

Original Research Article

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An Analytical Study to Assess the Awareness Level of Para-veterinarians about Antibiotic Resistance in Eastern Haryana, India

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ABSTRACT

Keywords

Health crisis, Incompetency, Diagnostic practices, Outreach, Decision-making.

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The issue of antibiotic resistance has become a catastrophe of the scenario witnessed by increasing animal's health crisis and burden of infectious diseases in India. It demands judicious extension approaches and outreach to track the decision-making among the stakeholders. The behaviour of Para-veterinarians (Paravets) regarding the antibiotic prescription and use were focussed in the study. The awareness of paravets regarding antibiotic resistance was measured using an Index developed for this study. The study revealed that paravets were having general awareness about antibiotic resistance but were not aware that it had spread throughout the geographical area. The antibiotic prescribing behaviour of paravets was also studied in detail. It was found that paravets were lacking appropriate knowledge about diagnostic practices and consequences. Low level of awareness about antibiotic resistance was found among 44 percent of paravets. They were unable follow judicious prescription of antibiotics due to lack of awareness and technical incompetency.

Introduction

Paravets provide advice and access to medicines to treat sick animals; they live in the villages and have close proximity with farmers. They receive training in administering injections, drenching, treating wounds and hoof trimming which help them to gain confidence in services, paving way for veterinary consultancy for dairy farmers. Thus, they treat animals at low cost based on their experience and prescribe antibiotics to treat bacterial diseases leading often to its over-use. They also receive training in administering injections, drenching, treating wounds and hoof trimming which helped them to gain confidence in services provided

paving a way for veterinary consultancy for dairy farmers. Although, paravets were provided initial training to assist veterinarians but they are not authorised to practice prescription of antibiotics. They were preferred mostly by the smallholder dairy farmers because of low consultation and services fee as compared with veterinarians. Although veterinarians should be the main source of information, veterinary consultancy and services but limited finances for expenditure on veterinary support for dairy farmers was a key barrier in seeking out antibiotic protocols (Friedman *et al.*, 2007). The choice of appropriate antimicrobials for

treatments may also be affected by farmers' own opinions and perceived needs i.e. withdrawal period, cost and profit margin, ease of medicine administration (De Briyne *et al.*, 2013). Thus, farmer's choice for veterinary consultancy is directly affects antibiotic prescription, prescription behaviours and antibiotic resistance. The over-use of antibiotics in livestock production is considered as major factor for increasing the antibiotic resistance in humans (Schwarz *et al.*, 2001). The In the year 2013, the G8 summit identified antimicrobial resistance as the major health security challenge of the 21st century (Gulland, 2013). It calls for the investigation about cross-resistance and co-selection mechanisms which resulted transfer of resistance along the food-chain. Our understanding regarding the effect of sub-inhibitory levels of antibiotics in environment resulted the selection of bacteria and resis to some burden aggravated the antibiotic contamination due to horizontal gene transfer is limited (Berglund, 2015). It calls for the investigation about cross-resistance and co-selection mechanisms which resulted transfer of resistance along the food-chain. The G7 summit in 2015 stressed the One Health Approach which integrated the antibiotic usage among human and livestock from the common point of view by considering the interlinked transfer of resistance among both the species (Harbarth *et al.*, 2015).

Materials and Methods

The study was conducted in the Eastern Haryana zone in which two districts namely Karnal and Kurukshetra were purposively and from each district twelve paravets were selected randomly for assessing the awareness about antibiotic resistance because they were performing the veterinary aid and artificial insemination and other services to dairy farmers in the study area. An awareness Index was developed to assess the awareness

level of paravets about antibiotic resistance. The following steps were considered for construction of Awareness Index.

Selection of indicators

The multidimensional aspects include general awareness about antibiotic resistance, farmer's behavioural aspects, animal husbandry practices at farm level, environmental impact, spread and contamination by antibiotic resistance etc. issues. Therefore, selected indicators were representative of the field with the help of review of literature.

