Oncology
and Radiotherapy©
18(9) 2024: 001-007 • REVIEW ARTICLE

Fruit selection based on seasonality: Integrating principles of Persian Medicine and nutrition science

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ABSTRACT

Objective: To assess the seasonal patterns of fruit consumption according to the perspective of Persian Medicine (PM) and compare these recommendations with those from modern nutrition science.

Methods: A comprehensive literature search was conducted to identify valid Persian Medicine manuscripts that discuss the consumption of fruits in relation to seasons. Additionally, relevant literature in the field of nutrition science was reviewed to compare these findings. The data obtained from both sources were subjected to qualitative analysis to extract meaningful insights and draw conclusions.

Results: Persian Medicine provides specific recommendations for fruit consumption based on the temperament of both the fruits and the seasons. These guidelines include suggestions for suitable fruits in each season and prohibitions based on their temperaments and the common seasonal disorders. In contrast, modern nutrition science does not offer a specific pattern for seasonal fruit consumption. The study found that fruits recommended for winter in Persian Medicine tend to have higher calorie content compared to fruits recommended in other seasons. This aligns with Persian Medicine's recommendation of consuming energy-rich foods in winter. Additionally, these winter fruits have lower water content, which is consistent with the cold and wet temperament associated with winter.

Conclusion: Persian Medicine offers a unique perspective on seasonal fruit consumption based on the concept of temperament, which is absent in modern nutrition science. The study's findings highlight the potential benefits of aligning fruit consumption with seasonal and temperamental considerations, as recommended in Persian Medicine.

Keywords: fruit, season, Persian Medicine, temperament, nutrition science

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Word count: 5014 **Tables:** 02 **Figures:** 00 **References:** 30

Received: 05 September, 2024, Manuscript No. OAR-24-148012
Editor Assigned: 07 September, 2024, Pre-QC No. OAR-24-148012(PQ)
Reviewed: 22 September, 2024, QC No. OAR-24-148012(Q)
Revised: 29 September, 2024, Manuscript No. OAR-24-148012(R)
Published: 05 October, 2024, Invoice No. J-148012

INTRODUCTION

The consumption of fruits is widely recognized as an essential component of a healthy diet. In nutrition science, fruits are considered as an important part of the food pyramid. It indicates the importance of daily consumption of this group. Fruits are rich in fiber, vitamins A, C, and potassium, and are free from sodium, fat, and cholesterol. According to nutrition science, fruit consumption is recommended for all person regardless of individual differences a nd s eason, W hile P ersian M edicine (PM), an ancient medical school based on temperament, offers a different perspective on fruit consumption. PM recommends the consumption of fruits based on the concept of temperament, which is a key factor in conceptualizing, diagnosing, and treating diseases. According to PM, a person is considered healthy when his/her temperament (which named "mizaj" in PM) is balanced. Imbalances in temperament called dystemperament leads to various disorders. In addition to humans, everything in the world has its own temperament, including fruits and seasons. This study aims to evaluate the seasonal patterns of fruit consumption according to the principles of PM, drawing comparisons with nutrition science. By conducting this assessment, it seeks to shed light on potential disparities and provide insights into the compatibility or divergence between these 2 approaches to fruit.

LITERATURE REVIEW

Principles of Persian Medicine (PM)

PM is considered a rich and known source in the healthcare field of medical history to the point that in a period of history, it has been used as an educational reference even at universities in European countries . PM is a humoral and temperament based medicine . Temperament is a key basic factor in traditional schools of medicine applied in conceptualizing Diagnosing and treating diseases [1, 2]. Temperament is a unique quality in hotness/coldness and wetness /dryness for everything in the world like seasons, fruits or persons [3]. This concept is generally accepted in conventional medicine in the form of individual differences in various physical, mental and personality traits among individuals [2]. Everything has own special temperament like foods, drugs, seasons, even conditions and climates [3]. According to PM, a person is considered to be in a healthy state when his or her mizaj keeps its balance and most of the diseases occur when the mizaj becomes imbalanced, which is called dystemperament [4]. One of the other basic concepts in PM is 4 humors (khelt: in

Persian language) including “dam” or blood (possessing hot and wet qualities), “balgham” or phlegm (possessing cold and wet qualities), “safra” or yellow bile (possessing hot and dry qualities), and “sauda” or black bile (possessing cold and dry qualities). Every humor is a matter produced from digestion and transmutation of foodstuffs in the digestive system. From the perspective of PM health is owing to the balance of these humors and abnormality or imbalance in humors can lead to illness [5]. It is important to acknowledge that the contemporary interpretation of blood, phlegm, and yellow bile in modern medicine deviates from these humors in PM.

