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ANALYTICAL STUDY OF THE ENVIRONMENTAL DIMENSION OF QUALITY OF LIFE IN KHENCHELA CITY

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ABSTRACT

This study aims at shedding light on the current state of the environmental dimension of the quality of life in the city of Khenchela by studying four variables : water, air, green spaces, and waste management. It focuses on the objective indicators of the four variables obtained from an international database and fieldwork, as well as on the use of subjective indicators of one variable through the distribution of an online questionnaire that included a random sample of 500 individuals. The findings of the study revealed that the environmental dimension of quality of life in the city of Khenchela is characterized by limited water sources with dilapidated distribution networks, good air quality despite the concentration of some pollutants exceeding the thresholds set by the World Health Organization, and lack of effective waste management in contrast to the availability of green spaces.

KEYWORDS

Quality of Life, Environmental Dimension, Environmental Variables (Water, Air, Green Spaces, Waste Management), Khenchela City

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Introduction.

Quality of life is a modern concept whose emergence dates back to the 1960s, when related interest was limited to economic and social affairs by trying to improve economic revenues, provide jobs, and improve health care. In the 1970s and 1980s, its field of interest expanded to include the environmental aspect due to the negative effects of urbanization and industrial development on the natural environment. Later, the concept of quality of life expanded to include other areas and became rather concerned with the psychological and social aspect seeking to achieve well-being and satisfaction. In the twenty-first century, the concept of quality of life has become more comprehensive and holistic that it is addressed in all fields and disciplines, as the studies that dealt with quality of life varied and diverged according to the speciality and the approach followed (subjective or objective) as well as the variables and indicators used in its evaluation. As is the case with the interest in the environmental dimension, each variable has received a special study, among which we find the study of "**Mohammed Yacoub, Marwan Al-Mubarak et al. 2022**", whose aim was to create a map of the urban quality of life index for the city of Al Ain, in line with the United Nations Sustainable Development Goals, where the quality of life in the city was evaluated using satellite images including Sentinel 2A, (AI) 5P Sentinel, Landsat 8 (LST), and SRTM from which the following set of spectral indicators were extracted; an index of Normalized Difference Vegetation Index (NDVI), Soil Adjusted Vegetation Index (SAVI), Natural

Difference Water Index (NDWI), Urban Difference Index (NDBI), Building Density Index (ENDISI), Modified Water Index (MNDWI) which shows where water is available especially in urban areas, Land Use Land Character Index (LULC), GIS was also used to extract infrastructure data, and Random Forest algorithm using machine learning. After integrating remote sensing and machine learning data, the study resulted in the creation of a quality of life map for the UAE city of Al Ain that showed spatial compatibility with traditional quality of life indicators, which confirms the validity of the methodology followed. The study also showed the positive impact of the presence of green spaces on the level of urban quality of life. The second study by "**Saleh Chaoui, 2023**", came to study the reality of one environmental variable, namely green spaces in the city of Annaba and to answer the main question: How can green spaces be managed for urban well-being and landscape quality? To answer this question, the researcher relied on two basic tools: field observation to identify and evaluate green spaces in terms of their quantity, quality, and individuals' behaviors towards them, in addition to interviews with concerned authorities such as the municipality) and the Directorate of Construction, Architecture, and Building (DCAB).

The study concluded that the city of Annaba knows a great shortage of green spaces, and the existing ones, represented by 10 public parks and barns, , not exceeding 19.59 hectares with an area of 0. 32 m² per capita. 32 m² per capita suffer from deterioration and the absence of urban furniture, maintenance, water sources, in addition to the lack of development, which facilitated their monopolization in favor of illegal trade at times and as parking places for vehicles at other times, and the research concluded with a set of recommendations that would improve both the framework of life for Annabi citizens, and the landscape of the city known for its tourist character. Another study **Clet Mesmin EDOU EBOLO et al. 2022.** conducted in Libreville, Gabon, with the aim of raising awareness about the importance of improving air quality and directing public policies towards protecting public health and the environment, through a comprehensive assessment of air quality by analyzing changes in the concentrations of two air pollutants: fine particulate matter (PM_{2.5}) and ozone (O₃) and studying their effects in terms of health risks on the population and estimating the economic cost resulting from them in the period from 1990 to 2019.

The study relied on three sources : annual data to estimate the concentration of pollutants (PM_{2.5}, O₃, and exposure to household emissions), data on health effects associated with air pollution, and data to estimate the economic cost of air pollution based on the number of premature deaths and the statistical value of life. All were taken from the Global Burden of Disease (GBD) project, the Institute for Health Metrics and Evaluation (IHME), and the Environmental Health Institute (HEI). The study concluded that air quality in Libreville has deteriorated, due to concentrations of fine particulate matter (PM_{2.5}) exceeding the World Health Organization (WHO) guideline limit of 10 µg/m³ to range between 34.1 and 39.7 µg/m³ in the aforementioned period between 1990 and 2019. Ozone (O₃) also reached 67.4 µg/m³ from 2000 to 2015, and in 2019 its concentration exceeded the minimum Mozambican standard of 72 µg/m³.

