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The effect of Rosa Canina hydroalcoholic extract on ventricular arrhythmias in heart failure patients with implantable cardioverter-defibrillators: A Randomized Clinical Trial

Mehrsa Movahed[1], Vafa Baradaran Rahimi[1,2], Mohammad Tayyebi[1], Amir Hooshang Mohammadpour[3], Zahra Zandi[1]*

1. Department of Cardiovascular Diseases, Faculty of Medicine, Mashhad University of Medical Sciences, Mashhad, Iran.
2. Patient Safety Research Center, Clinical Research Institute, Mashhad University of Medical Sciences, Mashhad, Iran.
3. Department of Clinical Pharmacy, School of Pharmacy, Mashhad University of Medical Sciences, Mashhad, Iran.

***** ***Corresponding author:*** Zahra Zandi; Assistant Professor; Department of Cardiovascular Diseases, Faculty of Medicine, Mashhad University of Medical Sciences, Mashhad, Iran. zandiz@mums.ac.ir

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Abstract

Background: Heart failure (HF) transpires when the heart is unable to pump sufficient blood. A key cause of ventricular arrhythmias in HF is oxidative stress and prolonged inflammation. Few clinical studies exist on the heart-related effects of *Rosa Canina*, especially in high-risk patients with implantable cardioverter-defibrillators (ICDs).

Objectives: This study was designed to assess whether Rosa Canina extract could reduce ventricular arrhythmias in these patients.

Methods: This double-blind, randomized clinical trial was conducted on 100 patients with HF and ICDs. Patients were randomly assigned to two groups: one received Rosa Canina extract tablets (250 mg, two tablets twice daily) and the other received placebo tablets of similar shape and color (two tablets twice daily). The extract was prepared and standardized in the pharmacognosy laboratory using the wet granulation method. Patients were followed for one month, and the number of ventricular arrhythmias, PVCs, ICD shocks, and hospital admissions was recorded.

Results: The Rosa Canina group had significantly lower PVC frequency (22% vs. 58%; P<0.001) and lower ICD shock frequency (14% vs. 40%; P=0.003) compared to the placebo group. In contrast, hospitalization rates did not differ significantly between groups (P = 0.180). Furthermore, 86% of patients in the *Rosa Canina* group achieved a successful outcome, compared to 60% in the placebo group (P = 0.003).

Conclusion: The findings suggest that *Rosa Canina* extract may be an affordable and helpful supplement to standard treatment for reducing serious complications in heart failure patients.

Keywords: Heart Failure, Arrhythmia, Rosa Canina, Device Lead Extraction, Implantable Cardioverter Defibrillator (ICD)

1. Background

Heart failure (HF) is a debilitating condition in which the heart cannot pump sufficient blood to meet the body's metabolic needs, placing a substantial burden on global healthcare systems. It often leads to electrical disturbances such as ventricular arrhythmias, including ventricular tachycardia (VT) and ventricular fibrillation (VF), which are major contributors to sudden cardiac death (SCD), accounting for nearly half of all cardiovascular fatalities (1-3).

Implantable cardioverter-defibrillators (ICDs) are the gold standard for preventing SCD in patients with reduced left ventricular function (4). ICDs effectively lower mortality and provide life-saving shocks, yet both appropriate and inappropriate shocks may increase overall mortality, likely due to disease progression or direct myocardial effects of the shock (5).

Oxidative stress and chronic inflammation are central to the development and persistence of ventricular arrhythmias (6). Reactive oxygen species (ROS) can overwhelm antioxidant defenses, causing damage to cell membranes, proteins, and DNA (7-9). Systemic and cardiac inflammation, through pro-inflammatory cytokines such as tumor necrosis factor alpha (TNF-α) and interleukin (IL)-6, can promote myocardial fibrosis, disrupt electrical conduction, and increase leukocyte adhesion to coronary vessels (10, 11).

Natural compounds that can modulate oxidative stress and inflammation have gained attention as complementary therapies in HF and arrhythmia management. The fruit of Rosa Canina (dog rose) is rich in bioactive compounds, including vitamin C, carotenoids, polyphenols, and galactolipids, with potent antioxidant and anti-inflammatory properties (12, 13). Studies indicate that Rosa Canina extract can neutralize free radicals, inhibit lipid peroxidation, and enhance total plasma antioxidant capacity (14). Reducing ROS may improve ion channel function, stabilize calcium handling, and decrease the risk of ventricular arrhythmias. Its anti-inflammatory effects can further mitigate arrhythmogenic factors in the heart (15).