Seasons from the perspective of PM

In PM viewpoint, medical seasons are different from contractual and calendar seasons. Spring is considered to occur medically when there is no need for cooling or heating instrument and no need for special clothing or covering, the weather is moderate, and trees and plants begin to turn green. Medical autumn coincides with the time when the leaves of trees change color and begin to fall. Summer is a time when the weather is generally warm, and winter is a time when the weather is generally cold. Clearly, these times do not necessarily correspond exactly to the calendar seasons. Each medical season causes special seasonal diseases according to its temperament, and for prevention and treatment, measures should be taken against that temperament to create balance. Therefore, seasonal recommendations for fruit consumption should be based on medical seasons rather than calendar seasons [6, 7].

The importance of fruits in PM and nutrition science

In PM, fruits are listed as one of the essential elements of healthy diet, but the type of fruit and the method of consumption depend on numerous factors such as the individual's temperament, level of physical activity, and the season [8]. Therefore, there is no fixed general recommendation for consuming fruit throughout the year for all individuals in PM.

From the perspective of PM, a conceptual framework is utilized to analyze the spectrum that categorizes foods and drugs based on their impact on bodily function and temperament. At one end of this spectrum, there are "absolute foods" that primarily contribute to tissue replacement without causing significant physiological changes. Conversely, at the other end, "absolute medicines" encompass substances that exert substantial effects on vital body systems, resulting in notable alterations in both function and temperament. Within this spectrum, fruits hold a crucial role as dietary medicines or medicinal foods within the PM paradigm [9]. These fruits serve a dual purpose by facilitating tissue regeneration and promoting functional adjustments. Their functions extend to modifying temperament, treating diseases, and preventing their occurrence [7]. For instance, individuals with a predisposition to conditions associated with a warm temperament are advised to consume fruits with cooling effects, while those with a cold temperament are recommended to incorporate fruits with warming effects into their diet [9, 10]. Similarly, individuals exhibiting a hot and dry temperament are counseled to consume citrus fruits with a cooling and moistening effect, thereby restoring equilibrium and alleviating diseases linked to an excess of safra humor [11].

In nutrition science, fruits are also considered as essential components of the food pyramid. Fruits provide minerals, especially electrolytes, phytochemicals, especially antioxidants, and fiber [9]. Daily consumption of fruits and vegetables is so important that even in the ketogenic diets where only 5% of total calories come from carbohydrates, consumption of non-starchy vegetables, avocado, and coconut is allowed. However, it is clear that this amount of carbohydrates will not be sufficient to meet the body's required nutrients. Therefore, individuals who follow such diets are always at risk of serious micronutrient deficiencies, and the consumption of multivitamin-mineral supplements is essential for them [9]. This once again emphasizes the importance of including fruits in the daily dietary intake. The goal of consuming this amount of fruits and vegetables is to provide most of the necessary vitamins and minerals required for growth, maintenance of various cell functions, and prevention of many diseases. Strong epidemiological studies recommend daily consumption of fruits and vegetables because these food groups play a protective role against various malignancies, especially gastrointestinal neoplasms and respiratory system tumors. Part of these protective effects can be attributed to antioxidants such as vitamin C and carotenoids, which protect cells from lipid peroxidation and oxidative damage. A recommended amount of about 150 grams of fruit per day has been suggested [10].

According to reports, polyphenolic acids and vitamins have been found to play a crucial role in preserving health and mitigating the risk of various ailments. Epidemiological, toxicological, and nutritional studies have established a significant correlation between the consumption of fruits and a decreased likelihood of developing chronic conditions like coronary disease, cancer, diabetes, and neurodegenerative disorders [11].

