Evaluation of Health Housing Characteristics in Kashan; Case study: Air Health

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Abstract

Today, the issue of providing health through environmental regulation has become an urgent need. The main issue of this research is to find the indicators and pattern of the type of housing that provides health through air, ventilation and respiration based on traditional medicine. The research is further aimed at studying successful examples of traditional and contemporary housing in Kashan to discover the quality of indoor air. The practical purpose of the research is helpful in exploring the feasibility of traditional housing. The type of research is interdisciplinary and qualitative with reasoning, analytical and case study methods. Indicators of the study were determined by interviewing medical and architectural researchers, and the results were verified by using Design Builder, a software for energy analysis. The required data was collected by searching library resources and articles published in reputable medical and architectural journals, and in order to deepen the understanding of the subject some exploratory interviews were also conducted. According to the results, the health of housing in Kashan depends on the indicators that have the ability to balance the heat and dry air with humidity and coolness and save the indoor from hot and dry air outside. These indicators include optimal location, climatic design based on seasonal or daily migration, priority of open and semi-open spaces over closed spaces, linkage of spaces, enclosure for pollution control, architectural and natural interaction, balance between space and air function and application of indigenous patterns. In contemporary houses of Kashan, the lack of natural air flow due to the location of openings in a single wall, deprivation of open and covered spaces with livelihood function and the priority of sunbathing over wind flow is one of the most important factors of inefficiency.

Keywords: Traditional medicine, health, housing, traditional architecture, Kashan

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Introduction

Human health is an important and vital issue in all areas. The human living environment has serious effects on human health. This article seeks to answer the following questions: Which one is a successful example of health housing in Kashan in terms of indoor air quality; traditional or contemporary examples? What are the characteristics of health housing in the hot and dry climate of Kashan? What features does traditional medicine recommend for housing design? The purpose of this study is to evaluate traditional and modern houses in terms of health quality in their architectural design. It is assumed that in terms of air health, traditional houses are better than new houses and have more efficient patterns.

Literature Review

Taheri (2016) in an article entitled "Climatic Measures of Residential Environments in Islamic Medicine" seeks to re-read the scientific history of sustainable human interaction with natural and artificial environment to maintain moderation and human health in Islamic medical texts in addition to analyzing the climatic knowledge of architects in creating residential environments. The results of this study show that the air factor (wind) is the most essential health factor in the climatic lifestyle and organization of residential environments, and it has played a major role in locating and organizing cities and housing spaces. This article provides appropriate criteria for the health aspects of the environment.

Hamzehnejad and Servati (2017) in an article entitled "Components of Indigenous Design of the Environment to Ensure Human Health based on Traditional and Islamic Medicine" try to find the rules of using or avoiding the main elements of the environment such as wind, water, sun, soil and plants. They seek the rules in different temperatures and environmental conditions to ensure human physical comfort. The study has also reached the practical record of urban econometrics based on medical principles.

Taghizadeh and Mollazadeh Yazdani (2015) in "The Role of Climatic Measures Based on Seasonal Displacement in Traditional Medicine on Human Health and Its Effect on the Formation of Traditional Architecture and Space Organization in Iran" have concluded that the principles of traditional medicine in climatic design based on seasonal displacement focuses on location, timing, elevation control, and space orientation. Case analysis shows that traditional houses are in harmony with the medical principles of climatic design based on seasonal displacement and can be used to achieve thermal comfort in contemporary homes.

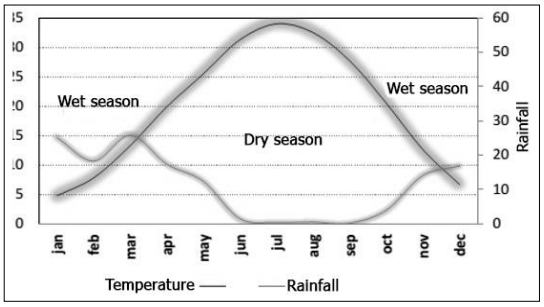
This research is concerned with health in the framework of traditional medicine. Traditional physicians have an integrated reading of the environment and human beings based on the common temperaments of coldness, hotness, dryness and wetness and interpret human-environment interactions in this format (Abdollahzadeh, 2015: 147). Traditional medicine considers six principles necessary for maintaining human health, four of which are related to environmental conditions. Air, physical movement and stillness, mental movement and stillness (mental states) and sleep and wakefulness are environmental factors in maintaining human health. The most important goal of traditional medicine in providing health conditions is to pay attention to the balance between the four temperaments (Savoji, 2012: 33). In the air factor, traditional medicine recommends to keep the balance between the four temperaments appropriate to the individual's climate, season, time of day, age, sex, and state of health or illness. It also explains the action and reaction in the factors of movement and physical and mental stillness and sleep and wakefulness in terms of four temperaments. For example, stillness brings with it wetness and coldness, and normal movement causes warmth (Avicenna, 2013: 217).

In this regard, architecture must have features and attributes to balance each of these factors. In other words, in order to regain the strengths, architecture should help by providing balanced air, a peaceful atmosphere in places without motion and a dynamic atmosphere in places with motion; creating balance between these two places; paying attention to qualitative dimensions of

architecture to have health efficiency on the mental state of residents; and arranging a good place for sleeping and wakefulness. In the findings of a comparative study between medical and traditional architecture documents, commonalities have been obtained between them in hot and dry climates (Taghizadeh and Mollazadeh Yazdani, 2018). In this study, these commonalities are consistent only with the findings of traditional physicians in the air factor. Having considered that these principles are constant, the health and pathogenic details were localized based on the natural and built environment of Kashan.

