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Original Article

Evaluation of sleep quality and nutritional status of patients with frequent ventricular premature complexes

Aliye Kuyumcu[1], Mevlut Serdar Kuyumcu[2]

[1]Isparta Suleyman Demirel University, Faculty of Health Sciences, Nutrition and Dietetics Department, Isparta, Turkey
[2]Isparta Süleyman Demirel University, Faculty of Medicine, Department of Cardiology, Isparta, Turkey

Abstract

Aim: Rhythm disturbances in the heart significantly affect the quality of life of the patients. The aim of this study was to investigate the effect of ventricular premature complexes (VPC) on sleep quality and nutritional status.

Material and Methods: This study was conducted on 50 patients with palpitations who were referred to the cardiology outpatient clinic and had more than 10,000 VPC per day as a result of a 24-hour holter, and 50 patients who presented with palpitations but had less than 10,000 VPC in the holter. Demographic characteristics, nutritional status, sleep quality and some anthropometric measurements of the patients were evaluated using a questionnaire. Food consumption record was taken to determine daily energy and macro nutrient intake of individuals. Pittsburgh Sleep Quality Index (PSQI) was used to evaluate sleep quality.

Results: PSQI scores indicating decreased sleep quality were found to be high in the VPC group ($p<0.001$). Energy consumption ($p = 0.004$) and carbohydrate consumption ($p<0.001$) were significantly higher in the VPC group. Saturated fatty acid consumption was high ($p<0.001$) and polyunsaturated fatty acid consumption was low in the VPC group ($p<0.001$).There was significant positive correlation found between VPC count and PSQI scores ($p<0.001$, $r = 0.788$).

Conclusion: It was clearly observed that the frequency of VPC decreases sleep quality and leads to imbalances in individuals' nutritional status. Therefore, in addition to the medical treatment of rhythm disorder, individuals should be given training to improve sleep quality and nutritional status by a multidisciplinary team (such as doctors, dietitians, psychologists).

Keywords: Ventricular premature complexes; nutritional status; sleep quality

INTRODUCTION

Cardiac arrhythmias can occur in different ways, such as faster, slower, or irregular heart functions. Palpitation is one of the most common reasons for admission to emergency services and polyclinics (1). Cardiac arrhythmias have serious effects on morbidity and mortality (2). Although ventricular premature beats are the most common form of arrhythmias in both patients with and without structural heart disease, ventricular premature beats may cause long-term left ventricular failure in patients with normal heart structure (3). Increased frequency of ventricular premature complexes (VPC) may be associated with mental and physical stress or lifestyle habits (4), as well as with cardiovascular risk factors such as hypertension, dyslipidemia, diabetes mellitus, and coronary artery disease (5). Sleep quality affects a wide range of health-related behaviors. Poor sleep quality may have indirect effects on nutrition/weight control, smoking, alcohol use, physical activity, and stress management, and may have direct effects on certain biological mechanisms such as insulin regulation and metabolic hormone deterioration, as well as changes in the cardiac and neuroendocrine system (6,7). In a study conducted on young and healthy adults, it was reported that the occurrence and frequency of VPC were related to various variables related to cardiovascular risk factors, cardiac structure, and socioeconomic status (8). In a study conducted on office workers in Japan, regular alcohol consumption and sleep disturbances were related to VPC increase in individuals (9). Lifestyle change, pharmacotherapy or catheter ablation may play an essential role in the clinical evaluation of patients presenting with frequent VPC and management of VPC frequency in patients (10).

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Corresponding Author: Mevlut Serdar Kuyumcu, Isparta Süleyman Demirel University, Faculty of Medicine, Department of Cardiology, Isparta, Turkey **E-mail:** kuyumcuserdar@hotmail.com

This study aims to evaluate the relationship between frequent Ventricular Extrasystoles (VPC) diseases and sleep quality and nutritional status.