Determination of scale values

Normalized Rank Order Method suggested by Guilford (1954) was used to assign scale values. As per the method, five different indicator of Awareness Index were ranked by the group of judges as per perceived significance. Ranking was obtained from judges who involved 40 experts in the field of Social Science, ICAR-NBAGR, Karnal and Dairy Microbiology Division, NDRI. Out of 40 judges 35 judges had returned the same set of indicators after duly recording their judgments in a stipulated span of 2 months. Out of 35 responses, 5 responses were found unsuitable thus were eliminated. The remaining 30 responses were considered for the item analysis. The proportions were worked out for the ranks assigned by all the judges using the following formulae:

$$p = \frac{(R_i - 0.5) * 100}{n}$$

Where R_i stands for the rank value of the dimension i in the reverse order as 5 to 1 and n indicates the number of indicator ranked by the judges. The p is the centile value which indicated the area of the indicator in the normal distribution. The C values were

determined for each rank from the Table-M (Guilford 1954, p. 577 In the case of this experiment the numbers of Indicator were 5, which were ranked. The C values are ranging from 1 to 9 only.

The same procedure may be adapted in finding out the C values for all the ranks (ri) from the Table-M. The next step $\sum f$ C value for each indicator was obtained by multiplying the frequencies found in the columns of the respective dimension by the C values of the rank (ri), followed by summing up the products for each indicator and entering the same in the row against $\sum f$ C. Thereafter, the $\sum f$ C values for each dimension was divided by the total number of judges 30 for obtaining the Mc (mean value) or Rj (response value) for each dimension. The Frequencies of Ranks as given by 30 Judges, Proportions (p), C Values and Rc Values for five Indicators of Awareness Index by using Normalized Rank Order Method Suggested by Guilford (1954).

Collection and editing of statements

By referring the available literature, a total 70 statements which were edited as per 74 informal criteria suggested by *Edwards (1957)* out of which, 35 statements were eliminated and 35 statements were retained after editing for judge’s rating.

Response to statements

The Performa was sent by post, through email and also handed over personally to the total 40 judges who were experts from NDRI and NBAGR, Karnal (Table 2).

Relevancy test

Three point continuums as ‘Most Relevant, Relevant and Least Relevant’ with scoring 3, 2, and 1 were used. The Relevancy Weightage

(RW) and Mean Relevancy Score (MRS) were worked out for all the selected statements individually by using the following formula

$$\text{Relevancy Weightage (RW)} = \frac{f_{xi} * 3 + f_{xii} * 2 + f_{xiii} * 1}{f_x * 3}$$

$$\text{Mean Relevancy Score (MRS)} = \frac{f_{xi} * 3 + f_{xii} * 2 + f_{xiii} * 1}{f_x}$$

- f_{xi} = Number of more relevant response
- f_{xii} = Number of Relevant response
- f_{xiii} = Number of Least relevant response
- f_x = Total Number of Judges

With the help of above two criteria the statements having Relevancy Weightage (RW) > 0.70 and Mean Relevancy Score (MRS) > 2.25 were considered for including in the Awareness Index.

Computation of the composite index

Each indicator of Awareness Index consists of different number of statement, as result their range of total scores was different. So, total score of each dimension was converted into unit score by using simple range and variance as given below,

$$U_{ij} = \frac{Y_{ij} - \text{Max } Y_j}{\text{Max } Y_j - \text{Min } Y_j}$$

Where,

U_{ij} = Unit score of the ith respondents on jth dimension

Y_{ij} = Value of the ith respondent on the jth dimension

$\text{Max } Y_j$ = Maximum score on the jth dimension

Min Y_j = Minimum score on the j^{th} dimension

Awareness Index value for each respondent was obtained by the following formulae:

$$AI_i = \frac{\sum U_{ij} * S_j}{\text{Sum of scale values}}$$

Where,

AI_i = Awareness Index of i^{th} respondent

U_{ij} = Unit score of the i^{th} respondent on j^{th} component

S_j = Scale value of the j^{th} component

Thus, the score of each dimension range from 0 to 1 i.e. when Y_{ij} is minimum, the score is 0 and when Y_{ij} is maximum the score is 1.

