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CLIMATE PERIODS AND PATHOLOGICAL RISKS AMONG FARMERS IN THE COMMUNE OF POBE

Mounirou SEIDOU[1], Thierry Hervé AZONHE[2] Fidèle K. MEDEOU [1]

[(1)] Laboratoire Pierre PAGNEY, Climat, Eau, Ecosystème et Développement (LACEEDE), Département de Géographie et Aménagement du Territoire de l'Université d'Abomey-Calavi.
[(2)] Maître de Conférences en Géographie et Gestion de l'Environnement ; Spécialité : Environnement, Santé et Développement, Enseignant au Département de Géographie et Aménagement du Territoire à Université d'Abomey-Calavi, Chercheur au Centre Béninois de la Recherche Scientifique et de l'Innovation (CBRSI);

Abstract

This research is devoted to the study of climatic periods and pathological risks among farmers in the municipality of Pobè. The analysis of Pearson correlation and linear regression tests performed in the XLSTAT software helped to assess the degree of linkage between climatic parameters and malaria, ARI, diarrheal diseases. Main Component Analysis allowed appreciating the appearance of pathological climatic periods. The results obtained show that in the municipality of Pobè during each climatic period, the moments of discomfort are responsible for the direct and indirect pathological risks for farmers. Thus, it is noted direct risks in times of high heat such as headaches (42%), fever (21%), heat pains (21%), vertigo (11%), muscle cramps (11%) and in harmattan period sore throats (45%), dry nostrils (24%), cleft lip (19%) and heels (12%). Indirect risks are the pathological risks of malaria (51%), Acute Respiratory Infections (17%), diarrheal diseases (11%) and intestinal diseases (8%). Faced with these climate-sensitive risks, farmers develop endogenous measures and often resort to traditional medicine, self-medication and before going to a health center.

Keywords: Municipality of Pobè, Health risks, Pathologies, Farmers, Climatic periods

Introduction

Health depends in the long run on the stable and continuous functioning of the ecological, physical and socioeconomic systems of the biosphere (Kortli, 2009). The human organism is subjected to numerous physical and chemical aggressions of both internal and external origin (Rousseau, 2006). Cold environments have a double direct and indirect impact on the human organism, on the one hand, promote the aggressiveness and long vitality of viruses, and on the other hand weaken the immune system (Jarraya, 2012).

In Africa, bioclimatic environments are modified by the rise in temperatures which, when they exceed the standards, weaken the human immune system and sometimes lead to the appearance of pathologies or even death (Biaou, 1999; Kalkstein, 2001et Besancenot, 2007).

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In Benin, bioclimatic environments and different types of weather accelerate the development of agents responsible for certain diseases such as malaria, respiratory diseases and diarrhea (Houndonougbo, 2008, Médéou, 2011 and Akindélé, 2011).

In order to characterize climatic periods and the occurrence of direct and indirect pathologies among farmers this study has been proposed. The geographical scope of this study is located between 6 ° 55 'and 7 ° 10' north latitude and between 2 ° 35 'and 2 ° 47' east longitude (Figure 1).

