

Original Article

The relationship between the Predicted Mean Vote model and Temperament Based on Persian Medicine on the Thermal comfort of aging adults in sanatoriums

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Abstract

Introduction: The aging procedure is an incremental reduction in the human systems, including the heart and respiration, blood vessels, endocrine glands, urinary-genital, and immune systems. This investigation evaluated the association between the Predicted Mean Vote (PMV) and Mizaj based on Persian medicine on thermal comfort of aging in sanatoriums in Mazandaran province in Iran.

Methods: This research was accomplished at Rasht Azad University from June 2022 to December 2023 in sanatoriums of aging adults under actual circumstances. Ninety-six aging adults above 65 years old were included. PMV, weather moister, clothing cover, temperament (Mizaj) based on Persian medicine, and thermal comfort in 4 seasons were considered. Linear regression was used to evaluate the efficiency of the PMV index in estimating the thermal sensation of aging adults according to their Mizaj.

Results: Temperament and sex shows a negative and significant relationship with thermal comfort ($P < 0.05$). The regression model showed that individual characteristics such as temperament and gender affect the thermal comfort score and PMV ($P < 0.05$).

Conclusion: Therefore, to propose the desired coefficients in the correction of PMV values, we consider the effect of people's temperament and gender in the regression model.

Keywords: Temperament, Mizaj, PMV, thermal comfort.

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Introduction

People spend most of their time in indoor spaces; for this reason, various heat and cold indices have been proposed to determine the thermal conditions in indoor spaces, which are influenced by various environmental parameters such as air temperature, radiant temperature, humidity, and airflow speed along with the individual's activity and The price of his clothes is shown as a number, and that number is an indicator and representative of the thermal conditions of the environment and shows the degree of desirability or thermal deterioration of the environment ¹⁻⁴. Considering the diversity of thermal comfort indices, it is necessary to evaluate the effect of the suggested ranges of these indices

on human health, performance, mood, and other aspects and to use an index to determine the thermal conditions, which, in addition to helping to save Energy consumption creates a fluid environment with high productivity ¹⁻².

The aging procedure is an incremental reduction in the human systems, including the heart and respiration, blood vessels, endocrine glands, urinary-genital, and immune systems ¹⁻³. Aging has evolved into a significant global sensation because of the growth in the world's older adults³.

According to Iranian medical origins, temperament is a moderate quality created by the interaction of quadruple elements, including unique dual qualities ⁴⁻⁶. The

diagnosis of temperament is essential in diagnosing health and illnesses in Iranian medicine. Temperament is one of the most critical issues in the foundations of Iranian medicine. It also generates emotional, perceptual, and behavioral differences in individuals. It can instantly influence individuals's convenience ⁷⁻⁸.

Thermal comfort is a situation in which the convenience of the thermal surroundings is supplied for humans ⁹⁻¹¹. The thermal comfort range in Iran has been permanently appointed and established based on foreign information. The question that arises is how Iranians adjust to the surrounding thermal environment, which factors affect the thermal image of their surroundings, and how these elements result in the occupants' adaption to the area they inhabit ¹²⁻¹⁵.

Thermal comfort is influenced not only by climatic characteristics but also by other variables. Determining what other factors influence thermal perception and convenience in weather situations ¹⁶. Recognizing these characteristics can assist in choosing the correct views in the configuration procedure to make compatible behaviors possible ¹²⁻¹⁶.

Various studies have stated the behavioral adaptation of people under the influence of different components. Some circumstances contain climatic details, context-related, psychological, physiological, and social components, and spatial factors influencing thermal comfort ¹⁷⁻¹⁹.

The convenience of the aging adults living in the sanitarium is impressionistic and affected by environmental characteristics and individual distinctions. Aging adults might sense distinct and hotter or more memorable in the same environment but could adjust to it and afford their convenience with more inferior expenses. The outcomes of this research support understanding why individuals have various thermal perceptions under the same circumstances and may be conducted to determine the essential nonenvironmental factors that affect the sensed consistency of healthiness, well-being, and academic performance. Thus, it affects decision-making during the creation and maintenance of sanatorium buildings. This investigation evaluated the association between PMV and Mizaj based on Persian medicine on thermal comfort of aging in sanatoriums in Mazandaran province in Iran.