In terms of health risks, the results indicated that deteriorating air quality poses a significant risk to public health, with 889 premature deaths per year caused by various diseases, mainly strokes, heart disease, and chronic respiratory diseases. As for the economic cost, the economic cost associated with the health damage caused by air pollution was estimated at 1,906 billion US dollars per year, That's about 13.71% of the national GDP.

The environmental dimension is one of the main pillars to which developing countries attach importance in their policies to improve the quality of life, while developing countries, including Algeria, face major challenges related to the environment, including pollution, water shortages, waste management, ..., etc.

Khenchela is an example of many Algerian cities that suffer from environmental issues that affect the quality of life, the health and well-being of the population, despite its diverse and picturesque natural environment. Hence, this study is summarized in the following questions :

- What is the reality of the environmental dimension of the quality of urban life in Khenchela ?
- What are the variables and indicators of the environmental dimension of quality of life ?

This study aims to present a presentation of the current situation of an aspect of the quality of life in the city of Khenchela related to its environmental dimension by highlighting the most important variables of this dimension, namely the quality of water, air, green spaces, and waste management.

The importance of the study lies in the fact that it deals with a delicate and sensitive aspect of an important topic, namely the environmental dimension of quality of life in an Algerian city for which we rarely find scientific studies.

Methodology and Tools of The Study:

The methodology of the study was based on objective and subjective approaches, the first of which was materialized through the use of objective indicators whose sources varied according to the nature of the studied variable as follows :

- Air quality: We used data to estimate the concentration of pollutants (PM_{2.5}, NO₂, and PM₁₀) in the air, and other data related to the health effects of air pollution. We extracted them from the Global Burden of Disease (GBD) project database of the Institute for Health Metrics and Evaluation (IHME) and the Health Effects Institute (HEI) available at (www.stateofglobalair.org). Other annual air quality data we obtained from Labo Plume (<https://air.plumelabs.com/air-quality-in-Khenchela-asfL#ae16>)

- Water quality : We used data on water standards obtained from the Algeria Water Laboratory in Khenchela. Other data on water volume, sources and distribution were obtained from the Directorate of Water Resources of Khenchela State.

- Green spaces : We obtained data on the size and type of green spaces by contacting the Environment Directorate of Khenchela and the Forestry Governorate, in addition to field investigation.

- Waste management : We obtained the data through the Public Corporation for the Management of Technical Landfill Centers and through an interview with the head of the municipality's barn.

The subjective measure in this work was limited to the residents' self-assessment index of water quality in the city of Khenchela, in which we relied on an electronic questionnaire consisting of 500 forms distributed in April 2024 through the pages of groups of Khenchela residents on the social networking site (Facebook), in which we relied on a random sample.

Defining The Concepts of The Study.

1- Quality of urban life :

1.1 The concept of urban quality of life :

The quality of urban life is an umbrella term whose concept is widely discussed in all different scientific fields, with many dimensions, most notably the urban dimension, the economic dimension, the social dimension, and the environmental dimension. Levent (2006) defined it as the level at which urban life leads to meeting the needs of the community. In other words, the quality of urban life refers to the degree of excellence of the urban environment." The World Health Organization defined it as "an individual's living situation, culture and value systems in which he or she lives and the extent to which this conforms or does not conform to his/her values, interests, expectations and concerns related to his/her physical health, psychological state, level of independence, social relationships, personal beliefs, and relationship with the environment in general, thus quality of life in this sense refers to an individual's subjective assessments of his/her life conditions."

1.2 Indicators of the quality of urban life :

Urban quality of life indicators are divided into two types, objective indicators, which are those indicators that can be measured quantitatively, such as the number of housing units, the size and level of existing facilities and equipment, especially health and educational facilities, the variety of transportation means and their capacity, water quality standards, the amount of pollutants in the air, the type and size of green spaces and others. Contrarily, subjective indicators measure the efficiency of the performance of objective variables based on the amount of satisfaction achieved by individuals through the performance of these variables, as well as the extent or degree of satisfaction of individuals with this. The comprehensive assessment of quality of life relies on both objective and subjective indicators.

2 The concept of the environmental dimension of urban quality of life :

According to (Ahmed Kamal and Khalaf Mohammed, 2014), « the environmental perspective of quality of life is explained in the light of environmental variables according to the interaction between the individual and the environment in which he lives and the outcome of this interaction in improving the quality of his life and satisfying his basic needs ».

2.1 the variables of the environmental dimension of quality of life:

Studying the environmental dimension of quality of life in cities requires familiarity with the elements of this dimension or what is known as its variables, namely air, water, green spaces, and waste management (waste).

