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Short Communication

Bitter Taste in the Treatment of Heart Diseases from Avicenna's Point of View

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Abstract

The function of bitter taste due to the existence of too much of its receptor on many extra-oral tissues is not only related to the oral cavity, but is effective in many physiological functions. More than ten centuries ago, Avicenna (980–1032 CE), a Persian physician, pointed to the effects and functions of various tastes in the body. In this research, we examined the heart medicines mentioned by Avicenna, relying on their taste, especially the bitter taste. The books used in the case of Persian Medicine included the following: Qanun Fi al-Teb (Canon of Medicine), Manafe-al-Aghzieh va Daf-e-Mazareha and Treatise on Cardiac Drugs. In addition, articles published in English in the last 10 years were searched in PubMed, Google Scholar, Scopus and Embase. Vasodilation, inotropic effects, cardio-protection, digital like effect, reducing the accumulation of calcium and nitric oxide in the heart, antioxidant activity, improving heart metabolism and preserving mitochondrial function after MI are some of the cardiovascular effects of Avicenna`s bitter tasting heart medicines, which are also confirmed by clinical evidences in modern investigations. The findings of this research show that the function of bitter-tasting herbal drugs in the body can have beneficial cardiovascular effects, some of which have been proven in studies, and more researches is needed in this field.

Keywords: Heart disease; Cardioprotective agents; Blood pressure; Persian Medicine; Bitter taste

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Introduction

Sense of taste is one of the important senses in humans. Current evidence show that taste receptors are also present in extra-oral tissues. This issue is especially related to three tastes, bitter, sweet and umami, whose receptors are G-Protein-Coupled Receptors (GPCRs), due to the existence of too much of them on extra-oral tissues such as skin, brain, heart, reproduction organs, urinary tract, pancreas and blood cells are more obvious [1]. Accordingly, it can be said that the function of taste is not only related to the oral cavity, but is effective in many physiological functions.

More than ten centuries ago, Avicenna (980–1032 CE), a Persian physician, pointed to the effects and functions of various tastes in the body [2]. According to his comprehensive medical textbook, the *Canon of Medicine* (Al-Qanun Fi al-Teb), humans are able to identify nine tastes: sweetness, bitterness, saltiness, pungency, sourness, fat, tightness, astringent and tastelessness [2].

In this manuscript, we explain the functions of bitter taste and the relationship between cardiovascular system and these functions based on Traditional Persian Medicine. In addition, we have stated the clinical evidence about the effects of bitter-tasting drugs on cardiovascular diseases based on new researches.

Methods

Articles published in English in the last 10 years were searched in PubMed, Google Scholar, Scopus and Embase with the following keywords in the article title: bitter taste receptor, (bitter taste and effects), (bitter taste and cardiovascular system), (bitter taste and heart). The next step was to examine the approach of Traditional Persian Medicine regarding the effect of bitter taste on cardiovascular system. The books used in this section included the following: *Al-Qanun Fi al-Teb* (Canon of Medicine), *Manafe-al-Aghzieh va Daf-e-Mazareha* and *Kitab al-Adviyat ol-Qalbiye* (Treatise on Cardiac Drugs).

Results

Among the different tastes, especially bitterness can be used for therapeutic issues; and new findings also show the role of Taste Receptors (T2Rs) in the production and function of thyroid hormones, glucose homeostasis, endocrine hormones and contraction and expansion of smooth muscles [3].

The identification of these receptors on cardiomyocytes [4], as well as the smooth muscles of blood vessels has attracted the attention of researchers. It has been observed that in laboratory conditions, the stimulation of these receptors causes strong vasodilation, which is dependent on the concentration and independent of the endothelium that can be used in the treatment of hypertension [4]. There is also the possibility of inotropic effects of T2Rs agonists on cardiomyocytes and their use for the treatment of ventricular tachycardia [4].

According to Traditional Persian Medicine, some parts of the body are interested in a certain taste, for example, sweetness is the favorite taste of the liver; while the heart has no desire for this taste. According to Avicenna, bitterness removes the harm of sweets [5]. Studies have also shown that the *in vitro* exposure of enteroendocrine cells to bitter substances stimulates the secretion of Glucagon-like peptide 1 (GLP-1) and this shows that the function of T2Rs may be useful in diabetes. In addition, the combination of bitterness with astringent taste will relieve the narrowness and blockage of the ducts [2], which is very important in the treatment of diseases such as ischemic heart disease. Avicenna in his "Treatise on Cardiac Drugs", mentions herbal medicines that affect the heart which more than half of them have a bitter taste [6].

Avicenna also recommended the use of bitter-tasting plants such as Bitter orange (blossom, fruit and peel), Mint (*Mentha* spp.), Saffron (*Crocus sativus* L.), and lavender (*Lavandula stoechas* L.) as treatment and even prevention in the diet of people suffering from cardiovascular diseases [7].

Avicenna believes that most drugs that are used in heart diseases exert their therapeutic effect on the body by creating two important actions, which called condense (*Ghabz*) and sweep (*Jalaa*) in Traditional Persian Medicine. Among these two actions, *Jalaa* is one of the most important functions of bitter taste in the body; which in Traditional Persian Medicine means to move the substances stuck to the walls of the arteries. This feature can be useful in people with atherosclerosis and for the people suffering from ischemic heart disease. Moreover, Avicenna points out that one of the effects of *Jalaa* is facilitating drug delivery of the heart drugs.

