Preliminary Observations On Accessibility And Utilisation Of Water In Selected Villages In Dodoma Rural And Bagamoyo Districts, Tanzania

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Abstract

A study was carried out to establish the availability and utilisation of water in eight villages in Dodoma Rural and Bagamoyo districts, Tanzania. A total of 128 respondents were interviewed, 64 in each district. Main sources of water for domestic and animal uses in Dodoma Rural district were wells and dams while in Bagamoyo district; main sources of water were dams and ponds. Nine percent of the respondents reported water to be 'readily available', whereas 50% and 41% reported water to be 'not easily available' and 'problematic', respectively. The average distance and time taken to water sources were 0.8±0.6 (mean±Std dev), 3.2±2.7 and 3.4±2.7 kilometres; and 0.5±0.6, 1.5±0.2 and 1.8±0.1 hours for respondents who reported water as "readily available", "not easily available" and "problematic", respectively. More than two-thirds of the respondents reported that water sources were shared between households and also 71.9% reported sharing of water sources between humans and animals, particularly cattle, sheep and goats. The proportions of respondents that reported occurrence of enteric or diarrhoeic cases amongst household members within the past three months before the study were 35.9% and 37.5% in Dodoma Rural and Bagamoyo districts, respectively. All respondents in Dodoma Rural district had latrines and 84% in Bagamoyo district had these facilities. All except one of the respondents who had no latrines in Bagamoyo district were from Chamakweza, a village dominated by a pastoral Maasai community. A significantly higher proportion of diarrhoeic cases were reported at this village when compared to the other three villages in Bagamoyo district (p=0.029). These preliminary findings show that availability of safe water is a serious problem in the study areas and that this may have serious consequences on public health. Studies to establish the association between water quality and magnitude of zoonotic enteric pathogens are underway.

Introduction

Water is an important resource that supports life of all living organisms. Water is used for different purposes including drinking, cooking, washing and crop cultivation. Despite the fact that water is an important resource, many areas particularly in poor countries, face the problem of access and availability of safe water. For instance, it is estimated that one billion persons in developing countries do not have access to safe drinking water (Rangel *et al*., 2003). In Tanzania, the Government launched a twenty-year 'National Water Supply Programme' during the year 1971 with the aim of improving access to safe and portable water in both the rural and urban areas. After twenty years of implementation of the programme, access to safe water was improved from less than 5% and 10% to 42% and 68% in rural and urban areas, respectively (Madulu, 2002; Ministry of Water and Livestock Development-MWLD, 2002). This indicates that access to safe water is still more a problem of rural than urban areas in Tanzania. Therefore, the impact of poor water supplies falls primarily on the poor rural-based communities. In addition to low supply of safe water for domestic uses, lack of water for agricultural purposes is another constraint in Tanzania. In most cases, due to increasing demand of water for domestic and agricultural uses, conflicts are not uncommon in rural areas (Kashaigili *et al*., 2002). A limited research work on water resources carried out in Tanzania has neglected ponds and dams, which are normally used as source of water for washing and livestock in areas dominated by livestock keepers (Madulu, 2002). Sharing of water source between humans and livestock may be associated with a number of problems including competition over limited resources and contamination of water bodies by either humans or livestock excreta which may lead to zoonotic water-borne diseases. Some studies have reported occurrence of epidemics that may be associated with bacterial, viral and protozoan infections in humans (Clark *et al*., 1996; Hutin *et al*., 2003).

Few studies have been conducted in Tanzania to assess the availability of water for both domestic and agricultural or livestock uses (Madulu, 2000). Consequently there is scanty information on water accessibility and utilisation for both domestic and animal uses. The aim of this work was to carry out a preliminary study to assess the accessibility and utilisation of water in Dodoma Rural and Bagamoyo districts of Tanzania, which are semi-arid and have chronic water shortage in addition to having high populations of livestock (Melewas and Rwezaula, 1998; Ngomuo *et al*., 2003). Another objective was to characterise the water sources for both domestic and animal uses and associated health risks.

