Assessment of Rational Use of Antimicrobial in Food Animal at Gimbi Veterinary Clinic, West Wollega Zone Ethiopia

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Abstract: The study was conducted from November 2015 to May 2016 at Gimbi veterinary clinic, Western Ethiopia. Retrospective, cross-sectional and prospective study designs were used to assess rational drug use and the awareness of farmers regarding to rational use of antimicrobials in food animals in and around Gimbi town. Three years data of 4069 animal patients were taken from case registration book for the retrospective study and 1002 animal patients encounters were randomly selected for the prospective study. Additionally, 80 farmers were interviewed to assess their awareness regarding rational use of drug. The average number of drugs prescribed per encounter was 1.59 with a maximum of 3 drugs prescribed for the past 3 years. The percentage of encounters in which antibiotics and anthelmintic were prescribed at Gimbi veterinary clinic were 1128/4069 (27.7%) and 802/4069 (19.7%) respectively and 2033/4069 (50%) of prescribed drugs were multi-drug combination. Among all patients that come to veterinary clinics during the study period, 846/4069 (20.8%) cases were treated with no diagnosis. The result of questionnaire interview indicated that, 30% of the farmers treat their animals by drugs purchased from different sources in the study area. As the study indicated that, majority of the livestock owners 52/80 (65%) and 48/80 (60%) of the respondents had no information regarding withdrawal period and drug resistance respectively. The longitudinal study shows that the average number of drugs per prescription at Gimbi veterinary clinic was 1.69 with a maximum of 3 drugs. The percentage of encounters in which antibiotics and antihelmintics were prescribed at Gimbi veterinary clinic were 214/1002 (21.4%) and 153/1002 (15.3%) respectively where as 611/1002 (61%) of prescribed drugs were multi-drug. Generally, there were no standard veterinary treatment guideline and drug formulary at Gimbi veterinary clinic. Therefore, veterinary drugs used for treatment of food animals should be monitored to minimize residual effects and antimicrobial resistance in the area.
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Introduction

The scale of growth of livestock and poultry has expanded throughout the world and particularly in Africa. This is so due to the increased demand for food asserted that today's livestock farming requires the usage of many pharmaceuticals, in order to keep the animals sound and to increase the production rates. Products are used to stimulate growth, to induce ovulation, but more importantly in the prevention or treatment of parasites and bacterial diseases. Further on stated that these farm animals are often bred on a large scale and as a consequence animal medicine or other drugs are applied in large quantities. The use of veterinary drugs and fattening agents has also increased due to the increase in consumption (Sanginga *et al.,* 2003(1) and Vanghel, 2012(2)).

Antibiotics/antibacterial drugs have been widely used globally in animals for more than 50 years, with tremendous benefits in animal production and economic development. Several antibiotic/antibacterial drugs are used in the treatment of many bacterial diseases of animals' especially in food-producing animals globally (CVM, 2011(3); FDA, 2010(4)). However, many of these drugs are abused by veterinarians as healthcare professionals and the general public where many farmers treat their sick animals with antibiotics/antibacterial drugs without seeking professional consultation. As a result of this, massive quantities of antibiotics/antibacterial drugs used are released in the environment thus increasing selection of the antibiotic resistant bacteria organisms that can spread from the animals to humans especially the bacterial zoonoses, increasing the cost of treatments in both animals and humans. The problem is likely to increase globally leading to severe future consequences. (Kummerer, 2009(5); Martinez, 2009(6); Peeples, 2012(7)).

Rational use of drugs is based on the use of right drug, right dosage and right cost which is well reflected in the world health organization (WHO) definition: "Rational use of drugs requires that patients receive medications appropriate to their clinical needs,

in doses that meet their own individual requirements for an adequate period of time, at the lowest cost to them and their community" (Hanmant, 2011(8)).

