The relationship between nutritional facts and temperament of selected Iranians' frequent food items: a summative content analysis study

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Abstract

Introduction: Dietary intake is considered as a major determinant factor in health maintenance as well as primary and secondary prevention of diseases. The knowledge on the relationship between food nutritional facts and their temperament (Mizaj) can be helpful in the integrative Iranian medicine and modern nutrition approach to individualized diet planning.

Material and methods: This study was carried out in three phases using a summative content analysis method: 1) Extraction of the Iranians' frequent food items through an academic discussion panel of nutritionists and MDs, PhDs of Iranian medicine; 2) Determination of the extracted food items' temperament and nutritional facts; 3) Statistical analysis of the extracted data using SPSS software.

Results: Foods with warm temperament had higher mean levels of energy and polyunsaturated fatty acids as well as iron, zinc, and manganese. On the other hand, the mean values of total fatty acids, cholesterol, vitamin B_{12}, and retinol were significantly higher in wet temperament foods. Additionally, the dryness of food items had a positive significant association with total carbohydrates, fiber, vitamin B_6, calcium, iron, magnesium, potassium, copper, and manganese. Finally, wet foods had higher amounts of moisture and vitamin A.

Conclusions: The results of the present study revealed that warmness of food items is associated with higher amounts of macronutrients as well as cell growth and proliferation related micronutrients. Moreover, foods with dry temperament had higher amounts of minerals. Further studies, especially food analytical studies, are required to validate the accuracy of aforementioned findings.

Key words: dietary intakes, nutritional facts, temperaments, traditional Iranian medicine, statistical analysis, analysis study.

Introduction

Dietary intakes affect the physiology of the body and different foods have various effects on the organ functions. Dietary intakes and patterns are important determinants for maintaining health and disease prevention [1, 2]. Previous studies have reported that an appropriate healthy diet can prevent, control, and treat some chronic non-communicable diseases such as diabetes, hypertension, dyslipidemia, cardiovascular diseases, and cancer. Additionally, it can improve the immune system, reducing the risk of viral, bacterial, and fungal diseases [1, 2].

In modern medicine, nutrients and bioactive components of the food item determine the nutritional value of foods and their effects on the human body. Major parameters including moisture content, ash, energy, macronutrients (carbohydrates, proteins, and fats), and micronutrients (water-soluble vitamins, fat-soluble vitamins, and minerals) are considered in routine diet planning [3–5]. In recent decades, modern nutrition has been shifted towards a personalized diet planning approach to have the best positive health benefits from dietary intakes in healthy individuals as well as patients [2].

In philosophers' opinion, maintaining health and disease treatment with appropriate foods and drinks is essential. Food is the primary substance of metabolism producing four humors (blood, yellow bile, phlegm, and black bile) [6–8]. The quality and quantity of consumed food has a direct effect on the produced humor and most diseases are caused by lack of attention to healthy diet and lifestyle by people [3–5, 7, 8]. Mohammad Zakaria Razi said: "whenever you can use food for treatment, do not use drugs" [7]. The mentioned narration is considered as a major determinant point of view in the medical management of healthy subjects as well as patients in the traditional philosophic approach [7].

From the philosophers' point of view, an individualized nutrition program is recommended for each person according to his/her characteristics such as age, season, gender, weather, occupation, climate, and gastrointestinal tract function and considering food properties including temperament [9, 10]. Four major temperaments of food items include warm, cold, wet, and dry. Identification of the food temperament is based on comparative (comparison with other foods in terms of color, taste, smell, etc.) and experimental (observation effects of food consumption by animals or humans under certain conditions or accidentally) models. Moreover, foods are divided into three degrees in each of the four temperaments based on the severity of their induced effect on the organ functions as well as the whole body physiology [9–14].

A comprehensive and integrated approach to individualized diet planning may lead to greater beneficial effects of dietary intake. Therefore, we investigated the probable relationships between temperament and nutritional facts of Iranians' frequent foods in the present study.

Material and methods

This study was carried out in three phases using the summative content analysis method during September-November 2019.

Extraction of the Iranians' frequent food items

First, in order to extract the Iranians' frequent food items, an academic discussion panel consisting of seven physicians specializing in nutrition and Iranian medicine was held and a list of frequent foods was prepared.

Secondly, the list was compared with the *Iranian Food Composition Table* (published by the National Nutrition and Food Technology Research Institute, 2018) and some available food frequency questionnaires (FFQ) [11–15] and a list of 152 food items was obtained.

Then, to reach a reviewable list for the integrative studies of nutrition and traditional medicine concepts, foods with the following characteristics were excluded:
• Compound foods: due to lack of traditional medicine information and sometimes accurate nutrition information in compound foods.

In this study, in order to reduce the study error, the following substances were excluded from the study: pickles, sausages, pasta, cream, and some dairy products such as cream cheese, pizza, cheese, and jams.
• Missing names in traditional medicine texts or not being found by the researcher: due to the impossibility of collecting traditional medicine information.

