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ASSESSMENT OF BACTERIOLOGICAL QUALITY AND TRADITIONAL TREATMENT METHODS OF WATER-BORNE DISEASES AMONG WELL WATER USERS IN JIMMA TOWN, SOUTHWEST ETHIOPIA

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ABSTRACT

The purposes of this study were to assess the bacteriological quality of drinking well water and the traditional methods of treatments used against water-borne diseases among residents of Jimma town well water users. A cross-sectional study design was conducted using structured and semi-structured questionnaire through interview to collect data regarding water handling practices, water-borne diseases, symptoms and traditional methods of treatments from 30 purposively selected well water owners of Jimma town. Ten wells were also randomly selected, and water samples were analysed for physico-chemical and bacteriological quality. The mean pH value of the water was 7.2 while the mean temperature was 21.56^{0}C. Moreover, the well water was not in acceptable level for drinking in terms of microbial quality as large number of diverse group of bacterial load was recorded during laboratory analysis. Accordingly, the mean cfu/ml of aerobic mesophilic bacteria (AMB) was 815.4; while the mean cfu/ml was 264 and 306.8 for coliforms and enterobacteriaceae, respectively. The isolated colonies also displayed diverse morphological and biochemical features. Furthermore, the position and distance of the wells from latrines, depth of the wells, water handling as well as water storage practices of the well water users were the major factors for the poor quality of the water. Multiple disease symptoms (diarrhoea, vomiting, abdominal cramp and others) were frequently reported cases among the well water users, children and women being the most affected groups. Various parts of different plants (seed, leaf, root, fruit etc) and spices such as korarima (*Aframomum corrorima*), garlic (*Allium sativum*), and ginger (*Zingeber officinale*)) as well as other materials like honey, butter and coffee flour have been used by the residents as traditional treatment methods against diverse water-borne diseases.

Keywords: drinking well water, bacteriological quality, physicochemical, traditional medicine, water-borne disease.

INTRODUCTION

Water is basic necessity for human health and biological activity within living things. It is well known that access to safe water and sanitation are important in reducing disease transmission [1]. Most infectious diseases are caused by pathogenic microorganisms such as bacteria, virus, protozoa and other parasites that cause life-threatening conditions in relation to drinking water. Insufficient treatment of water and contamination of the water by various pathogenic microorganisms can be potential to cause water borne diseases of diverse symptoms. The symptoms for these illnesses range from fever and malaise to gastro-intestinal symptoms such as diarrhea and stomach aches. Waterborne illnesses usually occur when sanitation and living conditions of human beings are generally poor in addition to lack of safe water sources [2, 3]. For instance, Study from some East African countries revealed that determinants of diarrhea morbidity are attributed to poor hygiene (unsafe disposal of faeces and wastewater), education level of household head, obtaining water from wells or surface sources and per capita water used for cleaning [4]. The risk of diseases like diarrhoea becomes worse when people continuously drink or use water obtained from wells, live in poor housing conditions, and have low family income and low educational attainment.

Water borne microorganisms can enter in to lake, river, stream, ground water and other body of water through any anthropogenic and natural processes worldwide. Any time such contaminated water may be used for drinking, cooking, swimming or other purposes and hence, there could be a risk that such organism will enter the body and cause disease and death [5]. According to estimates by WHO, about 80% of illness in less developed countries stems from lack of safe water and adequate sanitation. Certainly the majority of these illnesses are due to waterborne diseases and impurities in water.

To significantly reduce the rate of infection due to water related diseases, there is a need for improvements in water supply and sanitation services. Moreover, improvement must be accompanied by activities to promote change in health related waterborne diseases [6].

In Ethiopia about three-fourth of the health problems in children are communicable diseases arising from the environment and particularly related to water and sanitation, most of which being associated with microbial contamination of drinking water [1].

Access to drinking water in Jimma is very scarce even though majority of households have tap water lines [7]. The majority of the city residents are still using water in an irregular condition. Therefore many people widely depend on unprotected well water for various purposes such as cleaning utensils, washing clothes, bathing and even drinking. According to [8], assessment of the microbiological quality of drinking water primarily aims at protecting people who consume water, which may contain pathogens that lead to water borne diseases and illnesses.

This study was therefore designed to assess some physico-chemical and bacteriological quality of well-waters as well waterborne diseases and traditional methods of treatments used by well water owners in Jimma town.

