Pak. j. life soc. Sci. (2024), 22(1): 3755-3773 E-ISSN: 2221-7630;P-ISSN: 1727-4915

Pakistan Journal of Life and Social Sciences
www.pjlss.edu.pk

https://doi.org/10.57239/PJLSS-2024-22.1.00275

RESEARCH ARTICLE

The Impact of Climate Change on Working Women in Babylon Governorate

Adnan Kareem Gahar[1*], Hidood Mohammed Abood[2], Abdul Karim Abbas Karim[3], Aya Aqeel Ahmed[4]

[1,2,4] Department of geography education, College of Education for Human Sciences, University of Babylon, Babylon, Iraq

[3]Information Technology Office, Al Qasim Green University, Babylon, Iraq

ARTICLE INFO

Received: May 22, 2024

Accepted: Jul 8, 2024

Keywords

Climate Change

Working Women

Babylon Governorate

Workplace Challenges

Adaptation Strategies

***Corresponding Author:**

hum599.adnan.kareem@uobabylon.edu.iq

ABSTRACT

The impact of climate change on working women in Babylon governorate, Iraq, is investigated, focusing on temperature, rainfall, and dust storms. Climate data spanning four decades (1980-2020) were analyzed alongside survey questionnaires distributed randomly to 300 working women. Findings reveal a significant rise in average temperatures, fluctuations in rainfall, and an increase in dust storm occurrences. Working women reported delays to work due to climate-related factors, with temperature extremes influencing lesson preparation and health. Preferences for climate conditions during study periods and work hours varied among respondents. Climate change poses tangible challenges to working women, impacting their daily routines, health, and workplace productivity. Adaptation measures are crucial to mitigate these effects and enhance resilience in the face of changing climate conditions.

INTRODUCTION

The problem of climate change has become the most important and dangerous issue on the list of international challenges, necessitating mandatory cooperation among countries worldwide to mitigate its consequences (Hormio, 2023). This is especially true as its intensity has increased in recent times, with a surge in heatwaves, droughts, hurricanes, forest fires, and devastating floods (Hormio, 2023). Climate change is now negatively impacting the security and stability of countries, particularly those already grappling with conflicts and unstable situations (Malhi et al, 2020).

Iraq, for instance, has experienced prolonged heatwaves, irregular rainfall, higher-than-average temperatures, and increased severity of climate phenomena. Recognizing that climate change is not solely an environmental problem but also affects gender equality and justice, further study and analysis are deemed necessary (Climate risk profile, 2022).

This study builds upon previous research that extensively examined the global impact of climate change, particularly emphasizing the accelerating pace of global warming attributed to human activities. In contrast to broader environmental studies, this research stands out by focusing specifically on the impact of climate change on working women in Babylon governorate, Iraq [4,5,6]. The study integrates climate data spanning four decades with a survey distributed using the (Stephen Thamson) equation to ensure randomness and representativeness [7,8]. The novelty lies in its localized approach, providing nuanced insights into the various dimensions of impact on the movement, activity, and professional repercussions of working women. By shedding light on gender-specific ramifications, this research contributes valuable insights for policymakers and community leaders to develop targeted strategies for adaptation and mitigation. The integration of demographic-specific impacts adds depth to our understanding of climate change effects, making this study a significant and relevant contribution to the field.

It aims to understand the nature of the impact exerted by climate change on the elements and phenomena of the climate affecting working women in the study area. The goal is to provide adaptation elements for human comfort in work environments and to reduce the instances of discomfort they experience during the various activities and events they engage in.

METHODS

2.1 Climate data

The prevailing belief in the past was that the climate was stable. Some argued that the climate cycle, lasting 30-35 years, provided constant climate conditions (Al-Samarraie, 2008). According to their belief, the average climate elements represented a stabilization of the fluctuations observed in weather recordings. However, as knowledge accumulated and unknown climatic factors were discovered, scientists noticed that the climate was far from stable. Thus, attempts to understand past climates began (Al-Samarraie, 2008). Through the study of past climates, scientists found that the climate undergoes changes from time to time. Therefore, the concept of climate change can be formulated as a long-term alteration in one or more climatic elements lasting at least a hundred years, and perhaps extending to thousands of years, with natural and human causes contributing to its occurrence (Al-Hudhale and Al-Jubouri, 2014).

Climate change elements:

Temperature

Temperature is defined as the degree of sensation of heat or coldness (Musa, 1994). It is considered one of the most important elements in climate, as it influences other climatic factors by affecting atmospheric pressure, humidity, rainfall, winds, and their movement.

As indicated in Table (1), it was found that temperature rates have gradually risen over the past forty years due to the phenomenon of climate change and its effects on arid and semi-arid climatic regions. For the years from 1980 to 1989, the average temperature was recorded at 23.7 degrees Celsius, and this rate slightly increased in the years from 1990 to 1999, reaching 23.9 degrees Celsius. In the years 2000 to 2009, the temperature recorded an average of 24.4 degrees Celsius.

Over the last decade of the study, temperatures showed a significantly higher average for the years 2010 to 2020, reaching 25.2 degrees Celsius. This is a significant indicator of the impact of climate change in the study area, as it was found that the temperature increased beyond its natural rates over the past forty years by 1.5 degrees Celsius. This, undoubtedly, has significant implications for other

climatic elements, intensifying phenomena such as dust storms, rainfall fluctuations, and climate instability.

These changes will have a clear impact on humans and human activities, including working women in the study area. This will become evident through the research conducted using survey forms and questions directed at the targeted demographic of the study.

Tabel 1: The monthly and annual temperature averages in Babylon Governorate for the Period from (1980-2020)

Month	Temperature Average 1980 - 1989	Temperature Average 1990 - 1999	Temperature Average 2000 - 2009	Temperature Average 2010 - 2020
January	10.7	10.3	10.8	11.1
February	13.3	13.7	13.5	13.8
March	17.7	18.1	19.2	18.9
April	23.5	23.4	24.2	24.9
May	29.25	30.1	30.8	31.5
June	33	32.8	35.1	35.9
July	34.9	34.3	37.5	38.2
August	34.6	35.5	37.7	37.6
September	31.4	31.5	32.3	33
October	26.1	26.1	26.9	27.1
November	17.9	17.5	17.8	18
December	12.5	12.4	12.3	12.8
Average	23.7	23.9	24.4	25.2

Rain

It is a form of condensation, as the water vapor in the air (In the form of clouds) transforms into liquid state. Water vapor also condenses with condensation nuclei suspended in the atmosphere, forming water droplets that fall to the ground due to the force of gravity (Al-Rawi and Al-Bayati, 1990).