In this study, in order to reduce the study error, the following substances were excluded from the study: tomatoes and paste, soybeans, green beans, peas, onions, persimmons, peanuts, cocoa, potatoes, maize and maize oil, tangerines, and carrots.
• Lack of required nutritional information or not being found by the researcher: the impossibility of collecting nutritional information.

In this study, in order to reduce the study error, the following substances were excluded from the study: Damask rose, rosewater, okra, shallot, fumitory, coriander, jujube.

By excluding the above, the list of 110 frequent foods finally became the focus of this study.

Determination of the extracted food items' temperament and nutritional facts

Through a comparative study with Iranian medicine, textbooks including Al-Qanun, Al-Jame

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Le-Mofaradat Al-Adviah, va Al-Aqziah, Makhzan Al-Adviah, Al-Shamel, Tohfa Al-Momenin, Al-Ma, Farhang Nafisi, Farhang Taj Al-Arus and Farhang Arabic, the traditional names of these substances were extracted [10, 16–22].

Temperament of food has been determined from two valid books, Al-Qanun Fi Al-Tib (written by Sheikh Al-Ra'is Hakim Bu'Ali Sina) and Makhzan Al-Adviah (written by Hakim Mohammad Hussein Aghili Khorasani) [16, 21]. In case of differences between the two texts, due to the late use of Hakim Aghili, it was based on the opinion of Makhzan Al-Adviah.

Nutritional facts were also extracted from two references, the *Iranian Food Composition Table* and the *USDA* International Database (official website of the United States Department of Agriculture) [12, 19].

The food list table was completed by including food names (custom names, frequent/common English names, names in traditional medicine texts, and scientific names), temperaments, and nutritional facts.

Statistical analysis of the extracted data via SPSS software

Finally, using SPSS software and Jonckheere-Terpstra test, the probable association between temperament and nutritional facts was investigated. The statistical test determined whether due to changing different temperaments of food items (cold-moderate-hot and wet-moderate-dry), their nutritional facts change or do not change.

The study method process is summarized in Figure 1.

Results

Food temperaments

In this section, the temperaments of the analyzed foods are classified based on warm and cold temperaments (Table I) and wet and dry temperaments (Table II).

Water, ash and macronutrients

Ash, moisture and macronutrients including protein, total carbohydrates, fiber, total sugar, total saturated fatty acids, total monounsaturated fatty acids, total polyunsaturated fatty acids, and total trans fatty acids.

Table III shows the food assortment based on water, ash, and macronutrients.

Vitamins

Vitamins are organic molecules that are needed and their supply is completely dependent on food intake (except for vitamin D).

Vitamin content of different food items is determined using High-Performance Liquid Chromatography (HPLC) method [12, 23].
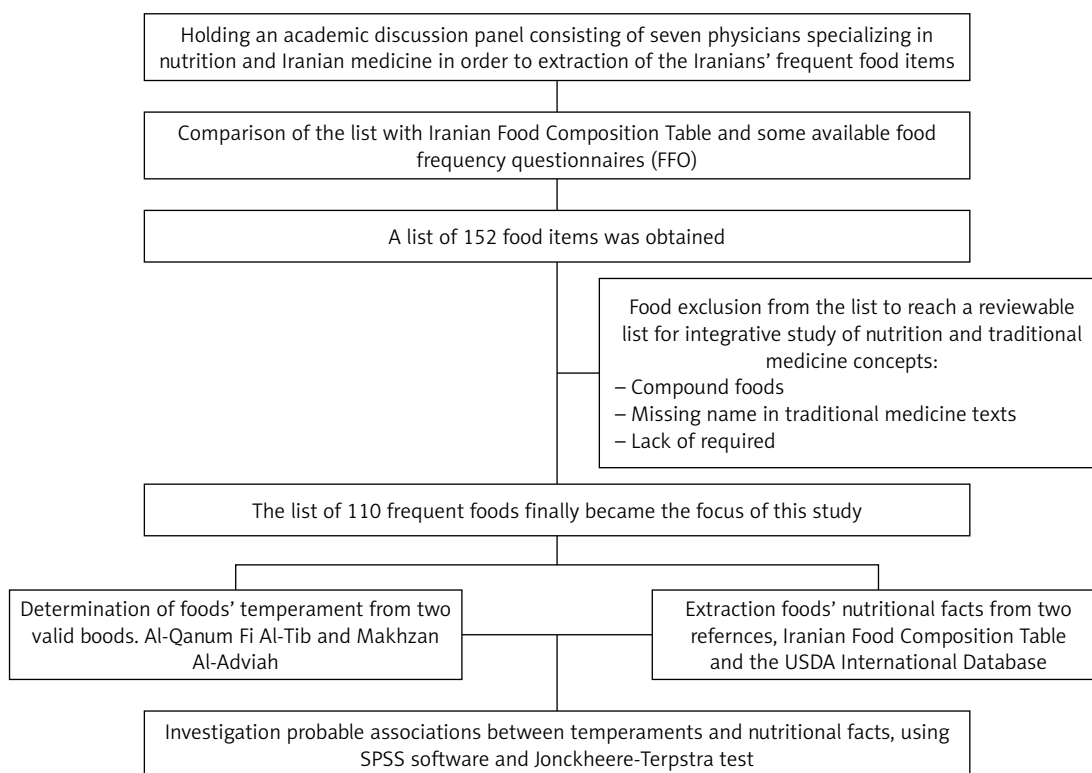

