AWARENESS ON RECOMMENDED VETERINARY DRUGS WITHDRAWAL PERIODS AMONG SMALL SCALE DAIRY CATTLE FARMERS IN KINONDONI MUNICIPALITY

By

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A dissertation Submitted in Partial Fulfillment of the Requirements for the Degree of Master of Public Health of Muhimbili University of Health and Allied Sciences

Muhimbili University of Health and Allied Sciences

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CERTIFICATION

The undersigned certifies that she has read and hereby recommend for acceptance by Muhimbili University of Health and Allied Sciences a dissertation entitled ***awareness on recommended veterinary drugs withdrawal periods among small scale dairy cattle farmers in Kinondoni Municipality,*** in (Partial) fulfillment of the requirements for the degree of Master of Public Health of the Muhimbili University of Health and Allied Sciences.

Signature .....

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(SUPERVISOR)

Date 11/10/2010

DECLARATION

I Bahati Yakobo Midenge, declare that this dissertation is my origin work and that it has not been presented and will not be presented to any other university for a similar or any other degree award.

Signature..... Date.....

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DEDICATION

This work is dedicated to my beloved parents the Late Jeremiah Sangija (guardian) and my Mother Scolastica Simon who strived to give me education which is the best inheritance to me.

ABSTRACT

Dairy cattle are faced with many problems like poor nutrition and diseases due to poor animal husbandry and extension services which lead to poor milk production. To overcome some of these problems, farmers indiscriminately use antibiotics for treatment as well as to enhance feed efficiency and improve productivity.

The antibiotic residues cause a significant health threat to humans when taken continuously above the Maximum Residual Limit (MRL) including a change in the resistance patterns of bacteria exposed to antibiotics, allergic reactions to some sensitive individuals and direct toxic effects.

A cross-sectional study was conducted in Kinondoni Municipality in June, 2010 to assess the commonly used antibiotics, awareness of small scale dairy cattle farmers on withdrawal periods and health effects. A total of 187 small scale dairy cattle farmers were interviewed using a questionnaire on use of veterinary antibiotics, awareness on withdrawal periods, awareness on health effects and reasons that enhance awareness on withdrawal periods. A multiple stage sampling method was used in selection of small scale dairy cattle farmers to get the study sample size of 187. The commonly used antibiotics were tetracycline (79.5%), penistreptomycin (30.6%), sulfadimidine (14.4%) and gentamycin (10.2%). One hundred and thirty five out of 187 small scale dairy cattle farmers (72.2%) were aware of the drug withdrawal periods. Ninety point six percent were above secondary level. The proportion of small scale dairy cattle farmers who were aware was statistically significant at ($p<0.05$) between those with relatively higher and those with lower level of education.

However, despite the large proportion of respondents who were aware of the drug withdrawal periods only 16.1% were aware of the health effects associated with consumption of milk that contains antibiotic residues. Awareness of the health effects varied significantly ($p=0.001$) with education level with the proportion of small scale dairy cattle farmers who were aware of health effects being those with relatively higher level of education.

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LIST OF ABBREVIATIONS

ADI	Acceptable Daily Intake
ICF	Informed Consent Form
MRL	Maximum Residual Limit
MUHAS	Muhimbili University of Health and Allied Sciences
SSDCF	Small Scale Dairy Cattle Farmers
SPSS	Statistical Package for Social Sciences
PI	Principle Investigator
RA	Research Assistant
LO	Livestock officer
ECF	East Coast Fever

DEFINITION OF TERMS

Veterinary drug withdrawal periods - in the context of this study it is the time which passes between the last dose given to the animal and the time when the level of residues in the tissues (muscle, liver, kidney, skin/fat) or products (milk, eggs, honey) is lower than or equal to the MRL. Until the withdrawal period has elapsed, the animal or its products must not be used for human consumption.

Maximum Residual Limit (MRL) - in the context of this study it is the maximum concentration of residue following administration of a veterinary medicine which is legally permitted or acceptable in food under the laws of the European Union.

Residues of veterinary medicinal products – in the context of this study are pharmacologically active substances (whether active principles, excipients or degradation products) and their metabolites which remain in foodstuffs obtained from animals to which the veterinary medicinal product in question has been administered.

Antibiotics - in the context of this study are medicinal products that have an anti-bacterial effect - they either kill bacteria in the system or keep them from reproducing, allowing the infected body to heal by producing its own defenses and overcome the infection.

Extra-Label Drug Use - An antibiotic or other chemical used on the advice of a veterinarian in a dosage, route of administration, for a different disease or in some other manner not included on the approved printed package label.

Herd - a group of animals (especially cattle), collectively considered as a unit.

Dairy cattle (dairy cows)- are cows (adult females) bred for the ability to produce large quantities of milk, from which dairy products are made.

Carcinogenic Effect-carcinogenic effect refers to an effect produced by a substance having carcinogenic or cancer producing activity.

Small scale dairy farmer- in the context of this study is a farmer whose major enterprise is dairy farming with not more than thirty five dairy cattle.

CHAPTER ONE:

1. 0 INTRODUCTION

1.1 Background

The population of cattle in Tanzania is estimated to be 18.8 million (Njombe, 2009) cattle are the main livestock species in the country which are mainly used for milk and meat production. Like many other developing countries; cattle production in Tanzania largely depends on indigenous local breeds which constitutes up to 97% of the total cattle population (MOA, 1995). More than 95% of indigenous local breeds of cattle are kept under extensive grazing system in rural areas characterized with poor production (MOA, 1995). The 3% of the cattle population comprise of exotic breeds mostly the dairy cattle like Friesian, Jersey and Ayrshire kept under commercial sector. The commercial sector is located in urban and peri urban areas, where by small-scale farms with 3 to 30 dairy cattle are found. About 70% of the annual milk production comes from the traditional sector (indigenous cows), where as the commercial sector (dairy cows) produces about 30%. Proportionally, milk production contribution by individual animals within the traditional sector is significantly low. Although the smallholder dairying is an important source of income to the people; it is faced with many problems. Poor management, poor nutrition, lack of good breeds, infertility, diseases, poor marketing system and lack of extension services are among the major constraints (Mdoe., 1993; Leslie *et al.*, 1999; Swai *et al.*, 2005). To overcome some of these problems, farmers excessively use antimicrobials as prophylactics or cure (Kurwijila *et al.*, 2006). However due to poor extension services and animal health delivery systems in the country, farmers are accustomed to buying veterinary antimicrobial agents from veterinary shops and treat by themselves. When such drugs are administered by nonprofessionals, correct dosages are unlikely to be complied.

Drugs given to cattle systemically may be found in tissues, particularly when the cattle are slaughtered without the observance of withdrawal period, or when milk is harvested and marketed within the withdrawal period of the drug (Karimuribo *et al.*, 2005; Mmbando.,

2004). This is more likely in instances where the drug is administered continuously over a long period of time, when used at an extra label dose or beyond recommendations. The problem is fueled with readiness availability of veterinary drugs in veterinary shops and easy access of the drugs by farmers themselves without any restrictions (Nonga *et al.*, 2009). Unfortunately there is no official residue monitoring program and consumer response towards the dangers posed by residues. Thus, there is a risk of sustained consumer exposure to residues.