- Air quality: The environmental dimension of the quality of life in cities is affected by the quality of air in cities, as clean air is a prerequisite for a healthy life for humans on this planet in general and in cities in particular. to which the city belongs, the proportion of factories that produce them, and the number of compounds they emit: ground ozone (O₃), nitrogen dioxide (NO₂), carbon monoxide (Co), sulfur dioxide (SO₂) and particulate matter with a diameter of less than 10 microns (PM_{2.5} and PM₁₀). « When air pollution occurs in a region of the world, its impact is not limited to the area of pollution but extends to other areas near and far from the air because air movement has no boundaries and does not recognize regional or international borders » (Ahmed Hamoud Saadi, Esraa Talib Al-Rubaie,2021)

- Water : The concept of water quality refers to the measure that determines the suitability of the physical, chemical and biological properties of water for a specific use, as the quality of drinking water is different from the quality of water for other uses. It must also address the rates of distribution of drinking water for different purposes, comparing the amount of water available to the amount of water consumed, the percentage of water lost or lost from water networks, the number of filtration plants that treat wastewater, and the percentage of water that is reused.

- Green spaces: They have many important roles in improving the environmental quality of life in cities, as they contribute to « reducing the negative impact of the urban climate on people, cooling the air of cities and saving energy, in addition to their contribution to providing a healthy environment by increasing relative humidity and providing fresh air / absorbing noise in addition to producing oxygen » (Ramesh Srikonda,2016) . « It is also a good filter for air, as one study found that the percentage of pollution in the air decreases in green spaces by up to 20 to 40% compared to the rest of the city » (Jo, Hyun-Kil,2022) The effectiveness of green spaces in improving environmental quality increases with the increase in their size in cities and vice versa.

- Waste management : Good waste management depends on a series of stages including selective sorting of waste, collection and transportation, and finally safe treatment and recycling of waste, using modern technologies that can minimize its negative environmental and health impacts.

Study Area:

The city of Khenchela is the headquarters of the state, located in eastern Algeria, 600 km from the capital Algiers, at an altitude of 1122 m above sea level, covering an area estimated at 32 km² with a population of 151,820 in 2023. Administratively bordered by :

- El Hamma municipality from the north and west
- Baghai municipality from the northeast
- Nsiga municipality from the south and southeast

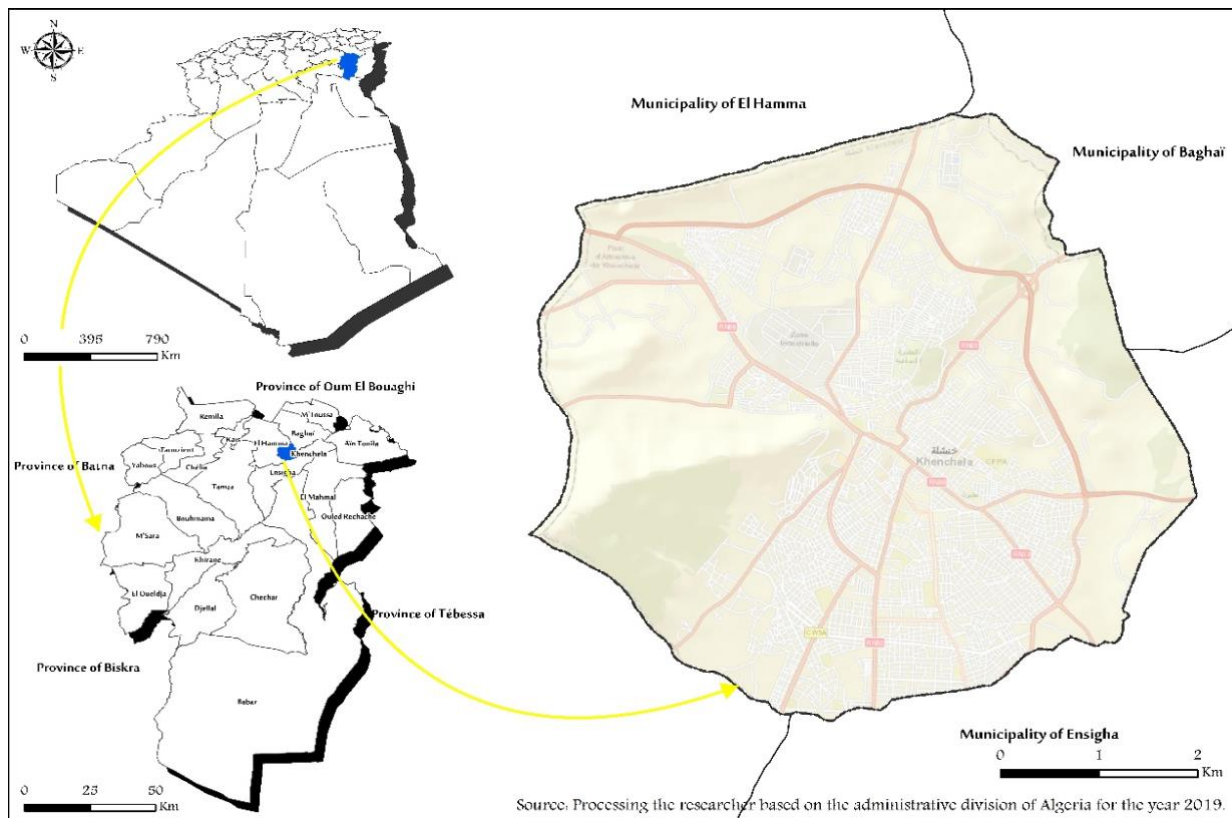


Fig. 1: The administrative location of Khenchela Municipality

Results.

