Original research

Palm temperature and core temperature as important indices of temperament

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Abstract: ***Background:*** Although temperament is considered one of the most important principles of traditional medicine, it has always been one of the challenging issues among experts. Therefore, the present study was planned aiming to determine the importance and validity of temperature and anthropometric factors in determining temperament.

Methods: A cross - sectional study was performed on 20 to 25 year old students of Tehran University of Medical Sciences. Initially, using a standard questionnaire temperament of the participants was determined. Then its relationship with central and peripheral temperature, height and weight and body mass index (BMI) was analyzed via correlation test and with the significance level of $p < 0.05$.

Results: 102 students (45.1% male and 54.9% female) were enrolled. Analyses showed the significant correlation of temperament score with core temperature, and skin temperature at the tip of the index finger, palm and wrist as well as anthropometric factors. Among them, temperature of palms (r=79.0, $p < 0.0001$) and core temperature (r=78.0, $p < 0.0001$) had the highest correlation.

Conclusion: The findings of the present study showed that palm temperature and sublingual temperature had a strong correlation with temperament and can be considered as the two main indices used for determining temperament.

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1. Introduction

One of the important factors for diagnosis and treatment in traditional medicine is determining temperament or Mizaj of the individual. Temperament determination, in turn, plays a key role in both health preservation and therapeutic measures (1, 2).

However, temperament determination and factors affecting temperament have always been a matter of debate between the experts. Therefore, considering the new approach to traditional medicine, an urgent need is felt for finding accurate and reliable indices in determining temperament, especially in researches concerning traditional medicine (3, 4).

Traditional medicine practitioners use different methods for determination of temperament, the most important of which is history taking based on traditional medicine references and using Mizaj-related indices (1). However, knowing which Mizaj-related indices are

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more important in determination of temperament has been of great interest in traditional medicine community and is widely discussed and debated. Unfortunately, no organized study has been carried out for answering this question and the answer is still unknown (5).

Mizaj-related indices that are used for determination of temperament include the state of tens of skin (temperature, and skin softness/dryness), body shape (slim/fat), status and color of hair, body color, ratio of body parts, being affected by natures (hot/cold, wet/dry), speed of doing activities, quality of excrements, rate of sleep and being awake, and psycho-mental status (1, 6). However, determining hotness or coldness of temperament cannot be done accurately and quantitatively for use in studies based on these variables, because they are qualitative. Therefore, making efforts to quantify the variables determining temperament seems necessary for a more accurate determination of the individual's temperamental score.

Among these Mizaj-related indices, temperature variables and anthropometry indices can be easily quantified. Therefore, in this study we tried to evaluate the importance and validity of these variables in determination of temperament.

2. Method

The present study is a cross-sectional study that was carried out on 20 – 25 year old healthy, single, male and female students who lived in the dormitory and followed the food regimen of Tehran University of Medical Sciences. The participants were selected during December and January 2010 via simple randomized sampling and were included if they did not have a chronic disease, weren't taking any long-term medication and did not take medication throughout the study period. In addition, if symptoms such as constipation, bloating or any other gastrointestinal problems were present, the participant was excluded. Moreover, to make sure that the participants were healthy, routine tests (CBC, FBS, BUN, Creatinine, Lipid profile, Bilirubin) were done and if any of the test results was not normal, the individual was excluded.

Temperament score of each person was determined using a questionnaire designed by the researchers of this study. The questionnaire was designed based on traditional medicine books and its validity was approved by the professors of faculty of traditional medicine. The questionnaire was filled for 10 samples and its Cronbach's alpha coefficient was calculated to be 0.77.

Questionnaire of temperament includes 38 questions that contain temperament-determining factors. Based on the answer the participant gives, a score between 1 and 7 is given to each question. Thus, the total score could be a number between 38 and 266. The closer the score was to 38, the colder the temperament was and the closer it was to 266, the hotter the temperament of the participant. Additionally, questions regarding demographic data, age, sex, and ethnicity of the participants were also asked using the questionnaire.

15 ml fasting venous blood sample was drawn from each participant to evaluate their blood parameters including CBC, ESR, FBS, triglyceride, cholesterol, BUN, creatinine, and bilirubin. It should be noted that the participants were fasting for 10 hours before blood drawing and all blood drawings were done between 7:30 and 8:30 AM in December and January.

Temperature measurements were done between 1 and 4 PM in a room with the temperature of 25°C. The participants would rest for 15 minutes in the room at a seated position and after filling the questionnaire and determination of temperament, the skin temperature of the tip of their index finger, palm of the hand, and wrist were measured using a digital thermometer and recorded. Core temperature of the body was also measured via sublingual temperature using a mercury thermometer and putting it under the participant's tongue for 2 minutes. The participants had avoided eating and drinking for at least 30 minutes before measurement of sublingual temperature.

Using a digital scale with 500 g error and a digital height gauge with 0.1 cm accuracy, weight and height were measured and recorded. When determining height, the participants were standing straight without their shoes and their knees were completely straight and their head was facing forward. In determining the weight, they were evaluated wearing minimum clothes possible and no shoes, then their body mass index (BMI) was calculated using this formula: BMI=Weight/Height2.

