

Food Reduction in Avicenna's View and Related Principles in Classical Medicine

Aisan Nozad,¹ Mohsen Naseri,² Mir Bahram Safari,³ Azam Abd Al Ahadi,⁴ and Farzaneh Ghaffari^{4,5,*}

¹Traditional Iranian Medicine Department, Medicine Faculty, Shahed University, Tehran, IR Iran

²Clinical Trial Research Center for Traditional Medicine, Shahed University, Tehran, IR Iran

³Faculty of Medicine, Urmia University of Medical Sciences, Urmia, IR Iran

⁴School of Traditional Medicine, Shahid Beheshti University of Medical Sciences, Tehran, IR Iran

⁵School of Allied Medical Sciences, Shahid Beheshti University of Medical Sciences, Tehran, IR Iran

*Corresponding author: Farzaneh Ghaffari, School of Traditional Medicine & School of Allied Medical Sciences, Shahid Beheshti University of Medical Sciences, Tehran, IR Iran. Tel: +98-9143418085, Fax: +98-2166464321, E-mail: ghaffariinfo@gmail.com

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Abstract

Context: Traditional Iranian medicine (TIM) is a rich and valuable school of thought that believes medications are not the only effective approach for the treatment of diseases but that nutrition is also important.

Evidence Acquisition: Our study includes two parts; the first is a book review of the Canon of Medicine by Avicenna (10th and 11th centuries), in which we focus on finding and understanding Avicenna's point of view. In the second part, we searched for "food reduction" as a key word from 2000 to 2015 in databases such as Google Scholar, PubMed, Copernicus, DOAJ, EBSCO-CINAHL, and the Iranian search database Iranmedex for principles of food reduction in classical medicine.

Results: The main methods of treatment in traditional medicine include changes in lifestyle, especially diet, the use of medications, and the use of manipulation methods. For diet, the individual may be prohibited from eating or food amounts may be decreased or increased. Centuries ago, Avicenna was making use of methods of food reduction as an important therapeutic approach in the treatment of diseases. According to him, food reduction, to the extent that it does not cause energy loss helps to cure disease. Avicenna has proposed food reduction as an aid to treating a variety of ailments such as headaches and reflux.

Conclusions: Today, a variety of basic and clinical research has shown that food reduction or calorie restriction to a standard level can effectively prevent and treat a variety of diseases such as neoplasms, diabetes, and kidney disease. Practical principles explained by traditional Iranian medicine, in particular Avicenna, could open important and quite uncomplicated strategies for the prevention and treatment of diseases.

Keywords: Avicenna, Traditional, Medicine, Iran

1. Context

Traditional Iranian medicine (TIM) is a rich and valuable school of thought that believes medications are not the only effective approach for the treatment of diseases but that nutrition is also important. As described in his Canon of medicine (10th and 11th centuries), Avicenna believes treatment is performed by three methods: change in the six essentials of life, particularly diet, the use of medications, and manipulation procedures. He knows the position of treatment with diet prior to medication therapy and the use of manipulation (1).

The six essentials for treating and maintaining health mentioned above and discussed by Avicenna include air, foods and drinks, sleeping and waking, body cleansing methods, body motion and rest, and mental matters, among which Avicenna places particular emphasis on food approaches (2).

Because this paper studies food reduction from the

viewpoint of TIM and no similar English review paper was found in Google Scholar or PubMed, we decided to review the original books of TIM, particularly Avicenna's Canon of Medicine. To understand TIM principles in modern literature, we searched Google Scholar and PubMed.

We aim to introduce a cost-effective method with few if any side-effects for preventing and treating diseases.

2. Evidence Acquisition

In this review study, we focused on the Canon of Medicine by Avicenna (10th and 11th centuries) to find and understand Avicenna's point of view. For this part of our study we do not find any similar articles in international databases and our only reference for Avicenna's view is the Canon of Medicine.

For the next part of our article, related principles in classical medicine, we searched for "food reduction" between 2000 and 2015 in Google Scholar and found 1220 ar-

ticles. We then selected the 87 articles in English. Some of these articles were not related to our study, so we selected only those in which principles of food reduction were described, totaling 17. Finally, articles without PMID or DOI number were eliminated, leaving 15 articles. These 15 articles were reviewed twice by one reviewer.

