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Assessment of Dairy Farmers' Hygienic Milking Practices and Awareness of Cattle and Milk-Borne Zoonoses in Jimma, Ethiopia

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Abstract
This study was conducted to assess smallholder urban dairy farmers' milking hygiene practices and awareness of cattle and milk-borne zoonoses in Jimma, Ethiopia. Data were collected from a total of 54 randomly selected dairy farmers using structured questionnaire. The results of the study showed that all respondents practiced hand milking, with twice (88.9%), thrice (7.4%) and once (3.7%) milking frequency per day. Most (93.6%) farmers were adhered to dairy hygiene practices. Majority (85.9%) of the farmers washed hand, milk utensils and udder before milking. Over 70.0% of the farms used treated municipal water supply for farm activities. About 61 and 13% of the farmers used common and individual towel for wiping udder, respectively. None of the farmers practiced post-milking dipping of teats and dry cow therapy. Of all the farmers interviewed, 57.4% were aware of anthrax only, while 42.6% were aware of anthrax, mastitis and tuberculosis are cattle zoonoses. Respondents' awareness levels of milk-borne zoonoses were 13, 11.1, 29.9, 70.4 and 7.4% for anthrax, brucellosis, mastitis, tuberculosis and salmonellosis, respectively. About 13, 27.8, 75.9 and 35% of the respondents reported that routes of contracting the listed cattle and milk-borne zoonoses were through contact with infected animal, contact with infected animal products, consumption of infected meat and consumption of infected milk, respectively. None of the farmers cooled milk before sale. Over 92% farmers boil milk before consumption, while 100% respondents and their family consumed unboiled sour milk (*ergo*). Based on the findings of this study, farmers' awareness level on cattle and milk-born zoonoses was low except for tuberculosis. Thus, to reduce animal and public health risks arising from cattle and milk-borne zoonoses, it is imperative to strengthen farmers' awareness, extension services and training programmes.

Keywords: Dairy cattle, farmers' awareness, milking hygiene, milk-borne zoonoses, urban

1. Introduction

Milk is considered as nature's single most complete food (O'Mahony, 1988) and is definitely one of the most valuable and regularly consumed foods. Milk is a complex mixture of fats, proteins, carbohydrates, minerals, vitamins and other miscellaneous constituents dispersed in water (Harding, 1999). Similarly it is a good growth medium for spoilage and pathogenic micro-organisms (Speer, 1998). Milk should have normal composition, not adulterated and produced under hygienic condition (Chamberlian, 1990). Contamination of milk and milk products with pathogenic bacteria is largely due to handling, processing and unhygienic conditions (Maity *et al*., 2010).

A Zoonoses is any infectious disease that can be transmitted from animals, both wild and domestic, to humans (WHO/FAO/OIE, 2004). Zoonotic diseases are major global threats to human and animal health. Of all recognized species of human pathogens, 58% are zoonotic (Woolhouse and Gowtage-Sequeria, 2005). In developing countries they constitute an important threat to human health (wastling *et al*., 1999). In Africa, it is estimated that infectious diseases account for up to 68% of all deaths especially in children and people infected with HIV/AIDS (Black *et al*., 2010). Sixty-one percent of the 1,415 species of infectious agents reported to cause disease in humans are naturally transmissible from vertebrate animals to humans and vise-versa (Taylor *et al*., 2001).

Animal source foods have found guilty for the majority of food-borne diseases (De Buyser *et al*., 2001) and incidences increase with increasing access to such foods especially without adequate hygiene, inspection for safety or satisfactory heating for killing pathogens (McCrindle, 2008). Being highly perishable commodity and highly nutritious food, milk serves as an ideal medium for the growth and multiplication of various microorganisms (Parekh and Subhash, 2008). According to Bertu *et al*. (2010) humans may be infected with milk-borne pathogens through consumption of infected raw or unpasteurized milk and milk products. Although milk and milk products are minor constituents in most diets but contaminated milk are responsible for up to 90% of all dairy related diseases of humans (De Buyser et al., 2001). Shirima *et al*. (2003) reported several pathogens resulting to milk-borne zoonotic diseases including brucellosis, enterotoxaemia and tuberculosis.

In the past two decades, urban dairy production constituted an important sub-sector of the livestock production system in Ethiopia. This system is contributing immensely towards filling in the large demand-supply gap for milk and milk products in urban centers, where consumption of milk and milk products is remarkably high (Azage and Alemu, 1998). The government of Ethiopia has developed favorable policy environment on the development of dairying to increase the supply of milk from smallholder farms both at rural and urban areas.

