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Monitoring and Analyzing of the Relationship between Climatic Elements and Skin Cancer in the Years 2012-2014

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ABSTRACT

Introduction: The present study investigated one of these types of disease (skin cancer) and its relationship with climatic parameters. The aim of this study was to investigate the relationship between climate change and skin cancer in Ardabil province.

Materials and Methods: This descriptive correlational study was conducted to investigate the effect of six climatic parameters (frost, sunny hours, minimum mean humidity, maximum absolute temperature, minimum absolute temperature, and mean temperature) on skin cancer in Ardabil province in a 3-year statistical period (2012-2014). The data were analyzed using the Spearman correlation relationship in SPSS version 24 software, also Minitab version 16 software was used for linear interpolation.

Results: According to the findings, the highest correlation (more than 95%) of skin cancer in three cities of Parsabad, Khalkhal, and Ardabil with the climatic parameter was related to minimum absolute temperature. However, in Khalkhal station in three years of study, sunny hours had the highest correlation and the lowest correlation was related to glacial climate parameter in all four cities. It can be said that the factors of sunny hours and maximum temperature have an effect on the incidence of skin cancer, and the minimum absolute temperature increases the exacerbation of this type of disease.

Conclusion: According to the results of statistical correlation and the effects of climatic parameters on skin cancer, it can be concluded that climate parameters are one of the effective factors in skin cancer.

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Introduction

One of the most important diseases that affect human skin is skin cancer. This cancer is among the most common cancers worldwide [1,2]. The main cause of skin cancer is constant exposure to sunlight and the maximum length of time a person is exposed to sunlight [3,4]. The most common malignancy worldwide is skin cancer, which is associated with high disability and relatively low mortality. The origin of skin tumors can be basal layer cells, squamous cells, melanocyte cells, immune cells, skin appendages, connective tissue, vascular or metastatic tissue. Cancer ranks first among men and second among women [5-7]. The incidence of skin cancer is higher in white and older men. Although many genetic factors have been implicated in the development of skin cancer, the most important factor in skin cancer is sunlight and skin type. Skin cancer is a major public health problem [8-10]. Skin cancer is one of the most common cancers, especially in sunny areas, and this area is also one of the sunny areas

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and skin cancer is common in this area. The most common skin cancer in men is the high prevalence in people over 50 years of age. Skin cancer is one of the most common types of cancer that about one third of new cases can be prevented and also one third of cases can be treated due to early detection and appropriate capabilities [11-13]. Researchers have studied the incidence and geographical distribution of skin cancer in Kurdistan Province of Iran. The results showed that men's lifestyle and their occupational exposure to the sun can be an important risk factor in the growth of skin cancer in Kurdistan Province. The expected correlation between skin cancer incidence in cities and the geographical distribution of the global index of solar UV radiation was not observed. More complete research is needed in this field [14-16]. Researchers have studied the incidence of skin cancer in Isfahan province. The results showed that the incidence of skin cancer in Isfahan province was not significant. However, given the increase in incidence and also the double incidence of this cancer in men compared to women, it is required to educate people to use protective equipment and do more research on the risk factors for the disease[17-19]. Researchers have investigated the most important factors affecting non-melanoma skin cancer using data mining algorithms. The results of this study for the first time identified the most important factors affecting Non-Melanoma Skin Cancer (NMSC) using data mining. These factors should be considered in self-examinations or skin screening tests in high-risk groups. Also, in future studies, the participation of physiological, ecological, and genetic factors in the development of skin cancer should be explored [20-22]. Researchers have studied the techniques and steps of diagnosing skin cancer with the help of a computer. The results indicated that the automatic detection system works on two corresponding steps, including first, the diagnosis of skin abnormalities, and second, the diagnosis of melanoma of benign or malignant. This article presents the steps and methods of diagnosing skin cancer. It starts by useful information of techniques and early stages of skin cancer diagnosis for researchers at the beginning stage [23-25]. Researchers have studied the pattern of skin cancer in Dammam Medical Complex, Saudi Arabia. The results show a lack of malignant skin tumors in skin treatment in Dammam. However, basal cell carcinoma (BCC) and squamous cell carcinoma (SCC) should be considered in dermatological surgery. The most common skin cancers seen are BCC, SCC, Medical fetal scalp blood (MFSB), and Myelofibrosis (MF). The BCC and SCC distribution site in the present study is similar to studies conducted in different parts of Saudi Arabia and other countries [26-28]. Given the limited resources available to meet health care needs, careful planning for the use of this method and the subject of research seems necessary. In the current study aimed to monitor and analyze the relationship between climatic elements and skin cancer in Ardabil province using the correlation relationship to show the spatial distribution of skin cancer.