Natural and artificial factors that pollute the air of Kashan and its effect on human health

Considering the hot and dry climate of Kashan and the factors reducing the quality of air for human health, climatic cases that are more effective on the health of residents are described in this section. According to the ombrothermic diagram, the dry season in Kashan starts from the beginning of May and ends at the end of October, lasting for almost half a year. During this period, the temperature is higher than the rainfall temperature and thus the period is called the "dry season" (Applied Meteorological Research Office. 2015).



F1. Ombrothermic diagram for measuring temperature and rainfall in different months in Kashan in a 50-year period (1967-2014)

The results of the peasant research in determining the air quality index of Kashan during 2011, show that Kashan had 187 polluted days. Air quality was unhealthy for sensitive groups for 86 days, unhealthy for 38 days, very unhealthy for 32 days and dangerous for 31 days. The weather in Kashan was healthier in May, August, September and February (Dehghani et al., 2014: 317). Therefore, half a year, the weather in Kashan is unhealthy, which indicates a crisis in air quality for the health of residents. The main cause is dust particles in spring and summer, ozone gas in autumn and carbon monoxide in winter (ibid).

Environmental factors reducing the quality of air health in each season			Risks to human health
Climatic	Summer	Low latitude and intense sunlight	Skin disease
		Long distance form sea moisture and the presence of dry air	Skin and respiratory diseases and dryness of temperaments
		High temperature	Respiratory and cardiac issues and reduced body stamina
		Wind impact (East and Northeast)	Mental, respiratory and vision problems
Human pollutant	Autumn	Ozone gas	Pulmonary diseases and weakness
	Winter	Carbon monoxide gas	Pulmonary and cardiac disease, general weakness of the body
	Autumn and Summer	Sulfur dioxide gas	Pulmonary and mental illnesses, reduced body stamina
Climatic-human factors	Spring and Summer	Dust particles	Pulmonary, cardiac, hepatic, renal and dermal diseases

T1. The effect of climatic and human barriers of healthy air on the health of people on an urban scale - Source: Author (with adaptation of Shabani, Ezzatian and Roshani)

The effects of pollutants in Kashan on human health are as follows:

According to recent research, artificial factors disrupting the health of residents include the abundance of cars, the dispersion of medical centers, industrial and waste collection stations due to the priority of access to urban facilities and services over the priority of a healthy urban environment (Shabani and Ezzatian, 2011). In fact, if a house is located in the unhealthy area of Kashan, it has to have an introverted design to protect itself from the polluted conditions outside. In order to serve this purpose, houses in traditional architecture had indoor spaces such as basins, porches and central courtyards. Due to the importance of airflow and the pathogenic effects of stagnant air, especially in hot seasons, indoor and outdoor

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spaces have been used to facilitate airflow.[1] Therefore, due to the efficiency of these spatial qualities, priority is given to designing indoor and outdoor spaces over closed spaces. Although traditional medicine emphasizes on sunbathing especially in the early hours of the day.[2] Moreover, controlling the sunlight due to the intense angle of radiation is another issue that should be addressed by designing natural and artificial canopies.

Presenting the characteristics of health housing in Kashan

Table 2 summarizes the principles for architecture in the hot and dry region of Kashan. The following characteristics of health housing architecture are for hot and dry climate across the world, which have been localized based on studies of Kashan context, its health dimensions and disease.

Health-friendly architecture in housing		Pathogenic architecture in housing	
Optimal location and its solution	Choosing a location in the most pleasant climate of Kashan, introverted architecture to control dry or polluted air	Choosing a place of residence in the east near the desert and near the industries in the northwest and northeast of Kashan	Balkhi / Davido
Climatic and indigenous design	Receive southwest, northwest and north wind, air flow	East and northeast wind, stagnant air	Balkhi, Avicenna, Aghili, Savoji, Jilani / Davido
	Radiation: Sunbathing for clean and light air, prioritizing natural daylight and controlling the intensity of light radiation	Sunburn and heavy weather, eye disease caused by not controlling the intensity of light and use of artificial light during the day	
	Water: Humidifier with basins, plants and basement	Ignorance of dry air in building design	
	Soil: Have a part of the building into the soil to avoid hot weather	Building houses on platforms instead of the ground	
Seasonal design	Two- or three-sided patterns for seasonal migration	One-sided east-west construction pattern with north courtyard	Balkhi / Haeri
Interference or connection of open and closed space		Separation and closure of open and closed space relative to each other	Balkhi / Haji Ghasemi
Priority of open and semi-open space over closed space		Priority of closed spaces over open and semi-open spaces	Avicenna, Jorjani / Shahri
Complementary interaction of architecture and nature to moderate heat, dryness and air pollution		Architectural conflict with nature	Balkhi, Baghdadi / Noghrekar and others
Shelter inside to avoid unhealthy air outside [enclosure]		Opening of spaces to unhealthy air outside	Balkhi, Aghili
Balance between space and air quality	Air balance and spatial function (more air ventilation of hot and crowded places than private and sparsely populated places)	Ignorance of the appropriateness of air and function (same quality and airflow of crowded and secluded space)	Balkhi, Ibn Sina / Shahri
	Application of indigenous architectural patterns to balance the air and the building	Extroverted design regardless of indigenous patterns	

T2. Characteristics of health housing in Kashan and its pathogenic dimensions based on the teachings of traditional medicine

Research Method

This research is an interdisciplinary research and a combination of analytical studies and case studies with a qualitative approach. In order to be more precise, before setting the criteria, medical and architectural researchers were consulted to deepen the medical concepts, and then, we extracted the initial basis of indicators. The results of analytical methods and logical reasoning have been converted into measurable and common variables between traditional and modern architecture in order to make effective deductions in traditional and contemporary houses. The method of data collection was searching library resources, articles related to prestigious medical and architectural journals, and exploratory interviews to deepen the understanding of the subject.

