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Evaluate the Natural Factors and their Effect on Health: A case Study Edduiem Locality, White Nile State, Sudan (2021-2022)

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Abstract

The study aimed to assess the impact of natural factors on disease prevalence in Edduiem locality, White Nile State, Sudan. The study employed a descriptive-analytical approach, utilizing observation and interviews. Data were analyzed using Pearson's correlation coefficient. The study found that the locality's location places it within the range of tropical diseases such as malaria, schistosomiasis, typhoid, and diarrhea, with a disease prevalence rate of 95.3%. Malaria is endemic and prevalent throughout the year, with infection rates increasing during the autumn season. The correlation between rainfall and diarrhea was found to be 0.77%. The study recommended that relevant authorities activate vector control measures, provide financial support for disease control, and prioritize drainage during the autumn season and activating the role of health education to raise citizens' awareness of the dangers of handling contaminated water in order to reduce the incidence of these diseases.

Keywords: Natural factors, Diseases, Natural environment, Health, Edduiem locality, Sudan.

Introduction

Environmental studies and the growing understanding of the natural and cultural environment are among the most prominent scientific developments that emerged in the 1970s. The scientific and applied importance of environmental science and environmental planning has increased due to the growing negative impact of various human activities on the elements of the environment, this has led to a disruption of the ecological balance. The role of environmental science is to diagnose environmental problems, identify their causes (whether natural or human-induced), and select methods to address them, mitigate their risks, and confront them. These environmental changes have led to the spread of previously unknown diseases linked to these issues, and to the occurrence of numerous environmental disasters in various parts of the world. The environment is in continuous decline due to the increasing quantities of hazardous waste from industrial, medical, and domestic sources. Because of the danger this waste poses to health and the environment, it requires effective monitoring and environmentally sound management. The international community has begun to realize that pollution knows no borders, and that disposing of hazardous waste in industrialized and wealthy countries by transferring it to developing countries does not solve the problem but rather exacerbates it. The best solution to the hazardous waste problem is to manage it in environmentally sound ways to reduce its effects and risks to health and the environment, given the diversity of contemporary environmental problems in terms of their causes and consequences, environmental science is an interdisciplinary science that transcends traditional

boundaries such as life sciences, chemical sciences, geography, geology, economics and engineering, so that it bridges the gaps between those sciences and acts as a link between them.

Study Problem:

The study problem was formulated in the following main question: What is the effect of natural factors on the spread of diseases in Al-Duwaim locality?

The importance of the study: This study came as an attempt to address the problems of diseases through studying the environment from the perspective of medical geography, in addition to highlighting the importance of geographical information and its connection to health aspects. The Sudanese library still lacks any detailed study on the environment of the White Nile State as an independent research topic, except for some broad outlines and quick references scattered in the pages of books and articles that dealt with the geography of Sudan on the one hand and health conditions on the other.

Study Hypothesis: The main study hypothesis is formulated as follows:

The characteristics of the natural environment in Edduiem locality have a direct impact on the spread of diseases.

Study Objectives: The study aims to achieve the following objectives:

- To identify the most important health (related to human health) and environmental (related to location) indicators and their relationship to disease incidence.
- To determine the impact of geographical environmental factors on diseases.

Previous studies:

Dutta (1978): This study aimed to investigate the ecology of malaria, demonstrating the life cycle of the disease vector and its relationship to climatic conditions, specifically linking it to a belt extending from South America through Africa to Asia. The study concluded that combating illiteracy reduces the incidence of this disease.

Park (1979) highlighted the disease of malaria in India. The study concluded that the percentage of pregnant women increased the risk of the disease, that the country's economic development plays a major role in reducing malaria, that malaria is a disease that affects rural areas and health professionals in particular, that the weather helps the parasite to increase, and that the malaria vector is not found at altitudes higher than (2000-2500 meters).

Al-Ghamdi (1984) revealed the distribution and spread of diseases among pilgrims in the holy sites. The study found that there were about (19) diseases that patients visiting outpatient clinics complained of, with influenza representing 29%, followed by headache and dizziness at 15.5%, then skin infections at 9.7%. The most important environmental factors contributing to pilgrims contracting various diseases were climatic conditions, especially extreme heat (headache, skin diseases, dizziness and influenza, sunstroke and fever), the second factor was overcrowding (headache, dizziness, bleeding), and the third factor was malnutrition (colic and diarrhea).