Also, many bitter-tasting drugs mentioned in Treatise on Cardiac Drugs, have condense (*Ghabz*) action and are called astringent (*Ghabez*) drugs. It was believed that these drugs strengthen the organ by compressing tissue components and preventing harmful substances to enter into the tissue. They are also used as heart tonics [6].

Another effect that can be seen in many of bitter-tasting drugs, as has stated in the articles, is their effect on ventricular tachycardia that is called (*Khafaghan*) in Traditional Persian Medicine. In the case of chicory, even its topical use as a poultice on the heart is also effective to relieve tachycardia. In a study that was conducted on obese people suffering from anxiety, the electrocardiogram symptoms were significantly improved in people who used a mixture of several plants, including chicory, to reduce anxiety symptoms [8].

In table 1, the cardiotonic drugs mentioned in Treatise on Cardiac Drugs that have bitter taste are shown along with their effect on the cardiovascular system. In this table, related articles obtained by searching PubMed, Google Scholar and Scopus databases are also collected, which show the cardiac effects of bitter-tasting drugs.

Table 1. Cardiovascular effects of heart tonic drugs with bitter taste in Avicenna's point of view and recent studies

Common name	Scientific name	Persian name	Cardiac effects based on Avicenna's point of view				Cardiac effects based on new studies	Reference of new studies
			Astringent	Sediment Remover	Heart tonic	Palpitation treatment		
Cocoon	*Bombyx mori*	Abrisham			✓	✓	Cardio protective	[12]
Bergamot	*Citrus medica* var. *cedrata*	Toranj			✓		None	
Common Myrtle	*Myrtus communis* L.	Aas (Mourd)	✓	✓	✓	✓	Protective effect on the heart with an effect on atherosclerosis	[15]
Lavender	*Lavandula stoechas* L.	Ostokhodous	✓	✓	✓		Reduction of systolic blood pressure in rats	[15]
Chicory	*Cichorium intybus* L.	Kaasni	✓	✓	✓	✓	Antioxidant activity and protective effect on the heart	[16]
Rose	*Rosa damascena* Herm.	Gol Sorkh	✓	✓	✓	✓	Neutralization of pathological changes caused by oxidative stress in heart tissue and muscle relaxation through stimulation of beta-adrenergic receptors	[13,14]
Saffron	*Crocus sativus* L.	Zafaran	✓		✓		Protective effect on the heart	[15]
Bamboo	*Bambusa bambos* (L.) Voss	Tabashir	✓		✓	✓	None	
Mint	*Mentha* spp.	Nana	✓	✓	✓	✓	Blood pressure reduction in normal people, blood pressure reduction in animal models	[15]
Galingale	*Alpinia galanga* (L.) Willd., *A. officinarum* Hance	Soed	✓		✓		Protective effect on the heart	[15]
Cinnamomum tamala	*Cinnamomum citriodorum* Thwaites, *C. tamala* (Buch.-Ham.) T.Nees & C.H.Eberm.	Sazej			✓	✓	Reducing the accumulation of calcium and nitric Oxide in the heart	[15]
Agar Wood	*Aquilaria malaccensis* Lam.	Oud	✓	✓	✓		None	

Lemon balm	*Melissa calamintha* Benth.	Farangjmeshk	✓	✓	✓	✓	None	
Common peony	*Paeonia officinalis* L.	Phavania	✓	✓	✓		A digitalis-like effect on the heart and a slight decrease in blood pressure in animal models	[17]
Santalum	*Santalum* sp.	Sandal	✓	✓	✓	✓	None	
Elecampane	*Inula helenium* L.	Rasen		✓	✓		improving heart metabolism and preserving mitochondrial dysfunction after MI	[18]
Polypore	*Polyporus officinalis*	Gharighoon		✓	✓		None	

In the review of the drugs mentioned in Treatise on Cardiac Drugs, it was evident that the vast majority of these drugs exert their cardiac effects through blood dilution; and since dilution is one of the important actions of bitter taste in the body, paying attention to the taste of the drug can play a role in choosing the more effective drug on the cardiovascular system.

Discussion

Due to the importance of prevention and treatment of cardiovascular diseases, paying attention to the effects of bitter taste on the cardiovascular system and herbal medicines that exert their cardiovascular activity with minimal side effects by stimulating the bitter taste receptor can be considered in future studies. Still, some functions of bitter taste mentioned in Traditional Persian Medicine have not been considered by researchers. Also, the cardiac effects of some drugs mentioned in Treatise on Cardiac Drugs, which had a bitter taste, have not been clinically tested.

On the other hand, natural components that cause bitterness in plants can be used as more effective medicines in the treatment of cardiovascular diseases. Some of the natural extracted components that are responsible for the bitter taste are cyanogenic glucoside amygdalin in the kernels of apricots [9], amygdalin in almond and peach kernel [10] and solanidine, amygdalin, salicin, and arbutin in bamboo [11].

Conclusion

According to the evidence about the presence of bitter taste receptors (T2Rs) on cardiomyocytes and their effects on the heart physiology and presence of a large number of bitter-tasting drugs in Avicenna's book (Treatise on Cardiac Drugs); these natural drugs can be used in order to collect more scientific evidence about the effects of bitter taste on the heart.

Conflict of Interests

None.

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