The data from the analysis of the houses lead to the grading of each variable based on the degree of success to the dimensions of health. The next step after grading the variables is classification. Given that the average numerical indicators in the degree of health are often decimal numbers, after grading, the word leveling should be used to determine the numerical intervals in determining the health of homes. On this basis, to increase the accuracy of the work, the health level is divided based on the base unit of 0.5. Different levels of health are as follows: First Level = 1.5> a> 1; Second Level = 2> a> 1.5; Third Level = 2.5> a> 2; Fourth Level = 3> a> 2.5; Fifth Level = 3.5> a> 3; and Sixth Level = 4>a> 3.5. In the final stage, considering that the analysis of the houses was done from the aspect of air

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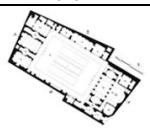
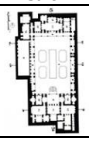
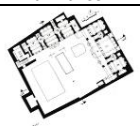
health and to verify the results, the study used Design Builder, an energy analysis software.

Research Context

According to the evaluation of two classes of houses, houses should be selected in a context that the two classes of traditional and modern houses are in a stable condition to have a correct analysis. Therefore, the selection of the city of Kashan was due to its ideal condition in terms of the coexistence of traditional and modern houses. In addition, Kashan has been one of the most polluted cities in terms of air quality in recent years. Therefore, this study aims to evaluate the effectiveness of traditional and modern residential architecture in solving this crisis.

Criteria for selecting samples

The criterion for selecting traditional housing is based on the value of the house. The value of the house depends on its registration in the Cultural Heritage Organization of Kashan. Another criterion is the construction patterns of site and standing property because of the effect they have on the air quality. The contemporary period refers to the houses bult after the Islamic revolution. The selection of contemporary models is based on three general criteria: residential uses of national plans, selected architectural plans and engineering system approval plans (depending on the south or north construction of the building and the number of floors and bed differences).

Traditional samples				
Four-sided pattern	Three-sided pattern		Two-sided pattern	
	Longitude	Transverse	Opposite	Adjacent
Abbasian	Ale Yassin	Tahami	Saleh	Karkhanechi
				

T3. Traditional houses and the structure of their selection

Contemporary samples				
Engineering system			National	Selected
Southern	Northern	Southern-Northern		
Felezi	Afrouz	Jalali	Maskan Mehr	Kashan house
				

T4. Contemporary houses and the structure of their selection

Discussion and Analysis Results

Description and analysis of health housing characteristics

The first and most important factor in maintaining human health is air (Jorjani, 1966: 218). This study analyzes the health status of the air factor in Kashan houses. The following principles and characteristics have been expressed for this factor based on the sources of traditional medicine and variables. Given that traditional and modern homes are compared to each other, the measure of variables must be common to the two samples.

Optimal location and its solution

Based on the amount of health benefits in different areas of Kashan, the location of the building in each of these areas affects the health quality of housing. This principle also includes the solution of dry air in the city and the building. Priority is given to houses that have northwest-southeast direction in Kashan. The degree of health of the variables of this principle is given in Table 6.

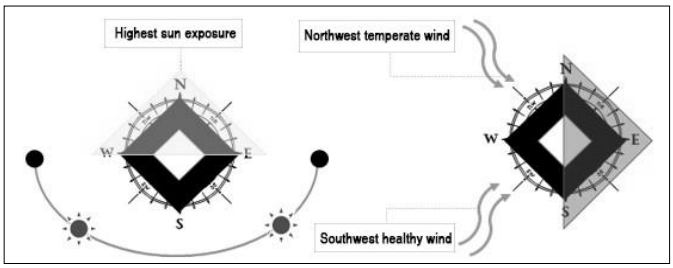
Climatic and indigenous design

Based on traditional medicine, the four main elements that are effective in regulating climatic conditions include sun (fire), wind, moisture (water) and soil. In expressing this principle, we considered the general orientation of the residence, openings and skylights, dehumidification solutions to compensate for the dryness of the air and the

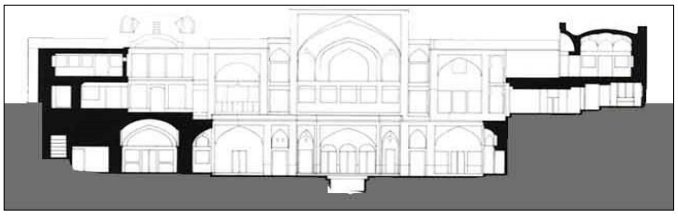
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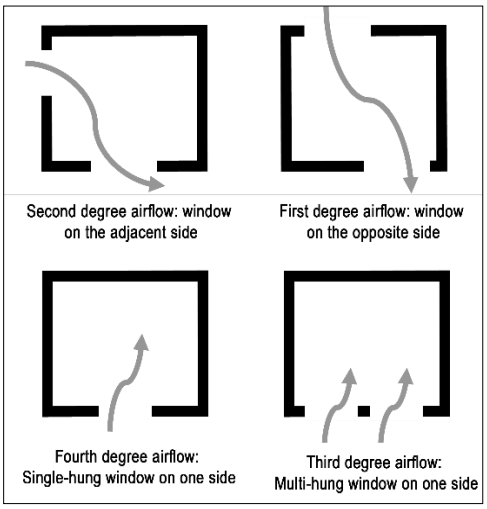
use of natural ventilation to moderate the hot and dry air of Kashan.