Hassan (1999) examined health and the environment in medical planning in the Asyut region. The study concluded that patient behavior regarding treatment depends on the economic status and the head of household's education level. It recommended disseminating health education among the population to prevent many diseases, most notably schistosomiasis and malaria.

Sharaf (1972) investigated the geographical environment and its relationship to diseases and health problems in Sudan. The study concluded that the natural geographical environment plays a role in the

spread of diseases (malaria, schistosomiasis, leprosy, river blindness, and erysipelas). It found that climatic elements (temperature, humidity, sunlight) and other geographical factors contribute to the presence of disease vectors and disease-causing insects. The study also identified areas where these diseases are prevalent due to their natural conditions.

Al-Hassan (1992) revealed waterborne diseases. The study concluded that there was a low level of health awareness among citizens in Wad Madani, and that the spread of waterborne diseases was due to many reasons, including those related to water resource management systems, uses, and handling, as well as those related to a lack of health awareness.

Zakaria (1997) aimed to determine the economic and social impacts of malaria in the Al-Manshiya and Al-Dukhainat districts of Khartoum State. The study concluded that higher income, better diets, and healthier home environments were more effective in reducing malaria infection rates in Al-Manshiya than in Al-Dukhainat. Furthermore, the study found that more effective health education was associated with higher economic and educational levels. Malaria also significantly impacted worker absenteeism and productivity compared to other professions, with the effects being particularly pronounced among Al-Dukhainat residents.

Al-Hassan (1998) investigated the spread of diseases and the geographical factors influencing disease distribution and its impact on development within the Gezira Scheme, using fieldwork in the Al-Madina Arab locality. This area was chosen due to the Gezira Scheme's importance to the Sudanese economy.

Ibrahim (1998) aimed to determine the causes of malaria prevalence in Khartoum State. It concluded that malaria poses a significant health problem in the state, as transmission continues year-round, with infections occurring three to four times a year.

Al-Rudaisi (2001) addressed the concept of medical geography from its various dimensions, including disease classifications and the natural and human ecology of disease. The study concluded that medical geography plays a leading role in achieving social and economic development, especially in situations of steady population growth and the associated health concerns.

The Natural Environment of Edduiem Locality and its Impact on Health

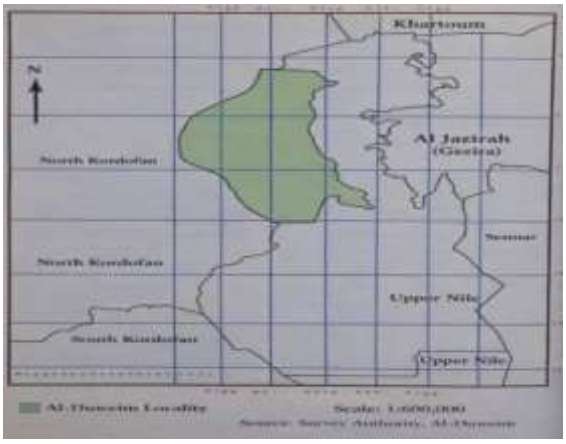
The natural components of the environment are a protective layer surrounding humans and determining various aspects of their lives, including the occurrence of disease. Understanding natural factors, their components, and their effects on diseases helps in avoiding them, coexisting with them, and developing strategies to help the community adapt to its environment in a way that promotes better health. This chapter will address the natural environmental factors affecting the prevalence and spread of diseases in the locality, namely location, geological formation, topography, climate, soil, natural vegetation, and water, considering these as contributing factors to disease. The researcher relied on recorded government data, statistics, and information gathered from fieldwork in writing this section.

Location

The location of any place near one of the areas where any infectious disease is endemic, especially epidemic diseases, makes it always susceptible to outbreaks of these diseases among its inhabitants. It is not only humans who transmit the disease, but also many animals and insects whose movement cannot be controlled. In countries located in the African savanna and tropical forests or in the adjacent semi-desert areas, epidemics often appear as a result of the movement of some animals among them, for example, monkeys are known to harbor the yellow fever virus, dogs (rabies), and tsetse flies transmit

sleeping sickness. Location in relation to latitude also has a health impact in terms of its relationship to climate, which in turn affects the distribution of diseases, such that some, like cholera, schistosomiasis, and malaria, are prevalent in tropical latitudes, while others, like rickets and bronchitis, are prevalent in cold latitudes.

