

# The Impact of Climate on Human Comfort and Health in the City of Najaf

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## Abstract:

Human health and comfort are affected by many climatic conditions which have a direct impact on his feeling of comfort or distress, and despite the many studies that tried to find solutions to this problem, they still represent the biggest challenges that human beings face because of the great contrast between these elements from one region to another and the difference in the feeling of comfort and distress between one person and another from one region to another, Temperature, humidity and wind speed are among the most important climatic elements affecting the health and comfort of humans. The study of this research was to show the relationship between heat, humidity and wind speed through the use of the guide ways, basel and the village of Thom and its impact on human health and comfort to the city of Najaf and ways to address this problem. The third research includes the effects of high temperatures as well as the use of the wind cooling manual and the Thom presumption to measure the appropriate comfort of humans, in addition to conclusions, recommendations and a list of sources.

## Introduction :

Since ancient times, man knew the impact of weather factors on his health, and he was moving in search of fresh air and the warm sun, and the correlation between the succession of health and disease and the change in weather conditions was his main concern. The reason may be the difference in a person's feeling of comfort or distress and illness from one region to another. and gender, but the climate with its various elements directly or indirectly affects human life and health, as heat and humidity are among the most important climatic elements influencing other elements (<sup>1</sup>).

## Research problem:

The research problem is summarized in the following questions:-

- Do climatic factors affect human health and comfort? .
- How can recent studies be used to demonstrate the interrelationship between climatic and environmental potentials in the study area.

## Research hypothesis:

The research hypothesis is confined to an analytical natural geographical framework that can be formulated through two hypotheses:

- Climate elements affect the human health and comfort in the study area.
- Recent studies can be used to demonstrate the interrelationship between climate elements and their impact on human comfort

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<sup>1</sup> - Bilal Saadi Abdullah, The Impact of Climate on Human Health in the City of Jericho, Research Presented to the Journal of the Islamic University, College of Graduate Studies, No. 44, 2011, p. 32.

### **Research Methodology:**

Several study methods were used, including the morphological approach to clarify the natural features of the study area such as the site, as well as the use of the deductive approach to try to explain the relationship between climatic variables on which the research hypotheses were built such as heat, humidity, wind speed and the relationship between them and their impact on human health. The analytical and statistical method for analyzing geographical data to verify the validity of the study hypotheses and to show the relationship between the research variables and their treatment using the spss program statistically through the use of the ways and Basel guide to apply them to human comfort.

### **Research objective:**

The research objective is determined by several axes:

- 1- Identifying the morphology of the city of Najaf.
- 2- To identify the climatic variables that affect human comfort and health.
- 3- Knowing the average maximum and minimum temperatures during the study period.
- 4- The possibility of applying the Subul and Basel coefficients by using the elements of temperature and wind speed for the study area.
- 5- The possibility of applying the garlic clove through the use of the elements temperature and relative humidity of the study area.

### **Research limits:**

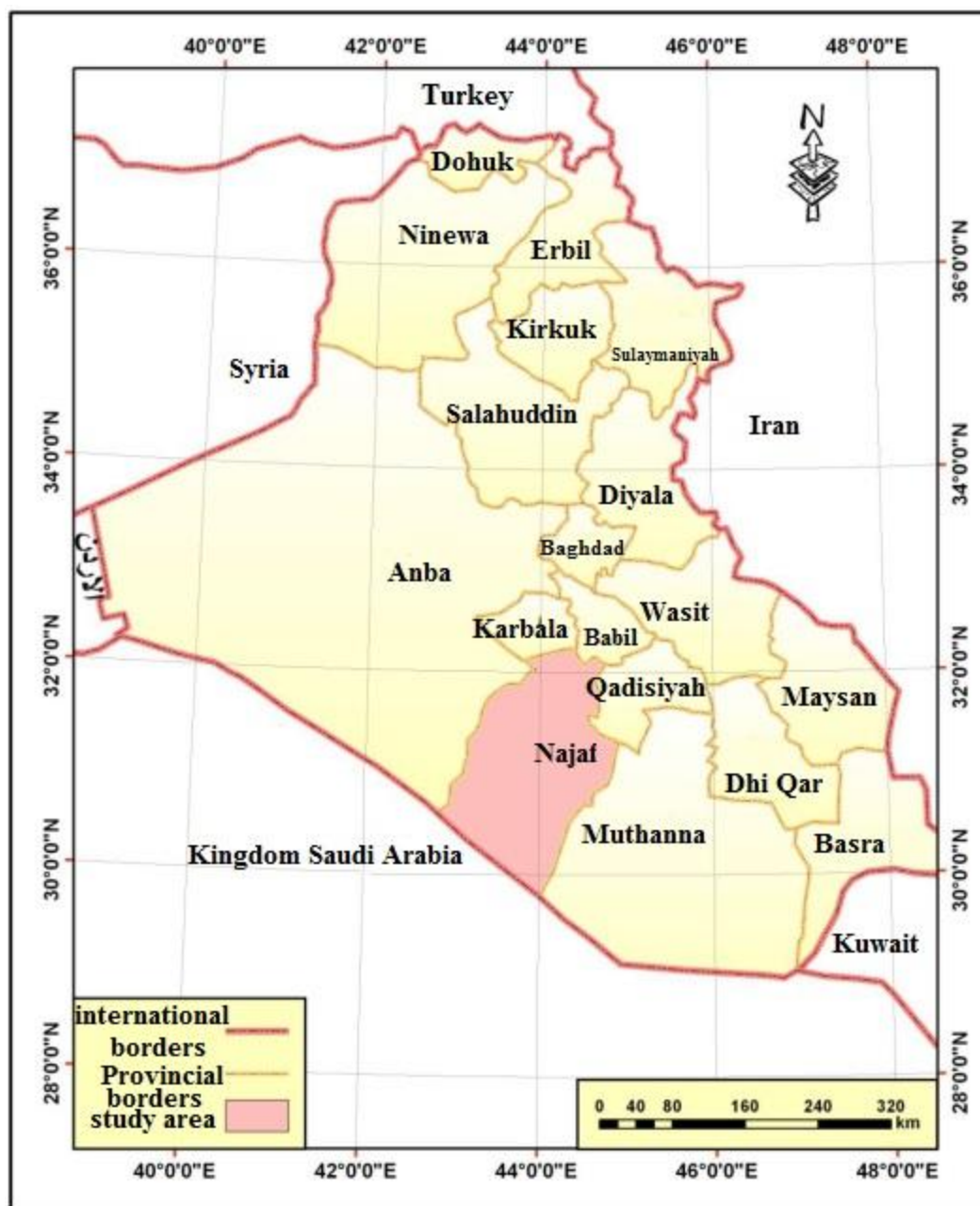
The research is determined by studying the climatic variables that affect human health for the study area for the period from (1990 - 2020). On the borders of the Kingdom of Saudi Arabia, where it is bordered on the west by the Najaf Sea and the Western Plateau, on the south by Qasbah al-Hira and Abu Sakhir, on the north by the Najaf plateau, and bordered on the east by the city of Kufa.

