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Water Scarcity and Trachoma Prevalence in Gaza Strip, Palestine: Possibilities and Precautions according to WHO SAFE Strategy for Trachoma Control

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Review Article

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Abstract

The widespread dissemination of trachoma throughout the world and the jeopardy of subsequent blindness make this eye disease a momentous public health crisis in many parts of the world. World Health Organization has considered the trachoma threat to be associated with poor water services, limited access to healthcare in addition to personal and community hygiene. Even supposing trachoma was eradicated from most of the developed countries in the last century, this infectious disease persists in numerous parts of the developing nations mainly in the societies without sufficient access to water and sanitation. Based on PubMed keywords, there were a few studies reported about Trachoma among Gazan people. Our study was aimed to discuss the potentiality of trachoma pervasiveness in the Gaza strip due to water scarcity in this area and suggest preventative measures according to WHO SAFE strategy for trachoma control. This paper reviews existing literature and discusses the possibilities of trachoma prevalence in the Gaza strip, Palestine due to water scarcity and precautions according to WHO SAFE strategy for trachoma control. Based on PubMed keywords, there was only one study that evaluated the prevalence of Trachoma in the West Bank and the Gaza Strip in the Palestinian Territories implemented in 1988. There was a consensus among scholars on the correlation between water availability and Trachoma.

Keywords: *Water Scarcity, Trachoma, Prevalence, Personal Hygiene, Gaza Strip, Palestine.*

Introduction

Trachoma a majority common infectious cause of blindness has been an important subject of research, that it can be considered as the global magnitude of a preventable cause of blindness[1, 5].

Trachoma is caused by a repeated, chronic eye infection with bacterium organism *Chlamydia trachomatis*, which is a highly infectious agent that can easily be transmitted and passed from one child's eyes to the eyes of other children within a few minutes, when they are playing together[3-5, 6-14.]

Like all other neglected tropical diseases[15], World Health Organization has deemed trachoma to be allied with poor water services, limited access to healthcare in addition to personal and community hygiene[1,2, 8,16,17], poverty and household crowding[2,17-21].

To enhance a preventable cause of blindness due to trachoma, the WHO has established the Alliance for Global Elimination of Trachoma (GET) as a public health problem to be eradicated by the year 2020[22]. The elimination strategy has been summarized with the acronym SAFE, which stands for **S**: Surgical correction of trichiasis, **A**: Antibiotic treatment of trachoma), **F**: Facial cleanliness which is a simple and effective method of preventing infection with trachoma and reducing the spread of disease, and **E**: Environmental changes to improve personal and community hygiene, for instance clean water and toilets[3].

To some extent, prevention is based on humanizing personal hygiene through enhancing facial cleanliness and supplying fresh and safe water for face washing, and promoting the safe disposal of human faeces, thereby reducing fly profusion[22]. For instance, facial cleanliness is renowned as being significant and sound to function independently of water quantity[28]. This statement is supported by a review of the evidence to hold up environmental and facial cleanliness interventions in integrated trachoma programmes[23].

Most studies of the incidence of trachoma suggest that it is hygiene behaviour that is the primary determinant[23]. In the same context different studies revealed that, while water-related diseases have largely been eliminated in more affluent and

developed countries due to improved living conditions and standards of Hygiene, they remain a major concern in much of the developing countries where community and family living conditions continue to foster its transmission[2, 3,8,24]. This paper reviews existing literature and discusses the possibilities of trachoma prevalence in the Gaza strip, Palestine due to water scarcity, and the precautions according to WHO SAFE strategy for trachoma control.

Review of Empirical Researches

Trachoma Control: Assessment and Strategy

In view of the WHO campaign to eradicate trachoma by 2020[25], many countries have taken on this decree and put into practice the Surgery, Antibiotic, Face washing and Environmental improvement (SAFE) trachoma control strategy within their deterrence of blindness programs[13]. Subsequent to evaluation of the strategies to control trachoma as a result of various researches, scholars strongly advocated that environmental improvements and provision of water supplies were vital that getting better access to water, enhanced hygiene and promoted sanitation diminished trachoma transmission and the blinding eventually vanish[1-3,8,23,26, 27].

