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Review Article

Role of Livestock in Sustainable Living for Soliga tribe in B R Hills of Karnataka

Arun Somagond*, B. H. M. Patel, Bosco Jose, Pranay K. Kumar, Seema Yadav and Pramod Kumar Soni

[1]Ph.D Scholar, Livestock Production & Management Section, IVRI, Bareilly, Uttar Pradesh, INDIA
[2]Principal Scientist, (LPM), I/c Isolation Unit, IVRI, Bengaluru (Karnataka) India
[3]Ph.D Scholar, Division of Physiology & Climatology, IVRI, Bareilly, Uttar Pradesh, INDIA
[4]Ph.D Scholar, Division of Physiology & Climatology, IVRI, Bareilly, Uttar Pradesh, INDIA
[5]Ph.D Scholar, Livestock Production & Management Section, IVRI, Bareilly, Uttar Pradesh, INDIA
[6]Ph.D Scholar, Animal Nutrition Division, IVRI, Bareilly, Uttar Pradesh, INDIA

*Corresponding Author: arunsomagond@gmail.com

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Abstract

Tribals are indigenous communities living in forests since centuries having distinct culture, sharing commonalities with marginalized sections of society. Many positive features of tribal society must be appreciated. Non-tribal people have much to learn from the richness of tribal cultures and systems of knowledge. Tribal population in India, though a numerically small, has an enormous diversity. The Soliga tribe in B. R. Hills of Karnataka is weakest among the all tribal communities existing in India. Crop enterprise and collection of Non-Timber Forest Products (NTFP) could not help to increase their livelihood due to poor productivity and stringent government regulations. Tribals are the guardians of nature and play a crucial role in environmental conservation. The tribal households depend on animal husbandry to improve their socioeconomic status. Research need to be undertaken to encourage tribals to adopt animal rearing practices in a scientific manner.

Keywords: B. R. Hills, Indigenous, Isolation, NTFP, Soliga

Introduction

The tribal population in India, though a numerically small, represents an enormous diversity of groups. Tribal populations are the aboriginal inhabitants of our country as *Adivasis, Moolavsis, Ethnic minorities* (Kujur, 2011). Central Indian states have the country's largest tribes about 75% of the total tribal population. About 12 % of populations inhabit the northeastern region, 5 % in the Southern region and 3% in the Northern States (MOTA, Annual Report, 2010 -2011). The predominant tribes in India are *Gonds, Chenchus, Gaddis, Khasi, Gujjars and Santhal*. The Tribals in Karnataka (a south Indian state) constitute 34.64 lakhs (6.95%) of the total population. The *Toda, Beda, Soliga, Hakki-Pikki, Iruliga, Jenu Kuruba, Yarava and Siddis* are some important tribes of Karnataka.

According to an anthropological study, *Soligas* are believed to belong to veddoid race (Radhamani, 2014). The *Soliga* is a Scheduled Tribe (ST), who lives in the hilly forest areas of Bili Giri Rangana Hill and Mahadeshwara Hill of Chamarajanagar district of Karnataka in India. The *Soligas* were referred to as *Sholiga, Soliga, and Soligaru* by early authors. The crop enterprise could not help tribal farmers to increase their income because of poor productivity and low availability of per capita arable land. Hence, there is heavy dependence on forest products and animal husbandry activities. Non-Timber Forest Products (NTFP) is the major source of livelihood for them & also engaged in agriculture, labour and livestock rearing (Kumar, 2006; Somasundaram *et al.*, 2007). Kumar and Singh (2011) noted the importance of ethnoveterinary practices for controlling various diseases in tribal areas of Jharkhand a state in central India. Thus, livestock rearing generates a continuous source of income, makes it an inevitable component of tribal development. However, there are area and species-specific constraints in carrying out the animal husbandry activities by the tribal community. The decrease in the forest products of B R Hills was due to less rainfall (50 % of average rainfall) and spread of *Lantana camara* (30.2% of the respondents (Madegowda and Rao, 2013). *Lantana camara* is a straggling shrub native to Central and South America, and is one of the most widely distributed invasive species in India (Sundaram *et al.*, 2012). Only 19 families had bullocks, 56 families possessed cows and 6 families owned sheep (Madegowda and Rao, 2013). Thus, there is much scope for animal husbandry in *the Soliga* tribe to improve their economic status.

The government agencies worked in *Soliga* are focused only on the anthropological point of view like providing medical facilities, electricity, low cost houses and other necessities. The scanty literature exists on *Soliga's* animal husbandry practices in general and Bilgiri Rangaswamy Temple Wildlife Sanctuary (core and buffer zone) in particular. This review provides baseline information on animal husbandry practices followed by *Soligas* in B R hills.