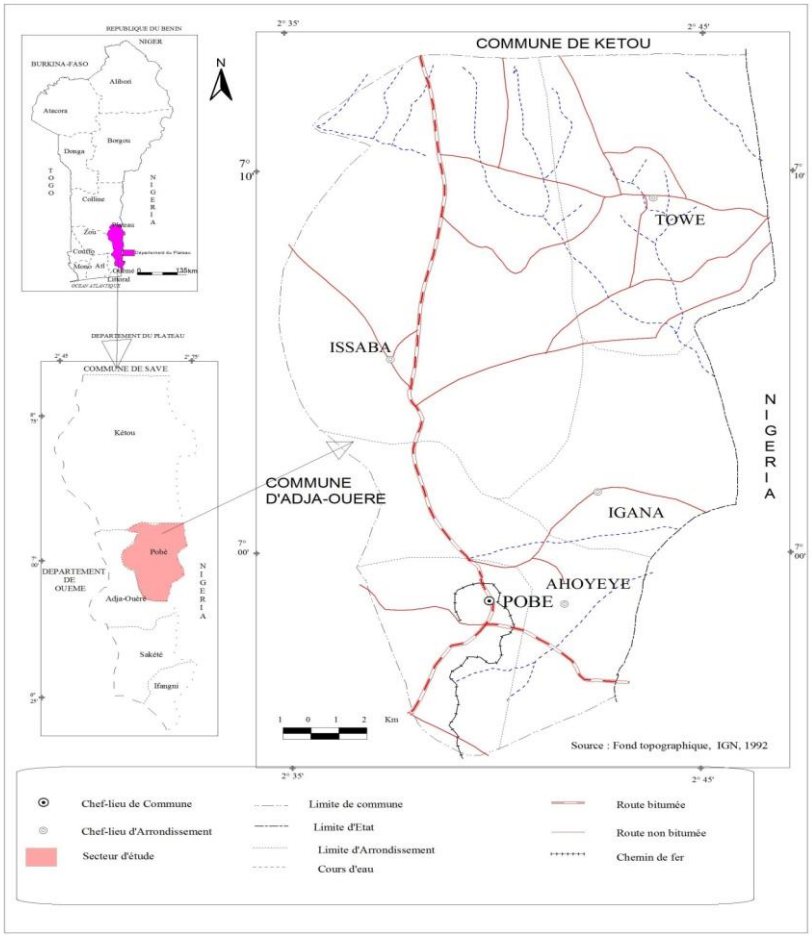

Figure 1: Geographical and administrative situation of the Municipality of Pobè

Data and Methods

As part of this study, data was used. These are data on common pathologies recorded in health centers. These data are obtained at the Departmental Department of Health (DDS) Ouemé / Plateau, at the Pobe Hospital in the period from 2002 to 2017. These data made it possible to

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study the temporal variation of these pathologies. , considered to some extent as dependent on weather events (Houssou, 1998 and Médéou, 2015).

Data relating to pathologies related to climatic periods obtained in the field. These data made it possible to characterize the pathologies associated with each climatic period among farmers. Monthly rainfall height, minimum, maximum, and relative humidity data. These data were taken from the database of the Pobè climatologically station (CRA-PP) and supplemented by that of ASECNA over the period 1981 to 2017. These data made it possible to correlate the climate with the common pathologies.

The sample size was determined by the Schwartz formula (1995). The application of this formula resulted in a total of 272 farmers. This number is distributed among the five (5) boroughs according to the importance of agricultural activities.

The analysis of Pearson correlation and linear regression tests performed in the XLSTAT software helped to assess the degree of linkage between climatic parameters and malaria, ARI, diarrheal diseases. The Analysis in Main Component allowed to appreciate the appearance of pathological climatic periods.

Results and discussion

Farmers' perceptions of climate-pathological risks

In the municipality of Pobè, 99% of farmers emphasized that health risks fall into two broad categories. The first one takes into account the direct climatological-pathological risks such as the direct effects of the climatic parameters (heat stroke, freshness, strong winds, high humidity and violent rains) and the second are the indirect climato pathological risks such as as malaria, ARI, diarrheal diseases and dermatoses.

Frequency of direct pathological conditions on farmers

During periods of high heat and harmattan, farmers are exposed to direct pathologies (Figure 2).

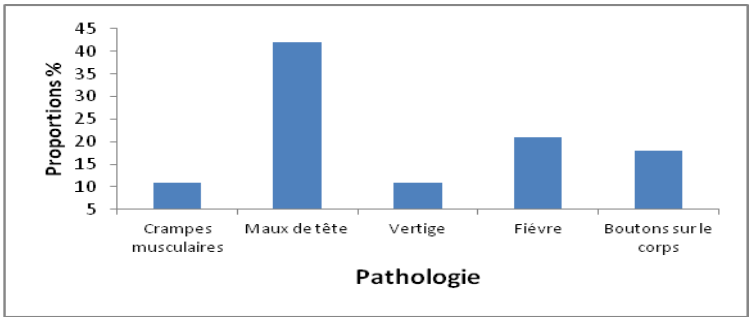

Figure 2: Frequent pathologies among farmers during hot weather

Source: *Field Investigations, November 2017*

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From the analysis in Figure 2, it appears that headaches are most common under the effect of heat on farmers. Pathologies such as muscle cramps, dizziness and the appearance of pimples on the body are confirmed by farmers. The fever occurs after a long time spent in the heat. These pathologies are especially frequent in the months of February to July under the effect of strong solar radiation on the body. Physiologically, the body overexposed to heat is dehydrated, suffers from hyperthermia and disturbances of the thermolysis mechanism (Houndonougbo, 2009).