Now, in the clinical practice of human and veterinary medicine throughout the world large amount of antibiotics are used. Equally, many scientists intensively work on discovery and synthesis of new drugs with broader antimicrobial spectrum, stronger action and more satisfactory safety profile. Most failures during antibiotic therapy may occur when the pathogenic microorganism is unknown and combination of two or more drugs administered empirically. To avoid these mistakes, clinically confirmed, effective antibiotic combinations should be used (Vitomir *et al.,* 2011(9)). Globally, more than half of all medicines are prescribed, dispensed or sold improperly, and 50% of patients fail to take them correctly. This is more wasteful, expensive and dangerous, both to the health of the individual patient and to the population as a whole that magnifies the problem of misuse of antimicrobial agents (WHO, 2012(10)).

Irrational use of drugs in veterinary medicine as well as the need for control of their use becomes even bigger problem when used on food producing animals. In this case, there is the possibility that minimal quantities of drugs and their metabolites (residues) which remain in edible tissues or in animal products (meat, milk, eggs) induce certain harmful effects in humans as potential consumers of such food (Sanders, 2007(11)). When drugs are used to improve the productivity of food animals that are intended for human consumption, then there is possibility for producing adverse effects on humans. To prevent this risk, it is necessary to use drugs rationally, i.e., to use them only when they are really indicated, in the right way, at the right time, in the right dose and respecting withdrawal period. Also, it is necessary to regularly control sensitivity to antimicrobial agents and regulate residue of antimicrobial agents commonly used in veterinary practice (Barbosa *et al.,* 2005(12)).

Over use of antibiotic and anthelmintic in veterinary practice, for both food producing animals, favors the development of both intrinsic or acquired antibiotic and anthelmintic resistance. Acquired resistance develops due to widespread and irrational use of drugs while intrinsic resistance is a result of inherent structural or functional characteristics, which allows tolerance of a particular drug or antimicrobial class. Antibiotic/anthelmintic drug resistance is a growing problem; and indeed developing new drugs may not be the solution for this problem. Some of the common causes that contribute to the development of antimicrobial resistance are unnecessary

Use of antibiotic drugs, inappropriate dose, inadequate duration of therapy, use of irrational antibiotic fixed dose drug combinations (Ernest, 2005(13)).

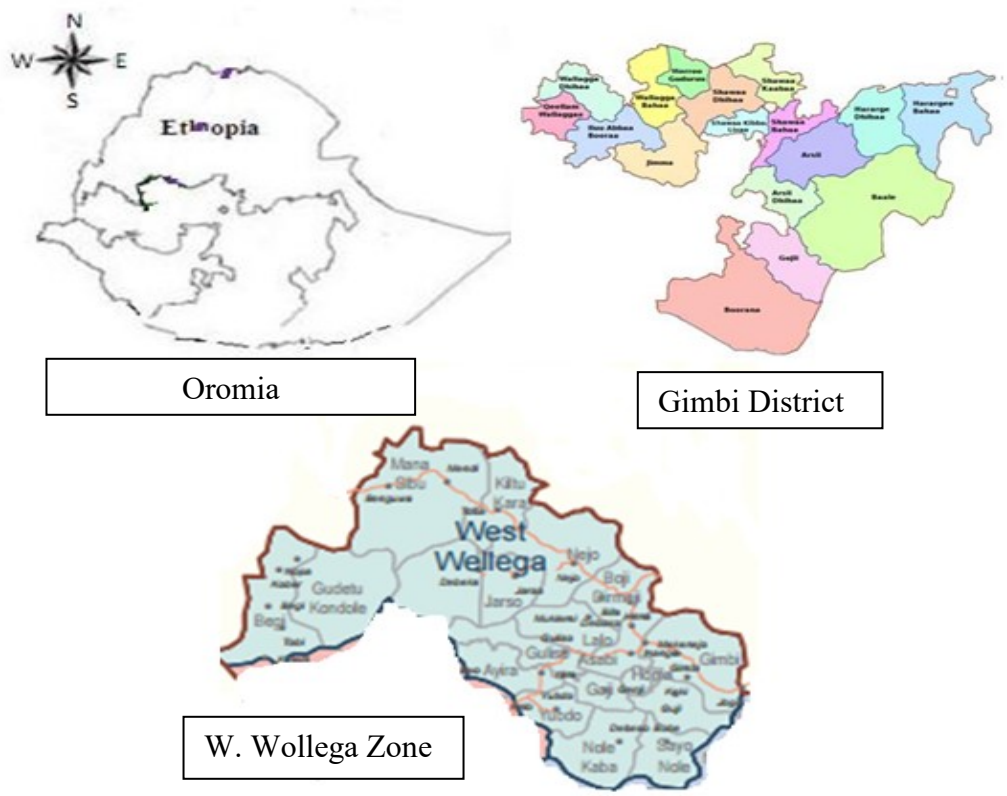
In human medicine, assessments of drug use patterns with the WHO drug use indicators are becoming increasingly necessary to promote rational drug use. These indicators are now widely accepted as a global standard for problem identification and have been used in developing countries (WHO, 1993(14); Laing, 2001(15)). In Ethiopia, a survey conducted on human subjects at hospitals located in different regions of the country revealed the presence of irrational drug use. However, in veterinary practice, there is no study or report on rational use of veterinary drugs in Ethiopia in general and in western Oromia in particular. Therefore, the objective of this study was to assess the rational use of antimicrobials for treatment of food animals at Gimbi veterinary clinic (Endale *et al.,* 2013(16)).