The strategy used for determining sample size to carry out this study was based on evaluation of the correlation (correlation coefficient) of temperament score with skin temperature, core temperature and anthropometric indices. In the initial assessment of this study, the lowest correlation coefficient of the studied factors with temperament score was calculated to be 0.41, which belonged to BMI. Therefore, to evaluate the significant difference of this correlation coefficient with 0 at the level of 95% confidence interval (α=5%) with 90% power of study (β=10%), sample size of 90 participants is proper for doing the study.

To determine the correlation of temperament with different variables, correlation test was applied. Power of significance was also reported with correlation coefficient (r) and level of significance was considered to be $p < 0.05$. To evaluate the effect of confounding factors such as sex, ethnicity and age, initially a bivariate analysis was performed between the confounding factor and

Table 1: Demographic data of the studied participants

Variable		Number	Percent	Mean ± SD of age	Mean ± SD of temperament score
Sex	Male	46	45.1	22.8±1.7	166.1±16.7
	Female	56	54.9	22.1±1.7	156.6±15.4
Ethnicity	Persian	68	66.7	22.3±1.7	161.5±16.9
	Turk	21	20.6	23.2±1.5	160.1±16.2
	Kurd	11	10.8	22.2±1.6	160.6±19.4
	Lur	2	1.9	22.5±1.7	161.0±16.8

SD: standard deviation.

Table 2: Demographic data of the studied participants

Factor	R	p	Adjusted R	p
Core temperature (degree of Celsius)	0.77	<0.0001	0.78	<0.0001
Skin temperature (index finger)	0.75	<0.0001	0.75	<0.0001
Skin temperature (palm)	0.81	<0.0001	0.79	<0.0001
Skin temperature (wrist)	0.67	<0.0001	0.62	<0.0001
Difference of core temperature with and palm skin temperature	-0.70	<0.0001	-0.65	<0.0001
Difference of core temperature with and index finger skin temperature	-0.61	<0.0001	-0.61	<0.0001
Difference of core temperature with and wrist skin temperature	-0.49	<0.0001	-0.44	<0.0001
Height (cm)	0.74	<0.0001	0.70	<0.0001
Weight (kg)	0.43	<0.0001	0.38	<0.0001
body mass index (kg/m^2)	-0.30	0.002	-0.31	0.002

All analyses have been adjusted for sex.

temperament score, any of the confounding factors that showed a significant relationship with temperament score was entered to the model and by doing a partial correlation analysis all analyses were adjusted for the intended factor. For this purpose, to assess the effect of sex and ethnicity on temperament score, Kruskal Wallis test was used and for evaluating the effect of age, Spearman test was applied.

3. Result

In the present study, 102 female (54.9%) and male (45.1%) students studying in Tehran University of Medical Sciences with the mean age of 22.5±1.7 years were evaluated. All the participants were single, healthy, and non-smokers and did not have any history of chronic disease or long-term use of medication (Table 1).

The range of temperament scores for the participants was 122 to 201 with the mean score of 160.9. Mean and standard deviation of temperament score based on sex was 156.6± 15.4 for women and 166.1±16.7 for men, showing that mean score in men was higher than women (p = 0.004).

Bivariate correlation test showed that ethnicity (p=0.8) and age (p=0.6) did not correlate with temperament, but sex (p=0.003) had a significant correlation with temperament score. Therefore, in all analyses, sex was entered to the analyses as a confounding factor and thus, the effect of sex on the correlation of temperament score with the studied parameters was adjusted for all analyses.

In addition, bivariate correlation test showed that with increase in temperament score (indicating hotter temperament) core temperature of the body (p<0.0001 and r=0.77), and skin temperature in palms (p<0.0001 and r=0.81), tip of the index finger (p<0.0001 and r=0.75) and wrist (p<0.0001 and r=0.67) increase. However, temperament score showed a reversed and significant correlation between the difference of these 2 temperatures in palms of the hand (p<0.0001 and r=-0.70), index finger (p<0.0001 and r=-0.61) and wrist (p<0.0001 and r=-0.49) (Table 2).

Additionally, in multivariate correlation test the correlation between core temperature and skin temperature was significant. Temperament score had a significant and direct correlation with core temperature (p<0.0001 and r=0.78), and skin temperature in palms of the hand

(p<0.0001 and r=0.79), tip of the index finger (p<0.0001 and r=0.75), and wrist (p<0.0001 and r=0.62). The data in this regard is presented and summarized in table 2. In addition, temperament score also correlated with the difference between core temperature and skin temperature in palms of the hand (p<0.0001 and r=0.65), tip of the index finger (p<0.0001 and r=0.61), and wrist (p<0.0001 and r=0.44). Anthropometric factors that were evaluated in this study included height, weight and BMI, and bivariate correlation test showed that all 3 of these factors have a significant correlation with temperament score. Height (p<0.0001 and r=0.74) and weight (p<0.0001 and r=0.43) had a direct correlation with temperament score, while BMI (p=0.002 and r=-0.30) had a reversed correlation with it.

