



KNOWLEDGE, ATTITUDE AND PRACTICE ON SOLAR WATER DISINFECTANT AT HOUSE HOLD WATER TREATMENT IN MAALIM SALAT LOCATION, WAJIR COUNTY

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Abstract: In the developing world, and especially in Africa, water related diseases account for 80% of the disease burden, and contribute to over 5 million deaths, where it is estimated to kill over 3million people every year, the overwhelming majority being children. To counter this problem, Solar Water Disinfection (SODIS) has been promoted in most of the developing countries including Kenya. SODIS is a simple method of household water treatment that uses transparent PET-bottles and sunlight to disinfect drinking water and exposed to the sun for 6 hours. During this time, the UV-radiation of the sun kills diarrhoea generating pathogens. The SODIS-method helps to prevent diarrhoea and thereby is saving lives of people. This study aimed at determining knowledge, attitude and practice on solar water disinfectant at House hold water treatment in Maalim Salat location, Wajir County. A cross-sectional design was used because it is more cost-effective and easy to carry-out in this area with a very short time. Systematic sampling procedure was employed to determine knowledge, attitude and practice on solar water disinfectant at House hold water treatment in Maalim Salat location, Wajir County. Information was collected using interviewer-administered questionnaire, the data was sorted, cleaned-out then entered and evaluated for Chi-square and analysis of variance using latest SPSS programme package. The analyzed data was summarized and presented using frequency tables, graphs, central tendency and standard deviations. The study found that most of the households in Maalim Salat Location had knowledge on SODIS, although a good number had no knowledge on SODIS. In addition, most of the household heads know how SODIS works but a good number do not know how it works. The study also found that most of the households in Maalim Salat Location were not using SODIS water treatment method despite the fact that the method was found to be really effective. It was further revealed that most of the households in this study were not using SODIS water treatment method. Further, the house holds that were using SODIS method had experienced problems or challenges with the SODIS method. Establishing a good follow-up network, in the case of NGOs, or service practices, in the case of manufacturers, that educates the user in the appropriate manner could help increase the knowledge of Maalim Salat Location residents. This study therefore recommends that SODIS practitioners need to be trained carefully and then have ongoing monitoring after training.

Introduction

Solar water disinfection, also known as SODIS is a method of disinfecting only and plastic PET bottles. SODIS is a free and effective method for decentralized water treatment, usually applied at the household level and is recommended by the World Health Organization as a viable method for household water treatment and safe storage (WHO, 2007).

The SODIS water purification uses one of the most abundant, free resources in the world, sun light. More specifically, the UV (ultra violet) rays that are emitted from the sun. Anyone that has looked into smaller UV water purification systems, primarily those used by hikers and backpackers, will know that small, battery powered devices are becoming popular for sterilizing water on the hiking trail (Elliot, 20002). In 1991 an interdisciplinary team composed of sanitary engineers, photochemists, bacteriologists and virologists from EAWAG/ SANDEC embarked on extensive laboratory and field tests to assess the potential of SODIS and to develop an effective, sustainable and low-cost water treatment method. In the past, two different water treatment processes using solar energy were used to improve the microbiological water quality. The first, UV-radiation was used for its bactericidal effect. The second, infrared radiation raising the water temperature, is known as pasteurisation. During research phase one, the researchers at EAWAG combined the two effects and discovered a strong synergy between radiation and heat. The experiments showed that at a water temperature of 50°C, only a fourth of the amount of UV-light required at 30°C is necessary to inactivate the same amount of faecal coliforms (Larry, 2000).

During the third phase the socio-cultural acceptance, applicability and financial viability of SODIS were studied in demonstration projects in local communities in Colombia, Bolivia, Burkina Faso, Togo, Indonesia, Thailand and China. The survey assessing the socio-cultural acceptance of SODIS revealed that users appreciate the sustainable and simple water treatment method. An average of 84% of the users stated that they will certainly continue to use SODIS after the conclusion of the demonstration projects (Larry, 2000). Over 2 million people in 28 developing countries use SODIS for daily drinking water treatment. Experience has shown that SODIS is best promoted and disseminated by partner institutions based in the project area (Justus, 2004).