Map (1) Location of Edduiem Locality



Edduiem locality is located in the central plains region of the country, extending over a vast area west of the White Nile between latitudes 13.45° and 15° North and longitudes 31.45° and 32.15° South. It is bordered to the north by Al-Qutaynah locality, to the south by Kosti locality, to the east by the White Nile, and to the west by North Kordofan State. This location near the equator places it within the area prone to tropical diseases such as malaria, schistosomiasis, and cholera. Edduiem locality is divided into five administrative units: Edduiem Administrative Unit, Shabsha Administrative Unit, Umm Ramta Administrative Unit, Al-Tadamun Administrative Unit, and Al-Wahda Administrative Unit.

Surface and Topography

The relationship between topography and human health is evident either through its direct impact on the human body's systems or its influence on climate and the distribution of various organisms related to the occurrence of certain diseases. Regarding its direct impact on the human body's systems, it is known that high altitude affects the lungs, heart, and circulatory system, resulting in decreased atmospheric pressure, air permeability, and a decrease in oxygen levels. In the study area, there are no high mountainous regions inhabited by humans, in terms of surface features, two distinct topographical phenomena can be observed:

The first is the uniformity of the terrain, and the second is that drainage almost entirely collects in the White Nile. Clay plains stretch as far as the eye can see, with few isolated, low-lying areas. This has influenced population stability, making the area attractive for human settlements that have spread throughout its expanse. This has presented a challenge in terms of providing public and health services, especially across such a vast area. These plains have been associated with certain diseases in the study area, particularly in irrigated plains, such as malaria and schistosomiasis. The relationship between these diseases and elevation is weak and negative.

Soil

Endemic and epidemic diseases occur on different types of soil. Soil is known to play a significant role

in harboring pathogens and worms, and researchers have confirmed this relationship. Certain diseases are more common in low-lying alluvial areas, while recorded human cases are less frequent on soils above 2,000 feet. Soil pollution results from improper agricultural practices and unsanitary methods of disposing of liquid and solid waste. It can also result from atmospheric pollution and the subsequent deposition of these pollutants. Biological agents can also contaminate the soil and cause diseases in humans, it is divided into three types: disease-causing germs that humans excrete in their feces and that are transmitted through the soil to another human, germs of animal origin that are transmitted through the soil to humans, and disease-causing germs that are naturally found in the soil and are transmitted to humans. (W.H.O.1972), the local soil of Edduiem is a significant source of pollution, primarily from human waste. This pollution is particularly evident in cities, not to mention rural areas. Furthermore, the heavy use of pesticides exacerbates the problem, especially given the region's agricultural projects. The soil varies from east to west, ranging from light clay to mixed to sandy, with a small area of semi-rocky soil in the northeastern corner, Fieldwork revealed a clear impact of soil type on disease incidence. Malaria infection rates, in particular, were found to be significantly higher in the eastern part of the country, reaching 58%, while they decreased to 41.5% in the western part. This is attributed to the low permeability of clay soils due to the cohesion of clay particles, which increases the soil's ability to retain rainwater during the autumn and prevents its seepage, unlike sandy soils. This leads to the formation of stagnant water, creating a suitable environment for the breeding of disease-carrying insects and mosquitoes.

Climate

According to the Köppen classification, the climate of White Nile State falls within the arid and semi-arid desert climate zone. To identify climatic characteristics, the researcher relied on the monthly statistics from the local meteorological station. Climatic elements are among the most influential natural factors affecting human health due to their impact on disease-causing organisms and their direct influence on disease types, seasonality, and incidence rates. These elements include:

Temperature: The geographical distribution of climate influences the prevalence of certain diseases in specific environments, such as tropical climates. Climate is defined as the sum of weather conditions-radiation, temperature, evaporation, precipitation, wind, and humidity-over a period exceeding twenty-four hours. Climate is distributed across the globe according to latitude, from the equator to the poles. Al-Duwaim locality is located within the arid climate belt or semi-desert region. One of its most important characteristics is the high temperature, which is subject to a large difference between summer and winter and between night and day. The temperature rises in the summer months, which begin in March and continue until June. The months of July and August represent the autumn months, when rain falls and the temperature drops. December and February are also the months of winter, when the temperature is at its lowest. The effect of heat on the human body is closely related to metabolism and psychological pain. Scientifically, studies have confirmed that the internal heat of the human body produced by metabolic functions requires a suitable external temperature in order to be dissipated (Al-Radisi, 2001). However, the location of the locality within the tropical belt, which is characterized by high temperatures throughout the months of the year, hinders the process of dissipating the produced heat due to the lack of external cooling, which weakens activity and vitality, and thus the body is susceptible to diseases and responding to their symptoms. In tropical regions, the average temperatures in the rainy season help create a suitable environment for the reproduction of pathogenic organisms

