Original Research

Behavioral Intention of Dairy Farmers of Punjab State of India towards Antimicrobial Usage: A Dairy Perspective Study

Neela Madhav Patnaik*, Jancy Gupta, Priyajoy Kar, Parag Acharya[1], Arghyadeep Das[2] and Jagdeep Gupta

Dairy Extension Division, ICAR-National Dairy Research Institute, Karnal-132001, Haryana, INDIA

[1]Division of Livestock Production and Management
[2]Division of Dairy Economics, Statistics and Management

***Corresponding author:** neela.patnaik@gmail.com

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Abstract

Antimicrobial resistance is a multi-sectoral global threat affecting human and animal health as well as environment. For ensuring prudent use of antimicrobials as a disease control measure on dairy farms, research is needed to understand farmers psychological factors that influence decision-making empirically. The present study looks into the capabilities and facilitating factors of dairy farmers for usage of antimicrobials drugs and their attitude towards its use. The study was conducted in Punjab state of Northern India which was purposively selected and data were collected by structured interview schedule from 180 dairy farmers. The study revealed that cost incurred in purchase of antimicrobials and reduction of antimicrobial use through better management practices to enhance the profit ranked first for outcome attitude. Social referents veterinary doctor and scientist were ranked first and second respectively and were considered credible information sources by the dairy farmer for animal health management practices. Purchasing the full recommended dose and the relative easiness/difficulty associated with purchasing it was ranked first for perceived behavioural control items. To ensure rational usage of antimicrobials without affecting access to antimicrobials, spreading awareness among farmers and increasing the communication among the professionals and field functionaries is a crucial step.

Key words: Antimicrobial Resistance, Dairy Farmer, Health Management, Intention

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Introduction

Poor health of livestock infected with diseases affects the dairy farmer adversely and results in economic losses (Constable *et al.*, 2009). When an animal falls sick due to any microbial infection, it should be treated

with antimicrobials. Antimicrobial resistance (AMR) occurs when antimicrobials drugs that are used for treating various diseases due to bacteria, viruses and fungi no longer fight the infectious pathogens. When improperly used, the once-miracle drugs cause microbes to develop mutations that make them ineffective. There are increasing reports of resistance to antimicrobial drugs used in veterinary medicine and also the threat to both animal and human health, through the selection of resistance (WHO, 2000; Marshall and Levy, 2011; Saini *et al.*, 2012). Antimicrobial resistance is a concern in livestock production due to the fact that if pathogens develop resistance, the antimicrobials will stop working, animals will not respond to treatment, performance will suffer and death losses may increase (Ramchandani *et al.*, 2005; WHO, 2007). Humans can be exposed to antimicrobial-resistant bacteria's by ingesting them through the food supply. Antimicrobial drug residues have been found in milk and milk represents a source where resistant bacteria can enter the human food chain (Uninkrishnan *et al.*, 2005; WHO 2014; Scoppetta *et al.*, 2016).

In India, the antibiotics are used widely in food animals as growth promoters and to prevent and treat disease infections. Non-therapeutic usage of antibiotics has been restricted to poultry production. Antimicrobial resistance has been a low-priority area in most of the developing countries. With the challenges posed by HIV/AIDS, tuberculosis, malaria, pneumonia, and many other infectious diseases, the loss of antibiotics at some future time has been largely ignored. As far as consumption of antimicrobials in food animals is concerned, the global consumption was estimated to be 63,151 (±1,560) units in 2010; India accounts for 3% of the global consumption and is the fourth highest in the world, behind China (23%), the United States (13%) and Brazil (9%). By 2030 antimicrobials consumption in food animals section in India is expected to double (National Action Plan on Antimicrobial Resistance, 2017). In India (and around the world), resistance against certain antibiotics is already at high levels but the problem has remained largely unknown due to relatively few studies being published and nationwide surveillance has not been carried out (National Policy For Containment of Antimicrobial Resistance India, 2011).