The phenomenon of climate change in the study area has begun to impact the amount of precipitation, causing fluctuations and instability. As evident from Table (2), rainfall totals have varied significantly over the past forty years, alternating between increases and decreases, indicating

a state of fluctuation and instability. In the years 1980 to 1989, the average rainfall total was recorded at 97.7 mm, and it then increased to 100.7 mm in the years 1990 to 1999. However, this average decreased in the years 2000 to 2009, reaching 95.6 mm. Subsequently, there was an increase in the average rainfall total in the last decade from 2010 to 2020, recording 103.9 mm. Through this analysis, the variability and fluctuation in rainfall become apparent, with periods of increase and decrease, as well as variations in intensity.

This can be attributed, relatively, to the phenomenon of climate change and the climatic instability experienced in the study area Babylon Governorate in particular, Iraq, and globally in general. This directly or indirectly affects working women, whose responses varied in the questionnaires distributed to them during the study period.

Table 2: The monthly and annual total rainfall in Babylon Governorate for the period from (1980-2020)

Month	Rainfall Total 1980 - 1989	Rainfall Total 1990 - 1999	Rainfall Total 2000 - 2009	Rainfall Total 2010 - 2020
January	20.4	21.2	19.3	22.1
February	14.3	13.6	11.9	13.7
March	12.7	14.2	14.5	15.1
April	13	16	13.3	12.9
May	2.2	2.3	2.8	2.1
June	0	0	0	0
July	0	0	0	0
August	0	0	0	0
September	0.1	0.3	0.2	0.1
October	3.9	3.2	2.9	4.5
November	14.6	14.8	15.2	16.1
December	16.3	15.1	15.5	17.3
Average	97.7	100.7	95.6	103.9

Dust storms

Dust storms occur when the wind speed exceeds the natural threshold for the initiation of a dust storm, which is approximately 5.5 meters per second. As the winds lift dust particles into the air, they

form dust storms, reaching several kilometers. In severe dust storms, visibility decreases significantly, ranging from 100 meters to 1 kilometer. The size of dust particles in dust storms is typically minute, measuring around 100 microns (Jaber, 2010).

The aggravation of climate change is not hidden from everyone, particularly in arid and semi-arid climatic regions, which include the study area. The rise in temperature levels affects atmospheric pressure systems and other climatic elements, such as dust storms. By observing Table (3), it is evident that the average number of dust storm days has varied significantly over the past forty years. For the period from 1980 to 1989, the total was recorded as 3.88 days. Subsequently, this total gradually increased over the years from 1990 to 1999, reaching a total of 4.75 days. In the years from 2000 to 2009, the total reached 5.52 days. Remarkably, the cumulative number of dust storm days doubled in the last ten years, registering a total of 7.41 days from 2010 to 2020. This doubling is a serious indicator of the worsening of climate change and its effects on the increased occurrence of dust storms. This impact has far-reaching consequences on various aspects of life, especially for working women in Babylon governorate. This influence was evident through the responses of working women, collected through a questionnaire distributed to 300 women in the study area, and the results will be further elaborated in the research later on.

Table 3: The monthly and annual average number of dust storm days in Babylon Governorate for the period from (1980-2020)

Month	Dust storms 1980 - 1989	Dust storms 1990 - 1999	Dust storms 2000 - 2009	Dust storms 2010 - 2020
January	0	0	0	0.01
February	0.06	0.05	0.08	0.3
March	0.6	0.7	0.9	1.3
April	0.4	0.7	0.6	0.9
May	0.09	0.08	0.1	0.3
June	0.7	0.9	1.1	1.6
July	0.6	0.4	0.5	0.4
August	0.6	0.9	0.7	0.5
September	0.03	0.02	0.04	0.4
October	0.7	0.6	0.7	1.1
November	0.1	0.4	0.8	0.6
December	0	0	0	0

2.2 Study area

The study region encompasses one area, namely Babylon, located in the central region of Iraq, as depicted in Figure 1. Geographically, it spans the western portion of the sedimentary plain and the northern segment of the middle Euphrates region. Positioned as a central hub among multiple cities, Babylon is bordered to the north by Baghdad, northeast by Wasit, northwest by Anbar, west by Karbala, and southwest by Najaf. Additionally, its eastern and southeast borders connect with the city of Al-Diwaniyah. Astronomically, the study area is positioned between latitudes (6°32' - 8°33' North) and longitudes (57°43' -12°45' East) (Azeez, 2021).