Currently, a large number of smallholder urban dairy productions are operating in the present study area using improved dairy breeds. However, information about milking hygiene practices and farmers' awareness on cattle and milk-borne zoonoses remains scarce. Thus, lack of information could result in public health risks and economic losses affecting the livelihoods of smallholder dairy producers. Hence, an understanding of farmers' knowledge on milking hygiene and cattle and milk-borne zoonoses is very important to reduce risk of cattle and milk-borne zoonoses transmission to humans. The aim of this study was to assess milking hygienic practices and farmers' awareness of cattle and milk-borne zoonoses in smallholder urban dairy producers in Jimma, Ethiopia.

2. Materials and methods

2.1 Description of the study area

The study was conducted carried in smallholder urban dairy farmers in Jimma, Oromia National State, Ethiopia. Jimma is located at 355 km south-western of Addis Ababa, capital of Ethiopia, having latitude of 7°41′N and longitude of 36°50′E and an elevation of 1704 meters above sea level. The area is characterized by a sub-humid climate of heavy annual rainfall that ranges from 1200-2000 mm. About 70% of the total annual rainfall is received during wet season, which lasts from the end of May to early September. Mean minimum, maximum and average temperatures recorded at the Jimma Station are 11, 25 and 17°C, respectively, and having a minimum temperature of 7°C to 12°C during the months of October to December (OPEDJZ, 2002).

2.2 Sampling procedure

A random sampling technique was used to select the households for the purpose of this study and a random survey of 54 smallholder urban dairy farmers who were actively involved in dairy production was conducted. A list of households owning dairy farms was obtained from records maintained by the Jimma City Multipurpose Dairy Development PLC. Before the formal interview a preliminary visit was made to locate the farms, obtain farmers consent and to give a brief description on our research objectives and farmers potential benefits of involving in the research.

2.3 Method of data collection

A single-visit-multiple-subject formal survey technique (ILCA, 1990) was used to collect data through interviews, conducted in the local language by the researcher using a pre-tested, structured questionnaire. Data obtained from respondents were on demographic characteristics, milking system, milking frequency, milking hygienic practices (washing of milkers' hand, milk utensils and udder before milking), farmers' awareness of cattle and milk-borne zoonoses, transmission routes, sources of farm water, housing management.

2.4 Statistical analysis

The computer Excel was used for data management and entry. All the collected data were coded and entered into the computer with Excel. The Statistical Package for Social Sciences (SPSS) software version 16.0 computer programme was used for data analysis. Descriptive statistics such as frequencies distribution and percentages were used to summarize the data.

3. Results and Discussion

3.1 Demographic characteristics of the respondents

Results of this study show that the average age and family size of the respondents was 51.26±10.99 years and 6.02±2.52 members/household, respectively. The average family size in the present study was lower than the findings of Asaminew and Eyasu (2009) showed that the mean family size in Bahir Dar and Mecha districts was 8.2 and 7.2 persons, respectively, and that of Tesfaye (2007) who reported the average family size of 5.7 persons. Of the total households, 42.9% had college and university education, and was higher than the findings of Yousuf Kurtu (2003) who reported in Harar milk shed 24% of the respondents had college and university education. Most of the respondents (75.9%) were male. In agreement with present findings, Azage (2004) Yitaye (2008) reported that in Addis Ababa and northwest Ethiopia, there were more male-headed households.

Most (96.3%) of the respondents owned no land use their residential compound as a place where dairying is carried out. Similar observations were made by different researcher (Sintayehu et al., 2008; Yitaye, 2008; Lobago et al., 2007; Azage, 2004; Teferee, 2003; Yosef et al., 2003) who reported that more than 80 % of the urban dairy farmers in different regions of Ethiopia lack access to land and use their residential compound for dairy production. According to RUFA (2001) accessibility to urban agriculture is curtailed by intense competition from other urban land uses such as housing and industrial development.

