



## Tribal farmers' perceived constraints in the adoption of good dairy farming practices in the northern hills zone of Chhattisgarh, India

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**Abstract:** This study was carried out during the year 2014-15 to explore the perceived constraints encountered by the tribal dairy farmers in the successful adoption of Good Dairy Farming Practices (GDFPs). Out of 27 districts in Chhattisgarh, three tribal populated districts were selected for this study from northern hills zone of the state and totally 300 respondents were selected for constraints analysis. The study revealed that 55.33 % of the tribal farmers realised that insufficient knowledge and awareness towards good dairy farming practices is the major constraints in the adoption process, majority (70.00 %) of the tribal farmers perceived that lack of progeny tested superior bulls for AI and natural service are the main constraint in the adoption of good breeding practices, about (75.70 %) of the tribal farmers expressed the higher cost of concentrates, mineral mixtures and vitamin supplements are the main constraints in the adoption of good feeding practices, majority (70.70 %) of the tribal farmers responded that less number of veterinary hospitals in their locality is the main constraints and its ranks first in the healthcare constraints list, little less than three-fourths (67.67 %) of the tribal farmers articulated that lack of advanced farm machineries (portable milking unit) for small dairy holders is the main constraints in the adoption of good management practices and about three-fourths (75.30 %) of the tribal farmers conveyed that the lack of insurance for longer period is the main constraints and tops in the socio-economic constraints. This constraints study will be highly useful to policy makers and the scientific community to assess the dairy production technologies for refinement and appropriate strategies can be formulated to promote tribal dairying from subsistence level to intensive in order to increase the income from dairy sector.

**Keywords:** Adoption, Constraints, Good dairy farming practices, Tribal dairying

### INTRODUCTION

Over the span of four decades, India has transformed from a country of acute milk shortage to the world's leading milk producer (Meeta, 2010). India ranks first in milk production, accounting for 18.5 % of world production, achieving an annual output of 146.3 million tonnes during 2014-15 as compared to 137.69 million tonnes during 2013-14 recording a growth of 6.26 % with the per capita availability of 322 grams per day. Whereas, the Food and Agriculture Organization (FAO) has reported a 3.1 % increase in world milk production from 765 million tonnes in 2013 to 789 million tonnes in 2014 (Economic Survey, 2015-16). Dairy sector plays an important role in the country's socio-economic development and constitutes an important segment of the rural economy. Dairy industry provides livelihood to millions of homes in villages, ensuring supply of quality milk and milk products to people in both urban and rural areas (LMIS, 2015). About 23% of households owning milch animals are

landless and some 30 % are marginal farmers with land holding of less than 1 ha (World Bank, 1999). Though technologies to improve productivity of dairy animals do exist, however, the awareness and rate of adoption in smallholder mixed farming systems worldwide is consistently low, because of the existing research and extension set up and related other constraints (Reddy *et al.* 2005, Parthasarthy Rao *et al.* 2005). The adoption gap attributed by various socio-economic and psychological factors. Misra *et al.* (2012) reported that the main reasons behind the low yield are lack of use of scientific practices in milching, inadequate availability of fodder in all seasons and unavailability of veterinary health services. India is a vast and diverse country, which is also a home for over one-fourth of world's absolute poor. Among the social groups in India, Scheduled Tribes (ST) have the highest proportion of the poor. While they account for only 8 % of the total population, they comprise 40 % of the displaced population. The popu-

lation of Chhattisgarh is notable for the high proportion of Scheduled Tribes which constitute 31.8 % of the total state populace (TIN, 2013). Chhattisgarh state is playing an important role by generating self-employment through dairy in rural areas for most of the tribal community belongs to weaker section of the society which in turn provides nutritious food to rural folks (CTDS, 2013). Unfortunately, Chhattisgarh state is still in primitive stage in dairy farming though the state has good number of cattle population compared to other leading milk producing states. Adoption of improved good dairy farming practices by the tribal people is one of the important pre-requisites to substantially improve the quality of their life, but there are various constraints which hinders its adoption. Any programmes aimed at alleviating poverty through dairy production will have to be based on sound knowledge of the situation in small-holder farming systems, including gender issues, in the context of the prevailing socio-economic conditions (Misra *et al.*, 2012).