F2. Wind exposure (right), Sun exposure (left)



F4. Soil element: Abbasian house, an example of earth house



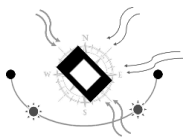
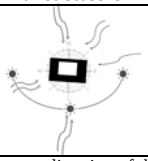
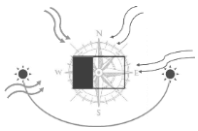
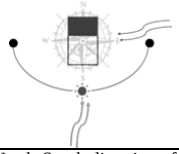
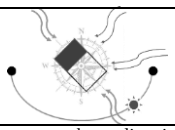
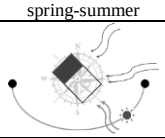
F3. Wind element: Different degrees of airflow based on the location of windows

Seasonal shift or migration

The importance of this principle lies in the effect of architecture on the adjustment and improvement of pathogenic and adverse weather conditions of each season in the houses of Kashan. The seasonal efficiency of Kashan houses based on the order of site and standing property is shown in Table 5. The range of this variable is given in Table 6.

Linking open and closed spaces

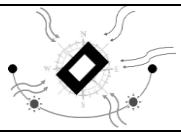
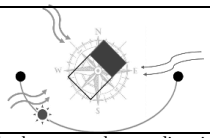
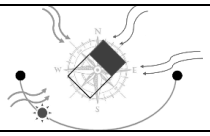
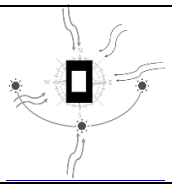
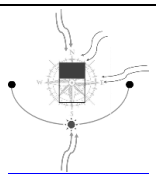
This principle emphasizes on controlling temperature changes and air quality in Kashan. The high difference between day and night temperatures in Kashan highlights the importance of the quality of open, closed and indoor spaces. To measure this principle, the number of closed spaces and its relationship with semi-open and open spaces must be determined. Priority is given to the fruitful connection (with the possibility of moving) between closed spaces with open or semi-open spaces, visual connection (opening without the possibility of moving) and finally closed spaces that have no connection with open or semi-open spaces. The grading of the variables of this principle is given in Table 6.

Grade (1) Responsive house in four seasons	Grade (2) Responsive house in three seasons	Grade (3) Responsive house in two seasons	Grade (4) Responsive house Single season
			
Northwest-southeast direction of a traditional house	East-west direction of the a traditional house: autumn-spring-summer	East-west direction of a contemporary house built in the south: spring-autumn	North-South direction of a contemporary house built north: Winter
			
North-west-southeast direction of a contemporary house built in the south	North-west-southeast direction of a contemporary house built North: winter-spring-autumn		

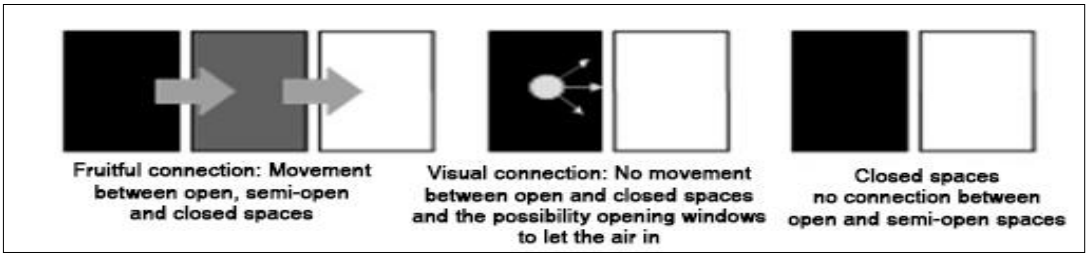
T5. Classification of Kashan houses according to the possibility of seasonal migration based on the navigation and system structure of the site and standing property to benefit or avoid environmental conditions

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Northeast-Southwest direction of a traditional house	North-east-south-west direction of a contemporary house built North: winter-autumn-summer	North-east-south-west direction of a contemporary house built in the south: winter-autumn	
			
North-south direction of traditional house	North-south direction of a contemporary house built in the south: winter-summer		

T5. Classification of Kashan houses according to the possibility of seasonal migration based on the navigation and system structure of the site and standing property to benefit or avoid environmental conditions