3.2 Milking hygiene practices

Methods of milking and milking hygiene practices are shown in Table 1. Results of this study showed that milking is done by hand (100%), with milking frequency of twice (88.9%), thrice (7.4%) and once (3.7%) a day, respectively. In agreement with our findings, Milligo et al. (2008) reported that all smallholder farmers in peri-urban areas in Burkina Faso practiced hand milking. In this study, farmers who kept local cows milked once a day due to their poor milk production. The findings of Zelalem (1999) showed that in Holetta, Selale and Debre Zeit, 83.3, 93.3 and 96.7% of crossbred cows are milked twice a day, respectively. Yitaye (2007) reported that 83.8% of the farmers in northern Ethiopia milked their cows twice a day. Once and thrice per day milking frequency was also reported by Sintayehu *et al*. (2008) in other urban dairy farms in Ethiopia.

In the present study, farmers indicated that thrice milking has increased milk production than milking once or twice/day. Despite increased milk production, respondents indicated that thrice milking of cows per day was labour and time demanding. The findings of Amos et al. (1985) showed that increasing the frequency of milking results in increased milk production. If the herd is provided with adequate nutrition to support the increased milk production, then the benefits are maintained over time (Amos *et al*., 1985).

The production of milk of good hygienic quality for consumers requires good hygienic practices, such as clean milking utensils, washing milker's hands, cleaning udder, and use of individual towels during milking and handling, before delivery to consumers or processors (Getachew, 2003). Results of the present findings revealed that majority (96.3%) of the farmers practiced hygienic milking, such as washing hand, milk containers and udder before milking. In the present study majority (85.19%) of the farmers used warm water for washing udder. Consistent with this study, Shewangizaw and Adisu (2014) reported that 93 and 77% of the farmers in Wolayta Sodo, Ethiopia washed hand and udder before milking, respectively. Depiazzi and Bell (2002) reported that pre-milking udder preparation and teat sanitation plays important part in the microbial load of milk, infection with mastitis, and environmental contamination of raw milk during milking.

In this study, most (85.19%) of the farmers used warm water and detergents to wash hand, milk handling containers and udder before milking. The respondents also reported that they wash their milk containers before and after use. The study observed that there was no a practice of medical examination of farm workers, particularly milkers for the reason of preventing the contamination of milk with diseases carried by man (e.g. typhoid, typhus and tuberculosis), which are the most common diseases in this study area. In addition, most of the dairy farm works had no proper farm cloths, boots, and hair cover.

In this study, 61 and 13% of the farmers used common and individual towels for wiping udder after washing, respectively. This is in agreement with the findings of Zelalem and Faye (2006) who reported that in the central highlands of Ethiopia, small and large scale dairy producers used common towel for drying udder. Shewangizaw and Adisu (2014) reported that only 7% of the farmers in Wolayta Sodo of southern Ethiopia used individual towel, and this is lower than our present findings (13%). The use of common towel may result in transmission of diseases, particularly mastitis. Therefore, this needs adequate extension services and training of the farmers on the problems of using common towel in the transmission of milk-born diseases. In this study, none of the farmers practiced dipping of teat after milking, as well as dry cow therapy. In contrast to our findings, Shewangizaw and Adisu (2014) reported that 10% of the farmers in Wolayta Sodo used teat dip solutions after milking.

In the present study, 100% farmers did not practice milk cooling after milking, because of lack of facilities for cooling milk, which is a serious problem to hygienic milk production. Contrary to the present findings, Shewangizaw and Adisu (2014) reported that 50% of the farmers in Wolayta Sodo cooled milk immediately after milking. Quinn et al. (2002) reported that cooling milk after milking reduces the risk for the growth of both pathogenic and spoilage bacteria.

Boiling of milk before consumption was highly practiced by 92.6% of the respondents, whereas all of the respondents and their family consume unboiled fermented/sour milk (*ergo*). A few households (3.7%) also indicated that they consume raw milk. Contrary to the results of the present study, Zelalem and Faye (2006)

reported that 45% of the respondents did not boil milk before consumption. About 92.6 and 3.7% of the farmers collected milk using plastic buckets and stainless steel cans, respectively. In agreement with this study, Shewangizaw and Adisu (2014) reported that 37 and 16% farmers used plastic bucket and stainless steel for collecting milk, respectively. Produced milk is delivered to place of sell using narrow-necked plastic containers and stainless steel. The farmers said that they preferred stainless steel pails for the reasons of easy cleaning and durability, but their high price and availability was a limitation to their wide utilization.