Importantly, Rosa Canina extract has been shown to enhance immune function without significant side effects (12, 15), making it a safe and promising long-term adjunct therapy for HF patients, who often use multiple medications. Given the key roles of oxidative stress and inflammation in ventricular arrhythmias and the limited studies on hydroalcoholic Rosa Canina extract in high-risk ICD patients, this study aimed to evaluate the effects of tablets containing this extract on ventricular arrhythmias in HF patients with ICDs.

2. Methods

2.1. Study Population:

This double-blind randomized clinical trial included 100 patients with HF who had ICDs. Patients were eligible if they were over 18 years old, had a confirmed diagnosis of HF, had an ICD implanted for more than three months, and provided written informed consent. Patients were excluded if they had NYHA class IV HF, severe kidney or liver dysfunction, underweight (BMI ≤ 18.5 kg/m²), were pregnant or suspected pregnant, used warfarin, lithium, or chemotherapy drugs, had recent antiarrhythmic medication changes, had undergone catheter ablation, coronary revascularization, or open-heart surgery, had recent stroke or transient ischemic attack, seizures, infections requiring hospitalization, major surgery, type 1 diabetes, pituitary or adrenal disorders, malnutrition, substance or alcohol abuse, gastrointestinal disease, cancer, ICDs incapable of recording arrhythmias, experienced serious adverse events during the study, or were unwilling or unable to continue the study.

2.2. Sample Size:

The sample size was calculated based on the mean proportion of PVCs relative to the total number of heartbeats per hour. Assuming 70% of HF patients exhibit PVCs and that the baseline PVC frequency is similar between groups, with a type I error of 0.05 and 90% statistical power, 32 patients per group are required (calculated using PASS 2021 software). Given a 10% potential dropout rate, the final sample size was increased to 50 patients per group. ICD shocks were considered a secondary endpoint; therefore, the study was not specifically powered to detect differences in shock reduction. (Figure 1)