Thus, due to its natural geographical location, it occupies the transitional zone between the sedimentary plain and the western plateau, which form the types of surface in its middle and south, and the Najaf Sea is a boundary between the two regions. As for the western sides of it, it forms a region that does not help the emergence of settlement in it, while in its southwest, in the Bahr al-Najaf region, we find a region capable of agricultural development, and to the east of it, an agricultural region around Kufa and the middle Euphrates. The city of Najaf is built on a high mound above a wide sandy ground, about 70 meters above sea level. Old Najaf is located on the land road between Baghdad and Mecca. At a distance of 260 leagues from Baghdad, as mentioned by Al-Mustafi Al-Qazwini, who died in 750 AH. Today, Najaf is 9 kilometers from Kufa Bridge, and 85 kilometers from Karbala. This location makes it within the region of the desert climate with a winter appearance and its descent is limited to the cold season of the year, while the temperatures rise in the summer and reach (24°) in several days of it, and this is due to the distance of the water bodies from them, which would reduce this range Thermal temperature, as well as being a bare area of vegetation., at a latitude (32°1'44°N) and a longitude (20°44°E) (<sup>2</sup>)As shown in map (1)

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<sup>2</sup> - Business Associations in the Al-Najaf Governorate and in cooperation with the Center for International Private Projects, Najaf Governorate Business Agenda, 2009, pp. 5-6.

**Map (1) The location of the study area**



Source // Ministry of Water Resources, Directorate of Public Survey, Iraq's administrative map at a scale of 1:1000000, 2001.

Research Structure: The research included three sections. The first topic included the theoretical framework, which included the introduction, the research objective, the problem, the structure and the methodology. As for the second topic, it included the location of the city and climatic variables, while the third topic included the use of the Basel and Ways guide for the elements of temperature and humidity, and a garlic clove for the elements of temperature and relative humidity of the study area, as well as conclusions, recommendations and a list of sources.

## **The functional importance of the city of Najaf:**

### **1- The tourism sector**

A- Tourism is a sustainable economic resource, and the importance of tourism in Najaf Governorate can be determined as follows:

Religious importance: Najaf is a center of wide religious polarization for most Muslims in the world, and therefore this importance can be exploited for tourism and to create appropriate conditions for all visitors coming to Najaf.

- The presence of more than (300,000,000) (three hundred million visitors wishing to visit the holy shrines in Najaf).
- The number of visits and religious and private events in the holy city of Najaf is about 40 visits annually.
- The number of visitors on normal days is 3000 visitors. The number of visitors on Thursdays and Fridays is 10,000 visitors.
- The number of visitors on religious occasions ranges between (1-4) million visitors.

B- The importance of entertainment: Recreational tourism is no less important than religious tourism, as Najaf possesses the basic ingredients for the success of recreational tourism, especially its possession of large and green lands. Al-Habbaniyah tourist destination, and the Euphrates River passes through the historic city of Kufa, whose banks can be exploited as the best tourist place among the palm trees.

### **2- Economic importance:**

The economic importance of tourism lies in being one of the most important basic resources that generate huge profits, and these profits can contribute to improving the economic situation in the region as a whole and the Najaf Governorate in particular.

3- Cultural and social importance Najaf is one of the most important centers for the dissemination of culture in all its forms, and there are many students who flock to it for knowledge (<sup>3</sup>).

## **The second topic**

### **The effect of climatic elements on human health and comfort in Najaf Governorate**

#### **1- Temperature:**

The maximum and minimum thermal limits of human activity and comfort vary according to several factors, including the location in relation to the geographical latitudes in which humans live and adapt to their thermal conditions. Thermal anomalies of maximum temperatures, meaning their deviation from their general average, have the most impact on human health and comfort. The occurrence of this thermal anomaly occurs more often within the regions that lie within the middle widths of the globe, i.e. between the latitude (30-60) north and south of the equator. However, despite the fact that temperature has a significant impact on human health, this effect is associated

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<sup>3</sup> - Business Associations in the Al-Najaf Governorate and in cooperation with the Center for International Private Projects, Najaf Governorate Business Agenda, 2009, pp. 5-6.

with the element of humidity in the extent of the stability of the atmosphere and its freedom from horizontal and vertical winds (<sup>4</sup>)

As the temperature (26 degrees Celsius) with relative humidity of (85%) is disturbing for the human being and affecting his health, while if the same temperature is combined with relative humidity of (30%) the atmosphere becomes suitable for humans, while the temperature may be (26 degrees Celsius) with a relative humidity of (80%) disturbing to the inhabitants of the tropics, but it is comfortable for the inhabitants of the cold temperate areas. It varies between (15-18 degrees Celsius) as minimum limits and (25-28 degrees Celsius) as upper limits. Scientists have considered that the temperature between (18-25 degrees Celsius) is generally optimal for human health, comfort and activity (<sup>5</sup>).

According to a report prepared by the World Health Organization to study the impact of climate on human health, it was found that rising temperatures in the world may cause a noticeable increase in diseases, especially for regions located within the temperate and tropical latitudes of Asia and the islands located in the Indian Ocean. In addition, rising temperatures will lead to the recurrence of droughts, floods and hurricanes, which have a direct impact on the spread of diseases associated with these phenomena, such as malaria and cholera (<sup>6</sup>)

The extremes of temperature in its lower and upper limits involuntarily push the human body to restore the body's thermal equilibrium, which directly depends on the amount of what it absorbs or loses in relation to the air temperature.

Restoring thermal equilibrium requires chemical and physical efforts by the human being.

Therefore, the ideal temperature of the air is the temperature that is very close to the core temperature of the human being. The disease-free, 37 AD. Therefore, the site that provides air heat. In relation to sunlight and humidity. Closer to this degree is the most healthy sites suitable for human life (<sup>7</sup>).