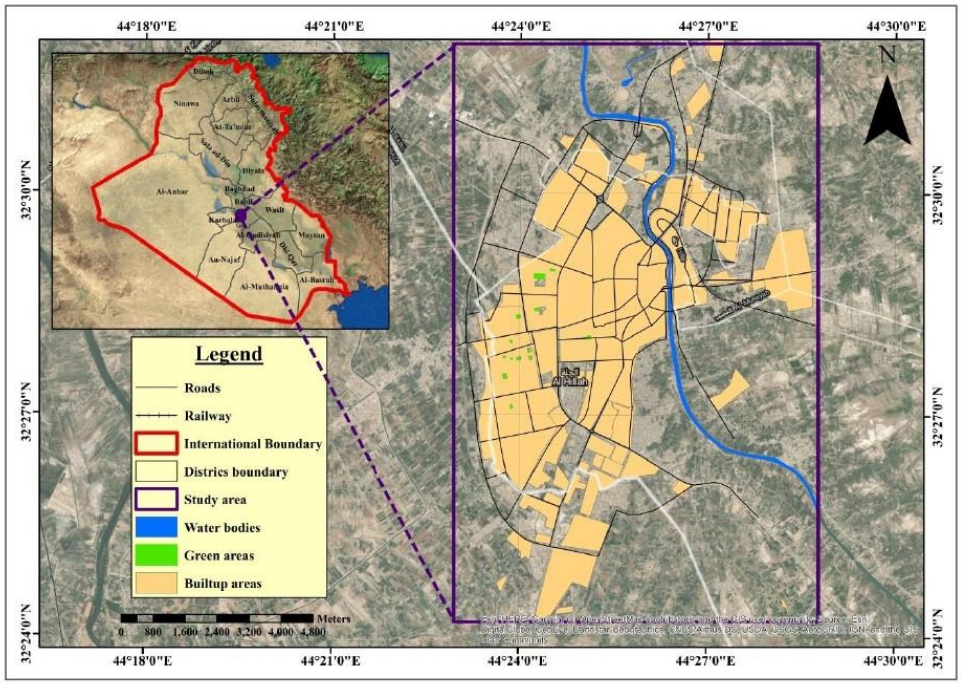

Figure 1: The study area in the city of Al-Hillah, Babylon Governorate (Azeez, 2021)

2.3 Research stages

Information gathering:

Compilation of climate data from academic thesis, research papers, and published reports.

Climate data collection:

Collection of climate data for the past forty years (1980-2020) with a focus on temperature, rainfall, and dust storms.

Field visits:

On-site visits to diverse work environments for women in Babylon Governorate.

Administration of a survey questionnaire randomly among working women using the (Stephen Thamson) equation for representativeness.

Data organization:

Systematic organization and categorization of gathered information and survey results for analysis.

Data analysis:

Utilization of statistical tools to analyse climate data trends, questionnaire responses, and correlations between climate elements and the experiences of working women.

Study Sample:
The researchers selected a sample consisting of 300 female workers using simple random sampling, with the intention of including women working in school environments.

RESULTS AND DISCUSSION

3.1 Analysis and discussion of questionnaire results

Late arrival to work due to rain and fog

Both rain and fog significantly impact visibility, and the study area has experienced noticeable rainfall as a result of climate change in regions with extreme climates. Naturally, this reflects on the commuting of working women to their workplaces, as evident from the results we have obtained.

The survey results recorded in Table (4) regarding the inquiry about being late for work due to rain among the study sample revealed diverse responses. The responses indicating 'Yes' were recorded as (187), constituting 62%, while 'No' responses were recorded as (113), representing 38% of the total sample in the study area. Regarding the question about being late for work due to fog, 'Yes' responses came first with (212), accounting for 71%, while 'No' responses were second with (88), representing 29% of the total sample in the study area.

It is evident from this data that fog has a significant impact on the working women in the study area, reaching 71%. This can be attributed to the difficulty of traffic movement, poor visibility, and the fact that fog increases the desire to sleep and the feeling of fatigue. This is a result of the body receiving less oxygen during breathing in foggy conditions, leading to a lower oxygen level in the bloodstream, which affects the functioning of vital body organs.

Table 4: Late arrival to work due to rain and fog

No.	Late arrival to work due to heavy rainfall	Number	Percentage %	Late arrival to work due to fog	Number	Percentage %
1	Yes	187	62	Yes	212	71
2	No	113	38	No	88	29
	Total	300	100	Total	300	100

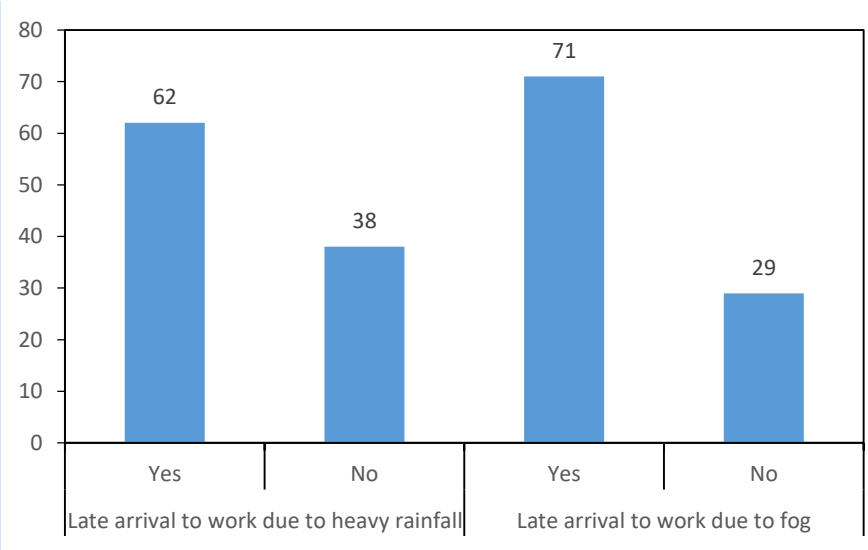

Figure 1: Late arrival to work due to rain and fog

Late arrival to work to dust storms and rainfall

The survey results recorded in Table (5) regarding the inquiry about the delay to work due to dust storms among the study sample revealed varied responses. The "Yes" responses were first with approximately (233) and a percentage of (78%), while the "No" responses were second with around (67) and a percentage of (22%) of the total sample in the study area. As for the question about absenteeism from school due to rainfall, the "Yes" responses came first with about (271) and a percentage of (90%), while the "No" responses came second with (29) and a percentage of (10%) of the total sample in the study area.