Milk production has grown at a faster pace during the last three decades but milk production per animal is very low. Meanwhile, adoption of recommended dairy farming practices are far from satisfactory level and it directly influence the overall milk production. The nation still has the potential to meet the growing demand for milk and milk products, but need of the hour is to adopt the recommended technologies in dairy farming. To increase the country's milk production, a thoughtful strategy focusing on improved management technology is required. Before that, it is very much essential to know the existing status quo of technology and its related constraints faced by the tribal dairy farmers in the adoption of good dairy farming technologies. Hence, present study was planned to identify constraints that hinders the tribal dairy production. This constraints analysis revealed the barriers which catalyze the low level adoption of good dairy farming practices in housing, feeding, breeding, healthcare, management and advances of dairy farming in the three tribal populated districts of Chhattisgarh.

## MATERIALS AND METHODS

The study was carried out in Surajpur, Surguja and Balrampur district of northern hills zone of Chhattisgarh state during the year of 2014-15. From each district, four villages were selected and from each village 25 dairy tribal respondents were selected through ran-

dom sampling thus 300 respondents were selected for constraints analysis. To measure the perception level of respondents on GDFPs, a list of items seeking different contents were prepared. These listed items were administered to the respondents. The individual farmer was asked to state on a three-point continuum Most Constraints, Some What Constraints and No Constraints with the statements in his hand, with a score of 1, 2, and 3 for the responses respectively. Based on the scores the Perception Index (PI) was calculated using the formula given below and the overall perception level was categorized based on the identified class interval. All the analyses were performed using statistical software SPSS (Version 17 for Windows). The constraint analysis helps the planners, administrators, development workers, scientists and others to frame policies and to implement developmental schemes. Hence, the multiple responses of constraints towards the adoption of good dairy farming was worked out.

## RESULTS AND DISCUSSION

**Perceived constraints in adoption of GDFPs:** It could be observed from Table 1 that the major constraints related to overall adoption of GDFPs is insufficient knowledge and awareness towards good dairy farming practices (55.33 %) followed by lack of technical assistance from extension and veterinary services/experts (49.67 %), little less than half of the respondents expressed the undulated topography in their constraints, 45.00 % reported that wild animals attack on cattle, little more than one-fourth (34.33 %) stand for higher maintenance cost of the herd (inputs and medicine) is the major constraints in the dairy farming. Knowledge and timely farm information regarded as one of the crucial input for profitable farming. Tribal farmers aptly pointed out the ground realities and constraints towards dairy farming. This study observed that majority of the respondents were low level of awareness of GDFPs, so the policy implications has to be developed for systematic arrangement of large scale awareness campaigns and mass media could be utilized in a big way to promote the dairy farming. Lack of knowledge was given first rank among constraints affecting livestock production adversely. Similarly, Singh and Chauhan (2006), Mohi and Bhatti (2006) and Rathore *et al.* (2009) also reported lack of knowledge is the major constraint in livestock

**Table 1.** Tribal farmers' perceived general constraints in dairy farming (n=300).

S. N.	General constraints	MC*	SWC*	NC*	Rank
1.	Wild animals attack on cattle	135(45.00)	8(28.70)	79(26.30)	IV
2.	Undulated topography	137(45.70)	147(49.70)	16(5.30)	III
3.	Insufficient knowledge and awareness towards good dairy farming practices	166(55.33)	113(37.66)	17(5.66)	I
4.	Lack of technical assistance from extension and veterinary services/experts	149(49.67)	54(18.00)	97(32.33)	II
5.	Higher maintenance cost (inputs and medicine)	103(34.30)	174(58.00)	23(7.70)	V

Note: \* MC - Most Constraints, SWC - Some What Constraints and NC - No Constraints