Veterinary drug residues are considered as public health hazards. Human accidentally receives different amounts of these drug residues which can consequently cause a number of health hazards effects. For example, penicillin in chicken is reported to cause severe anaphylactic reaction in consumers (Teh and Rigg., 1992). Skin allergies in subjects hypersensitive to sulfonamides could occur following consumption of foods like milk containing high concentrations of sulfonamide residues (WHO., 1989). Nitrofuran drugs commonly employed for the treatment of salmonellosis and other bacterial infections in livestock are banned for use in livestock feed in many countries, because of their mutagenic potentials (NAFDAC., 1996). The WHO has recommended the prohibition of use of chloramphenicol in all food producing animals, particularly lactating cows because it causes rare idiosyncratic aplastic anaemia in people (Settepani., 1984; WHO., 1988). Non detected effects of antimicrobial residues in human communities are revealed by a wide spectrum resistance to antibiotics as a chronic effect (Simonsen *et al.*, 1998). An outcome of resistance to antibiotics is necessity to new antibiotics for controlling infectious diseases of human (Kotretsu., 2004). Indeed, a recent survey by Nonga and Muhairwa (2009) showed that up to 65% of thermophilic Campylobacter isolated from poultry were resistant to different types of commonly used antibiotics in veterinary and humans practices. Surveys indicate that most antimicrobial residues are generally found at levels below 1 parts per billion (ppb) (Mac Cracken *et al.*, 1976), but even at these low concentrations they may have an effect on the human gut flora. For example, 225 people in Jalisco, Spain reported symptoms of trembling, headache and malaise after consuming beef with antimicrobial residues (Doyle., 2006).

Internationally recognized organization such as World Health Organization (WHO), Food and Agriculture Organization (FAO., 1988) and Veterinary Medicine Directorate (VMD) (VMD., 1997., VMD., 2000) of the European Union as well as Food and Drug Administration (FDA) of USA (Arousal., 1975) have set tolerance or Maximum Residual Limit (MRLs) and Acceptable Daily Intake (ADI) for humans and withholding times for pharmacologically active substances including antimicrobial agents prior to marketing. The antimicrobial residues in animal tissues above maximum residue limit (MRLs) clearly have an impact on human health. Concern has been expressed about possible harmful effects on humans through the extensive indiscriminate use of antimicrobial drugs (Khachatourians., 1998; Simonsen *et al.*, 1998).

Elsewhere in Tanzania, some studies have reported the presence of antibiotic residues in milk (Karimuribo *et al.*, 2005; Kurwijila *et al.*, 2006), in beef (Mmbando., 2004) and in chicken meat and eggs (Nonga *et al.*, 2009). Dar es Salaam being among the leading region in urban and peri urban livestock keeping has limited information on the veterinary antimicrobial drug use in dairy cattle, awareness of farmers on drug withdraw period and possible health effects of antimicrobial residues to milk consumers. Therefore this study will establish the baseline information on the general uses of veterinary antimicrobials in dairy cattle, establish farmers awareness on drug withdraw period and knowledge on effects of antimicrobial residues to consumers in Dar es Salaam, Tanzania. The findings were expected to be useful in supporting initiatives for public health educational interventions on health hazards associated with antibiotic residues and open doors for further study on magnitude of the antibiotic residues problem.

1.2 Statement of the problem.

Large quantity of milk consumed by Tanzanians (in urban) especially infants who under certain circumstances are unable to get breast milk is produced by the SSDCFs. The produced milk is alleged to contain drug residues of which perceived to cause allergic reactions and other problems to the infants.

In this context, the problem of antibiotic residues in milk could be even greater possibly due to various factors including lack of advice from livestock officers on withdrawal periods and low literacy level of small scale dairy cattle farmers (SSDCFs).

In Tanzania substantial number of studies report antibiotics residues in broiler chicken (Nonga *et al.*, 2009), antibiotic residues in chicken eggs (Karimuribo *et al.*, 2005) and antibiotic residues in milk collected from the market agents along milk supply chains in and around Mwanza and Dar es Salaam regions (Kurwijila *et al.*, 2006). Despite the fact that research findings disclosed the presence of drug residues in milk, little has been done to assess awareness of milk suppliers (SSDCFs) on withdrawal periods and possible health effects.

The in depth feeling is that if the issue of assessing the awareness of SSDCFs on withdrawal periods was not treated with the seriousness it deserves, there would be continued presence of drug residues in milk. Consequently milk that contain drug residues would cause a significant health effects to consumers including those related to a change in the resistance patterns of bacteria exposed to antibiotics, allergic reactions to some sensitive individuals, possibly cancer and direct toxic effects.

This study therefore aims at assessing the antibiotic uses, awareness of SSDCFs on withdrawal periods and health effects to milk consumers in order to institute health education interventions to SSDCFs and the general public at large. The study identified reasons that the researcher had hypothesized to be associated with awareness.

Pictorial presentation for the problem of antibiotic residues in terms of reasons that influence the problem.

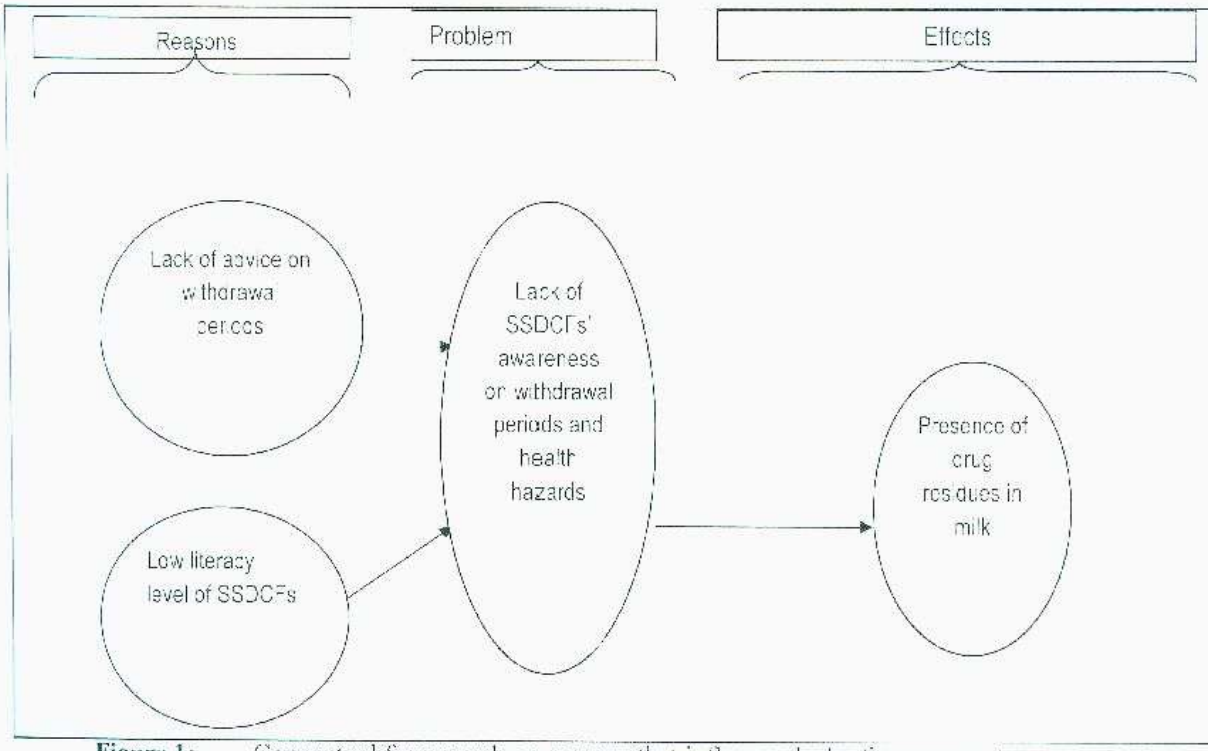


Figure 1: Conceptual framework on reasons that influence lack of awareness to withdrawal periods.

1.3 Rationale of the study

Antibiotics are used by the SSDCF and veterinarians to cure diseases, enhance growth, feed efficiency and improve animal production. The antibiotic residues can consequently be present in milk if the SSDCF are not aware of the withdrawal periods.

Therefore:

- The study was anticipated to generate baseline scientific data that would add knowledge on the level of SSDCF's awareness on withdrawal periods and health effects of drug residues.

- The study would also form basis for airing of health education interventions to cattle farmers and general public on the issues related to drug withdrawal periods and possible health hazards.