There exists consensus between nutritional science and PM concerning the vital role of fruits in preserving well-being, disease prevention, and even treatment. However, when it comes to selecting appropriate fruits for specific circumstances, distinct criteria are employed.

Fruits which have recommended or prohibited in each season in authentic manuscripts of PM gathered together in table 1.

Some nutritional characteristics of recommended fruits in each season are collected in table 2.

Criteria for selection fruits for seasons in PM

After a survey in PM references, it is discovered that there are some criterions for choosing each fruit for each season:

Temperament:

According to PM each season has its own temperament as well as each fruit. To select suitable fruits for each season, both of these temperaments should be considered to adjust the body temperament balanced.

The temperament of recommended fruits in spring:

In PM, it is advised to consume fruits during the spring season that possess a cooling temperament and help regulate blood concentration by avoiding excessive production of "dam" humor [12]. Conversely, it is discouraged to consume fruits that elevate body heat and dampness. So, fruits with a very sweet and hot temperament, such as dates, bananas, and grapes, should be avoided [7].

Tab. 1. Persian medicine advices for seasonal consumption of fruits

Forbidden Fruits	Temperament	Recommended Fruits	Temperament	Season
Unripe fruits Fruits with hot and wet temperament Fruits which increased "dam "humor like sweet grape, date and fig.	Near temperate	Apple	Temperate	Spring
	Cold and dry	Sour lemon		
	Near temperate	Pomegranate		
	Cold and wet	Barberry		
	Cold and dry	Sour grape		
	Near temperate	Quince		
	Cold and dry	Sour Orange		
	Cold and wet	cucumber		
	Cold and wet	Pear		
	Cold and wet	Apricot		
	Cold and wet	Cherry		
Unripe fruits Every fruit with hot and dry temperament like date and banana.	Hot and wet	Mulberry	Hot and dry	Summer
	Cold and wet	Peach		
	Cold and wet	Plum		
	Cold and wet	Cherry		
	Cold and wet	Sour Cherry		
	Cold and wet	Apricot		
	Cold and wet	Watermelon		
	Cold and wet	Cucumber		
	Cold and dry	Meles and sour apple		
	Hot and wet	melon		
	Cold and wet	Pomegranate		
	Cold and wet	Blackberry		
	Cold and wet	Meles grapes		
	Cold and dry	Sour grape		
	Cold and wet	Sour Orange		
	Cold and dry	Sour lemon		
	Cold and wet	Fresh juicy Fruits with meles taste		
Unripe fruits Excessive consumption of some fresh fruits which picked in autumn Every fruit with dry temperament.	It is dependent on fruit	Dried fruits	Cold and dry	Autumn
	Near temperate	Quince		
	Hot and wet	Sweet apple		
	Near temperate	Pear		
	Near temperate	Sweet pomegranate		
	Hot and wet	Raisins		
	Hot and wet	Fig		
	Cold and wet	Watermelon		
	Cold and wet	Cucumber		
	Hot and wet	Melon		
Unripe fruits Every fruit which increases phlegm and make body temperament cold and wet like: watermelon, cucumber, cherry, peach.	Hot and wet	Fig	Cold and wet	Winter
	Hot and dry	Date		
	Hot and wet	Grape		
	Hot and dry	Coconut		

This table is takes into account healthy people with moderate temperament.