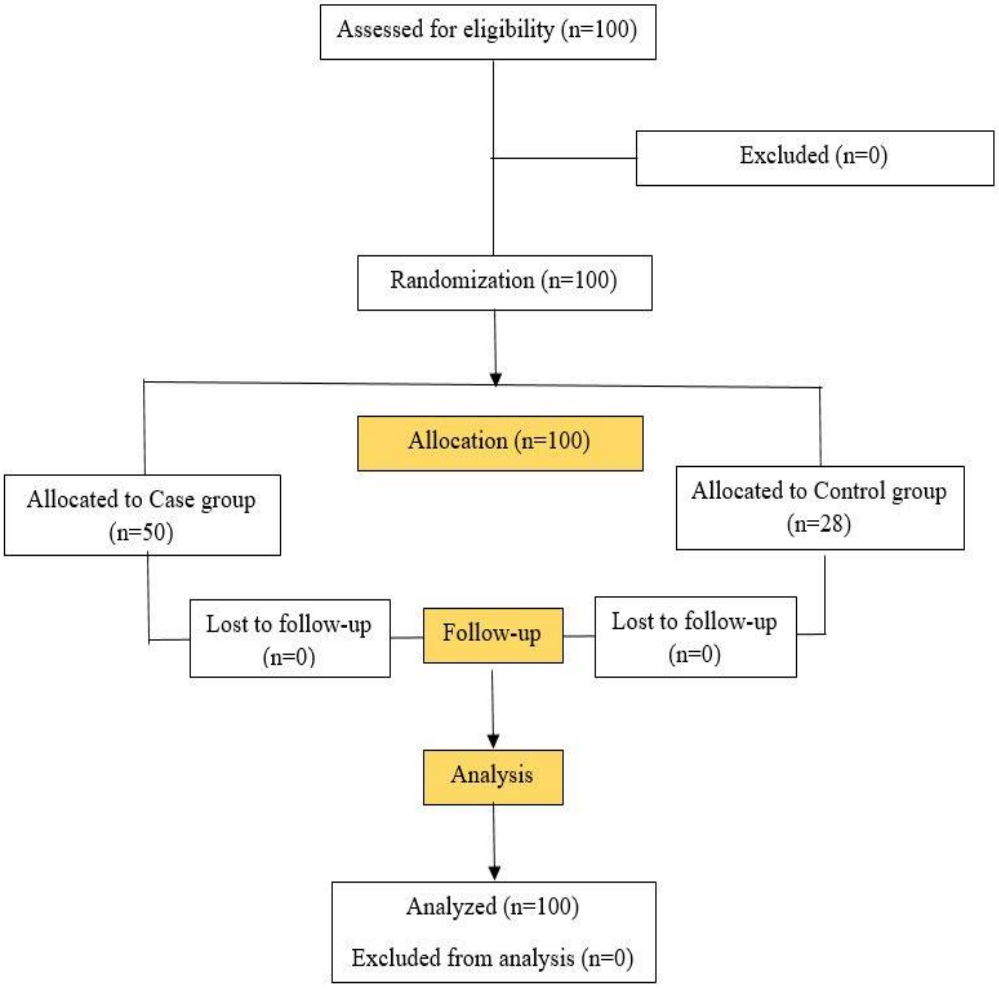

Figure 1: The CONSORT diagram of the study.

2.3. Preparation of Extract and Tablets:

Rosa Canina fruit extract was prepared in the Pharmacognosy Laboratory at Mashhad School of Pharmacy. Tablets containing the extract and matching placebos were produced in the Industrial Pharmacy Laboratory under the supervision of a pharmaceutics specialist. Tablets were manufactured using wet granulation: starch and microcrystalline cellulose were mixed thoroughly, then concentrated Rosa Canina extract was added as the active ingredient and binder to form wet granules. After drying, the granules were compressed into round, convex tablets weighing approximately 700 mg each, containing 250 mg of extract. Placebo tablets were prepared using the same excipients, with a small amount of food coloring added. The total phenolic content of the extract tablets was standardized using the Folin–Ciocalteu method with gallic acid as the reference, yielding an average phenolic content of 27% w/w per tablet.

2.4. Study Procedure:

Participants were randomly assigned to intervention or control groups using a 4-patient block design. Random sequences (e.g., AABB, ABAB, ABBA, BBAA, BABA, BAAB) were generated, and patients were allocated sequentially according to their enrollment order. Study medications were labeled A or B to maintain blinding. Patients in the intervention group received two tablets of Rosa Canina extract (250 mg) twice daily, and patients in the placebo group received two placebo tablets twice daily for 1 month.

At baseline, the study objectives and procedures were explained, and informed consent was obtained. Demographic data, ICD-recorded ventricular arrhythmias (Ventricular Tachycardia, Ventricular Fibrillation, Non-sustained Ventricular Tachycardia, and Premature Ventricular Contraction), number of device shocks, and hospitalization needs were recorded. Additional baseline information included age, sex, body mass index (BMI), HF duration, left ventricular ejection fraction (LVEF), type and implantation date of ICD, comorbidities, and current medications, including beta-blockers. After one month of receiving either the extract or the placebo, the same parameters were reassessed. Statistical comparisons were conducted between the intervention and control groups, as well as within each group before and after treatment. All patient data were recorded and stored confidentially without personal identifiers.

Successful outcome was defined a priori as the absence of any sustained ventricular tachycardia (VT), ventricular fibrillation (VF), appropriate ICD shock, or hospitalization due to cardiac causes during the one-month follow-up period.

2.5. Data Analysis:

All collected data were entered into SPSS version 26. Descriptive statistics were presented using mean, standard deviation, and other relevant measures. Normality of continuous variables was assessed using the Kolmogorov–Smirnov test. For group comparisons, independent t-tests were used for continuous variables, while chi-square or Fisher's exact tests were applied for categorical variables. A significance level of 0.05 was considered for all analyses.

3. Result

Our study included 100 patients: 50 received Rosa Canina extract tablets and 50 received placebo tablets (Figure 1). In both studied groups, 40% of patients were female, and 60% were male (P = 1.00). As shown in Table 1, the mean age, BMI, LVEF, and gender were well distributed across the groups (P > 0.05). Besides, the prevalence of comorbid conditions, including previous myocardial infarction, hypertension, diabetes, dyslipidemia, chronic kidney disease, and obstructive lung disease, did not differ significantly between the two studied groups (P > 0.05) (Table 1).