MATERIAL and METHODS

Patients with palpitations who were admitted to the cardiology outpatient clinic of Süleyman Demirel University between December 2018 and September 2019, with more than 10,000 VPC per day as a result of a 24-hour Holter, and patients without 10,000 VPC per day, were included in the study. Many publications and guidelines suggest the catheter ablation or medical therapy for VPC cut-off value as 10,000 (5). A total of 397 patients were evaluated by the cardiologist and the study was completed when both groups reached 50 patients. The groups formed within the scope of the study were interviewed face to face by the responsible researcher dietitian and the sleep quality of the patients was evaluated with PSQI. Also, a 72-hour food consumption record (2 weekdays, one day weekend) and nutritional habits of all food groups were questioned and the nutritional status of the patients was evaluated (11). Recommended carbohydrate intake in healthy individuals is recommended at a rate of 50-55%. 25-35% of daily fat intake is recommended, while saturated fat intake is recommended to be below 10%. Above and below this value is considered abnormal (11). Body weight (kg), height (cm), and waist circumference measurements (cm) of the individuals were taken in accordance with the measurement technique (11) and body mass index (BMI) was calculated according to these measurements. BMI was calculated by dividing body height by the square of height (m^2).

Hypertension was defined as patients with a systolic/diastolic blood pressure of 140/90 mmHg or higher and/or taking antihypertensive drugs. Diabetes mellitus was evaluated as patients with fasting plasma glucose level≥126 mg/dL or actively taking oral anti-diabetics and/or insulin. Hyperlipidemia was defined as a total cholesterol level≥200 mg/dL. The Pittsburgh Sleep Quality Index is a self-report scale that assesses both sleep quality and sleep disturbance in the last month. PSQI evaluates 7 components: sleep duration, sleep disturbance, sleep latency, and daytime dysfunction due to sleepiness, sleep efficiency, overall sleep quality, and sleep medication use. The total PSQI score between 0-5 indicates good sleep quality, 6-10 indicates poor sleep, 11 and above indicates a long-term sleep disturbance (12). Patients with an active infection, tachycardia due to secondary causes, congestive heart failure (also VPC induced tachycardiomyopathy), symptomatic congenital heart disease, symptomatic heart valve disease, diagnosed coronary artery disease, diagnosed psychiatric disorder, and eating disorders such as anorexia neurosis and bulimia neurosis were not included in the study in. Necessary permissions were obtained for carrying out the study.

Statistics

All statistical analyses were performed using SPSS for Windows version 19.0 (SPSS, Chicago, IL). Number of each group was adjusted as 50 patients. We calculated the minimum number of individuals that should be sampled with 90% power and 0.05 Type-I error as at least 44 (R 3.0.1. open source program). Primary effect variable was calculated as ± 0.18. For the descriptive statistics of the data, mean, standard deviation, rate, and frequency values were used. The Kolmogorov–Smirnov test was used to evaluate whether the distribution of continuous variables was normal. For the analysis of parametric data, Student's t-test was used. For the analysis of nonparametric data, the Mann–Whitney U test was used. The v2 test was used to compare the categorical variables between groups. For correlation analysis, Pearson correlation analysis was used. Statistical significance was defined as p<0.05. Reminder method was asked by the researcher about all foods consumed the previous day (72 hours) and energy and macro nutrient intake of individuals regarding nutrient consumption status were evaluated in Nutrition Information Systems (BeBIS) 7.1 program.

RESULTS

Table 1 shows the baseline parameters of the study groups. There was no difference between the two groups in terms of clinical and demographic characteristics. However, PSQI scores indicating decreased sleep quality were found to be high in the VPC group (p<0.001).

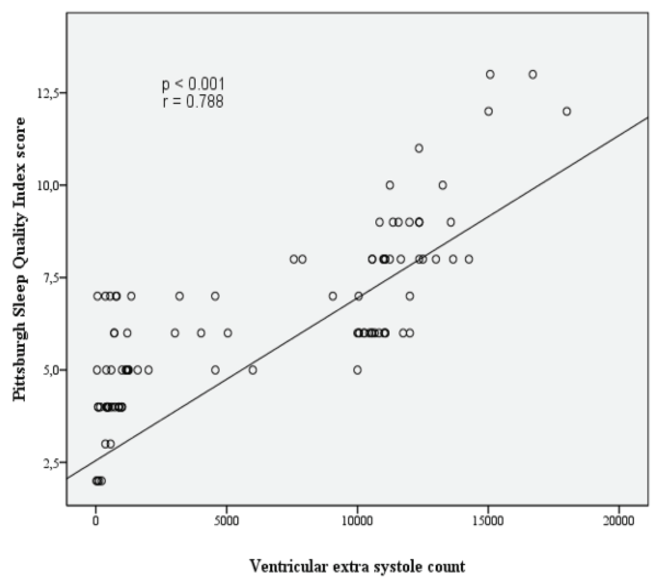

Figure 1. Correlation between Pittsburgh Sleep Quality Index score and ventricular premature complexes count.