1. Water, limited quantities and dilapidated distribution networks.

The table below (01) shows the results of the drinking water standards for the city of Khenchela for the second month of each season for the year 2023 (January, April, October and August) in different

neighborhoods in the city, showing the conformity of most drinking water specifications to Algerian standards, except for the value of the disinfectant represented by chlorine in April and October, which is estimated at 00 mg / l, which is less than the reference value estimated at more than 0. 1 mg / l, in addition to sodium, which was estimated at 235 mg / l in January, which is also below the reference value estimated at more than 0.1 mg / liter, in addition to sodium, which was estimated at 235 mg / liter in January, which is also greater than the maximum reference value specified in the law at 200 mg / liter, in addition to calcium carbonate, which also exceeded the maximum reference value of 500 mg / liter to reach 528 mg / liter.

The results of the survey showed that 2% of the population drink tap water, while 98% of them confirmed that they do not use tap water for drinking, where they resort to well water and buy spring water. As for the reasons for refraining from drinking tap water, 16.66% of them attributed the reason to its bad smell, 50% of them attributed the reason to its unpalatable taste (heavy and chlorine), which is confirmed by the high values of sodium and calcium carbonate from the reference values shown in the table below, while 20.83% confirmed its discoloration and mixing with dirt.

Table 1.
Standard specifications for drinking water in Khenchela city

Parameters	Unit	Months 2023				Algerian standard Treated water	
		Month 1	Month 4	Month 8	Month 10		
Organoleptic Parameters	Color	mg/l platinum	/	/	/	/	15
	Odor at 25°C	Dilution rate	/	/	/	/	04
	Flavor at 25°C	Dilution rate	/	/	/	/	04
	Free residual chlorine	mg/l	0.1	00	0.2	00	>0,1
Physico-Chemical Parameters	Hydrogen ion concentration	pH unit	8.64	8.24	7.98	8.48	≤ 9 و ≥ 6,5
	Conductivity at 25°C	µS/cm	1828	2470	1137	1175	2800
	Temperature	°C	13.4	17.4	27.3	22.5	25
	Turbidity	NTU	2.26	1.05	0.54	1.41	5
	Dissolved oxygen	Mg/l	/	/	/	/	--
	T D S	Mg/l	/	/	/	/	--
Pollution parameters	Dry residue at 105°C	Mg/l	/	/	39	/	--
	Ammonium (NH4+)	Mg/l	0.051	0.065	0.033	0.034	0.5
	Nitrites (NO2-)	Mg/l	<0.2	<0.2	0.003	<0.001	0.2
	Orthophosphate (HPO4---)	Mg/l	0.046	0.026	0.020	0.028	0.5
Bacteriological Parameters	Ammonium (NH4+)	Mg/l	/	/	/	/	5
	Total coliforms	n/100ml	Absence	Absence	Absence	Absence	10
	Escherichia Coli	n/100ml	Absence	Absence	Absence	Absence	0
	Fecal streptococci	n/100ml	Absence	Absence	Absence	Absence	0
Unwanted Parameters	Sulphite-reducing bacteria	n/20ml	Absence	/	Absence	Absence	0
	Iron	Mg/l	/	0.029	/	/	0.3
	Manganese	Mg/l	/	/	/	/	0.05
	Aluminum	Mg/l	/	/	/	/	0.2

Ionic parameters	Fluorides (F ⁻)	Mg/l	/	/	/	/	1,5
	Cyanides (CN ⁻)	µg/l	/	/	/	/	70
	Bromides (Br ⁻)	Mg/l	/	/	/	/	--
	Hydrogen sulfide (H ₂ S)	Mg/l	/	/	/	/	--
Global Mineralization	Calcium (Ca ⁺⁺)	Mg/l	128	22.4	90	115	200
	Magnesium (Mg ⁺⁺)	Mg/l	51	05	44	37	--
	Total hardness (TH)	Mg/l CaCO ₃	528	76	404	440	500
	Sodium (Na ⁺)	Mg/l	235	/	127	19	200
	Potassium (K ⁺)	Mg/l	/	/	7.6	2.3	12
	Chlorides (Cl ⁻)	Mg/l	313	64	301	181	500
	Sulfates (SO ₄ ²⁻)	Mg/l	92.338	4.803	28.932	13.604	400
	Nitrates (NO ₃ ⁻)	Mg/l	8.075	22.69	7.074	0.052	50
	Bicarbonate (HCO ₃ ⁻)	Mg/l	174	/	77	145	--
Complete Alkalimetric Title (TAC)	Mg/l CaCO ₃	143	/	63	119	--	