The researchers justified their postulation referring to the prevalence of blindness as of trachoma due to consequence and recurrent infections repeated over many years, accordingly, to achieve ultimate success for sustainable transmission reduction; and control programs need to be enhanced by strategies that reduce transmission; this is logistically practical to be attained through the F and E components of SAFE, more than applying surgery and antibiotic therapy alone[3-5, 6-14, 28-30].

On the other hands, the reports of WHO indicated that in 1994 the worldwide magnitude of ocular disability was 37.9 million blind and 109.9 million with low vision[31].

Immense modifications in trachoma control have taken place in the last 12 years, as a result of the development and implementation of the WHO's comprehensive SAFE strategy for control Trachoma, and the founding of the Alliance for Global Elimination of Trachoma by the year 2020[32]. As indication to more precise disease assessment, and economic progress in some trachoma endemic areas, WHO presented recent statistics in 2009 which indicated that in the neighborhood of 42 out of 57 endemic countries; 40.6 million citizens were estimated to be suffering from active trachoma and 8.2 million estimated to have trichiasis, the trachomatous condition that leads to blindness[2].

This appears to be a noticeable decline for the prevalence of trachoma from 81 million in 2003, most likely reflecting the accomplishment of the ''AFE'' elements of control programs, that nowadays this number decreased to affects about 21.4 million people of whom about 2.2 million are visually impaired and 1.2 million are blind in 2011, that the endemic blinding trachoma persists to be hyper endemic and mainly restricted to most of which are in the area with poor personal and community hygiene such as, highest inaccessible poor rural areas of Africa, Asia, Central and South America , Australia and the Middle East[2,13,31,32]. This could be justified by the achievement in applying the control strategy, by providing more accurate statistics, along with improving socioeconomic status in endemic communities[32]. Therefore, the ability for reducing or possibly eradicating this devastating cause of blindness is within reach [2, 33].

Improved Community Hygiene and Sanitation to Prevent Trachoma

Different studies confirmed that distance from a primary water source to home appears to be the most significant water supply factor influencing[1]. In another words, trachoma is strongly related to *Water-washed diseases*[21] that occur through the use of insufficient amount of personal hygiene and this happen often due to absence of nearby sources of safe water, for washing face or when there is contact with contaminated water[1,8].

Such a consideration take into account the importance of adequate water quantity for human health, as there has been an extensive debate that, where the basic access service level has not been achieved, hygiene cannot be assured and consumption requirements may be at risk [34,35]. Therefore providing a basic level of access is the highest priority for the water and health sectors[1].

There were six studies that pointed out a positive association between improved access to water supply and reduced incidence of trachoma, with a median reduction of 27%, and with a range of 11-83% reduction[27]. Taking on views from another finding[23] which supported the evidence revealed from intervention studies which showed that trachoma transmission was trimmed down in the absence of eye-seeking flies due to enhancing the face washing.

Many of the recent studies have demonstrated that provision of latrines, improved access to water combined with environmental improvement are associated with a lower prevalence of active trachoma due to reduced the risk of transmission of ocular Chlamydia[3].

The world's leading preventable cause of blindness to eradicate the blinding trachoma, now seems possible[36]. The prevalence of active trachoma was less in children who had received treatment with azithromycin, had clean faces, had faces washed more frequently, and used toilets compared to children who had not received these interventions[3]. A study carried out in 2006[25], evinced that behavioral changes were efficacious for the averting of trachoma transmission and water-related

diseases even if they were evaluated after two years of enforcement.

Water scarcity (the highest in the world) will increase in the Middle East and North Africa (MENA) which is considered as one of the most vulnerable area to warming, diminished rainfall and an increase in sea levels. With this water shortage the Middle East and North Africa (MENA) region is accustomed to dealing with environmental stress[37].
The neglected tropical diseases (NTDs) are highly endemic but patchily distributed among the 20 countries in the MENA[38]. As stated by the WHO Global Health Atlas, trachoma is endemic in 10 of the 22 countries in the region, and more than half a million infected with trachoma take place in the MENA region, with the largest number in Yemen (204,000 cases), subsequently Algeria and Iraq (approximately 140,000 cases each)[39]. In 2011, 2 countries (Sudan and South Sudan) reported the implementation of elimination campaigns. Iran reported the elimination of trachoma after carrying out a rapid assessment in the historically known endemic regions[39].