Table 1. Milking methods and hygienic milking practices followed by farmers at urban dairy farms, Jimma, Ethiopia

Parameter	N	%
Milking system		
Hand milking	54	100
Milking is done		
Hygienically (washing hands, udder and milk utensils before milking)	52	96.3
Not hygienically	2.0	3.7
Udder washing done with		
Warm water	46	85.19
Normal water	8.0	14.81
Use of towel for drying udder		
Individual towel	7.0	13.0
Common towel	33	61.1
No use of towel	14	25.9
Milking frequency per day		
Once	2.0	3.7
Twice	48	88.9
Thrice	4.0	7.4
Practice of teats dipping and dry cow therapy		
Yes	0.0	0.0
No	54	100
Milk collection containers		
Plastic bucket	50	92.6
Aluminum bucket	2.0	3.7
Both	2.0	3.7
Storage of milk before sale		
Cooled	0.0	0.00
As milked	54	100
Milk consumption		
Boiled	52	92.6
Raw	2	3.7

3.3 Dairy farmers' awareness of cattle and milk-borne zoonoses

Farmers' awareness of cattle and milk-borne zoonoses are shown in Table 2. The results of this study showed that almost all (100%) of respondents were aware of the existence of cattle zoonoses. Among the cattle zoonoses, 57.4% of farmers were aware of anthrax only, while 42.6% were aware of anthrax, mastitis and tuberculosis are cattle zoonoses.

With regard to farmers' knowledge about milk-borne zoonoses, they were aware of anthrax (13.0%), brucellosis (11.1%), mastitis (29.9%), tuberculosis (70.4%) and salmonellosis (7.4%). The results of the current study revealed that majority (70.4%) of the farmers were more aware of bovine tuberculosis than other milk-born zoonoses due to its frequent occurrence in the study area. In agreement with this study, the findings by Stanly (2012) showed that farmers were more knowledgeable about tuberculosis compared to brucellosis (74.3 vs. 2.9%) in north Malawi. Girma et al. (2012) reported that in Addis Ababa 88.54% and 49.48% of the respondents knew bovine tuberculosis and brucellosis respectively. In the present study, farmers' had lack of awareness on anthrax (87%), brucellosis (88.9%), and mastitis (70.1%), tuberculosis (29.6%) and salmonellosis (92.6%) as milk-borne zoonoses was recorded. Similar observations were made by Ekuttan (2005) who showed in Kenya dairy farmers lacked knowledge on specific milk-borne zoonoses.

The results of the present study revealed that respondents had low level of awareness on milk-borne zoonoses, except mastitis and tuberculosis, which are commonly available in this study area. The main reasons for the low level of awareness among dairy farmers are poor extension services, inadequate training and low education level. This is in agreement with the findings of Belay et al. (2012) and Jergefa et al. (2009) in Ethiopia, and Munyeme et al. (2010) in Zimbabwe. Thus, one way to approach the low awareness level of respondents on cattle and milk-borne zoonoses would be providing adequate extension services, training and education to the dairy producers on ways of controlling these diseases from infecting farm workers, dairy farming families and the public.

In the current study, respondents indicated that the most important means of contracting cattle and milk-borne zoonoses were through direct contact with infected animals (13%), contact with infected animal products (27.8%), consumption of infected raw meat (75.9%) and consumption of infected milk (35%). Most (75.9%) of the dairy farmers were aware of consumption of raw meat is the major means of contracting zoonoses disease, especially anthrax which occurs in Jimma and its soundings more often. The farmers reported that they disposed afterbirth and dead aborted calves without protection. Al-Majali et al. (2009) showed that proper disposal of aborted materials, infected milk or its products and practice of hygienic milking and milk storage are important in controlling zoonotic pathogens.

Table 2. Farmers' awareness of cattle and ilk-borne zoonoses at urban dairy farmers in Jimma, Ethiopia

Variables	Frequency	Percentage
Awareness on cattle zoonoses	54	100
Named cattle zoonoses		
Anthrax	31	57.4
Anthrax, mastitis and tuberculosis	23	42.6
Named milk-borne zoonoses		
Anthrax	7	13.0
Brucellosis	6	11.1
Mastitis	16	29.9
Tuberculosis	38	70.4
Salmonellosis	4	7.4
Routes of transmission of animal and milk-borne zoonoses		
Contact with infected animal	7	13
Contact with infected animal products	15	27.8
Consumption of raw meat	41	75.9
Consumption of raw milk	19	35

3.4 Sources of farm water

Table 3 gives the different sources of water for dairy farms. An adequate supply of fresh and clean water is an important pre-requisite for hygienic milk production and farm sanitation. In the present study, 70.4% of the dairy farmers had access to clean treated water supply. Similarly, Shewangizaw and Adisu (2014) reported that 80% of dairy farmers in Wolayta Sodo of southern Ethiopia had access to clean water. The watering frequency of cattle was once a day (92.5%) in wet season and twice a day (83.3%) in dry season. The findings of this study (Kedija et al., 2008) indicated that watering frequency of cattle were reduced from 'every day' watering in the wet season to 'once in two days' for 97% of the households in the dry season in Mieso district in east Ethiopia.

