

Effects of the valerian root extract on cardiac echocardiography indexes in the female Cats

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Abstract. Aim: The Valerian plant is known as a medicinal plant with sedative, anxiolytic, anti-inflammatory properties and somnifacient effect. Therefore studying cardiac effects of this plant can help to gain a better understanding of its pharmacodynamic effects in order to provide above properties. Material and method: In this research 18 healthy female pet cats, 2 years old in the mean, were selected. Cardiac function indexes including the fractional shortening, ejection fraction and normal stroke volume were measured using echocardiography. Cats were fed by 500 mg/kg Valerian root extract and clinical signs like distraction and incoordination were observed after 15 minutes; the factors were measured. Results were analyzed by the statistical method of independent T-test. Results: Obtained data was showed satisfactory results which are detailed described in the text below. The results showed that stroke volume index increased significantly while fractional shortening index decreased significantly. Also the ejection fraction index was not significant statistically. Conclusion: Therefore extract of the Valerian root decreases the sympathetic performance, effects on the heart indirectly, relaxes the myocardium in result of the decrease in the fractional shortening of the heart muscle and consequently increases the diastolic and systolic volume and increases the stroke volume of the blood accompanied by the decrease in the preload and after load.

Key Words: Valerian root extract, echocardiography, Cat, cardiac function index, ejection fraction, stroke volume.

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Introduction

The Valerian plant is an herbaceous plant with multiple upright stalks and length of its stem which can reach up to 2m. This plant has sweetly scented pink or white flowers and grows in clusters. The plant odor is very attractive for the cats, so this is the reason why it is also known as 'cat grass'. Cats follow the plant odor and approach it where it is existed and after smelling its odor the state of thirst is provided. The Valerian plant is known as a desirable medicinal plant between users of natural drugs with sedative, anxiolytic, and somnifacient effects. Among available compounds in the aqueous extract of the Valerian root (for example alkaloids, Iridoids, flavonoids and terpenoids) and valeric acid have been reported to be responsible for the plant medicinal effects (Mirabi & Mojab 2013; Taavoni et al 2013). Recommended effects are resulted from the mechanism of the extract effect and more backs to two effects antihistamine and interference with the GABA receptor. The main effects like decreasing anxiety in addition to decreasing antihistamine effects can be related to the interference with GABA receptor in a way that consumption of this extract increases the Phenobarbital

performance (Glass et al 2003; Oliva et al 2004; Felgentreff et al 2012).

Echocardiography is a valuable non-invasive diagnostic tool that is used to evaluate the size of heart cavities, thickness and movement of the wall, anatomy and movement of valves, great vessels and pericardium and some heart disorders (Yadegari et al 2013). The authors used echocardiography to study the procedure of drug effect on the heart performance. Of the most significant cardiac function parameters the heart shortening fraction (index to estimate myocardial contractile force), stroke volume (the volume of blood pumped from one ventricle of the heart with each beat) and ejection fraction (the volumetric fraction of blood pumped out of the ventricle) can be stated. The present project was aimed to studding the effects of the valerian root on cardiac echocardiography indexes in the (species) cats.

Materials and Methods

This study was carried out only at Shahrekord Branch, Islamic Azad University Veterinary Hospital and was designed approved according to the requirements by its Ethics Committee. Written

informed consent was obtained from all the cat owners in accordance with the Declaration of Helsinki, and the Tokyo update. In this study effects of the Valeria root aqueous extract on cardiac indexes were done through M-mode and 2D echocardiography as a non-invasive method in order to measure cardiac changes imposed by the extract. Identifications were consequently confirmed with the help of the authentic specimens deposited at the Herbarium of Research Center of Agriculture and Natural Resources of Chaharmahal va Bakhtiari (CHB) and I.A.U. Shahrekord Branch (IAUSHK), Iran. In this study 18 female pet cats, 2 years old in the mean, were selected. The animal were skin prepared and clipped before checked by echocardiography. In order to ensure that the cardiovascular system is healthy some clinical and paraclinical examinations like electrocardiography, complete blood test and heart auscultation were performed. Then echocardiography with the device EX8000, MEDISON with the Phased Array transducer and frequency of 5 MHz was conducted (Thomas & Mattoon 1995).