Materials And Methods

Study areas

The study was carried out in Bagamoyo and Dodoma Rural districts located about 100 km East and 300 km West of Morogoro town, respectively. Bagamoyo is one of the six districts of the Coast region that has chronic water shortage. The district receives approximately 800 mm of rainfall per annum and has human population estimated at 230,164 (Ngomuo *et al*., 2003; United Republic of Tanzania-URT, 2003). This study was specifically carried out in Msoga division of Bagamoyo district as it is the area mainly dominated by pastoral Maasai communities who own a large number of cattle, goats and sheep estimated at 135,800; 13,080 and 6,972, respectively (Ngomuo *et al*., 2003). The other study site, Dodoma Rural district, is one of the five districts of a semi-arid Dodoma region. The district receives less than 600 mm of erratic rainfall per annum and has human population estimated at 443,680 (Kanuya *et al*., 2002; URT, 2003). The study area in Dodoma Rural district is dominated by agro-pastoral Gogo communities. These two study areas were considered ideal for assessment of human-livestock interaction in sharing

water resources and associated public health implications and environmental degradation.

Study design and data collection

This study was carried out between February and May, 2003 in the two districts. Participatory Rural Appraisal (PRA) techniques including focus group discussions and in-depth interview of key informants were used to collect information related to water resources and livestock keeping in the study areas. This allowed identification of study villages for the cross-sectional study, which were selected, based on presence of different water sources that supply water to villagers. A total number of eight villages (four in each study district) were included in the cross-sectional study. These were Chamakweza, Chahua, Mindu-tulieni and Matuli villages in the Bagamoyo district and Chalinze, Matumbulu, Ikowa and Msisi villages in the Dodoma Rural district. A total of 128 respondents were interviewed, 64 in each district.

A number of indicators for accessibility and availability of water for domestic use were used in this study. Three categories of "readily available", "not easily available" and "problematic" were adopted to classify availability of water. Respondents were also asked to estimate distance in kilometres (km) and time in hours (hrs) taken to reach the nearest water source 'within the village'. Other information related to contamination of water sources and history of enteric problems, defined by occurrence of diarrhoeic cases amongst family members within the past three months before the study was collected.

Data analysis

Information collected was entered into Epi Info database for storage and further analysis (Dean *et al*., 2001). The proportions of categorical variables and means were computed. The Chi-squared test was used to compare proportions while Analysis of Variance (ANOVA) was used to compare means of categorical variables. Such comparisons were made using the Epitable calculator in the Epi Info software. This software was also used to determine associations between dependent and independent variables using 2X2 contingency tables.

Results

Sources of water for domestic and animal uses

Of the 128 respondents in the two districts, 45 (35.1%) reported wells as their main source of water for domestic uses. Other sources of water for domestic uses were dams 30 (23.4%), ponds 28 (21.9%) and tap water 23 (18.0%). Comparison of the two districts showed differences, with Dodoma Rural (n=64) depending more on wells 43 (67.2%) compared to the Bagamoyo district (n=64) where most people 60 (93.8%) depended on either ponds 24 (37.5%), dams .19 (29.7%) or tap 17 (26.6%) as their main sources of water for domestic uses. Of the 128 people interviewed, 106 (82.8%) responded to the question on source of water for animal uses. Different sources of water for animal in the two districts are shown in Figure 1.

Again there was differences between districts, with the Dodoma Rural respondents (n=49) reporting dams 27 (55.1%) and wells 16 (32.7%) to be their main sources of water for animal uses while in Bagamoyo district (n=57), dams 21 (36.8%) and ponds 21 (36.8%) were the main sources of water for animal use. Water sources were either solely constructed by the government or jointly with villagers and only a few water facilities were solely constructed by villagers. Involvement of non-governmental organisations in construction of water facilities was reported in Dodoma Rural district only. Of the 128 respondents in the two districts, 91 (71.1%) reported that water sources were shared between households and also 92 (71.9%) reported sharing of water sources between humans and animals, particularly cattle, sheep and goats.

Of the 128 respondents interviewed, 94 (73.4%) were aware of problems associated with sharing of water between humans and animals. More than 50% of respondents interviewed reported multiple problems associated with shared water resources. The most common problems were risk of disease transmission between humans and animal, competition between humans and animals for water resources and damage of water sources (Fig. 2). A small proportion of respondents 5 (5%) reported conflict between agricultural crop farmers and livestock