**Table 2.** Perceived constraints in adoption of good breeding practices (n=300).

S.N.	Breeding constraints	MC*	SWC*	NC*	Rank
1.	Lack of knowledge and awareness about appropriate heat symptoms	125(41.70)	144(48.00)	31(10.30)	VII
2.	Inadequate knowledge towards Artificial Insemination (time and precautions)	208(69.30)	90(30.00)	2(0.70)	II
3.	Poor infrastructure and negligible services at AI centre	196(65.30)	64(21.30)	40(13.30)	III
4.	More distance between veterinary hospitals and AI centre from farmers house	142(47.30)	111(37.00)	47(15.70)	VI
5.	Unavailability of good quality semen	119(39.70)	103(34.30)	78(26.00)	IX
6.	Lack of skilled technician for artificial insemination	122(40.70)	100(33.30)	78(26.00)	VIII
7.	Lack of progeny tested superior bulls for AI and natural service	210(70.00)	59(19.70)	31(10.03)	I
8.	Non-availability of suitable location specific crossbred/indigenous milch breed	115(26.30)	108(28.70)	77(45.00)	X
9.	Lack of knowledge on good breeding practices (estrous interval, proper time of insemination, service period, pregnancy diagnosis, calving interval)	181(60.30)	111(37.00)	8(2.70)	IV
10.	Lack of knowledge and awareness about repeat breeding problems	179(59.70)	111(37.00)	10(3.30)	V

\*MC - Most Constraints, SWC - Some What Constraints and NC - No Constraints.

production.

**Tribal farmer's perceived constraints in adoption of good breeding practices:** Table 2 shows that majority (70.00 %) of the tribal farmers understand that lack of progeny tested superior bulls for AI and natural service are the main constraints and its ranks first in the breeding constraints list followed by little more than half (69.30 %) goes to inadequate knowledge towards Artificial Insemination (time and precautions), 65.30 % reported the poor infrastructure and negligible services at AI centre, 60.30 % feels lack of knowledge on good breeding practices (estrous interval, proper time of insemination, service period, pregnancy diagnosis, calving interval), little more than half (59.70 %) stand for lack of knowledge and awareness about repeat breeding, 47.30 % sensed more distance between veterinary hospitals and AI centre from farmers house, 41.70 % perceived the lack of knowledge and awareness about appropriate heat symptoms as an important constraint under the good breeding practices. The results clearly depicts that tribal dairy farmers having low level of adoption and awareness level towards GBPs, but they are very much interested to adopt in future. This finding is supported by (Balakrishna, 1997) and (Meena *et al.* 2008). Genetic upgradation of local non-descript animals through crossbreeding with superior germplasm should be started. The farmers should be encouraged to breed indigenous cows and buffaloes with improved breeds through artificial insemination to improve the productivity of the existing livestock resources (Dhaka *et al.* 2010). Sharma *et al.*

(2008) reported that there is immediate need of imparting quality practical training and periodical assessment of performance of lay inseminators to improve their skill and knowledge of estrus detection and insemination. It can be suggested from the results that the Model Dairy Villages (MDVs) may developed at gross-root level to create awareness and capacity building about GDFPs among tribal farmers in turn to accelerate the adoption level for good breeding practices.

The success of any dairy farming activities solely depends on the strategic breeding plan and policies. Tribal farmers undoubtedly understood the importance of AI in the breeding programme, since Chhattisgarh government has taken number of new initiatives to improve the non-descript in to high yielding cow.

**Tribal farmer's perceived constraints in adoption of good feeding practices:** The results in Table 3 indicates that majority (75.70 %) of the tribal farmers expressed the higher cost of concentrates, mineral mixtures and vitamin supplements are the main constraints and it ranks first in the feeding constraints list followed by 71.70 % feels unavailability of concentrates and mineral mixtures in villages, 64.70 % correspond to the inadequate knowledge about nutrient requirement of different physiological stages of dairy animals, 57.70 % experienced lack of artificial irrigation for fodder crops during summer, little less than half (49.00 %) shrinkage of agricultural land for fodder production, 48.30 % sensed less availability of grazing/pasture land, 48.00 % perceived overall higher production cost of feed and fodder, 39.30 % articulated the

**Table 3.** Perceived constraints in adoption of good feeding practices (n=300).

S.N.	Feeding constraints	MC*	SWC*	NC*	Rank
1.	Non availability of green and dry fodders	118(39.30)	131(43.70)	51(17.70)	VIII
2.	Inadequate knowledge about nutrient requirement of different physiological stages of dairy animals	194(64.70)	31(10.30)	75(25.00)	III
3.	Unavailability of concentrates and mineral mixtures in villages	215(71.70)	69(23.00)	16(5.30)	II
4.	Higher cost of concentrates, mineral mixtures and vitamin supplements	227(75.70)	70(23.30)	3(1.00)	I
5.	Unavailability of quality seeds and fodder	97(32.3)	203(67.70)	0(3.30)	IX
6.	Lack of artificial irrigation for fodder crops during summer	173(57.70)	107(35.70)	20(6.70)	IV
7.	Less availability of grazing/pasture land	145(48.30)	112(37.30)	43(14.30)	VI
8.	Shrinkage of agricultural land for fodder production	147(49.00)	102(34.00)	51(17.00)	V
9.	Overall higher production cost of feed and fodder	144(48.00)	141(47.00)	15(5.00)	VII