Source: Algerian Water Laboratory, Khenchela Unit. 2024

The distribution of drinking water for various purposes in the city of Khenchela is associated with the limited available quantities, which deprives the citizens of Khenchela of daily use even for limited hours, as 50% of the city's population, equivalent to 75,910 individuals, benefit from a distribution rate of 1 day/3 days, while 50% benefit from a distribution rate of 1 day/4 days, which forces the population to use tanks to store water. As for comparing the amount of water available and consumed daily, it is equal, where the amount of water available in Khenchela is estimated at 29,400 m³/day, including (19,000 m³ surface water from the Kadia El Madour Dam and 10,400 m³ underground water from springs and wells), which is the same amount consumed daily without counting the water lost from the networks, which threatens the future water security of the city. The percentage of water lost or lost from the distribution networks is estimated at 35%, equivalent to 10290 m³, which is a significant value. The reason for the loss is due to the age and wear and tear of the distribution network in many neighborhoods of the city, such as Hassnaoui neighborhood, Mostakbal neighborhood, 120 residences, Miskiana Road, and other neighborhoods.

The water reuse rate is estimated at 0%, as the city of Khenchela has one filtering station located at the level of Baghai Road, which filters used water and then discharges it directly into the valley, and currently the station has been inactive since 2019 due to rehabilitation works.

2. Good air quality.

The air quality index in Khenchela is affected by the concentrations of pollutants that vary on a daily basis. According to the Labo Plume, the average value of the air quality index in Khenchela between January 2024 and June 2024 is 31, i.e. in the good category, where the worst value of 151 was recorded on May 17, 2024, while the best value of the index was 16, according to the last update on August 26, 2024

As shown in Figure 2, throughout the year, the city records 329 days when the air quality is good and does not pose a danger to the population, compared to 29 days when the air quality is moderate (acceptable), in two neighborhoods that are unhealthy for sensitive groups of the population during only 7 days of the year, and this is due to the good location of the city at an altitude of more than 1000 meters above sea level at the feet of Mount Namamche, in addition to the richness of the region with forested green areas (780 hectares) that have an important role in improving air quality by reducing the pollutants present in it.

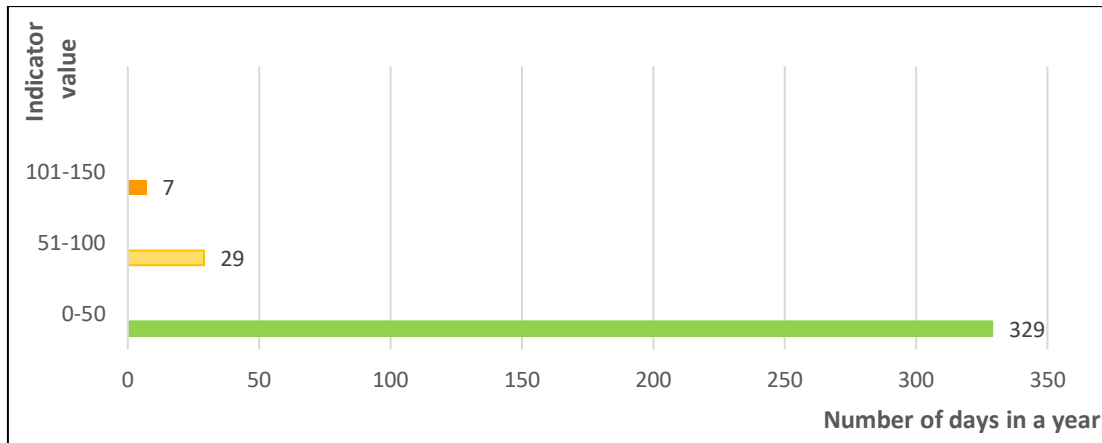


Fig. 2. Numerical distribution of AQI values over the days of the year

Source : Created by the researcher based on the air quality index data of plume laboratory

2.1- Concentration of air pollutants (particulate matter (PM2.5) and nitrogen dioxide (NO₂)) in the city of Khenchela between 2000 and 2019.

From 2000 to 2019, as shown in Figure 3, PM_{2.5} (Pm₂₅) in the air of the city of Khenchela recorded an average annual concentration that exceeds the threshold of the average annual concentration specified in the 2005 WHO global air quality guidelines (10 µg/m³) and at the same time the values of the average annual concentration of the first (15 µg/m³) and second (25 µg/m³) interim targets set by the WHO, as the highest value of the average annual concentration of these substances in the air of the city reached 22.3 µg/m³ in 2002, while the lowest value recorded in 2017 was 14.7 µg/m³.

For the second pollutant, nitrogen dioxide (NO₂) gas recorded in the same time period (2000-2019) values between 17.5 µg/m³ in 2010 and 23.1 µg/m³ as the highest value in 2016. It is noteworthy that its concentrations in the same period are above the threshold set by the Health Organization for air quality (10 µg/m³) and below the first time target of 40 µg/m³.