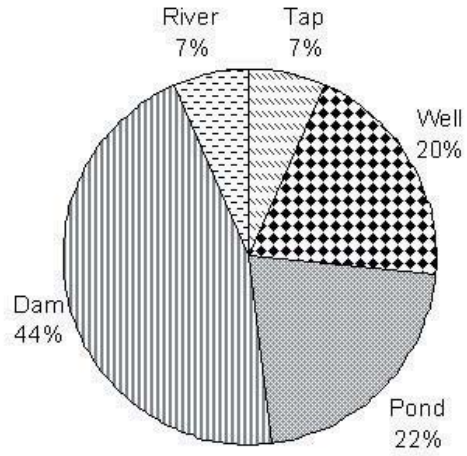

Fig. 1: Sources of water for animal uses in Dodoma Rural and Bagamoyo districts

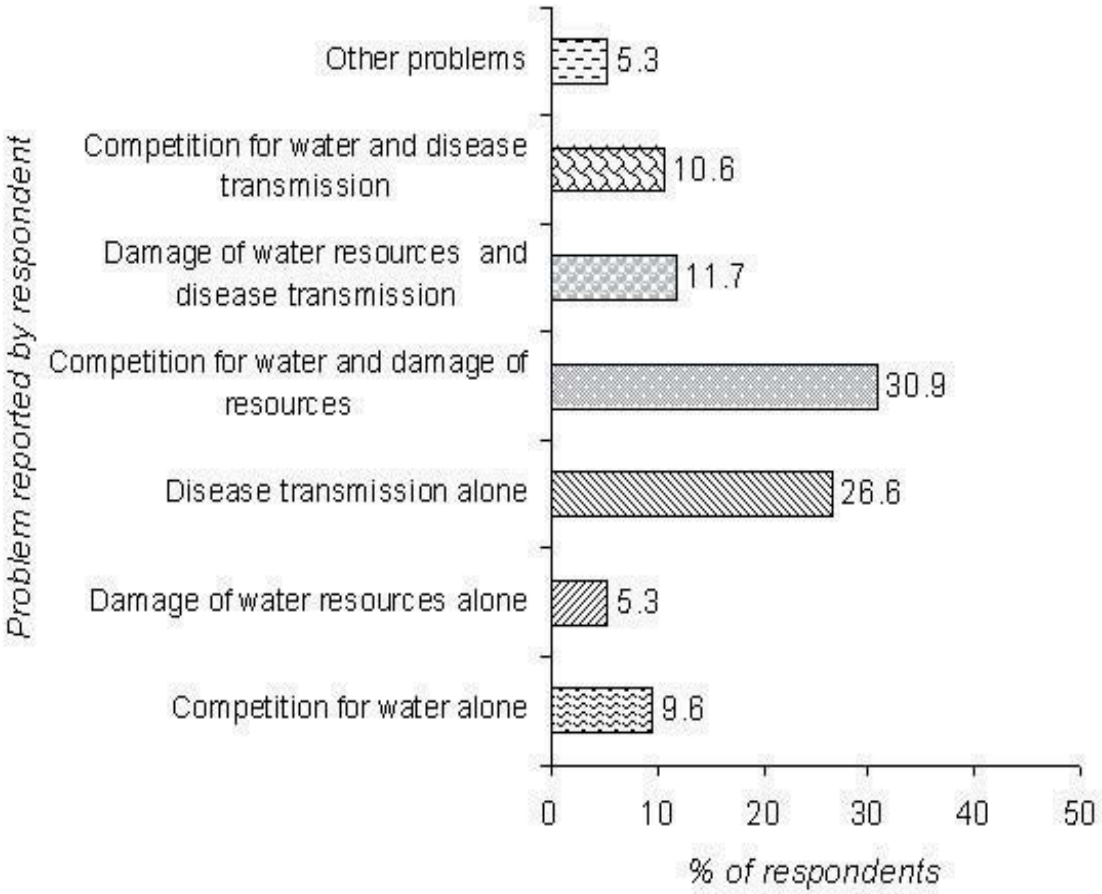

Fig. 2: Problems associated with sharing of water resources between humans and animals as reported by respondents in Dodoma Rural and Bagamoyo districts

keepers as other problems associated with sharing of water between humans and animals. Respondents in the two districts had similar knowledge and perceptions regarding problems associated with sharing water resources between humans and animals. Of 128 respondents, 65 (51%) were aware of sustainable use of water resources. There was significantly lower number of respondents in Bagamoyo 25 (39.1%), which was aware of the sustainable use of water resources compared to the respondents in Dodoma Rural district 40 (62.5%) (p=0.008). The methods of sustainable use of water resources reported by farmers included contribution to the village water fund, care and maintenance of water sources and punishment to the defaulters using by-laws related to proper use of water sources in the villages.