We also searched other databases such as DOAJ for “food reduction,” which resulted in 7389 articles. We then selected articles with subject of “Nutrition, food and food supply,” of which there were 859. Of these, we selected those in English, and in food and nutrition science there were 56. However, we did not find any articles about mechanisms and principles of food reduction that we were able to use in our article. The same thing occurred in Iranian databases, for example, in Iranmedex we found 19 articles about food reduction from 1380 but they were not compatible with the concept of our article and we could not use them in our article. We summarized our study in the PRISMA checklist (Tables 1 and 2).

3. Results

Avicenna classifies nutrition intervention into four categories: food reduction, food prohibition, food increase, and a specific dietary intervention (taadil e ghaza). In this paper, we discuss his views on the role of food reduction in the treatment of diseases.

Given the importance of food reduction in treating diseases and maintaining health, this study was performed by the library method using Avicenna’s Canon of Medicine, and related content was then extracted and examined from the resources of modern medicine.

3.1. Food Reduction in Traditional Iranian Medicine

In Avicenna’s view, food reduction is done in three ways: Reducing the quantity of food, reducing the quality of food, or doing both together. Patient power, disease type, disease duration, disease stages, physical condition, age, location, and the season of the year must all be considered in the amount of food reduction.

Because of their cold and dry temperament, adults and the elderly consume fewer substances in the body and require less energy; therefore, food reduction is regarded as more appropriate for that population than adolescents and children. Regarding the diet of older people, Avicenna believes they need to eat small amounts of food based on the strengths and weaknesses of their digestion at a variety of times.

In cold regions and cold seasons, food intake should not be reduced as much as in hot seasons and hot regions.

Avicenna considered the power and energy of the patient to be the most important issue in the amount of food

reduction; if the person is deficient in any circumstances, even at the peak of health, nutrition must be complete (1).

3.1.1. Food Reduction Types Described in the Canon

3.1.1.1. Food Quality Reduction

Food quality reduction is administered in the case of *Imtila*. *Imtila* means food and blood accumulation in the body. Avicenna described *Imtila* as excess of food, alcohol, and rest, in addition to lack of exercise, resulting in accumulation of waste products in the body, whether beneficial (*Mahmooda*) or non-beneficial (*Ghair-mahmooda*), both of which would be toxic for the body. The accumulation of these waste products might lead to increase in blood volume, vessel wall tension, and vascular pressure (3). Food restriction can help reduce this accumulation and because of this effect, it can also be helpful for reducing inflammation.

While the appetite is good and the individual desires to eat, Avicenna recommends that foods with low nutritional quality, low calorie density, and high volume be used. Such foods include fruits, vegetables, and diluted soups. The purpose of this type of administration is to reduce waste and weight of the body (1).

3.1.1.2. Food Quantity Reduction

When the need is to strengthen the powers of the individual, as in the case of a patient who is convalescent, or a child who is in a period of growth but the gastro-intestinal (GI) tract cannot digest foods easily and completely, Avicenna advises that low-volume and calorie-dense foods should be used. This includes foods such as egg yolks and foods made from rooster or meat juices such as lamb, or gruel.

Due to the reduced food volume, this type of nutrition is more easily digested while expending less energy. The patient will also be strengthened due to the high quality of food (1).

3.1.1.3. Food Quality and Quantity Reduction

If the individual is weak, does not have a good appetite, and also has a body filled with waste, then the patient’s digestion should be improved first and foods with high quality and low volume should be used (1).

3.1.2. According to Disease Stage

According to Avicenna, foods should be given according to the disease. Food reduction is advised more often in acute diseases than chronic diseases, because in chronic diseases the main focus is on reserving individual forces due to the gradual loss of body forces. The Canon states: in most cases, food reduction is used for the treatment of acute diseases.

