Short Communication

Reverence of Community towards Grassroot Livestock Innovation: Responding to Stakeholders Need against Sub-Clinical Mastitis in Amreli District, Gujarat, India

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Abstract | Mastitis is an ailment of economic importance affecting livestock worldwide. Several initiatives have been initiated globally through investment of highly skilled human resource along with unconstrained financial support. The nature of disease, cost of medication, difficulties in reaching out to needy livestock population and accessibility to diagnostic facilities are main impediments. Innovations from creative individuals in similar setting can address such difficulties better. Hence, listening to farming communities will enhance the scope of intervention and leverage experimental learning in society. Indigenous livestock system sustained by outstanding traditional livestock holders can complement efforts of scientific community. Appreciating the role, mainstreaming of indigenous veterinary medications has been revitalized. However, successful evidence of communities' role in bringing out suitable researchable issues, and response to meet, share and discuss with them were limited. The study illustrates successful outcome to bring desired attention in this area. During this engagement with civil society a novel innovative medicine coded AHP/BSD/SCM in treatment of sub-clinical mastitis was evaluated and was found effective. A specific research question posed by indigenous healer provided different perspective to control mastitis. This research study offers art of engaging different stakeholders to construct a meaningful situation for expressing and implementing creative, affordable technologies. It highlights the role of society in sharing a solution that has been collectively preserved by them and essential direction to formal system.

Keywords | Innovation, Sub-clinical mastitis, Indigenous, Creative society, Community

Editor | Kuldeep Dhama, Indian Veterinary Research Institute, Uttar Pradesh, India.
Received | September 02, 2015; **Revised** | October 05, 2015; **Accepted** | October 06, 2015; **Published** | November 14, 2015
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Citation | Devgania BS, Khordia D, Chodvadiya MB, Patel R, Patel D, Kinhekar AS, Singh PK, Kumar V, Bhojne GR, Ravikumar RK, Kumar V (2015). Reverence of community towards grassroot livestock innovation: Responding to stakeholders need against sub-clinical mastitis in Amreli District, Gujarat, India. Adv. Anim. Vet. Sci. 3(12): 689-693.
DOI | http://dx.doi.org/10.14737/journal.aavs/2015/3.12.689.693
ISSN (Online) | 2307-8316; **ISSN (Print)** | 2309-3331

Mastitis is a disease of economic importance causing havoc in dairy sector throughout the world. National mastitis control program envisages minimizing spread of infection, protecting mammary gland tissue and curtailing entry of pathogens through teat orifice. Farm productivity has been limited with lack of appropriate technologies to meet location specific requirements (Kadivendi et al., 2015). Periodic assessment of milk is important to know the health status of udder (Syed et al., 2009). Dairy farmers differ in undertaking risk, seeking alternative source of employment and level of motivation in any region. The enhanced occurrence of coagulase negative staphylococci (CNS) is cause of concern (Reyher and Dohoo, 2011; El-Jakee et al., 2013). Incidence of subclinical mastitis (SCM) upto 50% in cows was reported in different regions (Gianneechini et al., 2002; Alhussien et al., 2015). In India, SCM occurs forty times more than clinical form with annual economic loss of Rs. 4365.32 crore (NAAS, 2013; Bhanderi et al., 2014). These findings reflect that SCM needs to be given adequate attention (Abrahmsen et al.,

2014). The role of trace elements to reduce pathogens in mastitis affected udder was studied (Ibtisam et al., 2006). There are limited studies to compound these factors and to suggest suitable interventional strategies for control. of mastitis.

There is imminent necessity to find new tools to overcome resistance of causative agents and minimize antibiotic residues (Pieterse and Todorov, 2010). The veterinary profession is concerned with potential risk in transfer of such resistance to humans (FDA, 1996). Alternative approach to control SCM is felt as it causes reduced milk yield and quality (Bhikane et al., 2011). More than twenty percent of farmers reported use of homeopathic medication to control mastitis (Egan, 1998). The values cherished by local communities so as to solve location specific problem without outside support were shared (Gupta et al., 2003). The evaluation of clinical efficacy of *Azadirachta indica* (neem) in controlling udder infection emphasized need for alternative therapy (De and Mukherjee, 2009). Natural products offered quality approach for prevention and treatment of mastitis (Nurdin et al., 2011; Nagwa et al., 2014). The protective role of indigenous veterinary system towards environment needs to be given importance (Ravikumar et al., 2015). Realistic need and aspiration of farming community in catering to quality veterinary health care need to be addressed. Social mobilization is paramount for seeking benefit of new ideas and skills among members (Ng et al., 2010). The research study was conducted to share a suitable strategy to focus on delivery of veterinary health system relying on farmer's innovation with a specific reference to SCM. The study also illustrated the need for institutions to acknowledge and compassionately embrace creative solutions from society.