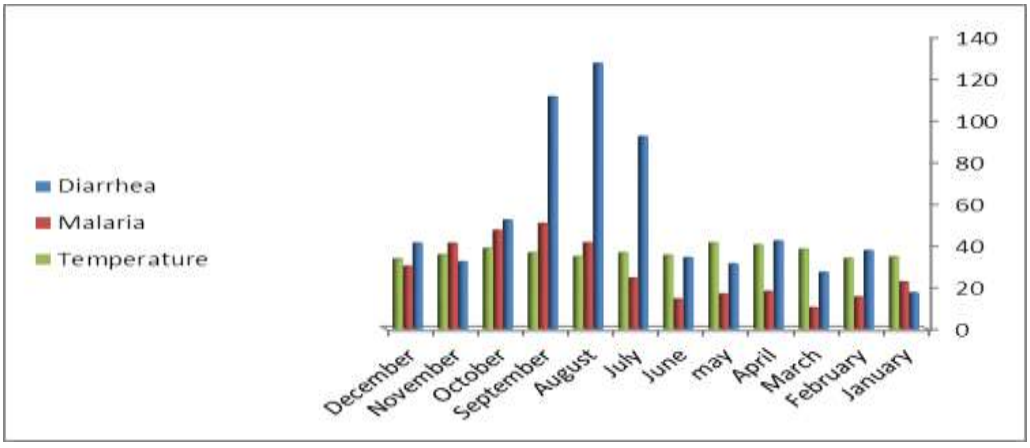
whose temperature ranges vary according to their types. Scientifically, studies have proven that most vectors reproduce at a temperature between 25-30 degrees Celsius. In the study area, we find that the annual average temperature is (38) degrees Celsius, and there is no great variation in temperatures, which reduced the creation of a clear variation in its effect on the disease.

Table (1) Relationship between temperature and diseases (by month)

Months	Temperature	Malaria	Diarrhea
January	34.4	22.4	17.2
February	33.7	15.2	37.4
March	38.1	10.1	27
April	40.2	17.9	42
may	41.1	16.6	31
June	35.2	14.2	34
July	36.4	24.2	92
August	34.5	41.1	127
September	36.4	50.4	111
October	38.5	47.1	52
November	35.4	40.9	32
December	33.5	29.9	41

Source: State Ministry of Health, Edduiem Meteorological Center, 2021.

Figure (1) Relationship between temperature and diseases (by month)



Source: Prepared by the researcher from Excel Package, 2021.

From Figure (1), we observe that the incidence of diarrhea increases in the period from July to September, which is the period in which temperatures decrease. Using Pearson's coefficient to verify the hypothesis of the relationship between the disease and temperatures, it was shown that the relationship between temperatures and the incidence of diarrhea is a negative relationship with a rate of (-0.11). This means that as the temperatures increase, the incidence rates decrease due to the death of the vectors when the temperature rises. This applies to the incidence rates of malaria, where we find that the relationship between them and temperature is a negative relationship with a rate of (-0.9). We observe from the figure that the incidence rates of malaria increase in the winter season due to the decrease in

temperatures to a degree that helps mosquitoes to reproduce, especially since the winter season follows the period of rainfall.