Materials and Methods

Ardabil province, with an area of about 17867 km^2, covers about 1.1 percent of the total area of the country, and longitudinally (north-south), with geographical coordinates of 47°19′ to 48°55′ east longitude and 37°11′ to 39°42′ north latitude of the equator, is located northwest of the Iranian plateau (east and north of the Azerbaijani plateau). Ardabil province, in its northern part, has about 282.5 km of border with the Republic of Azerbaijan, of which approximately 159 km, Aras river flows. The cities of Aslandooz and Bilesvar are the only roads connecting this province to the mentioned republic [29,30,31]. From the east, Ardabil province has a border with Gilan province (through Talesh and Astara counties) in a 175 km long route. The existence of the difficult mountain ranges of Talesh and Baghro, like a stone wall, has separated these two provinces. In the southern region, Ardabil province is bordered by Zanjan province through Khalkhal city, in a route with an approximate length of 62.5 km

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[32,33,34]. Finally, from the west, it shares a border with East Azerbaijan Province of about 324 km. Figure 1 reveals the location of the study area in Iran and Table 1 shows the coordinates of the studied stations in Ardabil province.

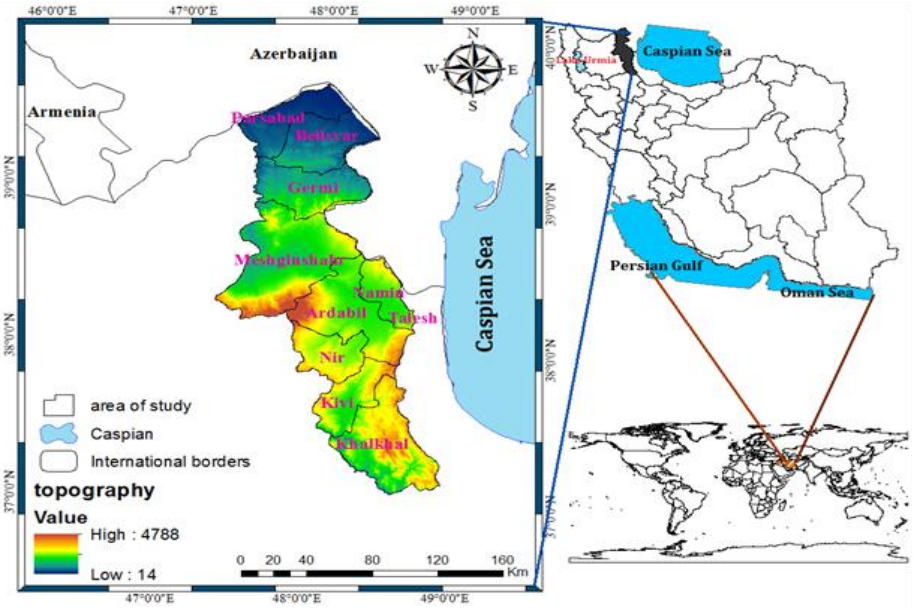

Figure 1: Geographical location of the region and stations studied in the country

Table 1: Details of the studied stations in Ardabil province

Station	Longitude	Latitude	Height (m)
Parsabad	47° 50 ′	39° 40 ′	67.2
Ardabil	48° 20 ′	38° 20 ′	1332
Meshginshahr	47° 70 ′	38° 40 ′	1568.5
Khalkhal	48° 30 ′	37° 40 ′	1796

According to the general purpose of the research, which is to monitor and analyze the relationship between climatic elements and skin cancer in Ardabil province using correlation, in this section about the research methodology including: research method, population and statistical sample, tools and methods data collection, variables and statistical methods of research will be discussed [35,36,37]. In this applied, descriptive, and correlational studythe relationship between variables was analyzed based on the purpose of the research. In this regard, the effect of six climatic parameters (frost, sunny hours, minimum mean humidity, maximum absolute temperature, minimum absolute temperature, and mean temperature) on skin cancer in Ardabil province in the years 2012 - 2014 was studied [38,39]. Therefore, in order to investigate the effect of climatic parameters on skin cancer in Ardabil province, first monthly and annual skin cancer statistics and information for a 3-year statistical period for each city were taken according to meteorological data of four cities, including Ardabil, Parsabad , Khalkhal, and Meshginshahr. Then, SPSS version 24 software and run test and the correlation between climatic variables and skin cancer statistics were used to ensure the data and their homogenization. Excel software was also used to prepare charts and tables, and Minitab software was used for linear interpolation of climate parameters with skin cancer data. Monthly and annual statistics were analyzed.

The software used in the present study according to the needs included:

Excel 2010 software to perform other required calculations,

SPSS software version 24, in the test of

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homogeneity and accuracy of data,

ArcGIS software to map the study area,

Minitab version 16 software for linear interpolation mapping.

Results

Monitoring and analyzing of the relationship between climatic elements and skin cancer in Ardabil station

Investigation of the relationship between climatic parameters and skin cancer in Ardabil in 2012:

According to the correlation results, the relationship between skin cancer and temperature had a mean correlation of 79%, which is directly incomplete and the correlation intensity was very strong at 99% confidence level, and its error was 0.02. The correlation between skin cancer and the absolute minimum temperature was 90%, which was directly incomplete. This correlation was very strong at 99% confidence level and the error was zero. The correlation between skin cancer and the maximum absolute temperature was 76% which was straight incomplete and very strong at 99% confidence level and the error was 0.04. The correlation between skin cancer and the minimum mean moisture was -65% which was inverse incomplete and its severity was very strong at 95% confidence level and the error was 0.22. The correlation between skin cancer and frost was -79% which was inverse incomplete. The correlation intensity was very strong at the confidence level 99% and the error was 0.02. The relationship between skin cancer and sunshine was 84% which was straight incomplete and its intensity was very strong at 99% confidence level and the error was zero.