Table 1. Comparison of the demographic characteristics of patients in the two study groups

Parameters		Intervention N=50	Placebo N=50	P-value
Age (Year) [&]		65.8 ± 12.6	65.04 ± 10.33	0.74 [€]
Sex [¥]	Male	30 (60%)	30 (60%)	1.00 [£]
	Female	20 (40%)	20 (40%)	
BMI (kg/m^2) [&]		26.08 ± 3.49	24.52 ± 3.99	0.052 [€]
EF (%) [&]		22.5 ± 6.56	21.9 ± 6.21	0.64 [€]
History of Myocardial Infarction [¥]		49 (98)	50 (100)	0.310 [£]
Hypertension [¥]		38 (76)	37 (74)	0.810 [£]
Chronic Kidney Disease [¥]		5 (10)	3 (6)	0.460 [£]
Diabetes Mellitus [¥]		21 (42)	15 (30)	0.210 [£]
Dyslipidemia [¥]		11 (22)	13 (26)	0.640 [£]
COPD [¥]		4 (8)	8 (16)	0.210 [£]

BMI: Body mass index, EF: Ejection fraction, COPD: Chronic Obstructive Pulmonary Disease. Data were presented as [&] Mean ± SD and [¥] N(%). Data analysis was performed using [€] Independent T-test and [£] Chi-square test.

Table 2 demonstrates that the use of beta-blockers and antiarrhythmic medications was similar across groups (P > 0.05).

Table 2. Frequency distribution of medication used in the two study groups

Medication ¥	Intervention N=50	Placebo N=50	P-value £
Beta-blocker	48 (96)	45 (90)	**0.240**
Antiarrhythmic drugs	31 (62)	35 (70)	**0.390**

Data were presented as ¥ N (%). Data analysis was performed using £ Chi-square test.

As shown in Figure 2, the intervention group had a significantly lower PVC frequency than the control group (22% vs. 58%, respectively; P < 0.001). Additionally, ICD shocks were alleviated following Rosa Canina extract treatment compared with the placebo group (14% and 40%, respectively; P = 0.003). In contrast, hospitalization rates did not differ significantly between groups (P = 0.180). Furthermore, 86% of patients in the Rosa Canina group achieved a successful outcome, compared to 60% in the placebo group (P = 0.003) (Figure 2).

