



ASSESSMENT OF CLIMATE CHANGE ON GROUND WATER QUALITY OF JIMETA ENVIRONS.

BY

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ABSTRACT

This paper is a review of the challenges and effects of climate change on ground water quality. Looking at the destructive effect and consequences of climatic change that is associated with weather challenges on broader perspectives, it was noted that there is significant relationship between climate change and ground water quality. Stratified sampling techniques were use on 16 sample of water collected from hand dug well and borehole and each water sample were subjected to both chemical and bacteriological test in the laboratory. Analysis of water quality were determine as it relates to health, the results revealed that ground water were found to be more contaminated for both chemical and bacteriological contaminates, as a result of the influence of climatic effects which pose a serious challenge on water quality of Jimeta Environs. Conclusion were drawn that the quality and quantity of water to a large extend determines the outbreak and spread of water borne diseases. Therefore some recommendation were made in order to enhance the quality of ground water and measures to be put in place to address the challenges of climate change and the possible remedies on its effects, this include strict adoption on water and Environmental Laws, treatment of water for public supply, proper disposal of waste management practices and avoid locating new water source close to contaminates among others.

KEY WORD: Climate Change, Ground Water Quality, Challenges

INTRODUCTION

Water is a universal resource, due to its free occurrence in nature, it is often taken for granted and abused, especially in the third world nations where information is neither readily accessible nor disseminated to the society. Omole and Long (2008) noted that water is a chemical compound made up of two molecules of hydrogen and molecule of oxygen which is very essential to life. Like all scarce resources, which have regulations guiding their exploration, ownership, preservation and substance, water is protected by a body of law, policies and regulations all over the world in order to prevent abused (FGN,2008).

However, effective legislations cannot be made without the prior ascertaining of the quality of water sources. Water can either be sources from surface and sub surface. Hence the quality and quantity of water are been influence by the climatic change. Anyata and Nwaiwu (2000) state that the use to which water is to be put that determines the quality standard that must be imposed. And seasonal climate change of the environment seriously becomes a big challenge that affects the quality and quantity of ground water of Jimeta Environs.

Other land uses and fluctuations of ground water level lead to considerable variations in the concentration of geochemical and bacteriological pathogens in the water. According to Sharma et al (1995) in the third world countries 80% of all the diseases are directed related to poor water quality and unsanitary conditions. It's obvious water in any environment is usually contaminated through pollution and other characteristics of urban sprawl. Its against this backdrops that this paper work seek to assess the challenge and effects of climate change on ground water quality of Jimeta Environs and this will bring more knowledge in the field of water resources management, climate challenges and ground water quality.

CHALLENGES OF CLIMATE CHANGE IN NIGERIA

There is favorable climate, yet there are some challenges that Nigeria is facing as a result of climate change. Among those problems are:

- Persistent droughts, flooding, and off-season rains have sent growing season out of orbit on a country dependent on rain-fed agriculture.
- Alarm bells are ringing with lakes drying up, increased risk of death, hunger, migration and a reduction in river flow in the different parts of the country resulting in low water supplies for use in agriculture, hydro power generation and other users
- Increase in greenhouse gasses such as carbon dioxide and other gases which is problem to human existence.
- More than 100,000 farming families move southwards as a result of the desertification which is the resultant effect of climate change in the country.

- Increasing incidence of disease, declining agricultural productivity, and rising number of heat waves in Nigeria. Climate change often appears very esoteric but in Nigeria it is real and this call for scientific study of this kind.

WATER QUALITY

Water quality is defined as the physical, chemical and biological characteristics of water in relation to intended use. Water quality however, relates to water borne disease especially when the water quality is compromised by contaminants as a result of pollution. Adrian and David (2001) noted that when water is contaminated it causes disease when drinking or for domestic purpose. Concern for water quality can be traced back to 1649 in Massachusetts, United State of America, a legislation was enacted to prevent pollution of Boston labour. As the climate warms, it changes the nature of global rainfall, evaporation, snow, stream flow and other factors that affect water supply and quality. Freshwater resources are highly sensitive to variations in weather and climate. Climate change is projected to affect water availability. In areas where the amount of water in rivers and streams depends on snow melting, warmer temperatures increase the fraction of precipitation falling as rain rather than as snow, causing the annual spring peak in water runoff to occur earlier in the year. This can lead to an increased likelihood of winter flooding and reduced late summer river flows. Rising sea levels cause saltwater to enter into fresh underground water and freshwater streams. This reduces the amount of freshwater available for drinking and farming. Warmer water temperatures also affect water quality and accelerate water pollution.