Morocco was the first country in the Middle East to eradicate trachoma as a public health problem due to the implementation of the SAFE strategy, which has achieved significant outcome in diminishing of the trachoma incidence[41]. Trachoma has also been eradicated in Oman, while almost eliminated in eight nations in the MENA[38].
However, elimination targets are on track in the countries of Algeria, Iran, Libya, Saudi Arabia, Tunisia, and the United Arab Emirates[42].
Egypt, which is the neighborhood to the Gaza strip historically associated with blinding trachoma, reported presence of trachoma to the GET2020 Alliance in 2007 but a comprehensive assessment of the extent of the problem has not yet been conducted[39].

Environmental Health Situation In Gaza Strip - Palestine
Notwithstanding, right to use safe water resources is a global concern, in Palestine, which is part of MENA region, people are struggling for access to water, and against contamination of the only and precious resource that they have[43]. Resembling any other parts in the Middle East, the Gaza Strip, the southern part of Palestinian groundwater has a manifest and significant scarcity of water supply[44].

For instance, Gaza's 1.6 million residents rely on the Coastal Aquifer to supply them with water for various reasons such as domestic, agricultural and industrial purposes[45], and population of the Gaza Strip is supposed to reach about 2.6 Million inhabitants by the year 2025 according to the Palestinian Central Bureau of Statistics[46].

About 98% of Gazan citizens are connected to the water network but access to a continuous supply of running water is much less widespread[47, 48], and the overall rate of water distribution in Gaza is between 70 to 85 liter per capita / day, while the ratio of water distribution networks efficiency is about 63% including the illegal networks and leaks[45]. The coastal aquifer is the only source of freshwater. 95% of its water is unfit for human consumption, and the aquifer could become unusable as early as 2016, with the damage irreversible by 2020[49].

It is more clear and serious that different factors have contributed to the degradation of this solely water resource in its quantity and quality, commencing from low rainfall that the long term average rainfall rate in all over the Gaza Strip is about 317mm /year [50], where the Gaza Strip is one of the semi-arid area where rainfall is falling in the winter season from September to April[51] as well as escalate and wide spread in the urban areas which led to a decrease in the recharge quantity of the aquifer[44], more to the point increasing the population with long-term over exploitation for water depleted the aquifer and lowered water tables which in sequences lead to seawater intrusion in some areas of coastal regions as a result in pressure differences between the groundwater elevation and sea water level or by leakage from adjacent layers that contain saline water[45,52,53]. Furthermore, the sanitation sector was, to some extent, neglected and this is due to the recurrent closures of Gaza crossings and the limited funding for sanitation sector, and the network coverage of this sector has reached 70.7% distributed amongst the Gaza Strip governorates[45]. Consequently, contaminants seeping into the ground have resulted in a decreasing water quantity, accompanied by the degradation of its quality, threatening this vital resource[43, 54-56.]

In view of that, the only water source in the Gaza strip is considered unfit for human consumption due to levels of chlorides and nitrates as high as six times the WHO guidelines, and UN agencies and the Coastal Municipal Water Utility (CMWU) estimate that the aquifer's supply of water, suitable for human consumption, will disappear over the next 5 to 10 years [43, 47, 48, 51, 54, 57-61].