Present Status of Tribals in India

The tribal situation in every state of India is different**.** Their dependence on forest and the problems faced by them are also different. But, most of them face displacement due to the stringent forest conservation policies and are living with limited basic amenities. Over the centuries, tribals have been subjected to disabilities like poverty, malnutrition, disease, ill-treatment, exploitation, illiteracy and marginalisation (Sinha, 2012). Most of their requirements are met from forest like wood for building purposes, resins, gums, dyes, firewood, herbal medicines, fodder for cattle, M*ahua* flower, S*al* seeds, S*al, Tendu* leaves, edible roots, tubers, bamboo and wild fruits are met by the forests (Lal, 2013). Indigenous people use the natural areas where they live for hunting animals and for collecting non-timber forest products (NTFP), fuel-wood, and medicinal plants (McNeely 2004; Bird-David 1992; Guha and Gadgil, 1989).The tribal communities continue to be vulnerable not because they are poor, asset-less and illiterate, but because they are often unable to negotiate and cope with the consequences of their integration with mainstream society. The requirements of planned development, which includes dams, mines and industries are located in hearts of tribal land which hampered their existence. With these, came the concomitant process of displacement followed by a conflict between development and protection of tribal rights. The process of deforestation compelled *Adivasis* to migrate to other areas. In the name of development, 18.5 million people were displaced, still, 75 % of displaced people have not been rehabilitated (Gautam and Singh, 2011). Adding to further misery, tribals were considered alien to their homeland ecosystem and were evicted from national parks and sanctuaries (Lele and Rao, 1996). Most of the tribals survive with the collection of forest products for fulfilling their requirement of food, fuel, fodder, fruit, fertilizer, fibre**,** and so on. In their diversified economic system, agriculture, animal husbandry, fishing and forest activities have a significant contribution (Shukla, 2012). The educational services could not reach them due to multiple reasons, as a result, tribals were not only remained backward and

poverty-stricken, but also were deprived of the benefits (Narkulwad, 2012). A large number of tribal communities of India continued to be extremely backward and some of them are still in the primitive food-gathering stage, whereas others have registered economic and educational advancement (Padhy, 2000). The problems of the *Bonda* tribe not only arise from constraints of their natural habitat but also substantially from their cultural and social imperatives buttressed by the lack of education and awareness of acceptable and available alternatives (Mahapatra and Mohanty, 2000).

There was no deliberate attempt to strengthen the economic base of backward communities in the country. The tribals are living in the forest, facing different problems**,** due to change in successive forest policies which affected their livelihood.

Soliga Tribe of Karnataka and their Life Style

The *Soliga* are an aboriginal forest tribe inhabiting the states of Karnataka and Tamil Nadu. In Karnataka, they are mainly distributed in the slopes of the Biligiri Rangana (BR) Hills and other hilly parts of Mysore and Chamarajanagar districts (Kumar, 2008). The Biligiri Ranga Tiger reserve is part of the Western Ghats biodiversity hotspot (Norman 2003; Mittermeier *et al.,* 2004) was designated as a wildlife sanctuary in 1973 (Barve *et al.*, 2005). *Soliga* are well suited to life in the thick forests of the region (Somasundaram *et al.,* 2007). As a community, the *Soliga* are one of the poorest in India (Krishna Raj *et al.,* 2017). Prior to 1973, Soliga resident in BRT practiced shifting agriculture. They also hunted game and gathered wild tubers, fruits, and honey to supplement their diet. Additionally, the forest department managed areas within present-day BRT for timber, bamboo, and grass resources (Sundaram, 2011). Post-1973, once BRT came under the purview of the Wildlife Protection Act, the *Soliga* practices of shifting agriculture and hunting were banned (Setty *et al.,* 2008). The extraction of timber, bamboo, and grass by the Forest Department was also suspended. The *Soliga*s settled in Podus (tribal settlements*)*, where they were given land to cultivate and to lead a sedentary way of life. The *Podu* consists of a group of 10 to 50 huts. The BRT Wildlife Sanctuary has 61 *Soliga podus* of which 22 *Podus* are found inside the forest and 39 *Podus* are around the periphery or outside the forest. The permanent settlements of *Soligas* are called '*haadi*'. *Soliga*s are heavily dependent upon forest produce for their livelihood. Main occupation of *Soligas* is to collect minor forest produces like gum, honey, soap nuts, root and tubers, tamarind etc. According to the 2001 Indian population census, they were about 29,198 population of *Soliga*. *Soligas* speak an old dialect of Kannada, a classical language India called '*Soliga* nudi'. The Soliga language is a spoken one, and has no script.

