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Relationship between Temperament (Mizaj) and Metabolic Parameters in a Healthy Adult Population: A Cross-sectional Study

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Abstract

Background: Temperament is a critical concept in Persian Medicine (PM) school, and its determinants independently affect human metabolism.
Objectives: The present study investigated the potential relationship between PM-based temperament and metabolic parameters.
Methods: This cross-sectional study was carried out at the PERSIAN Organizational Cohort Study at Mashhad University of Medical Sciences Research Center, Imam Reza Hospital, Mashhad, Iran. The participants temperament, physical activity, and dietary intakes were assessed through valid questionnaires. Anthropometric indices were measured by bioelectrical impedance analysis, and energy expenditure components were evaluated using indirect calorimetry.
Results: A total of 334 individuals entered the study. Cold-tempered participants were similar to the warm-tempered in terms of age, sex, general physical activities, and environmental conditions. Warm-tempered participants had lower intakes of spices (P=0.01). Moreover, warm-tempered subjects had more muscle mass (P=0.008) and body water (P=0.007). Finally, the lower metabolic rate in cold-tempered participants was not significant (resting energy expenditure=1468±337 vs. 1519±366 Kcal/day, for cold and warm-tempered subjects, respectively)
Conclusion: Findings of the present study supported the potential relationship between PM-based temperaments and dietary intakes, anthropometric indices, and metabolic parameters. However, further large-population-based studies are required to find the exact mechanisms and interrelations between modern nutrition propositions and PM concepts.

Keywords: Fat-free mass, Fat mass, Metabolism, Persian medicine, Resting energy metabolism, Temperament

1. Background

Different mental and physical characteristics of healthy adults, as well as wide normal ranges and variations of anthropometric indices and paraclinical test results, are extensively presented and accepted in modern medicine (1-3). Personalized medicine has been of particular interest in recent years, considering the inter-individual differences in the state of health and illness and response to treatments (4). Persian Medicine (PM) has been developed based on an individualized approach regarding the fundamental concept of "temperament" (Mizaj) (5). From the PM point of view, hypochondria, phlegm, bile, and sanguine are the four humors, and the interaction between their functions leads to various individualized temperamental statuses (6). According to PM valid and reliable sources, temperament as a fundamental concept should be determined considering physical and psychological phenotypical manifestations (5). Some temperament determinators are age, gender, fat and lean body mass, body size, climate, and dietary patterns (5) .

In traditional medicine, temperament is considered the most important element in maintaining health and treating diseases. Any advice to modify the lifestyle should be given after diagnosing the temperament, and also, to treat any disease, the patient temperament must be determined first (5-7).

For example, warm-tempered individuals have higher rates of lean body mass and body surface (especially in the chest and joint areas) (7, 8). Additionally, younger age, being male, and living in tropical climates are associated with warm temperaments (9). These determinants could be interpreted under some historical and physical exam-related indices, including hair, skin (touch and color), soft tissue, physique (body dimensions), physical and physiological functions, quality of stool, urine, and sweat, and sleeping habits (5).

Furthermore, the temperament determinants are regarded as major independent factors affecting the basal metabolic rate (BMR) values in different individuals (10). The BMR plays a key role in individualized nutritional management to promote health and treat disease in modern clinical nutrition (11) .

Although many efforts have been made to find the potential associations and correlations between the PM concepts and scientific propositions of modern medicine in recent years, there is still a lack of evidence in this field due to the vast scope and existence of a limited history of scientific approach tothe Persian school of traditional medicine in medical universities (6, 12-19) .

2. Objectives

The current study aimed to investigate the potential relationship between temperament and metabolic parameters in a healthy adult population.

3. Methods

3.1. Study Design and Setting

This prospective cross-sectional study was conducted from August 2018 to December 2020 at the PERSIAN Organizational Cohort Study at Mashhad University of Medical Sciences (POCM) Research Center, Imam Reza Hospital, Mashhad, Iran.