As the extreme cold and high temperature areas are repelling tourists towards the temperate areas that provide the person with a feeling of physical and psychological comfort, as the temperature between (18-35 degrees Celsius) is the optimum temperature for human comfort and various activities, and such temperatures are not available throughout The year, except in the regions of the tropical highlands, where the altitude ranges between (500-2000 meters), and temperatures above (28°C) and below (15°C) are considered an obstacle to tourism. , which are thermally unsuitable for tourism, which the tourist feels, resulting from the heat generated in their bodies by the metabolism process, which increases with movement.

The temperature that does not exceed (25 degrees Celsius) and the relative humidity does not exceed (60%) has been determined that provides the ideal climate, while the temperature between (18-25 degrees Celsius) is considered optimal for human comfort and activity, and that such a thermal limit It is not available all year round, except in the highlands of the tropics between altitudes (500-2000

<sup>4</sup> - Fawaz Al-Mousa, Comfortable Human Temperatures, Lectures in Applied Climate, Aleppo University, Syria, 2010, p. 16.

<sup>5</sup> - World Health Organization, Report on the Impact of Climate Changes on Human Health, 2019, p. 76.

<sup>6</sup> - Human Development Report, Climate and Man, 2007, p. 87.

<sup>7</sup> - Adel Saeed Al-Rawi and Qusai Abdul Majeed Al-Samarrai, Applied Climate, Ministry of Higher Education and Scientific Research, University of Baghdad, 1991, pp. 205-206.

meters), while the low parts of the tropics, especially the tropics, are considered thermally unsuitable as the average daily temperature constantly exceeds (25 degrees Celsius).

Almost all scientists in climate agree that the temperature (25 degrees Celsius) is the upper limit for human comfort, while the minimum threshold varies according to the human habitat, the activity practiced, and the nature of food and drink, regardless of clothing, and it ranges between (10-15 degrees Celsius).<sup>(8)</sup>.

## **2- Wind:-**

Wind characteristics are one of the climatic factors affecting human health and comfort. Wind here is a cooling factor for the human body, as the lack of wind movement, when the air is in a state of rest, makes the transfer of heat to the human body directly, so the best blowing of air is when it is in the form of a breeze at a speed ranging between (3, 0-5.1 ms/sec), or as a light breeze (1.1-3.3 ms/sec), and form a light breeze between (4.3-5.1 ms/sec).

## **3- Air humidity**

Relative humidity is one of the climatic elements of great importance because of its effective role in human comfort and activities, and its impact is evident in determining the actual value of heat, as the relationship between them is a very strong relationship that is difficult to separate between them in the field of their vital impact on humans, as well as being a climatic element that depends on Treating sick people with a number of diseases, as doctors advise a number of patients to go to areas where the air is clean first, and the air humidity is low secondly, and this is generally available in mountainous areas, especially the interior mountains far from the influence of water bodies.<sup>(9)</sup>

Studies in this aspect indicate that the appropriate air humidity, which ranges between (40-60%) is the most effective suitable for the human body, while if it exceeds (70%) during the cold or hot season<sup>(10)</sup>, the person will feel cold in winter, Especially if the temperature is close to freezing between (0-5 C), his feeling of warmth increases in the summer with the increase in temperature and humidity on his body, that is, if the absolute humidity is high due to the increase in the pressure of water vapor and the values of sweating decrease as a result first, and the cooling of the surface of the body decreases because of that secondly. As for the relative humidity decreasing to less than (40%), which drops in the dry areas in the summer to less than (10%) with the rise in temperature, then the weather will be hot and not bitter, but it is less disturbing than the very hot and high humidity weather, except The combination of low relative humidity with a decrease in temperature, which reaches less than (5°C), will make the climatic conditions feel cold and uncomfortable.

## **Climatic characteristics of the city of Najaf:**

Climate is one of the important factors that enter into the formation of the natural environment, as it stands behind the changes that occur to living organisms (humans, plants and animals) either directly or indirectly. The role of climate elements and their impact on shaping the character of the climate of

<sup>8</sup> - Ali Sahib Talib Al-Moussawi, The spatio-temporal relationship between climatic characteristics, tourism and entertainment, Proceedings of the First International Scientific Conference of the University's College of Human Studies., April 19-20, 2016.p. 17-19.

<sup>9</sup> - Ali Sahib Talib Al-Moussawi, the same source, p. 23, 24, 26.

<sup>10</sup> - Qasim Suwayh Halbot Al-Aboudi, Characteristics of the Tourist Climate in the Cities of Najaf and Karbala, Master's Thesis (unpublished), College of Arts, University of Kufa, 2014, p. 51.

the study area The elements of climate will be clarified, which are temperature, humidity, rain and evaporation.

### 1. Temperature:

Heat is defined as the means used to measure the amount of energy in the body or the amount of heat , Table No. (1) shows that the general annual average of normal temperatures reaches (24.41) degrees Celsius, while the annual average of the minimum temperature reaches (17.9) degrees Celsius, and the maximum annual temperature is (31.2) degrees Celsius.

As the normal temperature begins to rise with the beginning of the month of April, the average temperature during this month was recorded (24.5) degrees Celsius, then the temperatures gradually increased due to the increase in the angle of incidence of the sun's rays and the resulting increase in the amount of heat gained and the increase in the number of daylight hours to reach in months May, June, July and August recorded (30.1), (34.7), (37) and (36.6) degrees Celsius, respectively, while the month of September recorded high temperatures due to the accumulated heat accumulation during the months of July and August, which recorded (32.5) Celsius, either the decrease in the average temperature begins after (23) September due to the movement of the sun towards the Tropic of Capricorn. February) and January is the lowest in temperature. Either maximum temperature, it is the highest temperature recorded during the day.

**Table (1) Monthly averages of temperatures and maximum and minimum temperatures for Najaf station for the period (1990-2020)**

