A Survey on the Use and Resistance of Antibiotics in Maharashtra

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Abstract

Livestock is an important integral part to the sustainability of economy of this state. Antibiotic resistance is worldwide very common problem. The current study aimed to assess the knowledge, attitude, and practices pertaining to antibiotic usage among the field veterinarians.Feedback of 291 veterinary officers of Maharashtra state was taken regarding the use and resistance of different types of antibiotics in supplied format. It was revealed that ampicillin and amoxicillin in “Penicillin group”, oxytetracycline in “Tetracycline group”, cefotaxime and ceftriaxone in “Cephalosporine group”, enrofloxacine in “Quinolones group”, gentamycin in “Amynoglycosides group”,erythromycin in “Macrolides”group and Ampicillin &Cloxacillinin “Combination group” was used mostly due to their efficacy.The most important reason for using the antibiotics was found to be “effectiveness of antibiotic” (4.36 ± 0.08).It was indicated that in “bacterial infection” (4.62 ± 0.07) antibiotic was used mostly. Most important reason for antibiotic resistance was found to be “indiscriminate use of antibioticsby owners / paravets” (4.45 ± 0.08).The most important measure for prevention of antibiotic resistance was observed to be “ensuring proper dose and duration of treatment of antibiotics” (4.46 ± 0.08).

Full Text

Livestock sector plays an important role in socio economic development of our country. The success of livestock industry depends on good health of the livestock. Maharashtra is rich source 1 & 3. Principal Scientist, TEC, IVRI, Shivajinagar, Pune, Maharashtra. 2. Station In Charge, TEC, IVRI, Shivajinagar, Pune, Maharashtra.

of livestock population. As per 19 th Livestock Census (2012) the bovine livestock population of Maharashtra is 21.07 million out of which cattle population is 15.48 million and buffaloes population is 5.59 million. In Maharashtra goat population is 8.44 million. Livestock thus is an important integral part to the sustainability of economy of this state. Antibiotics are widely used in animal husbandry sector for therapeutics and non-therapeutic purposes. Antibiotic resistance is a burning health-care issue influencing both humans and domestic animals across the globe (Rushton *et al*, 2014). Globally, India stood 4th in antibiotic consumption (3%) for livestock production in 2010, which has led to an increase in antibiotic resistance at an alarming rate(Van Boeckel*et al*, 2015). So, information on the use and resistance of antibiotic in Maharashtra will definitely help the State Animal Husbandry Department to plan properly for use of antibiotic and its level of use to minimize its resistance with the object to treatment and control measures of livestock and poultry diseases properly. So, the current study is aimed to assess the knowledge, attitude and practices pertaining to antibiotic usage among the livestock development officers who serve as nodal officers and play a crucial role in disseminating knowledge to the farmers regarding livestock management practices in India. Therefore this survey work was conducted as a part of extension work in the year 2017 and 2018.

Materials And Methods

Feedback of 291 livestock development officers (LDO) of Maharashtra State Animal Husbandry Department, Maharashtra was taken regarding the use and resistance of different types of antibiotic in supplied format in 1–4 scale, where score 4 was given to most frequently used antibiotic, 3 for antibiotic used sometimes, 2 for antibiotic used rarely and 1 was assigned for antibiotic which was never used. For efficacy of antibiotic 1–5 scale was used where 5 was most effective, 1 was assigned for not effective. For other parameters such as reasons for using antibiotics, common condition for using antibiotics, reasons for antibiotic resistance and prevention of antibiotic resistance, 1–5 scales was followed. Afterwards score mentioned by them were analysed statistically as per Snedecor and Cochran (1994) using SPSS 10.5 version software. Mean, standard error, one way analysis of variance, critical difference test was carried out.

Results And Discussion

Maximum number of respondents was from Jalgaon district (29) followed by Yavatmal (21) and Gadchiroli (21). 24 respondents did not mention their address properly (Table-1).

Table – 1: District wise respondents for the survey

Sl No	Name of District	Number of respondent	Per cent (%)
1	Ahmadnagar	11	3.78
2	Akola	7	2.41
3	Amravati	10	3.44
4	Aurangabad	9	3.09
5	Bhandara	2	0.69
6	Bid	7	2.41
7	Buldana	5	1.72
8	Chandrapur	2	0.69
9	Dhule	8	2.75
10	Gadchiroli	21	7.22
11	Gondiya	5	1.72
12	Hingoli	2	0.69
13	**Jalgaon**	**29**	**9.97**
14	Jalna	1	0.34
15	Kolhapur	4	1.37
16	Latur	4	1.37
17	Mumbai	2	0.69
18	Nagpur	1	0.34
19	Nanded	9	3.09
20	Nandurbar	17	5.84
21	Nashik	9	3.09
22	Osmanabad	5	1.72
23	Palghar	11	3.78
24	Parbhani	5	1.72
25	Pune	9	3.09
26	Raigarh	6	2.06
27	Ratnagiri	1	0.34
28	Sangli	5	1.72