Standardization of an index

Experts’ judgment technique was used to test the content validity of the index in which statements with at least 80 percent judges’ agreement were retained.

Results and Discussion

Statements having Relevancy Weightage (RW) > 0.70 and Mean Relevancy Score (MRS) > 2.25 were considered for including in the Awareness Index.

Purpose of antibiotic prescription

The antibiotics for therapeutic purpose were given frequently (always) by 95 percent of paravets, while 5 percent of them preferred it less frequently (sometimes). The antibiotic for sub-therapeutic purpose was subjected by 25 percent of the respondents and all of them used it sometimes as indicated in Table 1. Use of antibiotics for prophylactic purpose was practised by 15.00 percent of respondents and all of them prescribed it sometimes.

Table.1 Purpose of antibiotic prescription

Sr. No.	Purpose	Always	Sometimes	Never
1	Therapeutic	95.00	5.00	0
2	Sub-therapeutic	0	25.00	75.00
3	Prophylaxis	0	15.00	85.00

Farmer’s behavioural aspects affecting antibiotic prescriptions

It is apparent from Table 2 that 40 percent of the farmers asked for a particular drug and mostly it was found to be antibiotics. The interference of farmers based on their previous experience and related disease history was revealed by 25 of the paravets.

It was found that 5 percent of the farmers used to express their concerned knowledge about antibiotics to the paravets (Table 1).

Farmer’s behavioural aspects affecting antibiotic prescriptions

It is apparent from Table 2 that 40 percent of the farmers asked for a particular drug and mostly it was found to be antibiotics. The interference of farmers based on their previous experience and related disease history was revealed by 25 of the paravets. It was found that 5 percent of the farmers used always expressed their knowledge and 15 percent sometimes expressed their knowledge about antibiotics to the paravets (Table 4).

Perceived consequences of irrational prescription of antibiotics

It was revealed that 15 percent of the respondents were aware about antibiotic resistance and 5 percent were aware about the antibiotic toxicity which was the result of experience based treatment and antibiotic usage based on initial symptom of the disease.

Table.2 Selection of indicators for awareness index for paravets

ri	Ri	Indicators for Awareness Index (AI) for paravets					Σ	p	C
		General awareness of issue	Farmer's behavioural aspects	Diagnostic approaches	Animal husbandry and management	Animal human linked resistance			
1	1	7	6	9	3	5	30	90.00	8
2	2	9	6	4	5	6	30	70.00	7
3	3	5	10	7	4	4	30	50.00	6
4	4	6	4	4	10	6	30	30.00	6
5	5	3	4	6	8	9	30	10.00	5
Σf		30	30	30	30	30	150	250	32
ΣfC		200	194	196	183	187	960		
Mc or Rj or Rc		6.67	6.47	6.53	6.10	6.23	M=6.4 σ=0.20 Standard error for Mc=0.07		
<p>r_i= Correct rank order, R_i= Reverse rank order, Σ = Sum, p= Proportion, C = C values of respective ranks, Mc= Mean value, R_j= Response value, Rc = Scale Value, σ = Standard Deviation, Standard Error</p>									

Table.3 Relevancy and mean relevancy for statement of indicator of awareness index for farmers