Material and Methods

Study Area

The study was conducted from November 2015 to March 2016 in Gimbi district veterinary clinic, West Wollega Zone, Ethiopia. Livestock population of West Wollega Zone is 1,766,647 Bovines, 378,279 Ovine, 353,385 caprine, 126,934 Equines, 2,236,682 poultry and 623,386 Bee colonies. The farming system in the zone is mixed Livestock crop production. Livestock production system is usually extensive and the most common breeds are the local zebu breeds. Common grasslands provide extensive pasture for all parts of the areas of the study districts (GDFEDO, 2015(17)).

As reported by Gimbi District Finance and Economic Development office (2015), the district has high livestock potential with 109,243 cattle, 13,662 Ovine, 5,091 Caprine, 5,245 Equine and Poultry 45,122 and 24,861 Bee Colonies. Gimbi Town, which is located at a distance of 441 km from Addis Ababa, is the capital of the West Wollega Zone, which is located between 9°–17° N and 35°–36° E and at altitudinal range of 1200 m–2222 masl. It has the mean minimum and maximum annual temperature ranges between 10 °C and 30 °C, respectively. The mean annual rainfall is 1400–1800 ml. Gimbi district is one of the densely vegetation covered areas of the country. The area is covered with forests and tree crops including fruit trees. The natural environmental conditions of the district includes; broad leafed forest, grasslands and wetlands/marshlands. Grasslands consisting of different species cover limited areas in Wetlands/marshlands (GDFEDO, 2015(17)).



Source (CSA, 2013(18))
Figure 1: Map of the study area.

Study Animal

All food animals (cattle, sheep, goats and chicken of all ages and sex groups) which come to Gimbi district veterinary Clinics and treated with drugs were study animals. All other non-food animals (e.g., pets and equines) and animal patients that were admitted to veterinary clinics but did not receive any medicines were excluded from the study.

Study Design and Sampling Method

Retrospective, cross-sectional and prospective studies were used to assess rational drug use and to evaluate the commonly used drugs for the treatment of food animal diseases at Gimbi veterinary clinic. For retrospective data three years prescribed case book registered animal patients (from 2005-2007 E.C) were used. A total of 4069 animal patients which treated at the clinic were taken from case registration book. Animal patients encountered Gimbi veterinary clinic during the time from November, 2015 – March, 2016 were randomly selected for longitudinal study. Thus a total of 1002 cases of animal patients were followed for the way of diagnosis and prescription of drugs. Animal owners were also interviewed for additional information about rational use of veterinary drugs in the area. Accordingly a total 80 animal owners were interviewed for the questionnaire survey.