Tab. 2. Nutrients of recommended fruits based on season in Persian medicine

Season	Fruits (100 gram)	Energy (Kcal)	Vitamin C (mg)	Beta-Carotene (IU)	Water (Gm)	Glycemic Index
Spring	Sour cherry	49.68	10	425.241	86.45	22
	Pomegranate	68.18	6.097	0	81.17	35
	Sow berry	213	3	-	39.4	-
	Lemon	28.97	52.93	-	88.97	40
	Apple	57.03	4	16.65	84.38	36
	Quinces	56.96	15	13.32	83.8	35
	Pear	58.82	3.996	6.66	83.61	38
	Apricot	47.88	10	-	86.4	41
	Mulberries	43	36.43	9.99	87.86	-
	Peach	43	6.588	-	87.65	42
	Plums	70.42	3.521	-	77.82	40
	Sweet cherry	72.06	7.059	-	80.74	20
	Sour cherry	49.68	10	425.241	86.45	-
	Apricot	47.88	10		86.4	41
	Watermelon	32	9.625	-	91.25	76
	Melon	35	24.82	-	89.41	60
	Apple	57.03	4	16.65	84.38	36
Summer	Grape	63.04	4.022	-	81.3	53
	Pomegranate	68.18	6.097	0	81.17	35
	Blackberry	52.01	20.97	-	85.42	40
	Quinces	56.96	15	13.32	83.8	35
	Lemon	28.97	52.93	-	88.97	40
	Dehydrated apricot	320.2	9.496	870.129	7.504	32
	apple	57.03	4	16.65	84.38	36
	pears	58.82	3.996	6.66	83.61	38
Autumn	Pomegranate	68.18	6.097	0	81.17	35
	Grape	63.04	4.022	-	81.3	53
	Fig	74	2	46.62	79.2	35
	Dehydrated fig	254.8	0.799	43.3566	28.44	50
	date	266	-	-	31	103
Winter	Raisin	300.6	3.306	-	15.47	56
	Coconut	353.8	3.25	-	47	45

In modern medicine, it is understood that extreme hypothermia and hyperthermia can impact hematocrit levels, but the typical variations in seasonal temperatures do not have such an effect on blood concentration [13]. It should be considered that blood in modern medicine is different from blood humor in PM.

An interesting aspect of PM recommendations is the use of cold and dry fruits like sour lemon, sour grape, and sour orange in the form of sherbet during the spring season [12]. The temperament of sherbet, which contains sugar or honey along with water, is warmer and moister compared to these fruits. Therefore, when transformed into sherbet, a cold and dry fruit attains a more balanced temperament suitable for the moderate nature of spring without causing an imbalance in the body.

The temperament of recommended fruits in summer:

In the summer, it is generally recommended to consume edibles which have cold and wet temperament. These fruits can effectively counterbalance the hotness and dryness typically experienced during this time. Specifically for a person who is tired after intense activity in the heat of summer it is recommended to use cold and wet fruits such as berries, plum and apricot before eating food to relieve the heat and dryness [14].

In accordance with this recommendation, there is ample evidence supporting the preventive effects of fruits against exercise-induced oxidative stress [15]. From the perspective of PM, both summer and exercise have the potential to induce a hot and dry temperament in the body [7]. Therefore, the consumption of fruits is advised as a means to mitigate the adverse effects associated with excessive heat and dryness.

The temperament of recommended fruits in autumn:

The autumn temperament is generally characterized as cold and dry. However, due to the significant temperature fluctuations between day and night, it is not advisable to recommend exces-

sively hot temperament edibles during this season [6]. Conversely, excessive heat can exacerbate dryness in the body's temperament. Therefore, it is recommended to consume fruits with a moderately temperate nature during autumn [7]. Despite the dryness associated with autumn, it is not only unadvisable to rely solely on fresh juicy fruits or juices to counteract this dryness but also discouraged to consume fresh fruits altogether. Instead, it is preferable to opt for dried fruits [16].

PM scholars explain the reason as follows:

cold and dry weather in autumn makes the pores of the body get constricted and blocked, so the excess moisture of the fruits is trapped in the body like stagnant water, which can lead to various fevers and inflammatory diseases.

Exceptionally melons, watermelons, and cucumbers, which are juicy fruits, are recommended only in extremely dry autumns, particularly following a hot summer lacking rainfall [17].

Contrary to this view recent medical and nutritional reports indicate that polyphenolic acids, vitamins, minerals, and other components of fruits may play an anti-inflammatory role against numerous diseases [11].

In order to elucidate any ambiguities, it is imperative to undertake the design of targeted studies and clinical trials that take into account the influence of seasonal variations on the effects of fruits. the

Temperament of recommended fruits in winter:

In winter, due to cold and wet temperament of the season, suggested fruits have hot and dry temperament to balance the body temperament. Most of the fruits are not suitable for winter due to high water content. From PM viewpoint a healthy body declares the real need to water with thirst, so in winter, reduction of thirst is an indication of reducing the body's demand on water [12]. A few fruits like date, dried fig or raisin which are low in water content are recommended, although, according to nutrition science, the amount of water in 2 to 4 serving of fruits that usually recommended based on food pyramid, does not even reach a glass; so, it cannot cause any health problem [18].