Rainfall

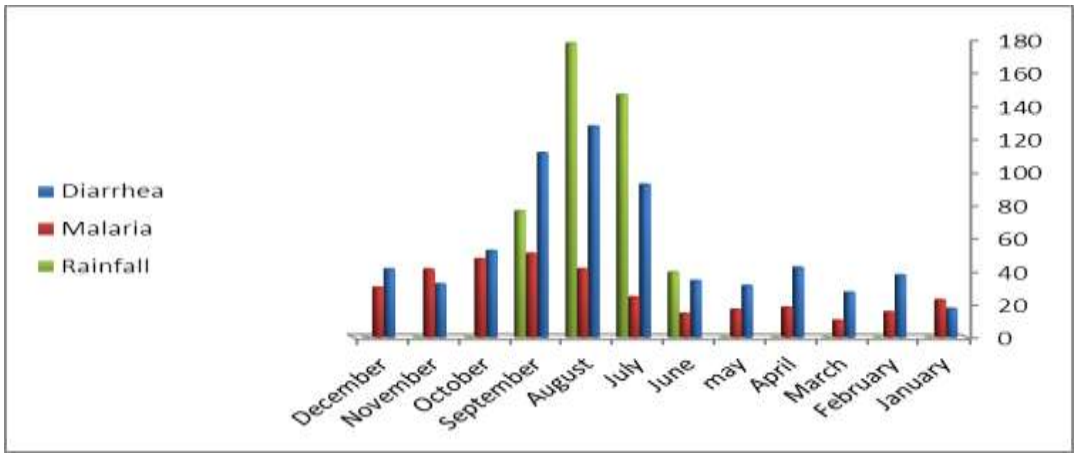
Rainfall is a climatic element that helps moderate the temperature in this hot region, in addition to purifying the air of suspended pollutants. Furthermore, the rainy season helps curb the spread of meningitis. The study area lies within the arid climate zone, characterized by limited rainfall, which increases as one moves south. The average rainfall ranges between 343 and 463 mm (Al-Tarifi et al., 1995), typically beginning in June and continuing until the end of September. Rainfall amounts vary from 200 mm in the northern parts to 460 mm in the southern regions. Field research has shown that the autumn season is one of the most prevalent seasons for disease-carrying insects and organisms, The annual reports of the State Ministry of Health showed that hospital visits increase in November and December, the months following the rainy season. Using Pearson's correlation coefficient to determine the relationship between malaria, diarrhea, and rainfall, it was found that the relationship between rainfall and diarrhea is strong (0.75), while the relationship between malaria and rainfall for the same period is negative (-0.19). This means that there are other, more sustainable factors affecting malaria infection rates. This does not mean that rainfall has no effect on malaria infection, as the study confirmed that malaria is an endemic disease that spreads locally throughout the year, but its infection rate increases in the rainy months.

Table (2) Relationship between rainfall and diseases (by month)

Months	Rainfall	Malaria	Diarrhea
January	0	22.4	17.2
February	0	15.2	37.4
March	0	10.1	27
April	0	17.9	42
may	0	16.6	31
June	39.1	14.2	34
July	146	24.2	92
August	177	41.1	127
September	76	50.4	111
October	0	47.1	52
November	0	40.9	32
December	0	29.9	41

Source: State Ministry of Health, Edduiem Meteorological Center, 2021.

Figure (2) Relationship between rainfall and diseases (by month)



Source: Prepared by the researcher from Excel Package, 2021.

From Figure (2) regarding diarrheal diseases, in the rainy months the health of the environment deteriorates significantly due to the accumulation of water, which makes the environment a haven for the breeding of vectors, which leads to pollution. Through field work by observation, it became clear that the rainy season represents the season in which insects spread the most, and rain represents the most important factors affecting the health of the environment.

Relative humidity

Low atmospheric humidity leads to a decrease in water vapor from body cells, which in turn leads to microscopic cracks in the mucous membrane, especially on cold days. Prolonged and high levels of cold stimulate the constriction of peripheral capillaries and reduce blood flow, causing dryness and cracking of skin cells (Hassan, 1999). Relative humidity is directly related to rainfall rates in the study area, and increased humidity promotes the growth of parasites and disease-carrying insects. It also has a direct impact on human vitality and disease resistance, using Pearson's correlation coefficient to measure the correlation between humidity and disease in the study area, it was shown that there is a positive relationship between humidity and diarrhea and malaria, with a rate of (0.51) for diarrhea and a rate of (0.7) for malaria. Figure (8) shows the relationship between relative humidity and the rate of infection with malaria and diarrhea in the study area.