\*MC - Most Constraints, SWC - Some What Constraints and NC - No Constraints

**Table 4.** Perceived constraints in adoption of good healthcare practices (n=300).

S.N.	Healthcare constraints	MC*	SWC*	NC*	Rank
1.	Less number of veterinary hospitals	212(70.70)	23(7.70)	65(21.70)	I
2.	Poor knowledge in health management of animals	175(58.30)	120(40.00)	5(1.70)	III
3.	Lack of understanding about importance of vaccination	115(38.30)	108(36.00)	77(25.70)	VI
4.	Lack of awareness about deworming	103(34.30)	108(36.00)	89(29.70)	VII
5.	Higher veterinary consultancy fee	70(23.30)	119(39.70)	111(37.00)	VIII
6.	Unavailability and high cost of veterinary medicines	69(23.00)	209(69.70)	22(7.30)	IX
7.	More distance between veterinary hospitals and farmers house	125(41.70)	142(47.30)	33(11.00)	V
8.	Lack of diagnostic facilities at village level	210(70.00)	61(20.30)	29(9.70)	II
9.	Lack of veterinarian and para-medical technicians	172(57.30)	110(36.70)	18(6.00)	IV
10.	Crossbred animals are more susceptible to many diseases	40(13.30)	192(64.70)	68(22.70)	XI
11.	Higher calf mortality	56(18.70)	167(55.70)	77(25.70)	X

\* MC - Most Constraints, SWC - Some What Constraints and NC - No Constraints

non availability of green and dry fodders and 32.3 % sensed unavailability of quality seeds and fodder as an important constraint among the good feeding practices. Dhaka *et al.* (2010) suggested that in order to improve the productivity of animals proper nutritional management is essential. Rations must be formulated to provide for the basic physiologic needs of the animal and to ensure optimal growth and productivity. Meena *et al.* (2008) also reported the lack of knowledge regarding balanced feed as constraint regarding fertility problem. In general, tribal dairy farmers showed less importance towards the purchase the feed and fodder due to the extensive nature of farming.

**Tribal farmer's perceived constraints in adoption of healthcare practices:** It could be observed from the Table 4 that majority (70.7 %) of the tribal farmers expressed that less number of veterinary hospitals in their locality is the main constraints and it ranks first in the healthcare constraints list followed by 70.00 % feels lack of diagnostic facilities at village level, 58.30 % corresponded to the poor knowledge in health management of animals, 57.30 % experienced lack of veterinarian and para-medical technicians, little less than half (41.70 %) feels more distance between veterinary hospitals and farmers house, 34.30 % sensed lack of awareness about the advantages of deworming, 23.30 % perceived higher veterinary consultancy fee, 23.00 % sensed unavailability and high cost of veterinary medicines and least % (18.70 %) expressed higher calf mortality as an important constraint under the good healthcare practices. This finding is supported by Venkatasubramanian and Rao (1993). Farmers should be encouraged to keep more productive animals and adopt

a regular vaccination and de-worming schedule as a preventive measure, and provide mineral supplements to animals to overcome the problem of infertility in case of buffaloes and crossbred cattle (Dhaka *et al.*, 2010). Overall, tribal dairy farmers showed greater importance towards good healthcare practices, since healthcare is the basic requirement of a healthy herd. Dairy farming is at primitive stage in the study area and Chhattisgarh state in the rapid establishment stage, so for the timely veterinary services and apt infrastructure has to go long way to attain the maximum coverage of animal and people.