IMPORTANCE OF WATER

Water is the most common substance on the surface of the earth, with the oceans covering over 70 percent of the planet. Water is one of the few substances that can be found in all three states (i.e. gas, liquid and solid) within the earth's climatic range. The very presence of water in all three forms makes it possible for the earth to have a climate that is habitable for life forms: water acts as a climate ameliorator through the energy absorbed and released during transformation between the different phases. In addition to lessening climatic extremes the transformation of water between gas, liquid and solid phases is vital for the transfer of energy around the globe: moving energy from the equatorial regions towards the poles. The low viscosity of water makes it an extremely efficient transport agent, whether through international shipping or river and canal navigation. These characteristics can be described as the physical properties of water and they are critical for human survival on planet earth.

SEASONALITY OF CLIMATE AND WATER BORNE DISEASES

Bashir (2001) simply put seasonal pattern of climate results in seasonal fluctuations in ground water level and increases the velocity of river discharge both of which significantly affect the concentration of chemical and bacteriological constituents of water and hence its quality. He further stressed that another important impact of seasonal variation is the seasonal water storages experienced in the area especially during the dry season. This situation compels the inhabitants to resort to the consumption of water of questionable quality.

Ariel (1993), also pointed out that water scarcity and quality problem occur around the globe, Harday et al (2001) also stressed that water can affect human health on many levels disease causing agent or pollutant in water. As the climate warms, it changes the nature of global rainfall, evaporation, snow, stream flow and other factors that affect water supply and quality.

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EFFECTS OF CLIMATE CHANGE ON HUMANS

Climate change has brought about severe and possibly permanent alterations to our planet's geological, biological and ecological systems. The Intergovernmental Panel on Climate Change (IPCC) contended in 2003 that "there is new and stronger evidence that most of the warming observed over the last 50 years is attributable to human activities". These changes have led to the emergence of large-scale environmental hazards to human health, such as extreme weather, ozone depletion, loss of biodiversity, stresses to food-producing systems and the global spread of infectious diseases. The World Health Organization (WHO) estimates that 160,000 deaths, since 1950, are directly attributable to climate change. Many believe this to be a conservative estimate. These then entails that the impact of climate change on humans are numerous which can be narrow to scarcity of water, food insecurity, drought, natural disaster and complete dryness of rivers of which from historical point of view it can be seen from river Benue which flow at the epicenter of Jimeta over some decade show practical decrease in size and volume. Also this decrease in size of the river may not be far from the impact of climate which is associated with extreme weather event which triggered much environmental and human problems cut and uncut. This also shows that when rivers dry it will definitely lead to scarcity of water for either domestic or industrial use in which subsequently result to poor quality of water for human consumption.

However, climate change debate and summit will be achievable if pragmatic actions are taking by the indigenous populace to address climate change impact at their own end before broader perspective action. Impacts of climate change on health, food supply, economic growth, migration, security, societal change, and public goods, such as drinking water. Human impacts can be both negative and positive. Climatic changes in Siberia, for instance, are expected to improve food production and local economic activity, at least in the short to medium term. Numerous studies suggest that the current and future impacts of climate change on human society are and will continue to be overwhelmingly negative.

The majority of the adverse effects of climate change are experienced by poor and low-income communities around the world, who have much higher levels of vulnerability to environmental determinants of health, wealth and other factors, and much lower levels of capacity available for coping with environmental change. A report on the global human impact of climate change published by the Global Humanitarian Forum in 2009, estimated more than 300,000 deaths and about \$125 billion in economic losses each year, and indicating that most climate change induced mortality is due to worsening floods and droughts in developing countries. This also

raises questions of climate justice, since the 50 least developed countries of the world account for not more than 1% of worldwide emissions of greenhouse gases. Daniel P. Bebber, Mark A. T. Ramotowski & Sarah J. Gurr (2013).