In Latin America the promotion is channeled through a regional reference center, Fundação Sodis. The Fundação's strategy is to build and strengthen a network of partner institutions. The Fundação does not implement projects, but focuses on training trainers, technical assistance, and lobbying activities. More than 100,000 people are using SODIS in Latin America. In Assam, India, Assam University provided technical and training support for a SODIS promotion project with a local NGO. The dissemination phase targeted 20,000 households based on lessons learned during the pilot phase. An approach involving active participation of institutions such as village councils, schools, and health centers was adopted to ensure the project is community owned and sustainable (Slim, 2004). The CBO KWAHO promotes SODIS in the Kibera slums of Nairobi, Kenya. Over 250,000 people are reached by trained promoters using social marketing to disseminate knowledge about SODIS. Research-based information is given out by promoters to potential users, especially when users are skeptical about SODIS (Ocholla, 2006). In Wajir East district, the method was promoted in Maalim Salat location in the year 2008 by KWAHO in partnership with the district public health office Wajir East.

Statement of the Problem

The lack of clean drinking water for some 1.1 billion people in this world has dramatic consequences: approximately 4 billion cases of diarrhoea are reported annually, of which 2.5 million ends in death. Every day around 6000 children die due to the lack of safe drinking water. Criteria for improving water supplies only consider water availability and its accessibility. However, since the drinking water quality is not taken into account, the situation is far worse as

more than 1.1 billion people are exposed to unsafe drinking water. Water and sanitation are some of the key elements of Primary Health Care (PHC). For this reason, most PHC are putting emphasis on provision of safe drinking water and appropriate sanitation in an effort to reduce diseases linked to these elements. The success of these interventions depends partly on strong community participation in identifying their health problems and finding practical solutions to them.

The ministry of public health and sanitation in conjunction with Kenya Water for Health Organisation (KWAHO) promoted the use of SODIS that covered parts of the country including the study area. The broad objectives of the promotion of SODIS was to strengthen and revitalize preventive health care in order to reduce incidence of preventable diseases particularly those associated with lack of safe water at households. As much as SODIS water treatment method was introduced in Wajir in the year 2008 by KWAHO, since its promotion, no form of evaluation has been carried out to determine the use of the method. Similarly there was no study as far as the researcher is concerned that has been conducted to determine the effectiveness of the method in reducing illnesses linked to the consumption of unsafe water. This study therefore sought to determine knowledge, attitude and practice on solar water disinfectant at House hold water treatment in Maalim Salat location, Wajir County.

The specific objectives of the study were;

1. To determine knowledge on solar water disinfection at House hold water treatment in Maalim Salat location, Wajir County.
2. To determine attitude on solar water disinfection at House hold water treatment in Maalim Salat location, Wajir County.
3. To determine practice on solar water disinfection at House hold water treatment in Maalim Salat location, Wajir County.

Literature Review

Solar Water disinfection

SODIS, which stands for Solar Water disinfection, is a simple method that utilizes the synergy of the UV-A (radiation effect) and infrared light (thermal effect) to kill the bacteria and viruses in the water. The system Figure 2 All faecal bacteria in the transparent bottles where there is synergy between the UV-A radiation and heat is inactivated when the temperatures reaches 50°C, top picture, but not in the dark bottle that only gets the heat from the sunshine, uses PET (Polyethylene) transparent plastic bottles that are exposed to the sunshine for several hours. These are ordinary plastic drink bottles of the kind used for soft drinks and bottles water- they do need to be clear and transparent. The plastic bottles have proven to be an adequate and safe container for the treatment (Martin, 2009).