MATERIALS AND METHODS

Study design

A cross-sectional type of study design with structured questionnaires and interview were used in the study.

Study area and period

The study was conducted in Jimma town, Oromia region, south west Ethiopia. Jimma town is situated at 353 km from Addis Ababa and located at 07^{o}39' latitude and 36^{o}50' longitude. The town has 220 km^2. The climate condition of the district is Woina Dega and the mean temperature ranges from 18^{0}C-26^{0}C. The major ethnic group is Oromo and coffee is the main product of the town. The study was conducted from February to May, 2011.

Preliminary study

Before conducting the actual study, a socio-demographic data of the residents in the study area were conducted to understand the awareness of the community towards water borne diseases. Structured questionnaire was prepared considering the preliminary information as a basis to collect available information from the community. Accordingly, data was collected using structured questionnaire and interview from 30 purposively selected well water owners and users in the town. Furthermore, 10 well water owners and users were randomly selected among the 30 well water owners to take water samples for further laboratory analysis.

Sample size and sampling techniques

A pre-designed open and close ended questionnaire was used to collect information from 30 purposively selected well water owners in Jimma town. The sample size was determined by using [9] formula

$$n = \frac{Z^2 pq}{d^2} \quad \text{where,}$$

n = minimum sample size

M = total well water = 1900

N = total population = 95475

p = estimated prevalence of well water owners

$$p = \frac{M}{N} = \frac{1900}{95475}$$

p = 0.0199

q = 0.9801

Z = 1.96

d = margin of error = 0.1

$$n = \frac{(1.96)^2(0.0199)(0.9801)}{(0.05)^2} \approx 30$$

Physico-chemical analysis of well water

The temperature and pH of well water samples were measured using thermometer and pH meter, respectively at Jimma University, Biology Department Postgraduate and Research Laboratory.

Microbial analysis

About 100ml water sample from each 10 randomly selected well waters were collected using sterile flask of 250 ml capacity.

Aerobic mesophilic count

About 30ml of water from each of the samples was taken and series of serial dilutions were conducted. From appropriate dilution, 0.1 of ml aliquots were spread plated in duplicates on pre-sterilized and solidified plate count agar (PCA) and MacConkey agar. The plates were incubated at 30-32^{0}C under aerobic condition for 24 hrs and counts were carried out.

Counts of coliforms

From appropriate dilution, 0.1ml of aliquots were spread plated in duplicates on pre-sterilized and solidified violate red bile agar (VRBA) plates and then incubated at 35^{0}C for 24 hrs. Purplish red colonies surrounded by reddish zone of precipitated bile were considered as coliforms.

Counts of enterobacteriaceae

Similarly, from appropriate dilution of sampled well water, 0.1 ml of aliquots were spread plated in duplicate on pre dried surface of MacConkey agar (Oxoid). The plates were incubated at 35^{0}C for 24 hrs after and appearance of pink to purple mucoid colonies were counted as Enterobacteriaceae.

Characterization of the flora

After enumeration of aerobic mesophilic bacteria, enterobacteriaceae and coli form, about five to ten representative colonies of all types were picked randomly from countable plates and inoculated into tubes containing about 5 ml nutrient broth (Oxoid) and incubated at 32-35 ^{0}C over night and further characterized for their diverse morphological and physio-chemical features.

Cell morphology

From overnight pure broth culture, wet mounts were prepared on microscope slides and observed under light microscope using oil immersion objective lens to determine cell shape, arrangement and motility status.

KOH-test (test on lipopolysaccharide)

The KOH test (lipopolysaccharide) was carried out by using 3% potassium hydroxide on fresh bacterial culture as described by [10] to differentiate Gram-postive and Gram-negative bacteria.

Catalase test

Two to three drops of 3% (w/v) hydrogen peroxide solution was transferred on to colonies of 24 hr pure culture on nutrient agar plates and effervescence of gas bubble was taken as a positive result for presence of catalase.

Cytochrome oxidase tests

Cytochrome test on fresh (24 hr) pure culture was conducted following the method outlined by [11].

Data analysis

The collected data were organized and analyzed by using Ms Excel and simple descriptive statistics.