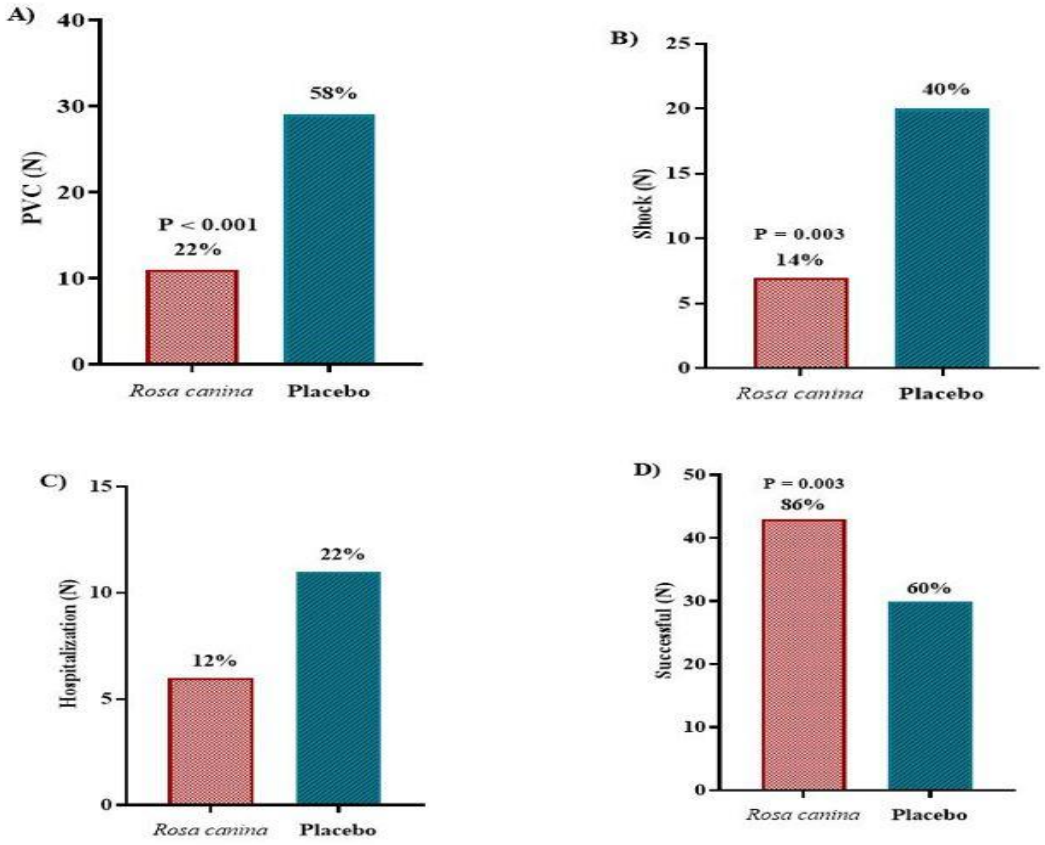

Figure 2: Frequency distribution of clinical outcome in the two study groups: A) PVCs, B) Shock, C) Hospitalization, and D) Successful.

4. Discussion

In recent years, several studies have examined the anti-inflammatory and antioxidant properties of Rosa Canina (rosehip) across various health conditions, including osteoarthritis (15-17) and metabolic disorders (13, 14). However, to the best of our knowledge, no research has specifically investigated its effect on ventricular arrhythmias in patients with HF who have an ICD. It makes the current study unique and highlights its innovative contribution.

In a randomized, cross-over clinical trial in obese participants, researchers found that 6 weeks of Rosa Canina supplementation significantly reduced LDL cholesterol, systolic blood pressure, and oxidative stress markers compared with the placebo group (13). Similarly, Nagatomo et al. reported reductions in visceral fat and improvements in metabolic profile after daily intake of Rosa Canina extract (14). These beneficial metabolic and vascular effects may indirectly enhance cardiac performance and reduce the risk of arrhythmia (1, 18).

The results of our study showed that tablets containing an alcoholic extract of Rosa Canina fruit significantly reduced the frequency of ventricular tachy-arrhythmias and the need for therapeutic shocks in heart failure patients with ICDs. Improving prognosis and minimizing unnecessary ICD shocks have been key objectives in many studies.

Proietti et al. reported in a large meta-analysis that receiving appropriate ICD shocks was associated with a 50% increase in long-term mortality, suggesting that any intervention capable of reducing shocks could meaningfully improve patient outcomes (5). Likewise, Wong et al. demonstrated that advanced heart failure is an independent risk factor for ICD shocks (19).

Although the observed 45% reduction in cardiac hospitalizations in the Rosa Canina group was not statistically significant, this trend remains clinically important. Tan et al. recently showed that patients with advanced HF often experience a heavy burden of ventricular arrhythmias and repeated hospital admissions (20).

In an experimental study, Gorchakova et al. reported that a herbal preparation containing Rosa Canina improved electrophysiological parameters and reduced the occurrence of ventricular arrhythmias (21). This observation is conceptually consistent with our finding of reduced arrhythmia episodes and ICD shocks.

The reduction in arrhythmias and shocks observed in the present study carries substantial clinical significance. ICD shocks are known to affect patients' quality of life negatively and have been consistently associated with higher mortality, particularly in those with advanced heart failure (5, 19). Therefore, the 26% reduction in ICD shocks found in our trial is noteworthy and highlights the potential value of this herbal intervention (19, 20, 22).

Although the decrease in cardiac hospitalizations was not statistically significant, it still has important clinical implications. This trend aligns with previous evidence showing that ventricular arrhythmias are major contributors to cardiac decompensation and hospitalization (20). Large-scale studies, including those by Wong and Tan, have clearly shown that ventricular arrhythmias are closely linked to increased rates of cardiac admissions (19, 20). Hence, the observed reductions in shocks and arrhythmias in the Rosa Canina group could reasonably lead to fewer hospitalizations, which might reach statistical significance in larger studies.