Sl No	Name of District	Number of respondent	Per cent (%)
29	Satara	9	3.09
30	Sindhudurg	1	0.34
31	Solapur	12	4.12
32	Thane	3	1.03
33	Wardha	3	1.03
34	Washim	11	3.78
35	Yavatmal	21	7.22
	Not reported	**24**	**8.25**
	GT	**291**	**100.00**

It was revealed from Table – 2, that ampicillin and amoxicillin in **Penicillin group** was used mostly (3.58 ± 0.07) as it was most effective. In **Tetracycline group**oxytetracycline was found to be used maximum (3.90 ± 0.06) due to its maximum efficacy. In **Cephalosporine group** antibiotic of generation three iecefotaxime and ceftriaxone were reported to be used mostly (3.67 ± 0.06) as it was most effective. In **Quinolones** group enrofloxacine was mostly used (3.74 ± 0.08) antibiotic due to its highest efficacy. In **Amynoglycosides**group gentamycin was reported to be mostly used (3.67 ± 0.07) as it was most effective. In **Macrolides** group erythromycin was mostly used (1.89 ± 0.09) as its effectiveness was highest.In **Combinations antibiotic group** Ampicillin & Cloxacillin was found to be used frequently (3.49 ± 0.12) as its effectiveness was highest. In **Miscellaneous group**Chloramphenicol (2.46 ± 0.08) was used mostly due to its efficacy. ANOVA revealed that highly significant difference ($P < 0.01$) of score was observed between the antibiotics in all groups except Combinations group (Table – 2).

Table 2
Use of different types of antibiotics

SL NO	Name of antibiotic	Mean Score	SE	F Value	CD Value
1	**Penicillin**			23.51 **	0.17
i	Penicillin G	3.14[b]	0.08		
ii	Methicillin / Oxacillin	1.26[c]	0.07		
iii	Ampicillin / Amoxicillin	**3.58[a]**	0.07		
iv	Mezlocilin / Piperacillin / Ticarcillin	1.14[c]	0.05		
2	**Tetracyclines**			104.89 **	0.14
i	Tetracycline	2.68[b]	0.09		
ii	Oxytetracycline	**3.90[a]**	0.06		
iii	Doxycycline	2.01[c]	0.07		
iv	Minocycline	1.05[d]	0.05		
3	**Cephalosporine**			4.84 **	0.18
i	Gen I (Cephalexin, Cefazoline)	2.82[b]	0.08		
ii	Gen II (Cefuroxime)	1.92 [c]	0.07		
iii	Gen III (Cefotaxime, Ceftriaxone)	**3.67[a]**	0.06		
iv	Gen IV (Cefozopran, Cefquinome)	1.73[c]	0.08		
4	**Quinolones**			112.60 **	0.19
i	Enrofloxacine	**3.74[a]**	0.08		
ii	Ciprofloxacine	3.56[a]	0.07		
iii	Norfloxacine	1.95[c]	0.07		
iv	Gatifloxacine	1.22[d]	0.06		
v	Ofloxacin	2.39[b]	0.07		
5	**Amynoglycosides**			32.16 **	0.26
i	Amikacin	2.86 [b]	0.08		
ii	Gentamycin	**3.67[a]**	0.07		

SL NO	Name of antibiotic	Mean Score	SE	F Value	CD Value
iii	Kanamycin	1.34[d]	0.07		
iv	Neomycin	2.12[c]	0.09		
v	Streptomycin	2.65 [b]	0.10		
vi	Tobramycin	1.33[d]	0.06		
6	**Macrolides**			1.88 *	0.13
i	Erythromycin	**1.89[a]**	0.09		
ii	Roxithromycin	1.09[b]	0.06		
iii	Azithromycin	1.84[a]	0.07		
7	**Combinations**			1.31 NS	0.28
i	Sulfa&Trimithoprim	3.37[a]	0.11		
ii	Streptomycin & Penicillin	3.34[a]	0.09		
iii	Ampicillin &Cloxacillin	**3.49[a]**	0.12		
iv	Ceftrioxone&Tazobactrum	3.48[a]	0.08		
v	Metronidazole combination	3.22 [a]	0.10		
8	**Miscelleneous**			51.25 **	0.11
i	Chloramphenicol	**2.46[a]**	0.08		
ii	Colistin	1.20[b]	0.06		
iii	Any Other	0.70[c]	0.07		

NB: Number of Observations 291

Figures having different superscripts in a column differ significantly ($P < 0.05$)