Figure 3 shows the common pathologies among farmers during the harmattan period.

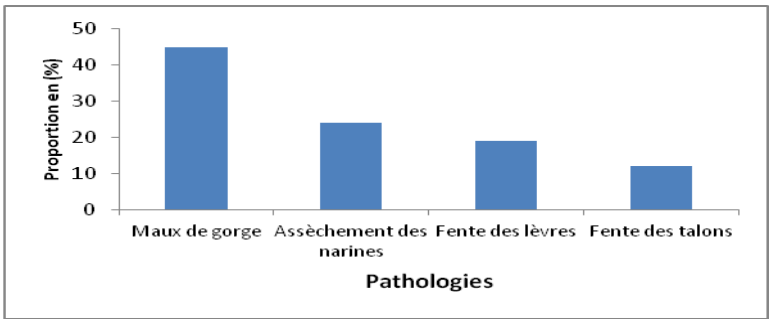

Figure 3: Frequent pathologies among farmers during the harmattan period

Source: *Field Investigations, November 2017*

The analysis in Figure 3 shows that during the harmattan, farmers suffer from sore throats and dry nostrils. The appearance of the crack of the lips and heels are also confirmed by these agricultures. The appearance of these pathologies during the harmattan period (December to January) is due to the dry wind that blows during this period. According to Houssou (1998), dry air with less than 40% moisture causes cracking of the skin.

To better appreciate the periods of high heat and harmattan and the appearance of different pathologies, a Principal Component Analysis (PCA) was performed (Figure 4).

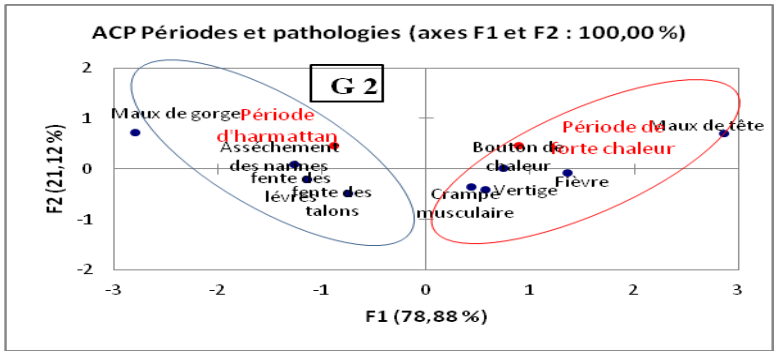

Figure 4: Main Plan 1-2 showing the correlations between periods and pathologies

Source: *Field Investigations, November 2017*

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Analysis of the PCA matrix shows a total inertia of 100% of which 78, 88% for the factor F1 and 21.12% for the factor F2. This high proportion is largely sufficient to draw a relative conclusion between the variables studied and the observations. Thus, the analysis of this figure shows two groups:

- Group 1 is composed of pathology such as headaches, heat pains, fever, dizziness, muscle cramps that appear during periods of high heat;

- the group of 2 is composed of pathology such as sore throat, drying of the nostrils, the crack of the lips and heels that appear during the harmattan period.

This classification makes it possible to conclude that each period is conducive to the appearance of pathologies in farmers. The climatic atmosphere also triggers indirect pathological risks for these farmers.

Indirect climatologically risks on farmers

The indirect climatologically risks relate to vector-borne diseases such as malaria, ARI, diarrheal diseases, dermatoses and schistosomiasis.

Pathological profile among farmers in the municipality of Pobè

Various climate-sensitive pathologies constitute the epidemiological facies of farmers (Figure 5).