SN	Indicators and statements	Relevancy Weightage	Mean Relevancy Score
1	General awareness of the issue		
a	Antibiotic resistance is a global threat which is accelerating over years.	0.9	2.7
b	Antibiotic resistance is the ability of bacteria to resist or being unaffected by effects of medication.	0.86	2.57
c	'Judicious use' of antibiotics involves decreasing unnecessary or inappropriate use to preserve efficiency for future.	0.79	2.37
d	Prescription with sympathetic intension disregarding cost of antibiotic is aggravating antibiotic resistance.	0.97	2.90
e	Lack of direct animal diagnostics and lack of treatment guidelines, empirical antibiotic therapy is attributing to issue.	0.79	2.37
2	Farmer's behavioural aspects		
a	Milk of animal under antibiotic treatment should not be fed to calf and discarded for use.	0.84	2.53
b	It is necessary to complete the course of prescription even if animal gets healed.	0.81	2.43
c	Separate animal husbandry practices adopted for the sick, antibiotic treated animal and healthy animal is required during diagnosis.	0.83	2.50
d	Indirect animal diagnostics and lack of treatment guidelines forces physicians to choose empirical antibiotic therapy based on experience is attributing the issue.	0.81	2.43
3	Diagnostic approaches		
a	Increasing the dose of antibiotics in case of poor response and treatment failure is not judicious.	0.77	2.30
b	Using antibiotics for disease prevention and 'dry cow therapy' is not a recommended practice.	0.78	2.33
c	Reliance on broad-spectrum antibiotics for the diseases and experience per se is hazardous.	0.86	2.57
d	Therapeutic interventions should be used when animal reaches advance stage of disease, initially management alternatives should be considered.	0.79	2.37
4	Animal husbandry and management		
a	Cleaning of utensils, maintaining isolation and special care of animals under treatment are management practices for effective diagnosis.	0.76	2.27
b	Dry cow therapy at herd level is a major factor for antibiotic resistance.	0.82	2.47
c	Alternative therapeutic options should be considered prior to antibiotic therapy.	0.90	2.70
d	Under-dose and over-dose of antibiotics, sharing of antibiotics, demand for prescription issues are responsibility due to close proximity with farmers	0.79	2.37
5	Animal-human linked resistance		
a	Antibiotic resistance among animals and human beings has linkage through animal product and common antibiotics.	0.76	2.27
b	Dung leads to antibiotic resistance through commensal bacteria and antibiotic residues transferring to the soil.	0.76	2.27
c	Dairy cattle are reservoirs of many human pathogens which are carrier of antibiotic resistance.	0.77	2.30

Table.4 Antibiotic prescription and farmer's behavioural aspects

Sr. No	Activity showing interest	Always	Sometimes	Never
1	They ask for antibiotics	40	15	45
2	They discuss the previous experience and related disease history	5	25	70
3	They describe the experience of their neighbors/ relatives/ progressive farmers	5	20	75
4	They express their knowledge about antibiotics	5	15	80

(Figures indicate percentage)

Table.5 Perceived consequences of irrational prescription of antibiotics

Sr. No.	Consequences	Agree	Disagree
1.	Antibiotic resistance	15	85
2.	Antibiotic toxicity	5	95
3.	Multidrug resistance	0	100
4.	Increased burden on 3 rd and 4 th generation antibiotics	0	100
5.	Increased failure of treatment	10	90

(Figures indicate percentage)

Table.6 Distribution of respondents as per Awareness Index scores about antibiotic resistance

Sr. No.	Issues	Awareness Index score
1	General awareness	0.14
2	Farmer's behavioural aspects	0.12
3	Diagnostic approaches	0.08
5	Animal-human linked transfer of resistance	0.06

(Numerical figures are in continuum from 0 to 1)

Table.7 Awareness about antibiotic resistance among paravets (n=25)

Sr. No.	Category	Frequency	Percentage
1	Low (<0.09)	11	44
2	Medium (0.09-0.19)	8	32
3	High (>0.19)	6	24

None of the paravets were aware about multidrug resistance and they advised the farmers to visit the veterinary hospital when the two or more antibiotics were found to be ineffective.

None of them were aware about the increased burden on 3rd and 4th generation antibiotics which were common for human and animals. The failure of treatment due to over-use of antibiotics leading to resistance was recognised by 10 percent of the respondents.

Assessment of awareness about antibiotic resistance

It was done with the help of Awareness Index to identify the practices which should be addressed for controlling the antibiotic resistance in future to build surveillance. The awareness about the issue was judged with respect to diagnostic aspects and practices linked with the disease treatment.