Methods

This research was accomplished at Rasht Azad University from June 2022 to December 2023 in sanatoriums of aging adults under actual circumstances. PMV, weather moister, clothing cover, temperament based on Persian medicine, and thermal comfort in 4 seasons were

considered. Sanatorium sites were selected from Chalus and Ramsar cities from Mazandaran province, Iran. Overall, 96 people aged 65 years old were studied. All patients with extreme underlying illnesses were excluded. In addition to the thermal responses and the measurement of internal and external physical requirements, individual details of each respondent about determining temperament and thermal perception were collected.

The standard questionnaire was prepared for measuring data. Preferences, thermal sensations, PMV, and behaviors were recorded. A seven-point scale was employed to estimate thermal comfort. In this scale: =-3 it was cold, and +3 was hot. The PMV index is an index to predict the average thermal ratings of people based on a seven-point scale for thermal sensation. Computer software written in BASIC programming language specific to this index is used to calculate these two indexes. For this purpose, the required data is entered into the software, and its output is the number calculated for this index. Accordingly, according to the ASHRAE 55 standard, PMV ranges between -3 and +3. These numbers and values represent the thermal heat people feel inside the space.

The physical variables in this research include environmental parameters, i.e., air temperature (T_a , Goisan temperature, T_g , relative humidity, R_h , and airflow v , which were recorded through a temperature and humidity measuring device and an anemometer in the indoor environment. The tools for measuring environmental conditions are thermometers, hygrometers, data loggers) temperature and humidity, pressure meters, flowmeters, airflow, and laser thermometers of surfaces. The minimum and maximum outdoor temperatures recorded in Chalus City were -0.5 degrees Celsius in winter and +34.20 degrees Celsius in summer, and the minimum and maximum relative humidity outside were 20% and 100%, respectively. The minimum and maximum outdoor temperatures recorded in Ramsar city were 2.4 degrees Celsius in winter and +38 degrees Celsius in summer, and the minimum and maximum relative humidity outside were 10% and 100%, respectively.

A standard Mojahedi Mizaj questionnaire and a traditional medicine expert estimated people's temperaments ⁵.

Statistical analysis

Data analysis was done by SPSS-25 software. A regression model was used to find the relationship between PMV and temperament, sex, and Thermal comfort. The P-value < 0.05 was assumed for statistical significance.

Results

In this study, 54 older adults (56.3%) were female, and 42 older adults (42.7%) were male. Thirty-six older adults from Ramsar City (37.5%) and 60 older adults (62.5%) from Chalus City were included.

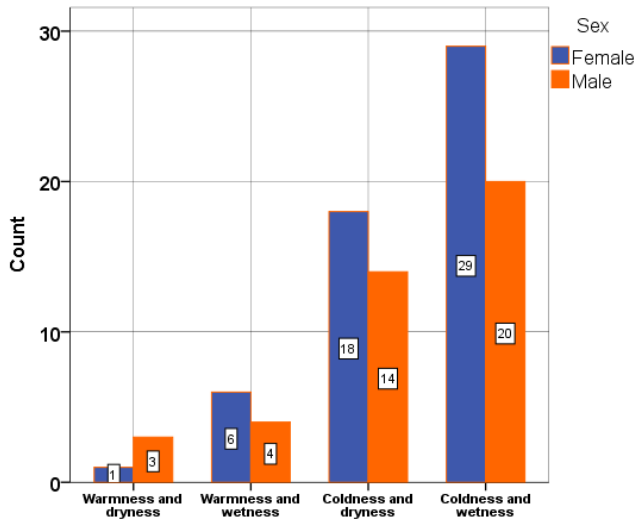


Figure 1. Distribution of study participants by temperament and gender

The average thermal comfort score in the warm-temperated groups was higher than the cold-temperated groups ($P<0.001$). The average score of thermal comfort in the summer season was higher than other seasons in the cold-temperated groups ($P<0.01$). Also, the average score of thermal comfort in summer and autumn seasons was higher than other seasons in warm temperament groups ($P<0.01$) (Fig 2).

