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# Water Intake from the Points of View of Rhazes and Avicenna

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**Keywords**
Water intake · Hypohydration · Traditional Iranian medicine · Rhazes · Avicenna

**Abstract**
Owing to the effect of acute and chronic hypohydration on health and the lethal effects of hyperhydration, an appropriate amount of water intake is important for each individual. Traditional Iranian medicine (TIM) is a holistic system one of whose important parts deals with lifestyles and how to maintain health, including the amount of water intake for every person and the appropriate principles of drinking water. In this study, Avicenna's *Canon of Medicine*, Rhazes' *Benefits of Food and Its Harmfulness*, and conventional medical articles were reviewed to evaluate the amount of water intake for each person and the principles of drinking water. TIM has expressed an individualized difference in the amount of water intake in the form of temperament and the relationship between the appropriate time of drinking water with other daily activities. In this view, drinking water at the inappropriate time causes liver and gastrointestinal diseases; it can create the foundation for conducting new studies in the field of appropriate water intake and lifestyle changes to reduce malnutrition complications.


**Schlüsselwörter**
Wasseraufnahme · Flüssigkeitsmangel · Traditionelle iranische Medizin · Rhazes · Avicenna

**Zusammenfassung**
Die Aufnahme einer adäquaten Menge an Wasser ist wichtig, da sich ein akuter oder chronischer Flüssigkeitsmangel auf die Gesundheit auswirkt und eine Hyperhydratation zum Tod führen kann. Die traditionelle iranische Medizin (TIM) ist ein ganzheitliches System, das in einem seiner zentralen Bestandteile auf den Lebensstil sowie auf die Erhaltung der Gesundheit abzielt, darunter auch die Wassermenge, die jeder Mensch aufnehmen sollte und die richtigen Prinzipien des Wassertrinkens. In der vorliegenden Studie wurden der *Kanon der Medizin* von Avicenna, die *Vorteile von Lebensmitteln und ihre Schädlichkeit* von Rhazes und konventionelle medizinische Artikel überprüft, um die von jedem Menschen aufzunehmende Wassermenge und die Prinzipien des Wassertrinkens zu bewerten. Gemäß TIM bestehen individuelle Unterschiede hinsichtlich der Wasseraufnahme je nach Temperament und sie betont den Zusammenhang zwischen dem richtigen Zeitpunkt des Wassertrinkens und anderen Alltagsaktivitäten. Danach führt das Trinken von Wasser zum falschen Zeitpunkt zu Leberkrankheiten und gastrointestinalen Erkrankungen. Dies könnte die Grundlage für neue Studien darstellen, in denen die adäquate Wasseraufnahme und Lebensstiländerungen untersucht werden, um malnutritionsbedingte Komplikationen zu verringern.

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## Introduction

On average, water constitutes 60% of a human's body weight; it also forms a major component of blood, saliva, and articular fluid. It also plays an important role in the disposal of waste materials from the body. In spite of the entrance and the exit of water from the body, the kidneys, and the stimulation of thirst, the amount of water in the body is adjusted within a certain range. Dehydration occurs in the absence of the replacement of lost water [1].

Determining the amount of water appropriate for each individual has become important in recent studies due to the effect of chronic and acute hypohydration on the body. Mild hypohydration (2% loss in body mass) affects cognitive functions and physical performance [1]. Older people are more likely to be prone to hypohydration [2]. Children lose more water from the skin [3]. The prevalence of dehydration is reported between 16 and 28% in adults [4]. In pregnant mothers, oligohydramnios is seen followed by hypohydration [5]. Chronic and acute hypohydration is associated with a higher rate of mortality and disability in vulnerable groups [6]. Receiving low levels of water with chronic elevation of angiotensin II, antidiuretic hormone, and aldosterone leads to chronic vasoconstriction, a ground for the formation of vascular plaques and increasing blood pressure. Regarding the role of the renin-angiotensin-aldosterone system in obesity, diabetes, and cancers, it is necessary to pay more attention to the amount of water needed to eliminate hypohydration [7]. Low habitual fluid intake and mild dehydration have an effect on the creation of asthma, constipation, diabetes, urinary tract infections, high blood pressure, coronary artery disease, venous thromboembolism, and stroke [6].