SODIS was first field tested in Indo- nesia in 1997 by Yayasan Dian Desa, an Indonesian NGO based in Yogyakarta, Indonesia, and more recently there has also been collaborative work with EAWAG-SANDEC, who also provide technical back up. Support has been provided by UNICEF, SIMAVI and from some private sector companies such as the Coca Cola Company and Georg Fischer. The two main areas of SODIS dissemination in Indonesia are in two islands,

East Lombok District in Lombok Island and Sikka District in Flores Island. Between these two islands there are more than 150,000 beneficiaries in more than 40 villages (George, 2010).

John (2003) states dissemination phase of the project in Uzbekistan, implemented from April 2002 to March 2004, was based on the lessons learnt during the preceding pilot project. The aim of the dissemination phase was to introduce SODIS in 10 villages, create education and training material for medical personnel, health institutions, implementing agencies, schools and local SODIS staff. A broader network for dissemination was to be established and coordinated through a national workshop, regional workshops and training seminars for partner organizations and their staff. National extension activities involving the health authorities of the Uzbek Government started in summer 2004.

Household water treatment and safe storage (HWTS) interventions are proven to improve water quality and reduce diarrheal disease incidence in developing countries. Four of these proven HWTS options – chlorination, solar disinfection, ceramic filtration, and flocculation/disinfection – are widely implemented in developing countries. Organizations wanting to develop HWTS programs are often faced with the difficult decision of selecting which option or options are appropriate for their particular circumstances. The most appropriate HWTS option for a location depends on existing water and sanitation conditions, water quality, cultural acceptability, implementation feasibility, availability of HWTS technologies, and other local conditions (Sum, 2003).

In India over 2 million people in 28 developing countries use SODIS for daily drinking water treatment. Experience has shown that SODIS is best promoted and disseminated by partner institutions based in the project area. Important partners are community-based organizations (CBOs) such as women's clubs, youth associations or self-help groups, well-established NGOs working on community development projects, institutional organizations such as health posts, hospitals, and teacher training centers, and government programs. Individuals, such as community and religious leaders as well as politicians and decision-makers, play a key role and should be involved from the beginning of a project. SODIS promotion in a new area begins with a pilot project of one year that reaches 2000-4000 families (Bandeep, 2003).

Solar disinfection (SODIS) was developed to inexpensively disinfect water used for oral rehydration solutions (Acra et al., 1984). In 1991, the Swiss Federal Institute for Environmental Science and Technology began to investigate and implement solar disinfection as a HWTS option. Users of SODIS fill 0.3-2.0 liter plastic soda bottles with low-turbidity water, shake them to oxygenate the water, and place the bottles on a roof or rack for six hours (if sunny) or two days (if cloudy). SODIS has been proven to inactivate bacteria and viruses (Wegelin et al., 1994; Sommer et al., 1997). Recent research has shown the protozoa cryptosporidium and giardia are sensitive to solar irradiation as well (Méndez-Hermida et al., 2005; Martin Wegelin & Regula Meierhofe, personal communication, March 8, 2005). SODIS has also been shown to reduce diarrheal disease incidence in randomized controlled studies by 9-86 percent (Conroy et al., 1996, 1999, 2001; Hobbins, 2003).

Knowledge level on solar water disinfectant at House hold water treatment

A study by Michael (2004) in Ukraine revealed that the knowledge and acceptance study discovered that more than half of the households in the project villages have used SODIS during the summer (54.1%), of which almost 70% have used SODIS every day. More than 89% of the permanent SODIS users were very positive towards the new method and wanted to continue in the future. Nobody thought that they would not use it again in the next year. This is a strong argument from the rural population itself about their confidence in SODIS. Household water treatment and safe storage (HWTS) interventions are proven to improve water quality and reduce diarrheal disease incidence in developing countries. Four of these proven HWTS options – chlorination, solar disinfection, ceramic filtration, and flocculation/disinfection – are widely implemented in developing countries. Organizations wanting to develop HWTS programs are often faced with the difficult decision of selecting which option or options are appropriate for their particular circumstances. The most appropriate HWTS option for a location depends on existing water and sanitation conditions, water quality, cultural acceptability, implementation feasibility, availability of HWTS technologies, and other local conditions.