- In addition the study would possibly fill the existing gap on the association between presence of drug residues in milk collected from the market and the SSDCF's awareness on withdrawal periods.

1.4 Research questions

- What is the degree of awareness of SSDCF on the recommended drug withdrawal periods?

- What is the degree of awareness of SSDCF on health effects of antibiotic residues to milk consumers?

- What factors/reasons enhance awareness of SSDCF to drug withdrawal periods and health hazards of antibiotic residues? Is there association between level of education of SSDCFs and awareness on drug withdrawal periods? Is education regarding withdrawal periods given to farmers by livestock officers? Is administration of drugs done by qualified personnel?

- What kinds of antibiotics are frequently used in treatment of dairy cattle?

1.5 Objectives

1.5.1 Broad objective

To assess the veterinary antibiotics use on dairy cattle, SSDCFs' awareness on withdrawal periods and knowledge of possible health effects of antibiotic residues to milk consumers.

1.5.2 Specific objectives

(i) To establish the commonly used veterinary antibiotic drugs in small scale dairy farms.

(ii) To assess the awareness of SSDCFs on drug withdrawal periods.

(iii) To assess the awareness of SSDCFs on health hazards of drug residues.

(iv) To establish factors that enhances awareness of SSDCFs on drug withdrawal periods.

CHAPTER TWO:

2.0 LITERATURE REVIEW

2.1 Cattle population in Tanzania.

The livestock industry in Tanzania largely depends on cattle which are estimated to be 18.8 million (Njombe., 2009) and are the main livestock species used for milk and meat production. The cattle industry largely depends on indigenous local breeds that constitute up to 97% of the total cattle population (MOA., 1995). More than 95% of indigenous local breeds of cattle are kept under extensive grazing system in rural areas characterized with poor production (MOA., 1995).

Improved dairy type constitute a small proportion (303 704) (URT., 2003) that plays a clear and definite role in urban and peri-urban livelihood and survival. The improved dairy breed that are found in the country are the crosses of Friesian, Jersey and Ayrshire kept under intensive system (zero grazing) in a dairy farming business aimed at making profit. About 70% of the annually produced milk comes from the traditional sector (indigenous cows), where as the dairy farming business that aims at making profit (dairy cows) produces about 30%.

Intensively reared cattle are susceptible to diseases compared to extensively kept cattle thus they are frequently subjected to frequent medications especially antibiotics.

2.2 Use of antibiotics in dairy cattle.

Antibiotics are used in dairy cattle for various purposes. Antibiotics have been used in food animal production for the treatment and prevention of diseases for nearly 50 years ago (Mitchell., 2005). Penicillin G was the first antibiotic introduced to veterinary medicine in 1947 for use in intramammary infusions. Since that time the use of antibiotics has become an integral part of managing animal health.

The drugs are administered to animals through several different routes including injections, orally in the food and water, topically on the skin and by intramammary and intrauterine infusions. Theoretically, all of these routes may lead to residues appearing in foods of animal origin such as milk, meat and eggs if withdrawal periods are not observed.

The antibiotics abuse occurs when they are used indiscriminately like, overprescription employed in wrong combination, changed quickly over to the other drugs, used persistently, given in inadequate dosage and used for preventive purposes. Due to the above mentioned practices, antibiotic residues accumulate in various body tissues of cattle like muscles, liver and kidney and may be a source of chemical hazards to the milk consumers.

2.3 Potential hazards of drugs residue to human being.

The antibiotic residues when taken above the MRL can cause a number of health hazards which include the emergence of resistant strains of bacteria in humans (Ladefoged, 1996). Production of harmful effects from direct toxicity or from the allergic reactions (hypersensitivity reactions) in sensitized persons O'Brien and Campbell (1984).

Some drugs and/or their metabolites possess carcinogenic potential e.g. meat preserved with sodium nitrate and contains sulphamethazine residues, may develop a triazine complex that has a considerable carcinogenic potential (Ladefoged., 1996). Other effects are like prolonged ingestion of tetracycline in food has detrimental effects on teeth and bones in growing children. It is pertinent to mention that except for some tetracyclines; most therapeutic antibiotics are relatively heat stable and resist to both pasteurization and cooking process Booth and McDonald (1986).

There have been also several reports on drug residues to destroy useful microflora of gastrointestinal tract, especially in children and hence lead to enteritis problems (Ladefoged., 1996).

2.4 Commonly used antibiotics in dairy cattle

Antibiotics are the commonly used drugs in prophylactic or treatment of dairy cattle. A recent survey by veterinarians in the United States revealed that antibiotics were the drugs most often prescribed or used in the treatment of lactating dairy cows. The most commonly used antibiotics in dairy animals can be grouped into 5 major classes. These include the beta-lactams (ß-lactams) (e.g. penicillins and cephalosporins), tetracyclines (e.g. oxytetracycline, tetracycline and chlortetracycline), aminoglycosides (e.g. streptomycin and gentamicin), macrolides (e.g. erythromycin) and sulfonamides (e.g. sulfamethazine)(Mark., 2005). In that study it was established that Penicillin G was the most frequently used, and except for oxytetracycline, the five most prescribed drugs were all ß-lactams approved for use in lactating dairy cattle: penicillin G, ceftiofur sodium, cloxacillin, cephapirin and ampicillin.

However the frequency of antibiotic uses may be determined by the method of cattle raising that is practiced by dairy cattle farmers. A study carried out in Minnesota, Michigani, Wisconsin and New York on the use of antibiotics established that the most commonly used antibiotic on conventional dairies were penicillin (86%), cephalosporin (78%), and tetracyclines (41%). Almost all dairy cattle farmers treated calves with respiratory conditions and the most often used antibiotics were tilmicosin, ceftiofur, penicillin and florfenicol (Zwald *et al.*, 2004).

In Tanzania, a study by (Mmbando., 2004) in cattle established that oxytetracycline was the commonly used antibiotics in cattle. However, from author experience of working with veterinary pharmaceuticals in Morogoro; the most antibiotics commonly used in cattle are oxytetracyclines and penicillin derivativetis. All these drugs are indiscriminately used and probably the farmers are not aware of withdrawal periods and consequently may have serious effects to the milk consumers.

2.5 Awareness of farmers on withdrawal periods of veterinary drugs and health effects.

Awareness of SSDCFs on withdrawal periods of veterinary drugs may have a significant contribution to the absence of drug residues in milk. Under a certain circumstances withdrawal periods might not be adhered to despite the awareness. A study carried out in Uganda to assess the possible contribution of the knowledge, attitudes and practices of poultry farmers to the presence/levels of sulfonamide residues in hen eggs revealed that (95%) of the farmers never observed withdrawal periods although 80% of them knew the importance of withdrawal periods (James *et al.*, 2005).

Similarly a study conducted in dairy farms in California, New York, Pennsylvania, Virginia and Wisconsin regarding use of antibiotics and treatment practices established that 81.1 % of producers of milk were aware of efforts to reduce residues (Wilson *et al.*, 1998).

Differently, a study by John and Alwynelle (1987) in Michigani USA to 614 dairy farmers on attitudes and knowledge about veterinary drugs residues established that thirty percent (30%) had insufficient knowledge about withdrawal periods.

However involvement of the drug regulatory institution may have contribution towards awareness of farmers on withdrawal periods. The study conducted in Ghana established that where no regulatory legislation or mechanisms are in place for drug approval and use or for a residue monitoring it is possible to have the occurrence of residues (Turkson., 2001). There may be no quality control of the substances supplied and concentrations and dosage rates may be incorrectly recorded.

Some dairy farmers might not be aware of the drug withdrawal periods if education regarding withdrawal periods is not imparted to them. In Michigan there was a study carried out to dairy farmers as a monitoring program on recommended withdrawal periods. It was reported that among diary cattle farmers visited during a monitoring program, compliance with

recommended withdrawal times for antibiotics was 96%, indicating that some farmers, although a small number, may not have been aware of drug withdrawal times (Marteniuk and Bartlett., -1988).