Hyperhydration is rare and is more likely to occur in the elderly, athletes, and in hospitalized surgical patients; it has harmful consequences, like cerebral edema [5].

Owing to the undesirable effects of hypohydration and hyperhydration on the body, the amount of water intake has a significant effect on health. However, studies conducted to determine the amount of water intake as well as its appropriate principles are inadequate. In addition, the amount of water intake appropriate for each individual to prevent hypohydration is one of the most important issues [8].

The philosophical background and the general outlook of traditional medicine systems have been led to treat humans by these systems for many years. Traditional Iranian medicine (TIM), as one of these systems, expresses human lifestyle within six principles as follows: (1) air, (2) body movement and repose, (3) sleep and wakefulness, (4) diet, (5) evacuation and retention, and (6) mental movement and repose. These principles are used to prevent diseases, and in the event of a disease, the evaluation and modification of lifestyle based on individual and temperamental differences are the first steps of treatment [9].

From the perspective of TIM, the time and quantity of eating and drinking as well as the type of food and drink have a significant effect on health. The laws of drinking liquids and water are one of the most important principles in TIM [10, 11].

Rhazes (865–925 AD) was a scholar from the Golden Age of Islam. He provided medical information to others in addition to designing a system for teaching doctors with 200 books. His most important book (*Liber Continens*) is a medical encyclopedia that was translated into Latin in the thirteenth century [12].

Rhazes' books on nutrition include: *Benefits of Food and Its Harmfulness (manfe 'al aghzie va mazareha), Medicine for Kings* (*teb al moluki*), and *Food for Patients (Ata'me al marza).*

Rhazes can be considered as a pioneer of nutrition science [13].

Avicenna (980–1032 AD), another scholar of the Golden Age of Islam, has written over 450 books and articles. His most important book, *Canon of Medicine (al-Qānūn fī al-Tibb)*, was translated into Latin in the twelfth century, and was used until the sixteenth century as a reference book in the West [14]. In this book, Avicenna emphasizes that a correction of diet and adhering to the principles of appropriate eating and drinking can prevent many diseases [10].

In this review, the *Canon of Medicine* (*al-Qānūn fī al-Tibb*) and the *Benefits of Food and Its Harmfulness* (*manfe 'al aghzie va mazareha*) have been reviewed to evaluate the views of TIM with respect to the amount of water intake as well as its principles.

The general principles of eating and drinking and the principles of how to drink water correctly in particular have been explained in *Benefits of Food and Its Harmfulness* (*manfe 'al aghzie va mazareha*) [13].

Then, the principles of drinking water correctly were evaluated in the first book of the *Canon of Medicine* in its chapter on lifestyle [10].

The purpose of this study is to express the viewpoints of two therapists of TIM about the appropriate amount and time of drinking water and their related factors as well as a comparison of these views with conventional medicine.

## Results

*Water Intake in Conventional Medicine*

On average, 20% of the body's water content is supplied through food; the rest is supplied by drinking water and fluids, and a small amount is supplied through metabolism. Water leaves the body through urine, stool,

sweat, the skin, and the lungs [1]. The effect of the amount of water received on health was used to determine the amount of water intake based on a person's age and sex by the European Food Safety Authority (EFSA), and the Institute of Medicine of National Academies (IOM). The EFSA sets the recommended amount of water intake for men at 2 L/day and in women at 1.6 L/day; IOM recommended the amount of water intake in men as 2.6 L/day and in women as 1.6 L/day. The amount of water intake in humans is a consequence of the influence of factors such as physical characteristics, physiological phenotypes, genetics, daily habits, and cultural and environmental factors spread over a wide range. Obesity, body size, and the variability of insensible water loss, especially the amount of sweating due to physical activity, and exposure to a warm environment affect the outflow of water from the body and, consequently, the amount of water required [15]. In recent studies, the differences in the amounts of sweating and the amounts of sodium in sweat have led to differences in the onset of hypohydration and amount of water needed by the body [16]. Individual differences in the interoceptive states for hunger and thirst lead to individual differences in response to thirst and the amount of water intake [17]. With regard to genetic variation and its relationship with the water needed by the body, more than ten types of genes and their resulting proteins in the hypothalamic-neurohypophysis-kidney axis are involved in the body's water balance [18]. Some studies have tried to investigate the relationship between these genes and the individual differences in water intake. Single nucleotide polymorphisms within arginine vasopressin receptor 2 gene have been related to weight loss due to dehydration as a result of endurance activity in triathletes [19].