Investigation of the relationship between climatic parameters and skin cancer in Ardabil in 2013:

According to the correlation results using the Spearman method, the mean correlation between skin cancer and temperature was 70% which was directly incomplete and the correlation intensity was very strong at the 95% confidence level and error rate was 0.11. The correlation between skin cancer and the minimum mean temperature was 72% which was direct incomplete and the correlation intensity was very strong at 99% confidence level and the error rate was 0.07. The correlation between skin cancer and the absolute maximum temperature was 77% and direct incomplete and its intensity was very strong at the 99% confidence level and the error percentage was 0.03. The correlation between skin cancer and the mean absolute humidity was at least -20%, which was inversely incomplete and the correlation intensity was relatively moderate at the 0.47% confidence level and the error rate was 0.53% and the relationship between skin cancer and frost was -0.69 which was inversely incomplete and very strong at the 95% confidence level and the error rate was 0.13. The correlation between skin cancer and the amount of sunshine was 66% which was directly incomplete and very strong at the 95% confidence level and the error rate was 0.18.

The study of the relationship between climatic parameters and skin cancer in Ardabil in 2014:

According to Table 2, the correlation between skin cancer and temperature was 78%, which was directly incomplete and the correlation intensity was very strong at the confidence level of 99% and the error rate was 0.02. The correlation between skin cancer and the minimum absolute temperature was 74% which was directly incomplete and the intensity of the correlation was very strong at the confidence level of 99% and the error rate was 0.05. The correlation between skin cancer and the maximum absolute temperature was 82% which was directly incomplete. The correlation intensity was very strong at the 99% confidence level and the error rate was 0.01. The correlation between skin cancer and the mean moisture rate was at least -18% and the type of correlation was inversely incomplete. The correlation intensity was weak at the confidence level of 0.43 and the error rate was 0.57. The correlation between skin cancer and frost was -80% which was inversely incomplete and the correlation intensity was very strong at 99% confidence level and the error rate was 0.02. The correlation between skin cancer and sunny hours was 56% which was directly incomplete and the correlation intensity was strong at the 44% confidence level of and the error rate was 0.54 (Figure 2).

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Table 2: Correlation of climatic variables and skin cancer in Ardabil in 2014

			Skin cancer	Medium temperature	Absolute minimum temperature	Absolute maximum temperature	Mean minimum humidity	Glacial	Sunny hours
Spearman's Rho	Skin cancer	Correlation Coefficient	1.000	.786**	.746**	.822**	-.183	-.802**	.568
		Sig.(2-tailed)	.	.002	.005	.001	.570	.002	.054
		N	12	12	12	12	12	12	12
	Medium temperature	Correlation Coefficient	.786**	1.000	.946**	.986**	-.491	-.941**	.804**
		Sig.(2-tailed)	.002	.	.000	.000	.105	.000	.002
		N	12	12	12	12	12	12	12
	Absolute minimum temperature	Correlation Coefficient	.746**	.946**	1.000	.914**	-.448	-912**	.834**
		Sig.(2-tailed)	.005	.000	.	.000	.144	.000	.001
		N	12	12	12	12	12	12	12
	Absolute maximum temperature	Correlation Coefficient	.822**	.986**	.914**	1.000	-.495	-.934**	.776**
		Sig.(2-tailed)	.001	.000	.000	.	.102	.000	.003
		N	12	12	12	12	12	12	12
	Mean minimum humidity	Correlation Coefficient	-.183	-.491	-.448	-.495	1.000	.396	-.730**
		Sig.(2-tailed)	.570	.105	.144	.102	.	.203	.007
		N	12	12	12	12	12	12	12
	Glacial	Correlation Coefficient	-.802**	-.941**	-.912**	-.934**	.396	1.000	-.730**
		Sig.(2-tailed)	.002	.000	.000	.000	.203	.	.007
		N	12	12	12	12	12	12	12
	Sunny hours	Correlation Coefficient	.568	.804**	.934**	.776**	-.730**	-.730**	1.000
		Sig.(2-tailed)	.054	.002	.001	.003	.007	.007	.
		N	12	12	12	12	12	12	12