F5. Types of connection between open, semi-open and closed spaces

Principles of Health Housing		Measurable variables	Grades of health			
			Grade (1)	Grade (2)	Grade (3)	Grade (4)
Optimal location and its solution		The level of health in different locations	Level (1)	Level (2)	Level (3)	Level (4 & 5)
		Direction	Northeast-Southwest	Northwest-Southeast	North-South	East-West
Climatic design	Wind	Degree of wind health in the hot season	Southwest	Northwest, North	Southeast	Northeast, east
		Degree of prevailing wind	Opposite window	Window in two sides	Multi hung window in one side	Single hung window in one side or without window
	Sun	Average ratio of sun exposure windows to facades	a>25	25>a>17.5	17.5>a>10	10>a
	Water (humidity)	Ratio of cool and humid space to infrastructure	a>30	30>a>20	20>a>10	10>a
		Ratio of the basin to the yard	a>7.5	7.5>a>5	5>a>2	2>a
	Soil	The ratio of earth houses to the infrastructure of site and standing property	a>30	30>a>20	20>a>10	10>a
Seasonal design		Based on the orientation and structure of the site and standing property	4 seasons	3 seasons	2 seasons	1 season
Connection between open and closed spaces		Based on the connection of closed space with open or semi-open space with three types of fruitful connection (with the possibility of movement), visual (capability of air exchange and ventilation) and without connection	Fruitful connection between open and closed spaces ≥ Visual connection between open and closed spaces > closed spaces without connection	Visual connection between open and closed spaces > fruitful connection between open and closed spaces > Closed space without connection – fruitful connection between open and closed spaces > closed space without connection > visual connection between open and closed spaces	Visual connection between open and closed spaces > closed space without connection > fruitful connection between open and closed spaces	Closed space without connection with open spaces more than fruitful and visual connections

T6. Grading the level of realization of air health indicators in Kashan houses

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Priority of open and indoor spaces over closed spaces		Ratio of open and indoor spaces to closed spaces	a>1	1>a>0.7	0.7>a>0.4	0.4>a
Interaction of architecture and nature		Ratio of garden area to yard (percentage)	50>a>25	25>a>15	15>a>5	
Shelter inside the house from the polluted air outside		The degree of enclosure to the passage	4 sided	3 sided	2 sided	1 sided
Balance	Balance of air and function	Ratio of living spaces area to bedrooms	a>2	2>a>1.5	1.5>a>1	1>a
		Public to private height ratio	a>2	2>a>1.5	1.5>a>1	1>a
	Application of indigenous architectural patterns	Percentage of attention to indigenous patterns	a>75	75>a>50	50>a>20	20>a

T6. Grading the level of realization of air health indicators in Kashan houses

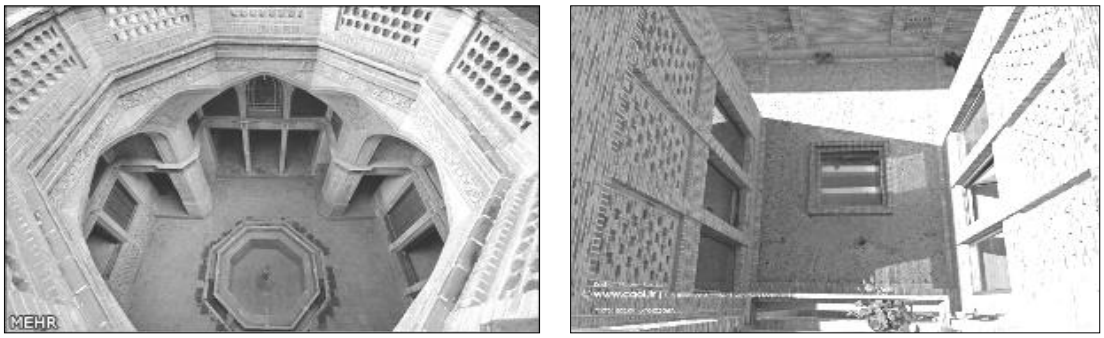
Inside shelter from bad weather outside

Total enclosure is a priority due to air pollution in cold seasons, heat and dryness in hot seasons, and dust storms in temperate seasons. In order to enclose the spaces of the house from unfavorable weather conditions, the criterion is to measure the construction and the condition of the external openings, which has several grades. The grades of this indicator is given in Table 6.

Balance between spaces and air quality

A. Balance between air and function: In public spaces, due to the large number of people, more air is needed to breathe. Lack of residents means reduced need for air and the number of air changes. Also, in an indoor or enclosed space, hot air rises and cool air flows down. In houses, the space and the height of the sky of collective spaces should be more according to the functional needs. The grades of this variable in terms of the ratio of area and height of the main living space to the sleeping space is given in Table 6.

B. Using indigenous architectural models: Based on traditional medicine in the words of Imam Reza, the temperament of the people of a city can be recognized from the works they create (Amir Sadeghi, 2002: 191). According to Balkhi, balance is achieved by following local patterns (Ahmad Ibn Sahl, 1426: 139). Common spatial patterns in Kashan architecture such as basin, porch and basement are an attempt to moderate the air, the pattern of the middle open space is to control it and the use of indigenous structures is to balance the air temperament, the temperament of buildings and human temperament. The grades of indigenous patterns are given in Table 6.



F6. Abbasian House (Right), Kashan House Spatial model of the basin to moderate drought and air flow (Left)

Complementary interaction between architecture and nature

Nature in architecture means the use of plants in the home. Its architectural manifestation is the allocation of outdoor garden or greenhouse space in houses for this purpose. In Kashan climate, the existence of plants that moderate drought and heat is due to intense sunlight, hot winds and lack of humidity. Moreover, according to the evidence of traditional medicine, dense trees cause fever in residents. Therefore, the ratio

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between the garden and the yard should be neither high nor low, but in the middle. The grading of this variable is given in Table 6.