A study in Kenya revealed that to establish a successful application of SODIS, it is important to implement a comprehensive education and training program aiming at creating knowledge, awareness and establishing a sustainable behaviour change accordingly. Important factors that support project success are: the local availability of PET-bottle and interventions that support the take-up of a certain behaviour, such as education and awareness creation (for example through using participatory methods such as PHAST), motivation and the use of convincing and emotional arguments. Tools applied in this phase are training through motivated health-workers of groups and individual households, dissemination of information materials, demonstrations, demonstration of water quality tests, fun during educational events, and education in schools (Stella, 2005). In Kenya, diarrhoeal diseases rank third after malaria and respiratory infections. Water related diseases accounted for 38% of illness or morbidity in Kenya in 2001 while 61% cases of admissions at Kenyatta national hospital were due to diarrhoea or diarrhoeal related complications. (Kenya, MOH 2002). According to Unicef/Kenya and MOH reports, one in every ten children dies of diarrhoea. Places reporting the highest morbidity from the diseases have started practicing SODIS and spreading the knowledge of water treatment using this method in their households which had so far proved very popular and effective in North-Eastern region of Kenya (Juma, 2006)

Attitude on solar water disinfectant at House hold water treatment

The most difficult issue was the strict control exercised by the authorities. People are hesitant to accept new ideas if they were not endorsed officially from the authorities. This made it sometimes very challenging to work in the communities. We also had to be quite creative to overcome the passiveness of the population. This is a left-over from the socialist times, where self-initiative and creativity was not encouraged (Larry, 2003). Organizations wanting to develop HWTS programs are often faced with the difficult decision of selecting which option or options are appropriate for their particular circumstances. The most appropriate HWTS option for a location depends on existing water and sanitation conditions, water quality, cultural acceptability, implementation feasibility, availability of HWTS technologies, and other local conditions.

Nicaragua is among the poorest countries of Central America (World Bank, 2004), and the lack of safe drinking water is one of its many problems. According to the Swiss agency for development and cooperation in Nicaragua (COSUDE, 2004), 60% of households outside of urban centers have no access to safe drinking water. Existing methods for water purification are often complicated or costly, and therefore they are rarely used. Solar water disinfection (SODIS) provides individual households with a straightforward technology to disinfect their drinking water without the need for large investments. The exposure of water-filled transparent plastic bottles to sunlight for approximately 6 hours (or for 2 consecutive days when the sky is cloudy) produces safe drinking water. A combination of UV-A rays and the temperature of the water inside the bottles kills or incapacitates,

When promoting a change in behavior or a new technology, it is an advantage to understand the processes that lead to the behavior and the factors that influence it. Preexisting beliefs or the lack of resources can be factors that greatly influence the use of a new technology. In the case of SODIS, gathering information on such factors can help to identify the influences on the individual's current and future use of this technology (Harkness, Wyon, & Super, 1988).

Practice on solar water disinfectant at House hold water treatment

Generally, one year after project implementation, 20-80% of the trained people use SODIS on a regular basis (MEIERHOFER 2009). After the practice has been established in a community, it is necessary, to implement interventions that support the continued practice of the behavior and establish a habit such as regular household visits, tools that remind people of treating the water, mass media campaigns, regular application in schools and homes. Solar disinfection, which combines thermal and UV radiation, has been repeatedly shown to be effective for eliminating microbial pathogens and reduce diarrhoeal morbidity (Hobbins 2004) including epidemic cholera (Conroy 2001). Among the most practical and economical is the "SODIS" system, developed and promoted by the Swiss Federal Institute for Environmental Science and Technology. It consists of placing low turbidity (<30NTU) water in clear plastic bottles (normally 2L PET beverage bottles) after aerating it to increase oxygenation and exposing the bottles to the sun, usually by placing them on roofs. Exposure times vary from 6 to 48 hours depending on the intensity of sunlight. Like filters, thermal and solar disinfection do not provide residual protection against recontamination. Accordingly, householders must have a sufficient number of bottles to allow them to cool and maintain treated water in the bottles until it is actually consumed.