**Correlation is significant at the 0.01 Level (2-tailed).
*Correlation is significant at the 0.05 Level (2-tailed).

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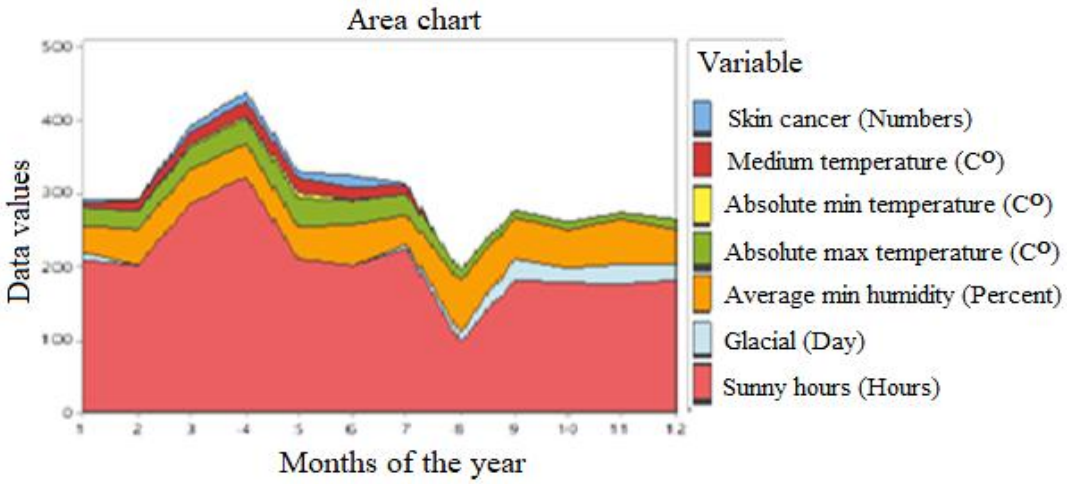

Figure 2: Area diagram of climatic variables and skin cancer in Ardabil in 2014

Monitoring and analyzing the relationship between climatic elements and skin cancer in Parsabad station

Investigating the relationships between climatic parameters and skin cancer in Parsabad in 2012:

According to the correlation results, using the Spearman method, the correlation between skin cancer and mean temperature was 86%, which was directly incomplete, and the correlation intensity was very strong at the confidence level of 99% and the error rate was zero. The correlation between skin cancer and absolute minimum temperature was 88%, which was directly incomplete and the correlation intensity was very strong at the confidence level of 99% and the error rate was zero. The correlation between skin cancer and maximum absolute temperature was 77%, which was directly incomplete and the correlation intensity was very strong at the confidence level of 99% and the error rate was 0.03. The correlation between skin cancer and mean moisture was -76%, which was inversely incomplete and the correlation intensity was very strong at the confidence level of 99% and the error rate was 0.04. The correlation between skin cancer and frost was -71%, which was inversely incomplete and the correlation intensity was very strong at the confidence level of 99% and the error rate was 0.09. The correlation between skin cancer and sunny hours was 80%, which was indirectly incomplete and the correlation intensity was very strong at the confidence level of 99% and the error rate was 0.02.

Investigation of the relationships between climatic parameters and skin cancer in Parsabad in 2013:

According to the correlation results, using the Spearman method, the correlation between skin cancer and mean temperature was 88%, which was an incomplete direct correlation and the correlation intensity was very strong at 99% confidence level and the error rate was zero. The correlation between skin cancer and absolute minimum temperature was 87% which was an incomplete direct correlation and the correlation intensity was very strong at 99% confidence level and the error rate was zero. The correlation between skin cancer and maximum absolute temperature was 83% which was an incomplete direct correlation and the intensity of the correlation was very strong at 99% confidence level and the error rate was 0.01. The correlation between skin cancer and mean absolute humidity was -41% which was an incomplete direct correlation and the intensity of the correlation was very strong at 83% confidence level and the error rate was 0.17. The correlation between skin cancer and frost was -72% which was an incomplete inverse correlation and the intensity of the correlation was very strong at 99% confidence level and the error rate was 0.08. The correlation

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between skin cancer and sunny hours was 68%, which was an incomplete direct correlation and the intensity of the correlation was very strong at 95% confidence level and the error rate was 0.15.

Investigating the relationships between climatic parameters and skin cancer in Parsabad in 2014:

According to Table 3, using the Spearman method, the correlation between skin cancer and mean temperature was 88%, which was an incomplete direct correlation and the correlation intensity was very strong at 99% confidence level and the error rate was zero. The correlation between skin cancer and minimum absolute temperature was 90%, which was an incomplete direct correlation and the correlation intensity was very strong at 99% confidence level and the error rate was zero. The correlation between skin cancer and maximum absolute temperature was 85%, which is an incomplete direct correlation and the correlation intensity was very strong at 99% confidence level and the error rate was zero. The correlation between skin cancer and mean absolute humidity was -57%, which was an incomplete inverse correlation and the correlation intensity was very strong at 0.50% confidence level and the error rate was 0.50. The correlation between skin cancer and frost was -88%, which was an incomplete inverse correlation and the correlation intensity was very strong at 99% confidence level and the error rate was zero. The correlation between skin cancer and sunny hours was 81%, which was an incomplete direct correlation and the correlation intensity is very strong at 99% confidence level and the error rate was 0.01 (Figure 3).