RESULTS

Utilization and handling of well water

Regarding the utilization of the well water, it was found that the residents use it for various purposes (including drinking, bathing and food preparation). However, the water does not look properly handled nor consistently treated (Table-1) and consequently, it was very turbid in appearance. Concerning where to keep drawing containers, the majority of well water owners keep either outside the well (36.7%) or inside (36.7%) while only few (26.6%) of well water owners keep the containers at home as revealed from interview and field observation results.

Table-1. The status of well waters and its utilization among well water owner found in Jimma town April, 2011.

No.	Items	Alternatives	Frequency	Percent
1	Way of using the well water while drinking	Direct use (without treatment)	10	33.4
		Boiling (sometimes only)	18	60
		Filtering (in rare occasions)	4	13.3
2	Depth of the well (meter)	1-5	8	26.7
		6-10	18	60
		11-15	4	13.3
3	Distance of the well relative to latrine (meter)	5-10	19	63.4
		11-15	9	30
		16-20	1	3.4
		>20	1	3.4
4	Method of well protection from contamination	Covering	27	90
		Fencing	3	10
5	Position of well with respect to latrine	Uphill direction	16	53.4
		Same level (parallel)	7	23.3
		Downhill	5	16.6
6	Way of drawing water from the well	Using rope	27	90
		Using pulley system	3	10
7	Storage place of drawing containers	Outside the well water	11	36.7
		Keep inside the water	11	36.7
		Keep at home	8	26.6

Concerning the water handling practice, the well water owners use different containers and the majority of the well water owners also close (cover) the containers using different materials (Table-2). On the other hand, only women (most frequently) and children were involved in drawing water from the wells and there was almost no practice of washing hands before fetching the water.

Table-2. Water handling, collection and transport practice of well water owners in Jimma town (April, 2011).

No.	Item	Alternative	Frequency	Percent
1	Type of container to collect water	Bucket	2	6.6
		Clay pot	7	23.4
		plastic container (“Jerikan”)	21	70
2	Is the container covered/closed during fetching and storage?	Yes	29	96.6
		No	1	3.4
3	Type of the material for covering the well	Screw cap	19	63.4
		different plant leaves	1	3.3
		Tin	10	33.3
4	Who frequently collects water?	Children	3	10
		Women	27	90
5	Is there practice of washing hands before collecting water?	Yes	6	20
		No	24	80

Regarding the major health problems in the study area, about 21 (70%) of the well water owners claimed that water and sanitation related diseases have been common health problems in the family since the past and also within the last one year (Table-3), of which about 56.6% learned that the most common diseases were typhoid and /or typhus and diarrhoea followed by cholera.

Table-3. Common water-borne and water related diseases in well water users.

Common diseases	Frequency	Percent
Water-borne	17	56.6
Water-washed	3	10
Water-related	6	20
Water-based	4	13.4

There were several causes of such water-borne and related diseases (Table-4), the major factor being inadequate water supply.

Table-4. Major causes of water borne and water related diseases in the study.

Causes of disease	Proportion (%)
Inadequate water supply	43.4
Poor water quality	20
Lack of sanitation	20
Other environmental factors (flooded waste)	23.3

Concerning health risks associated with the well water, the residents had clear awareness that children and/or mothers and children were the most affected groups by the water-borne diseases (Figure-1).

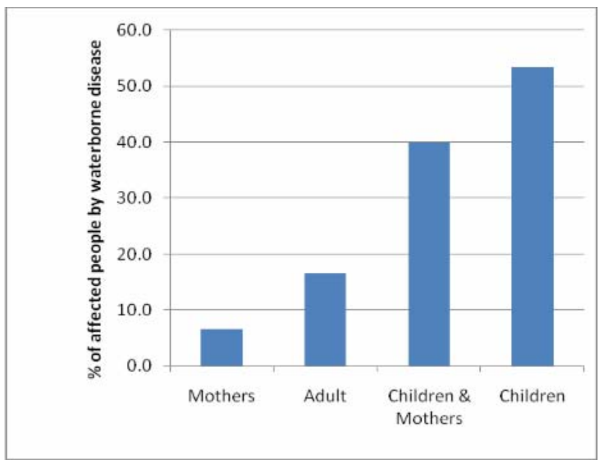

Figure-1. Most affected family members by water-borne disease in Jimma town.

There were also diverse disease symptoms among the well water users as clearly revealed by respondents (Figure-2) in the study area. There was also multiple disease symptoms in an individual (s) suffering from water-borne diseases in many occasions as revealed during interview.