Many health impact studies have been conducted that show a positive impact of SODIS practice in reducing diarrhoeal illnesses. The first studies conducted in Kenya by the Irish Royal College of Surgeons found a reduction of 16-24% of severe diarrhoea among SODIS users. In addition, children under the age of 6 had 88% less cases of Cholera during a Cholera epidemic in the project area. The protective effect of SODIS against Cholera was confirmed during the present Cholera epidemic in the North-Kivu Region in the Democratic Republic of Congo, where no Cholera cases were observed in the villages using SODIS. Other health impact studies have been carried out in Bolivia and India which found a diarrhoea reduction of about 40% among SODIS users. Not surprisingly, an evaluation of the SODIS project in Kenya found that the proportion of treated water consumed has an important influence on diarrhoea. Even if a family treats part of their water with SODIS, they will not experience a positive health impact if they continue to

consume more than 20% untreated water. The education of SODIS users therefore not only has to focus on establishing the regular practice of the method but also on eliminating the consumption of any untreated and contaminated water.

For almost 10 years, the SODIS method has been promoted in developing countries in areas where people still drink heavily contaminated water. Presently, more than 3 million people in about 30 countries regularly use SODIS for the treatment of their drinking water. Educating people in the application of any new household water treatment method is a demanding task (as noted by WHO). Often people are reluctant to change their current behavior and adopt new hygiene practices such as hand-washing, use of improved sanitation infrastructure or water treatment. The SODIS method is often difficult to promote in developing countries because people living in the villages and urban slums doubt that simply exposing bottles to the sun will provide them with safe drinking water. An extended, careful and participatory training approach taking into account the cultural context and local habits, is a precondition for establishing a sustainable practice of SODIS in the project areas. Years of working with project teams in different countries in a variety of contexts, has revealed that not all conditions are equally conducive for establishing SODIS practice. The most important factor to establish a high uptake of the method is the work of the promoters in the community. Highly motivated promoters seeking to facilitate behavioural change in the community by using participatory approaches are more likely to succeed than efforts to force a community into a certain practice by using a top-down approach. Community leaders and community members must take ownership of the need to improve their drinking water quality and this ownership should be established before the project begins. Other success factors include a follow-up strategy that strengthens the newly acquired behavior and establishes a habit, the local availability of PET-bottles and a conducive environment including an endorsement by health authorities, visibility of others practicing the method, application and promotion in schools, health centers etc.

Materials and Methods

Study area: Study area was Maalim Salat location, which is one of the locations in Wajir East District with a population projection of 9,600 persons. There are 2,732 households. The inhabitants of the district are mainly Somalis whose main lifestyle is pastoralist with livestock rearing forming the backbone of their economy. Wajir East District is one of the four districts carved from the former larger Wajir County covering an area of approx. 14,471-km sq. (*District Commissioner's Office, Wajir East, 2012*). Wajir East District has a Population projection of about 226,563 people as per the District Statistical Office, Wajir East, December, 2010. Administratively the district is divided in to 3 divisions i.e. Central, Khorof-Harar, and Wajir-Bor respectively. Politically, the district has been divided in to two constituencies as per the proposed 80 constituencies. Wajir East District is one of the towns in the country where bucket latrines are used as a method of excreta disposal, although the region is generally arid; the water table around Wajir town is quite high at an average of 6 metres below the ground surfaces. This has encouraged the proliferation of about 6500 unprotected shallow wells less than 30ft from toilet facilities. The high water table makes pit latrines impracticable in wajir. Primarily, the water situation in Wajir has always been wanting. The main source of water both drinking and domestic use is shallow wells in the townships and bore-hole, pans, dams in the out-skirts. The bucket latrine as a method of excreta disposal this has led to high incidence of sanitation and hygiene related diseases among the population. Recently the district was affected by upsurge of diarrhoeal diseases.