In conventional medicine, water consumption during exercise is more noticeable. In hypohydration without hyperthermia, decreasing stroke volume reduces a muscle's ability to adapt to conditions [20], and it reduces muscular endurance, strength, and anaerobic muscle strength [21] through the effect on the cardiovascular system, muscle metabolism, buffering system, and the neuromuscular system [22]. During a sports activity, the purpose of drinking water is to keep the individual at an appropriate hydration level so that he/she does not lose more than 2% of body weight in terms of water and the individual's weight does not increase until it is exposed to hypohydration and hyperhydration. As the person is to be at the euhydration stage, an athlete should drink as much water as the water lost which depends on factors like the amount of sweating which varies from one person to another. Thus, each athlete should have a personalized water intake program depending on the amount of sweating [23].

*Water Intake and the Principles of Drinking Water from the Perspectives of Avicenna and Rhazes*

From the viewpoints of Avicenna and Rhazes, water consumption varies according to temperament, age, gender, season, occupation, country, and the type of consumed food [24]. Avicenna and Rhazes believe that water consumption is proportional to the body's needs; it improves the health of the skin and increases the amount of vision. Water intake that is below the body's needs results in appetite reduction, the weakness of vision and other senses, insomnia, aging, and weight loss; consumption of water in excess of the body's needs causes forgetfulness, tremors, and sleepiness [10, 11].

Temperament is an important concept in TIM focusing on individual differences. Each person has his or her own mental, physical, and physiological characteristics; the temperament of each person is determined by these symptoms and characteristics [25]. Certain aspects of temperament can be changed, and this change leads to illness [26]. Sustaining a temperament in which a person feels well is associated with the appropriate lifestyle of a temperament [27]. The appropriate amount of water intake per person depends on each individual's temperament in addition to environmental factors [10, 11]. In addition to inappropriate water intake, inappropriate time of drinking water, such as drinking water during physical activity, fasting, or after sexual intercourse, as a general principle for most people, initially disrupts food digestion and damages other organs by damaging the alimentary canal and the liver [11, 28]. The correct method of drinking water in terms of quantity, quality (temperature), and time in relation to other activities has been presented in Table 1.

## Discussion

In the proposed amounts determined by the EFSA and the IOM, the differences in water intake are observed based on gender and age, and lesser water intake has been recommended for women compared to men [4]. Reduced water intake has been observed with respect to aging [29]. The body's water content changes from 70% during infancy to 60% during childhood and, ultimately, reduces to 50% due to aging. For this reason, old people's temperaments have been known as cold and dry by traditional medicine [30]. This change in the body water percentage can change the amount of water needed per day [15]. Dehydration rate, serum sodium, water intake, and lost water during sporting activities have been different in men and women [31, 32]. Avicenna and Rhazes consider gender and age as two influential factors in water intake. Although there is temperament diversity in women, in general, they tend to be cool and wetter than men; thus, they require less water [10].

**Table 1.** The principles of appropriate drinking water from the books *Canon of Medicine* and *The Benefits of Food and Its Harmfulness*

| Title | Correct method | Incorrect method | Description |
|---|---|---|---|
| Quantity | Attention to individual circumstances | Drinking to the extent of the dilatation of the stomach or to a lesser extent than needed | Water consumption varies depending on the temperament under the same environmental conditions |
| Quality (temperature) | Ordinary cool water | Very cold water | Causes damage to internal organs, especially the liver |
| | | Warm water | Causes stomach weakness and does not resolve thirst |
| | | Lukewarm water | Causes nausea |
| Time (relationship with other activities) | | | |
| Eating | After emptying food from the stomach (2 h after a meal) | Drinking water during or immediately before and after food | Prevents appropriate digestion of food |
| Sleeping | Do not drink water in fasting mode before breakfast and drink water after emptying stomach of food after breakfast | Drinking water immediately before bedtime, and between sleeping and fasting | Causes gastrointestinal and joint problems |
| Sexual intercourse | Shortly after the body returns to normal | Immediately after sexual intercourse | Damages the liver |
| Sporting and intense physical activity | After return to normal breathing and heart rate, and the restoration of body heat to a normal temperature | During a sporting activity and immediately afterward | Damages the liver; during the event of intense thirst, water should be sipped and sucked in a small amount |
| Hot bath (sauna) | After the body returns to normal | In the bathroom or immediately afterward | Damages the liver |
| How to drink | Sip gradually | Sip quickly | Sipping water helps to match the temperature of the water with the temperature of the body |