Table 1. [Part 1] PRISMA Checklist

Section/Topic	#	Checklist Item	Reported on Page #
Title			
Title	1	Food Reduction in Avicenna's View and related principles in classical medicine	1
Abstract			
Structured summary	2	<i>Background:</i> Traditional Iranian medicine (TIM) is a rich and valuable school of thought that believes medications are not the only effective approach for the treatment of diseases but that nutrition is also important. <i>Data sources:</i> Our study includes two parts: the first is a book review of the Canon of Medicine by Avicenna (10th and 11th centuries), in which we focus on finding and understanding Avicenna's point of view. In the second part, we searched for "food reduction" as a key word from 2000 to 2015 in databases such as Google Scholar, PubMed, Copernicus, DOAJ, EBSCO-CINAHL, and the Iranian search database Iranmedex for principles of food reduction in classical medicine. <i>Results:</i> The main methods of treatment in traditional medicine include changes in lifestyle, especially diet, the use of medications, and the use of manipulation methods. For diet, the individual may be prohibited from eating or the amount of food may be decreased or increased. Centuries ago, Avicenna was making use of methods of food reduction as an important therapeutic approach in the treatment of diseases. According to him, food reduction, to the extent that it does not cause energy loss, helps to cure disease. Avicenna has proposed food reduction as an aid to treating a variety of ailments such as headaches and reflux. <i>Conclusion:</i> Today, a variety of basic and clinical research has shown that food reduction or calorie restriction to a standard level can prevent and treat a variety of diseases effectively such as neoplasms, diabetes and kidney disease. Practical principles explained by traditional Iranian medicine, in particular Avicenna, could open important and quite uncomplicated strategies in the prevention and treatment of diseases. <i>Keywords:</i> Avicenna; Traditional; Medicine; Iran	2
Introduction			
Rationale	3	Traditional Iranian medicine (TIM) is a rich and valuable school of thought that believes medications are not the only effective approach for the treatment of diseases but that nutrition is also important.	2
Objectives	4	Our study aims to introduce a cost-effective method with few if any side-effects for preventing and treating diseases.	3
Methods			
Protocol and registration	5	We searched for the term "food reduction" and selected articles explaining the principles and mechanisms of its effects.	4
Eligibility criteria	6	We searched from 2000 to 2015 for human studies discussing the principles of food reduction.	4
Information sources	7	Google Scholar, PubMed, Copernicus, DOAJ, EBSCO-CINAHL, Iranmedex	4
Search	8	We searched for "food reduction" between 2000 until 2015 in Google Scholar, finding 1220 articles. We then selected only articles in English, of which there were 87. Some of these articles were not related to our study, so we selected only those in which principles of food reduction were described, which numbered 17. Finally, articles without a PMID or DOI number were discarded, leaving 15 articles. In DOAJ we searched for "food reduction," which first resulted in 7389 articles. We then selected articles with the subjects "Nutrition, food and food supply," of which there were 859. Of these, we selected those in English and in food and nutrition science, leaving 56. However, we did not find any articles about the mechanisms and principles of food reduction that we could use in our article. The same thing occurred using Iranian databases, for example in Iranmedex we found 19 articles about food reduction from 1380, but they were not compatible with the concept of our article and we could not use them in our article. Because of this we only mention results from Google Scholar and Pubmed in our article and we do not discuss the other databases, but we now mentioned the other results in our article as above.	4
Study selection	9	Refer to item 8	4
Data collection process	10	Refer to item 8	4
Data items	11	Refer to item 8	4
Risk of bias in individual studies	12	All articles were reviewed twice by one reviewer.	4
Summary measures	13	Refer to item 8	4
Synthesis of results	14	Refer to item 8	4

In the early stages of acute diseases, the amount of food given to the individual is reduced, but it must be done in

moderation. In the late stages of the disease, food reduction should be done more seriously.

In chronic diseases, drastic food reduction and even moderate reductions should not be done. In later stages, moderate food reduction can be done.

Rapid weight loss of the patient during the illness indicates that disease has a potent power to weaken bodily forces, and food should be reduced to a lesser degree (1).

3.2. Food Reduction in Classical Medicine

In the developed modern world, the average amount of food consumed by people has increased over previous generations (3). Food reduction, in the form of restricted caloric intake but not to an extent that will cause malnutrition, is discussed as a way to aid in curing diseases.