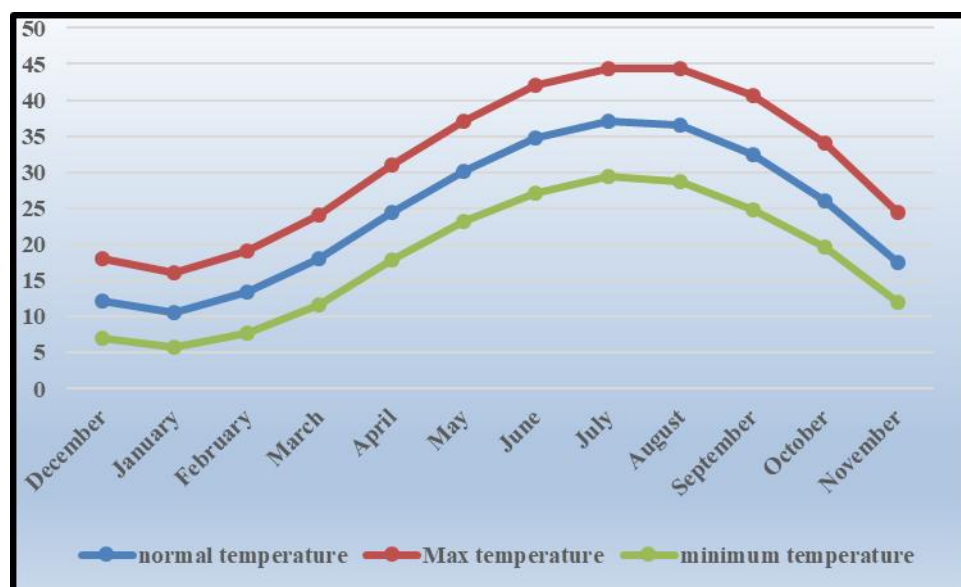
minimum temperature	Max temperature	normal temperature	month
7.1	18.0	12.1	December
5.7	16.1	10.5	January
7.7	19.1	13.4	February
11.7	24.1	18	March
17.8	31.0	24.5	April
23.2	37.1	30.1	May
27.2	42.0	34.7	June
29.4	44.3	37	July
28.8	44.3	36.6	August
24.8	40.6	32.5	September
19.6	34.0	26.1	October
12.0	24.5	17.5	November
17.9	31.2	24.41	annual rate

Source // Ministry of Transport, General Authority for Meteorology and Seismic Monitoring, Climate Division, unpublished data.

It is clear from Table No. (1) that the annual average of the maximum temperature is (31.2) degrees Celsius, as the maximum temperatures begin to record the highest temperatures during the months of April, May, June, July, August and September), as their averages in Najaf station reached (31.0, 37.1). , 42.0, 44.3, 44.3 and 40.6) degrees Celsius, respectively, due to the large angle of incidence of solar radiation and the accompanying increase in the number of daylight hours and then the rise in temperatures.

The monthly averages of temperatures in the study area were characterized by variation in most months of the year, and that rising temperatures affect human health and comfort.

**Figure (1) Monthly averages of temperatures and maximum and minimum temperatures for Najaf station for the period (1990-2020)**



The researcher's work is based on table (1).

## 2- wind

Figure (2) and Table (2) show that the annual average wind speed reached (2.7) m/sec, while the monthly rates ranged between (1.8) m/sec during the month of November as a minimum and (4.0) m/sec during the month. July .

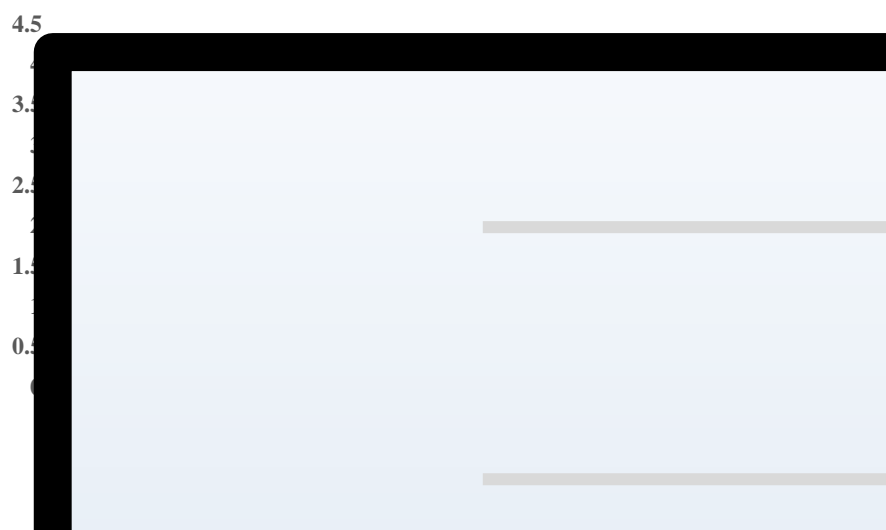
**Table (2) Monthly averages of wind speed (m/s) for Karbala station for the period (1988-2018)**

Monthly rate	month	Monthly rate	month
3.9	June	1.9	December
4.0	July	2.1	January
3.1	August	2.5	February
2.4	September	3.0	March
1.9	October	3.1	April
1.8	November	3.1	May

Source // Ministry of Transport, General Authority for Meteorology and Seismic Monitoring, Climate Division, unpublished data.



**Figure (2) Monthly averages of wind speed (m/s) for Najaf station for the period (1990-2020)**



The researcher's work is based on table (2).

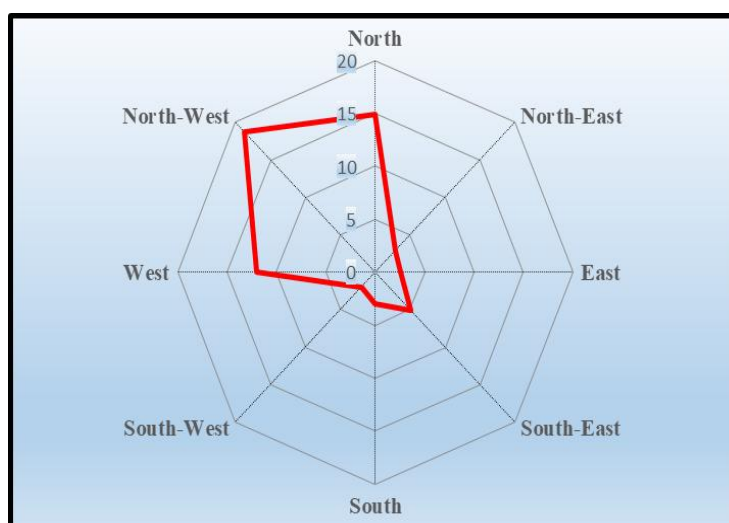
As for the wind direction, the highest annual rate of recurrence of the northwest wind direction was recorded at (18.81), while the lowest rate of the wind direction was recorded for the southwest winds with limits (2).

**Table (3) Percentages of the frequency of the prevailing wind direction for the Najaf station for the period (1990-2020)**

stillness	North-West	West	South-West	South	South-East	East	North-East	North
38.77	18.81	12.06	2	2.95	5.07	2.57	2.82	14.95

Source // Ministry of Transport, General Authority for Meteorology and Seismic Monitoring, Climate Division, unpublished data.

**Figure (3) Percentages of the frequency of the prevailing wind direction for the Najaf station for the period (1990-2020)**



The researcher's work is based on table (3).