The awareness of dairy cattle farmers on health hazards of drugs residues above the MRL vary from one dairy farmer to another. A study conducted in Canada to determine associations between the occurrence of antibiotic residues in bulk milk and various farm management practices established that approximately 96% of farmers thought that antibiotic residues were of public health significance. Ninety eight percent thought that residues could interfere with the manufacture of cultured milk products and 97% thought that antibiotic residues were significant because of the effect they had on public opinion (Scoll *et al.*, 1991).

2.6 Factors those enhance awareness of SSDCFs on drugs withdrawal periods.

Concerns over veterinary drug usage and residues are primarily related to food safety and the possibility of the development of antibiotic resistant pathogens. However the main impetus behind the increased interest of developing country governments is the need to meet requirements for international trade. Failure to meet the international standards could have devastating economic consequences. There is also growing public concern regarding drug residues in many developing countries. In a survey in Nigeria, for example, more than half of the respondents were concerned about residues in meat and favoured the introduction of legislation for residue prevention, including condemnation of contaminated meat (Kabir *et al.*, 1999).

A study carried out by Nonga et al., (2009) reported high awareness of drug withdrawal period among chicken farmers in Morogoro but did not comply because were afraid of losses due to condemnation of eggs.

Similarly a study which was conducted to dairy farmers in Minnesota, Michigan, Wisconsin and New York about the antibiotic use showed that veterinary extension services have a

significant impact on awareness to withdrawal periods of drugs. The primary sources of information about antibiotic use, dosage and withdrawal times were veterinarians (Zwald *et al.*, 2004) and that other prominent sources of information were personal experiences and product labels.

A report given by (Canada Animal Health Institute – CAHI., 2004) explained that although all pharmaceutical products are labeled, veterinarians often leave additional written instructions on the farm. The veterinarians verbally review important label information with producers, including withdrawal times for prescribed products for the sake of creating awareness to drug withdrawal periods.

Contrary to other studies, a survey conducted by Andrew., (2004) in Nigeria on awareness of the withdrawal periods of veterinary drugs by dairy farmers established that limited veterinary advice, administration by unqualified personnel and limited use of drug manufacturers instructions were among the factors fueled the problem.

Similarly a study carried out in Zambia on regulatory issues and drug residues in Africa's Regulatory framework established that most African countries recognize the importance of food hygiene particularly with regards to meat safety. There are also laws and regulations that govern food production and processing like meat inspection and drug residue levels. In such study it was established that dairy cattle farmers, for instance, sometimes buy veterinary drugs over the counter and administer then on their own (Bruce., 2004).

CHAPTER THREE:

3.0 METHODOLOGY

3.1 Study Area

The study was conducted in Kinondoni Municipality which is one of the three municipalities in Dar es Salaam city. It covers 531 km^2 of land that includes offshore islands. The Municipality was established as an autonomous body in 2000.

The municipality is bordered by the Indian Ocean to the northeast, Ilala municipality to the south, Bagamoyo district to the north, Kibaha district to the west and Kisarawe district to the southwest (Figure 2).

The municipality is well linked by roads and other communication networks to the rest of the city and other parts of the country. Major road links include Morogoro road, Bagamoyo road, Kawawa road, Mandela road and Sam Nujoma road.

The municipality has 27 wards and 127 streets with a total of 3,760 SSDCFs and 20,350 dairy cattle (Kinondoni Municipality Dairy Cattle Sensus., 2003).

The municipality was proposed as a study site because it has highest number of small scale dairy cattle farmers (3760) with highest number of dairy cattle (20350) in Dar es salaam city. Therefore the milk produced from Kinondoni municipality is also supplied in different locations of the city.

3.2 Study design

The study design used was cross -sectional analytical study (Kivaria *et al.*, 2006). A cross-sectional study is one in which subjects were studied once at a particular point in time, as in a random-sample health survey. The term "cross sectional study" (or "prevalence study") usually refers to studies at the individual level.

This design was chosen in order to get the association between variables and outcome. It would also allow exploration of factors that increase awareness on drug withdrawal periods and health hazards. The method can study entire population or a representative sample; it may however be susceptible to selection bias.

3.3 Study population

A selected number of SSDCFs in Kinondoni Municipality (both women and men) who keep from one or more dairy cattle were considered in the study.

3.3.1 Inclusion criteria

- The SSDCFs (both women and men) who keep from one to thirty five dairy cattle.
- Willingness to participate in the study and able to give informed consent.

3.3.2 Exclusion criteria

- The SSDCFs (both women and men) who keep more than thirty five dairy cattle.
- Unwillingness to participate in the study.

3.4 Sample size

The sample size in this study was obtained from the single proportion formula.

The estimated proportion (p) was 70% (John *et al.* 1987), the margin of error on p estimated as 7% and considered at 95% confidence level.

Using $\mathbf{n} = \frac{z^2\, p(100-p)}{\varepsilon^2} =$

$\frac{1.96^2\, 70(100-70)}{7^2} =$ **165** small scale dairy cattle farmers.

Z is the point of the normal distribution corresponding to the level of significance. (Z=1.96)

P is the estimated proportion of small scale dairy cattle farmers who are aware of the drugs withdrawal periods.

ε is the margin of error

No response rate 10% would be 17.

Setting the margin of error on P as 7% and considering a 95% confidence level in the estimate of the proportion of small scale dairy cattle farmers, and adding 10% of no response rate, the above formula yields a minimum required sample size of about 187 small scale dairy cattle farmers.

3.5 Ethical consideration.

Institutional ethical clearance for the proposed study was sought from MUHAS ethical review board. Research permit was sought from the Executive Director of the Kinondoni Municipal Council. Participation in the study was on voluntary basis given that information for participation and significance of the study was clearly explained orally to participating SSDCF. The signed informed consent was sought from participants and data were under the custody of the researcher as confidential and the study farmers' households were anonymized.

3.6 Plan for data collection

3.6.1 Training and recruitment of research assistant.

One research assistant was recruited to assist the researcher in data collection. Qualification of that assistant was certificate in Animal Health, previous research experience on interaction with dairy cattle farmers and good communication skills. Involvement of the research assistant was important as this maximized trust of SSDCFs and interviewer - interviewee interaction. The research assistant was briefed on the objectives of the study, data collection process, respondents' selection criteria, obtaining consent from SSDCF, approach during interview, understanding questions, elaborating why and how each question is asked, assuring the respondents confidentiality and how to record responses from interviewees.

3.7 Sampling method of the SSDCFs.

A three level multistage sampling technique was employed as follows:

Stage 1

This stage involved selection of study wards within Kinondoni Municipality. All (27) wards were listed down and purposive sampling was done to select the five (5) wards with many SSDCFs. The five wards selected were those at the outskirts (rural areas of Kinondoni

Municipality) of town which had a mixture of highly educated and those who were less educated SSDCFs.

Stage II

Selection of streets in the selected five (5) wards was done by simple random sampling. In each ward three (3) streets were selected by simple random sampling. In the situation where the selected street had few SSDCFs, then reselection of another street was done.

Stage III

This stage involved obtaining SSDCFs from each of the selected street in stage II. A list of SSDCFs was obtained from streets leaders in collaboration with the ward livestock extension officer. If in the street there was substantial number of SSDCFs, a systematic sampling was employed using the obtained list as sampling frame. In each street approximately 12 SSDCFs were involved in the study. In the situation where the small scale dairy cattle farmers were few all who were willing to participate in the study were involved.

Systematic sampling was done in five steps.

(i) The sampling frame was obtained from either street leader or the ward livestock extension officer within the street. All SSDCFs in the street were listed down.