The study was conducted at Amarapur, Gandhinagar district of Gujarat state. Animals in the livestock farm were examined clinically and California Mastitis Test (CMT) was conducted for identification of sub-clinical mastitis (SCM). Throughout the experiment holding of CMT paddle was maintained at the same position for collection of milk. The collected milk represents the quarter foremilk (QFM) of udder. The results of each of the quarter were observed immediately. The reaction to the CMT test reagent was scored in order of severity as Negative (-), Suspicious or Trace (+/-) and Positive [+ (weak positive), ++ (Distinct positive), +++ (Strong positive)] as per standard protocol (Pardo et al., 2007; Beheshti et al., 2011). The first stripping of milk was carefully avoided and about 3 ml of milk was directly stripped into the CMT paddle. Equal quantity of CMT reagent was added to each chamber of the paddle and observed for reaction (NVC, 2009). The reaction was aided by swirling the paddle, as well as tilting the paddle from side to side as per standard protocol. The degree of change in colour, thickening and gel formation were observed for 25 seconds with slight modification in duration (Reddy et al., 2014).

The CMT positive samples of QFM were marked as subclinical mastitis. Udder and teats were observed for any debris so as to eliminate any other cause for mastitis. None of the animals was in the dry period or approaching calving. The CMT paddle was emptied with its content and cleaned with cold water before proceeding for examining next animal. The medication AHP/BSD/SCM was applied topically over affected udder surface twice daily for 4 days. Further, the study attempted to explore nature of social participation upon sharing the scientific validation in the place of knowledge origin and to understand embedded values by community in acknowledging indigenous system. The implications of such arrangements in generating new form of knowledge or sustaining creativity at farming communities were assessed.

A total of eleven animals and forty three quarters were examined and seven animals and twenty six quarters were found positive for subclinical mastitis (Table 1). The rate of quarterwise prevalence of SCM was 60.46 percent among the experimental animals. Among 26 quarters positive for CMT, 16 (61.53%) had shown weak positive and 10 (38.46%) had distinct positive reaction. Studies indicated that level of biochemical response to infection at udder level used to be higher than at quarters (Hamann et al., 2010). All seven animals positive for SCM were subjected to testing clinical efficacy of indigenous medication.

Table 1: CMT evaluation reflecting degree of SCM among experimental animals: [Day 0 (Before treatment)]

Sr. No.	Animal No. with description	Udder Quarters			
		RF	LF	RH	LH
1	198252 (Kankrej)	+	++	++	+
2	684207 (Crossbred)	+	+	++	++
3	198480 (Crossbred)	++	+	++	+
4	198296 (Crossbred)	+	Blind	+	+
5	198365 (Kankrej)	++	+	+	+
6	No tag (Crossbred)	++	++	+	+
7	198321 (Crossbred)	+	++	+	-

Twenty six quarters were observed for evaluating impact of medication over sub-clinical mastitis (Table 2). It was found that 92.30 percent (n =24) of quarters were negative for CMT on 5th day of observation. One of the positive quarters for CMT did not show any change (3.86 percent, n=1), whereas another quarter showed some improvement, however, it was suspected for SCM (Trace). The severity of SCM condition was reduced after topical application of AHP/BSD/SCM for a period of four days. This may

be important tool for overall intervention program as attempts like antibiotic, vaccine have their own limitation. Unhygienic intramammary treatment was found responsible for mycotic mastitis and clinical mastitis with poor or no response to conventional antibiotics (Langer et al., 2014). In fact, the national policy attributed limited use of vaccine in mastitis control strategies to inability to prevent new infections (NAAS, 2013). An *in vitro* effective antibiotic might not give same results under clinical conditions. Hence, these environmental friendly technologies are appropriate for small holder production system (Ravikumar et al., 2015a).

Table 2: Impact of medication against SCM

Sr. No.	Nature of CMT reaction	Before treatmenty	After treatment
		(Day 0)	(Day 5)
1	Trace (+/-)	00	01
2	Weak positive (+)	16	01
3	Distinct positive (++)	10	00
4	Strong positive (+++)	00	00
	Total	26	02
	Recovery (%)	92.30	

It is pertinent to share scientific findings to knowledge holders as a part of ethical research system. Marfo (2013) argued that pragmatic policies can be laid by understanding dynamics of human security. The social needs have to be addressed for developmental initiatives. Various efforts were made by *National Innovation Foundation-India* in sharing and diffusion of research findings in controlling ailments like endoparasite, ectoparasite infestation, enhancing poultry immunity by involving civil society (Bharwad et al., 2015; Gaikwad et al., 2015; Patel et al., 2015). Sharing such findings with knowledge holders and their society would create empathetic environment that can foster innovation systems (ADB, 2014). In this respect, an interactive meeting with villagers and knowledge holder was called in the month of July, 2015, at Hadida village, Savarkundla Taluk of Amreli district, Gujarat. Forty participants from the village had assembled and the research team shared scientific efficacy of the medication sustained by knowledge holder *Shri Becharbhai Samantbhai Devgania*. Investigators felt overwhelmed upon visualizing community response to discus and acknowledge efforts of traditional livestock healer. The general feeling of marginalization of knowledge system by community in advent of modern medicine was not noticed. These natural scientists sustained technologies that are easy to adapt by farmers or make minimum demand (Gupta, 1995).