### 3- Relative humidity:

It is defined as the amount of water vapor present in the air at a certain temperature relative to the maximum amount that the air can hold at the same temperature, so it is directly affected by the temperature.

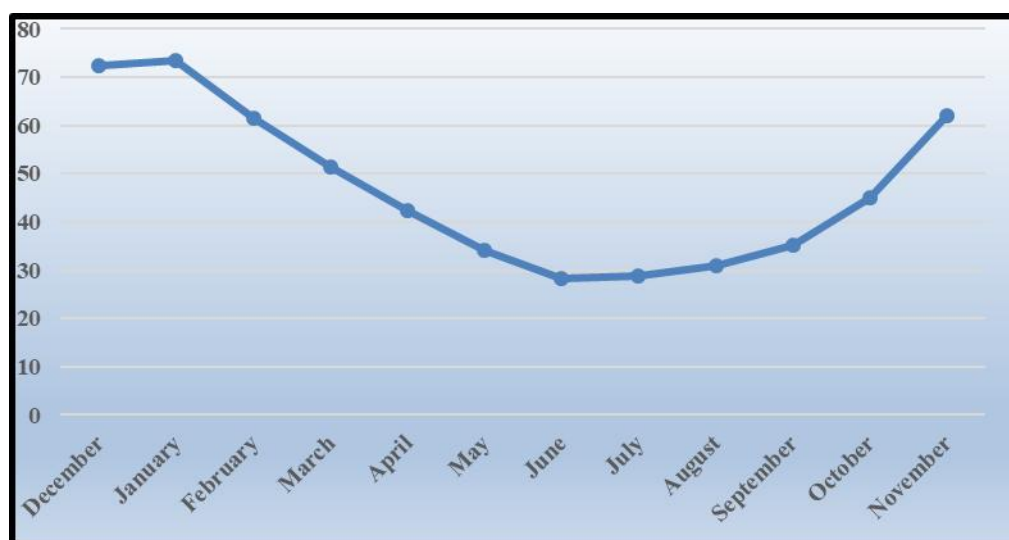
Table (4) shows that the annual average relative humidity is (47.1%), and humidity varies during the months of the year, rising during the winter season, especially in the months of (December, January and February), at a rate of (72.4%, 73.5%, 61.4%), respectively, and that In order to expose the study area to cold and humid air masses, which decrease temperatures and increase relative humidity, either during the summer, the relative humidity decreases, specifically during the months (June, July and August), as the relative humidity rates were recorded (28.4%, 28.9%, 31.0%) for each of them, respectively, due to the gradual rise in temperatures during this period and the decrease in rainfall .

**Table (4) Relative humidity percentages for Najaf station for the period (1990-2020)**

Monthly rate	month	Monthly rate	month
28.4	June	72.4	December
28.9	July	73.5	January
31.0	August	61.4	February
35.2	September	51.5	March
45.0	October	42.4	April
62.1	November	34.1	May

Source // Ministry of Transport, General Authority for Meteorology and Seismic Monitoring, Climate Division, unpublished data.

**Figure (4) Relative humidity percentages for Najaf station for the period (1990-2020)**



The researcher's work is based on table (4).

### 4- rain:

The study area is characterized by low rainfall in winter and absence in summer. Table (5) shows that the amount of rain in general is few and fluctuating, and its annual total does not exceed (94.1 mm), as the rainfall starts from the month (October and ends to the end of May) and is the maximum amount during January (18.2 mm), then December, at a rate of (14.2 mm). In general, the rains

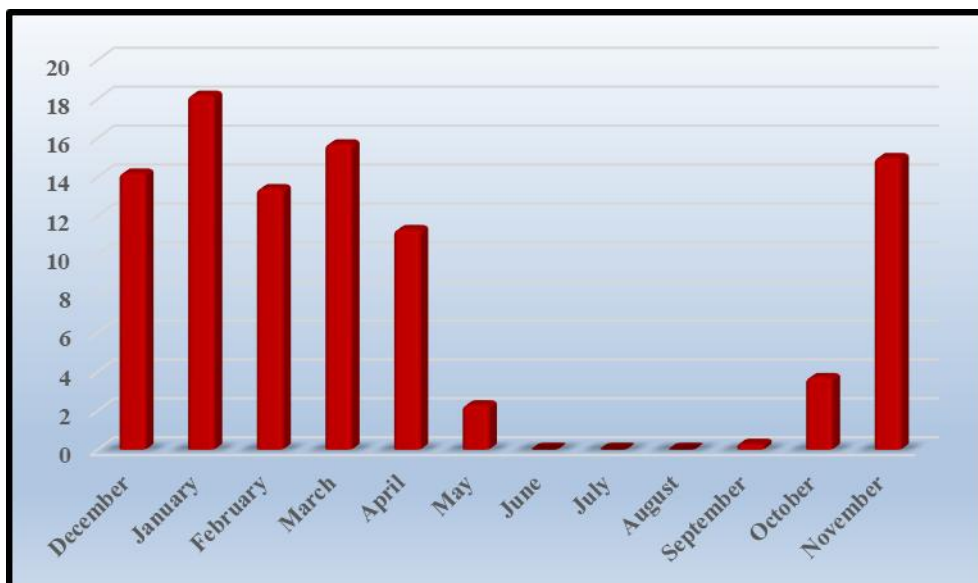
falling on the study area are limited during the winter season only to the passage of the central depressions coming from the Mediterranean. Then the rain stops completely during the summer, specifically the months (June, July and August), as its quantity reached (0) mm, so it is considered one of the dry months due to the lack of influence of the Mediterranean air depressions, in addition to the high temperatures and low humidity, so the level of condensation rises, which works on the absence of fall rains in that period .

**Table (5) Total monthly rainfall rates mm for Najaf station for the period (1990-2020)**

Monthly rate	month	Monthly rate	month
0	June	14.2	December
0	July	18.2	January
0	August	13.4	February
0.3	September	15.7	March
3.7	October	11.3	April
15	November	2.3	May

Source // Ministry of Transport, General Authority for Meteorology and Seismic Monitoring, Climate Division, unpublished data.