Socio-Economic and Cultural Factors of *Soliga* Tribe

Family Size and Head

Majority *soliga* families were patriarchal (Madegowda and Rao, 2017). Also, Somagond *et al.* (2019a) reported that males were the family head in core (79%) and buffer (65%) zones of B. R. Hill respectively. The majority (75%) of tribal respondents were male and 25% were female in Jharkhand state of India (Smriti, 2013). Further, Jyoti (2018) in the same area reports that 92.13% of the tribal households were male-headed and 7.88 % of the female-headed. Shukla, (2011) studied the *Birhor* tribes of Madhya Pradesh and explored that their family is patriarchal and their organizations of families called Band. The head of the band is called Naya. All heads of the family of the Birhor Tanda or Band work under the leadership of the 'Naya', who is a priest as well as a secular headman. In *Soliga* community family size consisting of 2 members was more in the core (56.19%) and less in buffer (24.16%) zone of B. R. Hill. However, a family size 2-4 member was more in the buffer (46.30%) than the core zone (29.52%). There are no joint families are reported either in buffer or core zone (Somagond *et al.,* 2019a). The majority (87.9%) of the respondents emerged from the nuclear family as compared to joint family in of *Soliga* tribes (Krishna Raj *et al.,* 2017). Nearly 84.3 % of the respondents belong to nuclear families, 9.2 % of the respondents belong to joint families, and 6.5 % respondents belong to extended families. Each of the 84.3 % nuclear families was constituted of 3 to 5 members while each joint family was constituted of 4 to 7 members. Average family size is 4.22 per family in *Soliga* tribes (Nanjunda, 2010). Nuclear types of families are predominantly found in the *Ao* (name of tribe) community as after marriage, the newly married couple live separately in a new house constructed by the husband (Boruah, 2011). Only 88 families (38.66%) of the total sample were found living jointly and the majorities (63.66%) were in the nuclear family (Singh and Sadangi, 2012). More than 60 % respondents were belonged to the nuclear family and rest in a joint family in Koraput and Rayagada district of Odisha, in Chitradurga district of Karnataka states and Ranchi district of Jharkhand states respectively (Nagaraja and Kusugal, 2013; Islam *et al.*, 2015).

In each *Soliga Podu*, they have a well-organised Nyaya system of justice. In consultation with the senior members of the community, important decisions are taken to resolve any crisis. The social system of this tribal community is guided by self-sustainable, eco-friendly, use-value based production and exchange. There is a wide gap between the culture, lifestyle and social values of a tribal community and the mainstream population in the district (Kumar, 2006).

Soliga's do possess assets which are mainly used for day to day life. Percentages of people with bike/bicycle in core and buffer zones were (87.61%) and (83.89%) respectively. About 3 villages did not have any electricity connection; they were dependent on solar light and the firelight. The latter was produced by burning tree branches in front of their houses (Somagond *et al.,* 2019a). A study in *soliga tribe* says that 71.9, 44.6 and 20.3 % of the respondents own a radio, watch and television respectively. Due to the influence of the outside world, 5.7 % possessed gold (Madegowda and Rao, 2017). 78.77 % of tribal families of Jharkhand states were having a cycle, 40.77 % having a radio, about 30 % having mobile, 6 % having TV and rest 1.85 % having motorcycle (Jyoti, 2018).

Landholding

Majority of the *Soliga*s have marginal land (< 2.5 acres). Very small population, 11.4% in core and 6.71% in the buffer zone have more than 2.5 to 5.0 acres of land (Somagond *et al.,* 2019a). The landholding of *Soliga* families is forest and revenue land. Forest land is given on agreement basis for their livelihood by the forest department and it cannot be sold. This meant that most of the *Soliga*s were holding forest land while (25%) of the respondents were landless which included those who cultivated the leased land and the landless families. The Survey conducted by Madegowda and Rao (2009) informs 370 families, 37.5 % of the respondents were holding 1-2 acres of land, 19.4 % of the respondents were holding 51-99 cents of land, 7.2 % of the respondents were holding 0.50 cents of land and the same percentage of respondents were holding 2-3 acres of land and 20 % of the respondents were landless. The average size of landholding patterns varied in different types of land like 1.6 acres of revenue land, 1.5 acres of forest land and 1.3 acres of other lands. Nagaraju (2001) reported that 48 % *of Koya* tribes possessed medium level landholdings. Nearly 75% of respondents were marginal farmers, 25% were small farmers, and no respondents were either landless, medium or large farmers among tribals of Ranchi district (Smriti, 2013). Most of the dairy farmers possessed marginal/small landholdings (Kumar 1999; Mishra 1994; Kharat 2006; Shisode *et al.,* 2009). According to Varunika (2005) over the years, self-sufficiency and sustainability in crop and animal husbandry have not been achieved among tribal farmers due to fragmented, scattered and undulated landholdings, inadequate irrigation/ nutrient supply, lack of technical knowhow and marketing facilities.