(ii) Sample size in each street was approximately twelve (12) SSDCFs. The estimation of twelve is computed from the total sample size of the study in the five wards which is 187 SSDCFs.

(iii) Sampling interval was calculated by taking the total number of SSDCFs in the street as a numerator and sample size in the street (12 SSDCFs) as a denominator.

(iv) The first number of SSDCF was selected at random by simple random sampling from one of the first SSDCFs within the sampling interval.

(v) The first number of SSDCF selected from the list was added to the sampling interval to get a second SSDCF. A third SSDCF was obtained by adding the selected first number of SSDCF to the first summation. Addition of selected first number of SSDCF to previous summation continued until 12 SSDCFs were obtained.

3.8 Sampling method of the key informants (livestock officers and veterinary drug shops sellers).

3.8.1 Simple random sampling for livestock officers was done in the following steps:

(i) A numbered list of all livestock officers stationed at Kinondoni Municipal Council was obtained. The total number of livestock officers was six (6).

(ii) The size of the sample which was two (2) was decided.

(iii) The required number of livestock officers at Municipal council were selected using ''lottery'' system.

3.8.2 Simple random sampling for veterinary drug sellers was done in the following steps:

(i) A numbered list of all veterinary drugs shops in Kinondoni Municipal Council was obtained. The total number of shops was nine (9).

(ii) The size of the sample was three (3) veterinary drugs shop sellers. At least one third of the sampling frame was computed to get the sample size.

(iii) The required number of veterinary drugs shops sellers in Kinondoni Municipality were selected using ''lottery'' system.

3.9 Key informants and literature search.

Additional data on the information of types and amount of veterinary antibiotics sold, availability of any extension services, diagnosis and treatment of cattle diseases were collected from Municipal Veterinary Officers, Private Veterinary practitioners, veterinary drug shop owners/sellers and literature search from Health Information Network Analysis Research Initiatives (HINARI) (checklist appendix IV). The information helped compare with the information given by SSDCFs regarding the use of antibiotics. The process of data collection was preceded by questionnaire pretest.

3.10 Key informants

The interview with key informants was used to complement the questionnaire results. The checklist of questions (As given in appendix) was used in interviewing the key informants namely livestock officers and veterinary drug shop owners/sellers. Information on the types and amount of veterinary drug used, availability of any extension services on uses of antibiotics/antimicrobials, diagnosis and treatment of cattle diseases, drug withdrawal periods and any health effects reported due to veterinary drug toxicity was explored.

3.11 Data collection techniques and tools.

3.11.1 Questionnaires

Data were collected from respondents (SSDCFs) during household visits by interview using questionnaire with both closed and open-ended structured questions. The questionnaire was designed in English, translated into Swahili, retranslated into English to validate and pretested to ensure that it is well structured and understood.

The face -to- face interview targeted all selected farmers to obtain information regarding type of antibiotics used, awareness on withdrawal periods, awareness on drug residues related health hazards and reasons that increse awareness on withdrawal periods. The study tool was administered by a researcher and assisted by one research assistant.

3.12 Pretesting of data collection tools.

The preliminary study survey was done to pretest the questionnaires as well as estimate time taken for each questionnaire. A total of 10 respondents were interviewed. The revised version of the questionnaire was translated into 'Kiswahili', the national language understood by majority of Tanzanians and used in the study.

3.13 Process of data collection

At the Municipal Council

The principal investigator obtained a list of all 27 wards of Kinondoni Municipal Council. Five wards out of 27 were selected by simple random method and included Kimara, Kibamba, Kawe, Mbezi and Kunduchi.

At the ward level

The principal investigator obtained a list of streets from the Ward Executive Officer (WEO). There were 13 streets at Kimara ward, 10 streets at Mbezi ward, 10 streets at Kibamba, 14 streets at Kawe ward and 12 streets at Kunduchi ward. Three streets out of the mentioned streets in each ward were randomly selected for collection of data.

At the street level

At each selected street a researcher was given the names of all SSDCFs in that street. Twelve SSDCFs were randomly selected for data collection. The household heads were targed as respondent (father or mother) and in case of absence, another permanent resident-adults (> 18 years) in the households took part in the interview.

During visiting of SSDCFs selected households in the study, a researcher was accompanied by the street leader or other person who was appointed on behalf of the street leader. In this setting the researcher was able to get the targeted respondents and interviewed approximately 36 SSDCFs in each ward.

During the visit to the SSDCFs' households a brief general introduction was done.

The researcher or research assistant went through the informed consent form (ICF). Meanwhile the study participants followed the information given by the researcher or research assistant in respect of the consent form and finally signed the form upon satisfaction of what is written in the form. The SSDCFs who were not able to read and write, a finger painted with ink which served as a signature, was stamped on the consent form.

Therafter the actual interview based on the structured questions begun. Each respondent was interviewed for approximately 30- 40 minutes.

3.14 Data handling and control of the quality.

Monitoring of questionnaires filling was the main obligation of the researcher in order to ensure that data collected are of good quality. Generally supervision of questionnaire filling minimized the chances of having poor data.

3.15 Data analysis

Quantitative data analysis was done using SPSS version 15.0 statistical software. The principal investigator entered cleaned and analyzed data with assistance from a stastician who ensured the right procedure was observed. Frequencies were generated for categorical variables where proportion of level of awareness to veterinary drugs withdrawal periods and commonly used antibiotics were obtained. Differences between proportions were examined using Chi-square test or Fishers exact test for proportions. All the analysis was two-tailed and P value < 0.05 was considered to be

significant. Descriptions of qualitative data were made based on their thematic contents. The interaction between independent variables was analysed using logistic regression techniques.

3.16 Research variables

Outcome variable (problem).

Awareness of SSDCFs on the recommended veterinary drugs withdrawal periods.

In this dependent variable the author wanted to assess whether SSDCFs were aware of the withdrawal periods. It was important to establish it because without which dealing with drug residues issues in milk would be difficult.

Independent variables

- Level of education of SSDCFs.

  The level of eduction of SSDCFs was assessed in order to establish whether it determines the awareness on drug withdrawal periods. The SSDCFs who were more educated were expected to enquire information from personnel who administered drugs in respect of withdrawal periods of drugs. Nevertheless, the more educated SSDCFs were able to read label of drug bottles and sachets, hence get aware of the withdrawal periods.

- Qualification of a personnel who administers drugs.

  Qualification of personnel who treated dairy cattle was expected to have a significant contribution to the awareness of SSDCFs on withdrawal periods. The qualified personnel adviced SSDCFs on withdrawal periods during service delivery to their dairy cattle thus made them aware of the withdrawal periods

CHAPTER FOUR: 4.0 RESULTS

4.1 Demographic characteristic of the study population. A total of 187 small scale dairy cattle farmers were interviwed. The socio-demographic information of respondents showed that majority were exclusively SSDCFs (75.4%). Many of respondents (54.5%) had primary school education and majority were aged between 40 and 59 years (51.3%) Table1.