The aerial parts of the plant were dried inside for one week at room temperature ($30\pm 5^{\circ}\text{C}$), and the ground to fine a powder using moulinex food processor. The hydro-alcoholic extract was obtained by maceration of the crude plant powder with ethanol/water (70/30) for four days in a chamber temperature ($35\pm 5^{\circ}\text{C}$) in the dark. The extract was filtered using a sterile cloth sheet. The filtrate was evaporated under reduced pressure at temperature below 45°C with a rotary evaporator and a dark green hydro-alcohol extract (yield $\sim 11\%$) was obtained. The extract samples were stored in universal bottles and kept at 4°C prior to use.

Animals were prepared in a calm environment with the minimum stress. Intercostals' spaces were clipped and echocardiography was placed from the 3th and 5th intercostals' spaces in the longitudinal and transverse views on the left and right thorax. The 2D and M-mode echocardiography with approach of right intercostal space (next to the sternum) from the longitudinal view and right intercostal space (next to the sternum) from the lateral view was performed individually in each of cats before they were fed with Valeria extract. After this performance, echocardiography indexes including fractional shortening ejection fraction and stroke volume were assessed and measured (Sepulveda *et al* 2005).

The Valeria extract, in dosage of the 500 mg/kg, was prepared by the percolation method. Animals were fed and the echocardiography was repeated after obvious clinical signs (like incoordination and distraction). Then obtained data were analyzed with the SPSS 16 software and mean and standard deviation of measurements were calculated. The level of significance was determined at $P < 0.05$.

After testing to ensure the health of animals, for 10 days in the hospital were kept in Islamic Azad University of Shahrekord Branch.

Results

Clinical signs were appeared in 10 cats (57%) 15 minutes after cat were fed with the extract. Clinical signs were included distraction that was obviously apparent in this group. Another 8 cats (43%) had not certain clinical reaction. Clinical changes was showed in echocardiography indexes including fractional shortening, ejection fraction and stroke volume, left ventricular

internal diameter at end-diastole, left ventricular internal diameter at end-systole, left ventricular posterior wall thickness at end-diastole and left ventricular posterior wall thickness at end-systole. Interventricular septal thickness at end-diastole and interventricular septal thickness at end-systole (Figure 1 & Figure 2), standard and mean deviation for each of indexes individually were evaluated and measured, as well (Table 1). Obtained results in each part were entered to the SPSS software version 16 and by the independent T-test were studied, so results were divide to significance and no significance.



Figure 1. Evaluated and measured of echocardiography indexes by M-mode and 2D methods

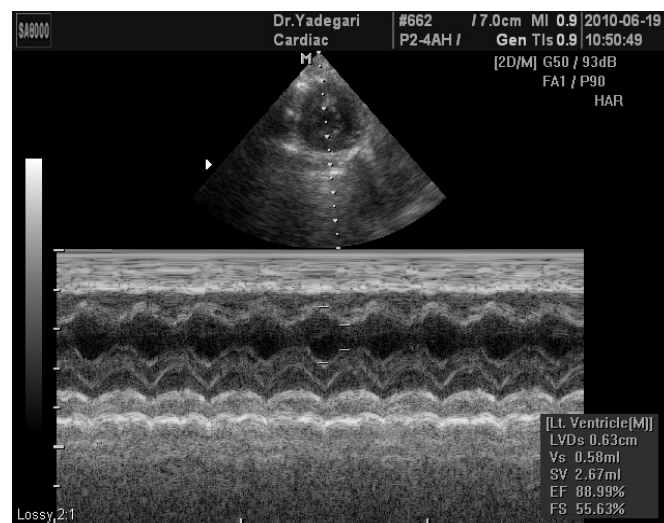


Figure 2. Evaluated and measured of echocardiography indexes by M-mode and 2D methods

The stroke volume and left ventricular internal diameter at end-diastole, left ventricular internal diameter at end-systole in the treatment group was increased than the control group what was significant statistically ($P < 0.05$). Furthermore, the fractional shortening, ejection fraction, left ventricular posterior wall thickness at end-diastole and left ventricular posterior wall thickness at end-systole in the treatment group was decreased than the control group what was significant as well ($P < 0.05$). Interventricular septal thickness at end-diastole and interventricular septal thickness at end-systole in the treatment group decreased than the control group significantly ($P < 0.05$).