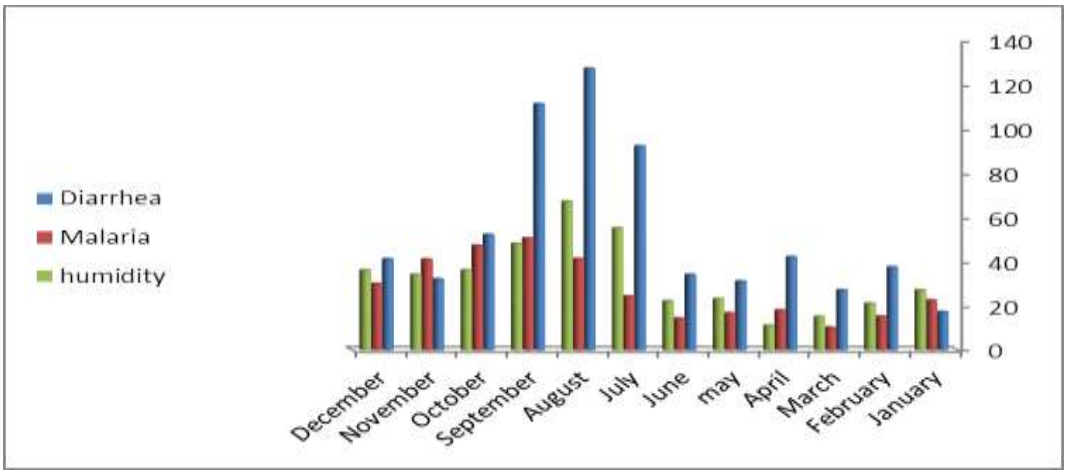
Table (2) Relationship between humidity and disease (by months)

Months	humidity	Malaria	Diarrhea
January	27	22.4	17.2
February	21	15.2	37.4
March	15	10.1	27
April	11	17.9	42
may	23	16.6	31
June	22	14.2	34
July	55	24.2	92
August	67	41.1	127
September	48	50.4	111
October	36	47.1	52

November	34	40.9	32
December	36	29.9	41

Source: State Ministry of Health, Edduiem Meteorological Center, 2021.

Figure (3) shows the relationship between humidity and disease (by months)



Source: Prepared by the researcher from Excel Package, 2021.

From Figure (3), we observe that the period from June to September has an increase in the rates of malaria and diarrhea infection due to the increase in humidity during the same period, which confirms that the relationship between them is direct due to the increase in the growth rate of disease vectors.

Winds

The prevailing winds in the region vary according to the seasons. In winter, northeasterly winds are prevalent; these are dry, light winds that stir up dust and sand, affecting human health due to the cold waves blowing from the far north. The incidence of respiratory illnesses, allergies, and related fevers increases throughout the region, and these illnesses become seasonal, with their severity depending on the community's standard of living. The winds shift to humid southwesterly winds, bringing rain in the autumn. However, the field study confirmed that the impact of windborne pollutants is almost negligible due to the nature of human activity, which is primarily based on agriculture and livestock grazing.

Natural Plants

The researcher in the relationship between natural plants and human health notes that it can be indirect, in that natural plants can shelter specific types of wild animals, reptiles, vermin, and insects that are related to the emergence and spread of some diseases, such as yellow fever, which affects monkeys in tropical rainforests. In addition to these indirect relationships, there are some direct relationships between some plants and human health, not only in that they may provide shade, food, or psychological comfort, but also in that some of them have certain medicinal properties, some of which may be beneficial and some harmful, for example, there are types of plants used in the manufacture of specific medicines, the most well-known being various medicinal herbs. On the other hand, there are also harmful medicinal plants, some of which contain toxic substances that can lead to the death of humans or animals when ingested, such as certain types of mushrooms. There are also some trees and shrubs whose leaves contain poisonous sap that, upon contact, can cause severe rashes and skin inflammation; examples include poison ivy, poison bilberry, and poison oak. Among the most important plant species