Tribal Education

Most of the tribals were not highly educated, especially those living in the forest areas of B. R. Hills and M. M. Hills. Basic education was available within the forest with the help of Government and NGOs, while access to higher education means relocation to urban areas. This was difficult for them as it involved exposure to a new culture and a new world which further entails considerable expense for fees, food, accommodation, clothes, shoes, and books. Such amounts of money are hard to come by for the forest-dependent *Soliga*s (Somasundaram *et al.,* 2007). The Ravulas (Yeravas) were bonded labourers for many years and before that, they were slaves. Hence, people in positions of power were habituated to exploiting the labour of this tribe. They have been educated in Ashrama Schools, but very few of them opt for higher education. However, politically they were in a better condition and can avail of the seats reserved for tribals in some areas (Veena, 2007). Increase in dropout rates, decrease in enrolment rates, lack of infrastructural facilities, indifferent attitudes of teachers towards tribal children, and vague understanding of the benefits of education among the parents of tribal children are some of the major ills plaguing the educational scenarios in the tribal areas (Nanjunda, 2010). The literacy rate was low both in the case of the core zone (20.95%) and buffer zone (10.06%) (Somagond *et al.,* 2019a). The marginally more literacy percentage in the core zone is due to the presence of Vivekananda Girijana Kalyana Kendra (an NGO) which has been working for education and human health since 1981. The level of education among tribal woman, in general, is 34.76% and among *Soliga*s women about 32.8% (Puttaraja and Heggade, 2012). A majority (83.2%) of respondents were noticed with illiterate followed by 12.4 % were up to primary education (12.4%) and higher secondary (4.4%) of *soliga* tribes (Krishna Raj *et al.,* 2017). Singh and Mate (2013) reported among scheduled tribes of Manipur, there is a significant positive association between educational level and economic status of tribal communities with the similar views of Tungdin and Kapoor (2010) and Puttaraja and Heggade (2012).

Sources of Income

As a community, the *Soliga*s are one of the poorest in India. After BRT was declared a wildlife sanctuary, the *Soliga*s were settled into *Podus*, where they have been allotted land to cultivate and to lead a sedentary way of life. The traditional income of bamboo basket weaving is lost to the *Soliga*s because of the Government ban on the cutting of bamboo after indiscriminate harvesting by pulp industries in the last six decades (ATREE, 2005-2008). The recent policy of Forest Rights Act 2006 which seeks to empower tribal communities in India, has recently resulted in the Soliga community gaining bona fide usufruct rights for the collection of NTFPs in BRT (Shrivastava 2011). Soliga retained usufruct rights to the collection of NTFP and a large proportion, nearly 50 % (Hegde *et al*. 1996), of their income was generated through the sale of NTFPs such as honey and *Phyllanthus sp*. fruits. Source of income from agriculture labour, NTFP, agriculture crop and animal husbandry was 59 %, 82 %, 69 % and 23 % in core zone the corresponding values for a buffer zone is 79 %, 53 %, 83 % and 35 % respectively (Somagond *et al.*, 2019a). NTFP was the common and highest source of income in the core zone, followed by agriculture, labour and least was the animal husbandry. NTFP includes honey, amla, lichen, broomsticks, *Acacia concinna* (Babul), *Terminalia chebula* (Harad), bee wax and fruits like jackfruit, orange, watermelon and chakota etc (Setty *et al*., 2008). Out of 28 NTFPs honey, amla, broomsticks and lichen are the major NTFPs collected by the *Soliga*s.

Table1: Distribution of income source from different months in core zone

Months	NTFP	Agriculture	Livestock sale	Labour/Wages
January			Kule mari*	
February	Orange: Rs20/kg	Pepper-Rs800/kg	Rotti habba *	Migration to coffee estate area (Kodagu)
March			Mari habba*-	
April	Honey: Rs 170/kg		Rs 6000/goat or sheep	Mini. Rs 500/person
	Bee wax: Rs 400/kg			Max. Rs 800-1000/person
	Acacia concinna (Babul): Rs 400/kg			
	Terminalia chebula (Harad): Rs 25/kg			
	Broom Sticks: Rs 30/bunch			
May	Jackfruit: Rs 50-60/Fruit			
June	Jamun hannu: Rs 20/kg			
July				
August			Pairu pooje*	Agriculture labour in the local area
September	Lichen: Rs 230/kg		Ragi habba*	Male- Rs 300/person
	Chakota/pomelo: Rs10/kg		Rs 6000/goat or sheep	Female- Rs150/person
October				
November				
December	Amla: Rs 15/kg	Coffee-145/kg		

**Name of festivals /celebrations during which animals are sold; # Same holds good for the buffer zone except wages (higher than core zone) and crops grown (Ragi i,e Finger Millet and Maize)*