Table 5: Late arrival to work to dust storms and rainfall

No.	Late arrival to work due to dust storms	Number	Percentage %	Absence from school due to rainfall	Number	Percentage %
1	Yes	233	78	Yes	271	90
2	No	67	22	No	29	10
	Total	300	100	Total	300	100

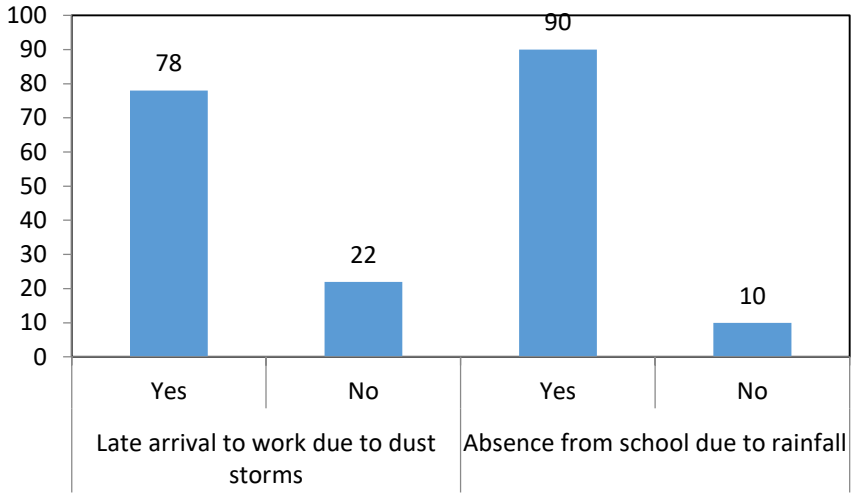

Figure 2: Late arrival to work to dust storms and rainfall

3.2 The impact of temperature

One prominent feature of climate change is the significant rise in temperature as an inevitable result of alterations in natural and human systems. It is natural that there are reflections of temperature changes on working women in the study area, affecting the nature of bioclimatic physiological comfort rates for individuals in the study region. This impact can lead to feelings of discomfort and unease, particularly for working women in various sectors.

Typically, all Iraqi governorate s in the central and southern regions have been under the burden of high temperatures, significantly exceeding 50 degrees Celsius in recent years. This is attributed to the effects of climate change, prompting government authorities to suspend official work to preserve the safety of citizens.

The table (6) shows variability in the role of temperature conditions that cause the most discomfort during work for individuals in the sample working in enclosed environments. "High temperatures" ranked first with approximately (145) and a percentage of (48%), followed by the response of "low temperatures" as the second choice with (92) and a percentage of (31%). The response of "moderate temperatures" came last with around (65) and a percentage of about (21%) of the total study sample. The result of this question reveals the extent of the impact of temperature conditions on women working within the educational process.

Table 6: The impact of temperature during work

No.	The impact of temperature	Number	Percentage %
1	High Temperature	145	48
2	Low Temperature	92	31
3	Moderate Temperature	65	21
	Total	300	100

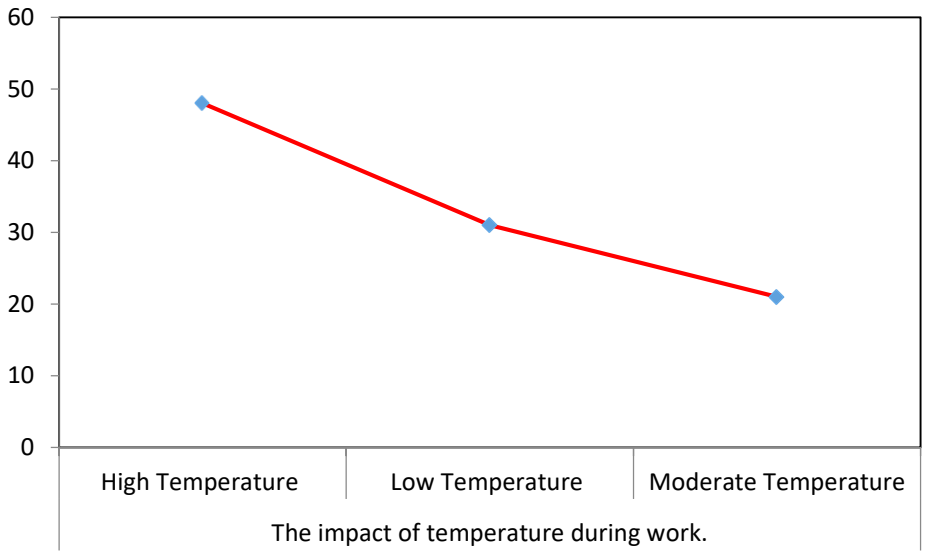

Figure 3: The impact of temperature

3.3 The Impact of wind and weather conditions

Wind speed and direction are subject to the influence of climate change, with this impact resulting from the variations in temperature differences across the Earth's surface. Consequently, differences in atmospheric pressure systems arise, forming centers that lead to the formation of low-pressure systems, encouraging the rapid movement of winds from one region to another. It is natural for the study area to experience an increase in the duration of exposure to easterly winds, which are often disruptive to the population in general and, specifically, to working women, due to their predominant wind directions.

The survey results recorded in Table (7) regarding the question of whether wind formation hinders your work in the study sample revealed diverse responses. The "Yes" responses were recorded first, with approximately 167 (56%) responses, while the "No" responses were recorded second, with about 133 (44%) responses, considering the total sample of the study area.

As for the question of whether weather conditions and their fluctuations hinder the completion of a specific academic year, the responses were as follows: "Yes" responses came first with approximately 194 (65%), while "No" responses came second with 106 (35%) out of the total sample of the study area.