Referring to the last report for 2012 by the Costal Municipalities Water Utility, the chloride ion concentration varies from less than 250mg/L in the sand dune areas as the northern and south-western area of the Gaza Strip to about more than 10,000mg/L where the seawater intrusion has occurred[44,45,62] Also, the source of the nitrate ion in the groundwater chemical components has resulted from different sources i.e. intensive use of agricultural pesticides beside the existence of septic tanks to dispose domestic wastewater in the areas where there is no wastewater collection system. The nitrate ion concentration reaches a very high range in different areas of the Gaza Strip, while the WHO

standard recommended a nitrate concentration less than 50mg/L [44, 45, 62]

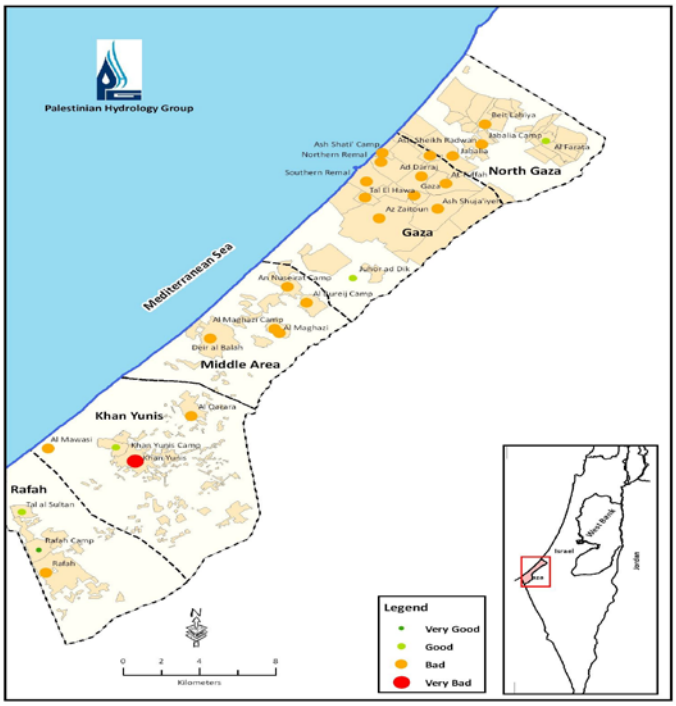

Figure 1: Drinking Water Quality in Gaza Strip (Source from UICEF and PHG, 2010)

Discussion

Possibility of Trachoma Prevalence and Opportunities for Precautions in Gaza Strip

Based on PubMed keywords, the only study which was made to evaluate the prevalence of Trachoma in the West Bank and Gaza Strip in the Palestinian Territories implemented in 1988[63], the researchers in this study assessed the prevalence and associations of trachoma in a prospective, randomized population based study of 9058 Palestinian Arabs living in the West Bank and the Gaza Strip, and in a prospective study of 1,000 consecutive unselected ophthalmic outpatients at St John Ophthalmic Hospital, Jerusalem[63]. The results of this study revealed that Trachoma was found to be widely distributed throughout the two regions, West Bank and the Gaza Strip. The highest prevalence was found in the Hebron in the West Bank and Jericho districts. An increased prevalence of trachoma was found to be statistically significant in communities without a continuous supply of running water compared with communities with this facility[63].

On the other hand, a household survey was conducted by United Nations Children's Fund (UNICEF) and Palestinian Hydrology Group (PHG) to identify areas necessitating crucial intervention to avoid prospect public health outbreaks in different areas in the Gaza strip in 2009[42]. A comprehensive survey on water quality and health indicators were accomplished, to correlate the incidence and prevalence of water borne diseases with water quality; and additional desalination units to expand access to safe water for drinking and home use[64].

Even if vastly gauntlet to appraise because of the conservative context in Gaza, hygiene was considered as one of the indicators since insufficient hygiene practices are constantly a foundation of concern due to the undesirable effect that this can have on the health of the inhabitants[47,59,65]. In consequence, the main indicators were determined; Frequency of bathing/showering that it could be used as an indicator to reflect the level of the households' awareness or the lack of water to do so. Also, hand washing before eating and cooking; such as asking the household if they practice hand washing before contact with food[48].

The main results of this survey revealed that hygienic practices vary, with 45% of all survey respondents washing their hands before cooking and 65% washing their hands before eating. The same proportion also reported washing their hands before eating. There was variation in the possibility of showering daily according to frequency of water supply to their houses, that they have running water four to seven days a week, (even though it mostly runs less than four hours a day). Although the availability of hygiene material does not seem to be a problem, good hygiene practices are not adopted by significant percent. Nearly 35 percent do not wash hands before eating and 55 per cent do not wash hands before cooking. This could be attributed to the lack of adequate water, cost of supplies and knowledge on hygiene practices[48].