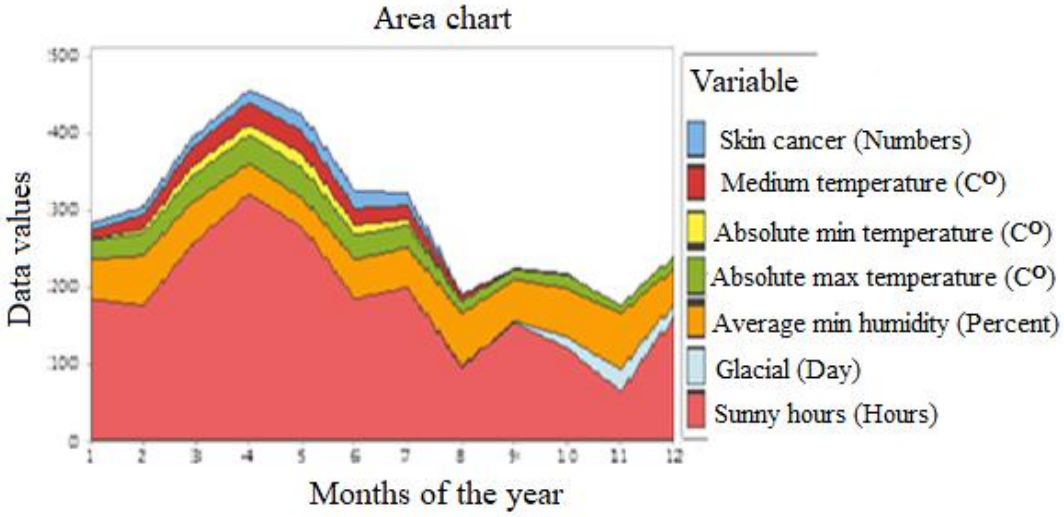

Figure 3: Area diagram of climatic variables and skin cancer in Parsabad in 2014

Table 3: Correlation of climatic variables and skin cancer in Parsabad city in 2014

			Skin cancer	Medium temperature	Absolute minimum temperature	Absolute maximum temperature	Mean minimum humidity	Glacial	Sunny hours
Spearman's Rho	Skin cancer	Correlation Coefficient	1.000	.889**	.908**	.859**	-.576	-.889**	.810**
		Sig.(2-tailed)	.	.000	.000	.000	.050	.000	.001
		N	12	12	12	12	12	12	12
	Medium temperature	Correlation Coefficient	.889**	1.000	.988**	.977**	-.622*	-.849**	.904**
		Sig.(2-tailed)	.000	.	.000	.000	.031	.000	.000
		N	12	12	12	12	12	12	12
	Absolute minimum temperature	Correlation Coefficient	.902**	.988**	1.000	.951**	-.568	-867**	.888**
		Sig.(2-tailed)	.000	.000	.	.000	.054	.000	.000
		N	12	12	12	12	12	12	12
	Absolute maximum temperature	Correlation Coefficient	.859**	.977**	.951**	1.000	-.712**	-.824**	.937**
		Sig.(2-tailed)	.000	.000	.000	.	.009	.001	.000
		N	12	12	12	12	12	12	12
	Mean minimum humidity	Correlation Coefficient	-.576	-.622*	-.568	-.712**	1.000	.502	-.768**
		Sig.(2-tailed)	.050	.031	.054	.009	.	.096	.004
		N	12	12	12	12	12	12	12
	Glacial	Correlation Coefficient	-.889**	-.849**	-.867**	-.824**	.502	1.000	-.852**
		Sig.(2-tailed)	.000	.000	.000	.001	.096	.	.000
		N	12	12	12	12	12	12	12
	Sunny hours	Correlation Coefficient	.810**	.904**	.888**	.937**	-.768**	-.852**	1.000
		Sig.(2-tailed)	.001	.000	.000	.000	.004	.000	.
		N	12	12	12	12	12	12	12

**Correlation is significant at the 0.01 Level (2-tailed).
*Correlation is significant at the 0.05 Level (2-tailed).

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Monitoring and Analyzing of the relationship between climatic elements and skin cancer in Meshginshahr station

Investigating the relationships between climatic parameters and skin cancer in Meshginshahr in 2012:

According to the correlation results, the correlation between skin cancer and mean temperature was 93% which was an incomplete direct correlation. The correlation intensity was very strong at 99% confidence level and the error rate was zero. The correlation between skin cancer and minimum absolute temperature was 80%, which was an incomplete direct correlation. The correlation intensity was very strong at 99% confidence level and the error rate was 0.02. The correlation between skin cancer and maximum absolute temperature was 92%, which was direct incomplete. The correlation intensity was very strong at 99% confidence level and the error rate was 0.02. The correlation between skin cancer and mean absolute humidity was -72%, which was inverse incomplete. The correlation intensity was very strong at 99% confidence level and the error rate was 0.07. The correlation between skin cancer and frost was -91% which was inverse incomplete. The correlation intensity was very strong at 99% confidence level and the error rate was zero. The correlation between skin cancer and sunny hours was 83% which was direct incomplete. The correlation intensity was very strong at 99% confidence level and the error rate was 0.01.

Investigating the relationships between climatic parameters and skin cancer in Meshginshahr in 2013:

According to the correlation results, using the Spearman method, the correlation between skin cancer and mean temperature was 80% which was direct incomplete. The correlation intensity was very strong at 99% confidence level and the error rate was 0.02. The correlation between skin cancer and absolute minimum temperature was 83%, which was direct incomplete. The correlation intensity was very strong at 99% confidence level and the error rate was 0.01. The correlation between skin cancer and mean temperature was 80%, which was direct incomplete. The correlation intensity was very strong at 99% confidence level and the error rate was 0.02. The correlation between skin cancer and minimum mean temperature was -21%, which was inversely incomplete. The mean correlation intensity was at 0.50% confidence level and the error rate was 0.50. The mean correlation between skin cancer and frost was -83%, which was inversely incomplete. The correlation intensity was very strong at 99% confidence level and the error rate was 0.01. The correlation between skin cancer and sunny hours was 63%, which was direct incomplete. The correlation intensity was very strong at 95% confidence level and the error rate was is 0.27.