As 20% of the water that is needed by the body is provided through food, the difference in the amount of water intake in different countries, in addition to the effect of the climate, is caused by the traditional regime of each region. Therefore, each country should collect water intake quantities by collecting information [33]. In a country like Korea, in particular, a diet rich in fruits and vegetables is different from those of European countries [34], which are consistent with the differences in the diets across countries, as mentioned in the works of Rhazes and Avicenna [10, 11].

Although the EFSA and IOM have presented the proposed water quantities only on the basis of age and gender, individual differences in terms of the amount of water needed by the body have been studied in conventional medicine. TIM delineates this difference in terms of temperament. The intake of water and liquids also depends on the individual's temperament. People with warm or dry temperaments need more water to balance their temperaments [10]. The amount of water loss from the body and, consequently, the amount of water required is variable based on body size [15]. Individuals with different temperaments have different body sizes. For example, people with warm and wet temperaments have a larger body size [10, 35]. In recent studies, the relationship between temperament and certain concepts in conventional medicine like basal metabolism have been investigated [36]. This relationship, if proven, can be investigated due to the effect of metabolism on the amount of water required by the body [33].

Studies show that 75% of water intake while eating is drunk to ease chewing and swallowing; there is a positive relationship between energy intake and drinking water during the same meal [37]. Rhazes and Avicenna believe that drinking water along with food disturbs food digestion, although warm-tempered people and children are excluded [10, 11] which is one of the contradictions of these two perspectives.

With regard to the association of mealtime with the reduction of gastroesophageal reflux symptoms [38], the effect of the recommendations made by Rhazes and Avicenna about the time of drinking water in relation to sleep on reducing the common gastrointestinal symptoms can be investigated.

In conventional medicine, fluid intake during physical activity has been recommended in addition to appropriate hydration prior to activity [39], and there is a strong recommendation to use water and fluids with individual planning during sporting events to prevent hypohydration and hyperhydration [23]. However, studies have also shown changes in gastrointestinal function, increasing gastrointestinal complaints with water intake during sports, and the ineffectiveness of water intake during sporting events. Gastrointestinal complaints have been different between 30 and 70% by the athletes who have had diverse complaints from such mild complaints as nausea, vomiting, and bloating, to such serious problems as ischemic colitis, hemorrhagic gastritis, and hematochezia. The emergence of these problems has depended on the type, severity, and duration of the sporting activity. The relationship of these symptoms with certain fluids and food is determined by the changes in the function of the alimentary canal during sporting events; these changes can include the reduction of esophageal sphincter tone and increasing reflux [40]. Increasing the rate of stomach emptying in moderate sports and reducing it in extreme sports [41], and swallowing air with water while involving oneself in a sporting event lead to an increase in the likelihood of gastrointestinal complaints related to water and fluid intake [40]. In spite of the recommendation to drink adequate water to equal the sweating rate during physical activity by miners, construction workers, soldiers, and certain athletes in a warm environment, there is a high level of sweating that can be compensated through drinking water and fluids. On the other hand, water and fluids can cause gastrointestinal problems and the impairment of functions [42]. As a consequence, in normal air, fluid intake during a sporting event has no effect on the heart rate, plasma volume, and electrolytes. The use of fluids during sporting events has, therefore, been questioned [43]. According to Avicenna and Rhazes, the consumption of water and fluids during a sporting event and physical activity is harmful at the level of slaking especially with cold water. In the event of intense thirst, drinking water should be imbibed through sipping in small amounts to prevent gastrointestinal problems. In addition to the acute effects of water intake during sporting events, there are some long-term effects like liver diseases according to Avicenna and Rhazes [11, 28].