Climate change poses a wide range of risks to population health - risks that will increase in future decades, often to critical levels, if global climate change continues on its current trajectory. The three main categories of health risks include: (i) direct-acting effects (e.g. due to heat waves, amplified air pollution, and physical weather disasters), (ii) impacts mediated via climate-related changes in ecological systems and relationships (e.g. crop yields, mosquito ecology, marine productivity), and (iii) the more diffuse (indirect) consequences relating to impoverishment, displacement, resource conflicts (e.g. water), and post-disaster mental health problems.

Climate change thus threatens to slow, halt or reverse international progress towards reducing child under-nutrition, deaths from diarrheal diseases and the spread of other infectious diseases. Climate change acts predominantly by exacerbating the existing, often enormous, health problems, especially in the poorer parts of the world. Current variations in weather conditions already have many adverse impacts on the health of poor people in developing nations, and these too are likely to be 'multiplied' by the added stresses of climate change. Daniel P. Bebber, Mark A. T. Ramotowski & Sarah J. Gurr (2013).

A changing climate thus affects the prerequisites of population health: clean air and water, sufficient food, natural constraints on infectious disease agents, and the adequacy and security of shelter. A warmer and more variable climate leads to higher levels of some air pollutants and more frequent extreme weather events. It increases the rates and ranges of transmission of infectious diseases through unclean water and contaminated food, and by affecting vector organisms (such as mosquitoes) and intermediate or reservoir host species that harbor the infectious agent (such as cattle, bats and rodents). Changes in temperature, rainfall and seasonality compromise agricultural production in many regions, including some of the least developed countries, thus jeopardising child health and growth and the overall health and functional capacity of adults. As warming proceeds, the severity (and perhaps frequency) of weather-related disasters will increase - and appears to have done so in a number of regions of the world over the past several decades. Therefore, in summary, global warming, together with resultant changes in food and water supplies, can indirectly cause increases in a range of adverse health outcomes, including malnutrition, diarrhea, injuries, cardiovascular and respiratory diseases, and water-borne and insect-transmitted diseases. Patz; S.Olson (2006).

Health equity and climate change have a major impact on human health and quality of life, and are interlinked in a number of ways. The report of the WHO Commission on Social Determinants of Health points out that disadvantaged communities are likely to shoulder a disproportionate share of the burden of climate change because of their increased exposure and vulnerability to health threats. Over 90 percent of malaria and diarrhea deaths are borne by children aged 5 years or younger, mostly in developing countries. Other severely affected population groups include women, the elderly and people living in Small Island developing states and other coastal regions, mega-cities or mountainous areas. Sahney, S., Benton, M.J. & Falcon-Lang, H.J. (2010)

CAUSES OF CLIMATE CHANGE

On the broadest scale, the rate at which energy is received from the sun and the rate at which it is lost to space determine the equilibrium temperature and climate of Earth. This energy is distributed around the globe by winds, ocean currents, and other mechanisms to affect the climates of different regions. Woodruffs (2006) Factors that can shape climate are called climate forcings or "forcing mechanisms". These include processes such as variations in solar radiation, variations in the Earth's orbit, variations in the albedo or reflectivity of the continents and oceans, mountain-building and continental drift and changes in greenhouse gas concentrations. There are a variety of climate change feedbacks that can either amplify or diminish the initial forcing. Some parts of the climate system, such as the oceans and ice caps, respond more slowly in reaction to climate forcings, while others respond more quickly. There are also key threshold factors which when exceeded can produce rapid change (Ferry,2010).

Forcing mechanisms can be either "internal" or "external". Internal forcing mechanisms are natural processes within the climate system itself .External forcing mechanisms can be either natural (e.g., changes in solar output) or anthropogenic (e.g., increased emissions of greenhouse gases).Whether the initial forcing mechanism is internal or external, the response of the climate system might be fast, slow or a combination (e.g., sudden loss of albedo in the arctic ocean as sea ice melts, followed by more gradual thermal expansion of the water). Therefore, the climate system can respond abruptly, but the full response to forcing mechanisms might not be fully developed for centuries or even longer (Ferry, 2010).