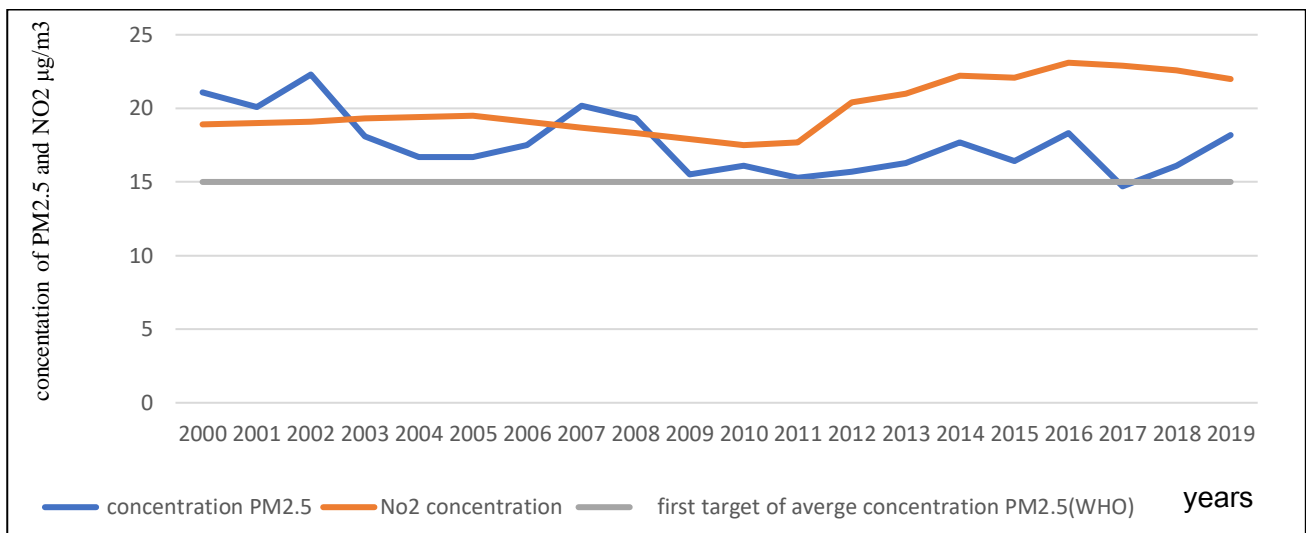


Fig. 3. Evolution of air quality according to the concentration of fine particulate matter (PM_{2.5}) and nitrogen dioxide (NO₂) in the city of Khenchela between 2000-2019

Source : <https://www.stateofglobalair.org/data/#/air>

2.2- The health effects of air pollution.

According to the Global Burden of Disease Project database (2019) « Air pollution is one of the biggest threats to human health in terms of its impact on life expectancy », as it causes many diseases that sometimes lead to death, including heart disease, pulmonary embolism, respiratory infections, and... etc. « The Air Quality

for Life Index (AQLI) shows that the impact of particulate matter with a diameter of less than $10 \mu\text{g}/\text{m}^3$ (PM2.5) on global life expectancy is comparable to that of smoking, more than 3 times that of alcohol use and unsafe water, more than 5 times that of transport injuries like car crashes, and more than 7 times that of HIV/AIDS » (Annual report for (AQLI),2023)

According to the Global Burden of Disease Study 2019 estimates, « PM2.5 air pollution in Khenchela caused varying average annual premature mortality rates, with the lowest rate of 23.4 individuals in 2009 and the highest rate of 34.2 individuals in 2002 », between 2000 and 2019.

3- Significant green spaces.

The city of Khenchela has an estimated total area of 784.84 hectares, equivalent to 24.52% of the area of Khenchela municipality, which is estimated at 3200 hectares. They are diverse in the forefront:

- The forests on the western and northwestern side of the city, consisting of the Foug Dfist forest, the Chabour forest and the Ras Sardoun forest, in addition to the forest of the Islamic cemetery north of the city and the Qallal forest on the eastern side along National Road No. (88).

A section of the Foug Davest forest was prepared and converted into a recreational forest located at the level of the Moussa Radah neighborhood at the northwestern entrance to the city opposite the urban barn and is called Dream Park with an area estimated at 8.58 hectares, which is functional, while the second recreational forest belongs to the Chabour forest near the headquarters of the Forestry Governorate, called the November Revolution Park with an area estimated at 2.21 hectares, but it has been out of service since 2020.

- An urban barn (45 hectares) northwest of the city along National Road No. (88), of which 37 hectares, 88 acres and 30 centimeters belong to the municipality of Khenchela, while the rest of the area estimated at 7 hectares, 11 acres and 70 centimeters belong to the municipality of El Hama.

- Three (03) public parks: Hassanawi neighborhood park with an area of 2300 m², February 18 park on Batna road with an area of 2241 m², and 20 August park next to the Palestine approach with an area of 4074 m².

- Three (03) public squares: Abbas Leghour Square in the city center with an area of 10700 m², Martyrs Square in front of the former municipal headquarters with an area of 788.30 m², and the new municipal square in Tarbak Babar with an area of 5600 m²

- Three (03) specialized parks with an area of 15900 m²

- Twelve (12) tree rows with a total length of 15.6 km.

Table 2.