**Tribal farmer's perceived constraints in adoption of good management practices:** It could be seen from the Table 5 that little less than three-fourths (67.67 %) of the tribal farmers expressed the lack of advanced farm machineries (Portable milking unit) for small dairy holders is the main constraints and it ranks first in the management constraints list followed by 64.30 % feels lack of record maintenance, 54.70 % corresponded to the poor knowledge about clean milk production, 43.30 % experienced shortage of skilled labour, little less than half (38.00%) feels unawareness of good dairy management farming practices, 30.30 % sensed lack of proper housing management, 23.30 % perceived lack of veterinary services as an important constraint among the good management practices. The finding receives support from the observations of Chugh (1995) and Kumar (1995). On the whole, tribal dairy farmers showed medium level importance towards good management practices, since management practices requires considerable investment. But in the mean time the study noticed that proper management

**Table 5.** Perceived constraints in adoption of good management practices (n=300).

S.N.	Management constraints	MC*	SWC*	NC*	Rank
1.	Unawareness of good management practices	114(38.00)	159(53.00)	27(9.00)	V
2.	Lack of proper housing management	91(30.30)	176(58.70)	33(11.00)	VI
3.	Lack of record maintenance	193(64.30)	52(17.30)	55(18.30)	II
4.	Shortage of skilled labour	130(43.30)	117(39.00)	53(17.70)	IV
5.	Poor knowledge about clean milk production	164(54.70)	75(25.70)	61(20.30)	III
6.	Lack of veterinary services	70(23.30)	113(37.70)	117(39.00)	VII
7.	Lack of advanced farm machineries (Portable milking unit) for small dairy holders	203(67.67)	45(15.00)	52(17.30)	I

\* MC - Most Constraints, SWC - Some What Constraints and NC - No Constraints

**Table 6.** Perceived socio- economic constraints in dairy farming (n=300).

Socio-economic constraints	MC*	SWC*	NC*	Rank
Lack of capital investment for housing, feed and fodders	131(43.07)	167(55.70)	2(0.70)	IX
Inadequate credit support from bank and higher interest rate	204(68.00)	41(13.70)	55(18.30)	IV
Poor adoption of good dairy farming practices due to illiteracy	164(54.70)	82(27.30)	54(18.00)	VIII
Lack of awareness towards value addition of dairy products	204(68.00)	85(28.30)	11(3.70)	III
Lack of dairy cooperative societies	221(73.70)	27(9.00)	52(17.30)	II
Lack of insurance for longer period	226(75.30)	23(7.70)	51(17.00)	I
More believes in cultural values and taboos	75(67.67)	143(15.00)	82(17.30)	X
Perishable nature of milk and milk products	191(63.70)	102(34.00)	7(2.30)	VII
Lack of price support and marketing channel for milk and milk products	203(67.70)	92(30.70)	5(1.70)	V
Lack of transport facility between village to milk processing unit	202(67.30)	48(16.00)	50(16.70)	VI

\* MC - Most Constraints, SWC - Some What Constraints and NC - No Constraints

practices were followed in the intensive production system.

**Tribal farmer's perceived constraints in socio- economic aspects:** It could be seen from the Table 6 that three-fourths (75.30 %) of the tribal farmers expressed the lack of insurance for longer period is the main constraints and it ranks first in the socio-economic constraints list followed by 73.70 % feels lack of dairy cooperative societies, 68.00 % corresponded to the lack of awareness towards value addition of dairy products, 68.00 % experienced Inadequate credit support from bank and higher interest rate, little less than three-fourths (67.70%) feels lack of price support and marketing channel for milk and milk products, 67.30 % sensed lack of transport facility between village to milk processing unit, 63.70 % perceived the perishable nature of milk and milk products, 54.70 % feels poor adoption of good dairy farming practices due to illiteracy, 43.07 % perceived the lack of capital investment for housing, feed and fodders and 67.67 % more believes in cultural values and taboos as an important constraint among the socio-economic constraints. In general, farmer's socio-economic position is the base for the adoption of any higher level dairy technologies, so the government has to make possible to reach the subsidy benefits to the gross root beneficiaries.

### Conclusion

The study revealed that majority of the tribal farmers understands that lack of progeny tested superior bulls for AI and natural service are the main constraints in the successful breeding programme. Most of the respondents expressed the higher cost of concentrates, mineral mixtures and vitamin supplements are the main constraints in the adoption of feeding practices. More than half of the tribal farmers expressed less number of veterinary hospitals in their locality are the main constraints in the adoption of healthcare practices. Less than three-fourths of the tribal farmers expressed the lack of advanced farm machineries (Portable Milking Unit) for small dairy holders are the main constraints in the adoption of management practices. Three-fourths of the tribal farmers expressed the lack of insurance for longer period is the main

constraint in socio-economic aspects. This pioneer study reported the overall perceived constraints of tribal dairy farmers in the adoption of Good Dairy Farming Practices in the northern hills zone of Chhattisgarh. The findings of this study will be highly useful for policy makers to develop alternative livelihood options in the study area.