Parameters to assess the awareness level of paraveterinarians regarding antibiotic resistance

General awareness

Majority of paravets revealed antibiotic resistance as the local threat and were not aware that it had spread throughout the geographical area. They gave antibiotics to farmers for disease treatment and they never focussed on the completing the course of treatment guidelines revealed by score of 0.14 which is apparent in Table 6.

Farmer's behavioural aspects

Majority of paravets interrupted their previous treatment course and randomly prescribed the antibiotic based on their experience. They discontinued the treatment as soon as symptoms of disease disappear to save the money of farmers. Table 6 revealed that

paravets were least aware about the post-treatment follow-up and were having the awareness score of 0.12 in the awareness index. They were least aware about separate animal husbandry practices adopted for the sick, antibiotic treated animals. Lacking awareness about treatment guidelines and technical knowledge about antibiotic resistance phenomena and consequence were responsible were found responsible for low insight in to farmer's behavioural aspects regarding the antibiotic usage practices.

Diagnostic approaches

Majority of paravets increased the dose of antibiotics in case of poor response and treatment failure. They started the diagnosis with broad-spectrum antibiotics and preferred the clinical and trauma practices on their own risk only when the advance stage of the disease was reached. Majority of paravets never encouraged the alternatives for disease treatment despite their close proximity with farmers and indiscriminately used the antibiotics based on marketing offers and advertisement of new antibiotics. So, due to above reasons they were having very low awareness index score (0.08 out of 1.00).

Animal-human linked transfer of resistance

Paravets were least aware (awareness index score of 0.06 on 1.00 point continuum) that antibiotic resistance could be transferred from cattle to human being via milk and milk products. It was revealed from Table 6 that they were not aware that commensal bacteria in cattle could act as reservoir of antibiotic resistance which get transferred through the dung of cattle and finally incorporated in the food chain.

It is apparent from Table 7 that 44 percent of paravets were having low level of awareness

(<0.09 out of 1.00) because they excel in performing artificial insemination services and deworming but in case of bacterial disease treatment they gave common antibiotics and were unaware about its effect other than disease treatment. Medium level of awareness about antibiotic resistance (0.09-0.19) was found among 32 percent of respondents who were cosmopolite in nature and were active in many surrounding villages. It was found that 24 percent of paravets who were having high awareness (>0.19 on 0 to 1 point continuum) about antibiotic resistance were engaged in providing their assisting services to veterinary doctors in veterinary hospitals where antibiotic sensitivity testing laboratory was available. So, they were aware about the resistance because they observed that few progressive farmers used to bring the samples for sensitivity testing. Although, High level of awareness (>0.19) is itself very low, level of awareness when considered as a whole, which is a contrast demands the full-fledge planning from the bottom level to address the issue of antibiotic resistance.

In conclusion, addressing the antibiotic resistance issue through the prevailing practices observed in the study area was a tough task by involving the two stakeholder namely paravets and farmers who were technically unaware about the issue and found incompetent with the prevailing existing practices. The sub-therapeutic use of antibiotics and antibiotic prescription with sympathetic intension, the least awareness about the antibiotic toxicity and no awareness about the multidrug resistance has aggravated the issue leading to a catastrophe. They were generally aware about antibiotic resistance issue and least aware about Animal-human linked transfer of resistance reflected by the awareness index score of 0.14 and 0.06 out of 1.00 which indicates a very low level of awareness. Starting treatment with broad-spectrum antibiotics without proper diagnosis

and simply by observing the symptom and performing the clinical and trauma practices on their own risk were found to be grossly inappropriate approach. Paravets have a better opportunity to interact with farmers through better insight into their behavioural aspects and close supervision of the animal husbandry practices, but they were unable to harness the opportunity due to lack of awareness and technical incompetency. If provided proper training and guidance, they could be better option to fight antibiotic resistance. It is bitter to accept ground- level reality that paravets are performing the diagnosis and treatment mostly in case of smallholder dairy farmers without having awareness and knowledge on antibiotic resistance. Hence there is an urgent need to bring awareness on antibiotic resistance among paravets and formulation of enabling policy as well as an appropriate surveillance program to tackle the issue of antibiotic resistance.

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