Data Collection Methods

Prospective data collection

Prospectively, 1002 animal patients were randomly selected within five months. Data was recorded for each individual animal treated for health problems at the veterinary clinic daily. During this period close observation was made on the clinic for assessing the way drugs and chemicals were used including advice for the customers. Additionally, during the study way of waste disposal, chemical use and storages, drug use and misuse and other possible conditions that can be risk for food animals were visited.

Questionnaire survey

Additional data was also collected through semi-structured questionnaire survey by interviewing farmers who visit the clinic for treatment of animals. The questionnaire was targeted assessing the chemicals and drugs used for treatment of food animals at the clinic and the awareness level of the farmers about drugs use and misuse and withdrawal period of drugs.

Retrospective study

Three years secondary data was collected on prescribing indicators retrospectively by using case registration books in Gimbi veterinary clinic. The specific data necessary to measure the prescribing indicators was recorded for each animal patient encountered and entered into an ordinary prescribing indicator form. For this particular study, 4069 cases that contain the animal's information (age, sex, clinical signs and symptoms), disease diagnosed, prescribed drugs, number of drugs prescribed, duration of treatment were collected retrospectively for the last three years (2005 – 2007 E.C). Accordingly, evaluation of rational use of veterinary drugs was made on generic prescription, antimicrobials and anthelmintic prescribed for tentatively diagnosed clinical cases.

Data Management and Analysis

All the data collected through prospective, questionnaire interview and retrospective was coded and entered on to Microsoft Excel spread sheet. Then the data was analyzed by using SPSS software version 20.

Results

Retrospective Study

Table 1: The different species of food animals treated during 2005 - 2007 E.C at Gimbi veterinary clinic

Species	N	%
Bovine	3284	80.7
Ovine	523	12.9
Caprine	103	2.5
Chicken	159	3.9
Total	4069	100.0

NB: N=number of observation, %=Percentage

Table 2: Common animal diseases diagnosed tentatively based on clinical signs and not specified in Gimbi veterinary clinic during 2005-2007 E.C.

Tentative Diagnosis	N	%
No diagnosis	846	20.8
Bacterial infection	578	14.2
Internal parasite	708	17.4
Ectoparasite	515	12.7
Mastitis	195	4.8
Babesiosis	85	2.1
Trypanosomosis	280	6.9
Fungal disease	91	2.2
Viral disease	96	2.4
Mixed infection	675	16.6
Total	4069	100.0

NB: N=number of observation, %=Percentage

From a total of 4069 patient animals treated and registered on case book at Gimbi veterinary clinic from 2005-2007 E.C, 3284 (80.7%), 523 (12.9%), 103 (2.5%) and 159 (3.9%) were Cattle, Sheep, Goat and chicken respectively (Table 1).

Among all patients admitted to Gimbi veterinary clinic, 3223/4069(79.2 %) were treated without getting correct definitive (laboratory supported) diagnosis and the diagnosis were tentative based on clinical signs rather than confirmatory laboratory tests. From the total, 846/4069 (20.8%) cases were not diagnosed (Table 2).

The retrospective study result showed that, from the total of 4069 cases, registered on casebook at Gimbi veterinary clinic, 6102 drug products were prescribed with average number of drugs per prescription 1.49 with a maximum of 3 drugs per encounter. Out of 4069, 1128(27.7%) of antibiotic, 802(19.7%) of anthelmintic, 106(2.6%) ant trypanosome and 2033 (50%) multidrug were prescribed at the clinic within 3 years. The most commonly prescribed antibiotics and anthelmintic were oxytetracycline 513(12.6 %), penicillin–streptomycin combination 615(15.1%), Ivermectin 544(13.4 %) and albendazole 258(6.3 %) (Table 3).

Table 3: Types of drugs prescribed in Gimbi Veterinary clinic from 2005 to 2007

Drug	N	%
Antibiotics		
Oxytetracycline	513	12.6
Penicilline-streptomycine	615	15.1
Anthelmintic		
Ivermectin	544	13.4
Albendazole	258	6.3
Others		
Antitrypanosome	106	2.6
Multi-drug	2033	50.0
Total	4069	100.0

NB: N=number of observation, %=Percentage

From the total of 4069 cases which were registered on case book at Gimbi veterinary clinic, 683(16.8%) of drugs were prescribed without indication of the dose. The routes of drug administration were not written for the entire prescribed drug (Table 4).