Table 1. Mean and standard deviation of the total echocardiographic parameters calculated in the control and treatment groups.

Groups	Control	Treatment	P
SV (ml) ¹	2.68±1.02 ^a	3.34±0.86 ^b	0.001
FS (%) ²	57.06±6.04 ^a	52.05±6.23 ^b	0.001
EF (%) ³	88.76±3.85 ^a	78.64±5.37 ^b	0.001
HR (beat/minute) ⁴	182.57±24.09 ^a	152.18±27.20 ^{ab}	0.06
IVSd (cm) ⁵	0.17±0.05 ^a	0.15±0.03 ^{ab}	0.109
IVSs (cm) ⁶	0.23±0.03 ^a	0.21±0.07 ^{ab}	0.116
LVIDd (cm) ⁷	1.13±0.14 ^a	1.23±0.13 ^b	0.001
LVIDs (cm) ⁸	0.48±0.09 ^a	0.58±0.11 ^b	0.001
LVFWd (cm) ¹⁰	0.25±0.04 ^a	0.16±0.03 ^c	0.001
LVFWs (cm) ¹¹	0.33±0.03 ^a	0.24±0.05 ^c	0.001

a,b Numbers with different superscripts in the same column differ significantly

1- Stroke Volume. 2- Fractional Shortening. 3- Ejection Fraction. 4- Heart Rate. 5- Interventricular septal thickness at end-diastole. 6- Inter ventricular septal thickness at end-systole. 7- Left ventricular internal diameter at end-diastole 8- Left ventricular internal diameter at end-systole. 9- Septum E Point. 10- Left ventricular posterior wall thickness at end-diastole. 11- Left ventricular posterior wall thickness at end-systole.

Heart rate was also measured and was increased in the treatment group than the control group but statistically was not significant ($P>0.05$).

Discussion

Since Valeria extract was introduced as a plant with sedative and anxiolytic effects, it imposes these effects on the heart and the central nervous system as direct and indirect. In this study, fractional shortening in cats was decreased this can be related to the decrease in stimulation that is provided by the sympathetic system (Simon *et al* 1980; Klein *et al* 1981; Krishnamurthy *et al* 2007) in result of increase in the GABA receptor performance (Khom *et al* 2010).

The stroke volume is a factor which is influenced indirectly by the preload and afterload. Increased stroke volume can be justified considering increase of these two parameters due to decrease in sympathetic output and decrease resistant vessels (Kenmure *et al* 1968; Kozłowski *et al* 2003). Heart rate in the treatment group was increased but statistically was not significant. With regard to the decrease in sympathetic output, the heart rate should decrease while in this study the heart rate was increased that can be attributed to activation of load and receptor reflex in result of decrease in sympathetic output on blood vessels. Relaxation of blood vessels and decrease in blood pressure consequently cause increasing in heart rate in order to compensate decrease in the blood pressure by activating the load and receptor reflex (Billman 2013; Horwitz *et al* 2013; Niu *et al* 2013).

Heart was enlarged because left ventricular dimension in end systole and end diastole was increased. Therefore ejection fraction and fractional shortening were decreased significantly and stroke volume was increased significantly because resistant of

blood vessels were decreased due to GABA effect and of sympathetic output.

Conclusions

Percentage of ejection fraction was decreased statistically that according to performed studies effective factors namely stroke volume and the left ventricle volume in the diastole time decrease the heart ejection fraction percent directly and indirectly respectively. Indexes like heart beat number, stroke volume and ejection fraction are factors that the cardiac system function has direct relationship with them and the pharmacodynamic performance of the Valerian root aqueous extract can be better determined when these factors are studied.

Competing interest

The authors declare that they have no competing interests.

Authors' contribution

All authors contributed extensively to the work presented in this paper and approved the final manuscript.

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