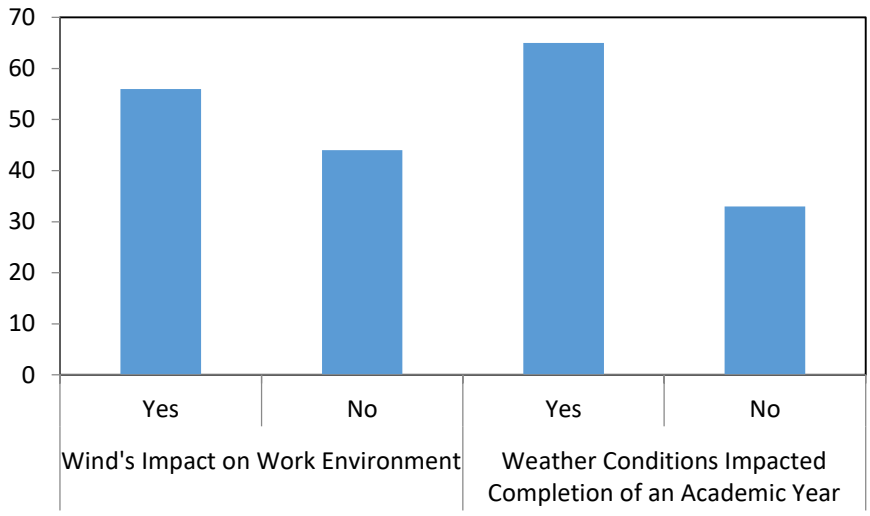

Figure 4: The Impact of wind and weather conditions

3.4 The optimal climate for study periods

Table (8) illustrates the ranking of the optimal climate for study periods according to the perspective of a sample from the study area. Spring takes the lead with (167) and a percentage of (56%), followed by winter with (94) and a percentage of (31%). Summer and autumn, on the other hand, record (21, 18) with percentages of (7, 6%) respectively, in sequence, from the total sample of the study area. It is evident from this that the study sample tends to favor the spring season as the most suitable for the school term.

Table 8: The optimal climate for study periods

No.	The optimal climate for study periods	Number	Percentage %
1	Winter	94	31
2	Spring	167	56
3	Summer	21	7
4	Autumn	18	6
	Total	300	100

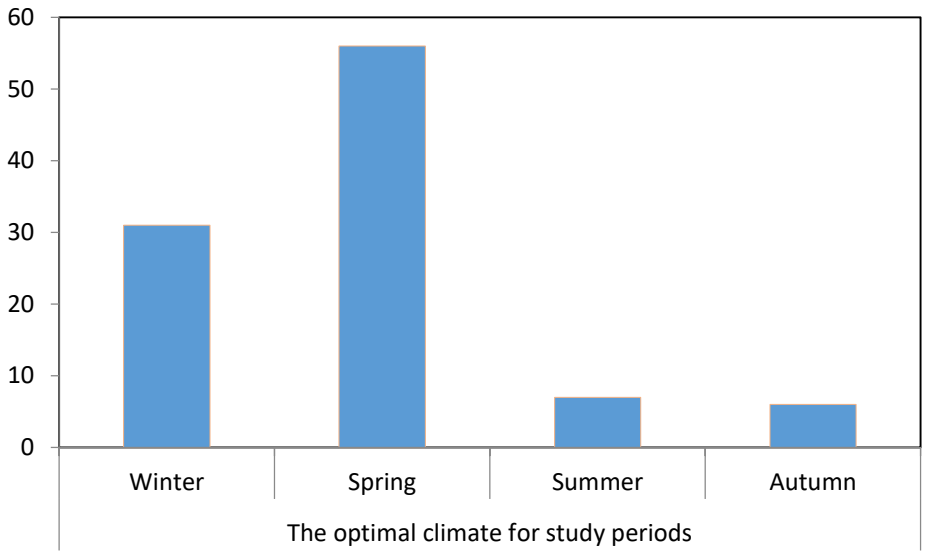

Figure 5: The optimal climate for study periods

3.5 The Impact of annoying months and climatic conditions

From Table (9), it is evident that the most annoying months are August, July, and January, with percentages of (57%, 68%, 54%) respectively. On the other hand, the least troublesome months were June, March, and April, with percentages of (5%, 11%, 12%) respectively, based on the total sample of the research in the study area.

As for the most bothersome weather conditions, dust storms ranked highest at (113) incidents and a percentage of (38%), followed by high temperatures at (26%). Meanwhile, low temperatures were the least annoying climatic conditions for the sample in the study area, accounting for (1%) of the total research sample.

Table 9: The Impact of annoying months and climatic conditions during working days

Month	Number	Percentage %	Most annoying weather conditions	Number	Percentage %
January	54	18	Rainfall	8	3
February	38	13	Temperature rise	79	26
March	33	11	Temperature drop	4	1
April	36	12	Dust	29	10
June	14	5	Strong winds	21	7
July	57	19	High humidity	46	15

august	68	22	Dust storms	113	38
Total	300	100	Total	300	100

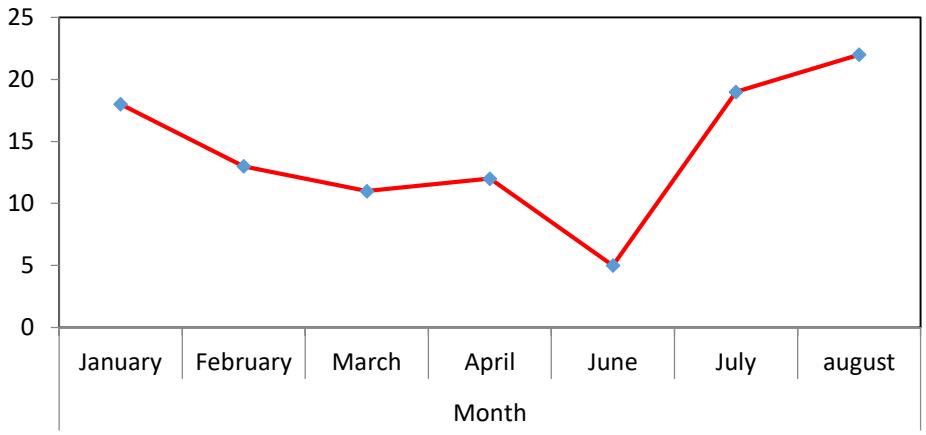

Figure 6: The Impact of annoying months and climatic conditions during working days