Grading of characteristics

The above variables were expressed in such a way that is possible to assess the quality of Kashan houses. Based on this, three levels of attention to these variables in Kashan houses are evaluated. In the qualitative classification, which is based on the degree of observance of the said principles, the highest level of attention is respectively given to health indicators of grade (1) and the lowest is given to grade (4). The table below shows the classification of health housing indicators in terms of air in each indicator.

Analysis of houses

By comparing the data obtained from the evaluation of health indicators in Kashan houses and Table 6, results in determining the degree of health of Kashan houses are obtained, which are given in Table 7. In the last row of the table, for each house, the average number of health indicators is taken, which indicates the health level of each house in terms of air qualiry. On this basis, the closer the number is to one, the healthier it is. The results of the numerical average of each house show that the healthiest house in the air dimension is Tahami house with the number 1.2 and the lowest level of health in the air dimension belongs to Afrooz house with the number 2.8.

In addition, this table shows that 80% of traditional houses are in compliance with the principle of optimal location and its solution, the principle of climatic design in wind and sun, the principle of seasonal design, the principle of the priority of open and indoor spaces over closed spaces, the principle of confinement for shelter from the dry and polluted air outside and the principle of the application of indigenous architectural patterns. It can also be said that the characteristics that cause differences in determining the health status of traditional houses in Kashan are the principle of climatic design in terms of soil and air and air suitability and function in the principle of balance.

Principles of Health Housing		Measurable variables	Traditional houses					Contemporary houses				
			Abbasian	Al Yasin	Tahami	Saleh	Karkhanechi	Felezi	Afrouz	Jalali	Maskan Mehr	Kashan House
Optimal location and its solution		The level of health in different locations	1	1	1	1	1	1	4	4	1	3
		Direction	1	1	1	2	1	1	2	2	1	1
Climatic design	Wind	Degree of wind health in the hot season	1	1	1	2	1	2	1	1	1	1
		Degree of prevailing wind	1	1	1	2	1	1	3	2	1	1
	Sun	Average ratio of sun exposure windows to facades	1	2	1	1	1	1	2	1	2	1
	Water (humidity)	Ratio of cool and humid space to infrastructure	3	2	2	1	1	4	4	4	4	4
		Ratio of the basin to the yard	1	2	1	1	4	4	4	4	4	3
	Soil	The ratio of earth houses to the infrastructure of site and standing property	1	3	1	2	3	4	4	4	4	2
Seasonal design		Based on the orientation and structure of the site and standing property	1	1	1	1	1	1	2	2	1	2
Connection between open and closed spaces		The ratio of open and indoor spaces to closed spaces	2	2	2	2	2	4	4	4	3	3
Priority of open and indoor spaces over closed spaces		Ratio of open and indoor spaces to closed spaces	1	1	1	1	1	1	1	3	4	2
Interaction of architecture and nature		Ratio of garden area to yard (percentage)	1	2	2	3	2	2	4	1	4	2
Shelter inside the house from the polluted air outside		The degree of enclosure to the passage	1	1	1	1	1	2	2	3	4	4
Balance	Balance of air and function	Ratio of living spaces area to bedrooms	1	1	1	1	2	1	1	1	2	3
		Public to private height ratio	3	3	2	1	3	4	4	4	4	2
	Application of indigenous architectural patterns	Percentage of attention to indigenous patterns	1	1	1	1	1	3	3	3	3	3
Average of paying attention to the quality of air in houses			1.3	1.6	1.25	1.4	1.6	2.2	2.8	2.7	2.7	2.3

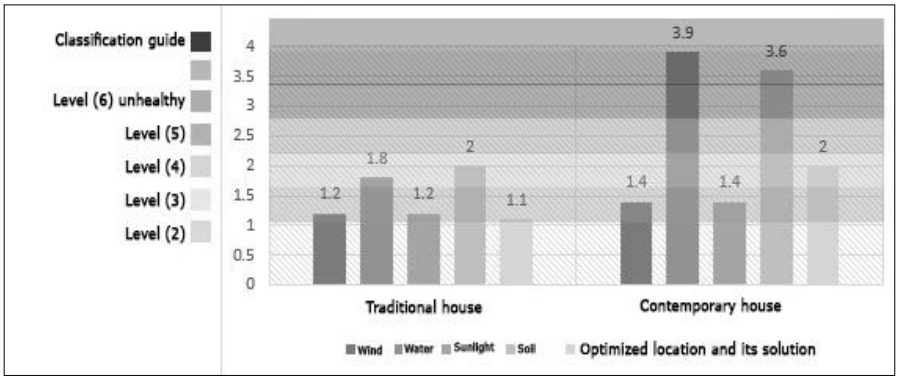
T7. Grading the level of realization of the characteristics of air health dimensions in traditional and contemporary houses of Kashan