3.2. Study Population

The participants were selected as a subgroup of the POCM volunteers to enter the study (20) . The inclusion criteria comprised healthy individuals aged 20-40 years. The participants lived in Mashhad, Iran, and were invited through a telephone call. The exclusion criteria consisted of a history of diagnosis of any diseases, chronic and continuous use of medications, presence of clinical symptoms in history or physical examination, suspicion of clinical situations of hyperlipidemia, diabetes mellitus, hypertension, cardiovascular diseases, thyroid function disorders, neuropsychological disorders, menstruation, pregnancy, and withdrawal from voluntary cooperation. A detailed explanation of the study aims and protocol was presented to the eligible subjects who entered the study.

3.3. Assessment of Temperament and Dietary Intakes

The participants temperament was determined using a valid and reliable 8-item self-administered questionnaire to detect whether the individuals temperament was warm, moderate, or cold (5) . This self-reported “Mojahedi’s Mizaj Questionnaire” was designed and validated by Mojahedi et al. in 2014, determining hotness-coldness ranging from 8 to 24 (hot ≥ 19 and cold ≤14) (5) .

Dietary intakes were recorded through the Willet format of the food frequency questionnaire (FFQ) [over 1 year] (21) . The FFQ was validated in the Iranian population in PERSIAN Cohort Study (22) . Moreover, the evaluation of physical activity was performed using the International Physical Activity Questionnaire (23) .

3.4. Anthropometric Measurements

Anthropometric indices, including height (cm) and weight (kg), were measured by an expert operator. The participants’ height measurements were taken by a stadiometer in the standing position to the nearest 0.1 cm (24) . Furthermore, body composition analyses were measured through bioelectrical impedance analysis (Inbody 770, Inbody Corporation, Seoul, Korea).

3.5. Metabolic Parameters Measurements

Energy expenditure components, including resting energy expenditure/resting metabolic rate (REE/RMR), respiratory quotient (RQ), and substrate utilization were measured through indirect calorimetry (IC) following 12 h fasting in a quiet temperature-regulated room using MetaLyzer 3B-R3 device. All participants were asked to stay motionless and awake in a supine position during the test.

3.6. Sample Size Estimation

Regarding the prevalence of warm temperament in the Iranian population (29%) (5) and assuming an alpha of 0.05 and an accuracy of 0.1, at least 77 people with warm temperament were needed for the present study. Therefore, after considering a probable dropout of 0.2, a final sample size of 313 participants was estimated to be necessary for this research.

$$N = \frac{(Z_1 - \frac{\alpha}{2})^2 \times p \times q}{d^2}$$

3.7. Ethics

Written consent was obtained from all participants. The Ethics Committee of Mashhad University of Medical Sciences (MUMS) reviewed and approved the study protocol. All study stages, such as the design of the study and data collection, analysis, interpretation of data, and writing the manuscript, were undertaken under the Ethics Committee supervision.

3.8. Statistical analysis

The statistical data analysis was performed using SPSS software (version 20). A p-value less than 0.05 was considered statistically significant. Moreover, the confidence interval was considered as 95%.

4. Results

A total of 334 eligible volunteers entered the study, of whom 153 individuals were male. Around 103, 70, and 161 participants had a warm, cold, and moderate temper, respectively. No significant difference in temperament between male and female participants was observed (Table 1).

The statistical analysis of the obtained data on dietary intakes showed that cold-tempered

Table 1. Temperaments of the participants

Sex Temperament	Total (N=334)	Male (N=153)	Female (N=181)	P-value*
Cold	70 (21.0%)	25 (35.7%)	45 (64.3%)	0.099
Moderate	161 (48.2%)	82 (50.9%)	79 (49.1%)	
Warm	103 (30.8%)	46 (44.7%)	57 (55.3%)	