Investigation of the relationship between climatic parameters and skin cancer in Meshginshahr in 2014:

According to Table 4, the correlation between skin cancer and mean temperature was 82%, which was direct incomplete. The correlation intensity was very strong at 99% confidence level and the error rate was 0.01. The correlation between skin cancer and minimum absolute temperature was 85%, which was direct incomplete. The correlation intensity was very strong at 99% confidence level and the error rate was zero. The correlation between skin cancer and maximum absolute temperature was 82%, which was direct incomplete. The correlation intensity was very strong at 99% confidence level and the error rate was 0.01. The correlation between skin cancer and minimum mean humidity was 21%, which was direct incomplete. The correlation intensity was pretty mean at 0.06% confidence level and the error rate was 0.94. The correlation between skin cancer and frost was -91%, which was inverse incomplete. The correlation intensity was very strong at 99% confidence level and the error rate was zero. The correlation between skin cancer and sunny hours was 72%, which was direct incomplete. The correlation intensity was very strong at 99% confidence level and the error rate was 0.07 (Figure 4).

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Table 4: Correlation of climatic variables and skin cancer in Meshginshahr in 2014

			Skin cancer	Medium temperature	Absolute minimum temperature	Absolute maximum temperature	Mean minimum humidity	Glacial	Sunny hours
Spearman's Rho	Skin cancer	Correlation Coefficient	1.000	.825**	.853**	.740**	.021	-.919**	.729**
		Sig.(2-tailed)	.	.001	.000	.006	.947	.000	.007
		N	12	12	12	12	12	12	12
	Medium temperature	Correlation Coefficient	.825**	1.000	.965**	.930**	-.278	-.952**	.860**
		Sig.(2-tailed)	.001	.	.000	.000	.382	.000	.000
		N	12	12	12	12	12	12	12
	Absolute minimum temperature	Correlation Coefficient	.853**	.965**	1.000	.874**	-.197	-934**	.825**
		Sig.(2-tailed)	.000	.000	.	.000	.540	.000	.001
		N	12	12	12	12	12	12	12
	Absolute maximum temperature	Correlation Coefficient	.740**	.930**	.874**	1.000	-.460	-.886**	.839**
		Sig.(2-tailed)	.006	.000	.000	.	.132	.000	.001
		N	12	12	12	12	12	12	12
	Mean minimum humidity	Correlation Coefficient	.021	-.278*	-.197	-.460	1.000	.153	-.436
		Sig.(2-tailed)	.947	.382	.540	.132	.	.634	.157
		N	12	12	12	12	12	12	12
	Glacial	Correlation Coefficient	-.919**	-.952**	-.934**	-.886**	.153	1.000	-.825**
		Sig.(2-tailed)	.000	.000	.000	.000	.634	.	.001
		N	12	12	12	12	12	12	12
	Sunny hours	Correlation Coefficient	.729**	.860**	.825**	.839**	-.436	-.825**	1.000
		Sig.(2-tailed)	.007	.000	.001	.001	.157	.001	.
		N	12	12	12	12	12	12	12

**Correlation is significant at the 0.01 Level (2-tailed).
*Correlation is significant at the 0.05 Level (2-tailed).

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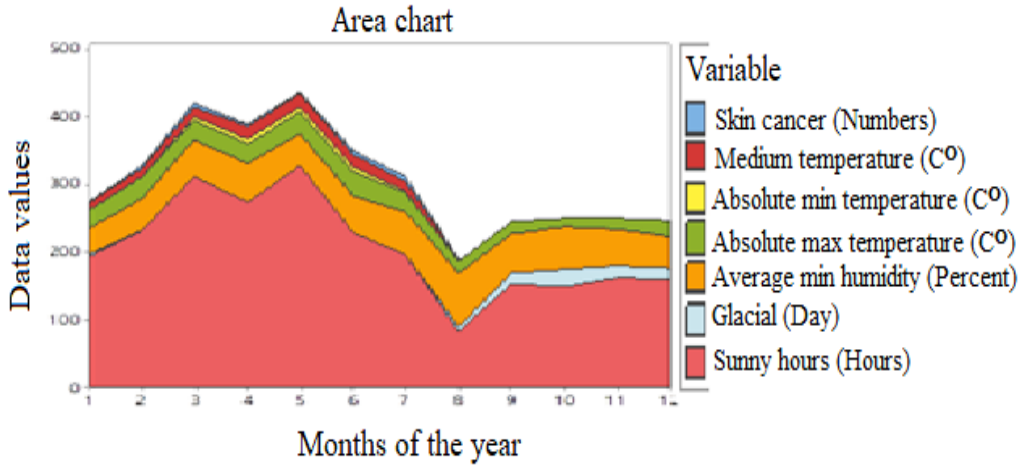

Figure 4: Area diagram of climatic variables and skin cancer in Meshginshahr in 2014

Monitoring and Analyzing of the relationship between climatic elements and skin cancer in Khalkhal station