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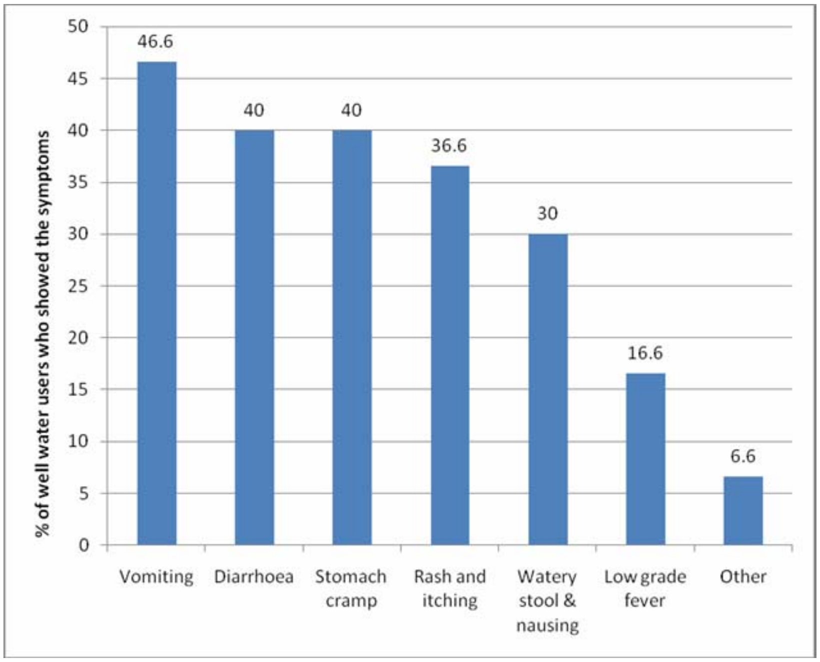

Figure-2. Symptoms of water-borne and related diseases among well water users in Jimma town (April, 2011).

Well water users in the study area were also using various plant parts as traditional treatment for various water-borne diseases (Table-5) unless the diseases are chronic (long lasting), in which case they visit health centers.

Table-5. Some of the major plants used for traditional treatments of various waterborne diseases among well water users in Jimma town.

Types of traditional medicine			
	Herbal	**Scientific name**	**Parts of plant used for treatment**
	Local (Vernacular) name		
1	Abasuuda gurraacha	*Nigella sativum*	Seed/fruit
2	Endod	*Phytolaca dodecandra*	Leaf
3	Sama	*Ortica simensis*	Root
4	Zingible	*Zingeber officinale*	Seed/fruit
5	Qullubbii adii	*Allium sativum*	fruit
6	Ebbicha	*Vernonia amygdalina*	Leaf
7	Abish	*Trigonella foenum-graecum*	Seed/fruit
8	Gesho	*Rhamnus prinoides*	Leaf
9	Pepper (berbere)	*Casicum annuum*	Fruit /flower
10	Hiddii	*Cucumis ficifolius*	Root
11	Lut (little mallow)	*Malva parviflora*	Root
12	Qoboo	*Ricinus communis*	Root
13	Bakkannissa	*Crotom macrostachyus*	Apical shoot
14	Hgamsa	*Corisa edulis*	Apical shoot

In addition, the respondents have cited various other traditional materials like honey, mixed with coffee flour and sugar (table sugar), local cheese mixed with butter stored for longer period (may be for years) together with various spices such as korerima (*Aframomum corrorima*), garlic (*Allium sativum*), ginger (*Zingeber officinale*), and others for treatment of various water-borne diseases.

Physico-chemical properties of well water

Table-6. The pH and temperature (^{0}C) of well water examined in Jimma town (April, 2011).

Sample of well water		W1	W 2	W 3	W 4	W 5	W 6	W 7	W8	W 9	W 10
Physico-chemical property	pH	5.4	8.2	6.4	6.8	9.5	7.3	8.7	7.5	5.3	6.9
	Temperature (^{0}C)	22.3	23.6	21.2	19.1	20.7	23.5	19.8	23.2	20.4	21.8

The mean pH value of the well water investigated in Jimma town was 7.2, which is around neutrality though the individual well water pH values were found to range from 5.4 to 9.5. The temperature of well water was found ranging from (19.1^{0}C-23.6^{0}C), the mean value being 21.56^{0}C, which is about 3.5^{0}C to 6.2^{0}C cooler than atmospheric temperature (27^{0}C).