Table 1 Socio-demographic information of respondents (n=187)

Socio-demographic information	Category	Number (%) of respondents
Sex	Female	94 (50.3)
	Male	93 (49.7)
Education	Primary education	102 (54.5)
	Secondary education	53 (28.3)
	Above secondary school	32 (17.1)
Wards of residence	Mbezi	44 (23.5)
	Kibamba	43 (23.0)
	Kawe	40 (21.4)
	Kimara	34 (18.2)
	Kunduchi	26 (13.9)
Age	20 – 39	52 (27.8)
	40 – 59	96 (51.3)
	60 – 79	38 (20.3)
	80 +	1 (0.5)
Occupation	Entire SSDCF	141 (75.4)
	Formal employment	26 (13.9)
	Business persons	20 (10.7)

4.2 Awareness on drug withdrawal periods and health hazards.

The proportion of the total 187 respondents who were aware of the drug withdrawal periods was 135 (72.2%). Out of the 135 respondents who were aware of the withdrawal periods only 30 respondents (16.1%) were aware of the health effects associated with consumption of milk that contain drug residues.**(Table 2).**

Table 2: Awareness of SSDCFs on drug withdrawal periods and health hazards of drug residues

		Number (%) of respondents
Awareness on drug withdrawal periods	Yes	135 (72.2)
	No	52 (27.8)
Total		**187 (100)**
Awareness of SSDCFs on health hazards of drug residues	Yes	30 (16.1)
	No	157 (83.9)
Total		**187 (100)**

4.3 Reasons that enhance awareness of SSDCFs on drug withdrawal periods

There were various reasons that were thought to increase awareness of SSDCFs on drug withdrawal periods. Analysis was done for 135 who were aware of the withdrawal periods. The main reasons mentioned by the respondents which increased awareness were advice from

veterinary private practitioners 119 (63.6%) and information on the label of the sachets or bottles 27 (14.4%) Table 3. Other reasons are shown in the table below. It was further specified by the respondents that the advice on drug withdrawal periods was given during dairy cattle treatment.

Table 3: Reasons that increase awareness of SSDCFs on drug withdrawal periods

		Number of respondents	%
Reason	Advice from veterinary private practitioners	119	63.6
	Information on the label of the packets/bottles	27	14.4
	Sellers of veterinary drugs	8	4.3
	Advice from livestock officers	5	2.7
	Learn from other farmers	2	1

4.4 Commonly encountered dairy cattle diseases.

Most of respondents (58.8%) reported encountering a tick-borne diseas, the East Coast Fever (ECF) as the most common disease that affects their cattle. Foot and mouth disease however was reported to occur sporadically (Fig. 3).

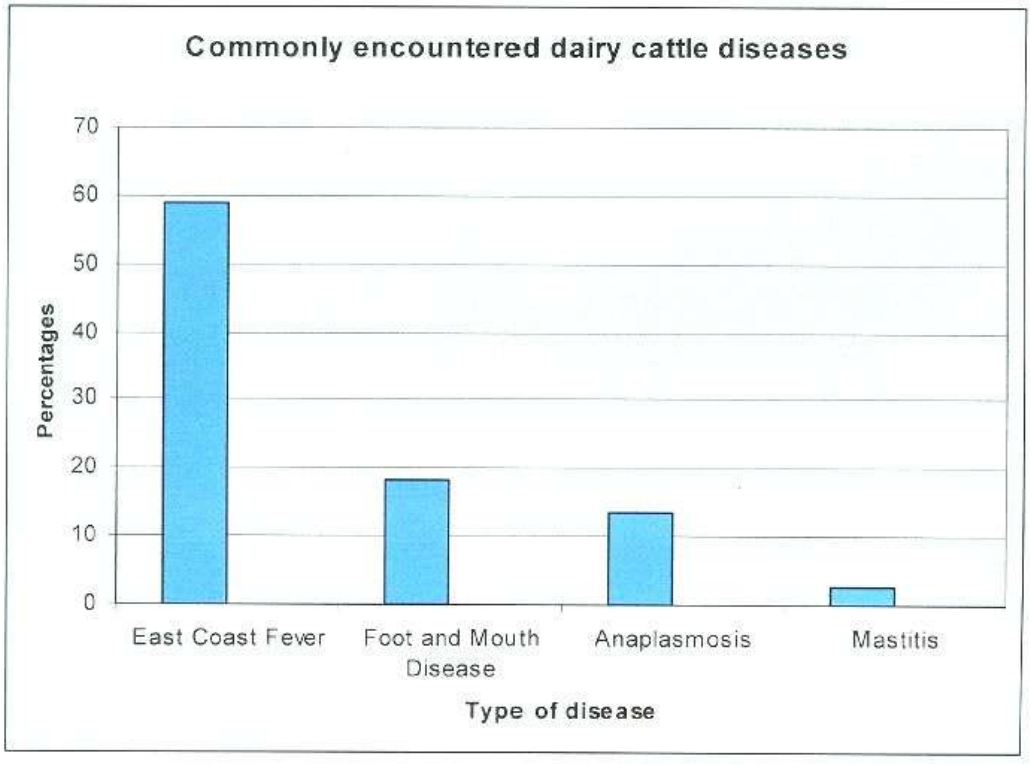


Figure 3. Commonly encountered dairy cattle diseases

4.5 Commonly used antibiotics

Up to 147(79.5%) of respondents mentioned that tetracycline was the frequently used antibiotic in dairy farming for treatment of the commonly encountered diseases. The diseases which were reported to be treated with tetracyclines included ECF for reducing the body temperature of the cattle. Another disease that was treated with tetracyclines was anaplasmosis. Fig.4.

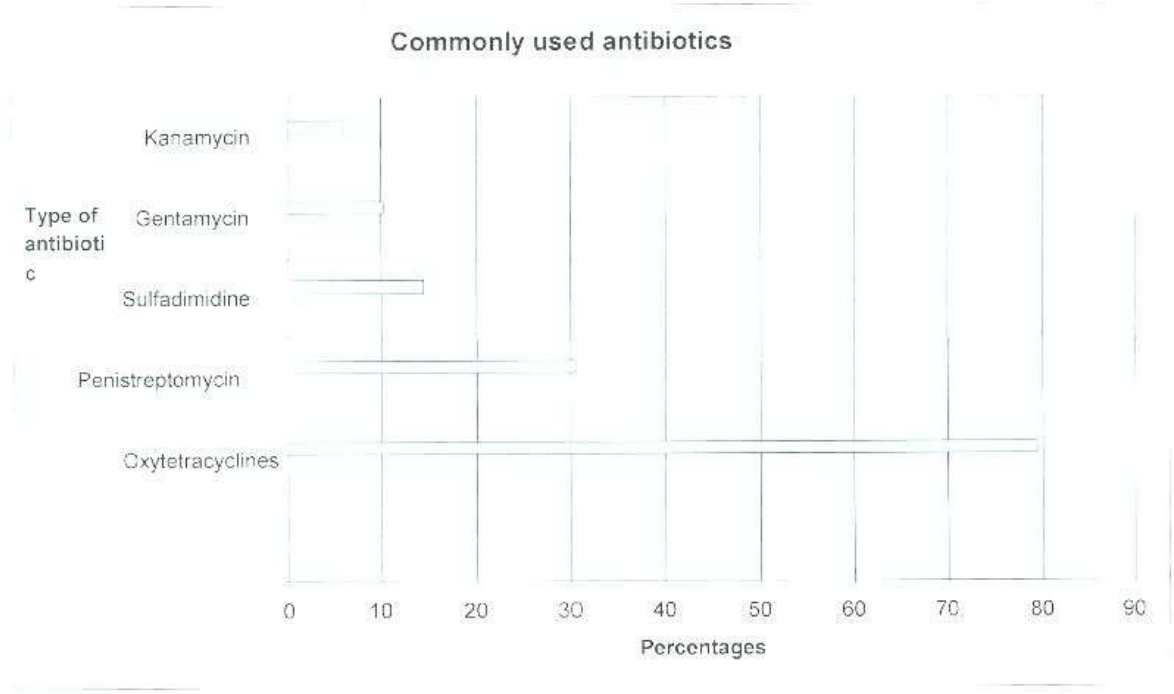


Figure 4: Commonly used antibiotics

4.6 Association between awareness of SSDCFs on drug withdrawal periods and their level of education

The analysis of association between awareness on drug withdrawal periods and level of education showed that awareness increased with level of education and the association was

statistically significant ($P = 0.004$). Ninety point six percent of respondents who had education above secondary level were aware. Table 4.