**Figure (5) Total monthly rainfall rates for Najaf station for the period (1990-2020)**



The researcher's work based on table (5)

#### 5- Evaporation:

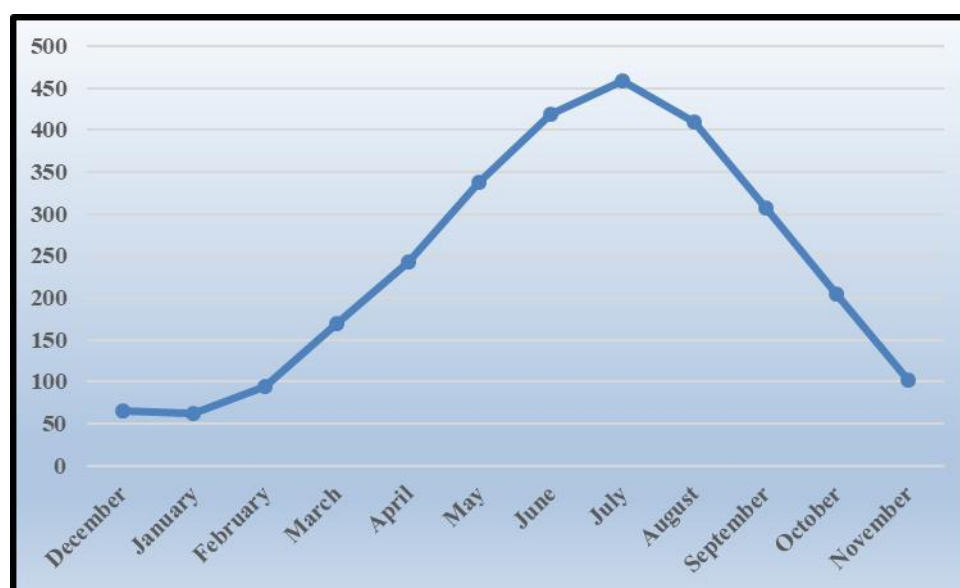
Table (6) indicates that evaporation rates vary from one region to another annually, seasonally and monthly, depending on the angle of sun rays, temperature, wind speed and direction. and August), as they were recorded at (418.5, 459.3, and 410.0) mm, respectively, due to high temperatures, blowing dry winds and lack of cloudiness, while the lowest rates of evaporation were recorded during the winter season, specifically (December, January and February) reaching ( 64.4, 61.4, 94.1) mm due to the low angle of incidence of sunlight, low temperature, and increase in relative humidity and atmospheric pressure (13).

Monthly rates of evaporation (mm) for Najaf station for the period (1990-2020)

Monthly rate	month	Monthly rate	month
418.5	June	64.4	December
459.3	July	61.4	January
410.0	August	94.1	February
307.6	September	168.8	March
204.4	October	242.8	April
101.1	November	337.0	May

Source // Ministry of Transport, General Authority for Meteorology and Seismic Monitoring, Climate Division, unpublished data.

**Figure (6) Monthly rates of evaporation (mm) for Najaf station for the period (1990-2020)**



The researcher's work based on table (6)

### **The third topic**

#### **Effects of high temperatures:**

The impact of thermal rise on human comfort is very important, as it results in deaths. The health effects differ if the weather is hot and dry than if the weather is hot and humid. In the event that the weather is hot and dry, the occurrence of heat stroke is predominant, as the infection increases when the temperature exceeds (48) degrees and the pressure of water vapor is about 1.1 mm. Heatstroke often leads to several diseases. Unusually high temperatures may lead to an increase in deaths.

Among the diseases that abound in hot, dry and dusty places are respiratory diseases, especially asthma patients, damage to the function of the kidneys, and diseases of the circulatory systems, and the eyes are often hurt in hot and dusty weather. Like ophthalmology patients. Sometimes cracks occur in the skin, especially in the lips, and severe nosebleeds. Either the hot, humid weather: more discomfort is felt than the hot, dry weather, and the person is exposed to many diseases, including:

- 1- An increase in the appearance of skin rashes.
- 2- The occurrence of disturbances in the functions of the body
- 3- Exhaustion or what is known as heat stress.

In addition, the hot and humid environment constitutes a fertile field for insects to reproduce, and thus an increase in the number of diseases such as malaria and yellow fever.

Equations used to determine the ideal climate

To calculate and estimate the value of the ideal climate, the researchers focused on evaluating the basic climatic elements, which are:

- 1- Solar radiation.
- 2- temperature
- 3- the wind
- 4- Relative humidity
- 5- The rain.

These elements have been taken by researchers in the calculation. The scientific operative interpretation of the description of the optimal climate is that it is a temperate climate that offers warm, humid, sunny winters and cool, sunny summers. Such a description seems to require a unique location. The most important attempts to calculate such a site were made by Poulter, Fergusson, Rackliff and Hughes in their equations below, and respectively (<sup>11</sup>)

$IK = 10T + (S / 6) - (R / 5)$	Poulter
$IK = 10TX + (S / 6) - (R / 3)$	Fergusson
$IK = 4T + (S / 13) - 2R^I$	Rackliff
$IK = TX + (S / 22) - (RD / 5)$	Hughes
$Io = 20 S - 7Rh + T$	Daifiss

whereas :-

IK - Guide to summer average temperature (June - July - August)

T = mean temperature centigrade

TX = daily average temperature

S = total hours of sunshine

s = daily average solar brightness

R = total rain – mm

RI = Total Rain – In

RD = total of rainy days

Rh = total relative humidity

Io = Summer Tourism Guide

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<sup>11</sup> - Ali Abdul-Zahra Al-Waeli, The Origins of Applied Climate, Ahmed Al-Dabbagh Press, Baghdad, 2014, p.234.

By looking at these equations, we find that the temperature is added to the solar radiation minus the rain, that is, the value of the index rises whenever the location is warm and sunny accompanied by little rain, and the higher the value of the optimal climate, and vice versa, the more rain, the lower the temperature and the solar radiation, the lower the value of the index and shifting The site to the expulsion site for tourism.

The use of these equations was identical to a natural European environment to evaluate the optimal climate, but a natural environment such as Iraq, the Arab world and most of the dry and semi-arid regions of the world reject this logic for the simple reason that sunlight becomes a hindrance to human activity outside the environment, where the person tends to stay in his home as a result of heat. And drought, and therefore it is not possible to combine sunlight and heat to give the value of the specific evidence. Rather, the exact opposite is that the ideal location in which the air temperature drops to the maximum possible extent, as is the case in the heights and under the shadows, and for the purpose of the human body performing its natural activities in an atmosphere compatible with these activities. Without a harmful effect on it, as most people are affected by high or low temperature, humidity, solar radiation and wind, and since there is a relationship between these elements, any element alone cannot be a sufficient indicator to feel comfortable. Hence, the regions of comfort in Iraq can only depend on Thom's study, which is the Humidity Index (THI) in light of the following equation:

$$THI = T - (0.55 - 0.55h)(T - 58)$$

whereas:

T: dry temperature (F), h: relative humidity (%)

Using temperature (C) instead of Fahrenheit, the relationship is:

$$THI(DI) = T - 0.55(I - h)(T - 14.5)$$

And (Tom) determined that if the temperature-relative humidity indicator is less than (21) then all residents feel comfortable, and if the indicator is between (21-24), a number of people feel uncomfortable, as about (50%) of people feel uncomfortable when The values of the context (24), and the feeling of discomfort increases when the values of the context become between (24-27), and then all people feel discomfort when the values of the context (26) and when the values of the context exceed (27), the discomfort is great and dangerous, and the person feels stress when the values of the context reach The correlation between temperature and humidity (29) <sup>(12)</sup>.