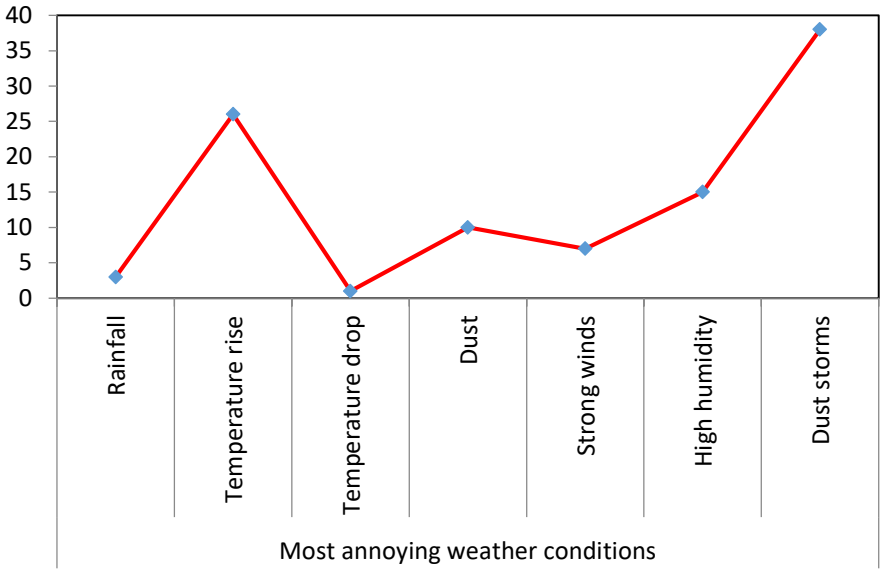

Figure 7: Most annoying weather conditions during working days

3.6 Winds' Impact on School Commuting and Ideal Climate Conditions

Climate conditions are among the crucial aspects that should be taken into consideration. According to Table (10), it is evident that (90%) of the study sample prefer morning work, with a total of (271 visitors), while (10%) prefer evening work, with a total of (29). Regarding the impact of strong winds on hindering the movement of individuals during the commute to and from school, the response was affirmative by (98%) of the total study sample, while the negative response was (6) with a percentage of (2%) of the total study sample.

Table 10: Winds' Impact on School Commuting and Ideal Climate Conditions

No.	The impact of strong winds on commuting to and from school.	Number	Percentage %	Suitable climatic conditions during the study period.	Number	Percentage %
1	Yes	294	98	Yes	271	90
2	No	6	2	No	29	10
	Total	300	100	Total	300	100

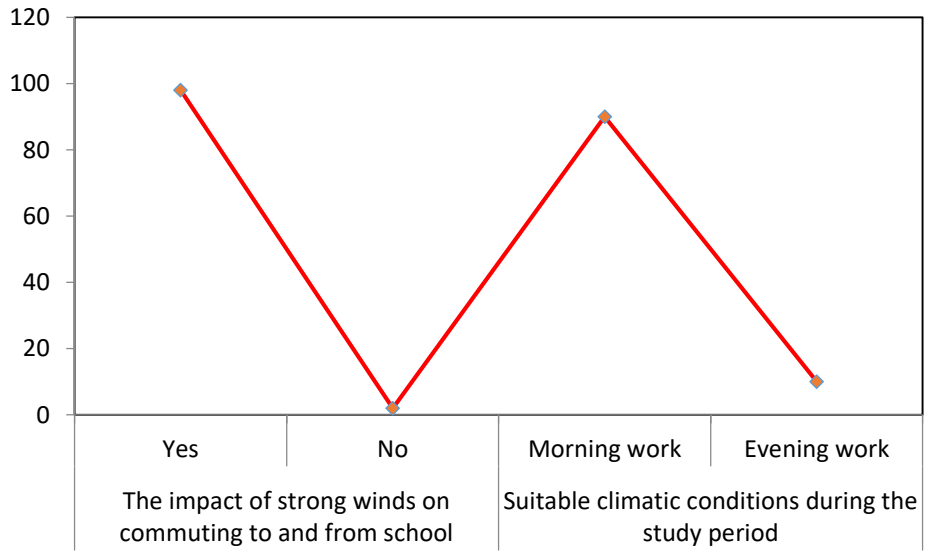

Figure 8: Winds' Impact on School Commuting and Ideal Climate Conditions

3.7 Lesson preparation and its correlation with temperature

The results of the survey recorded in Table (11) regarding the question about the failure in lesson preparation due to high temperatures among the study sample reveal diverse responses. The "Yes" responses were recorded first with approximately (271) and a percentage of (91%), while the "No" responses were recorded secondly with about (29) and a percentage of (10%) of the total sample in the study area.

As for the question about the failure in lesson preparation due to low temperatures, the "Yes" responses came first with about (213) and a percentage of (71%), while the "No" responses came secondly with (87) and a percentage of (29%) of the total sample in the study area.

Table 11: Lesson preparation and its correlation with temperature

Total	**300**	**100**	**Total**	**300**	**100**

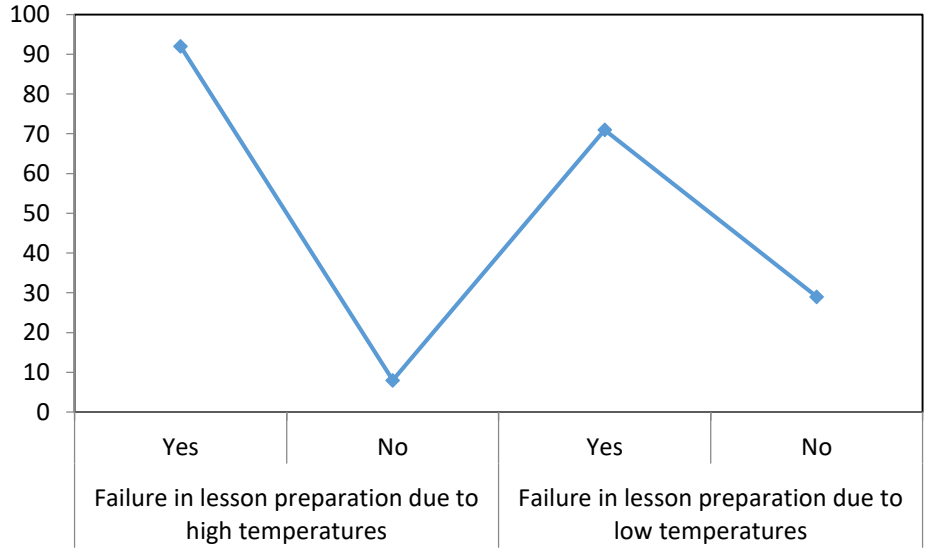

Figure 9: Lesson preparation and its correlation with temperature

3.8 The impact of temperature within the school environment

The results of the survey in Table (12) regarding the question about the positive impact of high temperatures on the study sample reveal diverse responses. The "Yes" responses were recorded first with approximately (233) and a percentage of (78%), while the "No" responses were recorded secondly with about (67) and a percentage of (22%) of the total sample in the study area.