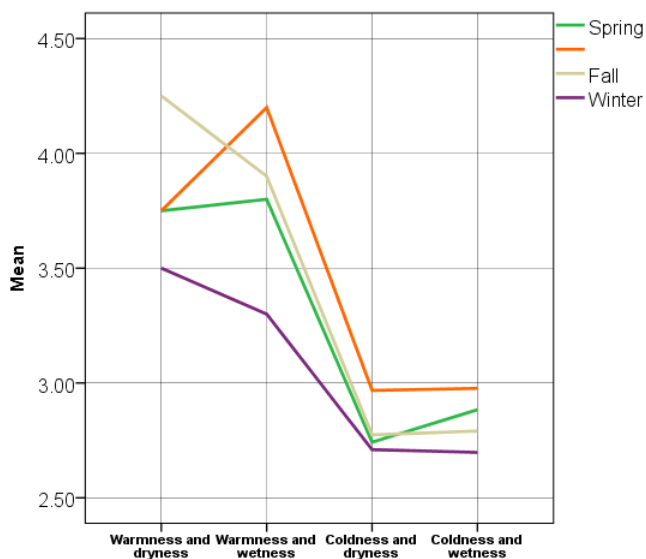


Figure 2. Average thermal comfort in the seasons and temperament of the participants

Table 1 shows the regression analysis of the relationship between thermal comfort and the amount of coverage by considering the temperament variables of gender, season, and city. The regression coefficient is positive and significant, which indicates a direct relationship between the two variables. Also, temperament shows a negative and significant relationship with thermal comfort, which suggests that people with warm medicine had more thermal comfort than people with cold medicine. The relationship between gender and thermal comfort is also significant, which indicates that thermal comfort is higher in men than in women.

Table 1. Regression analysis between thermal comfort and coverage amount

Model	Beta	T statistics	Significantly
Mizaj	-0.259	-5.230	0.000
Sex	0.277	2.662	0.008
Sesaons	-0.0051	-1.472	0.142
City	0.081	0.766	0.444
clothing cover	0.177	2.999	0.003

R=0.426, R square= 0.182

Table 2 shows the regression analysis of the relationship between thermal comfort and thermal sensation, considering the temperament variables of gender, season, and city. The regression coefficient is negative and significant, which indicates an indirect relationship between two variables, and increasing thermal sensation decreases thermal comfort. Also, temperament shows a negative and significant relationship with thermal comfort, which indicates that people with warm medicine had more thermal comfort than people with cold medicine. The relationship between gender and thermal comfort is also significant, which suggests that thermal comfort is higher in men than in women.

Table 2. Regression analysis between thermal comfort and thermal sensation

Model	Beta	T statistics	Significantly
Mizaj	-0.260	-5.478	0.000
Sex	0.286	2.790	0.000
Sesaons	0.009	0.246	0.006
City	0.099	0.956	0.806
Thermal sensation	-0.167	-4.581	0.340

R=0.455, R square= 0.207

To evaluate the efficiency of the PMV index in estimating the thermal sensation of people in the outdoor environment, linear regression was used. The results of linear regression between PMV and perceived thermal ratings show that the slope of the regression line between PMV and thermal comfort is equal to 0.14. This means that people's heat-feeling votes in real conditions are on average 0.14 times the number that PMV shows us. In other words, the PMV index shows the thermal sensation of people in the external environment 7.14 times more intense than what exists. Therefore, it can be said that PMV in current conditions is not considered a suitable indicator for predicting the thermal sensation of people in the outdoor environment.

In the results, it was found that individual characteristics such as temperament and gender affect the thermal comfort score. Therefore, to propose the desired coefficients in the correction of PMV values, we consider the effect of people's temperament and gender in the regression model.

Table 3 shows the regression analysis of the relationship between thermal comfort and airflow preference considering the variables of temperament and gender. The regression coefficient is positive and significant, which indicates a direct relationship between the two variables (Fig 3).

Table 3. Regression analysis between thermal comfort and PMV

Model	Beta	T statistics	Significantly
Constant	3.721	17.458	0.000
Mizaj	-.318	-6.641	0.000
Sex	0.251	3.104	0.000
PMV	0.371	3.700	0.001

R=0.419, R square= 0.176

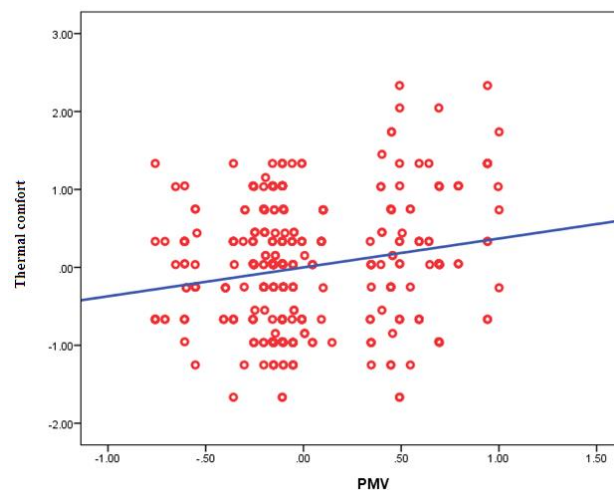


Figure 3. Regression curve between thermal comfort and PMV

Based on the results in table 3, the following formula can be suggested to correct the PMV value according to the temperament factor and gender in the elderly.