NS = > Non significant ie $P > 0.05$, * => $P < 0.05$, ** => $P < 0.01$

It was revealed from Table – 3, that ampicillin and amoxicillin in **Penicillin group** was was most effective (3.88 ± 0.09). In **Tetracycline group** oxytetracycline was found to have maximum efficacy (4.30 ± 0.08). In **Cephalosporine group** antibiotic of generation three ie cefotaxime and ceftriaxone was reported to be most effective (4.06 ± 0.11) in that group. In **Quinolones** group enrofloxacine was found to be most effective antibiotic (4.35 ± 0.29). In **Amynoglycosides** group gentamycin was reported to be most

effective (4.59 ± 0.44). In **Macrolides** group erythromycin was reported to be having highest efficacy (2.08 ± 0.12). In **Combinations antibiotic group** Ampicillin & Cloxacillin was found to be reported highest efficacy (4.04 ± 0.10). ANOVA revealed that highly significant difference ($P < 0.01$) of score was observed between the antibiotics in all groups except Combination group (Table – 3).

Table – 3: Efficacy of different antibiotics:-

SL NO	Name of antibiotic	Mean Score	SE	F Value	CD Value
1	**Penicillin**			213.92 **	0.23
I	Penicillin G	3.31 b	0.12		
Ii	Methicillin / Oxacillin	1.29 c	0.09		
Iii	Ampicillin / Amoxicillin	**3.88 a**	0.09		
Iv	Mezlocilin / Piperacillin / Ticarcillin	1.08 c	0.08		
2	**Tetracyclines**			170.97 **	0.25
I	Tetracycline	2.99 b	0.13		
Ii	Oxytetracycline	**4.30 a**	0.08		
Iii	Doxycycline	2.16 c	0.12		
Iv	Minocycline	1.07 d	0.08		
3	**Cephalosporine**			47.39 **	0.29
I	Gen I (Cephalexin, Cefazoline)	3.22 b	0.12		
Ii	Gen II (Cefuroxime)	2.21 c	0.13		
Iii	Gen III (Cefotaxime, Ceftriaxone)	**4.06 a**	0.11		
Iv	Gen IV (Cefozopran, Cefquinome)	2.37 c	0.14		
4	**Quinolones**			34.40 **	0.51
i	Enrofloxacin	**4.35 a**	0.29		
Ii	Ciprofloxacine	4.26 a	0.38		
Iii	Norfloxacine	2.23 b	0.13		
iV	Gatifloxacine	1.20 c	0.09		
v	Ofloxacin	2.52 b	0.13		
5	**Amynoglycosides**			31.55 **	0.49
I	Amikacin	2.90 b	0.13		
Ii	Gentamycin	**4.59 a**	0.44		
Iii	Kanamycin	1.54 d	0.11		

SL NO	Name of antibiotic	Mean Score	SE	F Value	CD Value
Iv	Neomycin	2.34 [c]	0.12		
V	Strptomycin	2.84 [b]	0.13		
Vi	Tobramycin	1.32 [d]	0.10		
6	**Macrolides**			20.71**	0.26
I	Erythromycin	**2.08 [a]**	0.12		
Ii	Roxithromycin	1.16 [b]	0.09		
Iii	Azithromycin	2.01 [a]	0.12		
7	**Combinations**			2.30 NS	0.26
I	Sulfa & Trimithoprim	3.87 [a]	0.11		
Ii	Streptomycin & Penicillin	3.65 [a]	0.13		
Iii	Ampicillin & Cloxacillin	**4.04 [a]**	0.10		
Iv	Ceftrioxone & Tazobactrum	3.97 [a]	0.11		
8	**Miscelleneous**			29.66**	0.22
i	Colistin	**1.53 [a]**	0.10		
ii	Any Other	0.81 [b]	0.08		

NB: Number of Observations 217

Figures having different superscripts in a column differ significantly (P < 0.05)

NS = > Non significant ie P > 0.05, * => P < 0.05, ** => P < 0.01

Survey was taken on reason of using different antibiotics. It was observed that “Effectiveness of antibiotic” (4.36 ± 0.08) was found to be most important reason for using the antibiotics followed by “easy availability “and “economical” ie cost of antibiotic (Table – 4). Highly significant (P < 0.01) difference was observed in score between the seven reasons.