The possible antiarrhythmic effects of Rosa Canina may be related to its active components—particularly flavonoids,

polyphenols, and galactolipids—which have potent antioxidant and anti-inflammatory properties (23, 24). Oxidative stress and systemic inflammation are well-recognized mechanisms that contribute to the initiation and persistence of ventricular arrhythmias in heart failure (8, 25). Oxidative stress can impair ion channel function, disturb intracellular calcium balance, activate protein kinase pathways, and disrupt gap junctions (e.g., connexin-43), all of which increase myocardial vulnerability to arrhythmias (6, 9).

By neutralizing reactive oxygen species (ROS) and reducing pro-inflammatory cytokines such as TNF-α and IL-6, Rosa Canina may help to interrupt these harmful pathways. Elevated levels of these cytokines in heart failure are known to directly affect cardiac electrophysiology by promoting myocardial fibrosis and slowing electrical conduction, creating a substrate for re-entry and ventricular arrhythmias (7). Lattanzio et al. also found that Rosa Canina extract significantly reduced paw edema and inflammatory cytokine release in animal models of inflammation (23).

These findings are consistent with other animal studies suggesting that plant extracts with vigorous antioxidant activity can reduce arrhythmogenic risk in ischemic myocardium (20). Furthermore, the increased susceptibility of failing myocardium to oxidative stress–induced ventricular fibrillation may explain the more pronounced protective effect of Rosa Canina observed in our study population (8).

The strengths of the current study include its randomized, double-blind clinical trial design, well-balanced baseline characteristics between groups, and the use of objective endpoints such as ICD shocks, PVCs, and confirmed ventricular arrhythmias. The study population also reflects real-world patients with advanced heart failure and ICDs. However, several limitations should be acknowledged: the relatively small sample size, the short follow-up duration, and the use of only one dosage and formulation (alcoholic extract tablet). Moreover, the lack of direct measurements of oxidative stress (e.g., MDA, TAC) or inflammatory markers (e.g., hs-CRP, TNF-α, IL-6), which limits our ability to confirm the proposed mechanistic pathway despite the observed clinical benefits. Finally, the single-center design and the exclusively Iranian study population, which may limit generalizability to other ethnic groups and healthcare systems.

5. Conclusion

The findings of this study suggest that supplementation with tablets containing an alcoholic extract of Rosa Canina fruit can significantly decrease the burden of life-threatening ventricular arrhythmias and reduce the need for therapeutic shocks delivered by implantable cardioverter defibrillators (ICD/CRT) in patients with advanced heart failure. The clinical benefits of this herbal extract were clearly evident throughout the study.

Taken together, these results indicate that Rosa Canina extract may serve as a safe, well-tolerated, and cost-effective adjunct to standard heart failure therapy. Its use could help reduce the frequency of painful and distressing ICD shocks, potentially enhance patients' quality of life, and even prolong device battery life in this high-risk population.

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Availability of data and material: The data used to support the findings of this study are available from the corresponding author upon reasonable request.

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Conflicts of interests: The authors declare that there is no conflict of interest.

Ethical Considerations: This study was approved by the Ethics Committee of Mashhad University of Medical Sciences (Approval No. IR.MUMS.IRH.REC.1403.025) and registered in the Iranian Clinical Trial Registry (IRCT20220516054874N17). All participants provided written informed consent after the study objectives and procedures were fully explained. Data collection was anonymous, and all results were reported in aggregate without patient identifiers. In the event of serious adverse events, immediate medical care was provided, and participants were withdrawn from the study if necessary. All procedures performed in studies involving human participants were by the ethical standards of the institutional research committee and the Declaration of Helsinki of 1964.

Author contributions: M.M: Investigation, Data Curation, Writing Original Draft; V.B.R.: Investigation, formal Analysis, writing the original draft, review and editing the final version of the manuscript; M.T.: Conceptualization, supervision, and investigation; A.H.M.: Conceptualization, investigation; Z.Z.: Methodology, funding acquisition, supervision, investigation, review and editing the final version of the manuscript. M.Y.: Methodology, Supervision, review, and editing of the final version of the manuscript.