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### REFERENCES

- Balakrishna, B. (1997). Evaluation of dairy production practices in selected farming systems of Karnataka state. Ph.D. thesis (unpublished) NDRI, Karnal.
- Chugh, M. (1995). An exploratory study of dairy farms owned by ex-servicemen in Karnal district (Haryana). M.Sc. thesis (unpublished), NDRI, Karnal.
- CTDS, (2013). Project on Chhattisgarh Tribal Development programme. Chhattisgarh Tribal Development Society, IFAD.
- Dhaka, B. L., Chayal, K. and Poonia, M. K. (2010). Identification of constraints limiting the productivity of livestock and strategies for its improvement in Bundi district of Rajasthan. *Indian Journal of Animal Sciences*, 81(1):94-96
- Economic Survey, (2015-16). Volume II, Prices, Agriculture and Food Management. Government of India. 115-116.
- Kumar, S. (1995). A study of delivery system of the Animal husbandry inputs in Bankra District (Bihar). M.Sc. thesis (unpublished), NDRI, Karnal.
- LMIS, (2015). *Report on Dairy Sector*. Agricultural Skill Council of India, Haryana, India. <http://asci-india.com/pdf/LMIS-on-Dairy.pdf>. Accessed 20 March (2016).
- Meena, H.R., Ram, H., Sahoo, A. and Rasool, T.J. (2008). Livestock husbandry scenario at high altitude Kumaon Himalaya. *Indian Journal of Animal Sciences*, 78(8): 882-886
- Meeta, P. (2014). India: Increasing demand challenges the dairy sector. FAO. <http://www.fao.org/docrep/011/>

- i0588e/I0588E05.htm. Accessed 20 June (2014).
- Misra, A.K., Subrahmanyam, K.V., Shivarudrappa, B. and Ramakrishna, Y.S. (2006). Experiences on participatory action research for enhancing productivity of dairy animals in rainfed agroecosystem of India. *Journal of SAT Agricultural Research*, 2:1-10
- Mohi, A.K. and Bhatti, J.S. (2006). Constraints encountered by dairy farmers in adoption of improved dairy farming practices. *Journal of Dairying Foods and Home Sciences*, 25(1):47-50
- Parthasarthy Rao, P., Brithal, P. S. and Ndjéunaga, J. (2005). *Crop-Livestock Economies in the Semi-arid Tropics: Facts, Trends and Outlook*. Patancheru, 502-324, Andhra Pradesh, India. ICRISAT Pp 68
- Rathore, R.S., Singh, R., Kachwaha, R.N. and Kumar, R. (2009). Constraints perceived by cattle keepers in adoption of recommended breeding, feeding and housing management practices. *Indian Journal of Animal Sciences*, 79(5):530-533
- Reddy, G.S., Reddy, B.M.K., Misra, A.K., Prabhakar, M. and Sambarajayam, A. (2005). On-farm Assessment and Refinement of Technologies in Southern Telangana Zone of Andhra Pradesh. NATP, CRIDA, Hyderabad. 54
- Sharma, M.S., Dhama, A.J., Sharma, K.S., Sarvaiya, N.P. and Kavani, F.S. (2008). Assessment of estrus detection and insemination efficiency of AI workers in buffaloes through plasma progesterone profile under field conditions. *Indian Journal of Animal Sciences*, 78(7):706-709
- Singh, M. and Chauhan, A. (2006). Constraints faced by dairy owners in adoption of scientific dairy farming practices. *Indian Journal of Dairy Science*, 59(1):49-51
- TIN, (2013). Tribal profile at a glance. <http://tribal.nic.in/WriteReadData/archiveDoc/201410170113319773837/STProfileataGlance.pdf>. Accessed 22<sup>nd</sup> February, 2016.
- Venkatasubramanian, V. and Rao, S.V.V. (1993). Incidence of health disorders in crossbreds and indigenous cattle under field condition. *Indian Dairy Science*, 46(7):302-06
- World Bank, (1999). India: Livestock Sector review: Enhancing Growth and Development. The World Bank and Allied Publishers: New Delhi.