Table – 4: Reason for using different antibiotics: -

Reasons	Mean	SE	F value	CD Value
Easy availability	4.10 [b]	0.09	116.82 **	0.25
Effectiveness	**4.36[a]**	0.08		
Economical	3.75[c]	0.10		
Ease of administration	3.37[d]	0.12		
Popularity among owners	2.26[e]	0.11		
Information provided by the manufacturer	2.50[e]	0.11		
Any other reason	0.82[f]	0.09		

NB: Number of Observations 291, ** => P < 0.01

Figures having different superscripts in a column differ significantly (P < 0.05)

Survey was taken on use of antibiotics in different conditions. It was indicated that in “bacterial infection”(4.62 ± 0.07) antibiotic was used mostly followed by “mastitis” (4.41 ± 0.09) and “respiratory tract infection” (4.35 ± 0.08). There were highly significant (P < 0.01) differences of score between different conditions (Table – 5).

Table – 5: Common conditions for using different antibiotics:-

Common Conditions	Mean	SE	F value	CD Value
Bacterial Infection	**4.62[a]**	0.07	98.53 **	0.23
Viral Infection	3.44[d]	0.10		
GIT Infection	3.82[c]	0.10		
Respiratory tract Infection	4.35[b]	0.08		
Uro - genital tract infection	3.84[cd]	0.10		
Mastitis	4.41[ab]	0.09		
Non specific pyrexia	3.09[e]	0.10		
Post operative condition	3.73[d]	0.09		
Wound / Abscess	3.98[c]	0.09		
Any other	1.15[f]	0.10		

NB: Number of Observations 291. ** => P < 0.01

Figures having different superscripts in a column differ significantly (P < 0.05)

The reasons of antibiotics resistance were studied by way of survey. Most important reason for antibiotics resistance (Table – 6) was found to be “indiscriminate use of antibiotics by owners / paravets” (4.45 ± 0.08), followed by “discontinuation of antibiotics therapy” during course of treatment (4.07 ± 0.09) and “improper or inadequate dose” (3.72 ± 0.10) of antibiotics. There was highly significant (P < 0.01) difference of score between different reasons of antibiotic resistance. Similar to present findings Parkunan et al (2019) also reported that irrational use of antibiotic was the main cause of antibiotic resistance. However, they reported that improper diagnosis of diseases is the major professional lacuna that is also responsible for the misuse of antibiotics.

Table – 6: Reasons of antibiotic resistance:-

Reasons	Mean	SE	F value	CD Value
Indiscriminate use by owners / paravets	**4.45[a]**	0.08	109.44 **	0.25
Discontinuation of antibiotic therapy	4.07[b]	0.09		
Improper or inadequate dose	3.72[c]	0.10		
Poor quality antibiotics	2.98[e]	0.08		
Use of antibiotics in feed	3.08[de]	0.10		
Use of multidrug	3.25[d]	0.11		
Any Other	0.92[f]	0.09		

NB: Number of Observations 291. ** => P < 0.01

Figures having different superscripts in a column differ significantly (P < 0.05)

Survey was also undertaken on the different ways of prevention of antibiotic resistances. The most important measure for prevention of antibiotic resistance (Table – 7) was observed to be “ensuring proper dose and duration of treatment of antibiotic” (4.46 ± 0.08) followed by “strict regulation ie non availability of antibiotic without prescription of veterinary doctor” (4.37 ± 0.08) and“ educating the farmers on adverse effect of indiscriminate use of antibiotics” (4.02 ± 0.09).There was also highly significant (P < 0.01) difference of score between different measures for the prevention of antibiotic resistance. In contradiction to present findings Parkunanet al (2019) reported that judicious prescription was the most important measure to reduce antibiotics usage and consequent resistance. However, they emphasised on extension related activities in generating awareness of different stakeholders including

farmers on consequences of indiscriminate use of antibiotics similar to present findings which was third important measure.

Table – 7: Prevention of antibiotic resistance:-

Preventions	Mean	SE	F value	CD Value
Strict regulation ie nonavailability of antibiotic without prescription of veterinary doctor	4.37^{a}	0.08	109.44 **	0.25
Ensuring proper dose and duration of treatment	**4.46^{a}**	0.08		
Judicial use after antibiotic sensitivity test	3.82^{b}	0.10		
Stop use of antibiotics in feed	3.03^{c}	0.11		
No use of human drugs in veterinary practice	2.92^{c}	0.11		
Educating the farmers on adverse effect of indiscriminate use of antibiotics	4.02^{b}	0.09		

NB: Number of Observations 291. ** => $P < 0.01$

Figures having different superscripts in a column differ significantly ($P < 0.05$)

Conclusion

Livestock Development Officers (LDO) plays a key role in safeguarding both human and animal health by improving animal husbandry practices, in particular, and public health, in general. So, it is of utmost importance to educate and train those LDO on priority basis to tackle antibiotic resistance to enhance the quality of health of the animals as well as the consumers. We are of the opinion that it is high time that such type of the study has to be replicated and conducted extensively all over the country to know the exact scenario of antibiotic resistance.

Declarations

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iv. Consent to participate: Not applicable

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