Unfortunately, due to inattention to and neglect of the richest sources of TIM, this history has been lost. Even classical medical sources say it has only been 80 years since new research has shown the effectiveness of this simple intervention to increase longevity and reduce the incidence of age-related diseases (4). Controlled restriction of caloric intake is an empirically tested method that delays the emergence of a range of diseases including neoplasm, diabetes, kidney and cardiovascular diseases, autoimmune diseases, and neuronal loss during aging in various species of animals (4).

Definition of food reduction from the perspective of classical medicine: In classical medicine many studies have been done on "food reduction," the equivalent of today's calorie restriction (CR), at a level which does not lead to malnutrition, and good results have been obtained.

CR has been introduced as the only non-genetic intervention that will delay the aging process (5).

Various articles have listed several amounts for the percentage reduction in caloric intake, for example, in a study in 1986 this reduction was equivalent to 30%, which increased longevity by 30% - 40% (6). Another paper in 2004 showed that a reduction of 8% is as effective as a 40% reduction.

Calorie reduction is sometimes defined as the Okinawa or CRON diets. The Okinawa diet is derived from the Japanese island of the same name, where the inhabitants have the highest longevity among the inhabitants of the earth; the diet was 20% lower than the average caloric intake of Japanese people, containing 30% yellow and green vegetables (7).

The calorie-restriction with optimal nutrition (CRON) diet is a very low-calorie yet nutritious diet that was developed by Walford et al.

In clinical studies, calorie restriction is defined as reducing daily food intake with intermittent fasting, i.e. one day of less food followed by a day of more food (8).

3.2.1. Food Reduction Effects

Research has shown that food reduction has increased the life expectancy in rodents and slowed the aging process in monkeys (9). Calorie reduction in humans leads to metabolic changes such as decreased levels of triglycerides, decrease in LDL, and regulation of glucose metabolism by enhancing cell responsiveness to insulin and reducing the incidence of atherosclerosis (10).

In experimental models, food reduction increases the resistance of brain neurons to diseases such as Alzheimer's, Parkinson's, Huntington's, and stroke. In clinical trials, the effectiveness of this intervention in improving memory has also been shown (11). Some studies have shown beneficial effect of food reduction in protecting neurons after traumatic brain injury, as well as improving heart function and angiogenesis after heart ischemic injury in rats (12, 13). Food reduction even without weight loss prolongs life expectancy in humans (7).

3.2.2. Mechanisms of the Effect of Food Reduction

Food reduction decreases the molecular mechanisms of ischemic injury: excitotoxicity, oxidative damage, and inflammation (14).

Excitotoxicity is a type of neuronal damage caused by the accumulation of amino acids in the nervous tissue, which could lead to an increase in intracellular calcium and sodium, resulting in activation of protease, kinase, and endonuclease enzymes and cause neuronal loss.

Oxidative damage is damage caused by free radicals, including superoxide anion, hydroxyl radical, and nitrous oxide, which are originally produced in mitochondria and account for apoptosis or programmed cell destruction and inflammation processes (15, 16).

In the inflammatory process, following tissue damage, inflammatory cytokines such as interleukin and tissue necrosis factor are released, which are responsible for destructive and reconstructive effects (17).

A candidate mechanism for the prolongation of life in response to food reduction, and more specifically protein shortage, is the activation of autophagy (18-20). This process turns over subcellular material in response to low nutrients and is as evolutionarily conserved as the CR effect itself (21). Autophagy is activated by reduced insulin and TOR (target of rapamycin) signaling and is therefore enhanced when both the energy and amino acid status of the organism are lowered (22-24). Autophagy acts to recycle damaged proteins and organelles from the cell and may, therefore, as a byproduct of this action, clear out damaged macromolecules that contribute to aging.

Autophagy is a cellular mechanism that protects the recycling of proteins that can lead to programmed cell death.

Autophagy can be caused by starvation and hypoxia. In certain areas, such as nutrient deprivation, autophagic activity is quickly adapted. It can also limit the activity of damaged proteins, which can be toxic or may cause apoptotic cell death (25).

Autophagy plays a dramatic role in the response to starvation. In starvation, autophagy allows the production of intracellular particles to be recycled into an internal source for macromolecular structure blocks, which is very important to maintaining cellular metabolism.