As for the question about the positive impact of low temperatures, the "Yes" responses came first with about (216) and a percentage of (72%), while the "No" responses came secondly with (84) and a percentage of (28%) of the total sample in the study area.

Table 12: The impact of temperature within the school environment

No.	The positive impact of high temperatures within the school	Number	Percentage %	The positive impact of low temperatures within the school	Number	Percentage %
1	Yes	233	78	Yes	216	72
2	No	67	22	No	84	28
	Total	300	100	Total	300	100

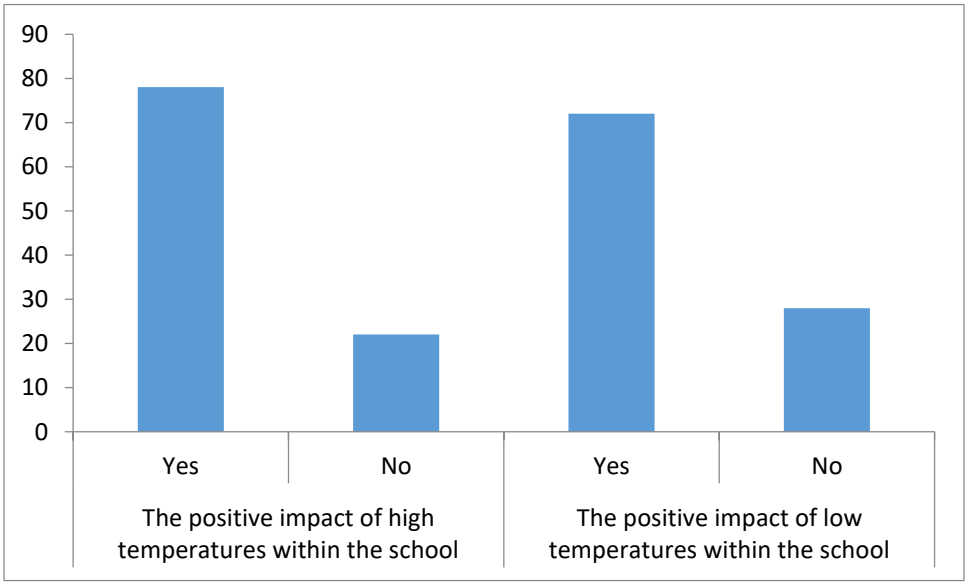

Figure 10: The impact of temperature within the school environment

3.9 The positive impact of rain and fog within the school

The survey results in Table (13) regarding the inquiry into the positive impact of rain on the study sample reveal varied responses. The "Yes" responses were recorded first, numbering approximately (194) with a percentage of (65%), while the "No" responses were recorded secondly, totalling about (106) with a percentage of (35%) of the total sample in the study area. As for the question about the positive impact of fog, the "Yes" responses came first, totalling about (213) with a percentage of (71%), while the "No" responses came secondly, numbering (87) with a percentage of (29%) of the total sample in the study area.

Table 13: The positive impact of rain and fog within the school

No.	Positive Impact of Rain Inside the School	Number	Percentage %	Positive Impact of Fog Inside the School	Number	Percentage %
1	Yes	106	35	Yes	87	29
2	No	194	65	No	213	71
	Total	300	100	Total	300	100

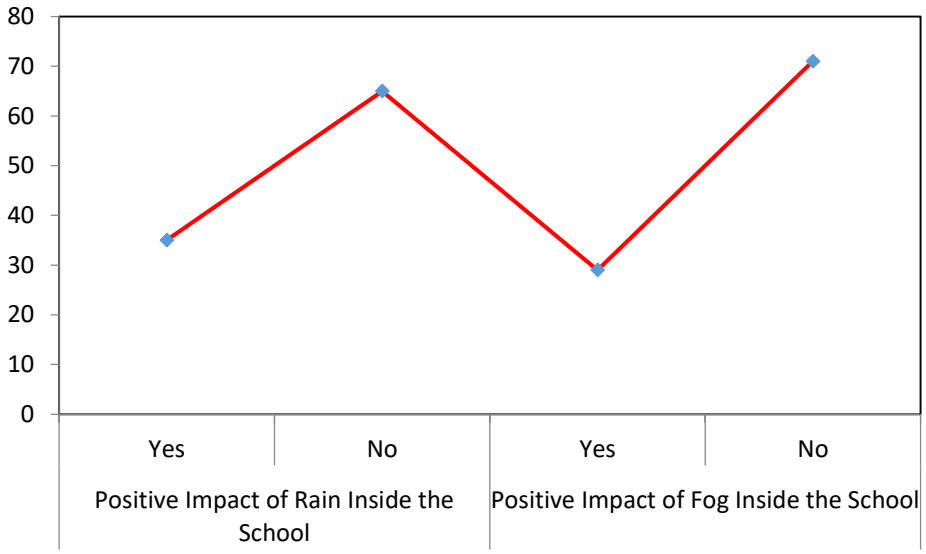

Figure 11: The positive impact of rain and fog within the school

3.10 The impact of dust and low temperatures on health.

The results of questionnaire Table (14) regarding inquiries about the incidence of diseases due to dust among the study sample reveal varied responses. The responses indicating "Yes" were recorded

at approximately 171 (57%), while those indicating "No" were recorded at around 129 (43%) of the total sample in the study area.

As for inquiries about the incidence of diseases due to low temperatures, responses indicating "Yes" came first at approximately 281 (94%), while responses indicating "No" came second at 19 (6%) of the total sample in the study area.