. And because the effect of wind on these two elements has not been assessed after a lack of comfort estimation, therefore, the comfort limits should not be separate from the wind capacity because the feeling of comfort in the specific temperature and humidity varies completely with the difference in wind speed in the site. In light of this, the division of comfort regions will be based on the evidence of heat and humidity along with the dependence of the wind's ability to cool, according to what was stated by Possel Siple in 1954, which takes the following equation:

$$Ko = \sqrt{100} V + 10.45 - V (33^\circ - Ta)$$

Where, Ko = the capacity of the wind to cool, measured in kilocalories / m<sup>2</sup> h

V = wind speed in millimeters

<sup>12</sup> - Ali Hassan Musa, The Biological Climate, Damascus, 2002, p. 58.

$T_a$  = Celsius temperature of dry air

33 = the natural body temperature (the bare parts) on which the cooling rate is built, and the reason for this is because this equation calculates the ability of the Earth's surface to absorb the amount of heat within the limits of this one square meter on the one hand and on the other hand, the previous equations only concerned two climatic elements, which are the degree Temperature and humidity, therefore, the wind element must be entered to calculate its effect in order to reach physiological comfort. Table (8) shows the internationally approved ranges according to the wind cooling equation.

The application framework of the Possel Siple guide for human feeling of comfort and discomfort in the city of Najaf

Table (7) shows the monthly values of the wind cooling guide for the station in the study area, and based on Table (8), which shows the criteria for human feeling of satisfaction and discomfort.

**Table (7) The monthly values of the index of human feeling of comfort according to the equation of wind cooling**

Climate description	Wind Cooling Equation Index Value	wind speed/meter/sec	Temperature/°C	month
I'm cold	466	1.9	12.1	December
I'm cold	514	2.1	10.5	January
I'm cold	468	2.5	13.4	February
cold	371	3.0	18	March
cold	212	3.1	24.5	April
hot	72	3.1	30.1	May
hot	45	3.9	34.7	June
refreshing	106	4.0	37	July
warm	90	3.1	36.6	August
hot	12	2.4	32.5	September
refreshing	154	1.9	26.1	October
cold	342	1.8	17.5	November

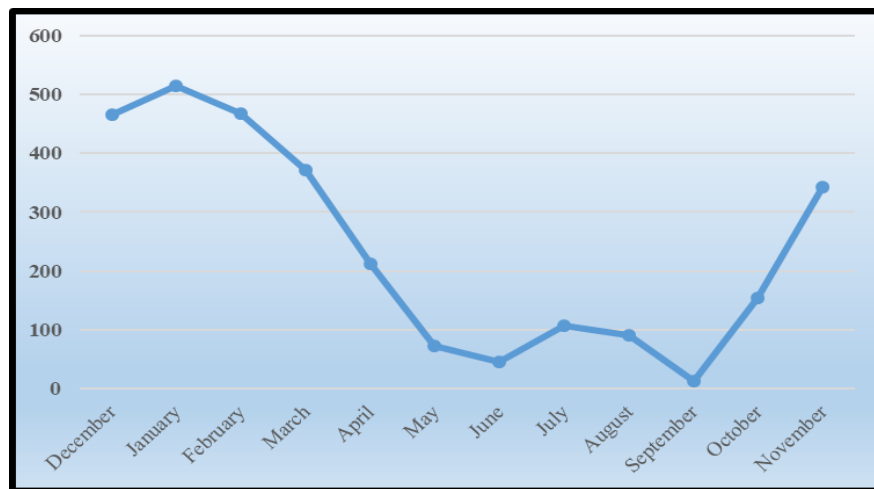
The researcher's work is based on //

Table (1) temperature

- Table (2) wind speed

- Table (8)

**Figure (7) The monthly values of the index of human feeling of comfort according to the equation of wind cooling**



The researcher's work based on table (7)

**Table (8) the digital guide to the equation of wind cooling and to determine the optimal climate and sense of comfort**

comfort staircase	Directory value	comfort staircase	Directory value
very cold (very cold)	1000-800	hot	less than(50)
Freezing cold	1200-1000	warm	100-50
Freezing of exposed parts of the skin	1400-1200	refreshing (nice)	200-100
Freeze exposed parts in a minute	2000-1400	cold	400-200
Unbearable	more than2000	I'm cold	600-400
		cold (cold)	800-600

Source: Ali Ahmed Ghanem, Applied Climate, 1st Edition, Dar Al Masirah for Publishing, Distribution and Printing, Amman 2010, p. 73.

It is evident from Table (7), Figure (7) and Table (8) that the months in which a person feels comfortable in the study area were (inclined to cold) during the months (March, April, November) due to the temperature range between (18) -17.5 degrees Celsius, and the wind speed ranged between (3.0-1.8) meters/second, while the months (December, January, and February), the temperature ranged between (12.1-13.4) degrees Celsius and the wind speed ranged between (1.9-2.5) ) m / s tended to be cold. As for the hot months, they are (May, June, September), as the temperatures ranged between (30.1-32.5) degrees Celsius and the wind speed ranged between (3.1-2.4) m/sec. It is also noted that the month of July was a refreshing climate. Despite the high temperatures, however, due to the increase in wind speed to 4.0 m/s, it was the reason for softening the air and overpowering it. In August, the climate was warm, while it is noted that October was a refreshing climate, despite the slightly lower temperatures, as it recorded 26.1 degrees Celsius, but due to the decrease in wind speed to 1.9 meters / sec, the climate has this characteristic.