Values represented as N (%)
* Analysis was carried out by Chi-square test

Table 2. Dietary intakes and physical activities of the participantss

Temperament Variable		Cold s (N=70)	Moderate (N=161)	Warm (N=103)	P-value
Dietary intakes (kcal/day)	Bread and Cereals	979 ± 830	997 ± 526	990 ± 631	0.979
	Beans	67 ± 52	71 ± 54	68 ± 58	0.863
	Meat and Products	473 ± 301	463 ± 291	539 ± 370	0.152
	Milk and Dairy	323 ± 190	329 ± 148	352 ± 229	0.510
	Fruit	277 ± 153	308 ± 201	321 ± 205	0.323
	Vegetable	158 ± 85	150 ± 69	147 ± 73	0.652
	Sugar	116 ± 96	125 ± 164	125 ± 160	0.911
	Oil and Oilseeds	334 ± 156	318 ± 186	309 ± 159	0.634
	Spices	0.7 ± 1.0	0.4 ± 0.6	0.5 ± 1.1	**0.018**
	Miscellaneous	342 ± 418	314 ± 387	318 ± 311	0.862
Physical Activity (hours/day)	Night Sleep	6.2 ± 1.0	6.3 ± 1.0	6.3 ± 1.0	0.871
	Midday Sleep	0.9 ± 0.7	1.1 ± 0.8	0.9 ± 0.7	0.192
	Rest	0.2 ± 0.4	0.2 ± 0.4	0.2 ± 0.4	0.432
	TV	1.5 ± 0.9	1.5 ± 1.0	1.5 ± 1.0	0.792
	Study	0.9 ± 0.8	0.7 ± 0.7	1.0 ± 1.2	**0.038**
	Desk Work	1.5 ± 1.7	1.3 ± 1.6	1.6 ± 1.8	0.417
	Computer Work	2.9 ± 2.4	3.1 ± 2.5	3.0 ± 2.3	0.903
	Eating	3.3 ± 1.1	3.1 ± 1.2	3.1 ± 1.1	0.266
	Cooking	2.1 ± 1.6	1.9 ± 1.4	2.0 ± 1.5	0.544
	Driving	1.2 ± 1.5	1.2 ± 1.0	1.3 ± 1.2	0.597
	House Cleaning	0.7 ± 0.9	0.6 ± 0.7	0.6 ± 0.8	0.438
	Sale	0.0 ± 0.1	0.0 ± 0.2	0.0 ± 0.2	0.462
	Walking	1.9 ± 1.3	2.3 ± 1.4	1.7 ± 1.3	**0.011**
	Aerobic Exercise	0.2 ± 0.3	0.2 ± 0.3	0.2 ± 0.3	0.255
	Heavy Exercise	0.0 ± 0.0	0.0 ± 0.1	0.1 ± 0.4	0.247
	Carry Light Objects	0.3 ± 0.4	0.4 ± 0.5	0.4 ± 0.5	0.749
	Light Agriculture	0.0 ± 0.1	0.0 ± 0.1	0.0 ± 0.1	0.403

Values represented as mean ± SD
*Analysis was carried out by one-way analysis of variance (ANOVA)

participants used higher amounts of pepper and spicy foods, followed by warm and moderate-tempered subjects, respectively (0.7±1.0, 0.5±1.1, and 0.4±0.6 gr/day for cold, warm and moderate tempered participants, respectively; P=0.01). However, there was no significant difference between warm, moderate, and cold-tempered participants in the intake of bread and cereals, beans, meat, milk and dairy products, oil, fruits, vegetables, and sugar. Table 2 depicts the dietary intakes and physical activities of the participants.

Comparison of physical activities between the studied groups showed that individuals with warm temperaments had significantly higher study and lower walking activities during the day than the colds (P=0.03, and 0.01, respectively, for studying and walking).

The results of the bioelectrical impedance analysis indicated significantly higher height, more weight, body water, minerals, protein, and muscle mass in warm-tempered participants (P=0.01 for all mentioned variables). Body composition parameters of the three studied groups are shown in Table 3. As shown, after adjusting anthropometric indices results for the participants gender, all the mentioned variables were significantly different between warm-tempered and cold-tempered groups except for the height.