References

1. Ponikowski P, Voors AA, Anker SD, Bueno H, Cleland JG, Coats AJ, et al. 2016 ESC Guidelines for the diagnosis and treatment of acute and chronic heart failure. Polish Heart Journal (Kardiologia Polska). 2016;74(10):1037-147. https://doi.org/10.5603/KP.2016.0141 PMid:27748494
2. Ghasemi R, Imani Moghaddam S, Ramezani F, Yaghubi M. The Effect of the Door to Needle Time of Streptokinase Administration on the Left Ventricular Function and Thrombolysis in Myocardial Infarction (TIMI) Flow Grade in Patients With Anterior Myocardial Infarction: A Single-Center, Prospective Follow-up Study. Acta Med Iran. 2022;60(4):229-34. https://doi.org/10.18502/acta.v60i4.9267
3. Mohammadi F, Bigdelu L, Allahyari A, Morovatdar N, Rahimi VB. The effects of low-dose anthracycline-based chemotherapy on the levels of serum NT-proBNP level and left ventricular systolic and diastolic dysfunctions: A prospective observational study. Health Sci Rep. 2022;5(5):e841. https://doi.org/10.1002/hsr2.841 PMid:36189408 PMCid:PMC9493234
4. Al-Khatib SM, Stevenson WG, Ackerman MJ, Bryant WJ, Callans DJ, Curtis AB, et al. 2017 AHA/ACC/HRS guideline for management of patients with ventricular arrhythmias and the prevention of sudden cardiac death: a report of the American College of Cardiology/American Heart Association Task Force on Clinical Practice Guidelines and the Heart Rhythm Society. Journal of the American College of Cardiology. 2018;72(14):e91-e220.
5. Proietti R, Labos C, Davis M, Thanassoulis G, Santangeli P, Russo V, et al. A systematic review and meta-analysis of the association between implantable cardioverter-defibrillator shocks and long-term mortality. Canadian Journal of Cardiology. 2015;31(3):270-7. https://doi.org/10.1016/j.cjca.2014.11.023 PMid:25746019
6. Sovari AA, Rutledge CA, Jeong E-M, Dolmatova E, Arasu D, Liu H, et al. Mitochondria oxidative stress, connexin43 remodeling, and sudden arrhythmic death. Circulation: Arrhythmia and Electrophysiology. 2013;6(3):623-31. https://doi.org/10.1161/CIRCEP.112.976787 PMid:23559673 PMCid:PMC3716298
7. Tsutsui H, Kinugawa S, Matsushima S. Oxidative stress and heart failure. American journal of physiology-Heart and circulatory physiology. 2011;301(6):H2181-H90. https://doi.org/10.1152/ajpheart.00554.2011 PMid:21949114
8. Morita N, Sovari AA, Xie Y, Fishbein MC, Mandel WJ, Garfinkel A, et al. Increased susceptibility of aged hearts to ventricular fibrillation during oxidative stress. American Journal of Physiology-Heart and Circulatory Physiology. 2009;297(5):H1594-H605. https://doi.org/10.1152/ajpheart.00579.2009 PMid:19767530 PMCid:PMC2781379
9. Xie L-H, Chen F, Karagueuzian HS, Weiss JN. Oxidative stress-induced afterdepolarizations and calmodulin kinase II signaling. Circulation research. 2009;104(1):79-86. https://doi.org/10.1161/CIRCRESAHA.108.183475 PMid:19038865 PMCid:PMC2747806