Livestock farming is a common livelihood option in many parts of India, and a large proportion of the populations are in close contact with livestock. This puts those people at risk of acquiring resistant infections from their animals. But there is lack of documentation of AMR related issues in livestock and food animals especially in India. Very few small and localized studies have been carried out whose research impact and significance cannot be translated to any national level planning. Given that there are few regulations against the use of antibiotics for non-therapeutic purposes in India, the emergence of AMR from antibiotic overuse in the animal sector is likely to be an unmeasured burden in India (National Action Plan on Antimicrobial Resistance, 2017). To help ensure the responsible use of antimicrobials as a disease control measure on dairy farms, research is needed to understand farmers psychological factors that influence decision-making empirically (Busani *et al.*, 2005; Jones *et al.*, 2015). When considering the process by which farmers make decision about disease control, it is especially important to identify the

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variables which drive and motivate their behaviour (Jansen *et al.*, 2009). To predict whether a person intends to do something, we need to know whether the person is in favor of doing it (attitude), how much the person feels social pressure to do it (subjective norm) and whether the person feels in control of the action in question (perceived behavioral control) (Francis *et al.*, 2004). Many studies on dairy farmers reported the significant effects of Outcome Attitude (OA), Subjective Norms (SN) and Perceived Behavioural Control (PBC) on intention. Hence, under the study an effort was made to investigate which of the above factors affects the behavioural intention of the key stakeholders in northern India by using the TPB framework.

Materials and Methods

Sampling and Data Collection

The study was conducted in Punjab state which has been selected purposively keeping in view the highest milk productivity and per capita availability of milk (Basic Animal Husbandry and Fishery Statistics, 2016). Further, three districts (Ludhiana, Amritsar, Pathankot) were chosen randomly. From each district, 2 blocks were selected randomly and from each selected block, 2 villages were selected randomly. Thus, study was conducted in 12 villages. From each village, 15 dairy farmers possessing at least 2 milch animals were selected using stratified random sampling method constituting a total sample size of 180. A semi-structured interview schedule was developed which included a number of closed & open ended questions to gather information on antimicrobial usage in milk production.

Theoretical Model

Theoretical basis of study was Theory of Planned Behavior to identify the drivers and barriers of dairy farmers for rational use of antimicrobials (Ajzen, 1991; Fishbein and Yzer, 2003; Garforth *et al.*, 2013) which is depicted in Fig. 1. The variables in the behavioural model used for the study are psychological (internal) constructs where the predictor variables are to be measured directly e.g. by asking respondents about their overall attitude regarding antimicrobial usage and indirectly e.g. by asking respondents about behavioural beliefs and outcome evaluations.

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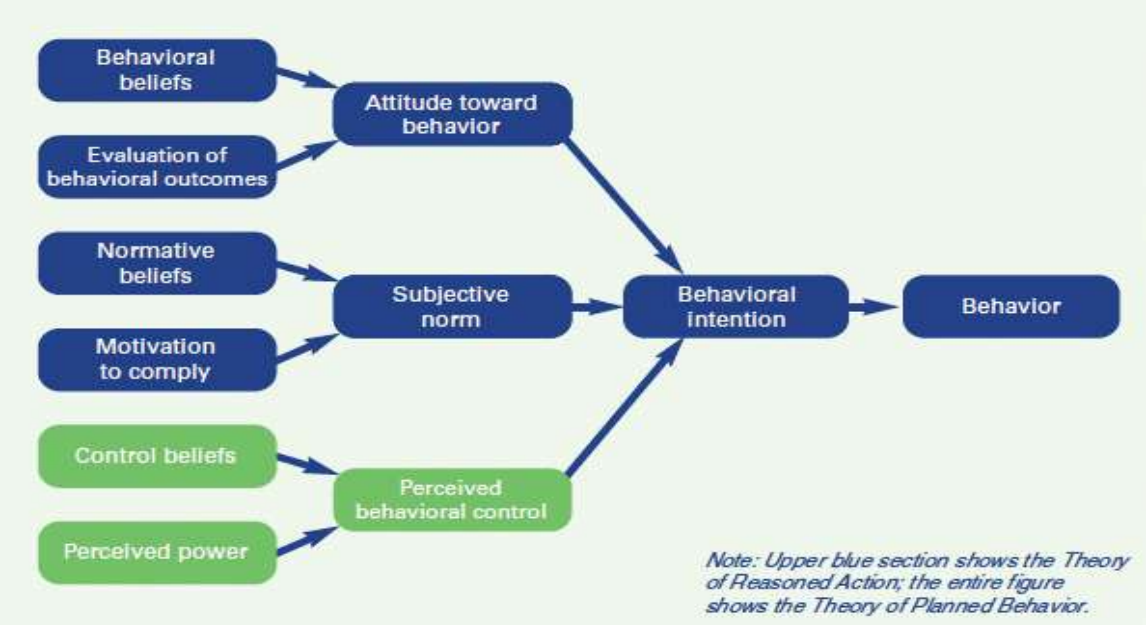