Perception on availability of water

Respondents were also asked to assess the availability of water for domestic uses using three categories of "readily available", "not easily available" and "problematic". Nine percent of the respondents reported water to be 'readily available', whereas 64 (50)% and 52 (40.6%) reported water to be 'not easily available' and 'problematic', respectively. The average distance and time taken to water sources were 0.8±0.6 (mean±Std dev), 3.2±2.7 and 3.4±2.7 km; and 0.5±0.6, 1.5±0.2 and 1.8±0.1 hours for respondents who reported water as "readily available", "not easily available" and "problematic", respectively (Table 1). The corresponding maximum time taken to reach the water source was 2, 6 and 5 hours, respectively.

Water availability was also compared between the two districts. Eighty three respondents were able to estimate the distance in kilometres to the nearest water source in the village. The average distance reported by respondents to reach the nearest water source within village in Dodoma Rural and Bagamoyo districts was 3.5±2.2 and 2.9±3.0 km, respectively (Table 1). There was no significant difference in the distances between the two districts. The time taken to reach water source within village was significantly longer in Dodoma Rural district (1.9±1.3 hrs) compared to the time taken in Bagamoyo district (1.2±0.9 hrs) (p=0.001).

Sanitation indicators and water-borne infections in study areas

All respondents in Dodoma Rural district reported to have a latrine in their compound. However, 10 (15.6%) of people interviewed in the Bagamoyo district had no latrines. All but one of these people were from Chamakweza, a village dominated by a pastoral Maasai community.

The number of respondents that reported occurrence of enteric or diarrhoeic cases amongst household members within the past three months before the study was 23 (35.9%) and 24 (37.5%) in Dodoma Rural and Bagamoyo districts, respectively. In Bagamoyo district, diarrhoeic cases reported at Chamakweza, Chahua, Mindu-tulieni and Matuli villages were 11(68.8%), 4 (25%), 5 (31.3%) and 4 (25.0%), respectively. There prevalence of diarrhoeic cases was significantly higher at Chamakweza village when compared to the other three villages (p=0.029). Of the 16 respondents at Chamakweza

Table 1: Respondents' perception on water availability in Dodoma Rural and Bagamoyo districts

Variable	Distance to water source (km) Mean±St Dev (Range)	Time taken to water source (hrs) Mean±St Dev (Range)
Water availability category (n=83)		
Readily available	0.83±0.61 (0.5-2.0)	0.54±0.57 (0.17-2.00)
Not easily available	3.24±2.72 (0.25-15.00)	1.46±0.19 (0.10-6.00)
Problematic	3.43±2.66 (0.50-14.40)	1.78±0.12 (0.17-5.0)
District		
Dodoma Rura (n=59)	3.47±2.19 (1.00-10.00)	1.88±1.34 (0.25-6.00)
Bagamoyo (n=59)	2.87±3.01 (0.25-15.00)	1.16±0.95 (0.10-5.00)

village, 9 (56.3%) had no latrines and a big proportion of them 5 (56%) reported diarrhoeic cases amongst family members within the past three months before the study (Fig. 3).

Discussion And Conclusion

Results from this study show that different sources of water exist, with wells dominating in Dodoma Rural while dams and ponds are common in Bagamoyo district. This difference may be explained by difference in the amount of rainfall in the two districts. Dodoma Rural receives less amount of rainfall than Bagamoyo, therefore it is easier to have enough surface water for ponds and dams in Bagamoyo than Dodoma Rural district (Kanuya *et al.*, 2002; Ngomuo *et al*., 2003). Another possible explanation may be the role played by the government and NGOs to construct the current water sources in the two districts, which may also be influenced by other geo-climatic factors.This is supported by the fact that with adoption of the national twenty-year 'Water Supply Programme' during 1971, the Government of Tanzania was responsible to construct and supply free water in rural and urban areas until 1991 when the water policy, with concepts of cost-sharing and cost-recovery in water supply, was launched (MWLD, 2002; Rugeiyamu, 2003).

This study found also that water resource was not easily available for both domestic and livestock uses in the two districts. For instance, more than 95% of respondents in Bagamoyo and Dodoma Rural district reported that water was not easily available. Overall, the average distance to a water source 'within a village' as reported by respondents in this study was 2.5 km. The proportion of households that had to walk distance less than 400 metres (the indicator set by the government in the Water Policy) to the water source was 1.2% only. This shows how difficult it is to access water in the study areas. The maximum distance to a nearest water source 'within the village' as reported by respondents in this study was 15 km