Figure 1. Summarized study method process

Table I. Food assortment based on warm and cold temperaments

Food list	Heat quality
Onion, garlic, leek, turmeric, black pepper	Warm grade 3
Raisins, honey, camel meat, lamb meat, quail meat, thyme, watercress, dill, mint, eggplant, parsley, carrots, celery, turnip, raisins, date, melon, sesame oil, walnut, pistachio, olive oil, honey, sugar, cinnamon, salt, tea	Warm grade 2
Sweet almond, chicken meat, beans, bread, figs, sweet apple, sweet grapes, wheat, split peas, pea, candy, sweet almond, butter, tail oil, hazelnut, sesame, mulberry, radish, cabbage, beet, basil, cherries	Warm grade 1
Rice, sheep milk, yolk, sesame seed paste, leg of lamb	Warm with unknown grade in the texts
Lentils, cow milk, sweet quince, cantaloupe, banana, pear	Moderate
–	Cold with unknown grade in the texts
Mung bean, pomegranate, barley, beans, mung bean, fish meat, goat milk, spinach	Cold grade 1
Fresh cheese, albumen, yogurt, curd, doogh, cucumber, pumpkin, sour lemon, sour cherry, Omani lemon, watermelon, orange, apricot, peach, pumpkin seeds, watermelon seeds, vinegar, grapeseed oil	Cold grade 2
Mushrooms	Cold grade 3

Table II. Food assortment based on wet and dry temperaments

Food list	Moisture quality
Mushrooms	Wet grade 3
Figs, sweet apple, fresh cheese, albumen, fish meat, lamb meat, doogh, goat milk, cucumber, lettuce, pumpkin, carrots, radish, watermelon, orange, apricot, peach, banana, mulberry, melon, pear, sesame oil, watermelon seeds	Wet grade 2
Sweet almond, sweet grapes, cherries, pomegranate, beans, spinach, turnip, sweet quince, sesame, pumpkin seeds, butter, ghee oil, tail oil, sweet almond, candy	Wet grade 1
Pistachio, sesame seed paste, sheep milk, leg of lamb, yogurt, cow milk, yolk	Wet with unknown grade in the texts
Chicken meat, wheat, bread, cantaloupe	Moderate
Olive oil	Dry with unknown grade in the texts
Honey, raisins, mung bean, sugar, honey, hazelnut, walnut, date, raisins, Omani lemon, sour lemon, beet, watercress, mung bean, split peas, pea, barely, beans.	Dry grade 1
Lentils, rice, quail meat, tea, curd, thyme, leak, dill, mint, eggplant, celery, parsley, basil, cabbage, sour cherry, grapeseed oil, vinegar, cinnamon, coffee	Dry grade 2
Camel meat, onion, garlic, turmeric, black pepper, salt	Dry grade 3

Table IV shows the extracted food assortment based on the highest content of vitamins.

Minerals

Minerals are inorganic molecules which are divided into macro- and microminerals. Macrominerals include calcium, phosphorus, magnesium, potassium, sodium, chlorine, and sulfur and some highlighted microminerals are iron, zinc, copper, iodine, fluorine, and selenium.

In food items, after determining the content of ash (g per 100 g of food), the content of minerals is determined using the Atomic Absorption method.

Table V shows the food assortment based on the highest content of minerals.

Food temperaments and their nutritional facts

Table VI shows the probable associations between warm and cold temperaments and nutritional facts. Nutritional facts with a higher mean of numbers in foods with warm temperament include energy, iron, and manganese, and cold temperament foods had higher amounts of moisture.

The association between wet and dry temperaments and nutritional facts was also investigated. The results are summarized in Table VII.

As it is demonstrated in Table VII, nutritional facts with a higher mean of numbers in foods with wet temperament include moisture, total trans fatty acids, cholesterol, vitamin B_{12}, vitamin A,

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Table III. Food assortment based on water, ash and macronutrients