$$\text{Thermal comfort} = 0.371 * \text{PMV} - 0.318 * \text{Mizaj} + 0.251 * \text{Sex} + 3.72$$

Discussion

The results showed that the change of clothes was one of the most frequently performed tasks in case of feeling cold and hot in older people. Also, the comparison of women with different temperaments showed that cold-tempered women were consistently more affected by indoor and outdoor air temperatures than warm-tempered women and wore more clothes. Therefore, to propose the desired coefficients in the correction of PMV values, we consider the effect of people's temperament and gender in the regression model. Results show the regression analysis of the relationship between thermal comfort and the amount of coverage by considering the temperament variables of gender, season, and city. The regression coefficient is positive and significant, which indicates a direct relationship between the two variables. Also, temperament shows a negative and significant relationship with thermal comfort, which suggests that people with warm medicine had more thermal comfort than people with cold medicine. The relationship between gender and thermal comfort is also significant, which indicates that thermal comfort is higher in men than in women.

These factors and environmental variables correspond to the main ones examined in the various thermal comfort studies since they represent the basis of the process of the human body with the physical environment to sense thermal circumstances 18-20. Studies showed that personal factors such as age and gender occur more frequently and were utilized as contextual factors of the research when concluding thermal perception 19. A study showed that

gender shows significant main and interaction effects on thermal sensation. The female gender perceived the same thermal environment as significantly colder than their male counterparts, and thermal sensitivity was also systematically higher in women ²⁰. Another study revealed that youths are more sensitive to higher temperatures than adults with comfortable temperatures, and the study showed that children have a distinct thermal perception and that it is essential to adjust the representatives to present the thermal sensation sufficiently ²¹.

The term mental conditions emphasizes the importance of the role of individual differences and the thermal preferences of people ^{22, 23}. In the traditional sciences of Iran, people have different temperaments based on their differences, and the temperament of each person is a set of physical and mental characteristics of each person that can be diagnosed based on the examination of some symptoms and individual factors. This research helped us to know the thermal comfort of individual traits in older people, which led us to understand the patterns of behavior appropriate to the culture and climate of the region.

Conclusion

The results showed that personal characteristics can significantly explain individual differences and differences in behavioral-thermal patterns of people. On the other hand, both thermal sensation and thermal preference can be affected by individual differences. These findings are essential for a better understanding individual differences in people's thermal perception and behavior. Still, along with other studies, they can lay the foundation for the typology of care spaces for older people. This study can be used to improve the behavioral and perceptual models of nursing home residents in building simulation. For example, in modeling based on knowledge of factors, such knowledge makes it possible to recognize individual factors and include them in the simulation process. In addition to the mentioned cases, this research goes a step further and not only introduces principles and methods for introducing Iran's thermal standards but also introduces a new factor called people's personality as a psychological factor affecting thermal perceptions. Thermal comfort studies in the path of achieving thermal standards are also on the psychological needs of people. The expansion of this research and the expansion of data with the results of other experimental and field studies can be a basis for theorizing about the behavioral patterns of the residents, which is used in the simulation of building performance.

Highlights

What Is Already Known?

The suitability of the elderly people living in the sanitarium is impressionistic and influenced by environmental characteristics.

What Does This Study Add?

Personal features can significantly clarify individual differences and differences in behavioral-thermal patterns. Both thermal sensation and thermal preference can be affected by individual differences.

Authors' Contributions

Concepts: Bashir Razi Kazemi, Marzieh Kazemzadeh, Elham Parsa; Data gathering: Bashir Razi Kazemi, Marzieh Kazemzadeh, Elham Parsa; Preparing manuscript: Bashir Razi Kazemi, Marzieh Kazemzadeh, Elham Parsa; Approval the final proof: Bashir Razi Kazemi, Marzieh Kazemzadeh, Elham Parsa.

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None.

Conflicts of Interest Disclosures

We declare there was no conflict of interest.

Consent For Publication

We declare consent for publication.

Ethics approval

Department of Architecture, Rasht Branch, Islamic Azad University approved the proposal of this study.

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