Thus, autophagy can ensure survival and reduce damage, which plays a role like a double-edged sword in the case of cancer (26).

Autophagy is the regular turnover of cellular components based on catabolism of damaged organelles and non-consumed protein through lysosomal function (27).

Defects in the autophagy have serious consequences and Tom in conjunction with cell aging contributes to neurodegenerative diseases, cancer, myopathy, and cardiomyopathy (28).

4. Conclusions

Although in the majority of studies, food reduction is first attributed to McCay in 1935, it has been well noted in the sources of traditional Iranian medicine, and numerous methods have been explained for intervention in the nutrition of an individual. These include prohibition, reduction, and increase in the amount of food in a variety of diseases and conditions. For Avicenna, many diseases can be treated by creating a stylized diet and reducing food intake.

Avicenna also mentions the benefits of fasting as a method of reduction in food intake in many cases. For example, fasting was noted in the treatment of fevers and some types of headache.

Fasting and food reduction are useful not only for treatment of diseases but also have been presented as one of the best ways to stay healthy (1).

Calorie reduction is not the only method emphasized to be effective. Using various properties of foods in maintaining the balance of a healthy person and compensating for deviations from standards of patient safety and satisfaction provide valuable tips that today's medicine is heavily in need of for its success.

Unfortunately, despite numerous studies in the literature on food reduction, it is not currently studied or used in books and current clinical methods as it should be. Practical principles explained by Traditional Iranian Medicine, in particular Avicenna, could provide important avenues of prevention and treatment of diseases that are quite uncomplicated.

This study describes for the first time that Avicenna recognized the benefits of food reduction many centuries before 1935, when modern medicine believes it was introduced. However, because of the lack of papers and review articles on TIM viewpoints, searching was difficult and we focused on the Canon of Medicine.

Defending the rich sources of traditional Iranian medicine also requires numerous clinical studies in various fields, carried out in a documented and scientific way. These studies may then be used as guidance for the treatment of many diseases for which currently there are no effective treatments or which have complicated therapies.

In our future works, we will review food reduction in TIM based on the obtained classification. We need to mention some limitations that we faced during this study. TIM is the combination of different medical traditions from Greece, Egypt, India, and China from more than 4000 years ago. It is a temperamental medicine with specific structure different from other schools, and therefore, is not completely comparable to other traditional medicine schools. Consequently, reviews and articles on other traditional medicines were not very helpful.

In addition, due to the lack of papers and review articles on TIM viewpoints, we studied food reduction based on the Canon of Avicenna. Because accessing the original books was not as easy as accessing modern articles, it was not possible to review all the traditional manuscripts on this topic. Furthermore, humoral medicine is a very complex issue and we limited the scope of this study to a brief summary of the main issues involved. However, we hope that this study will stimulate some readers to look at this issue from a different perspective.