Macronutrients		Foods with the highest contribution									
Water	Food	Water-cress	Egg-plant	Mush-rooms	Pump-kin	Celery	Lettuce	Radish	Doogh	Cucum-ber	Vinegar
	g/100 g	90.6	90.6	91.4	91.6	91.7	91.9	92.5	93.8	95.5	96.3
	Measurement method	Using drying methods in a 100°C oven or a vacuum oven									
Ash	Food	Black pepper	Sesame seed paste	Pump-kin seeds	Cheese	Tea	Tur-meric	Noodle soup	Coffee	Curd	Salt
	g/100 g	4.54	4.62	4.88	5.16	5.8	6.02	6.4	9.6	13	99.9
	Measurement method	Mineral residues of a food after extraction of organic matter									
Energy	Food	Hazel-nut	Walnut	Butter	Tail oil	Sesame oil	Sun-flower oil	Ghee oil	Olive oil	Corn oil	Grape-seed oil
	kcal/100 g	646	683	742	747	884	893	897	898	899	900
	Measurement method	The energy is reported in kcal and is calculated using the content of protein, available carbohydrates, fat, fiber and WHO/FAO conversion factors: 4 kcal/g of protein, 9 kcal/g of fat, 2 kcal/g of dietary fiber, and 4 kcal / g of available carbohydrates									
Protein	Food	Sweet almond	Beans	Chicken Breast meat	Leg of lamb	Lentils	Split peas	Mung Bean	Pump-kin Seeds	Water-melon seeds	Curd
	g/100 g	20.71	20.95	21.52	21.94	22.03	22.38	22.8	24.49	26.01	35.05
	Measurement method	Based on the total content of nitrogen (N) obtained from Kjeldahl method, using the WHO/FAO 1973 coefficients in each food item									
Total carbohydrate	Food	Barley	Dried Omani lemon	Oat-meal	Cinna-mon	Raisins	Iranian rice	Rice flour	Honey	Candy	Sugar
	g/100 g	73.43	76.52	76.69	79.7	80.97	81.18	82.17	82.77	99.9	99.9
	Measurement method	Total carbohydrates = (moisture + fat + protein + ash) – 100. Total carbohydrates also contain dietary fiber. The value of dietary fiber, available carbohydrates and total sugar is calculated based on the compiling method									
Dietary fiber	Food	Barley	Pea	Oat-meal	Tur-meric	Lentils	Dried Omani lemon	Split peas	Black pepper	Thyme	Cinna-mon
	g/100 g	17.3	17.79	18.3	21.1	22.1	25.34	26	26.5	37	54.3
	Measurement method	The best method for determining the content of fiber is AOAC Prosky procedure, which contains non-starch polysaccharides, lignin, starch and resistant polysaccharides									
Available carbohydrate	Food	Sugar	Candy	Honey	Rice flour	Iranian rice	Raisins	Noodle soup	Corn	Thyme	Date dates
	g/100 g	61.64	63.94	65.74	67.7	76.14	76.76	80.73	82.67	99.9	99.9
	Measurement method	Available carbohydrates = dietary fiber – total carbohydrates									
Total sugar	Food	Cher-ries	Tur-meric	Banana	Yellow grape	Pome-granate	Curd	Date dates	Honey	Candy	Sugar
	g/100 g	11.81	14.16	15.98	16.4	16.48	41.57	54.79	82.67	99.9	99.9
	Measurement method										

Table III. Cont.

Macronutrients						Foods with the highest contribution					
Total fat	Food	Ses-ame seed paste	Hazel-nut	Walnut	Butter	Tail oil	Sun-flower oil	Ghee oil	Corn oil	Sesa-me oil	Grape-seed oil
	g/100 g	55.04	58.74	63.52	81.11	82.53	99.24	99.7	99.99	100	100
	Measure-ment method	Total fat represents the sum of a mixture of triglycerides, phospholipids, sterols and other similar compounds, calculated using Soxhlet, Mojonnier and Roses-Gottlieb methods									
Total SFA (saturat-ed fatty acids)	Food	Water-melon seeds	Cheese	Grape-seed oil	Sun-flower oil	Sesa-me oil	Olive oil	Corn oil	Tail oil	Butter	Ghee oil
	g/100 g	9.78	11.24	11.76	12.24	14.2	14.29	16.63	39.4	50	58.97
	Measure-ment method	Using gas chromatography (GC) [32, 35]									
Total MUFA (mono-unsat-urated fatty acids)	Food	Ses-ame seed paste	Pista-chio	Ghee oil	Sun-flower oil	Sweet almond	Corn oil	Tail oil	Sesa-me oil	Hazel-nut	Olive oil
	g/100 g	20.85	24.47	24.52	25.88	31.69	34.7	35.29	39.7	44.18	71.78
	Measure-ment method	Using gas chromatography (GC) [32, 35]									
Total PUFA (polyun-saturat-ed fatty acids)	Food	Pump-kin seeds	Sesa-me	Ses-ame seed paste	Water-melon seeds	Sun-flower seeds	Sesa-me oil	Corn oil	Walnut	Sun-flower oil	Grape-seed oil
	g/100 g	20.9	21.039	24.13	28.9	31.75	41.7	44.17	45.67	56.02	62.62
	Measure-ment method	Using gas chromatography (GC) [32, 35]									
TFAs (trans fatty acids)	Food	Curd	Sun-flower oil	Lamb neck meat	Goat milk	Cheese	Olive oil	Tail oil	Sheep milk	Butter	Ghee oil
	g/100 g	0.1	0.1	0.14	0.17	0.25	0.64	0.71	1.05	2.33	4.11
	Measure-ment method	Using gas chromatography (GC) [32, 35]									
Choles-terol	Food	Lamb shank meat	Camel meat	Drum-stick of chicken	Quail meat	Leg of lamb	Tail oil	Butter	Ghee oil	Egg	Yolk
	mg/100 g	68.33	69	70	76	107	109	230	273	584	1188.33
	Measure-ment method	Using gas chromatography (GC) [32, 35]									

and retinol. On the other hand, dry foods had higher content of ash, total carbohydrates, fiber, vitamin B_6, calcium, iron, magnesium, potassium, and manganese.