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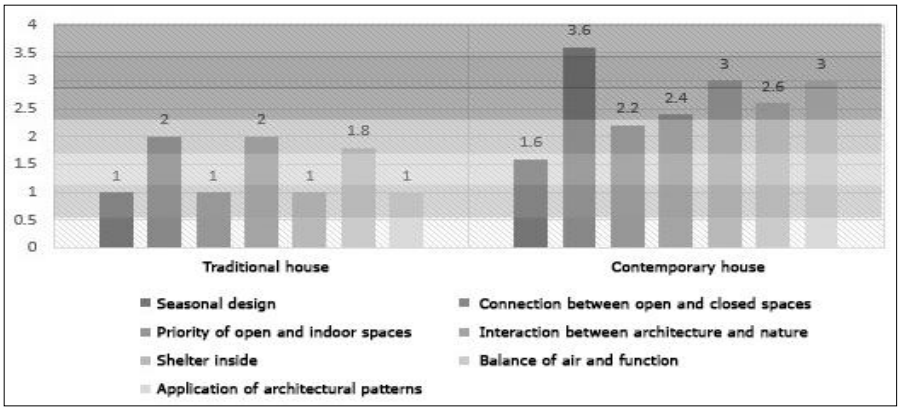
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In the example of contemporary houses, the most ideal state of health is the principle of climatic design in the dimension of wind and the principle of direction. At the same time, attention to soil-water characteristics is at the lowest level of health in the principle of climatic design and the connection between open and closed spaces.

The below diagram shows an average level of health in the characteristics of the principle of optimal location and its solution and climatic design in traditional and contemporary houses in Kashan. According to the diagram in these two principles, the health status of traditional houses is better than contemporary houses. In the principle of the optimal location and its solution, traditional houses are at the first level of health and contemporary houses are at the second level of health. In the principle of climatic design, the level of airflow and sunlight is in the first level of health in both traditional and contemporary houses, and this shows the undeniable role of these two elements in providing the minimum living conditions in Kashan. At the same time, in terms of soil and water, there is a significant difference between traditional and contemporary houses. In this respect, traditional houses are at the first level of health and contemporary houses are at the last (sixth) level of health, in a pathological condition. Therefore, the difference between the elements of airflow and sunlight in the principle of climatic design and the principle of optimal location is not significant in traditional and contemporary houses. However, the variable of water or humidity and the positive effects of earth houses and its role in moderating the hot weather are neglected in the climatic design of contemporary houses. Theoretical and practical experiences of contemporary architects show that the presence of soil in the roof of residential buildings increases the physical and mental health of the residents.



Ch1. Level of health in the principle of climatic design



Ch2. Level of health in the principles of health housing in terms of air quality

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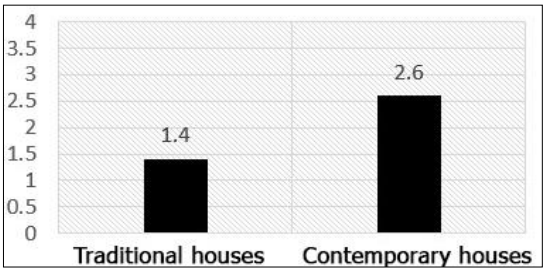
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The second diagram shows the indicators of health in terms of air quality. The attitude of this research was expressed in the principle of seasonal design in the introduction of features. By comparing this principle in traditional and contemporary houses, it is possible to see the full observance of this principle in traditional houses. The following diagram shows the most ideal situation in the principles of health housing in Kashan. In this diagram, we can see the characteristics of seasonal design, the priority of open and indoor spaces over closed spaces, the principle of shelter from dry and polluted air and the application of indigenous architectural patterns in the principle of balance. Moreover, the principle of connection between open and closed spaces, complementary interaction of architecture and nature, air balance and spatial function is in the second level of health in the principle of balance in Kashan traditional houses.

In contemporary houses, the most critical state of health is first related to the principle of connecting open and closed spaces, and then to the principle of sheltering from polluted air, and the application of indigenous patterns in the principle of balance. Contemporary architecture has ignored the efficient spatial patterns in modifying and improving the air condition in houses by neglecting the indigenous architectural resources of Kashan in the design of component spaces. Contemporary houses in Kashan have turned to mechanical facilities to compensate for this shortcoming, which is an important factor in disrupting the air health in this city. The diagram also shows the fading away of the importance of connecting open and closed spaces, especially in fruitful connections and the possibility of moving between spaces with different spatial quality and therefore different air quality.

The best situation in air health indicators in contemporary houses in Kashan is related to the principle of seasonal design. In the analysis of determining the multi-season of houses, the efficiency and performance of the building as a whole has been considered in maintaining moderation in the seasons of the year. It is important to note that in contemporary houses, one side is usually allocated to the spaces used for sleeping and resting and the opposite side is allocated to the hall. However, in determining the seasonality of the houses, the spatial function has not been considered and the ability of the structure of the site and standing property has been considered for seasonal design.

Figure 3 shows that the level of health in terms of the air quality in traditional houses of Kashan is in the first level of health and in contemporary houses, it is in the fourth level of health. In other words, attention to air health in contemporary houses has decreased compared to traditional houses. As a result, Kashan's contemporary houses are in an unbalanced state of air health. To prove this claim, two examples from Kashan houses are verified.