Table 4. Association between awareness on withdrawal periods and level of education of SSDCFs

	Awareness on drug withdrawal periods					
	Aware		Not aware		Total	
Level of education	**n**	**%**	**n**	**%**	**n**	**%**
Primary	64	62.7	38	37.3	102	54.5
Secondary	42	79.2	11	20.8	53	28.3
Above secondary	29	90.6	3	9.4	32	17.1
Total	**135**	**72.2**	**52**	**27.8**	**187**	**100**

$X^2 = 11.264$ P = 0.004

4.7 Association between awareness on drug withdrawal periods and the current main occupation

The results obtained in analysis showed that the occupation of respondents had no statistical significance association to the awareness on withdrawal periods, $P = 0.269$. However the respondents who were employees (84.6%) formed a large proportion among those who were aware. Table 5.

Table 5. Association between awareness on drug withdrawal periods and current main occupation of SSDCFs

Occupation	Awareness on drug withdrawal periods					
	Aware		Not aware		Total	
	n	%	n	%	n	%
Employees	22	84.6	4	15.4	26	13.9
Business person	13	65	7	35	20	10.7
SSDCF	100	70.9	41	29.1	141	75.4
Total	**135**	**72.3**	**52**	**27.7**	**187**	**100**

$X^2 = 2.628$ $P = 0.269$

4.8 Relationship between awareness on drug withdrawal periods and level of education of personnel who administered drugs.

It was difficult for SSDCFs to know the qualification of personnel who treated their cattle. However, names of those who administered drugs to each household were noted and thereafter their qualifications were obtained from livestock officer in the respective ward. Majority of respondents (73.4%) whose dairy cattle were treated by personnel who had attended long course in veterinary sciences, were aware of the withdrawal periods. The association however was not statistically significant $P = 0.419$. Table 6.

Table 6. Relationship between awareness on drug withdrawal periods and level of education of personnel who administers drugs

	Awareness on drug withdrawal periods					
	Aware		Not aware		Total	
Level of education of personnel who administers	**n**	**%**	**n**	**%**	**n**	**%**
Primary	5	55.6	4	44.4	9	4.8
Secondary	3	60	2	40	5	2.7
Long course in vet science	127	73.4	46	26.6	173	92.5
Total	**135**	**72.2**	**52**	**27.8**	**187**	**100**

X^2 = 1.739 P = 0.419

4.9 Association between awareness of SSDCFs on health effects of drug residues and their level of education

Majority of the respondents (31.3%) who had education above secondary level were aware of the health effects. The proportion of those who were aware increased with increase in the level of education. The association between level of education and awareness showed a statistical significance $P = 0.001$. Table 7.

Table 7. Association between awareness of SSDCF on health effects of drug residues and their level of education

	Awareness of SSDCF on health effects of drug residues					
	Aware		Not aware		Total	
Level of education	**n**	**%**	**n**	**%**	**n**	**%**
Primary	7	6.9	95	93.1	102	54.5
Secondary	13	24.5	40	75.5	53	28.3
Above secondary	10	31.3	22	68.8	32	17.1
Total	**30**	**16.0**	**157**	**84.0**	**187**	**100**

X^2 = 14.710 P = 0.001

4.10 Association between awareness of SSDCFs on health effects of drug residues and their main occupation.

Twenty six point nine percent of the respondents who were aware of the health effects were employees. However, the number of respondents who were aware of the health effects did not vary with the category of occupation. The relationship between occupation and awareness of health effects had showed to have no statistical significance $P = 0.227$. Table 8.

Table 8. Association between awareness of SSDCF on health effects of drug residues and current main occupation.

Occupation	Awareness of SSDCF on health effects of drug residues					
	Aware		Not aware		Total	
	n	%	n	%	n	%
Employees	7	26.9	19	73.1	26	13.9
Business person	2	10	18	90	20	10.7
SSDCF	21	14.9	120	85.1	141	75.4
Total	**30**	**16.0**	**157**	**84.0**	**187**	**100**

X^2 = 2.966 P = 0.227

4.11 Relationship between awareness on health effects of drug residues and level of education of personnel who administers drugs.

A total of 30 respondents were aware of the health effects. Twenty seven respondents whose dairy cattle were treated by personnel with a long course in veterinary sciences, were aware of the health effects. The association between level of education of personnel who administered drugs and awareness was not statistically significant $P =$ 0.314. Table 9.

Table 9. Relationship between awareness on health effects of drug residues and level of education of personnel who administers drugs

	Awareness on health effects of drug residues					
	Aware		Not aware		Total	
Level of education of personnel who administered	**n**	**%**	**n**	**%**	**n**	**%**
Primary	1	11.1	8	88.9	9	4.8
Secondary	2	40	3	60	5	2.7
Long course in vet science	27	15.6	146	84.4	173	92.5
Total	30	16.0	157	84.0	187	100

X^2 = 2.318 P = 0.314

4.12 Association between age of respondents and awareness on drug withdrawal periods

The respondents who aged between 40-59 years formed a large proportion of those who were aware of the withdrawal periods (76%). However, the relationship between age of respondents and awareness was not showed to be statistically significant $P = 0.267$. Table 10.

Table 10. Association between age of respondents and awareness on drug withdrawal periods.

	Awareness on drug withdrawal periods					
	Aware		Not aware		Total	
Age group	**n**	**%**	**n**	**%**	**n**	**%**
20-39	35	67.3	17	32.7	52	27.8
40-59	73	76	23	24	96	51.3
60-79	27	71.1	11	28.9	38	20.3
80+	0	0.0	100	0.5	1	0.5
Total						

X^2 = 3.947 P = 0.267

4.13 Association between place of residence and awareness on drug withdrawal periods

The proportion of the respondents who were aware on withdrawal periods in all five wards were almost the same. There was no variation in the proportion of respondents who were aware between places of residence. The association showed to have no statistical significance $P = 0.513$. Table 11.

Table 11.Association between place of residence and awareness on drug withdrawal periods

Ward	Awareness on drug withdrawal periods					
	Aware		Not aware		Total	
	n	%	n	%	n	%
Kibamba	30	69.8	13	30.2	43	23
Kimara	25	73.5	9	26.5	34	18.2
Mbezi	28	63.6	16	36.4	44	23.5
Kawe	31	77.5	9	22.5	40	21.4
Kunduchi	21	80.8	5	19.2	26	13.9
Total	**135**	**72.2**	**52**	**27.8**	**187**	**100**

X^2 = 3.275 P = 0.513

4.14 Livestock officers (informants).

Two livestock officers (LOs), one male and one female were interviewed at Kinondoni Municipal Office. One of the LO, a male had a diploma in Animal Production and the rest had diploma in animal health. The work experience of those LO ranged from 13 to 19 years. They listed a number of commonly used antibiotics in dairy cattle which included oxytetracyclines (10% and 20%), penstreptomycin and gentamycin which were all administered through intramuscular route. On the withdrawal period and health effects, LOs reported to rarely advice the SSDCFs through workshops and the follow up on their compliance was not done. Both of them were aware of the drug withdrawal periods and some of the health effects of drug residues to humans. However they said they had not received any complaint from consumers associated with drug residues.

4.15 Commonly sold antibiotics in the veterinary drugs shops.

Three veterinary shop sellers/owners (one male and two females) with their shops located at Ubungo namely Madunga Vetagro, Mema vetagro and Ubungo veterinary clinic were interviewed. Two sellers had diploma in animal health and one had a form four education. The sellers/owners had experience ranging from 3 to 13 years. The commonly antibiotics sold and the average number of bottles sold in a year are as shown in Table 12. All shop owners/sellers reported that normally SSDCFs get advice from the shops sellers on which drug to use. Before they are being given the proposed drugs, sellers advice SSDCFs on drug withdrawal periods. The two veterinary drug sellers with diploma in animal health knew the health effects of drug residues.

Table 12. Commonly sold antibiotics and amount sold per year.