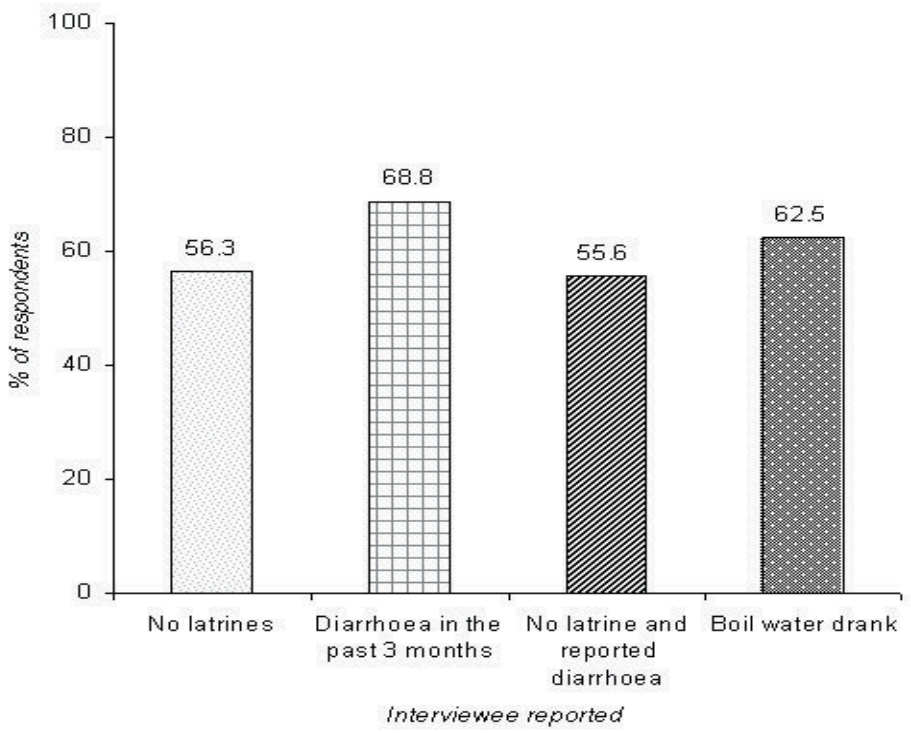

Fig. 3: Sanitation indicators and prevalence of diarrhoea at Chamakweza village

This is more than the maximum distance reported earlier in other studies of between 5 and 10 km (Madulu, 2002). Although this study did not collect information related to seasonal variation of access and uses of water, it is presumed that the situation is critical during the dry season when temporary sources of water are completely dry.

Unavailability of the water resources was also complicated by the fact that more than 70% of the households share this scarce resource with livestock. This may imply that there is high risk of water sources being contaminated with animal faeces, a process which may pose public health risks. Contamination of water sources with human and animal excreta is known to have serious impact on public health, particularly transmission of water-borne diseases. A number of water-related diseases of both humans and animals have been reported. In humans, these may include water-borne diseases such as cholera, typhoid, shigellosis, meningitis and hepatitis A and E (Anon, 1998). Other diseases that are caused by aquatic organisms include guinea worm (dracunculiasis), paragonimiasis, clonorchiasis and schistosomiasis. Other infections that may be acquired through drinking water contaminated with faeces of humans and animals include bacteria (*Salmonella, Campylobacter*), viruses and protozoan (*Cryptosporidium, Giardia*, and *Toxoplasma*) organisms. A number of clinical symptoms may be associated with water-borne diseases. The most common ones are diarrhoea, stomach cramps, nausea, vomiting and low-grade fever (Anon, 2000). More than 36% of the respondents reported diarrhoeic cases within the period of three months before the study. This may be an indirect indication of the prevalence of water-borne infections in the study areas. Although this paper has not yet associated diarrhoeic cases with the prevalence of water-borne organisms, further studies are being carried out in the same villages to establish the association.

Findings at Chamakweza village were interesting, in that, relatively higher proportions of households that reported diarrhoeic cases had no latrines. The possible explanation of these findings may be that drinking water in the village is contaminated with human and animal excreta. This is supported by dependency on ponds as the main source of water for both domestic and animal uses in this village. Another possible explanation may be that poor personal hygiene practices such as washing hands without soap prior to eating food which was also common at Chamakweza village, is a risk factor for water-borne diseases (Hutin *et al.*, 2003).

In conclusion, this study characterised the access and utilisation of water in semi-arid areas with chronic water shortage. The work has also identified other areas related to animal-water-human interaction and associated public health risks that need more research work. The next phase will focus on the extent of water contamination and associated water-borne diseases. The potential risks, both in space and time, will be identified and quantified so that the information may help policy makers in formulation of intervention strategies.

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