Table 2 shows the daily energy and nutrient intake status of the participants. Energy consumption (p = 0.004) and carbohydrate consumption (p<0.001) were significantly higher in the VPC group. In addition, saturated fatty acid consumption was high (p<0.001) and polyunsaturated fatty acid consumption was low in the VPC group (p<0.001).

Figure 1 shows the significant positive correlation found between VPC and PSQI scores (p<0.001, r = 0.788).

Table 1. Baseline general and clinical characteristics of the study population

Variables	VPC group (n=50)	Control group (n=50)	p value
Age,years	57.0 ± 10.6	55.1 ± 9.4	0.354
BMI, kg/m2	29.4 ± 3.1	27.7 ± 4.2	0.122
Waist circumference, cm	86.9 ± 7.3	85.1 ± 9.9	0.259
Smoking, n (%)	22 (44.0)	15 (30.0)	0.147
Hypertension, n (%)	6 (12.0)	4 (8.0)	0.505
Hyperlipidemia, n (%)	12 (24.0)	10 (20.0)	0.629
Diabetes Mellitus, n (%)	6 (12.0)	5 (10.0)	0.749
Female, n (%)	30 (60.0)	33 (66.0)	0.534
Married, n (%)	16 (32.0)	20 (40.0)	0.403
Ejection Fraction, (%)	62.3 ± 4.1	61.5 ± 6.2	0.433
Education level, n (%)			
Literate	10 (20.0)	12 (24.0)	
Middle School	22 (44.0)	38 (20.0)	0.807
High School and above	18 (36.0)	19 (38.0)	
Physical activity			
Sedentary (<600 METs-min/week)	30 (60.0)	32 (64.0)	
Inactive (600-3000 METs- min/week)	19 (38.0)	17 (34.0)	0.812
Active (>3000 METs- min/week)	1 (2.0)	1 (2.0)	
PSQI score			
0-5	17 (34.0)	33 (66.0)	**<0.001**
6-9	28 (56.0)	16 (32.0)	**<0.001**
>9	5 (10.0)	1 (2.0)	**<0.001**

Data are given as mean ± standard deviation or number (%) [n (%)], BMI: Body mass index, METs: Metabolic Equivalent Minutes, PSQI: Pittsburgh Sleep Quality Index

Table 2. Daily energy and nutrient intake status of the participants

Variables	VPC group (n=50)	Control group (n=50)	p value
Energy (kcal)	2513.7 ± 712.4	2067 ± 450.4	**0.004**
Carbonhydrate (g)	270.4 ± 115.8	198.7 ± 48.2	**<0.001**
Carbonhydrate (E%)	43.1 ± 9.1	39.6 ± 7.3	0.083
Protein(g)	79.9 ± 24.7	65.9± 21.7	0.320
Protein(g/kg)	1.1 ±0.3	0.9± 0.3	0.408
Protein(E%)	13.2 ± 2.8	13.1± 2.9	0.480
Fat(g)	120.0 ± 34.6	109.7± 32.9	0.776
Fat(E%)	43.4 ± 8.6	47.1± 6.9	0.083
Saturated fatty asid	50.4 ± 15.2	40.3 ± 16.2	**<0.001**
Mono unsaturated fatty asid	46.8 ± 14.5	43.8 ± 15.5	0.125
Poly unsaturated fatty asid	22.7 ± 13.8	27.7 ± 12.8	**<0.001**
Fiber (g)	28.1± 13.4	21.8± 6.6	0.009

Data are given as mean ± standard deviation, E: total energy percent

DISCUSSION

In this study, we found that, in the literature, sleep quality was noticeably impaired in VPC patients and a high-carb diet was associated with VPC frequency.

In the absence of structural heart disease, VPCs most commonly occur in the right ventricular outflow tract (13). Focal triggered mechanisms affected by delayed after depolarizations (DAD) are thought to play a role in the pathophysiology of VPC. DADs can be stimulated in the presence of various pathological factors (myocardial ischemia, drugs, genetic disorders, etc.) that may cause intracellular calcium overload in myocytes. However, apart from these pathophysiologic mechanisms, the pathophysiology of DAD-mediated arrhythmias is not fully understood. The increased sympathetic effect has the potential to play a role in the formation of DADs in the normal myocardium in a cAMP-mediated manner (13). Some extrinsic factors have also been shown to cause VPCs in structurally normal hearts: extensive use of alcohol, caffeine, or tobacco, electrolyte imbalance (hypokalemia), and some drugs represent the main examples (14,15).