Discussion

According to our search, few studies have been conducted on the relationship between modern scientific findings and traditional temperament of foods or drugs. To the best of our knowledge, this study was the first research investigating the probable association between nutritional facts and food temperaments.

Studies of Ardekani *et al.* on temperaments and chemical compounds of medicinal plants indicated that plants containing phenol compounds mostly have warm and dry temperaments; those containing tannins frequently have cold and dry temperaments and those

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Table IV. Food assortment based on vitamins

Vitamins		Foods with the highest contribution									
Vitamin C	Food	Omani sour Lemon	Sour lemon	Cabbage	Thyme	Water-cress	Cauli-flower	Dill	Black pepper	Parsley	Dried Omani lemon
	mg/100 g	37.87	45.62	47.95	50	55.14	58.84	74.75	159.7	170.33	304.75
Vitamin B_1 (thiamin)	Food	Beans	Pistachio	Sesame seed paste	Split peas	Lentils	Onion	Sesame	Pea	Curd	Sunflower seeds
	mg/100 g	0.62	0.773	1.058	1.09	1.11	1.2	1.205	1.25	1.477	1.923
Vitamin B_2 (riboflavin)	Food	Thyme	Beans	Albumen	Cheese	Sesame	Yolk	Dill	Tea	Sweet almond	Curd
	mg/100 g	0.399	0.43	0.432	0.46	0.466	0.467	0.509	0.51	0.856	2.4
Vitamin B_3 (niacin)	Food	Wheat flour	Sesame seed paste	Tea	Quail meat	Bread	Noodle soup	Chicken breast meat	Coffee	Drum-stick of chicken	Fish meat
	mg/100 g	5.888	5.942	7.15	7.538	18.6	21.051	23.222	24.991	27	44
Vitamin B_5 (niacin)	Food	Fish meat	Pea	Egg	Split peas	Lentils	Mush-rooms	Yolk	Curd	Beans	Sunflower seeds
	mg/100 g	1.591	1.624	1.637	1.7	1.742	1.832	3.997	4.006	4.94	6.745
Vitamin B_6	Food	Thyme	Sunflower seeds	Hazelnut	Quail meat	Beans	Walnut	Garlic	Pistachio	Turmeric	Curd
	mg/100 g	0.55	0.559	0.564	0.6	0.61	0.688	0.714	1.7	1.8	3.415
Vitamin B_9 (folates)	Food	Parsley	Lentils	Lettuce	Spinach	Pea	Split peas	Thyme	Beans	Beans	Mung bean
	µg/100 g	127	130	150	159	210	270	274	284	460	463
Vitamin B_{12}	Food	Quail meat	Sheep milk	Cow milk	Cheese	Egg	Lamb neck meat	Lamb shank meat	Curd	Yolk	Fish meat
	µg/100 g	0.43	0.61	0.75	1.31	1.93	2	2.53	2.57	4.06	4.68
Vitamin A (RAE)	Food	Black pepper	Water-cress	Basil	Parsley	Dill	Spinach	Yolk	Carrots	Ghee oil	Butter
	µg/100 g	221	253	273	416	464	477	499	662	801	846
Vitamin A (RE)	Food	Black pepper	Water-cress	Yolk	Basil	Ghee oil	Parsley	Butter	Dill	Spinach	Carrots
	µg/100 g	442	505	509	546	832	833	878	929	954	1324
Retinol	Food	Cow milk	Curd	Goat milk	Sheep milk	Quail meat	Cheese	Egg	Yolk	Ghee oil	Butter
	µg/100 g	33	36	46	48	73	152	210	489	769	815
Beta-caro-tene (EQ)	Food	Mint	Thyme	Water-melon	Black pepper	Water-cress	Basil	Parsley	Dill	Spinach	Carrots
	µg/100 g	1772	2264	2561	2654	3030	3276	4996	5571	5727	7946

containing volatile oils often have warm and dry temperaments. Moreover, plants with volatile oils with an alcoholic structure have cold and dry temperaments and those containing alkaloids based have cold or warm and dry temperaments. So, this study showed that plants have a special temperament based on their active ingredients and the effect of each plant based on the active ingredient is somehow related to the temperament [24].