During the meeting dairy farmers indicated that they spend on an average 22 USD for treatment of mastitis along with risk of medicine failure. The discussion revealed that regular availability of skilled manpower has been a concern in remote locations. This knowledge system had contributed towards social responsibility by reducing distress and cost of input owing to mastitis. The difficulties narrated by dairy farmers had motived knowledge holder to share better ways to control mastitis. His opinion was that administration of same medication, fifteen days before expected date of calving can minimize incidence of mastitis, as the dry period was crucial due to physiological changes occurring for next lactation. Arruda et al. (2013) shared that incidence of new intra-mammary infections (IMI) was to the tune of 25 percent during dry period. Studies also indicated the need to survey dry cow udder for effective mastitis control (Dufour et al., 2011). It was also illustrated that most common pathogen isolated during dry period was coagulase negative Staphylococcus (CNS). Hence, the tacit knowledge shared by traditional livestock healers needs to be verified so as to gain from such societal learning.

Knowledge holder acted as *gatekeeper* through their expertise and ability to identify potential problem (Fleming and Marx, 2006). This reinforces the need for generation and sustaining of mutual trust so as to understand technical cues from knowledge holders (Ravikumar, 2007). This is in concurrence to earlier findings reported elsewhere. The documented video of this explanation by knowledge holder is available with the corresponding author who carried out the discussion. Thus interactive meeting along with shared scientific findings to villagers infront of custodian of knowledge had resulted in sharing of new knowledge. During the process, characteristic of sustainable entrepreneurship interms of innovation by applying social practices as indicated by Kardos (2012) was illustrated.

Treatment with antibiotic has been concern as it affects dairy products and pose public health hazard (El-Jakee et al., 2013). The need for dry cow therapy has been advocated to control subclinical mastitis (Barua et al., 2014). These knowledge systems were researched that enabled sustenance of novel practice by society (Ravikumar et al., 2004). Studies had indicated that scientific opportunities need to be generated to understand indigenous knowledge system beyond narrated claim(s) (Ravikumar et al., 2015b). Studies need to be undertaken to understand the efficacy of this novel medication against intramammary infection (IMI) during dry period, its role against common pathogens and nature and incidence of IMI after calving.

The experimental nature of farming community to overcome problem through their understanding of existing solution needs to be tapped. Farmers can be proud of their innovation and this results in better adoption (Ravikumar

et al., 2002). Generation of such social capital and engagement of people in group at door step of creative people will open up new knowledge for experimentation. However, national policy in India could not reflect the strength of this creativity in rural society in its policy measures and recommendations (NAAS, 2013). The need for institutional transformation through influence of civil society is felt (Prasad, 2005). Further, it is paramount for youth to learn from these opportunities outside formal system so that they can cope up with difficulties (Tripon, 2014). Such trait of cohesive participation needs to be nurtured and positively maneuvered for developing suitable policies (Rainer, 2014). Scaling up of these scientifically validated innovations can be enhanced through linking with dairy societies (Ravikumar et al., 2015c).

The study delved upon farming communities concern, acknowledging local solutions, distinguishing creative individuals, scientific evaluation in clinical situation, sharing the results to community and enlarging scope for evolution of wider knowledge. The study recorded a prevalence rate of subclinical mastitis as high as sixty percent. The research study demonstrated an effective novel topical medication based on indigenous knowledge system. These medications are readily available, easy to develop and administer. It needs to be part of general management practices at cow side. The study also demonstrated the response of society in recognizing service of local knowledge system. Acknowledging knowledge holder by civil society as well as other stakeholders is paramount for sustaining creativity at farming community. The social capital endeavored by local knowledge system have to be harnessed for developing suitable solutions. It is difficult for public system alone to cater quality health care to vastly distributed livestock population. Hence, efforts need to be complemented with the help of the scientific community so as to unearth new knowledge domain by engaging farmers on larger scale.

ACKNOWLEDGEMENT

We acknowledge Gram Bharti, Amrapur, Gandhinagar, Gujarat for permitting to conduct experiment in livestock farm and Dept. of Veterinary Microbiology, Animal Biotechnology Teaching & Research Cell, Nagpur Veterinary College, Maharashtra Animal & Fishery Sciences University (MAFSU), Nagpur for providing CMT reagents.

CONFLICT OF INTEREST

Authors declare that they have no conflict of interest.

AUTHOR'S CONTRIBUTION

All authors contributed equally to the manuscript.

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