These products were available during different months of the year based on their season of growth leading to availability of products throughout the year. The traditional economy of the *Soliga* is mostly based on shifting cultivation and collection of minor forest produce (Siddappa *et al.*, 2008; Kumar 2006; Somasundaram *et al.*, 2007; Karmali 2013; Malini 2010; Kamal 2008). Men involved in honey, lichen and women involved in *amla*, broomstick collection. Women do not involve in honey and lichen collection, because they are not expert in climbing trees (Madegowda & Rao, 2009). Large-Sized Adivasi Multipurpose Cooperative Societies (LAMPS) play a very important role in meeting the socio-economic needs of the tribal people of Karnataka (Raja, 2012). All the tribal households (100%) of Odisha state had forest activities as their secondary or tertiary source of income (Singh and Sadangi, 2012; Islam *et al*., 2015). Agriculture is one of the major sources of income in the buffer zone and the most

common crops grown are finger millet (*Ragi*) and maize. However, the crops grown in the core zone are of commercial importance like coffee and pepper (Somagond *et al.*, 2019a). Earnings from the sale of agriculture products (spices and condiments, aromatic plants) are called cash income. *Ragi* is also grown for self- consumption is called non-cash income.

Considerable good percentages (60%) in the core zone and (75%) in the buffer zone of *soligas* work as labour in off-seasons (Somagond *et al.*, 2019a). They generally go to other places like Madikere (Kodagu district), where they earn a good amount of daily wages in a coffee estate. They earn a minimum of Rs 500/person/day and maximum Rs 800-1000/person/day. Madegowda and Rao (2017) reported that out of different types of activities 51.3 % of them involved in agricultural labour, 29.7 % of them involved in NTFPs/ labour, 25.7 % of them involved in NREGS and 8.4 % of them involved coffee estate work and other types of labour opportunities was very less to them. Although income from the livestock is least, still they do get financial help during an emergency by selling livestock. Smriti (2013) reports that income from crop production is seasonal; dairying provides a stable round year income. Madegowda and Rao (2017) revealed that income percentage-wise per individual family comes to agriculture Rs. 7,990.77, labour - Rs. 7, 751.08, forest products - Rs. 1,312.35 and livestock- Rs. 915.14, and totally Rs 17,969.34 per year. Livestock contributes to the cash and non- cash income of the *Soliga*s. Livestock used for self-consumption is a form of non-cash income and livestock sold for income is a form of cash income. It is a very important source of income, so nowadays a number of *Soliga* families have started to rear livestock for consumption and as well as for selling. The respondents are getting per year some cash and non- cash income per family. Income sources for *Soligas* throughout the year is been depicted in the table (Somagond *et al.*, 2019a).

Animal Husbandry Practices by Tribals

The percentage of livestock keepers in the core and buffer zone was (67.6%) and (65.77%) respectively (Somagond *et al.*, 2019b). Prajapati *et al.*, (2009-10) noticed that 48.00 % of tribal farm women were found fully participated in rearing layers for eggs and only 8.00 % participated moderately. Akand *et al.* (2011) studied that chicken and ducks are being reared by the villagers and chicken outnumbers ducks. Tochhawng and Rewani (2013) reported that backyard piggery rearing occupies a unique place in Mizoram since it is socio-culturally intermingled with the livelihood of tribal people of the state.

Type of Species/Breed

Soligas rear either one of the species like goat, sheep, cattle and poultry and a mixture of all. The predominant species in core zone was goats (41.9%) followed by poultry (17.14%) cattle (16.19%), sheep (8%). In the buffer zone, people had cattle (40.93%), goat (36.24%), poultry (6.04%) and sheep (11.40%) (Somagond *et al.*, 2019b). This indicates that in buffer zone cattle and goats are the most preferred species and conversely in core zone goat and poultry are more preferred species (Somagond *et al.*, 2019b). There is no trend of buffalo rearing among the *Soligas* in both core and buffer zone as *Soligas* belief that if they consume the buffalo milk their intelligence will be decreased. Male animals were removed as and when they felt excess or for their emergency. Further, poultry was also kept as alternative species in the core zone. Survey conducted by Madegowda and Rao (2009) informs 26.8 % of the respondents have cows and 73.2 % did not have cows; about 13.8 % of the respondents have bullocks and 86.2 % do not have bullocks; around 30 % of the respondents have goats and 70 % do not have goats, and at least 50 % of the respondents keep poultries and 50 % do not keep poultries. Most of *Soligas* (90%) of the people rear non-descript cattle breeds in core and buffer zones. Only a few people rear local recognized breed like Bargur. Bargur breed of cattle which is native to the Bargur forest hills in Anthiyur Taluk of Erode District in Western Tamil Nadu (Bargur belt) (Somagond *et al.*, 2019b).