After entering sex to the model and evaluating the correlation of anthropometric factors with temperament score, all of the 3 mentioned factors showed a significant correlation with temperament score and still the correlation of height (p<0.0001 and r=0.70) and (p<0.0001 and r=0.38) with temperament score was direct, while it was reversed regarding BMI (p=0.002 and r=-0.31). Therefore, it can be stated that with increase in temperament score, height and weight increase, while BMI decreases.

4. Discussion

Based on the findings of this study, temperament can affect physiological factors as an independent factor and therefore, core temperature, skin temperature and anthropometric factors had a significant correlation with temperament. In addition, the researchers of the present study defined a new factor called the difference between core temperature and skin temperature and it was shown that in addition to core and skin temperatures, their difference also varies between different temperaments. Thus, core temperature, skin temperature and the difference of these factors can be used for determining the temperament of the individuals.

Findings of the present study showed that with the temperament getting hotter, skin temperature and core temperature rise. In line with this findings, traditional medicine references express that individuals with hot temperament have warmer skin compared to those with a cold temperament (1, 6, 7). In addition, the difference between core temperature and skin temperature has a reversed correlation with hotness of temperament, which means that this difference is lower in those with hot temperament compared to individuals with a cold temperament. Therefore, it can be said that those with hot temperament experience a higher core temperature due to high metabolic activity but excrete a smaller portion of this temperature. Thus, the difference between core and skin temperatures and its correlation with temperament score showed that metabolic activities of individuals with cold and hot temperaments have different patterns. In the search done, no study that evaluated the correlation of skin and core temperature with temperament score was seen/found.

Additionally, in the present study height, weight, and BMI also had a significant correlation with temperament score. Among these 3 factors, height with the correlation coefficient of r=0.70 showed a much stronger correlation compared to the other 2 factors. Moreover, the correlation of height and weight with temperament score was direct, while the correlation of BMI with temperament is a reversed one.

Since BMI correlates with wetness of temperament (6, 7), the correlation being weak in this factor is due to the present study only evaluating coldness and hotness of temperament and not wetness of temperament. For this reason, BMI has a weak correlation with temperament score. For evaluating the correlation of BMI with temperament, future studies should also evaluate dryness and wetness of temperament.

The reason for the correlation between temperament and BMI being reversed is that temperament score has a much stronger correlation with height (r=0.74) compared to weight (r=0.43) and since in the formula for calculating BMI weight in kilograms is divided by height in meter squared, therefore this ratio will be higher in those with a cold temperament compared to those with a hot temperament. For the same reason it can be said that individuals with hot temperament are taller and slimmer than those with cold temperament, which has led to this factor being significant even in evaluating coldness and hotness of temperament. Consequently, it could be hypothesized that due to high biological activities in individuals with hot temperament, growth in this group is higher than those with cold temperament. This is why as temperament gets hotter, height and weight also increase.

In line with or in contrast to the findings of the present study, the following researches can be pointed out: in a prospective cohort Puttonen et al. studied the correlation of Cloninger temperament with some physiological factors and showed that when the individual's temperament leans towards danger avoiding temperament (linked with cold and wet temperament), BMI increases (8). However, Hintsanena et al. showed that individuals who have a reward-dependent temperament (linked with cold and dry temperament) and seeker temperament (linked with hot and wet temperament) have a higher BMI, while avoiding temperament has a reversed correlation with BMI (9). Presence of such contradictions is due to the differences in the type of study carried out. Since Puttonen et al. study is a prospective one with a large sample size it is more reliable than the other

study. The study by Puttonen et al. is in line with the findings of the present study and it can be concluded that BMI decreases with temperament becoming hotter. Yet, referring to traditional medicine references and the weak correlation of BMI with the cold-hot spectrum of temperament, it can be expressed that BMI has a strong correlation with dryness and wetness of temperament.

5. Limitations:

In the end, it should be noted that in Iranian traditional medicine, temperament has two axes of coldness-hotness and wetness-dryness (10). In this study, which is the first one to evaluate the correlation of temperament with the mentioned parameters, to make things simple and reduce the confounding factors to a minimum, only coldness and hotness of temperament were evaluated. The lack of correlation between some factors and temperament in this study are due to the fact that the correlation of these factors was only evaluated with the coldness-hotness axis. Therefore, for future studies it is suggested to evaluate the correlation of physiological factors with the wetness-dryness axis of temperament as well as the correlation of these factors with compound temperaments.

6. Conclusion:

The present study showed that physiological factors have a strong correlation with temperament score. Therefore, by measuring physiological factors and identifying the natural range of these factors in different temperaments, it is possible that these indices could be used for temperament determination in individuals. For this purpose, extensive studies with large sample size are required.

7. Acknowledgment

None.

8. Conflict of interest

No conflict of interest was declared.

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10. Author contribution

MY, MP and MK designed the study. MH analyzed the data. MY, ME, and MC participated in data collection. MY wrote the paper. All authors critically revised the manuscript and approved final version of the paper to be published. They agreed to be accountable for all aspects of the work.

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