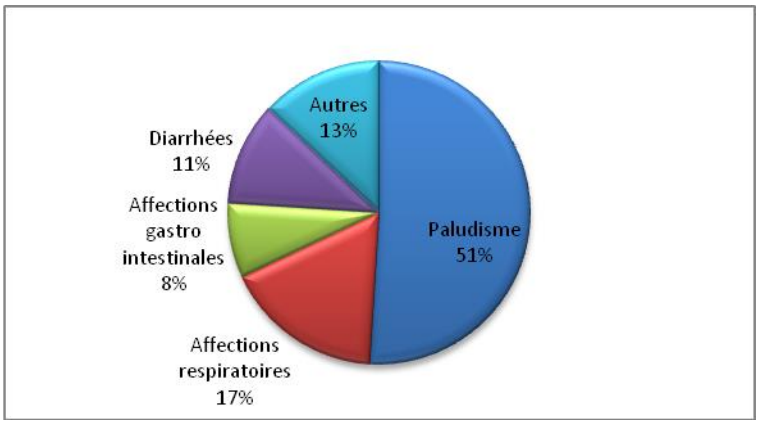

Figure 5: Proportion of common pathologies among farmers

Source: **Field Survey, November 2017**

The analysis in Figure 5 shows that malaria is the most common disease among farmers in this geographical area. This disease is recrudescent during the rainy seasons. Respiratory diseases (coughs, colds, flu, etc.) that occur mainly in the dry season and diarrheal diseases that are present during all seasons with a high rate. Gastrointestinal diseases and diseases such as

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dermatomes, schistosomiasis affects farmers. These affections are frequent all the seasons. Current pathological conditions in farmers have been correlated with climatic parameters.

Climatic rhythms and pathological rhythms in the municipality of Pobè

This part presents the coincidence of 2002 to 2017 of the rhythm of the affections (malaria, of IRA and diarrheal diseases) with the climatic rhythm. Figure 6 presents the analysis of rainfall patterns with that of malaria, ARI and diarrheal diseases.

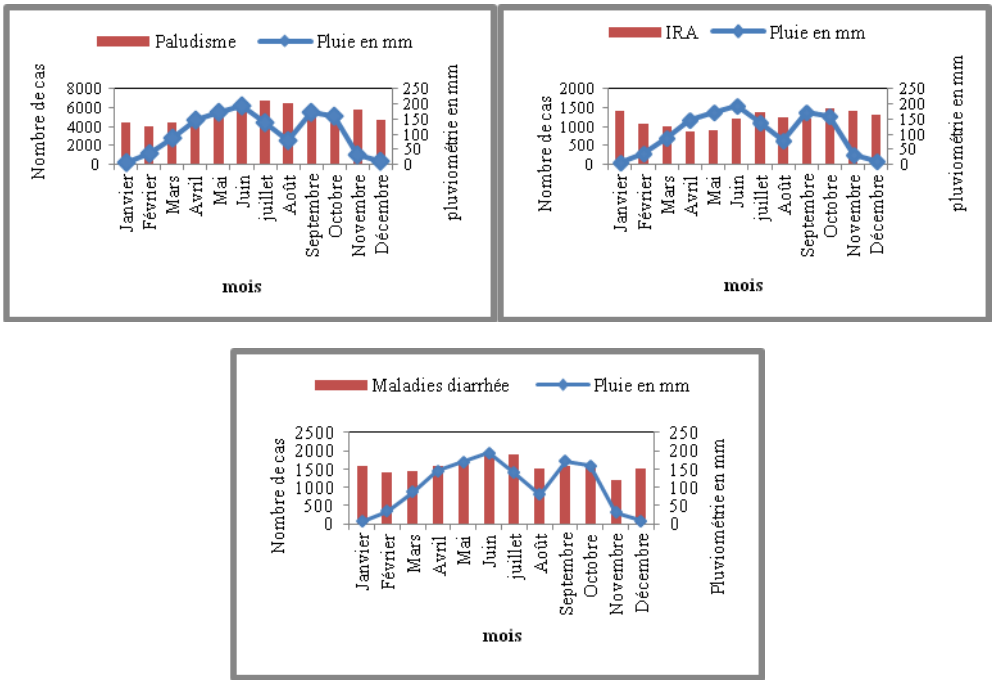

Figure 6: Intermittent Variation in Malaria, ARI, Diarrheal Disease and Precipitation from 2002 to 2017

Source: *ASECNA and DDS Ouémé / Plateau, November 2017*

Figure 6 shows that high prevalence of malaria is recorded mainly during the heavy rain months of May, June, July, September and October. ARIs occur during the coolest periods of the year; from June to October (rainy season) with a high prevalence in October. The prevalence of malaria is due to the multiplication of mosquito vectors (anopheles) and the IRA to the fresh wind blowing during this period. Diarrheal diseases have a high prevalence in all seasons with a high occurrence in June, July, September and October.