System of Feeding

All *soligas* provide green fodder during night time which is harvested from the forest. Few *soliga*s (around 16-18%) of *soligas* provide dry fodder in the core zone. Dry fodder mainly consists of dry leaves harvested from the forest and sometimes straw provided during night hours. The majority (60-80%) of the farmers in the buffer zone provide grains as supplement feeds (Somagond *et al.*, 2019b). Majority of the *soligas* feed grains and kitchen waste in both zones. Mohapatra *et al.*, (2012) revealed that the major constraints faced by tribal dairy entrepreneurs of Odisha, were high cost of concentrate (96.67%), lack of availability of veterinary literature in the village (79.67%), non-remunerative price for milk (100%), the problem of poor irrigation facilities for growing fodder crops for the

livestock animals (62.50%). Smriti (2013) reveals that 76.25%, did not adopt balanced concentrate feeding. All the respondents feed paddy straw to their dairy animal. She further revealed that 60% of respondents kept their animal for grazing as well as stall feeding and 40% of respondents adopted stall feeding. Maousami (2017) reported that 63.7% of respondents were following the grazing system and 80% respondents offered only straw by hill *Korwa* of Chhattisgarh. A similar observation was also made by Pankaj Mishra *et al.* (2017) Sharma and Singh (2008) and Singh *et al.* (2013). Oraon (1997) and Sabapara *et al.* (2012) who reports that paddy straw feeding was the main dry feed ingredient for dairy animal among their respondents.

More than 60% of the *soliga*s grazed their animals in groups and the rest of the people took their animals separately in small groups. Generally, it was observed that 2 or 3 people use to take the cattle and other species of the whole village. They will be paid a token amount for taking their animals for grazing. In both core and buffer zone animals were taken for grazing daily. There were no conflicts between the two herds while taken for grazing (Somagond *et al.,* 2019b). Sorathiya (2016) studied about herding arrangements in the absence of a regular person. Majority of them (79%) were herding the goats mutually especially the person from their combined flocks was employed for the herding. Only 16% were hiring the labours to graze the goats. A few goat keepers (5%) were arranging other family members who were untrained to herd the goat flocks. Survey area had community drinking water facility built by local bodies. Running stream, pond, harvested water, rain and well water are a common source of water. About (68.7 %) respondents of the core zone and (80.6%) respondents of the buffer zone were not having any water storage facility (Somagond *et al.,* 2019b). Nandi *et al.* (2011) found that the Bengal Goats in West Bengal Ponds water is the major source for drinking water (58.14%) of goats.

System of Housing

All *Soliga* (100%) livestock holders follow semi extensive system of rearing both in the buffer zone and core zone, wherein animals are taken for grazing during day time. Animals in the core zone brought back from grazing before 4 PM due to possibility of wild animals movement. One person among the community takes all categories of animals belonging to different owners for grazing. He will be paid a nominal fee. In the buffer zone (100%) of people keep the animal in an open house, where there will be an only fenced area without a covered area. Mohan *et al.* (2016) reported that goats were released in the morning and allowed to graze on natural grazing land, roadside grazing and till evening. Maousami (2017) also reports that the majority (86.9%) of respondents were practising a semi-intensive system of rearing in hill *Korwa* tribes in Chhattisgarh state.

Soligas keep poultry in closed house system to prevent from predators. The location of cattle shed was adjacent to their dwelling in the core zone, however, in case of the buffer zone, 35%, 8% and 57% were found attached to a dwelling, near to dwelling and at the field respectively (Somagond *et al.,* 2019b). Yadav and Khada (2009) stated that the majority of the goats in the tribal belt were kept in open and closed houses with kaccha roof and floor with full boundary wall attached to the residential- housing. In the majority (95%-98%) of the housing floor space is not adequate for cattle, sheep, goat and poultry. This could be due to scarcity of land. Natural Light was adequate in both core zone (97%) and buffer zone (93%). This is due to the side half wall made of wooden materials (Somagond *et al.,* 2019b). Animal houses were dirty to look. This dirtiness is due to uneven mud floor that led to stagnation of urine, faeces and also keeping of excess animals (of different species) in limited space (Somagond *et al.,* 2019b). The floor was made up of earthen and covered with bedding materials in the evening hours. This not only helped in maintaining cleanliness but also helped in the preparation of organic manure. Maousami (2017) reports that 37.5% of respondents were cleaning the livestock house daily. Kulkarni and Jawahar (2000) also report that 82.50 % of small goat holder did not adopt the sanitary practices in their goat shed. The pillar used in the construction of the animal shed was made of wood in both zones. The material used for the construction of the wall was either brick or mud. The roof is mainly made of thatched material. But no respondent had asbestos sheet roof (Somagond *et al.,* 2019). Maousami (2017) reported that the housing material for a shed in majority (68.7%) owners were using bamboo and woods whereas 31.2 % were using *kachcha* (Mud) house in hill *Korwa* tribes in Chattisgarh state. The majority (95-98%) of the people had not provided any facility for feeding inside the shed (Somagond *et al.,* 2019b). As we mentioned earlier also that most of the people provide the bedding materials in the evening hours, which is mainly leaves from the forest.