In our study, a decrease in sleep quality was observed with increasing VPC. Melatonin secreted by the pineal gland is a hormone that regulates the sleep cycle and the body's biological clock, known as circadian rhythm, and its deficiency can cause sleep disorders (16). Literature in the last decade shows that melatonin has a protective effect against arrhythmias (17). In a study examining the effect of melatonin on dogs showed that increased melatonin levels increase the excitability threshold of myocardial cells (18). The authors of the study suggested that this effect can be achieved by preventing the flow of arrhythmogenic sympathetic nerve traffic from the central nervous system to the heart (18). Furthermore, antioxidant activity and melatonin have been shown to significantly reduce ventricular arrhythmias caused by ischemia/ reperfusion (19,20). Recent studies show that melatonin receptors have MT1 and MT2 receptors in the heart tissue (16,21). Through these two G-protein-bound receptors (e.g. L-type calcium channel, ryanodine receptor, SERCA), melatonin can influence intracellular calcium content (22). In our study, the sleep quality of the patients with frequent VPC was significantly lower. The possible antiarrhythmic effects of melatonin are likely to be related to this result.

Studies on the possible antiarrhythmic effects of nutrition are increasing in the literature. N-3 polyunsaturated fatty acids (n-3 PUFA) are an important element of balanced nutrition and its cardiovascular benefits have been repeatedly demonstrated in studies (23,24). Anti-arrhythmic effects of n-3 PUFA have been demonstrated in animals and in-vitro studies (25). In a study, infusion of intravenous fish oil fatty acids in dogs with attached coronary arteries prevented ventricular arrhythmias caused by stress applied to the heart (26). Fish oil intake also reduced the rate of ventricular fibrillation induced in marmoset monkeys after stimulation in the electrophysiological study (27). It has been shown that n-3 PUFA modulates the conductivity of ion channels in the cell membrane of cardiomyocyte culture and thus prevents the formation of arrhythmia (28). The n-3 PUFAs also have the potential to affect sodium and calcium currents along the heart cell membranes that control heart rhythm (28). The n-3 PUFAs are thought to prolong the period in which these channels are inactive and reduce their conductivity (28). Furthermore, the inclusion of n-3 PUFA in cardiac membrane phospholipids may affect the production of various eicosanoids, which may reduce fragility to arrhythmias and thereby prevent ventricular fibrillation during myocardial ischemia and reperfusion (29).

In our study, carbohydrate consumption was found to be higher in VPC group and therefore energy intake was higher. There are limited data in the literature that dietary carbohydrates are arrhythmogenic. However, in a study conducted by Liu et al. the low carbohydrate diet was found to reduce arrhythmias after myocardial infarction (30). One of the reasons for this finding is that higher carbohydrate intake, especially in young patients, is often associated with high carbohydrate beverages containing caffeine or similar stimulants. It is also known that energy drinks or soft drinks can have arrhythmogenic effects (31).

Mineral imbalances resulting from dietary imbalance also have potential arrhythmic effects. Hypomagnesaemia is a predetermined risk factor for polymorphic ventricular tachycardia and intravenous magnesium sulfate continues to be the first-line treatment at points linked to the long QT interval according to existing ESC guidelines (32). In previous studies, it has been shown that deficiencies of potassium, calcium, and magnesium may trigger ventricular arrhythmias (33).

Our study has some limitations. Long-term data of the patients were not available in the study. PSQI is a retrospective measure of sleep quality and is not as accurate as sleep laboratories. The number of patients is relatively limited.

CONCLUSION

It was clearly observed that the frequency of VPC decreases sleep quality and leads to imbalances in individuals' nutritional status. Therefore, in addition to the medical treatment of rhythm disorder, individuals should be given training to improve sleep quality and nutritional status by a multidisciplinary team (such as doctors, dietitians, psychologists).

Competing interests: The authors declare that they have no competing interest.

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Ethical approval: This study was approved by the Institutional Ethics Committee and conducted in compliance with the ethical principles according to the Declaration of Helsinki.

Aliye Kuyumcu ORCID: 0000-0002-6830-1534
Mevlut Serdar Kuyumcu ORCID: 0000-0003-1934-5773

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