Urban survey of green spaces in Khenchela city

Green spaces	Urban Park adjacent to the city	Forests	specialized gardens	Public gardens and squares	Classification of treed rows located in urbanized areas	The Total
Number	01	05	03	06	12	25
Area m ²	378830	7424470	15900	29203.3	15.6 linear Km	7848403.3

Source: Khenchela State Environment Directorate , Khenchela Forest Governorate , field investigation 2024

The total area of green spaces in the city of Khenchela is estimated at 784.84 hectares, equivalent to 24.52% of the municipal area, distributed as shown in Table 02, where there are 5 urban forests estimated at 742.44 hectares or 94.59% of the total green spaces, one urban barn located at the northwest entrance (Patna Road) with an area of 37.8830 hectares or 4.82% of the total green spaces. 8830 hectares or 4.82% of the total green spaces, followed by three (03) public parks and three (03) public squares with an area of 2.92 hectares or 0.37%, while the lowest percentage of specialized parks is 0.2% or 0.159 hectares. In addition to the presence of tree rows with a length of 15.6 km.

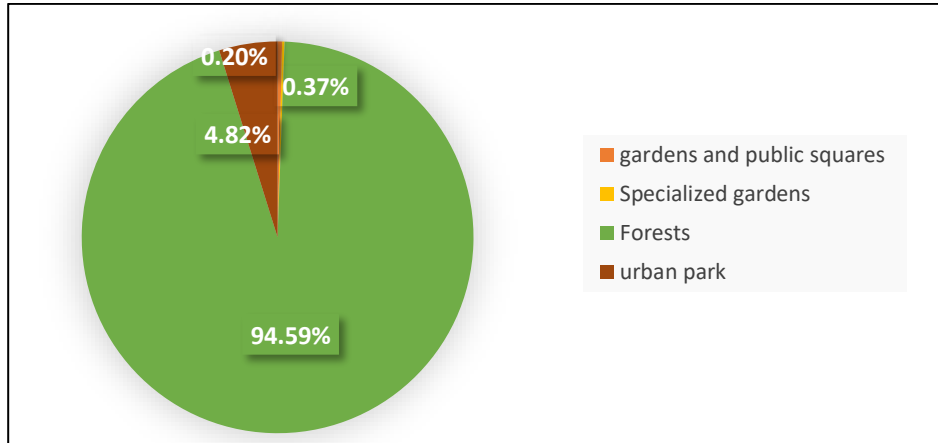


Fig. 4. Percentage distribution of green spaces in Khenchela city
Source: Compiled by the researcher based on the data in Table No. 2

4- Poor waste management:

In Khenchela, there are two types of waste: household solid waste and special waste.

4.1- Household solid waste:

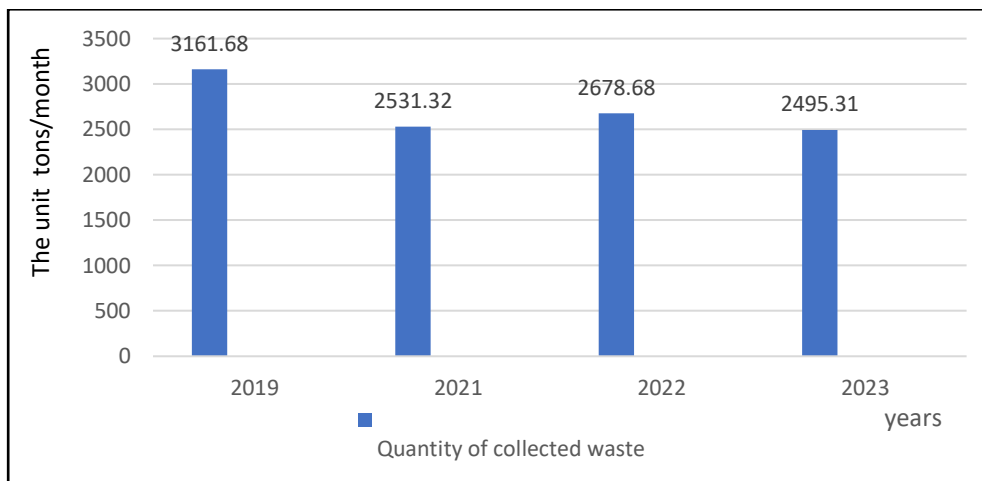


Fig. 5. Average monthly amount of solid waste in Khenchela city

Source: Researcher's treatment based on data from the Environment Directorate of Khenchela State, 2024

The amount of domestic solid waste produced in the city of Khenchela in the last four years varies from year to year, as shown in Figure (5). 2019 recorded the highest amount of 3161.68 tons/month, while 2023 recorded the lowest amount of 2495.31 tons/month.

Table 3 shows the amount of domestic solid waste for the municipality of Khenchela for the year 2023, estimated at 29943.73 tons with an average monthly rate of 2495.31 tons/month and with an average daily rate estimated at 82. Therefore, the amount of waste produced per day by the Khanshali citizen is estimated at 0.54 kg/capita/day, which is greater than the waste rate in poor countries of the world declared by the World Health Organization, estimated at 0.4 kg/capita/day

The amount of waste produced per day by citizens in the city of Khenchela varies from one sector to another, which is estimated at 31 sectors, 23 of which are supervised by the municipality and the rest are supervised by private companies.