## 2- Applied framework for garlic clove

It is evident from Table (9) and Figure (9) and based on the values of the evidence Table (10) that the values of the garlic clove for whether or not a person feels comfortable was during the months (January, February) severe discomfort as a result of the cold weather at a temperature ranging between (12.1 - 13.4 )degrees Celsius and relative humidity reached (72%-61%),

**Table (9) Monthly values of garlic cloves for whether or not a person feels comfortable**

comfort type	Equation application guide value	relative % humidity	Temperature/°C	month
very upset	7.76	0.72	12.1	December
moderate discomfort	10.75	0.73	10.5	January
very upset	5.51	0.61	13.4	February
Great stress and dangerous to the health of individuals	29.93	0.51	18	March
Great stress and dangerous to the health of individuals	138.91	0.42	24.5	April
Great stress and dangerous to the health of individuals	304.25	0.34	30.1	May
Great stress and dangerous to the health of individuals	496.68	0.28	34.7	June
Great stress and dangerous to the health of individuals	582.29	0.29	37	July
Great stress and dangerous to the health of individuals	549.73	0.31	36.6	August
Great stress and dangerous to the health of individuals	373.82	0.35	32.5	September
Great stress and dangerous to the health of individuals	163.01	0.45	26.1	October
comfort	19.32	0.62	17.5	November

The work of the researcher is based on:

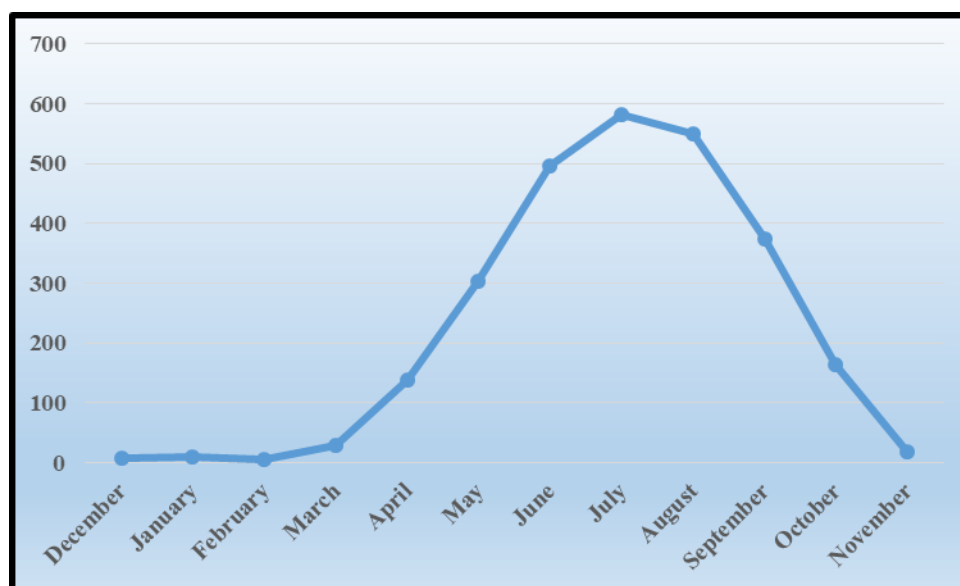
Table (1) temperature

Table (4) Relative Humidity

- Table (10)

while during the month of January, there was moderate discomfort at a temperature of (10.5) degrees Celsius and relative humidity (73%), while in the months of (March - October) there was a feeling of discomfort. People are under great and dangerous stress as a result of high temperatures and low relative humidity, as temperatures ranged between (18-26.1) degrees Celsius, and relative humidity (51-45%), while the month of November represented people feeling comfortable at a temperature (17.5) degrees Celsius and relative humidity (62%), and from this it turns out that the number of uncomfortable months affects the health and comfort of the person, whether by lower temperatures during the winter months or higher temperatures and lower relative humidity during the months of the end of spring, summer and the beginning of autumn.

**Figure (9) Monthly values of garlic cloves for whether or not a person feels comfortable**



The researcher's work based on table (9)

**Table (10) The digital evidence of garlic and the expression of people's feeling of comfort or lack of it**

Type of comfort	ValuesTHI
very upset	Without 10
moderate discomfort	14.9-10
relative comfort (warm)	17.9-15
comfort	20.9-18
Relative comfort (10% - 50%) of individuals feel discomfort	23.9-21
Moderate discomfort (100%) feel uncomfortable at a value of 26	26.9-24
very upset	29-27
Great stress and dangerous to the health of individuals	greater than 29

Source / Ali Abdul-Zahra Al-Waeli, The Origins of Applied Manakh, Ahmed Al-Dabbagh Press, Baghdad, 2014, p. 203.

### Conclusions:

- 1- It became clear through the research that there is a large variation in the rates of temperature, wind speed and humidity during the study period, which would affect human health and comfort.
- 2- It was found that the months in which people feel comfortable in the study area through the application of the wind cooling guide were determined by (the month of October) and the climate was refreshing despite the temperature dropping slightly, as it recorded 26.1 degrees Celsius, but due to the decrease in wind speed to 1.9 meters / sec. The climate is characterized by this characteristic.
- 3- It was found that the months in which people feel comfortable in the study area through the application of garlic is the month of November, where it represents the people's feeling of comfort at a temperature of (17.5) degrees Celsius and relative humidity (62%).
- 4- It became clear through the results reached by the researcher that the months (December, January, February), as the temperature ranged between (12.1-13.4) degrees Celsius and the wind speed ranged

between (1.9-2.5) m/sec was tend to cold, while the months The hottest is (May, June, September), as the temperature ranged between (30.1-32.5) degrees Celsius and the wind speed was between (3.1-2.4) m/sec.

5- It was also found that the values of garlic when feeling comfortable or not, during the months (January, February) were severe discomfort as a result of the cold air at a temperature ranging between (12.1-13.4) degrees Celsius and a relative humidity of (72%-61%). As for the month of January, there was moderate discomfort at a temperature of (10.5) degrees Celsius and a relative humidity of (73%), and in the months of (March - October), people felt great and dangerous stress as a result of high temperatures and low relative humidity, as temperatures ranged Between (18-26.1) degrees Celsius, and relative humidity (51-45%).

### **Recommendations:**

1- Attention is drawn towards studies in the field of applied climate that determine appropriate environments for a person's feeling of comfort to carry out his work without stress that affects human health and comfort.

2- Focusing on knowing the means by which a person can adapt to the high temperatures and humidity, which are used to protect the person and his health and provide him with comfort.

3- Determining the work that requires great effort for a person to perform under conditions of heat and high relative humidity, which cause great harm to humans through the impact of infection with some diseases such as heat stroke, by providing an appropriate environment to carry out these works.

4- Emphasizing the importance of providing adequate ventilation, whether in closed or open spaces, which may cause a person to feel comfortable or uncomfortable if it coincides with low or high temperatures.

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