Fig. 1: Theory of Planned Behaviour model

a) Outcome attitude (towards the behaviour) is a person's overall evaluation of the behavior. It has two sub-components: beliefs about consequences of the behaviour (behavioural beliefs) and the corresponding positive or negative judgements about the types of the behaviour (outcome evaluations). This implies the positive and negative effects of antimicrobial usage and how it affects the dairy farmer towards health care practices rendered to his livestock.

b) Subjective norms (about the behaviour) are a person's own evaluation of the social pressure to perform or not to perform the target behaviour. Subjective norms has two sub components: beliefs about how other people, who may be in some way important to the person, would like them to behave (normative beliefs) and the extent to which a person feels motivated to match his or her behaviour to various social referents(motivation to comply). The dairy farmers have a network of social referents and peers from whom he receives necessary information and treatment; and to the extent to which the dairy farmers complies with his peers and social referents.

c) Perceived behavioural control (of the behaviour) is the extent to which a person feels able to enact the behaviour. It has two aspects: how much a person has control over the behaviour (control beliefs) and how confident a person feels about being able to perform or not perform the behaviour (perceived power). It deduces the necessary skills and knowhow possessed by the dairy farmer regarding antimicrobial use and the extent to which he has control over enacting the behavior.

7 point continuum Likert type scale was developed which included forced choice items for the extent of agreement-disagreement to the item. The items were coded such that higher numbers indicate towards agreement to the behavior. The interview schedule was prepared following the guidelines by Francis *et al.* (2004).

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Data Entry and Analysis

Data were entered and analyzed in MS Excel®. Analyses were largely descriptive using tables for the survey data.

a) Weight (multiply) each behavioural belief item (1 to 7) by the score for the relevant outcome evaluation item (-3 to +3) to create a new variable that represents the weighted score. Similarly, weight each normative belief item (1 to 7) by the score for motivation to comply item (-3 to +3) and each control belief item (1 to 7) by the score for perceived power item (-3 to +3). The maximum obtainable weighted score after multiplication would range between -21 to +21.
b) The obtained scores by the respondents (180 dairy farmers) are averaged to create a composite score for outcome attitude, subjective norms, and perceived behavioural control.

Results and Discussion

The salient findings of the present study along with critical discussion to draw meaningful conclusions and their interpretations have been discussed regarding the intention of dairy farmers towards antimicrobial usage.

Dairy Farming Experience

As evident from Table 1, the respondents' dairy farming experience was analyzed by categorizing into 3 categories following cumulative square root frequency method as low, medium and high dairy farming experience. 36 percent of the dairy farmers had a medium farming experience ranging from 19-29 years. 32 percent of them had less than 19 years and 31 percent more than 29 years of experience in dairy farming.