Research Design: A cross-sectional design was used to determine knowledge, attitude and practice on solar water disinfectant at House hold water treatment in Maalim Salat location, Wajir County. This design was chosen because it is more cost-effective and easy to carry-out in this area with a very short time.

Target Population: The study population comprised all house-holds in the area for the last six months. Inclusion criterion was all the respondents who were household heads or responsible adults above 15 years and who had lived in the location for more than 3 months.

Sample size determination: The Fischer's Formula was applied. The two formulae are applied in successive steps since the reference population is less than 10,000.

$$N = Z^2 pq/d^2$$

Where:

N= desired sample size.

Z= Standard normal deviate set at 1.96 (95% confidence level).

p= Proportion of the targeted population that have the characteristic focusing in the study. In this study the particular characteristics are the households practicing SODIS water treatment method.

q= 1-p

d= degree of accuracy set at 0.05/ Degree proportion of error that should be accepted in the study. (0.05) that is 5%.

$$\text{Thus } n = \frac{(1.96)^2 * (0.5 * (1 - 0.5))}{(0.05)^2}$$

$$\frac{3.8416 * 0.25}{0.0025} = 384.16$$

Since the clients of interest to the study are less than 10,000 the sample size is corrected using finite correction formula.

$$nf = n$$

$$1 + n/N$$

N= is the number of expectant mothers that meets the inclusion criteria.

nf= desired sample size.

n= is the calculated sample size.

$$\text{Therefore } nf = \frac{384.16}{1 + 384.16/600}$$

$$\frac{384.16}{1 + 0.6402667} = 361$$

Sampling procedure: Systematic sampling procedure was employed to determine knowledge, attitude and practice on solar water disinfectant at House hold water treatment in Maalim Salat location, Wajir County. The procedure involved in systematic random sampling is very easy and can be done manually. The main advantage of using systematic sampling is its simplicity. It allowed the researcher to add a degree of system or process into the random selection of subjects. Another advantage of systematic random sampling over simple random sampling is the assurance that the population was evenly sampled.

Data collection instrument: Information was collected using interviewer-administered questionnaire, designed by the investigators and pre-tested prior to use. This instrument was picked because the interviewer can probe to ensure question is understood. The questionnaire both open and close ended was written in English, then translated in Kiswahili and the local language where necessary, it was administered by two trained local interviewers and one of the investigators in the language the respondent understands better. The questionnaire comprised of questions on socio-demographic characteristics, knowledge, attitude and practice of each household.

Data analysis and presentation: The data was sorted, cleaned-out then entered into the latest SPSS programme package. The data was analyzed by use of descriptive statistics such as mean, standard deviation, frequencies and percentages. The analyzed data was summarized and presented using frequency tables, graphs, central tendency and standard deviations.

Results and Discussions

This study had a sample of 361 household heads out of which 310 responses were obtained. This represented a 85.87% response rate. According to Babbie (2002) any response of 50% and above is adequate for analysis thus 85.87% is even better. Most of the household heads in this study were married and aged between 30 and 40 years. In addition, they had had secondary school education as their highest level of education.

Knowledge on SODIS

This study sought to determine knowledge on solar water disinfection at House hold water treatment in Maalim Salat location, Wajir County. The study established that typhoid and cholera were the most common waterborne diseases in Maalim Salat Location followed by diarrhea, pneumonia and bilharzias. According to Juma (2006), places reporting the highest morbidity from the diseases have started practicing SODIS and spreading the knowledge of water treatment using this method in their households which had so far proved very popular and effective in North-Eastern region of Kenya.