Finally, the metabolic parameters measured by IC were provided for the studied population.

No significant difference between the groups regarding REE, RQ, and substrate utilization was observed (Table 4).

Table 3. Body Composition of the participants

Temperament Variable	Cold (N=70)	Moderate (N=161)	Warm (N=103)	P-value*	β (95% CI)	P-value**
Height (cm)	163 ± 9.6	167 ± 9.0	165 ± 9.4	**0.018**	0.027 (-0.006 to 0.06)	0.108
Weight (kg)	65 ± 9.3	69 ± 10.0	69 ± 9.7	**0.011**	0.038 (0.007 to 0.069)	**0.016**
BMI (kg/m²)	25 ± 2.4	25 ± 2.4	25 ± 2.1	0.224	0.117 (-0.015 to 0.249)	0.082
TBW (liter)	32 ± 6.6	35 ± 7.1	35 ± 7.3	**0.010**	0.057 (0.015 to 0.1)	**0.008**
Protein (kg)	8.6 ± 1.8	9.5 ± 1.9	9.3 ± 2.0	**0.010**	0.214 (0.059 to 0.368)	**0.007**
Mineral (kg)	3.0 ± 0.6	3.3 ± 0.6	3.3 ± 0.7	**0.014**	0.623 (0.148 to 1.098)	**0.010**
Fat Mass (kg)	21 ± 5.2	21 ± 5.5	21 ± 4.8	0.988	-0.011 (-0.07 to 0.047)	0.706
Muscle Mass (kg)	24 ± 5.5	27 ± 5.9	26 ± 6.1	**0.010**	0.071 (0.019 to 0.122)	**0.007**

Values are represented as mean ± SD
*Analysis was carried out by one-way analysis of variance (ANOVA)
**Univariate variance analysis
Abbreviations: BMI: Body Mass Index, Kg: Kilogram

Table 4. Metabolic parameters of the three groups

Variables	Cold (N=70)	Moderate (N=161)	Warm (N=103)	P-value
REE (Kcal/day)	1468 ± 337	1437 ± 329	1519 ± 366	0.170
RQ	0.87 ± 0.06	0.87 ± 0.09	0.88 ± 0.06	0.785
Carbohydrate utilization (Kcal)	203 ± 76	193 ± 85	212 ± 85	0.188
Fat utilization (Kcal)	61 ± 26	63 ± 23	60 ± 27	0.723
Protein utilization (Kcal)	16.5 ± 3.8	16.2 ± 3.7	16.8 ± 4.2	0.376

Abbreviations: REE: Resting Energy Expenditure, RQ: Respiratory Quotient
Values represented as mean ± SD
Analysis was carried out by one-way analysis of variance (ANOVA)

5. Discussion

In the traditional PM school, the difference between people with hot and cold temperaments affects different physical, mental, psychological, and social dimensions of an individual life. In the present study, the effect of temperament differences on several indicators were represented.

Based on the current research findings, Total body water (TBW) was higher in warm-tempered individuals compared to cold-tempered people. In this regard, it should be noted that wet temperament is an indicator related to obesity. Since in this study, hotness and coldness of temperament have been investigated, the higher index can indicate that maybe warm-tempered subjects selected for this study were more humid than the cold ones.

The results of the present study showed that warm-tempered participants had a lower intake of spices. According to valid PM references, warm-tempered individuals would suffer from spicy foods, which is consistent with our results, indicating the difference in eating habits between the two studied warm-tempered and cold-temoered groups (9) .

Three components determine the body total energy expenditure, including BMR, the thermic effect of food (TEF), and activity thermogenesis (10). The BMR, the main component comprising 60-70% of the TEF, which depends on some determinant factors including sex, age, body composition, body surface, and environmental situation, as well as health/disease condition, may have associations with the concept of temperament in PM school (25). The PM is a holistic medical school in which temperament is considered a key component in health maintenance and physiopathology of different diseases (9, 26). We investigated the potential relationship between temperament and metabolism indicators, including BMR, RQ, and nutrient utilization in a healthy adult population.