Investigation of the relationship between climatic parameters and skin cancer in Khalkhal in 2012:

According to the correlation results, using the Spearman method, the correlation between skin cancer and mean temperature was 81% which was an incomplete direct correlation. The correlation intensity was very high at 99% confidence level and the error rate was 0.01. The correlation between skin cancer and absolute minimum temperature was 77% which was an incomplete direct correlation. The correlation intensity was very high at 99% confidence level and the error rate was 0.03. The correlation between skin cancer and absolute maximum temperature was 78% which was direct incomplete correlation. The correlation intensity was very high at 99% confidence level and the error rate was 0.03. The correlation between skin cancer and mean absolute humidity was -60% which was inverse incomplete. The correlation intensity was very high at 95% confidence level and the error rate was 0.37. The correlation between skin cancer and frost was -72%, which was inverse incomplete correlation. The correlation intensity was very high at 99% confidence level and the error rate was 0.08. The correlation between skin cancer and sunny hours was 93% which was an incomplete direct correlation. The correlation intensity was very high at 99% confidence level and the error rate was zero.

Investigation of the relationship between climatic parameters and skin cancer in Khalkhal in 2013:

According to the correlation results, the correlation between skin cancer and mean temperature was 72%, which was direct incomplete. The correlation intensity was very strong at 99% confidence level and the error rate was 0.08. The correlation between skin cancer and absolute minimum temperature was 69%, which was direct incomplete. The correlation intensity was very strong at 95% confidence level and the error rate was 0.13. The correlation between skin cancer and absolute maximum temperature was 65%, which was direct incomplete. The correlation intensity was very strong at 99% confidence level and the error rate was 0.21. The correlation between skin cancer and absolute minimum humidity was -51%, which was inverse incomplete. The correlation intensity was strong at 99% confidence level and the error rate was 0.87. The correlation between skin cancer and frost was -65%, which was inverse incomplete. The correlation intensity was very strong at 99% confidence level and the error rate was 0.20. The correlation between skin cancer and sunny hours was 57%, which was direct incomplete. The correlation intensity was strong at 95% confidence level and the error rate was 0.49.

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Investigation of the relationship between climatic parameters and skin cancer in Khalkhal in 2014:

According to Table 5, using the Spearman method, the correlation between skin cancer and mean temperature was 69%, which was direct incomplete. The correlation intensity was very strong at 99% confidence level and the error rate was zero. The correlation between skin cancer and absolute minimum temperature was 92%, which was direct incomplete. The correlation intensity was very strong at 99% confidence level and the error rate was zero. The correlation between skin cancer and absolute maximum temperature was 91%, which was direct incomplete. The correlation intensity was very strong at 99% confidence level and the error rate was zero. The correlation between skin cancer and absolute mean humidity was -84%, which was inverse incomplete. The correlation intensity was very strong at 99% confidence level and the error rate was 0.01. The correlation between skin cancer and frost was -82%, which was inverse incomplete. The correlation intensity was very strong at 99% confidence level and the error rate was 0.01. The correlation between skin cancer and sunny hours was 90%, which was direct incomplete. The correlation intensity was very strong at 99% confidence level and the error rate was zero (Figure 5).

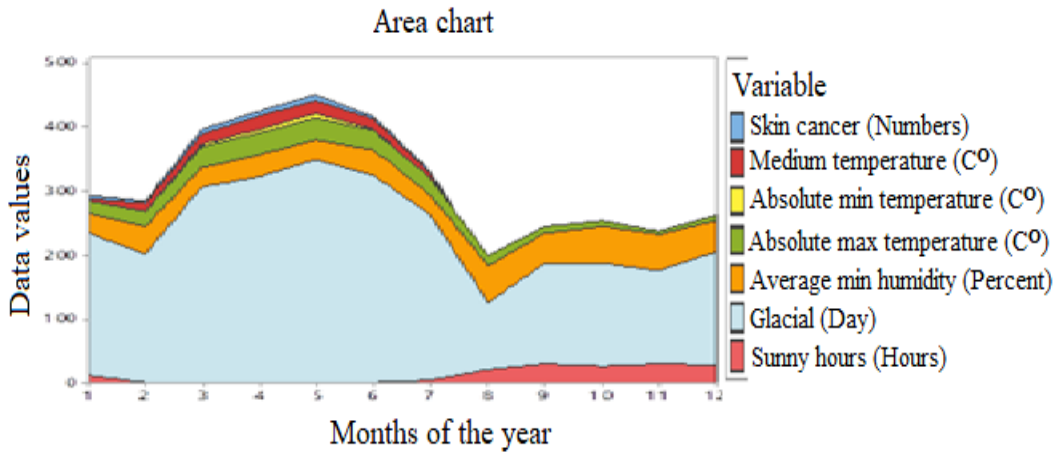

Figure 5: Area diagram of climatic variables and skin cancer in Khalkhal in 2014

Table 5: Correlation of climatic variables and skin cancer in Khalkhal city in 2014