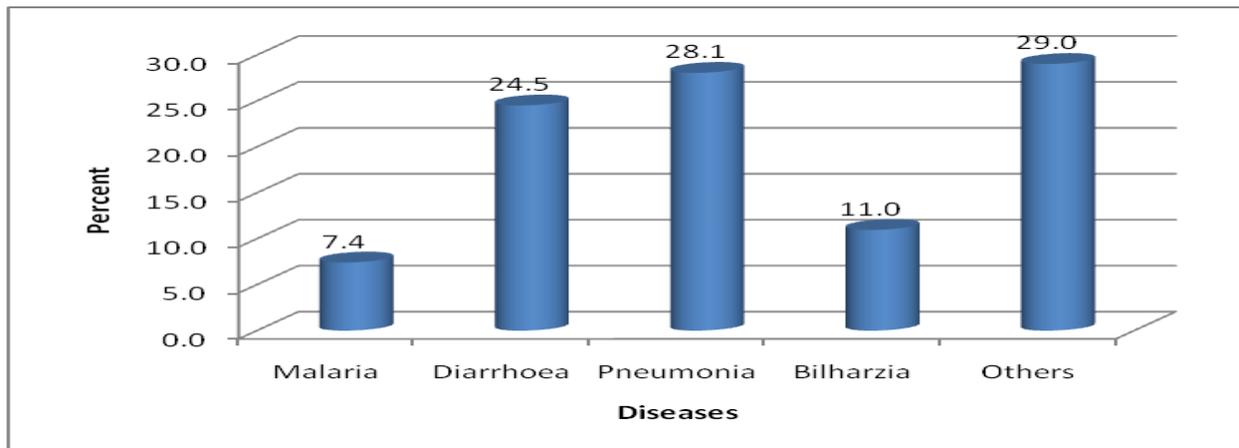


Figure 1: Common water-borne diseases

The study also found that most of the households in Maalim Salat Location had knowledge on SODIS (67.74%), although a good number had no knowledge on SODIS (32.26%). These findings agree with Michael (2004) findings that the knowledge and acceptance study discovered that more than half of the households in the project villages have used SODIS every day. Stella (2005) established that it is important to implement a comprehensive education and training program aiming at creating knowledge, awareness and establishing a sustainable behaviour change accordingly.

The study further established that most of the household heads know how SODIS works but a good number do not know how it works. In addition, most of the respondents knew that the SODIS bottle system was placed on the roof but a good number of households were not aware of where the SODIS bottle system was placed. It was also revealed that household heads knew that SODIS water treatment really works and most of the households in Maalim Salat Location can take water if it is from SODIS treatment or any other treatment.

Attitude on SODIS

The study sought to determine attitude on solar water disinfection at House hold water treatment in Maalim Salat location, Wajir County. Larry (2003) argues that people are hesitant to accept new ideas if they were not endorsed officially from the authorities. This makes it sometimes very challenging to work in the communities.

The study found that most of the households in Maalim Salat Location were not using SODIS water treatment method despite the fact that the method was found to be really effective. According to COSUDE (2004) solar water disinfection (SODIS) provides individual households with a straightforward technology to disinfect their drinking water without the need for large investments. According to Conroy (2001) solar disinfection, which combines thermal and UV radiation, has been repeatedly shown to be effective for eliminating microbial pathogens and reduce diarrhoeal morbidity including epidemic cholera.

The study also revealed that availability of SODIS equipments, was affecting the adoption of SODIS water treatment method to a great extent followed by lack of resources, culture and pre-existing beliefs. In addition, most of the household heads can give their children water treated with SODIS method. These findings agree with Stella (2005) argument that the local availability of PET-bottle and interventions that support the take-up of a certain behavior, such as education and awareness creation were affecting the use of SODIS method.