Ch3. Level of air health in kashan houses

Validating the Results

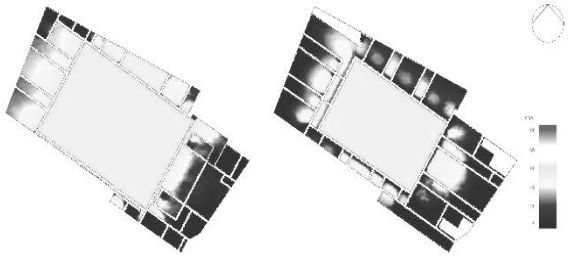
To validate the above results, we should test some of them. The examples considered for this test are the best (Tahami house) and the worst (Khan Afrooz) house in observing the health indicators in terms of air quality in the houses of Kashan. The factor under study in these houses is the natural light factor, which is an important and tangible factor in determining the quality of houses. The indicator for analyzing the illuminance is the sDA index, which indicates the average annual light intake of each space. The most important issue in this evaluation is the balanced distribution of natural light in the living spaces of the house. The output of the analysis of this indicator shows the amount of annual light received in space in percentage.

The first floor of Tahami house, with 60-70% of natural light is in better condition compared to the basement with 40-50% natural light. Figure 7 shows that the lighting

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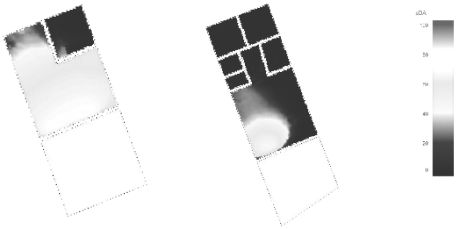
of the spaces around the central courtyard of Tahami house is in good condition. Due to the fact that the back spaces or closets in traditional houses had a storage function, the overall lighting of the living spaces where the residents live almost permanently is good. All in all, bedrooms, living spaces and seasonal receptions are bright spaces and closets and food storage areas do not receive light.



F7. Annual light reception in Tahami House, Basement (left), First floor (Right)

The results of this indicator in figure 8 show that light is not evenly distributed in Afrooz house. The lighting of the first floor of Afrooz house is better than the ground floor. At the same time, there is a strong contrast between its spaces in having natural light. Due to the fact that there is no storage space or closet in Afrooz house, everywhere in the house is used as living spaces except the water basin and the bathroom, which should receive enough light. However, in Afrooz House, the bedrooms and kitchen are not well lit and are considered dark spaces all year round. Adjacency of bedrooms with sanitary spaces, which have high humidity and are heavier with air gases, necessitates the presence of sunlight to purify the air and lighten the space. However, this has not been considered in the construction of Afrooz house, and thus receiving natural light is not balanced in different spaces of the house.

Traditional medicine emphasizes on the presence of sunlight in the whole space of the house for purity and lightness of air. Based on the above verification, in Tahami house, at least half or one third of living spaces receive natural light. While, in Afrooz house, unbalanced distribution of light has caused the moderation of lighting, and consequently decreased the air quality of bedrooms, kitchen and hall. In addition, this factor should be controlled in the yard as the main source of light to prevent heat and dry weather in hot seasons. In Afrooz house, however, no measures have been considered for this issue except in the outer wall. In contrast, there is a garden in Tahami house that controls this factor in summer by having native trees of Kashan, namely pomegranate tree.



F8. Annual light reception in Afrooz house, Ground floor (Right), First floor (Left)

Conclusion

The most important architectural features of health in terms of air in Kashan houses include variables that can balance the heat and dryness of the air with humidity and coolness and be safe from polluted air outside. Health housing characteristics include optimal location of accommodation (i.e. living in the best area based on urban health indicators), climatic and indigenous design, design for seasonal and daily movement, priority of open and semi-open spaces over closed spaces, connection of closed spaces with open and semi-open spaces, sheltering inside to avoid polluted air, complementary interaction of architecture and nature, balance between the function of space and air and the use of indigenous architectural patterns.

The results of the evaluation of Kashan houses show that traditional houses in Kashan are more efficient in terms of air health than their contemporary counterparts. Designing houses that are dependent on heating and cooling equipment ignores the role of architecture in air conditioning. Placement of openings in a wall, deprivation of open and semi-open spaces with livelihood function, inattention to protect the home

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space from environmental pollutants such as dust and pollutants from industries and the priority of sun exposure over wind in the structure of the site and standing property are the most important causes of inefficiency in Kashan. Ignoring these factors causes stagnation of air in the house or the flow of polluted air in the spaces and warming of the air in the house.

Patterns of health housing in Kashan will be presented by the authors in further articles. These patterns include optimal patterns and corrective patterns for contemporary housing, which include the orientation of blocks and the structure of the site and standing property, the location of housing spaces, the characteristics of each space (living room, bedroom, bathroom, etc.) and the characteristics of architectural elements (walls, stairs and windows).

Remarks

1. Jorjani, in explaining the function of air, says that the air around man is cold in comparison with the temperament of the soul, and when it is inhaled, it reaches an instinctual heat and heats up, and if it is not separated from the soul, the soul goes out of moderation and burns. Whenever that air comes out with the next breath, the fresh air heats up and comforts the soul. So fresh air is very beneficial for the soul. Whenever the movement of air in the heat causes the air to cool, and when it is still, it heats up the skin and improves its quality. This way, the air and the skin become the same in terms of quality because the air is in contact with the human skin. Moreover, since the sense of touch is not able to perceive like itself, whenever the air moves, it touches the skin around it and the fresh air touches the skin, and the skin perceives the quality of the fresh air (Jorjani, 2012: 342). Therefore, airflow - even if it is hot - is necessary for the human health.

2. According to Jorjani, the ceiling of the house should be high and the rooms should face east. The windows should be large and some of them should be opened eastward, so that the sun shines in the morning in the entire living space to soften the air (Jorjani. 2012. 369).

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