Based on PM, in winter, it is generally advised to avoid edibles that increase phlegm, because winter diseases are often caused by predominance of phlegm in the body [17].

Taste

In nutrition science there is no any recommendation to choose a specific fruit in each season only based on the taste, while in viewpoint of PM, tastes also have specific temperaments [19]. Accordingly, a single fruit with different tastes has different temperaments. For example, the temperament of sour taste is cold and dry, while for sweet taste is hot and wet. Therefore, a ripe and sweet apple has a warmer temperament than a sour apple. Plums, cherries and apricots, which have sour taste, are cold, while bananas, dates, and grapes, which have sweet taste, are hot. Of course, this gauge has exceptions; for example, despite its sweetness, watermelon has cold temperament. Nonetheless, tastes can be considered as an influential factor in selecting fruits. Based on this criterion, in the spring, sour and sweet (meles) fruits are preferred, and in the summer, there is more tendency towards sourness (because bile humor dominates in the summer, and sour edibles reduce it and help to eliminate it). In the autumn and winter, when the temperament is cold, sweet fruits are preferred [12, 16].

Special efficacies of fruits and seasonal illnesses

In PM suppression of the mood in autumn is probable due to predominance of sauda humor, so in PM some antidepressant fruits like apple, pear, quince and pomegranate are suggested to prevent this problem regardless of their temperament. One of the emphasized features in autumn foods in PM is fragrance. In recent researches, the anti-depressant effects of these fruits have been proven and aroma compounds have been identified in them [20, 21].

Consuming fruits out of season

In PM, there is a basic recommendation in all seasons that is to avoid from eating unripe fruits and those that are obtained outside their harvest season. Also Indigenous fruits of a region have more suitability for continuous consumption by the people of that region compared to fruits brought from other lands [22].

In viewpoint of nutrition science, picking fruits out of season prevents them from benefiting from natural sunlight and achieving their maximum nutritional value, fruits which picked during the harvest season taste better than out-of-season ones. Moreover, when fruits are harvested out of season, they face problems arising from transportation, storage, packaging, and the use of preservatives, which ultimately lead to a decrease in their nutritional value [23]. Consumption of fruits and vegetables during their respective seasons also contributes to achieving a sustainable diet [24, 25].

Both PM and nutrition science share a common perspective regarding the preference for consuming fruits during their respective harvest seasons.

Seasonal combination of fruits

Nutrition science, in line with PM, believes that the factors affecting the growth and quality of nutrients in fruits vary throughout the year [26].

PM scholars have discussed in detail the differences between various types of a single fruits during different seasons. For example, Pears are planted and harvested in different seasons. Despite some common features among all types of pears, some characteristics vary between them in different seasons. For instance, autumn pears have denser texture and take longer to ripen until the fall season. Summer pears contain more water and spoil faster, so they have a shorter shelf life than the winter type. Spring pears have a softer texture and therefore ripen faster [18].

According to a study conducted by Kim et al., the water content in apples and pears is higher in spring and summer compared to autumn and winter. Results of this study is in line with PM opinion.

Pomegranates have a very high-water content in winter, while strawberries have a high-water content in autumn. The levels of vitamin C and beta-carotene in apples, pears, and pomegranates are higher in autumn and winter than in spring and summer [27, 28].

In a study conducted in 2019 by Andre, et.al seasonal changes were observed in the levels of sodium, phosphorus, and potassium in apples and peaches. Sodium concentration decreases from July to august while it increased in summer in peach. Similar trend was also observed for phosphorus. However, other micronutrients remained constant throughout the year [26].

Based on the principles of nutrition science, fruits and vegetables are the primary sources of vitamin C for the body [27]. Although the amount of vitamin C in food sources varies depending on growth conditions, degree of ripeness, and temperature, fruits and vegetables remain the main way to get vitamin C throughout all seasons. The levels of vitamin C and beta-carotene in fruits vary in different seasons, and during the harvest season, they have the highest nutritional content. Therefore, as previously mentioned, nutrition experts recommend consuming fruits and vegetables during their respective harvest seasons [28].