The waste collection process takes place daily, in the morning for some sectors and in the evening for others, where each sector is assigned a special truck, a main driver, a substitute driver and assistant workers, then transported to the inter-municipal technical landfill center located in the municipality of Baghai, where it

is disposed of by landfill. The recycling process is limited to cardboard, PET and PEHD plastics, and iron, which is sold to factories.

Table 3.
Average amount of solid waste in the municipality of Khenchela for the year 2023

Months	Quantities	
	tons/month	tons/day
January	2553.62	82.37
February	1956.33	69.86
March	2536.84	81.83
April	2594	86.46
Water	1700.52	54.85
Joan	2889.44	96.31
July	2921.51	94.24
Out	2404.07	77.55
September	2535.42	84.51
October	2473.56	79.79
November	2724.15	90.80
December	2654.27	85.62
the total	29943.73	82.03

Source: Directorate of Management of Technical Backfilling Centers, Khenchela, 2024

4.2- Special Waste and Special Hazardous Waste.

According to Article 3 of Law 01-19 of 12/12/2001 on the management, control and elimination of waste, special waste consists of « all wastes resulting from industrial, agricultural, therapeutic, service and all other activities that, due to their nature and the composition of the materials they contain, cannot be collected with household waste ». As for special hazardous waste, it is « special waste that contains toxic substances and affects public health and the environment. » According to the Environment Directorate of Khenchela State, special and special hazardous waste is characterized by:

- (Polychlorinated biphenyls (PCB) based oil) which is estimated at 13,283 tons/year.
- Industrial waste : The Liquefied Petroleum Gas (GPL) storage center for Naftal, which stated that the amount of storage of nickel, cadmium, mercury and lead compounds varies from year to year and is estimated at 0.1 tons for 2016, 0.02 tons for 2021 and 0.03 tons for 2022 and is disposed of by a certified organization specialized in treating this type of waste.
- Waste from therapeutic activities : According to Article 3 of Law 01-19 of December 12, 2001 on the management, control and elimination of waste "Waste resulting from examination, follow-up and preventive or therapeutic treatment activities in the field of human or veterinary medicine." The amount of waste for therapeutic activities is estimated at 496.54 tons/year, which is disposed of by thermal treatment by incineration at the technical landfill center in Baghai.
- Rotten fertilizers and phytosanitary materials : This type of waste is not treated due to the lack of a special section at the Baghai Technical Landfill Center.

Discussion.

The results of the diagnosis of the existing situation of the environmental dimension of quality of life in the city of Khenchela showed that the level of quality varies among the variables of this dimension as follows:

- Water : The city of Khenchela suffers from a shortage of drinking water due to the limited water sources, which do not exceed 29,400 m³ per day on the one hand and the loss of daily quantities up to 35% on the other hand due to the deterioration of old distribution networks, which led to intermittent distribution of drinking water where 50% of the population benefits from 1 day / 3 days and the remaining 50% from 1 day / 4 days. In addition, residents are reluctant to use tap water for drinking and resort to other sources due to poor specifications affecting the senses (smell, color and taste).

- Air : The city of Khenchela is characterized by good air quality, as confirmed by the good values of the air quality index, which does not exceed the value of 50 during 329 days a year, compared to only 7 days when it is bad, due to the city's availability of significant forest areas that contribute to air filtration. However, it still suffers from nitrogen dioxide and fine particulate matter (PM_{2.5}) pollution caused by gasoline and diesel vehicles and sandy winds that come from the Algerian desert, especially since Khenchela is located in areas prone to desertification, which causes health issues that affect the population.

- Green spaces : The city of Khenchela has significant green spaces, mostly forests located in the western part of the city, which exceeds 24% of the total area. These areas contribute to improving air quality on the one hand and providing recreational areas for the population by developing parts of them and turning them into recreational forests, such as the Chabour Forest and the Foug El Dafist Forest

- Waste management : The city of Khenchela suffers from poor waste management due to the lack of environmental awareness about the importance of the selective sorting process, which greatly affects recycling, which is limited to the recovery of plastics and iron in small quantities, as well as the complete absence of waste treatment of fertilizers and phytosanitary materials due to the lack of a special section at the Darm Technical Center in the municipality of Baghai.

Conclusions.

This study, based on international and field data on the environmental dimension of the quality of life, allowed for the analysis of the current state of the environmental dimension of the quality of life in Khenchela, which is defined by four variables. The first is water, which the city is experiencing a shortage of sources and issues in its distribution network, which has affected its availability and the quality of its sensory qualities. The second variable is air, which was studied through the city's air quality index, which was found to be good on most days of the year, while the annual concentration of air pollutants (fine particulate matter and nitrogen dioxide) exceeded the threshold set by the World Health Organization and resulted in an early mortality rate that reached a maximum of 34 individuals in 2002. The city's green spaces occupy a significant area and contribute to improving air quality, in addition to their use as recreational areas for the city's residents, while waste management is ineffective due to the absence of selective sorting and the adoption of the landfill method, which will have negative effects on the environment in the municipality of Baghai.

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