Table 3: Dose indication for each drug used at the clinic

Dose	N	%
Not indicated	683	16.8
Indicated	3386	83.2
Total	4069	100.0

NB: N=number of observation, %=Percentage

Questionnaire Survey

In the present study 80 livestock owners were interviewed using semi-structured questionnaire. The result of this assessment indicated that from a total of 80 respondents, 30% treat their animal by using drugs purchased from different sources in the study area (Table 5).

Table 5: Types of drugs and the place where the farmers bought drugs to manage their animal

Types of drugs	N	%
Ox tetracycline	2	2.5
Albendazole	16	20
Penstrep	2	2.5
Ivermectin	4	5
Sources of drugs		
Veterinary clinic	2	2.5
Drug shops	18	22.5
Open market	11	14

NB: N=number of observation, %=Percentage

Longitudinal study

From a total of 1002 animal patients registered and treated from November 2015-March 2016 during the study period rational use of drugs were assessed with close observation in Gimbi veterinary clinic. From a total of 1002 patient animals, the maximum number of animal species encountered at the clinic was cattle.

Out of 1002 animal patients admitted to Gimbi veterinary clinic, 683/1002 (68.2 %) were treated based on tentative diagnosis (based on clinical signs). From these tentatively diagnosed cases, 264/1002 (26.3%) were suspected as mixed infection with two or more health problems. The remaining 290/1002 (28.9 %) were treated without any diagnosis (Table 6).

Table 6: Diagnosis and management of sick animals at Gimbi vet clinic during longitudinal study (2008 E.C.)

Diagnosis	N	%
No diagnosis	290	28.9
Bacterial infection	77	7.7
Internal parasite	91	9.1
Ectoparasite	88	8.8
Fasciollosis	29	2.9
Mastitis	44	4.4
Babesiosis	21	2.1
Trypanosomosis	40	4.0
Fungal disease	26	2.6
Viral disease	32	3.2
Mixed infection	264	26.3
Total	1002	100.0

NB: N=number of observation, %=Percentage

The rational use of drugs was also monitored during longitudinal study and it indicated that antibiotics, antihelmintics and multi-drug combinations were prescribed. From a total of 1002 cases, the result showed that 1697 drug products were prescribed and the average number of drugs per prescription was 1.69 with a maximum of 3 drugs (Table 7).

Table 7: Types of drug available at Gimbi Veterinary clinic for the treatment of patient animal

Types Drugs	N	%
Oxytetracycline	80	8.0
Penicilline-streptomycine	134	13.4
Ivermectin	91	9.1
Albendazole	62	6.2
Anti-trypanosome	24	2.4
Multi-drug	611	61.0
Total	1002	100.0

NB: N=number of observation, %=Percentage

Dose of the prescribed drugs was also evaluated during the assessment period at the clinic. Doses of drugs were indicated for the majority of cases 809(80.7%). The rest were prescribed without dose indication and routes of drug administration were not written for all of the prescribed drugs on the prescription paper (Table 8).

Table 8: Dose indication for each drug used at the clinic

Dose	N	%
Not indicated	193	19.3
Indicated	809	80.7
Total	1002	100.0

NB: N=number of observation, %=Percentage

Discussion

Retrospective study

The results of the present study shows that 3223/4069(79.2 %) were treated without getting correct definitive (laboratory supported) diagnosis and the diagnosis were tentative based on clinical signs rather than confirmatory laboratory tests. From the total of patient animal encountered to Gimbi veterinary clinic, 846/4069 (20.8%) cases were not diagnosed. The current study shows that the average number of drugs per prescription at Gimbi veterinary clinic was 1.49 with the maximum of 3 drugs were prescribed for most patient animals. This result had some deviation when compared with the WHO standard for human prescription is 1.6–1.8 (Isah *et al*., 2004(19)). These might be due to inadequate recognition of the disease, unavailability of diagnostic aids for confirmatory tests and absence of a right drug.