The desired bath conditions of Avicenna and Rhazes are almost equivalent to a present-day wet sauna. The warm environment of the sauna reduces the visceral bloodstream by increasing the blood flow to the skin. The sauna also increases the core body temperature [44] in the same way that sporting and drinking cold water reduces the core body temperature [45]. Cooling the body with a cold shower can increase blood pressure and is not recommended for people with high blood pressure [46]. However, the effect of drinking cold water and its effect on the sudden reduction of core body temperature on the body requires further investigations. According to Avicenna and Rhazes, everything leading to the body's sudden cooling can damage health. Therefore, water intake, especially cold water in a bath, has been considered harmful to the gastrointestinal system and the liver according to Avicenna and Rhazes [11, 28].

In a study on drinking cold water (4 °C), it was found that consuming cold water increases resting energy expenditures and is, therefore, effective in reducing the weight of obese children [47]. Avicenna and Rhazes consider the continuous consumption of cold water to be harmful, and this problem is contradictory to the suggestion of cold water intake for weight loss. In TIM, cold water intake, especially immediate consumption, has been considered to be harmful after sleep, sports or other physical activities, a hot bath, or sexual intercourse. Cold water has been found to be harmful to the liver, and this habit leads to many diseases, especially liver diseases [11, 28]. With regard to the prevalence of this behavior in modern society and the high prevalence of a nonalcoholic fatty liver [48], the relationship between nonalcoholic fatty liver and the inappropriate time of drinking water from the perspective of TIM in comparison with the conducted retrospective studies and the two groups of nonalcoholic fatty liver and healthy people in terms of the prevalence of this behavior can be investigated. This idea is at a level of a theory which is based on Rhazes and Avicenna's viewpoints, and needs to be proven by trial studies on lifestyle.

## Conclusion

With regard to the noxious effects of hyperhydration, and the numerous effects of acute and chronic hypohydration on health, appropriate water intake has a significant effect on health.

In TIM, which is based on experience and observation, lifestyle is described on the basis of individual differences in temperament; appropriate water intake in the same environmental conditions is also determined on the basis of temperament. The relationship between the types of temperaments and the amounts of water intake is one of the issues that can be investigated. Avicenna and Rhazes, two Iranian traditional medicine scientists, have varying opinions in comparison to conventional medicine about drinking water and its relationship to other activities. In this regard, certain orders have been given to protect the health of individuals. The above-mentioned orders can be considered as health recommendations of the health systems prescriptible for various communities if they are proven by trial studies on lifestyle.