The prevalence of these pathologies cannot be explained only by rainfall. It can also depend on the temperature (Figure 7).

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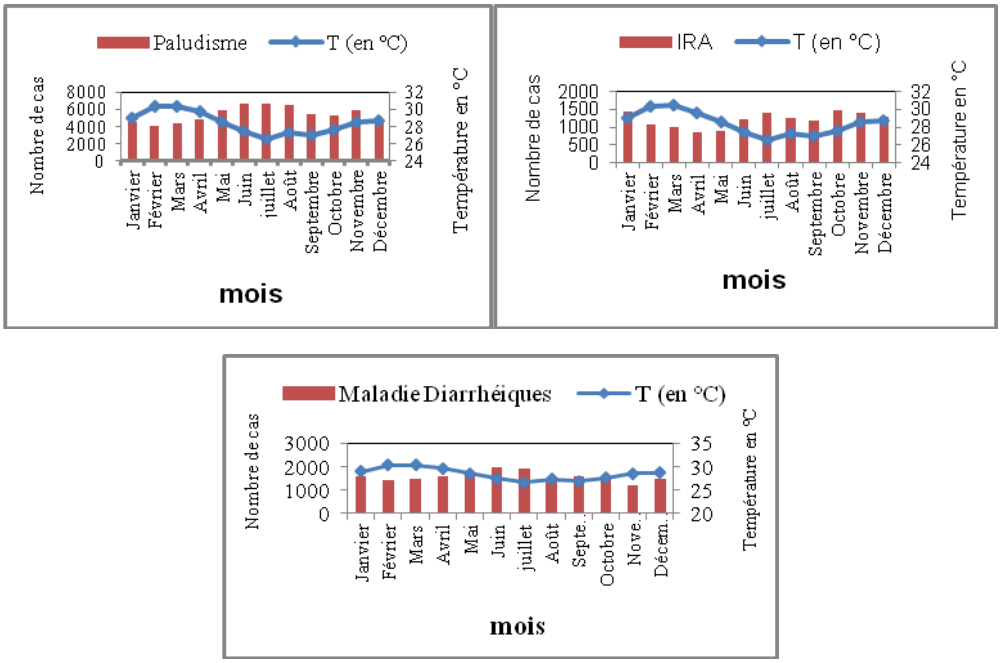
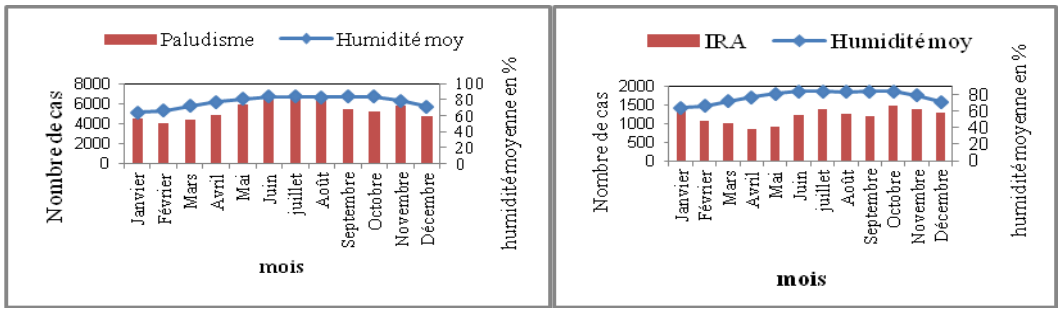


Figure 7: Interannual variation in cases of malaria, ARI, diarrheal diseases and temperature from 2002 to 2017 Source: ASECNA and DDS Ouémé / Plateau, November 2017

Source: *ASECNA and DDS Ouémé / Plateau, November 2017*

Examination of Figure 7 shows that low malaria cases were recorded during the months of high temperatures (January to April) while low temperature periods experienced a high prevalence of malaria. It is found that low ARI cases are recorded during the months (February to May) during which the temperature is high and cases of ARI elevated during the low temperature (June to January).

With regard to diarrheal diseases, there is an increase in the number of cases from June to July, coinciding with a decrease in temperature. However, consultations remain considerable throughout the year (Figure 8).