Table 1: Profile of dairy farmers based on dairy farming experience

S. No.	Experience (in years)	Frequency (n=180)	Percentage	Remarks
1	<19	59	32.77	Low
2	19-29	65	36.11	Medium
3	>29	56	31.11	High

Outcome Attitude of Dairy Farmers Regarding Antimicrobial Usage

The study revealed that cost incurred in purchase of antimicrobials and its reduction to enhance the profit ranked first though the farmers strongly favored allopathic treatment (Table 2). This contrasting situation where the dairy farmers want to reduce usage at the same time prefer allopathic treatment can act as opportunity for the extension workers to make the farmers aware on the adverse effects of AMR on cattle and consequently animal health. The farmers reported that they tend to get worried in case of cattle getting diseased and among the various consequences; milk yield reduction was the prime factor which is related to the profit aspect. Among the various treatment methods, the farmers preferred allopathic treatment along with preliminary treatment with Indigenous Technical Knowhow (ITK) for commonly occurring diseases; the reason being antimicrobials providing quick relief strongly agreed by the dairy farmers. From the fourth

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ranked items, the study found that the farmers were not much aware about the decreasing effectiveness of the antimicrobials but the easy availability of antimicrobials was undoubtable which may act as a risk contributor to AMR.

Table 2: Analysis of outcome attitude of dairy farmers (n=180) about their overall evaluation of the behavior of using antimicrobials for health management of their cattle

S. No.	Attitude Statements of Indirect Measures	Weighted Score (obtainable)	Weighted Score (obtained)	Rank
1a	It causes a lot of worry and concern if my cattle are diseased.	21	13.56	II
1b	The worry and concern is due to fact that milk yield gets decreased.			
2a	Allopathic is usually followed for treatment compared to other methods.	21	12.76	III
2b	Antimicrobials give quick results in curing/ treatment of my cattle.			
3a	Reduced use of antimicrobials would lower my production costs.	21	14.17	I
3b	An increased profit from dairy farming by going for allopathic treatment is preferred.			
4a	Antimicrobials become less effective the more they are used.	21	9.51	IV
4b	Antimicrobials are used more as they are easily available.			

*Statements/items 1a, 2a, 3a, 4a represents behavioural beliefs in the 7 point continuum (1to7) and statements/items 1b, 2b, 3b, 4b represents outcome evaluation in the 7 point continuum (-3 to +3). Composite average scores for outcome attitude is obtained by multiplying the values obtained for behavioural beliefs and outcome evaluation that is 1a*1b, 2a*2b, 3a*3b, 4a*4b.*

Effect of Social Referents and Peers on Dairy Farmers

From perusal of Table 3, the study revealed that veterinary doctor and scientist were ranked first and second respectively and were considered credible information sources by the dairy farmer for animal health management practices as far as usage of antimicrobials was concerned. The farmers were consulting the veterinary doctor and paravet for treatment of the diseased cattle in case of occurrence of ailments. The advice of veterinarian according to dairy farmers was more credible than other sources (Ison and Rutherford, 2014). Dairy farmers were more likely to use advice from veterinarians for recommendations of treatment (Zwald *et al.*, 2004).

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Table 3: Approval/disapproval of the social referents and peers and their significance for the dairy farmers (n=180) regarding antimicrobial usage

S. No.	Social Referents/ Peer Group	Weighted Score (obtainable)	Weighted Score (obtained)	Rank
1	Veterinary Doctor	21	17.23	I
2	Paravet	21	11.76	III
3	Other dairy farmer	21	9.2	IV
4	Scientist(KVK,SAU,ICAR)	21	15.42	II

Statements/items for the four referents/peer group of dairy farmer in the study (as mentioned in Table 3) were evaluated on normative belief (importance of each referent/peer advice on antimicrobial use) item and motivation to comply (extent to which the farmer comply with each referent/peer advice on antimicrobial use) item. The item values on normative belief (1 to 7) were multiplied with motivation to comply (-3 to +3) to obtain composite average score on subjective norm.