10. Ghasemi R, Vojdanparast M, Hosseinzadeh Maleki M, Yaghubi M. The Effect of the Door to Needle Time of Streptokinase Administration on the QTc Interval and the Incidence of Life-Threatening Arrhythmia in Patients With Anterior Myocardial Infarction. Acta Med Iran. 2022;60(3):144-9. https://doi.org/10.18502/acta.v60i3.9001
11. Lazzerini PE, Capecchi PL, Guideri F, Acampa M, Selvi E, Bisogno S, et al. Autoantibody-mediated cardiac arrhythmias: mechanisms and clinical implications. Basic research in cardiology. 2008;103(1):1-11. https://doi.org/10.1007/s00395-007-0686-8 PMid:17999027
12. Chrubasik C, Duke R, Chrubasik S. The evidence for clinical efficacy of rose hip and seed: a systematic review. Phytotherapy Research: An International Journal Devoted to Pharmacological and Toxicological Evaluation of Natural Product Derivatives. 2006;20(1):1-3. https://doi.org/10.1002/ptr.1729 PMid:16395741
13. Andersson U, Berger K, Högberg A, Landin-Olsson M, Holm C. Effects of rose hip intake on risk markers of type 2 diabetes and cardiovascular disease: a randomized, double-blind, cross-over investigation in obese persons. European journal of clinical nutrition. 2012;66(5):585-90. https://doi.org/10.1038/ejcn.2011.203 PMid:22166897 PMCid:PMC3343291
14. Nagatomo A, Nishida N, Fukuhara I, Noro A, Kozai Y, Sato H, et al. Daily intake of rosehip extract decreases abdominal visceral fat in preobese subjects: a randomized, double-blind, placebo-controlled clinical trial. Diabetes, metabolic syndrome and obesity: targets and therapy. 2015:147-56. https://doi.org/10.2147/DMSO.S78623 PMid:25834460 PMCid:PMC4358417
15. Christensen R, Bartels E, Altman R, Astrup A, Bliddal H. Does the hip powder of Rosa canina (rosehip) reduce pain in osteoarthritis patients?-a meta-analysis of randomized controlled trials. Osteoarthritis and Cartilage. 2008;16(9):965-72. https://doi.org/10.1016/j.joca.2008.03.001 PMid:18407528
16. Rein E, Kharazmi A, Winther K. A herbal remedy, Hyben Vital (stand. powder of a subspecies of Rosa canina fruits), reduces pain and improves general wellbeing in patients with osteoarthritis-a double-blind, placebo-controlled, randomised trial. Phytomedicine. 2004;11(5):383-91. https://doi.org/10.1016/j.phymed.2004.01.001 PMid:15330493
17. Winther K, Apel K, Thamsborg G. A powder made from seeds and shells of a rose-hip subspecies (Rosa canina) reduces symptoms of knee and hip osteoarthritis: a randomized, double-blind, placebo-controlled clinical trial. Scandinavian journal of rheumatology. 2005;34(4):302-8. https://doi.org/10.1080/03009740510018624 PMid:16195164
18. Tomaselli GF, Zipes DP. What causes sudden death in heart failure? Circulation research. 2004;95(8):754-63. https://doi.org/10.1161/01.RES.0000145047.14691.db PMid:15486322
19. Whang W, Mittleman MA, Rich DQ, Wang PJ, Ruskin JN, Tofler GH, et al. Heart failure and the risk of shocks in patients with implantable cardioverter defibrillators: results from the Triggers Of Ventricular Arrhythmias (TOVA) study. Circulation. 2004;109(11):1386-91. https://doi.org/10.1161/01.CIR.0000120703.99433.1E PMid:14993132
20. Tan NY, Roger VL, Killian JM, Cha YM, Noseworthy PA, Dunlay SM. Ventricular arrhythmias among patients with advanced heart failure: a population-based study. Journal of the American Heart Association. 2022;11(1):e023377. https://doi.org/10.1161/JAHA.121.023377 PMid:34935408 PMCid:PMC9075190
21. Gorchakova N, Heimuller E, Galkin A. Current safety data of the complex herbal medicine with sedative and cardioprotective actions. 2018. https://doi.org/10.20535/ibb.2018.2.3.143029
22. Patel S. Rose hips as complementary and alternative medicine: overview of the present status and prospects. Mediterranean Journal of Nutrition and Metabolism. 2012;6(2):89-97. https://doi.org/10.1007/s12349-012-0118-7
23. Lattanzio F, Greco E, Carretta D, Cervellati R, Govoni P, Speroni E. In vivo anti-inflammatory effect of Rosa canina L. extract. Journal of ethnopharmacology. 2011;137(1):880-5. https://doi.org/10.1016/j.jep.2011.07.006 PMid:21771653
24. Ayati Z, Amiri MS, Ramezani M, Delshad E, Sahebkar A, Emami SA. Phytochemistry, traditional uses and pharmacological profile of rose hip: A review. Current pharmaceutical design. 2018;24(35):4101-https://doi.org/10.2174/1381612824666181010151849 PMid:30317989
25. Aukrust P, Ueland T, Lien E, Bendtzen K, Müller F, Andreassen AK, et al. Cytokine network in congestive heart failure secondary to ischemic or idiopathic dilated cardiomyopathy. The American journal of cardiology. 1999;83(3):376-82. https://doi.org/10.1016/S0002-9149(98)00872-8 PMid:10072227