Table 2. [Part 2] PRISMA Checklist

Section/Topic	#	Checklist Item	Reported on Page #
Risk of bias across studies	15	Due to the lack of papers and review articles on TIM viewpoints, searching was difficult and we focused on Avicenna's Canon of Medicine, which could cause a bias	11
Additional analyses	16	We do not have any additional analysis	11
Results			
Study selection	17	For the first part of the study, we found that Avicenna classifies nutrition intervention into four categories: food reduction, food prohibition, food increase, and a specific dietary intervention (taadil e ghaza). In this paper, we discuss his views on the role of food reduction in the treatment of diseases. Given the importance of food reduction to treating diseases and maintaining health, this study was performed by the library method using Avicenna's Canon of Medicine, and related content was then extracted and examined from the resources of modern medicine. For the second part we searched for "food reduction" between 2000 and 2015 in Google scholar and found 1220 articles. We then selected articles in English, of which there were 87. Some of these articles were not related to our study and we selected only those in which the principles of food reduction were described, of which there were 17. Finally, articles without a PMID or DOI number were eliminated, leaving 15 articles.	4
Study characteristics	18	Refer to item 17	4
Risk of bias within studies	19	Due to the lack of papers and review articles on TIM viewpoints, searching was difficult and we focused on Avicenna's Canon, which could cause a bias.	4
Results of individual studies	20	Refer to item 17	4
Synthesis of results	21	Refer to item 17	4
Risk of bias across studies	22	Due to the lack of papers and review articles on TIM viewpoints, searching was difficult and we focused on Avicenna's Canon, which could cause a bias.	4
Additional analysis	23	We do not have any additional analysis.	4
Discussion			
Summary of evidence	24	Although in the majority of studies we reviewed, the first mentions of food reduction are attributed to McCay in 1935, it has been well noted in traditional Iranian medicine sources, and numerous methods have been explained for intervention in the nutrition of an individual. These include prohibition, reduction, and increase in the amount of food in a variety of diseases and conditions. According to Avicenna, many diseases can be treated by stylizing food and especially reducing it. Avicenna also mentions the benefits of fasting as a reduction in food intake in many cases. For example, fasting was noted in the treatment of fevers and some types of headache. Fasting and food reduction are useful not only for treatment of diseases but have also been presented as one of the best ways to stay healthy. The emphasis is not only on calorie reduction to be effective. The old methods of using various properties of foods to maintain balance of a healthy person and compensate for deviations from standards of patient safety and satisfaction provide valuable tips that today's medicine is heavily in need of for its success. Unfortunately, despite numerous studies that have been done in the literature on food reduction, it is not today described in books and current clinical methods as it should be. Practical principles explained by traditional Iranian medicine, in particular Avicenna, could open an important and quite uncomplicated strategies in the prevention and treatment of diseases. This study describes for the first time that Avicenna recognized the benefits of food reduction many centuries before 1935, when modern medicine believes it was introduced. However, because of the lack of papers and review articles on TIM viewpoints, searching was difficult and we focused on the Canon of Medicine. Defending the rich sources of traditional Iranian medicine also requires numerous clinical studies in various fields, carried out in a documented and scientific way. These studies may then be used as guidance for the treatment of many diseases for which currently there are no effective treatments or which have complicated therapies. In our future works, we will review food reduction in TIM based on the obtained classification. We need to mention some limitations that we faced during this study. TIM is the combination of different medical traditions from Greece, Egypt, India, and China from more than 4000 years ago. It is a temperamental medicine with specific structure different from other schools, and therefore is not completely comparable to other traditional medicine schools. Consequently, reviews and articles on other traditional medicines were not very helpful. In addition, due to the lack of papers and review articles on TIM viewpoints, we studied food reduction based on the Canon of Avicenna. Because accessing the original books was not as easy as accessing modern articles, it was not possible to review all the traditional manuscripts on this topic. Furthermore, humoral medicine is a very complex issue and we limited the scope of this study to a brief summary of the main issues involved. However, we hope that this study will stimulate some readers to look at this issue from a different perspective.	10
Limitations	25	Refer to item 24	10
Conclusions	26	Refer to item 24	10
Funding			
Funding	27	We do not have any funding.	14

Footnote

Authors' Contribution: Study concept and design: Aisan Nozad, Mohsen Naseri, Mir Bahram Safari, Azam Abd Al Ahadi and Farzaneh Ghaffari; acquisition of data: Aisan Nozad, Mohsen Naseri, Mir Bahram Safari, Azam Abd Al Ahadi and Farzaneh Ghaffari; analysis and interpretation of data: Aisan Nozad, Mohsen Naseri, Mir Bahram Safari, Azam Abd Al Ahadi and Farzaneh Ghaffari; drafting of the manuscript: Aisan Nozad, Mohsen Naseri, Mir Bahram Safari, Azam Abd Al Ahadi and Farzaneh Ghaffari; critical revision of the manuscript for important intellectual content: Aisan Nozad, Mohsen Naseri, Mir Bahram Safari, Azam Abd Al Ahadi and Farzaneh Ghaffari; statistical analysis: Aisan Nozad, Mohsen Naseri, Mir Bahram Safari, Azam Abd Al Ahadi, and Farzaneh Ghaffari; administrative, technical, and material support: Aisan Nozad, Mohsen Naseri, Mir Bahram Safari, Azam Abd Al Ahadi, and Farzaneh Ghaffari; study supervision: Aisan Nozad, Mohsen Naseri, Mir Bahram Safari, Azam Abd Al Ahadi, and Farzaneh Ghaffari.

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