Veterinary shop	Frequently sold antibiotics	Average amount sold per year
Madunga vetagro	Oxytetracyclines 10% and 20%	390 bottles @ 100ml
	Penistreptomycin	72 bottles @100ml
	Gentamycin	36 bottles @ 100ml
Mema vetagro	Oxytetracyclines 10%	144 bottles @ 100ml
	Penistreptomycin	78 bottles @ 100ml
	Sulfadimidine	84 bottles @ 100ml
Ubungo vet clinic	Oxytetracyclines 20%	1080 bottles @100ml
	Penistreptomycin	1000 bottles @ 100ml

4.16 Interactions between independent variables.

Direct logistic regression was performed to assess the impact of a number of factors on the likelihood that SSDCFs would be aware of the drug withdrawal periods. The model contained five independent variables (sex, age, level of education of SSDCFs, main occupation of SSDCFs and place of residence). As shown in table 13, only one of the independent variable made a unique statistically significant contribution to the awareness on drug withdrawal periods (level of education). The confidence interval in this case did not contain the value of 1, therefore this result is statistically significant at $p<0.05$.This indicated that SSDCFs who had high education were over five times more likely to be aware on drug withdrawal periods than those who had low education.

Table 13. Interactions between independent variables

	B	S.E	Wald	df	*p*	Odds Ratio Exp (B)	95.0% C.I for Odds Ratio	
							Lower	Upper
Level of education	1.77	0.69	6.64	1	0.01	5.88	1.53	22.64
Sex	-0.58	0.36	2.66	1	0.10	0.56	0.28	1.12
Main occupation	0.36	0.56	0.40	1	0.53	1.43	0.47	4.30
Place of residence	0.44	0.49	0.81	1	0.37	1.55	0.60	4.01
Age	0.12	0.25	0.22	1	0.64	1.13	0.69	1.86
Constant	2.27	0.94	5.94	1	0.02	0.10		

CHAPTER FIVE:

5.0 DISCUSSION

The study was conducted to assess awareness on drug withdrawal periods among small scale dairy cattle farmers in Kinondoni Municipality. The findings established that a large proportion of respondents were aware of the drugs withdrawal periods but only a small proportion was aware of the health effects associated with consumption of milk that contain drug residues. Level of education has shown statistically significant association with awareness of both drug withdrawal periods and health effects of drugs residues. The respondents with high education were more aware of withdrawal periods and health effects than those with low education.

This indicated that SSDCFs who had high education were five times more likely to be aware on drug withdrawal periods than those who had low education.

The main reasons which increase awareness as reported by the respondents were advice from veterinary private practitioners and information on the label of the sachets or bottles. The commonly used antibiotics included oxytetracyclines, penistreptomycin, sulfadimidine, gentamycin and kanamycin.

5.1 Awareness of farmers on withdrawal periods of veterinary drugs.

Findings from the current study show that most of the respondents were aware of the drug withdrawal periods. The results are in line with those published in a study carried out in Morogoro Tanzania (Nonga *et al.*, 2009b). Moverover the results of this study correspond to those established in a study carried out in Kiambu district, Kenya where high level of awareness on withdrawal periods among farmers delivering milk was established (Ombui., 1994).

Differently, a study conducted in Michigani to dairy farmers on awareness to withdrawal periods for antibiotics showed that 96% of dairy farmers were aware (Marteniuk *et al*, 1988).

This study suggests that the proportion of SSDCFs who were aware of the drugs withdrawal periods could have been a result of the advice that was given by the veterinary private practitioners who took a lead in delivery of veterinary services to dairy cattle.

Furthermore it is probable that those who had attained high level of education were likely to ask questions from those who delivered services to dairy cattle regarding the use of antibiotics and the withdrawal periods. The SSDCFs who attained high level of education were also likely to get the information regarding withdrawal periods directly from the bottles or sachets of drugs through reading of the labels.

The occupation of the SSDCFs had statistically not shown to have association with the awareness on drug withdrawal periods. However, those who were employees might have been getting access to various publications at their work places of which enable them get aware of the drugs withdrawal periods.

The SSDCFs whose dairy cattle were treated by the qualified personnel were aware probably the advice on drug withdrawal periods was given to them during service delivery to their dairy cattle.

The place of residence of the SSDCFs did not show association with the awareness on drug withdrawal periods. This is probably because the SSDCFs shared the personnel who delivered services of whom delivered the services from one side to another side of the Municipality. Majority of SSDCFs who were middle aged were aware of the drug withdrawal periods. The possible explanation could be that they had come into contact with many different personnel who deliver veterinary services and sellers of drugs some of whom might had been advising them.

5.2 Awareness of farmers on health effects

The findings on health effects are contrary to those established in a study conducted in Canada where 96% of dairy farmers thought that antibiotic residues were of public health significance (Scoll *et al.*, 1991).

The findings of this study don't correspond to those established in other similar studies probably because private veterinary practitioners didnot tell SSDCFs the exact health effects of drug residues. According to the respondents majority of the SSDCFs who were not aware of the health effects of drug residues were not educated by the private veterinary practitioners during service delivery. The SSDCFs were rather being made aware of the drug withdrawal periods only.

Some of the veterinary drug shop sellers were also not aware of the health effects of drugs residues. It is likely that the SSDCFs who purchase drugs from those shops are not educated on the health effects of drug residues.

However the level of education of SSDCFs had showed a statistical significant association with the awareness on health effects of drug residues. Those who had relatively higher level of education were likely to read various publications of which can make them aware of the health effects of drug residues.

Nevertheless, those at higher level of education are likely to enquire information from the personnel who administeres drugs on the real health effects of the drug residues.

5.3 Factors those enhance awareness of SSDCFs on drugs withdrawal periods.

The findings on the reasons correspond to those established in a study conducted in Minnesota, Michigan, Wisconsin and New York which revealed that the primary sources of information about antibiotic use, dosage and withdrawal times were veterinarians for the conventional dairy farmers (Zwald *et al.*, 2004) and that other prominent sources of information were personal experiences and product labels.

Furthermore a similar finding was given in a report produced by (Canada Animal Health Institute – CAHI., 2004). In the study it was established that although all pharmaceutical products are labeled, veterinarians often leave additional written instructions on withdrawal periods.

The possible explanation on increase of awareness might be that SSDCFs were educated by the personnel who administered drugs probably because most of them had the required qualification.

Moreover the SSDCFs who were able to read the information on the drug label were likely to get aware of the drug withdrawal periods through reading on the labels of the drugs bottles or sachets. Nevertheless, sellers of veterinary shops might have been advicing the SSDCFs on drug withdrawal periods during purchase of drugs.

Furthermore the livestock officers were likely to contribute to the awareness of drug withdrawal periods during the work shops with SSDCFs which were organized rarely anyway. The workshops discussed among other things the drug withdrawal periods and nutrition requirements of the dairy cattle.

5.4 Commonly used antibiotics in dairy cattle

The findings of the commonly used antibiotics are similar to those established in a study carried out in Morogoro (Mmbando., 2004).

Similarly, Muriuki *et al.*, (2001) and Mitema *et al.*, (2001) reported higher uses of oxytetracycline in livestock production in Kenya.

The possible explanation from the current study might be that climate in Kenya and Morogoro is the same as that of Dar es Salaam. The dairy cattle diseases that require oxytetracyclines as the first line of treatment are likely to be the same. The respondents explained that diagnostic tools for dairy cattle diseases were not available closer to SSDCFs thus treatment was mainly symptomatic one. The symptomatic treatment probably made those who deliver services to

dairy cattle opt mostly for oxytetracyclines. Furthermore the common use of tetracyclines as antibiotic was probably caused by its need as the first line of treatment in anaplasmosis and East Coast Fever. In this study it was established that the aforementioned diseases were the commonly encountered. It might also be that tetracycline is commonly used because it is among the cheapest antibiotic which is readily available in veterinary shop over the counter.