In another study conducted on rats, Parvinroo *et al*. investigated different parameters by giving hot spices including fennel, apricots, and anise seeds, and cold foods including watermelon, cucumbers and squash seeds. This study showed a significant increase in thyroid hormones using hot spices (FT4 in fennel and T3 in fennel, anise, and aloe) and a significant increase in corticosteroids in cold foods [25]. According to the changes in the body's hormones by food, it can be said that an increase in thyroid hormones increases the body's metabolism and indicates the warm temperament of food consumed and an increase in corticosteroids as an anti-inflammatory marker in-

Table V. Food assortment based on minerals

Minerals		Foods with the highest contribution									
Calcium	Food	Dill	Sweet almond	Sesame seed paste	Cheese	Black pepper	Turmeric	Tea	Cinnamon	Curd	Thyme
	mg/100 g	224	243	342	370	392	394	543	913	1200	1890
Iron	Food	Sesame seed paste	Sesame	Beans	Lentils	Pumpkin seeds	Tea	Black pepper	Cinnamon	Turmeric	Thyme
	mg/100 g	7.32	7.78	9.2	10.1	13.32	18.2	19.39	27.16	39.97	123.6
Magnesium	Food	Turmeric	Thyme	Tea	Sesame seed paste	Sweet almond	Sesame	Coffee	Sunflower seeds	Pumpkin seeds	Watermelon seeds
	mg/100 g	204	220	250	262	268	346	352	371	447	513
Phosphorus	Food	Tea	Yolk	Sweet almond	Pistachio	Sunflower seeds	Sesame seed paste	Sesame	Watermelon seeds	Curd	Pumpkin seeds
	mg/100 g	444	457	476	487	681	731	774	775	923	1066
Potassium	Food	Pea	Pistachio	Dried omani lemon	Mung bean	Black pepper	Beans	Curd	Tea	Turmeric	Coffee
	mg/100 g	990	1000	1110	1120	1259	1400	1569	2160	2228	3754
Sodium	Food	Drumstick of chicken	Watermelon seeds	Albumen	Egg	Bread	Doogh	Cheese	Noodle soup	Curd	Salt
	mg/100 g	110	110	174	190	310	421	1200	1654	2043	38000
Zink	Food	Turmeric	Lamb neck meat	Lentils	Lamb shank meat	Sunflower seeds	Thyme	Sesame seed paste	Watermelon seeds	Pumpkin seeds	Sesame
	mg/100 g	3.78	4	4.1	4.32	5.33	6.18	6.54	7.12	7.17	10.23
Copper	Food	Black pepper	Pistachio	Walnut	Hazelnut	Sesame	Pumpkin seeds	Watermelon seeds	Sunflower seeds	Sesame seed paste	Tea
	mg/100 g	1.129	1.3	1.37	1.452	1.457	1.479	1.538	2.011	2.066	2.5
Manganese	Food	Noodle soup	Wheat flour	Oatmeal	Leg of lamb	Turmeric	Black pepper	Hazelnut	Thyme	Cinnamon	Tea
	mg/100 g	3.146	3.213	3.324	5	5.767	6.063	6.092	7.867	11.184	71
Selenium	Food	Lamb shank meat	Quail meat	Barley	Leg of lamb	Wheat flour	Curd	Sesame	Sesame seed paste	Yolk	Sunflower seeds
	μg/100 g	16.05	16.6	19.35	23	25.6	29.44	34.4	35.03	35.33	54.83

dicates the cold temperament of food consumed. The results of another study conducted by Jafari Nejad Bajestani *et al.* on feeding rats with foods having different temperaments showed that feeding with watermelon juice reduced nerve conduction velocity and memory in rats, and feeding with carrot seed extract was effective on increasing thyroid hormones. This study also showed the effect of different temperaments of foods on physiology of the body [26, 27].

The classification of foods into cold-warm and dry-wet temperaments has caused different reactions in different people according to their temperament, from fluids (blood, lymph, interstitial fluid, and plasma) to organs (including the gastrointestinal tract, liver, heart, as well as the arterial and venous walls) and these effects can be acute, sub-acute or chronic.

Moreover, in our study, according to the obtained results, an association was found between nutritional facts and four temperaments. Energy, iron, and manganese were observed more frequently in foods with the warm temperament and were statistically significant. According to Iranian medicine, foods with the warm temperament have the ability to perform more metabolism and energy in the body due to the production of warm humors. Therefore, the component of energy is

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Table VI. Relationship between warm/cold temperament and nutritional facts