Table 1: Factors affect the adoption of SODIS water treatment method

	Mean	Std Deviation
Culture	3.45	0.892
Preexisting beliefs	2.98	0.652
Lack of resources	4.08	0.762
Availability of SODIS equipment	4.11	0.524

Practice on SODIS

The study sought to determine practice on solar water disinfection at House hold water treatment in Maalim Salat location, Wajir County. According to MEIERHOFER (2009), one year after project implementation, 20-80% of the trained people use SODIS on a regular basis. After the practice has been established in a community, it is necessary, to implement interventions that support the continued practice of the behavior and establish a habit such as regular household visits, tools that remind people of treating the water, mass media campaigns, regular application in schools and homes.

The study established that most of the households in this study were not using SODIS water treatment method. Further, the house holds that were using SODIS method had experienced problems or challenges with the SODIS method.

It was revealed that if the water bottles are not left in the sun for the proper length of time, the water may not be safe to drink and could cause illness. If the sunlight is less strong, due to overcast weather or a less sunny climate, a longer exposure time in the sun is necessary. Solar water disinfection does not remove toxic. According to Stella (2005), important factors that support project success are: the local availability of PET-bottle and interventions that support the take-up of certain behavior, such as education and awareness creation (for example through using participatory methods such as PHAST), motivation and the use of convincing and emotional arguments.

Conclusion

The study concludes that typhoid and cholera were the most common waterborne diseases in Maalim Salat Location followed by diarrhea, pneumonia and bilharzias. Most of the households in Maalim Salat Location had knowledge on SODIS, although a good number had no knowledge on SODIS. In addition, most of the household heads know how SODIS works but a good number do not know how it works. Further, most of the respondents knew that the SODIS bottle system was placed on the roof but a good number of households were not aware of where the SODIS bottle system was placed. Additionally, the household heads knew that SODIS water treatment really works and most of the households in Maalim Salat Location can take water treated by SODIS method.

The study also concludes that most of the households in Maalim Salat Location were not using SODIS water treatment method despite the fact that the method was found to be really effective. However, most of the household heads can give their children water treated with SODIS method. The study also revealed that availability of SODIS equipments, was affecting the adoption of SODIS water treatment method to a great extent followed by lack of resources, culture and pre-existing beliefs.

The study further concludes that most of the households in this study were not using SODIS water treatment method. Further, the house holds that were using SODIS method had experienced problems or challenges with the SODIS method. If the water bottles are not left in the sun for the proper length of time, the water may not be safe to drink and could cause illness. In addition, if the sunlight is less strong, due to overcast weather or a less sunny climate, a longer

exposure time in the sun is necessary. Additionally, solar water disinfection does not remove toxic

Recommendations

The study established that a good number of household head did not know how the SODIS water treatment method works and some were even unaware of it. It was also observed in many cases that people were not using the systems as prescribed by the implementer or manufacturer. Establishing a good follow-up network, in the case of NGOs, or service practices, in the case of manufacturers, that educates the user in the appropriate manner could help increase the knowledge of Maalim Salat Location residents.

The study also found that various household heads that had been trained in SODIS still made mistakes in the application of the project. Mistakes include bottles being exposed in the wrong position or in places that received little sunlight during the whole day, as well as purified SODIS water being stored in dirty containers. This study therefore recommends that SODIS practitioners need to be trained carefully and then have ongoing monitoring after training.

Perhaps the foremost challenge to the implementation on SODIS is overcoming the lack of knowledge, or attitude, about the process. The propagation of SODIS needs to focus on regions where communities drink untreated raw water and are hampered by health problems linked to the poor water and sanitation standards. The challenge is for SODIS to be spread to these remote regions and to earn - through testing and training - the trust of local people in the method. This study therefore recommends that the government in collaboration with non-governmental organizations should carry out trainings in Wajir County on water treatment and its benefits on waterborne disease control.

Areas for Further studies

From the study and related conclusions, the researcher recommends further research in the area of the factors affecting the adoption of solar water disinfectant at House hold water treatment. The study also recommends further studies in the area of the extent of use of solar water disinfectant methods in Kenya.

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