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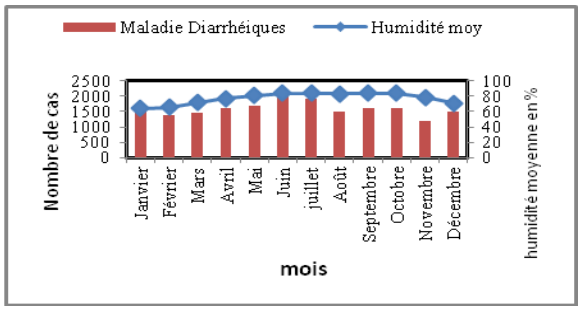

Figure 8: Interannual variation in malaria, ARI, diarrheal diseases and mean relative humidity from 2002 to 2017

Source: *ASECNA and DDS Ouémé / Plateau, November 2017*

Examination of Figure 8 shows that during the months of May, June, July, August and November when the humidity is high, the case of malaria increases. From June to January, ARIs evolve at the rate of relative humidity. This period is marked by a high humidity, favorable to the affections of the respiratory tracts. This recrudescence can be explained by a high humidity that makes the ambient air cooler.

The rate of diarrheal disease is bimodal with maximum in June and a secondary peak in July. The link between diarrheal diseases and relative humidity is difficult to establish. However, it is found that the rhythm of diarrheal diseases seems to follow that of humidity.

The inter-annual variation in epidemiological indices does not allow for an accurate understanding of the inter-annual variations of malaria, ARI and seasonal diarrheal diseases. A correlation analysis is important to better appreciate, if possible, the link between climate and these two pathologies.

Statistical link between climatic parameters and some common conditions

The degree of link between climatic parameters and conditions (malaria and ARI) were apprehended by the Pearson correlation test. The number of degrees of freedom (nddl) is 132; the correlation test is significant at 95%. The results of the statistical analysis are presented in Table I.

Table I: Statistical result of the correlation between climatic parameters and studied affections

Variable climatiques / **Variable clinique**	**Hauteur moyenne de pluie**	**Température moyenne**	**Humidité relative moyenne**
Paludisme	nddl = 132 r = 0,58 R = 0,34	nddl = 132 r = - 0,69 R = 0,48	nddl = 132 r = 0,62 R = 0,38

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IRA	nddl = 132 r = 0,19 R = 0,03	nddl = 132 r = - 0,16 R = 0,02	nddl = 132 r = 0,36 R= 0,13
Maladies diarrhéiques	nddl = 132 r = 0,18 R= 0,03	nddl = 132 r = - 0,48 R= 0,23	Nddl = 132 r = 0,3 R = 0,09
nddl = Nombre de Degré de Liberté r = Coefficient de corrélation de Pearson R = r^2 Coefficient de détermination			
	Corrélation forte	Corrélation moyenne	Corrélation faible

Source: *ASECNA and DDS Ouémé / Plateau, November 2017*

The analysis in Table I show that the values of r vary. The negative correlation (-0.69) between temperature and malaria cases means that the increase in temperature reduces the number of cases of malaria. This is justified since up to 37 ° C ambient temperature, Plasmodium can die in the body of the Anopheles (Houssou, 1998). On the other hand, a rise in relative humidity increases the number of malaria cases (r = 0.62). Anopheles finds their optimal ecological conditions at a relative humidity of more than 80%.

Rainfall and malaria change in approximately the same way (r = 0.58). The correlation coefficient (| r | <0.3) recorded at the IRA shows that the temperature / ARI relationship is weakly correlated (r equals - 0.16). In addition, the relationship between rainfall / ARI and moisture / ARI is low (r is 0.19 and 0.13, respectively). However, changes in temperature and relative humidity have an influence on malaria and ARIs.

The low correlation coefficients (| r | <0.3) recorded for diarrheal diseases show that the rainfall / temperature / humidity and diarrheal diseases link is respectively r (0.18, -0.48 and 0, respectively). 3. However, changes in temperature and relative humidity have a moderate influence on diarrheal diseases.

Conclusion

At the end of this study, it should be remembered that climatic periods cause farmers direct pathologies such as headaches, dizziness, muscle cramps, heat sores, fever during periods of high heat and the cracking of lips, heels, sore throat and dry nostrils in harmattan period. Indirect pathologies are malaria, Acute Respiratory Infections and diarrheal diseases.

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