Although there is no study on veterinary drug prescription pattern, instead reports of studies performed on human subjects are available. A high average number of drugs on humans might be due to financial incentives to prescribers to prescribe more and lack of therapeutic training of prescribers or shortage of therapeutically correct drugs but in case of animal, it was due to lack of therapeutic training of prescribers or shortage of therapeutically correct drugs and diagnostic facility. However, the low value in our study indicates the absence of shortage of therapeutically correct drugs and diagnostic facility in the clinic Bimo (1992(20)).

The percentage of encounters in which antibiotics and anthelmintic were prescribed at Gimbi veterinary clinic were 27.7% and 19.7%, respectively which was almost similar with that of the ideal standard percentage of encounters in which antibiotics are prescribed for humans is 20.0–26.8 % (Geary *et al*., 2010(21)) and 50% of prescribed drugs were multi-drug for patient animal. The high percentage of antibiotics prescribed in this study area were due to inadequate recognition of the disease, unavailability of diagnostic aids for confirmatory tests, absence of a right drug, prescribers belief of the therapeutic efficacy of the antibiotics is low and prescribers knowledge.

Overuse of antibiotics is an indication of inappropriate understanding of the cases encountered to the clinic where multi-drugs are indicated for unknown cases. All the cases that were encountered to Gimbi veterinary clinic received drug therapy after they had been tentatively diagnosed without getting correct laboratory supported diagnosis. However, the doses and routes of drug administration were not indicated for all of the prescribed drugs, which reveal the presence of irrational drug use. The result was in the agreement with the findings of (Pallares *et al*., 1993(22)) that the main reasons of irrational antibiotic prescribing are inadequate recognition of infections that lead to prescription of unnecessary drugs, inappropriate dose and duration of antibiotics.

Questionnaire Survey

In the present study 80 individuals of livestock owners were interviewed using structured questionnaires at Gimbi veterinary clinic. The result of this assessment indicated that from a total interviewee, 30% of the farmers complained that they purchase drugs to treat their animals from different sources in the study area. The most commonly used drugs by the farmers during the study were Oxytetracycline (2.5%), Penstrep (2.5%), Albendazole (20%) and Ivermectin (5%). These drugs were purchased from veterinary clinic, private clinic and open market in the study area. Albendazole and Ivermectin were most commonly purchased by the farmer for the treatment of patient animal, especially Albendazole are commonly available at open market at the study area. The result of this study was agreed with the idea that Albendazole and Ivermectin which are used for the treatment of parasitic diseases, are also commonly available and utilized at clinics (Geary *et al*., 2010(21)). As a result, over use of these drugs might favour development of anthelmintic resistance in the study area.

The irrational use of drugs, which is encouraged by over the counter sale of medicines, without veterinary prescription has been found to produce various side effects because some drugs were used by nonprofessionals and purchased from nonliscenced seller/open market and organization. The situation in developing countries was a particular problem. In these study area such practice were commonly performed by livestock owner. The present study was agreed with the idea that the use of antibiotics without professional order and guidance is largely facilitated by inappropriate regulation of the distribution and sale of prescription drugs (Byarugaba, 2004(23)). The current study was similar with the concept that the practice is more pronounced in developing and low income countries where legislations and regulations are weak in which antibiotics are illegally purchased without professional prescriptions (Lowe et al., 2009(24)). Sale of antibiotics, particularly over the counter is wide spread. As the study indicated that, majority of the livestock owners or 65% and 60% of the interviewee had no information regarding to withdrawal period and drug resistance respectively in the study area. Generally, this study shows that the use of antibiotics without prescription is motivated by a complex set of factors which include unchecked sales of drug by nonliscenced person, time constraints, cost, accessibility, shortage of knowledge on the side effect of drugs.