METHODOLOGY

LEVEL OF CHEMICAL CONTAMINATION OF THE WATER SOURCES IN JIMETA ENVIRONS

Location	Sources	Fe^{2+} mgl	Mg^{2+} mgl	PH value	Hardness mgl
Gwadabawa	Wells	0.4	27.3	5.1	141.1
	borehole	0.19	27.8	6.1	127.9
Karewa	Wells	0.35	25.9	6.5	152.1
	borehole	0.20	28.1	5.9	128.1
Dougbelli	Wells	0.5	26.1	6.4	172
	borehole	0.23	27.9	6.9	128.0
Capital	Wells	0.6	26.1	7.2	141.1
	borehole	0.20	29.0	6.4	128.4
Ribadu Square Area	Wells	0.4	25.1	6.0	200.1
	borehole	0.20	28.2	6.0	127.8
WHO Recommended Standard		0.3	0.20	6.5-8.5	300

Source: Grand microbiology laboratory

The analysis shows that the samples of water collected from hand dug well are having concentration of Fe^{2+} exceeding the WHO standard, and the implication of this is the limitation of the use of such water for laundry and staining of other fittings as a result of oxidation of iron contained in the water. The PH value also varies from one location to the other these can be attributed to the underlying geology of the area. The expected maximum permissible value for

magnesium concentration in portable drinking water by the WHO is 0.2mg/l and range between 25.1-29.0mg/l which shows an overdose concentration of magnesium in water.

BACTERIOLOGICAL CONTAMINATION OF THE GROUND WATER SOURCE

Location	Coliform 100ml		Total coliform cfu/100ml	
	Borehole	Wells	Borehole	Wells
Gwadabawa	571.1	561.9	7.9	8.49
Karewa	570.0	568.3	7.21	9.2
Dougbelli	581.1	543.1	8.01	9.0
Capital	571.0	561.8	7.45	8.81
Ribadu Square Area	562.2	576.8	6.73	9.03
WHO Recommended Standard	500/100ml	500/ml	10/100ml	10/100ml

Source: Grand microbiology laboratory

From the table above, it could be seen that all the sample of water collected from the various selected wards for hand dug wells and borehole falls within the range of 543.1-581.2 cfu/100ml under faecal coliform contamination. The recommended and prescribed maximum value by WHO standard is 500cfu/100ml. this however, suggest that none of the water samples selected met the recommended standard by WHO, based on this it can pose health threat to general populace of this area.

CONCLUSION

This paper concluded that climate change is a change in average weather conditions, or in the time variation of weather around longer-term average conditions. Climate change indeed is a big challenge that has brought about severe and possibly permanent alterations to our planet's geological, biological and ecological systems. The majority of the adverse effects of climate change are experienced by poor and low-income communities, who have much higher levels of vulnerability to environmental determinants of health, wealth and other factors, and much lower levels of capacity available for coping with environmental change.

The challenge and effect of climate change poses a wide range of risks to population health - risks that will increase in future decades, often to critical levels, if global climate change continues on its current trajectory. A changing climate thus affects the prerequisites of population health: clean air and water, sufficient food, natural constraints on infectious disease agents, and the adequacy and security of shelter. A warmer and more variable climate leads to higher levels of some air pollutants and more frequent extreme weather events. It increases the

rates and ranges of transmission of infectious diseases through unclean water and contamination of underground water.

RECOMMENDATIONS

To prevent and enhance better management of ground water quality associated with climatic challenge and its resultant effect. The government and relevant agencies who are concerned with managing challenges of climate and management of water need to consider the following:

1. Effective policing round the clock on water management.
2. Proper public enlightenment will do a lot of help to reduce occurrence of Climate change.
3. Strict adoption on water and Environmental Laws should be in place
4. Treatment of water for public supply
5. Governments and relevant authorities taking appropriate measures to tackle problem of Climate change
6. Avoid locating new water source close to contaminates among
7. Proper disposal of waste management practices

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