The descriptive review carried out through modern nutrition science and PM references shows that warm-tempered individuals may have higher BMR (25). Although the Body Mass Index of the study participants was statistically similar, there were significant differences in anthropometric indices between warm-tempered and cold-tempered subjects; warm-tempered individuals had more weight, body water, minerals, protein, and muscle mass. These findings were consistent with PM references that reported higher ratios of fat-free mass in warm-tempered individuals (7, 9, 25). Accordingly, cold-tempered people may have more fat and water in their bodies. Fat tissue is considered the primary determinant of coldness from the PM viewpoint (9, 26). Consistently, Mohammadi Farsani G et al. reported that cold-tempered adults had higher percentages of body fat (15).

According to the obtained data, cold tempered individuals were similar to the warm-tempered in terms of age, sex, and general physical activities and environmental condition. Therefore, the cold-tempered participants should have lower REEs compared to warm-tempered, followed by lower ratios of muscle mass (due to higher metabolic demands of muscular cells). However, the difference between them was not statistically significant. Moreover, the differences between the studied groups in other metabolic parameters, including RQ

and substrate utilization, were also not significant.

It is clear that in some indicators such as physical activity, the evaluation criterion of this study is only the use of approved questionnaires and this type of evaluation can have many biases and this is one of the limitations of this study, which is suggested in future studies with these items should be evaluated more accurately.

As REE fluctuations may lead to deteriorated clinical conditions in health and disease status and given the relationship between REE and PM-based temperaments, it seems that individualized lifestyle management and modification based on integrated modern nutrition and PM instructions is of particular importance. Further integrated interventional studies are needed to investigate the efficacy of merged preventive and therapeutic strategies in various study populations.

Considering validation study of the temperament questionnaire, the present research included only 20–40-year-old healthy individuals living in Mashhad, Iran, which could be a probable reason for non-significancy of the metabolic parameters differences between studied groups. Additionally, a single tool with acceptable specificity was used for determining the participants temperament; however, its sensitivity was reported to be low (5) . Therefore, further multi-center large population-based studies are required to investigate the exact relationships between the concept of temperament and metabolism. This study was the first step in incorporating PM design and modern nutrition-based lifestyle interventions to improve metabolic responses in different populations.

6. Conclusion

Muscle mass accumulation was associated with temperament warmness. In addition, warm-tempered individuals have higher amounts of lean body mass. Furthermore, PM-based temperament has relationships with metabolic parameters (e.g., REE and substrate utilization). However, further larger population-based studies are required to investigate the exact relationships between temperament from the PM viewpoint and metabolism in different age groups, sexes, physical activity levels, and climates, as well as health statuses and different disease situations.

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Footnotes

Conflicts of Interest: The authors declare that they have no conflicts of interest.

List of abbreviations: Basal Metabolic Rate (BMR)
Food Frequency Questionnaire (FFQ)
Indirect Calorimetry (IC)
Kilogram (Kg)
Persian Medicine (PM)
PERSIAN Organizational Cohort Study in Mashhad University of Medical Sciences (POCM)
Resting Energy Expenditure (RMR)
Respiratory Quotient (RQ)
Footnotes

Ethics Approval and Consent to Participate: Written consent was obtained from all participants. The Ethics Committee of MUMS reviewed and approved the study protocol (Ethical Reference Code: IR.MUMS.REC.1397.144). All study stages, such as the study design and data collection, analysis, interpretation of data, and manuscript writing, were undertaken under the Ethics Committee supervision.

Consent for Publication: Not applicable.

Availability of Data and Materials: The datasets used and analyzed during the current study are available from the corresponding author upon reasonable request.

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Authors Contributions: MZ, MM, and FR were involved in the study design. FR, MZ, and SE contributed in the data collection. FR and MZ analyzed the data. MZ, FR, MM[4,] and MM[1] interpreted the data. All authors read and approved the final manuscript.

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