Prospective

The present study shows that from a total of 1002 cases encountered to Gimbi veterinary clinic, 683/1002 (68.2 %) animal patients were treated based on tentative diagnosis (based on clinical signs). From these tentatively diagnosed cases, 264/1002 (26.3%) were suspected as mixed infection with two or more health problems. The remaining 290/1002 (28.9 %) were treated without any diagnosis (Table 6). These study indicates that there were no confirmatory diagnosis (laboratory supported diagnosis) for screening out the appropriate causative agent of the case due to lack of veterinary laboratory and diagnostic facility in the study area which leads to irrational use of drugs.

The current average number of drugs per prescription at Gimbi veterinary clinic was 1.69. This result has similarity with the results shown in

retrospective study and it has agreement with the WHO standard for humans is 1.6 to1.8 (Isah *et al*., 2004(19)) which was in the normal range according to this study. Also it has similarity with the study done in southwest Ethiopia, at Jimma Hospital, has shown that the average number of drugs per encounter was 1.59 (Abdulahi *et al*., 1997(25)). Although there is no study on veterinary drug prescription pattern, like that of retrospective study, reports of studies performed on human subjects are available. The percentage of encounters in which antibiotics and antihelmintics were prescribed at Gimbi veterinary clinic were 214/1002 (21.4%) and 153/1002 (15.3%) respectively and 61% of prescribed drugs were multi-drug combination. The percentage of encounters in which antibiotics were prescribed at Gimbi veterinary clinic were agreed with the ideal standard percentage of encounters in which antibiotics are prescribed for humans is 20.0 to 26.8 % (Geary *et al*., 2010(21)). In this current study more than 50% of drug was prescribed by unskilled worker, which reveals the presence of irrational drug use.

Rationality and cost effectiveness of pharmaceutical care requires continuous monitoring of activities and performance of health care providers as well as the facility. Appropriate drug use has both clinical and economic significance to any health system and should be given adequate attention. In the present study inappropriate use of drugs especially when cases complicate the prescriber due to lack of definitive diagnosis of the case, multi-drug prescription was the last option to manage mixed infection. This result seems with the idea that inappropriate use of antibiotics can potentially lead to increase the necessity to use of antibiotics to treat common and life threatening infections (Tamuno *et al*., 2012(26)). The most common problem in this study area were, there were no work share between the worker of the clinic and most drugs were prescribed by unskilled worker. Almost all patient animals that were encountered in Gimbi veterinary clinic and received drug therapy were diagnosed tentatively without getting correct laboratory supported diagnosis. The study showed that 290/1002 (28.9%) of drugs were prescribed with no diagnosis of the case encountered the clinic. This was because of inexperience and/or unskilled professional which lead to significant number of drugs prescribing without specifying the presence of infectious agent. The current study also showed that for 193/1002 (19.3%) prescribed drugs dose were not indicated. According to this study, the value for correct dose indication of the prescribed drug was not considered by the prescriber at this study area. This condition indicates irrational way of prescribing practice because professionals do not consider dose indication important as such. Also for indicated dose, it was not proportional with the weight of the patient animal because there was no weighing practice and facility to weigh patient animal for drug formulation.

Conclusions

The results of the present study show that there was no rational use of veterinary drug at the study clinic and the area. The assessment result of the prescribing practices for veterinary drugs at Gimbi veterinary clinic showed that there were problems of correct diagnosis and treatment of sick animals. On the other hand, the use of veterinary drugs without professional order and guidance is a common practice attributable to lack of rules and regulations on rational use of drugs and awareness. The patient animal encountered to the clinic was treated irrationally without confirmation of the case and an appropriate drug. Generally, lack of standard veterinary treatment guideline, awareness of drug formulary and confirmatory diagnosis in the study area were responsible for drug use and misuse. The government, private animal health practitioners and animal owners all should give due attention to promote rational use of veterinary drugs. A standard veterinary treatment guideline and regulation on drug formulation should be monitored. Awareness creation should be done on livestock owners about the impact of irrational use of drugs to their livestock and the public.

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