Perceived Behavioural Control of Dairy Farmers

Purchasing the full recommended dose and the relative easiness/difficulty associated with purchasing it was ranked first for perceived behavioural control items as evident from Table 4. The farmers reported the veterinarians/paravets treating their livestock bring with them the medicines and its charge was included in the fees paid by the dairy farmers to them. By default the farmers were purchasing the medicines from veterinary doctors/paravets and hence it was easy to get the medicines. Twenty-four percent of the dairy farmers reported they always completed the course of antibiotic treatment but failure to consult a veterinarian for treating sick animals, and failure to complete antimicrobial treatment course are some possible factors that can lead to inappropriate use of antibiotics (Sawant *et al.*, 2005).

Table 4: Analysis of the capabilities and know how possessed by the dairy farmers (n=180) for using antimicrobials for their sick cattle

S. No.	Perceived Behavioural Control Statements of Indirect Measures	Weighted Score (obtainable)	Weighted Score (obtained)	Rank
1a	I always purchase the full recommended dose of antimicrobials.	21	11.36	I
1b	Purchasing the full recommended dose prescribed to me is difficult.			
2a	I always complete the course of the prescribed antimicrobial.	21	-9.75	III
2b	Sometimes I prefer to use leftover medicines.			
3a	I always discard the milk of treated animal till the withdrawal period is completed.	21	1.15	II
3b	I would discard the milk of treated animal if premium price is provided for residue free milk.			

*Statements/items 1a, 2a, 3a represents control belief in the 7 point continuum (1to7). Statements/items 1b, 2b, 3b represents perceived power in the 7 point continuum (-3 to +3). Composite average scores for perceived behavioural control is obtained by multiplying the values obtained for control belief and perceived power that is 1a*1b, 2a*2b, 3a*3b.*

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The perceived behavioural control items which got second rank, the researchers found that not a single farmer was discarding the milk of treated animals. The farmers cited a number of reasons among which the financial loss incurred if the milk of the treated animal was discarded as the major one. The other reason the farmers reported was the lack of knowledge regarding the withdrawal period of different diseases. The dairy farmers were asked whether they would discard if premium price was provided to them; most of them agreed to this question while some farmers were apprehensive if at all such a program would be launched by the government in near future. From the third ranked perceived behavioural control items, the study found that the large farmers agreed of completing the antimicrobial course as prescribed by the treatment source but majority of small and marginal farmers were discontinuing the course as soon as the animal is cured. The farmers refused of using any leftover medicines for treatment of cattle.

Conclusion

AMR is a major health problem, especially in developing countries like India, due to easy availability and higher consumption of medicines leading to higher incidence of inappropriate usage of antibiotics thereby greater level of resistance. The dairy farmers perceived veterinary doctors to be the most credible source as far as treatment practices was concerned. As far as health care management related new practices, information and know how was required they ought to prefer consulting scientists. The paravets were found to be largely involved in treating minor infections involving the least of the technicalities. As in India the paravets are mostly entitled to carry out artificial insemination at farmers door step and being a personal localite to the dairy farmers they can add a lot of value in information dissemination. This implies that the policy makers need to target these social referents for passing on the information and awareness about the risk associated with AMR to the dairy farmers for the prudent use of antimicrobials. The dairy farmers need to be motivated to at least complete the course of antimicrobial as in the long run the animal will not develop resistance and disease incidence will be minimized which ultimately benefit the farmer. Cost of medicines being a crucial factor, necessary regulatory measures are needed to prevent indiscriminate use of antimicrobials and make dairy a profitable venture.

Majority of the dairy farmers reported that they would reconsider their decision of discarding milk of treated animal if a premium is given to residue free milk. Research on a wider scale may be carried out in this aspect to start any new initiative on a pilot basis in Punjab. Historically, AMR has not received adequate focus and attention in India. Recent trends clearly illustrate the growing political commitment at the highest levels to have a coherent response in place that can provide the necessary gravitas for nationwide surveillance and stewardship initiatives for containment of AMR. To ensure rational usage of antimicrobials without affecting access to antimicrobials spreading awareness among farmers and increasing the communication among the professionals and field functionaries is a crucial step.

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