Microbial load of well water

The bacterial colonies detected on PCA (for total colony count) from all well water samples investigated were beyond the specification set for drinking water. Accordingly, the mean count of aerobic mesophilic count on PCA was 815.4 cfu/ml (282-1264 cfu/ml), while those of coliforms and enterobacteriaceae count on MacConkey agar were found to be 264 cfu/ml and 308.6 cfu/ml, respectively (Figure-3).

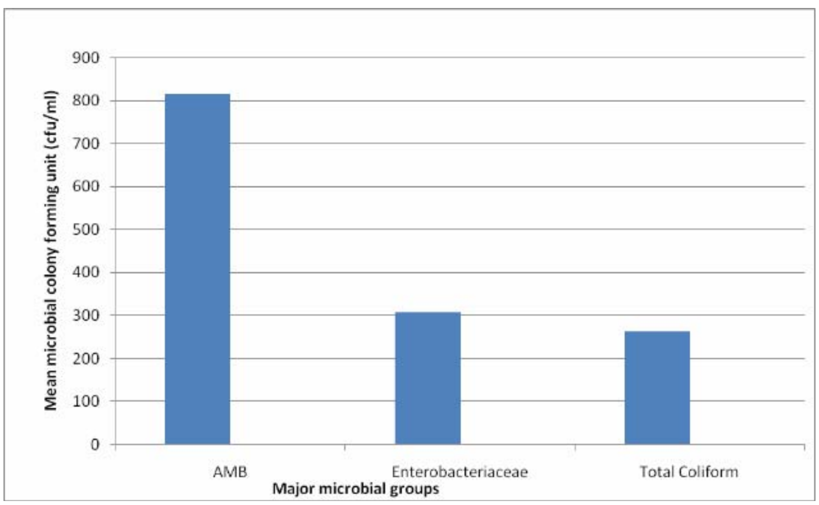

Figure-3. Microbial load of well water samples collected from Jimma town (April, 2011).

The various morphological and some biochemical properties of some bacterial isolates from the 10 well water samples are presented in Table-7. Accordingly, all isolates were catalase positive while, the majority of the colonies were oxidase negative and the frequency of Gram negative isolates was also larger (28 out of 40 isolates) as compared to Gram positive ones.

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Table-7. Some morphological and biochemical characteristics of representative isolates from well water in Jimma town (April, 2011).

Code of colony	Gram reaction	Motility	Shape	Arrangement	Catalase	Oxidase
JUW1	G+	nm	Cocci	Pairs	+	-
JUW2	G-	nm	Rod	Single	+	-
JUW3	G-	nm	Pleomorph	Cluster	+	-
JUW4	G-	m	Branched	Chain	+	-
JUW5	G-	m	Branched	Chain	+	-
JUW6	G-	nm	Branched	Cluster	+	+
JUW7	G+	nm	Cocci	Singles	+	-
JUW8	G-	m	Rod	Single	+	+
JUW9	G-	m	Rod	Pairs	+	-
JUW10	G-	nm	Rod	Single	+	-
JUW11	G-	m	Pleomorph	Cluster	+	-
JUW12	G+	m	Pleomorph	Chain	+	+
JUW13	G-	nm	Rod	Single	+	+
JUW14	G-	m	Cocci	Single	+	+
JUW15	G+	m	Cocci	Pairs	+	-
JUW16	G+	nm	Rod	Pairs	+	-
JUW17	G-	nm	Rod	Single	+	+
JUW18	G+	nm	Cocci	Chain	+	+
JUW19	G-	m	Cocci	Single	+	-
JUW20	G-	nm	Pleomorph	Chain	+	+
JUW21	G-	nm	Branched	Cluster	+	-
JUW22	G+	nm	Branched	Chain	+	-
JUW23	G-	m	Rod	Single	+	-
JUW24	G-	nm	Cocci	Pairs	+	+
JUW25	G-	nm	Rod	Chain	+	-
JUW26	G+	nm	Rod	Chain	+	-
JUW27	G+	m	Cocci	Single	+	+
JUW28	G-	nm	Branched	Chain	+	+
JUW29	G-	m	Cocci	Singles	+	+
JUW30	G-	nm	Pleomorph	Cluster	+	-
JUW31	G-	nm	Pleomorph	Cluster	+	-
JUW32	G+	m	Cocci	Pairs	+	-
JUW33	G-	nm	Rod	Single	+	-
JUW34	G-	m	Rod	Single	+	+
JUW35	G-	nm	Branched	Cluster	+	+
JUW36	G-	nm	Rod	Single	+	-
JUW37	G+	nm	Cocci	Pairs	+	-
JUW38	G+	nm	Cocci	Pairs	+	-
JUW39	G-	nm	Rod	Single	+	+
JUW40	G-	m	Branched	Cluster	+	-