The study of Chumbley et al., [63] discussed many factors which reflected the prevalence of trachoma in the surveyed community in West Bank and Gaza Strip. First of these factors, an increased prevalence of trachoma was found to be statistically significant in communities without a continuous supply of running water compared with communities with this facility, and in referring to the report by CMWU, 2012, the Gaza Strip suffers from critical water quantity and quality. Also, the researchers argued that more than 90% of the global burden of blindness from trachoma is found in the developing countries and the vast majority of the problem is seen in the countries where poverty, overcrowding, poor personal hygiene and poor environmental sanitation are much more prevalent[40]. According to[49], water, sanitation and hygiene are among the top humanitarian priorities in Gaza listed. On the other hand, active trachoma in children is often exceeds 50% [41], and about 52% of the Gaza strip population is children under 18 years old, and infants and children under five years comprising 16%

of the population, who are most vulnerable to water washed disease[64].

Referring to the facts mentioned about the critical water situation in the Gaza Strip in -2012 which state that the Gaza Strip will not be "a liveable place" by 2020 unless action is taken to improve basic services in the territory, and the coastal aquifer, the territory's only natural source of fresh water, may become unusable by 2016[49], and matching up with the global researches which signified that deprived water supply, and lacking personal hygiene practice associated with transmission of Trachoma among the community[1,2,8,16, 17], and water-associated diseases account for approximately 26 % of disease in Gaza[64], it can be deduced that there will be potential presence of trachoma among the Gazan's community.

However, since the study of [63], there is no any indication to this infectious disease in the reports of the Ministry of Health in Palestine for the last years[66]. Consequently, further studies required to develop a tool targeting a survey to evaluate the existent environmental health situation in the Gaza strip and the possibility of trachoma incidence. In addition to assessing the impact of improved water and sanitation facilities, there should be concern about increasing the level of awareness about active trachoma in the community. The standards of personal hygiene and sanitation for all age groups have great importance in avoiding many kinds of infection. This is particularly important in the prevention and treatment of trachoma. In order to be effective and sustainable, the society necessitates taking part in trachoma control activities. As a precaution against the transmission of trachoma within a community, raising individual and community standards of hygiene and sanitation should be attained. Clearly, available water increases the likelihood of good sanitation and good personal hygiene. Even if water is not available daily, very little water is required to wash a child's face and hands to prevent trachoma. Thus it is important to deliver this message to mothers, children and all the society. The simple deed of habitual, daily hand and face-washing will avert eye disease and even blindness.

Conclusion

There is a Consensus among scholars on the association between water availability and Trachoma. Improving the environment with an access to water, promote hygiene and providing sanitation will ultimately reduce the potentiality of trachoma transmission among the community. In the Gaza Strip there is a significant water crisis related to its quality and quantity which threatens the residents' health including water washed diseases such as Trachoma. However, the only study conducted to evaluate the prevalence of Trachoma in the West Bank and the Gaza Strip in the Palestinian Territories implemented in 1988 disclosed that trachoma was found to be widely distributed throughout the two regions, the West Bank and the Gaza Strip. However, there have been no records about the incidence of trachoma in this area. Thus, an exclusive survey should be applied to measure the prospective prevalence of trachoma among the citizens, in addition to applying different environmental and health promotion campaigns among the citizens to protect them from any susceptible infection with trachoma.

Recommendations

- Rapid assessment for blinding trachoma in Gaza Strip to estimate the prevalence, risk factors of this infectious disease, in order to develop a plan of action based on community needs.
- To facilitate after identification and prioritization of communities, more detailed evaluation of community resources and needs of implementation of the SAFE strategy.
- Water supply and health programmes should emphasize hygiene education to encourage the use of more water for personal and domestic hygiene.

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AUTHORS' CONTRIBUTIONS

Authors contributed equally to all aspects of the study.

PEER REVIEW

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CONFLICTS OF INTEREST

The authors declare that they have no competing interests.