Reproduction and Special Management Practices

They follow only natural service practices and few in buffer zone follow the artificial insemination method which

was available from the veterinary dispensary of state animal husbandry department. This indicates that still there is no penetration of veterinary dispensaries in the core zone. Breeding of animal is not by choice but rather is accidental during grazing hours (Somagond *et al.,* 2019b). Respondents who do not rear male animals were dependent on other owners who had for mating. As mentioned earlier animals were taken in the group for grazing where this mating among animals was taking place. Maousami (2017) reports that (87.5%) of respondents were preferring natural service for cattle, only 12.5 % of respondents were practising artificial insemination. In a study area, artificial insemination was performed by PIW (Private A.I. Worker), Pandey (1996) revealed that preference for natural service was the most important constraint in the adoption of AI.

There was no concept of colostrums feeding in both zones of B.R hills. There is a tendency of making sweet from colostrums in this area. Smriti (2013) reveals that 97.50% of tribal respondents adopted colostrums feeding to their newborn calves'. Maousami (2017) reports that 11.9 % of respondents of each were taking special care of a dam before and after birth to a newborn. There was no special management care given to either for pregnant or lactating animals. However, efforts were made to keep the advance animal separately wherever it is possible. There is no early weaning practice. No milk or milk products were sold. Most of the time milk is allowed to suckle by kids and calves; self-consumed or shared within the villages.

Animal & Animal Produce Sale as Source of Income

Live animals were slaughtered and the meat is sold during traditional festivals of *soligas* like *Mari habba*, *Kulemari*, birthday and obituary ceremonies. During these occasions, the feast was mainly of non-vegetarian type. The animal was also slaughtered on Sundays with an arrangement of assembly of 8-10 people. Whenever slaughtering of goat and sheep is done, it was shared on a cost basis (Rs 5000-Rs6000/animal) within the village. Dung is not sold in the core zone as it is being completely used by themselves for their agriculture field as manure. However, (85%) of *soliga*s in buffer zone sold (Rs 1200/tractor load) the dung to private people as there is a lot of demand for organic manure (Somagond *et al.,* 2019b). A study of *Baiga* tribals in Mondla district of Madhya Pradesh observed that the main reason for keeping goats were for cash sale (91%) to generate income followed by as means of saving (89%) during emergency period, traditional ceremonies (45%), family festivals (13%) like birth of a child, marriage ceremony etc. and home consumption(9%).

Healthcare Practices

Different general ill condition, metabolic and infectious diseases were observed by *soliga* tribes. Among the general ill conditions, diarrhoea was most frequently occurring. Among metabolic diseases, the bloat was frequently noticed among infectious diseases, FMD was most prevalent in both zones. However, BQ in cattle and PPR in goat equally felt on the top of deadly diseases. The animal suffered from external parasitic diseases most compared to internal parasitic diseases (Somagond *et al.,* 2019b). Jyoti (2018) opines bloat or tympanitis was one of the most common digestive disorders in livestock.

Very few people follow de-worming in core zone (25.3%) by local herbal drugs. However, the majority of the people did de-worming in the buffer zone (63.26%) but by veterinarians (Somagond *et al.,* 2019b). This indicates that the buffer zone had good link primary veterinary centre to villages. Whenever animals are ill they are generally treated by self in the core zone. However, it was vice-versa in the buffer zone. The animal was treated by veterinarians or livestock inspectors. However, the majority (80.41%) of *soliga* people followed the vaccination in the buffer zone by a veterinarian (Somagond *et al.,* 2019b). Maousami (2017) reveals that majority (92.5%, 75%, 75%, 95% and 92.5%) of respondents were not practising the use of antibiotics, vaccination schedule, deworming schedule, use of ectoparasitic drugs and treatment of a sick animal by veterinarians respectively. Smriti (2013) reveals that 63.75% did not adopt regular vaccination respectively. Chandra *et al.* (2005) reported in a study that uses of medicine during illness, deworming, colostrum feeding and vaccination against the disease were practised by less number of tribal goat keepers.

Ethno-Veterinary Practices Followed by Soliga Tribe

Although, Indigenous Traditional Knowledge (ITK) practices are not seriously followed in BR hills, but they came to rescue in emergencies. Respondents from the core zone follow these ethno-veterinary practices. The common ailments along with their ITK knowledge have been listed below-

Diarrhoea*:* Mixture of jamun tree (*Syzygium cumini*) chakke, nere, mavi, kende chakke with hot water will be given daily 2 times for consecutively 3 days.