Where: + = Positive for the test, - = Negative for the test
G+ = Gram positive, G- = Gram negative
nm = non motile, m = Motile

DISCUSSIONS

Water is unsafe for human consumption when it contains pathogenic or disease-causing microorganisms which are directly transmitted when contaminated fresh water is consumed. In the study area, the use of well water for various purposes (food preparation, bathing etc.) without prior treatment was very common. Such practices together with relative position of the wells with latrines, short distance of wells from the latrines as well as improper protection of the source (wells) were the major identified risk factors to result in various diseases (including typhoid fever, diarrhoea, cholera and others) related to consumption of contaminated water. [7] have also reported closeness of well waters to latrine and their existence on equal altitude to the latrine houses along with short depth to be the major risk factors among well water users. Despite the fact that the majority of the wells water owners practice to close (cover) their wells, the practice could not look to make the water safe. This could be due to the fact that the covers were neither frequently properly cleaned nor effectively fit to the wells, resulting in contamination of the water and that led to various diseases related to unsafe water consumption. Furthermore, absence of proper sanitation practices such as washing hands prior to drawing water accompanied with poor water drawing methods and materials as well as additional water flow (during rainy season) were also among the major contributing factors of the observed risks. Similarly, diarrhoea and shigella dysentery associated with uncovered materials such as buckets were reported [12]. [13] has also estimated that 80% of all morbidity in developing countries are due to water and sanitation related diseases. In the present study, it was revealed that children followed by women were the most affected groups by water-borne and related diseases. This could be partly due to the fact that they were the frequently involved groups in drawing water from wells in addition to the various socio-economic factors (such as less income of women) that negatively affect women and children. Furthermore, improper water quality can result in increasing mortality rates in children and immune suppressed people as revealed by [3]. WHO has also emphasized that about 2.2 million child death under the age of five in developing countries has been attributed to diarrhoea each year.

The diverse symptoms of waterborne illnesses in the study area could be due to the fact that characteristic of each symptom depends on the specific responsible pathogen (bacteria, viruses, or pathogenic microorganisms). Accordingly, vomiting, diarrhoea and abdominal discomfort or cramping was the frequently stated symptoms in the present study area. Diarrhoea together with other three diseases (ascariasis, dracunculiasis and hookworm infection) has already been reported to be wide spread in almost all developing countries [14] mainly due to water and sanitation problems. [12] has also reported the problem of diarrhoea, stomach-ache and vomiting among children in two study villages of Tanzania. It was revealed that the diseases were mainly due to proper sanitation problems related to excreta disposal.

The use of traditional medicine has been very common mainly in developing countries. In Ethiopia, the traditional health care is deep rooted with oral and written pharmacopoeias [15]. The present study has also revealed that there is dependence on various traditional medicine using extract of different parts (root, leaf, seed, fruit, flower etc.) to treat various water-borne and other diseases was very common. A large body of reports have also revealed that significant number of people depend on traditional medicines of mainly plant origin due to various reasons such as cultural acceptability, efficacy against certain type of diseases, physical accessibility [16] and economic affordability [15, 16] as compared to modern medicine. The various plant extracts, spices and others (honey, butter, pepper etc) were used in a non-formulated form and additives were usually incorporated and use of more than one extract/drug in a single dosage form was very common with the assumption that the various combinations could increase efficacy of the traditional drug against several diseases. Visiting health centers and/or searching for modern treatment was either when there were severe side effects of the traditional treatments or when the treatments failed to cure the diseases. Previous reports also confirm that in Ethiopia up to 80% of the population uses traditional medicine due to the cultural acceptability of healers and local pharmacopeias, the relatively low cost of traditional medicine and difficult access to modern health facilities [17]. Similarly, [15] indicated that large portions of human as well as livestock population in Ethiopia and other Sub-Saharan African nations mainly depend on traditional medicine.