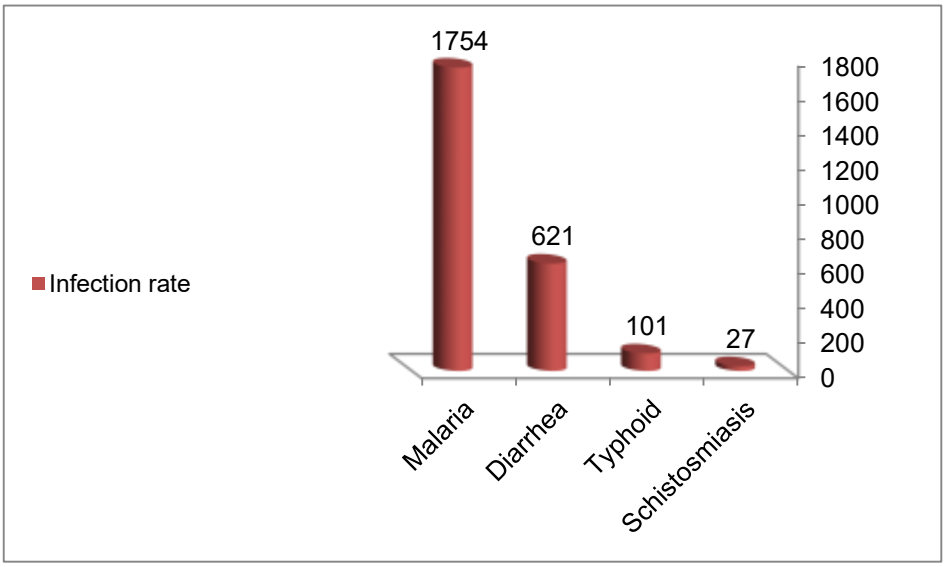
prevalent in the region are Acacia ruddinane, Acacia nilotica, Acacia mollifyeve, Acacia Senegal, Acacia troeilis, Calatropis proseera, Cappairs deciduas, and Cassia actifalia. Some shrubs and grasses are also found, such as Tephrosisembroiders and Arianetempenlandra.

Table (4) the local rate of waterborne diseases in Edduiem Locality

Diseases	Malaria	Diarrhea	Typhoid	Schistosmiasis
Infection rate	1754	621	101	27

Source: State Ministry of Health, Edduiem Meteorological Center, 2021.

Figure (4) The local rate of waterborne diseases in Edduiem Locality



Source: Prepared by the researcher from Excel Package, 2021.

There are several prevalent diseases in the study area, as illustrated in the figure above. Among the most important are endemic diseases (those related to environmental conditions), such as malaria, schistosomiasis, and typhoid fever, as indicated by the field research results. The surveyed population consisted of 2,503 individuals, and the percentage of disease prevalence was 70% for malaria. This is a very high percentage, as almost every household is affected by this disease, which impacts all age groups and all genders. While not tied to a specific season, it peaks in the autumn. Following malaria, diarrhea (24.8%) is the most common illness among children under five years old, these diarrheas constitute a major cause of death among them. Every child in Sudan is exposed to acute diarrhea 4-5 times a year on average, and the total number of deaths among them is about (100,000 children annually) (Federal Ministry of Health). Diarrhea is generally defined as an increase in the frequency and quantity of bowel movements, and it is also liquid. As for typhoid fever, which represents 4%, it is considered one of the most important diseases related to the human environment, and the natural environment hardly has a role in its emergence and spread. It can spread in any type of climate due to weak health controls, low hygiene standards, and poor health awareness. The most important methods of transmission are contamination of food and drinking water with the feces of infected individuals. This contamination often occurs through the hands of carriers of the microbe, and flies are considered one of

the most important means of food contamination with this microbe. Finally, there is schistosomiasis, which is considered an epidemic disease in the truest sense, as it does not appear or spread except when specific natural and human conditions are present that are suitable for the development of its parasite through its successive stages outside the human body.These are well-known stages, and they require conditions that must all be met, so that if any one of them disappears, its disappearance leads to the cessation of its life cycle. One of the most important of these conditions, which is abundant in the study area, is water, represented by the abundance of agricultural projects and the resulting construction of canals and waterways.

Discussion and Results

The field study was subjected to computer statistical processing as mentioned above by using chi-square tests, and the results will be compared with the study hypotheses to prove the extent of their conformity. The result was as follows: In a question about infection with malaria, schistosomiasis and some internal diseases such as diarrhea and gastroenteritis, i.e. diseases associated with the deterioration of environmental health, 92.3% of the surveyed sample answered that they were infected with these diseases, i.e. theoretically there is a relationship between the deterioration of environmental health and these diseases, but when these data were subjected to statistical processing, the results proved the significant effect, and thus the existence of a relationship or correlation between infection with these diseases and the deterioration of environmental health, that is, infection with these diseases is related to the environment, because the calculated significance level was 3.841, which is greater than the significance level of (0.05), and thus the research hypothesis was confirmed, which states: The deterioration of environmental health caused by the population due to household waste, garbage, and sewage water led to an increase in the incidence of environmentally related diseases (such as malaria, schistosomiasis, and some internal diseases such as diarrhea and acute gastroenteritis).

Table (5) Treatment Location

Treatment Location	Number	Percentage
I receive treatment in government institutions	**222**	**74%**
I receive treatment in private clinics	**78**	**26%**
Total	**300**	**100%**

Source: Prepared by the researcher from field work data, 2021.