Endoparasite*:* Dried powder of *Ilasangi* roots for calves will be fed animals

Ectoparasite*:* Smoking of *kadusoppu* in the animal shelter

Bloat*:* Animal made to drink Magallli Beru (*Decalepis hamiltonii)* root juice for 1-2days

Fever: Feeding of *Centella asiatica* leaves or stem or *Ravoulfia serpentine* plant

Cold: Mixture of garlic, chilly and jeera or *Ravoulfia serpentine* plant

Skin Diseases*: Cucurbitaceae* (highly bitter*)* smeared *on the site.*

Shivering*:* Feeding of Gadde, Eleyale, chilly and jeera paste for one day

Mouth Soar*:* Application of Ilasangi plant roots with salt and garlic

Fracture*:* Binding the leg with bamboo sticks with the application of *Sida acuta paste* and then final leg will be banded by jute rope.

Wound Cases*:* Application of *Cucurbitaceae* (highly bitter) smeared on the site.

Foot and Mouth Disease

1. The animal made to stand in soil slurry (Clayey soil) for 45minutes for 4-5 days.
2. Fish oil applied to the mouth lesions during the outbreak of FMD.
3. Neem oil application (Somagond *et al.*, 2019).

Ranganatha (2010) has discussed similar ITK practices in S*oliga*s, in which few of them are enlisted below. A mixture of salt, jaggery and turmeric powder is applied on the dislocated part of the animal to treat minor fractures. Foot and Mouth Disease (FMD) was treated by smearing, i) the juice of s*issoo plant (Dalbergia sissoo)* and tamarind bark, ii) mixture of tamarind and sesame oil iii) juice of *neem (Azadirachta indica*) leaves on the foot, iv) juices of Pongamia flowers (*Millettia pinnata*), muthugada tree (*Butea monosperma*) v) smearing sesamum oil on the crevices of cow's foot to minimize 70% of foot and mouth disease lesions. Applying juice of Mangarvalli and Agave plants, ragi powder, sesamum mixture on the swollen part within 24 hours of notice for treating Black Quarter (BQ). For treating the Ephemeral fever (*Sele roga*) a) feeding sweet neem leaves, juice of grind betel, jaggery and onion twice a day, b) juice of Bugadi leaves (*Vallaris solanacea*), Datoori sprouts, (*Datura facestosa*), chajjali chekke, ugani kudi, ekkada roots (Caolotripis gigantia), sesamum, lavanga(Clove), garlic and mixing with cow's milk is fed thrice a day. Juice of betel vine leaves and small onions fed to the animal for treating Infectious Bovine Rhino-Tracheitis (IBRT).

Praveen *et al.* (2010) collected the ITK information from livestock owners during the camel fair, in Rajasthan. Farmers treated Constipation by feeding decoction of *Citrullus colocynthis* (Linn.) root. Rumen impaction by the puslp of roasted fruits mixed with flour of *Pennisetum typhoides* and salt is fed to cure impaction with fever. Gireesha and Raju (2013) in the Western Ghats discusses that indigestion was treated by *Cyperus Rotundus* (Tunge gadde/tanga hullu), wound treated by application of *Bauhinia Variegata* (Mandare/kanchavala) roots and bark.

Constraints in Livestock Farming

Lack of sufficient pasture land and restriction of grazing in the forest area, no descriptive breeds, no commercial layer / broiler farming, lack of scientific knowledge about the livestock farming, timely delivery of veterinary services, lack of marketing facilities, problem of land alienation, illiteracy and ignorance of the government facilities (Somagond *et al.*, 2019b). Tailor *et al.* (2012) indicated that major constraints faced by tribal farmers were no availability of green fodder, inadequate knowledge about scientific feeding of animals, repeat breeding of animals, lack of pedigree bulls for natural services, low milk productivity of animals and lack of scientific housing etc.

Meganathan *et al*. (2010) stated that lack of sufficient pasture land, lack of marketing facilities, lack of adequate credit facilities, unremunerative price for the livestock products and lack of scientific knowledge on livestock farming were observed to be the major constraints perceived by the tribal farmers. Eqbal *et al*. (2013) concluded from their study in Chotanagpur, Jharkhand state that tribal dairy farmers are deficient in knowledge regarding improved dairy farming practices in all the areas like breeding, feeding, management and health care.

Conclusion

Soliga tribe is one of the most backward tribe among all other tribes in Karnataka and are virtually cut off from the mainstream of the society. S*oliga*s depend on Non-Timber Forest Products (NTFP). Majority of *soligas* work as labour, agriculture and livestock farming as the subsidiary occupation. Further, the majority of the *soliga*s area rear cattle and goats are being major. Research studies need to be carried to change the behaviour pattern of *soliga* tribes and their orientation towards a package of scientific practices and technologies for livestock health and production. Tribal animal resources should be upgraded with the highly productive animals/ birds. Establishment of Co-operative societies for organized marketing of livestock and their products. Financial institutions should provide credit facilities at a reasonable interest rate to tribal farmers. Study on adoption and diffusion of animal husbandry, agricultural and other innovations should be encouraged. It can be concluded that *soliga*s in the buffer zone are better settled than the core zone.

Conflict of Interests

There is no conflict of interest.

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