Use of plant extracts against various pathogens has been well reported. For instance, antibacterial activity of *Tamarindus indica* and *Piper nigrum* [18]; extract of green tea against Methicilin-resistant *Staphylococcus aureus* (MRSA) by [19]; leaf extracts of *Piliostigma thonningii* against some bacteria and fungi [20]; antimicrobial activities of different herbal extracts against fungal isolates [21] and liver damage [22] have revealed that about use of various of different plants to be used against diverse pathogens. Similarly, [23] have also conducted antimicrobial activity of herbal extracts against pathogenic bacterial isolates in Egypt using the following plants: Dill (*Anethum graveolens*), Parsley (*Petroselinum crispum*), Peppermint (*Menthax piperta*), Cinnamon (*Cinnamomum verum*), Anise (*Pimpinella anisum*), Hibiscus, ginger, Absinth, Coriandrum, Black Pepper, Chamomile, Nigella, Licorice, Sage and Rosemary. Accordingly, their findings revealed *P. aeruginosa* isolates were sensitive to Coriandrum, Black Pepper, Chamomile, Nigella, Ginger, Sage and Rosemary. *E. coli* isolate was sensitive against Cinnamon and Licorice extracts. *S. faecium* isolate revealed sensitivity against Sage and Rosemary extracts while *Salmonella choleraesius* isolate was sensitive against Ginger and Licorice extracts.

Hydrogen ion concentration (pH) is the master that controls all aquatic chemical and biological processes [23]. In the present study the mean pH values (7.2) of well waters was in the range of the recommended values as per [24], in which the usual pH values range from 6.5-8.5. However, individual well water pH values were ranging from 4.5-9.5 and in about 16.7% (n=30) of the wells, the recorded pH measurements were in contrary to what has been recommended in drinking water. Such pH difference could rather be attributed to various factors such as temperature, carbonate and bicarbonate system, as suggested by [25]

Temperature is another important factor to limit growth and reproduction of microorganisms. In the present study of well water, all the recorded temperature values were not in accordance with the standard temperature range (10°C to 16°C) of drinking water [24]. The fact that all well water samples to have temperature above the standard set for drinking water may favor growth rate of any aerobic mesophilic microbes [26] and hence this could favor the growth of aerobic mesophilic pathogens as diverse groups of isolates were recorded in this study. For instance, a decrease in prevalence of *V. cholera* as water temperatures fall below 20°C has been reported by [24] in contrast to enhancement of microbial growth by high water temperature, which may consequently increase problems related to taste, odour, colour and corrosion.

The higher (282-1264 cfu/ml) number of microbial load with diverse morphological and biochemical features recorded in all cases of the well water samples revealed that the water cannot be considered to be suitable for drinking as the load is beyond the maximum total count (100cfu/100ml). Furthermore, coliform counts of well water samples, which should have been 0 cfu/ml in drinking water as per the WHO's set guideline were found to be extremely high (264 cfu/ml), indicating that the well waters were contaminated with faecal material as this microbes are commonly found in intestine. From the presence of indicator organisms such as coliforms in drinking water, one can infer that there could also be water associated enteric and other pathogens such as *Salmonella*, *Shigella*, *Vibro cholera* and others in the water. Similarly, the detected number (815 cfu/ml) of aerobic mesophilic count was beyond the tolerable limit. The detected indicator microorganisms are usually tested for because they are easier and cheaper to test for than all the possible pathogens that might be present. The most common indicators are total coliform bacteria, fecal coliforms, and *Escherichia coli* (*E. coli*) which indicate the unhygienic situation though it does not lead to direct conclusion of pathogen presence. It only gives an indication that they might be present and calls for further investigation and treatment of the water. Presence of coliform or fecal coliform bacteria does not determine whether a sample will make someone ill.

CONCLUSIONS

The physic-chemical as well as the bacteriological quality of well waters used for various purposes in Jimma town were not to the acceptable level and various disease symptoms have been common among the residents. Furthermore, there is dependence on various traditional medicine using extract of different parts of various plants in a non-formulated manner and usually in a various combinations in a single dosage with the assumption that the various combinations could increase efficacy of the traditional drug against several diseases. The dependence on traditional medicines could be partly due to economic affordability Strong monitoring and evaluation of well water hygiene, proper construction of the wells as well as awareness creation among residents need due attention.

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