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## References

1 Benelam B, Wyness L. Hydration and health: A review. Nutr Bull. 2010;35(1):3–25.
2 Waldréus N, Sjöstrand F, Hahn RG. Thirst in the elderly with and without heart failure. Arch Gerontol Geriatr. 2011 Sep-Oct;53(2):174–8.
3 Guelinckx I, Frémont-Marquis AS, Eon E, Kavouras SA, Armstrong LE. Assessing Hydration in Children: From Science to Practice. Ann Nutr Metab. 2015;66 Suppl 3:5–9.
4 Gandy J. Water intake: validity of population assessment and recommendations. Eur J Nutr. 2015 Jun;54 Suppl 2:11–6.
5 El-Sharkawy AM, Sahota O, Lobo DN. Acute and chronic effects of hydration status on health. Nutr Rev. 2015 Sep;73 Suppl 2:97–109.
6 Maughan RJ. Hydration, morbidity, and mortality in vulnerable populations. Nutr Rev. 2012 Nov;70 Suppl 2:S152–5.
7 Thornton SN. Thirst and hydration: physiology and consequences of dysfunction. Physiol Behav. 2010 Apr;100(1):15–21.
8 Popkin BM, D'Anci KE, Rosenberg IH. Water, hydration, and health. Nutr Rev. 2010 Aug;68(8):439–58.
9 Jafari S, Abdollahi M, Saeidnia S. Personalized medicine: a confluence of traditional and contemporary medicine. Altern Ther Health Med. 2014 Sep-Oct;20(5):31–40.
10 Avicenna (Ibn Sina) H. Asbab-e-Sehat va Maraz; in : qanoon fi al-tibb (The Canon of Medicine). Volume 1. Beirut, Lebanon: Ehyaol Toras al-Arabi Press; 2005. pp. 217–21.
11 Rhazes: Ekhtiar-al-aghzie; in Hamavi H, editor. Manfe' al aghzie va mazareha (Benefits of food and its harmfulness). Tehran: Research Institute for Islamic and Complementary Medicine (RICM), Iran University of Medical Sciences and Health Services; 2012. p. 127–52.
12 Zarshenas MM, Mehdizadeh A, Zargaran A, Mohagheghzadeh A. Rhazes (865–925 AD). J Neurol. 2012 May;259(5):1001–2.
13 Nikaein F, Zargaran A, Mehdizadeh A. Rhazes' concepts and manuscripts on nutrition in treatment and health care. Anc Sci Life. 2012 Apr;31(4):160–3.
14 Zargaran A, Mehdizadeh A, Zarshenas MM, Mohagheghzadeh A. Avicenna (980-1037 AD). J Neurol. 2012 Feb;259(2):389–90.
15 Stanhewicz AE, Kenney WL. Determinants of water and sodium intake and output. Nutr Rev. 2015 Sep;73 Suppl 2:73–82.
16 Davis JK, Baker LB, Barnes K, Ungaro C, Stofan J. Thermoregulation, Fluid Balance, and Sweat Losses in American Football Players. Sports Med. 2016 Oct;46(10):1391–405.
17 Stevenson RJ, Mahmut M, Rooney K. Individual differences in the interoceptive states of hunger, fullness and thirst. Appetite. 2015 Dec;95:44–57.
18 Knepper MA, Kwon TH, Nielsen S. Molecular physiology of water balance. N Engl J Med. 2015 Apr;372(14):1349–58.
19 de Milander L, Kun MA, September AV, Schwellnus MP, Noakes TD, Collins M. AVPR2 gene and weight changes during triathlons. Int J Sports Med. 2012 Jan;33(1):67–75.
20 González-Alonso J, Mora-Rodríguez R, Below PR, Coyle EF. Dehydration markedly impairs cardiovascular function in hyperthermic endurance athletes during exercise. J Appl Physiol (1985). 1997 Apr;82(4):1229–36.
21 Savoie FA, Kenefick RW, Ely BR, Cheuvront SN, Goulet ED. Effect of Hypohydration on Muscle Endurance, Strength, Anaerobic Power and Capacity and Vertical Jumping Ability: A Meta-Analysis. Sports Med. 2015 Aug;45(8):1207–27.
22 Judelson DA, Maresh CM, Anderson JM, Armstrong LE, Casa DJ, Kraemer WJ, et al. Hydration and muscular performance: does fluid balance affect strength, power and high-intensity endurance? Sports Med. 2007;37(10):907–21.
23 McDermott BP, Anderson SA, Armstrong LE, Casa DJ, Cheuvront SN, Cooper L, et al. National Athletic Trainers' Association Position Statement: Fluid Replacement for the Physically Active. J Athl Train. 2017 Sep;52(9):877–95.
24 Nimrouzi M, Tafazoli V, Daneshfard B, Zare M. Optimal fluid intake in daily diet: avicenna's view. J Integr Med. 2016 Jul;14(4):241–4.
25 Salmannegad H, Mohajedi M, Mozaffarpur S, Saghe B. The review of indices of Mizaj-e-damagh (Temperament of brain) identification in Persian medicine. J Babol Univ Med Sci. 2016;18:71–79.
26 Mojtabaee M, Mokaberinejad R, Adhami S, Mansouri P, Rahbar M. Nutritional advice for patients with melasma in Iranian traditional medicine. J Skin Stem Cell. 2016;3:e42722.
27 Shirbeigi L, Zarei A, Naghizadeh A, Vaghasloo MA. The concept of temperaments in traditional Persian medicine. Tradit Integr Med. 2017;2:143–156.
28 (Avicenna)Ibn Sina H. Moalejat- al- kabed; in : qanoon fi al-tibb (The Canon of Medicine). Volume 3. Beirut, Lebanon: Ehyaol Toras al-Arabi Press; 2005. pp. 171–230.
29 Baron S, Courbebaisse M, Lepicard EM, Friedlander G. Assessment of hydration status in a large population. Br J Nutr. 2015 Jan;113(1):147–58.
30 Hooper L, Bunn D, Jimoh FO, Fairweather-Tait SJ. Water-loss dehydration and aging. Mech Ageing Dev. 2014 Mar-Apr;136-137:50–8.
31 Eijsvogels TM, Scholten RR, van Duijnhoven NT, Thijssen DH, Hopman MT. Sex difference in fluid balance responses during prolonged exercise. Scand J Med Sci Sports. 2013 Mar;23(2):198–206.
32 Baker LB, Munce TA, Kenney WL. Sex differences in voluntary fluid intake by older adults during exercise. Med Sci Sports Exerc. 2005;37:789–96.
33 Jéquier E, Constant F. Water as an essential nutrient: the physiological basis of hydration. Eur J Clin Nutr. 2010 Feb;64(2):115–23.
34 Lee MJ, Popkin BM, Kim S. The unique aspects of the nutrition transition in South Korea: the retention of healthful elements in their traditional diet. Public Health Nutr. 2002 Feb;5(1a 1A):197–203.
35 Mojahedi M, Naseri M, Majdzadeh R, Keshavarz M, Ebadini M, Nazem E, et al. Reliability and Validity Assessment of Mizaj Questionnaire: A Novel Self-report Scale in Iranian Traditional Medicine. Iran Red Crescent Med J. 2014 Mar;16(3):e15924.
36 Farsani G, Movahhed M, Motlagh A, Hosseini S, Yunesian M, Farsani T, et al. Is the Iranian traditional medicine warm and cold temperament related to basal metabolic rate and activity of the sympathetic-parasympathetic system? Study protocol. J Diabetes Metab Disord. 2014;13(1):74.
37 McKiernan F, Houchins JA, Mattes RD. Relationships between human thirst, hunger, drinking, and feeding. Physiol Behav. 2008 Aug;94(5):700–8.
38 Ness-Jensen E, Hveem K, El-Serag H, Lagergren J. Lifestyle Intervention in Gastroesophageal Reflux Disease. Clin Gastroenterol Hepatol. 2016 Feb;14(2):175–82.e1.
39 Rodriguez NR, Di Marco NM, Langley S; American Dietetic Association; Dietitians of Canada; American College of Sports Medicine. American College of Sports Medicine position stand. Nutrition and athletic performance. Med Sci Sports Exerc. 2009 Mar;41(3):709–31.