Table 14: The impact of dust and low temperatures on health

No.	Diseases caused by dust	Number	Percentage %	Diseases caused by low temperature	Number	Percentage %
1	Yes	171	57	Yes	281	94
2	No	129	43	No	19	6
	Total	300	100	Total	300	100

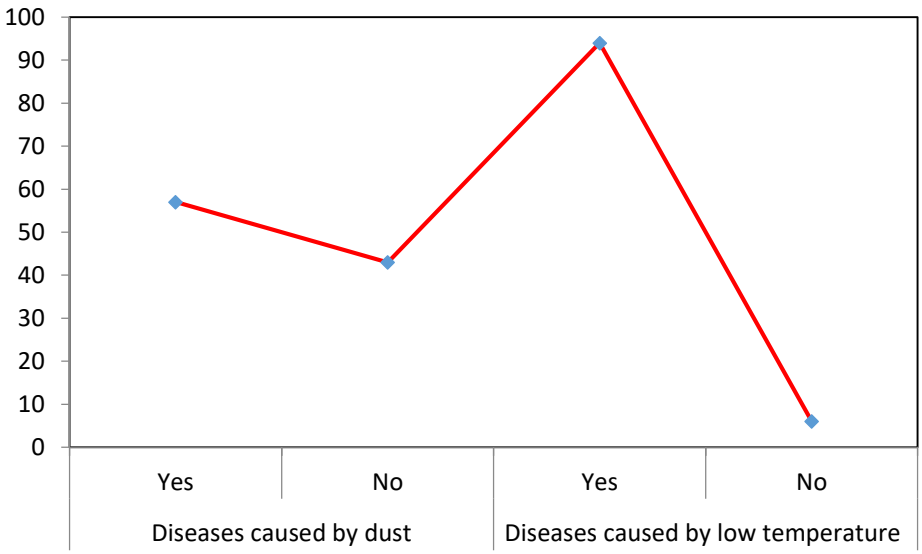

Figure 12: The impact of dust and low temperatures on health.

CONCLUSION

The research findings indicate significant changes in temperature patterns over the past four decades, with a confirmed rise of 1.5 degrees Celsius in average temperatures in the last forty years. This has substantial implications for climatic elements. Additionally, precipitation amounts have shown fluctuations, experiencing both increases and decreases. From 1980 to 1989, the total average was 97.7 mm, while from 1990 to 1999, it reached 100.7 mm. The years 2000 to 2009 recorded a total of 95.6 mm, and in the last decade, from 2010 to 2020, it increased to 103.9 mm. The study also

reveals a doubling of the total number of dust storm days in the last ten years, registering 7.41 days from 2010 to 2020, indicating a severe exacerbation of climate change effects and an increase in dust storm occurrences. Furthermore, the research emphasizes that the academic year in the study area is subject to various climatic factors, showcasing the impacts of climate change. Differences in preferences among female educators regarding the start of the academic year and working hours are also uncovered. Thermal characteristics prove to be the most influential climatic factors affecting working women. Lastly, many female workers in the study area face injuries resulting from dust phenomena and temperature drops caused by climate change.

Acknowledgments

This research was funded by Al-Mustaqbal University (Iraq) (*Proj. 1/2024*).

REFERENCES

Hormio, S., 2023. Collective responsibility for climate change. Wiley Interdisciplinary Reviews: Climate Change, p.e830.

Malhi, Y., Franklin, J., Seddon, N., Solan, M., Turner, M.G., Field, C.B. and Knowlton, N., 2020. Climate change and ecosystems: Threats, opportunities and solutions. Philosophical Transactions of the Royal Society B, 375(1794), p.20190104.

Climate risk profile: Iraq (2022) Weathering Risk. Available at: https://weatheringrisk.org/en/publication/Climate-Risk-Profile-Iraq (Accessed: 12 January 2024).

Hassan, W.H. and Nile, B.K., 2021. Climate change and predicting future temperature in Iraq using CanESM2 and HadCM3 modeling. Modeling Earth Systems and Environment, 7, pp.737-748.

Ghanim, M.S. and Farhan, A.A., 2023. Projected patterns of climate change impact on photovoltaic energy potential: A case study of Iraq. Renewable Energy, 204, pp.338-346.

Seyuba, K., O'Driscoll, D., Tarif, K., Kim, K., Ali, A., De Coning, C. and Krampe, F., 2023. Climate, Peace and Security Fact Sheet: Iraq (Updated).

Hassan, W.H., Nile, B.K., Kadhim, Z.K., Mahdi, K., Riksen, M. and Thiab, R.F., 2023. Trends, forecasting and adaptation strategies of climate change in the middle and west regions of Iraq. SN Applied Sciences, 5(12), p.312.

Jabal, Z., Khayyun, T. and Alwan, I., 2023. A Review of the Impact of Climate Change on Water and Food Security Concepts. Journal of Water Resources and Geosciences, 2(2), pp.46-65.

Al-Samarraie, Q.A., 2008, Climate and Climatic Regions. Amman: Dar Al-Yazouri for Publishing and Distribution.

Al-Hudhale , Y.A.H. and Al-Jubouri, S.A. (2014). Climate Change: Between the Past, Present, and Future. Baghdad: Dar Ahmed Al-Dabbagh.

Musa, A.H. (1994). Fundamentals of Climatology. 1st edn. Damascus: Dar Al-Fikr Al-Mu'asir, p. 36.

Al-Rawi, S.M. and Al-Bayati, A.H. (1990). Foundations of Climatology. 2nd edn. Mosul University, p. 211-212.

Jaber, M.A.H. (2010). The Impact of Dust Atmospheric Phenomena on Early Cultivation of Tomato Crop in Al-Jabayish District. Journal of Adab Thi Qar, (1), p. 103.

Azeez, O.S. et al. (2021). 'A site selection model based on Fuzzy logic and Artificial Neural networks for establishing recreational centers in the Center of Hilla , Iraq', (August). Available at: https://doi.org/10.13140/RG.2.2.10558.20807.

Al-Taai, O.T., Al-Rukabie, J.S. and Abdalkareem, I.H., 2017. Study of the Monthly and Annual Behavior of Temperature and its Impact on Climate Change in Iraq for the Period (1982-2012). International Journal of Environment, Agriculture and Biotechnology, 2(5), p.238905.