Nutritional facts	Cold temperament foods (n = 31)	Moderate temperament foods (n = 9)	Warm temperament foods (n = 67)	P-value for trend
Water	86.80 (81.2)	83.8 (44.95)	58.90 (78.5)	0.014
Ash	0.78 (1.37)	74 (0.59)	0.97 (1.51)	0.215
Energy	59 (292)	63 (166.5)	217 (317)	0.049
Protein	2.71 (10.21)	1.22 (7.7)	3.07 (15.93)	0.422
Total carbohydrate	8.83 (16.12)	6.79 (17.96)	8.72 (55.46)	0.601
Dietary fiber	1.29 (3.1)	0.78 (2.81)	2.08 (6.21)	0.202
Available carbohydrate	6.51 (12.59)	7.74 (14.64)	6.74 (36.9)	0.783
Total sugar	2.44 (6.68)	4.54 (6.88)	1.71 (5.32)	0.163
Total fat	0.68 (4.27)	0.95 (6.7)	0.87 (15.56)	0.422
Total SFA (saturated fatty acids)	0.07 (1.85)	0.12 (2.72)	17 (4.25)	0.313
Total MUFA (monounsaturated fatty acids)	0.08 (0.98)	0.06 (2.48)	17 (6.72)	0.375
Total PUFA (polyunsaturated fatty acids)	0.14 (0.52)	0.09 (0.5)	28 (1.57)	0.165
TFAs (trans fatty acids)	0 (0)	0 (0.05)	0 (0)	0.820
Cholesterol	0 (0)	0 (6.23)	0 (0)	0.883
Vitamin C	8.5 (18.5)	1.84 (12.26)	2.6 (18.63)	0.573
Thiamin	0.07 (0.27)	0.18 (0.16)	0.12 (0.22)	0.437
Riboflavin	0.13 (0.18)	0.12 (0.18)	0.11 (0.19)	0.977
Niacin	0.75 (1.74)	0.21 (0.54)	0.98 (2.95)	0.190
Pantothenic acid	0.34 (0.49)	0.32 (0.34)	0.28 (0.66)	0.365
Vitamin B_6	0.1 (0.31)	0.1 (0.34)	0.15 (0.25)	0.373
Folates	18 (43)	4 (22)	23 (59)	0.845
Vitamin B_{12}	00 (0.01)	00 (0.67)	00 (00)	0.241
Vitamin A (RAE)	12 (46)	3 (58.5)	3 (25)	0.081
Vitamin A (RE)	24 (90)	16.5 (133.75)	5 (48)	0.062
Retinol	00 (00)	00 (29)	00 (00)	0.350
Beta-carotene (EQ)	42 (500)	15.5 (23.25)	25.5 (290.5)	0.586
Calcium	25 (81)	11 (68)	38 (98)	0.647
Iron	0.5 (2.28)	0.27 (1.09)	1.32 (3.79)	0.032
Magnesium	13 (66)	10 (13.5)	20 (79)	0.460
Phosphorus	43 (222)	25 (105)	61 (179)	0.555
Potassium	194 (355)	160 (162)	269 (335)	0.380
Sodium	12 (47)	6 (47.5)	15 (45)	0.654
Zinc	0.26 (1.29)	0.18 (0.78)	1.05 (2.48)	0.058
Copper	0.08 (0.36)	0.1 (0.06)	0.12 (0.33)	0.256
Manganese	0.06 (0.61)	0.03 (0.25)	0.22 (1.97)	0.32
Selenium	1 (7.86)	1.01 (3.51)	1.15 (4.51)	0.945

Data expressed median (interquartile range (IQR)) with Jonckheere-Terpstra test.

directly related to the discussion of foods with the warm temperament. To the best of our knowledge, the warm temperament itself increases molecular activity and energy production, and in this study, the association between energy and foods with warm temperament was significant [10, 23].

The results of the present study demonstrated that a higher amount of iron was found in warm temperament foods than cold temperament ones. From the philosophers' point of view, iron has a warm temperament leading to blood production as one of the four main humors having warm and

Table VII. Relationship between wet and dry temperament and nutritional facts

Nutritional facts	Dry temperament foods (n = 51)	Moderate temperament foods (n = 6)	Wet temperament foods (n = 51)	P-value for trend
Water	11.2 (80.41)	71.25 (50.37)	81.7 (72.2)	0.048
Ash	1.2 (1.75)	1.03 (0.82)	0.74 (0.66)	0.046
Energy	247 (309)	166.5 (175.75)	70 (283)	0.338
Protein	3.52 (10.83)	14.8 (16.32)	1.4 (11.51)	0.379
Total carbohydrate	12.98 (58.64)	4.26 (60.57)	7.54 (14.53)	0.021
Dietary fiber	2.79 (10.12)	0.39 (4.48)	1.2 (2.37)	0.003
Available carbohydrate	6.8 (43.83)	7.74 (57.63)	6.68 (11.35)	0.247
Total sugar	1.77 (3.86)	0.31 (2.04)	3.84 (6.73)	0.156
Total fat	0.87 (4.98)	2.48 (9.04)	0.44 (16.32)	0.673
Total SFA (saturated fatty acids)	0.1 (2.01)	0.61 (2.95)	0.17 (6.7)	0.331
Total MUFA (monounsaturated fatty acids)	0.12 (1)	0.77 (4.35)	0.08 (6.72)	0528
Total PUFA (polyunsaturated fatty acids)	0.28 (1.02)	0.71 (1.31)	0.12 (1.49)	0.194
TFAs (trans fatty acids)	0 (0)	0.01 (0.06)	0 (0.03)	0.009
Cholesterol	0 (0)	17 (60.06)	0 (7.45)	0.006
Vitamin C	5.78 (36.5)	0.45 (8.28)	2.6 (13.6)	0.183
Thiamin	0.13 (0.28)	0.06 (0.26)	0.08 (0.19)	0.419
Riboflavin	0.12 (0.19)	0.14 (0.08)	0.11 (0.19)	0.723
Niacin	0.93 (1.83)	20.91 (23.16)	0.6 (1.3)	0.273
Pantothenic acid	0.25 (0.9)	0.79 (0.54)	0.31 (0.29)	0.765
Vitamin B_6	0.22 (0.36)	0.1 (0.11)	0.1 (0.15)	0.034
Folates	31 (86)	5 (22.25)	15 (26)	0.104
Vitamin B_{12}	00 (00)	0.16 (0.39)	00 (0.08)	0.002
Vitamin A (RAE)	2 (20)	12 (30.25)	8 (47)	0.057
Vitamin A (RE)	3 (29.25)	12 (56.75)	19 (103.5)	0.032
Retinol	00 (00)	3 (18.5)	00 (00)	0.014
Beta-carotene (EQ)	20 (170)	3.5 (765.75)	40 (295)	0.334
Calcium	44 (111)	9 (30.75)	18 (85)	0.016
Iron	2.3 (4.58)	1.13 (2.05)	0.44 (0.93)	0.002
Magnesium	27 (110)	16 (57)	12 (13)	0.026
Phosphorus	93 (253)	61(106.5)	38 (142)	0.159
Potassium	326 (601)	235 (239.5)	197 (190)	0.013
Sodium	12 (33)	51 (148.5)	10 (58)	0.664
Zinc	095 (2.22)	1.63 (1.43)	0.26 (1.28)	0.131
Copper	0.17 (0.35)	0.06 (0.34)	0.08 (0.1)	0.325
Manganese	0.3 (1.87)	0.03 (2.11)	0.08 (0.67)	0.030
Selenium	1.15 (4.2)	5.9 (9.11)	1.01 (5.4)	0.774