			Skin cancer	Medium temperature	Absolute minimum temperature	Absolute maximum temperature	Mean minimum humidity	Glacial	Sunny hours
Spearman's Rho	Skin cancer	Correlation Coefficient	1.000	.950**	.920**	.914**	-.846**	-.822**	.900**
		Sig.(2-tailed)	.	.000	.000	.000	.001	.001	.001
		N	12	12	12	12	12	12	12
	Medium temperature	Correlation Coefficient	.950**	1.000	.960**	.965**	-.744**	-.886**	.888**
		Sig.(2-tailed)	.000	.	.000	.000	.006	.000	.000
		N	12	12	12	12	12	12	12
	Absolute minimum temperature	Correlation Coefficient	.920**	.960**	1.000	.918**	-.692*	-921**	.872**
		Sig.(2-tailed)	.000	.000	.	.000	.013	.000	.000
		N	12	12	12	12	12	12	12
	Absolute maximum temperature	Correlation Coefficient	.914**	.965**	.918**	1.000	-.723**	-.915**	.895**
		Sig.(2-tailed)	.000	.000	.000	.	.008	.000	.000
		N	12	12	12	12	12	12	12
	Mean minimum humidity	Correlation Coefficient	-.846**	-.744*	-.692*	-.723**	1.000	.623*	-.772**
		Sig.(2-tailed)	.001	.006	.013	.008	.	.030	.003
		N	12	12	12	12	12	12	12
	Glacial	Correlation Coefficient	-.822**	-.886**	-.921**	-.915**	.623*	1.000	-.832**
		Sig.(2-tailed)	.001	.000	.000	.000	.030	.	.001
		N	12	12	12	12	12	12	12
	Sunny hours	Correlation Coefficient	.900**	.888**	.872**	.895**	-.772**	-.832**	1.000
		Sig.(2-tailed)	.000	.000	.000	.000	.003	.001	.
		N	12	12	12	12	12	12	12

**Correlation is significant at the 0.01 Level (2-tailed).
*Correlation is significant at the 0.05 Level (2-tailed).

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Discussion

In the present study, according to the data and method used as well as the theoretical foundations mentioned in the study, skin cancer was affected by climatic parameters, latitude, and altitude. Therefore, the effect of six climatic parameters (frost, Sunny hours, minimum mean humidity, maximum absolute temperature, minimum absolute temperature, and mean temperature) on skin cancer in Ardabil province was investigated using Spearman correlation relationship in SPSS software and Minitab software for linear interpolation . At Ardabil station in 2012, the highest correlation value was observed in the absolute minimum temperature and the lowest correlation value was observed in frost. In 2013, the highest correlation value was observed in the absolute maximum temperature and the lowest correlation value was in frost. In 2014, the highest correlation value was at the maximum absolute temperature and the lowest correlation value was in frost. In three stations of Parsabad in 2012, the highest correlation value was for the minimum absolute temperature and the lowest correlation value was for the mean absolute humidity. In 2013, the highest correlation value was for the mean temperature and the lowest correlation value was for frost. In 2014, the highest correlation value was for the minimum absolute temperature and the lowest was for the frost. In Meshginshahr in 2012, the highest correlation value was for the mean temperature and the lowest correlation value was for the frost. In 2013, the highest correlation value was for the absolute minimum temperature and the lowest correlation value was for frost. In 2014, the highest correlation value was for the minimum absolute temperature and the lowest was for the frost. In Khalkhal city in 2012, the highest correlation was in sunny hours and the lowest was in frost, and in 2013, the highest correlation was in sunny hours and the lowest was in frost, and in 2014, the highest correlation was in mean temperature and the lowest value was the minimum mean humidity.

The results of the present study can be of great help in preventing skin cancer that can cause problems for the human community in the future in the study area. With careful scientific planning, the number of skin cancer patients can be reduced in the future. The method used in this study carefully assessed the relationship between climatic parameters and skin cancer and also this method was studied for the first time in the study area, which was a new innovation in the field of geography, medical climatology, environmental health, and sustainable development. Comparing the results of the present study with the findings of other researchers, it was found that other similar studies in the past examined skin cancer in a one-dimensional and one-parameter manner. However, in the present study, multidimensional analysis and correlation of climatic parameters (frost, sunny hours, minimum mean humidity, maximum absolute temperature, minimum absolute temperature and mean temperature) with skin cancer were measured. In this study, the correlation between climatic parameters and skin cancer, in addition to case and one-dimensional analysis, were analyzed annually, which is one of the strengths of this study. It is suggested that the method studied in this research be tested in other regions of the country.

Conclusion

The results of the present study showed that in all four cities, skin cancer showed a high correlation with maximum and minimum temperatures and sunny hours**.** According to the percentage of correlation as well as the results of the research and the frequency of climatic parameters in the three cities of Ardabil, Parsabad and Meshginshahr, more dispersion appeared.

The results of the study showed that the maximum temperature and sunny hours are effective in the incidence of skin cancer and the minimum temperature after the disease increases its severity. To prevent entering this stage of the disease, the following items are suggested :

Use wide-brimmed hats to cover the head, ears, face, and neck.

Wear long pants and long-sleeved blouses to expose your skin to less direct sunlight.

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Use woven fabrics with dark colors, providing the most protection of the skin against sunlight.

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Conflict of interest

The authors of this study declare that they have no conflict of interests.

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