Despite studies showing changes in the levels of micronutrients in fruits and vegetables during different seasons, nutrition science does not recommend or advice against consuming fruits based on the season. This may indicate a change in the body's needs for micronutrients during different seasons. In other words, the body's requirements may fluctuate depending on the conditions of each season [29].

For example, winter fruits all have high levels of vitamin C. This emphasizes the importance of fruit consumption during the harvest season, as the need for this vitamin increases in cold seasons to strengthen the immune system [27].

Furthermore, some studies have shown seasonal fluctuations, especially in sunlight exposure levels, in the serum levels of nutrients [30]. This issue has been observed in all societies, regardless of degree of development. Seasonal changes have an important effect on the intake of nutrients such as calcium, potassium, riboflavin, and especially vitamins A and C.

Further considerations

In PM, alongside the general guidelines provided for health preservation, specific measures are recommended for various situations and crises. One of these exceptional circumstances pertains to "airborne diseases." Airborne diseases are illnesses that can be transmitted through the air and have the potential to cause epidemics. During such outbreaks, it is advised by PM to incorporate sour and drying foods into the diet, including sour grape soup, pomegranate soup, sumac soup, and vinegar soup. Another valuable recommendation during epidemics is the consumption of fragrant fruits such as apples and quinces, as well as sour astringent fruits like pomegranates. The possible efficacy of sour fruits and foods in combating epidemics may be attributed to their vitamin C content, which is known to support the immune system's defense against viral and bacterial infections. However, further investigation through clinical trials is necessary to validate these ideas.

In PM there are general advises about eating and drinking should be followed. For example, overeating is not allowed at all, and even recommended fruits cannot be eaten excessively. Eating multiple types of fruit at the same time is also prohibited, and only one recommended type of fruit should be selected per meal.

This issue is explained in nutrition science with the problem of interaction between nutrients. When the intake of nutrients exceeds the upper limit, in addition to the possibility of poisoning with that nutrient, it is also possible to interact with the digestion and absorption of other nutrients. These interactions mainly occur between divalent cations such as zinc and iron. Therefore, the number of servings of food groups has been adjusted so that there is no interaction between the received nutrients. Obviously, taking higher amounts is not only not beneficial, but also disturbs the absorption or metabolism of some nutrients.

Another notable point is that if a special fruit is not tolerated by a person due to illness or allergy and cause side effects so that fruit is prohibited for him/her.

In nutrition science, in agreement with PM, patients should contemplate some specific considerations. For instance, patients with diabetes are advised to minimize the consumption of dried fruits with a high glycemic index or patients who suffer from food allergies should avoid from those allergens.

Although numerous fruits are not explicitly mentioned in the PM recommendations for various seasons, it is feasible to ascertain the suitability of specific fruits for individuals during different seasons by consulting PM's references concerning fruit characteristics and recommendations tailored to diverse temperaments.

CONCLUSION

In conclusion, this study illuminates the categorization of fruits according to seasons in PM and its compatibility with the principles of nutrition science. While PM offers recommendations for appropriate fruit consumption in each season based on temperaments and specific fruit benefits, nutrition science does not advocate a specific pattern for seasonal fruit consumption. The findings of this study reveal that fruits recommended during winter exhibit higher caloric content and lower water content, which aligns with PM's emphasis on consuming energy-dense foods during the colder months. Moreover, the study emphasizes the necessity for further clinical trials to investigate the potential advantages of integrating PM and nutrition science in formulating fruit consumption guidelines.

ACKNOWLEDGEMENTS

The study was financially supported by School of Traditional Medicine, Shahid Beheshti University of Medical Sciences, Tehran, Iran (grant No:02-32613).

CONFLICT OF INTEREST

The authors have no conflicts of interest to declare.

FINANCIAL DISCLOSURE

These results were obtained from PhD thesis (Fateme Rabiee, no: 02-32613) and was granted by School of Traditional Medicine, Shahid Beheshti University of Medical Sciences, Tehran, Iran (grant No:02-32613).

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