Table (6) Doctors' Fees

Opinion	Number	Percentage
Doctors' fees are high	274	91.3%
Doctors' fees are reasonable	26	8.7%
Total	**300**	**100%**

Source: Prepared by the researcher from field work data, 2021.

Table (7) Possibility of Meeting with Specialist

Opinion	Number	Percentage
I am able to meet with the specialist	30	10%

I am unable to meet with him/her	270	90%
Total	**300**	**100%**

Source: Prepared by the researcher from field work data, 2021.

Table (8) Number of Medical Staff

Statement	Sufficient	%	Insufficient	%
Number of Specialist	28	9.3	272	90.7
Number of Physicians	95	31.7	205	98.3
Number of Technicians	129	43	171	57
Number of Nurses	176	58.7	124	41.3

Source: Prepared by the researcher from field work data, 2021.

From Tables (5) and (6), it became clear theoretically that there is a relationship between those who receive treatment in government institutions and the high salaries of doctors, as the percentage of those who receive treatment in government hospitals reached (74%), while those who answered that doctors' salaries are high reached (91.3%). However, when the factor – those who receive treatment in government hospitals and contracting diseases – was subjected to statistical analysis, the results proved that its effect was not significant because the calculated significance level was 0.411, tables (7) and (8) also revealed a shortage of specialists and doctors, and citizens' inability to access them for appropriate treatment. This theoretically suggests a correlation, as 90.7% of respondents indicated an insufficient number of specialists, while 90% reported being unable to access specialists. However, when the availability of specialists in hospitals and the prevalence of the disease were statistically analyzed, the results showed no statistically significant effect, with a calculated significance level of 3.841. Therefore, the research hypothesis can be accepted: the high cost of doctors in outpatient clinics has led citizens to seek treatment at government hospitals despite their poor services, resulting in a rise in disease rates. When asked about how they dispose of wastewater used for household purposes, 26.3% said they dispose of it in the sewer system, 45% in the street, and 28.7% in other areas. In another question about going to the doctor when feeling ill, 30.7% said they do, while 69.3% said they do not. These figures practically indicate a lack of environmental awareness, (73.7) dispose of household wastewater in the street and other areas, while 69.3% do not seek medical attention when feeling ill. Furthermore, when the data were subjected to statistical analysis, the results demonstrated a significant correlation between illness and a lack of environmental awareness. This is because the calculated significance level was 3.841 in the cross-sectional table for disposing of wastewater for domestic purposes and 5.991 in the cross-sectional table for seeking medical attention when feeling ill and contracting illnesses. In both cases, the figures 3.841 and 5.991 are greater than the standard value of 0.05, therefore, the research hypothesis was confirmed: low educational levels have led to a lack of environmental awareness, which has negatively impacted human health by increasing disease rates. When asked about the role of voluntary organizations in improving environmental health and reducing disease rates, 79.3% of respondents indicated that such organizations play a role in this regard. This theoretically suggests a relationship between the role of these organizations and disease reduction. Furthermore, when subjected

to statistical analysis, the results proved statistically significant, confirming a correlation between disease incidence and the role of voluntary organizations, as the calculated significance level was 3.841. It is greater than the significance level (0.05), thus confirming the research hypothesis that voluntary organizations in the study area have a major role in reducing the incidence of diseases.

Results:

a) The locality's location places it within the area prone to tropical diseases such as malaria, schistosomiasis, and diarrhea, with an infection rate of 92.3%.
b) The study confirmed that malaria is an endemic disease prevalent throughout the year, although the incidence increases during the autumn season.
c) Using Pearson's correlation coefficient, a strong correlation of 0.77 was found between rainfall and malaria, and a positive correlation of 0.54 was also found with relative humidity.
d) Typhoid fever accounts for 4% of cases and is considered one of the most significant diseases linked to the human environment. Natural factors are rarely the primary cause of its emergence and spread. It can spread in any climate due to weak health controls, low levels of hygiene, and a lack of health awareness.

Recommendations:

1. Responsible authorities should activate their role in multi-pronged efforts to combat disease vectors and provide financial support for disease control.
2. Attention should be paid to drainage systems, especially during the autumn season.
3. Health education programs should be strengthened to raise public awareness about the dangers of handling contaminated water and to modify public behavior regarding it.

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