of therapy, availability of quality livestock service. Lacasse et al. (2008) indicated increased presence of pathogens which are resistant due to usage of antibiotics.

3.2. Model for sustaining indigenous knowledge system

Hilly regions enable people to develop suitable social roles and create identity by nurturing relevant skills which were either acquired or by tradition. Shri Ukardiyabhai Somabhai Raot, an indigenous livestock healer had sustained the novel herbal medication in treatment of mastitis among farm animals. He had learnt the medication from his family member Shri. Mangalbhai Janubhai Raot. Based on the practice shared by healer, a formulation *Mastiherb* was developed with the help of Sadbhav-SRISTI sanshodhan laboratory, a dedicated natural product laboratory for creative individuals from informal knowledge system.

Generation of technologies for livestock welfare has been a huge challenge owing to lack of investment both from public and private industry. Limited progress has been made in extending quality livestock service and lack of resources in developing countries (Rahman et al., 2005; Byaruhanga et al., 2015). It is in this context indigenous livestock system needs to be visualized as it is based on herbs that are ecofriendly and non-toxic in nature. The study illustrate that On-farm demonstration, linking with local users, veterinary institutions through advocacy can enhance rate of adoption of socially acceptable livestock medications. Farmer led innovations were likely to take shape as natural resistance from needy farm communities was found to be less (Ravikumar et al., 2016a). This void can be full-filled by sharing this technological practice, through established diffusion channels of agricultural research system. Currently service delivery method has been oriented towards purchase of requisite medicine elsewhere and unable to cater to the local demand. This makes the task of frontline professionals

difficult as they face with limited resources to address location specific need. The nature and preference of small holders need to be given adequate attention while promoting suitable technologies (Ravikumar et al., 2015b). Further, prudent use of anti-microbials was recommended so as to reduce antibiotic residues in milk and the potential for increased bacterial resistance to antimicrobials (Oliver and Murinda, 2012). These features indicate the utility value of technologies derived from traditional wisdom beyond the intended usage. This will help to unearth the full potential of these technologies for wider societal benefit.

3.3. Technological intervention derived from Indigenous system

Agricultural research System has been trying to move towards generating innovation and development in agriculture where community can able to set the agenda (Koutsouris, 2012). Sharing of medication developed on farmer's wisdom lend credibility to research system. This provides an opportunity for custodian of knowledge to link marketable technological advancement so as to gain social, commercial benefit from their experience. Demonstration and engagement with various actors of community is pivotal for sustaining this indigenous wisdom (Ravikumar et al., 2016). The network meeting enabled participation of indigenous livestock healers from 8 villages in this mountainous region. The interactive session was also participated from healers from regions of shehera taluk, Panchmahal district and Borsad taluk, Kheda district of Gujarat. This had provided an opportunity to network among healers who were devoid of such interaction among knowledge holders. The non-economic motivation in participating in such discussion have to be observed and reinforced for enhancing social amity, strengthening, sustaining of local wisdom. The study was in concurrence with research findings from the regions of West Bengal (Ravikumar et al., 2015a). Research approaches have to move beyond looking for technology alone as the study substantiates eminence of social behavior. Indigenous knowledge holders, villagers, investigators can able to discus and share in order to achieve mutually agreed upon goal of incubating technological practices.

An essential component of sustainability is to understand the fundamental knowledge that can yield social, economic, cultural and intellectual service (Tan et al., 2014). The developed formulation was maintained by community over a period of time that can reduce incidence of ailment. Gupta (1995) argued that self-reliance of community and future needs of marginal farmers, generating technological options need to be sustained. It was also opinioned that present policies need to be reconsidered for application of new technologies (Rukmani, 2008). Research studies from Gujarat, India refer that creative communities can able to share, experiment and generate new technologies (Devgania et al., 2015; Ravikumar et al., 2015). The network of creative individuals may be linked for incorporation of technologies in different societies through decentralized approach. These indigenous knowledge systems have to be reinforced by linking with network of farmers, recognize established credence in their community and create conducive program to be part of general veterinary service system for effective livestock healthcare. Larger efforts in terms of research need to be conducted towards implementation of these technologies at farmer's field. This will help to devise suitable strategy for these niche specific technologies.

4. Conclusion

The unique herbal formulation *Mastiherb* shared by indigenous knowledge holder had cured clinical cases by arresting multiplication of bacteria and reducing inflammatory condition. The study also reinforced the need for creating environment for participation among knowledge holders, rural youth, elders that are paramount for overall development including social behavior. This can enable formation of knowledge network and for effective utilization of technologies derived from indigenous healers or from farmer's knowledge.

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