40 de Oliveira EP, Burini RC, Jeukendrup A. Gastrointestinal complaints during exercise: prevalence, etiology, and nutritional recommendations. Sports Med. 2014 May;44(S1 Suppl 1):S79–85.
41 Horner KM, Schubert MM, Desbrow B, Byrne NM, King NA. Acute exercise and gastric emptying: a meta-analysis and implications for appetite control. Sports Med. 2015 May;45(5):659–78.
42 Maughan RJ, Watson P, Shirreffs SM. Implications of active lifestyles and environmental factors for water needs and consequences of failure to meet those needs. Nutr Rev. 2015 Sep;73 Suppl 2:130–40.
43 Wall BA, Watson G, Peiffer JJ, Abbiss CR, Siegel R, Laursen PB. Current hydration guidelines are erroneous: dehydration does not impair exercise performance in the heat. Br J Sports Med. 2015 Aug;49(16):1077–83.
44 Pawlak J, Zalewski P, Klawe JJ, Zawadka M, Bitner A, Tafil-Klawe M. Core body temperature changes after sauna exposition in healthy subjects. Med Biol Sci. 2012;26:111–4.
45 Siegel R, Laursen PB. Keeping your cool: possible mechanisms for enhanced exercise performance in the heat with internal cooling methods. Sports Med. 2012 Feb;42(2):89–98.
46 Pilch W, Szygula Z, Palka T, Pilch P, Cison T, Wiecha S, et al. Comparison of physiological reactions and physiological strain in healthy men under heat stress in dry and steam heat saunas. Biol Sport. 2014 Jun;31(2):145–9.
47 Dubnov-Raz G, Constantini NW, Yariv H, Nice S, Shapira N. Influence of water drinking on resting energy expenditure in overweight children. Int J Obes. 2011 Oct;35(10):1295–300.
48 Satapathy SK, Sanyal AJ. Epidemiology and Natural History of Nonalcoholic Fatty Liver Disease. Semin Liver Dis. 2015 Aug;35(3):221–35.