In this study, most of the households indicated that they provide rationed water by mixing it with concentrate feeds than providing free water alone. The findings of this study (Sintayehu et al., 2008) showed that farmers provide water to their cattle rationed with feeds. In this study, none of the respondents provided drinking water for their cattle *ad libitum*. Unlike the indigenous breeds, crossbred dairy cattle require higher amount of water, but farmers had limited knowledge on the importance of water for milk production. The findings of this study (Radostitis, 2001) showed that inadequate water supply results in reduced dry matter intake and milk production of dairy cows, and a consequential loss of body weight.

Table 3. Sources of water supply for dairy farms in the study area

Parameter	**N**	**%**
Sources of water for drinking and farm hygiene		

Pipe water	38	70.4
River water	1	1.9
Pipe and well water	2	3.7
River and pipe water	4	7.4
Well water only	1	1.9
Watering frequency in wet season		
Once per day	50	92.5
Twice per day	1	1.9
Three times per day	3	5.6
Watering frequency in dry season		
Once per day	3	5.6
Twice per day	45	83.3
Three times per day	6	11.1

3.5 Housing management

Housing characteristics of the farms is shown in Table 4. In the study area, cattle were managed under intensive production system due to land scarcity. The findings of this study (Gichohi, 1994) reported that good housing promotes livestock health and allows the animals to express normal behavior patterns. The findings of the present study showed that 100% of the farmers provided closed house, with corrugated iron sheet roofing. The findings of Hossain et al. (2004) showed that 63% farmers provided closed house to their cattle. In this study, 72, 13 and 11.1% cattle sheds had concrete, wooden and earthen floor structure, respectively. The findings of Emebet and Zeleke (2008) showed that the major floor structure of cattle shed was hardened soil in Dire Dawa, eastern Ethiopia.

The findings of the present study showed that Most (90.7%) of the farmers had both feed and watering troughs in animal shelter. Most (55.6%) of the farmers cleaned cattle sheds twice per day. The study observed that the animals in most of the farms were confined in poor ventilated, unhygienic and crowded stables both day and night, and milked there. Due to lack of space, disposal of manure poses a difficult problem. Generally, except very few farms animal sheds used by the farmers can be characterized as sub-standard in hygiene for quality milk production.

Table 4. Dairy cattle housing characteristics at urban dairy farmers in Jimma, Ethiopia

Variables	N	%
Housing system		
Permanent closed house	54	100
Open house	0.0	0.0
Roof type		
Corrugated sheets	54	100.0
Wall type		
Wood and mud	43	79.6
Wooden (inner) and brick (outer)	2	3.7
Corrugated sheets	9	16.7
Floor type		
Concrete	39	72.2
Wood	7	13.0
Concrete and wood	1	1.9
Stone slab	1	1.9
Earthen	6	11.1
Barn facilities		
Feed trough (FT) only	1	1.9
FT and water trough (WT)	49	90.7
No barn facility	4	7.4
Frequency of cleaning cattle house per day		
Once	14	25.9
Twice	30	55.6
Thrice	10	18.5

4. Conclusions

It can be concluded from the results of the present study that most of the farmers followed some standard milking hygiene practices such as washing of milk containers, milkers' hand and udder before milking.

Generally, dairy farmers' cattle and milk-borne zoonoses awareness was found to be low. Most of the dairy farmers had access to clean and treated water supply. The animals in most farms are kept in poor ventilated and crowded sheds. Due to lack of space, disposal of manure poses a difficult problem. Generally, except in a very few farms animal shelters used in the study area can be characterized as sub-standard in hygiene for production of quality milk. From results of the present study, it is imperative to provide adequate extension inputs and training to dairy farmers to increase their awareness on milk hygiene, cattle and milk-borne zoonoses and their control methods in order to reduce public health risks.

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