Data expressed median (interquartile range (IQR)) with Jonckheere-Terpstra test.

wet temperament. Similarly, iron is considered as an essential agent for hematopoiesis in modern medicine [10, 23].

Manganese is a mineral playing a role in regulating blood pressure and heart rate, as well as energy extraction from foods. Regarding the afore- mentioned association between energy and the warm temperament, it may be claimed that this mineral would have a warm temperament. Moreover, the heart as a dynamic organ that is constantly contracting, has a warm and dry temperament from the philosophers' perspective; and it

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is the warm temperament that causes this muscle contraction. Therefore, manganese seems to have a warm temperament due to its heart desire and its function in regulating blood pressure and heart rhythm. This mineral was found to be at higher levels in foods with a warm temperament.

The statistical analysis of the extracted data of the present study showed that zinc was also found to be at higher amounts in warm foods. Zinc is a micronutrient involved in protein synthesis, cell growth and proliferation related pathways. From the perspective of traditional medicine, the phenomenon of growth requires a warm temperament because it causes expansion and volume increase. In this regard, we can refer a warm temperament to individuals having larger physique and limbs.

There was a positive association between coldness of foods and the content of moisture in the present study.

Additionally, vitamin A was reported to be more in foods with cold and wet temperaments. Vitamin A is a fat-soluble vitamin that plays a role in the vision and preservation of the body's mucous membranes. Vitamin A deficiency causes the cornea to become dry and thick, which is called exophthalmia. It can be said that this vitamin has cold and wet temperaments and with these temperaments, it keeps the necessary moisture for the eyes from drying out [23]. The cold and wet temperament may also be effective in creating anti-inflammatory properties for the healing of skin wounds and mucous membranes. Furthermore, the total trans fatty acids (TFAs) and cholesterol levels were higher in foods with high moisture, which similarly may be due to the wet temperament of fats in Iranian medicine [18, 20, 22].

On the other hand, the average amounts of minerals including calcium, iron, magnesium, potassium, and manganese in foods with dry temperament were higher than the mineral content of cold foods. Ash was also observed at higher levels in foods with a dry temperament. By definition, ash is the residual of minerals of foods after the extraction of organic matter; so ash could have a dry temperament due to its mineral and soil components.

The obtained data from the present study showed that dry foods have higher amounts of fiber in comparison to wet foods as well. Consistently, dryness is a factor leading to food indigestion and malabsorption from the philosophers' point of view [28]. Further studies, especially food analytical studies, are required to investigate the accuracy of aforementioned findings.

Notably, the effect of each food item on the whole body function and organ physiology are not only affected by its temperament from the traditional medicine approach. In this medical approach, the complex of foods' matter, forms and accident may determine the net effect of that dietary intake on the body [18, 21, 22]. Therefore, we cannot exclusively address all findings of the present study to the temperament concept. Moreover, philosophers have a holistic approach to all phenomena including body and foods: as each food may have a unique effect on each consumer body and each food may be effective in the prevention and treatment of diseases without separating its constituent elements. Therefore, further studies are required to investigate the exact relationships between nutritional facts, foods' matters, forms, and accidents.

In conclusion, the summative qualitative content analysis of the obtained data in the present study demonstrated positive associations between warmness of the food temperament and their energy, iron, and manganese content. On the other hand, cold foods had higher amounts of moisture, fat, and fat-soluble vitamins. Additionally, ash and mineral content of dry foods were at higher amounts in comparison to foods with a wet temperament. These findings indicate probable relationships between the traditional philosopher's opinions and their medical approach and modern nutrition. However, further food analytical, experimental, and clinical studies are required to investigate the exact relationships between modern nutritional scientific facts and traditional foods' characteristics.

Acknowledgments

Conflict of interest

The authors declare no conflict of interest.

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