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Authors: Anna Szałek-Goralewska, Rafał Dankowski, Wioletta Sacharczuk, Stefan Ożegowski, Jędrzej Tschurl, Barbara Rabiega, Andrzej Szyszka

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Influence of training and half marathon run on the right ventricle in amateur runners.

Wpływ treningu i biegu półmaratońskiego na prawą komorę u biegaczy amatorów

Anna Szałek-Goralewska[1], Rafał Dankowski[1], Wioletta Sacharczuk[1], Stefan Ożegowski[1], Jędrzej Tschurl[2], Barbara Rabiega[1], Andrzej Szyszka[1]

[1]2nd Department of Cardiology, Poznan University od Medical Sciences, Poznań, Poland

[2]Department of Spine Disorders and Pediatric Orthopedics, Poznan University of Medical Sciences, Poznań, Poland

Address for correspondence: Anna Szałek-Goralewska MD, II Klinika Kardiologii Katedry Kardiologii, Uniwersytet Medyczny im. Karola Marcinkowskiego w Poznaniu, ul. 28 Czerwca 1956 roku 194, 61–485 Poznań, Poland, e-mail: szalek.anna@gmail.com

Abstract

Introduction. Endurance running may lead to heart remodelling. There are little data on the right ventricular (RV) changes in amateur athletes running shorter than marathon distances.

The study aimed to investigate whether training and running a half marathon affect the anatomy and function of the RV in amateur runners and whether these changes affect the athlete's competitive performance.

Material and methods. The study included 45 recreational runners with a mean age of 32.96 (5.12) years, 27 men. Echocardiography was performed before the ten-weeks training period and before and after the half marathon run. The morphological and functional parameters of the RV were analysed, including two-dimensional, Doppler and speckle-tracking echocardiography.

Results. In training period, the RV outflow tract (27.98 [5.46] vs. 30.07 [4.90]; p = 0.003) and the RV index of myocardial performance (0.36 [0.29; 0.45] vs. 0.39 [0.33; 0.52]; p = 0.017) increased significantly and no changes were found for E/e'. After the half marathon run, the absolute value of the RV free wall global longitudinal strain increased significantly (–25.89 [3.08] vs. –27.20 [3.42]; p = 0.008). Athletes who trained more intensively during the training period achieved significantly better half marathon results (r = –0.4; p ≤ 0.05).

Conclusions. More enhanced physiological RV remodelling under exercise in amateur athletes results in better half marathon finishing times. The preparation period and 21.0975 kilometres run do not affect the diastolic function of the RV in recreational runners. The RV systolic function improves immediately after the half marathon performance.
Key words: amateur athletes, echocardiography, global longitudinal strain, right ventricle, right ventricular strain

Introduction

Regular physical activity carries several health benefits [1]. Among its many forms, running is one of the most accessible forms of exercise. Over the last decades, a major increase in interest in long-distance running and competitions was observed. In the United States of America, the number of half marathon finishers increased from 612 thousand in 2004 to 2046.6 thousand in 2014 [2]. Many participants are amateurs whose training program is not always properly set and supervised. Moreover, amateur runners are not subject to obligatory medical examinations. This is a potential health threat, and recreational runners are not always aware of the risk [3].

Intensive endurance exercise may lead to myocardial remodelling [4]. There are numerous data concerning sport-related cardiovascular changes in professional runners [5–7], whereas the group of amateur athletes is studied less likely [8]. Moreover, previous studies have mainly assessed the influence of marathon distance running (42.195 kilometres) on cardiovascular function. While numerous studies have assessed several parameters of the left ventricular (LV) function in recreational long-distance running athletes [9], the influence of a half marathon run (21.0975 kilometres) on the right ventricular (RV) function remains unclear. Moreover, there is little data in the literature describing the influence of training on cardiovascular function in amateur runners.

Echocardiography is a well-established technique in the assessment of both the structure and function of the RV. Moreover, the recent introduction of RV global longitudinal strain (GLS) analysis expands the possibilities of echocardiographic evaluation of the RV [10]. Compared to magnetic resonance imaging, echocardiography requires less time and resources. Therefore, it is particularly useful in assessing larger groups of subjects and the parameters that change quickly over time. It is especially important in analysing post-exertional changes in amateur athletes.

This study aimed to evaluate the echocardiographic changes of the RV during the training period and after participating in the half marathon in amateur runners. It is hypothesized that amateur training affects the structure and function of the RV and that changes occurring during the training influence the result of the planned competition.

Methods

Study participants and inclusion criteria

We designed a prospective study that involved amateur runners preparing to participate in a half marathon run (21.0975 kilometres). The inclusion criteria were as follows: age of 18–40 years, both sexes, and a minimum of one previous start in a long-distance running competition (≥ 10 kilometres). The athletes diagnosed with chronic diseases — particularly cardiovascular conditions, such as coronary artery disease, hypertension, arrhythmia, heart failure, and valve abnormalities — were excluded from the study. Each person was in sinus rhythm, normotensive, and had no structural disease of the heart and no obstructive or restrictive lung diseases. All the participants gave written informed consent before enrolment.

Study protocol

Our study consisted of two stages and was conducted in 2019 and 2021 among amateur athletes preparing for the 12th PKO Poznan Half Marathon in April 2019 and for the 13th PKO Poznan Half Marathon in October 2021, respectively. Participants were recruited *via* the online application form posted on social media running forums.

Both recruitments were based on the same study protocol that involved three checkpoints. The first point (P1) was conducted 10 weeks before the run, the second point (P2) was carried out within 48 hours before the competition, and the third point (P3) was conducted within 48 hours after finishing the run.

At each checkpoint, blood samples were collected and a physical examination was performed, twelve-lead electrocardiogram and transthoracic echocardiography. No special diet was recommended before any of the three checkpoints of the study. Athletes were allowed to rehydrate as needed. At each checkpoint, participants were anthropometrically assessed — data on height, body mass, body mass index, arterial blood pressure and heart rate were collected. All participants were required to declare their regular training intensity, expressed in kilometres per week.

The study protocol was approved by the Bioethics Committee of the Poznan University of Medical Sciences, Poland (No.19/21) and was consistent with the Declaration of Helsinki.

Echocardiographic assessment

We performed the transthoracic echocardiography using commercially available ultrasound systems: Vivid E9 and Vivid S70N (GE Healthcare). All measurements were made following the guidelines of the European Association of Cardiovascular Imaging [11] in the lateral decubitus position. Echocardiographic data were transferred and analysed offline using EchoPAC software (GE Healthcare, version 204).

We measured the proximal RV outflow tract (RVOT) in the parasternal long-axis view (PLAX). RV basal diameter and fractional area change (FAC) were assessed from an RV-focused apical four-chamber view.

Early (E) and late (A) tricuspid inflow velocities and E/A ratio are recorded using pulsed wave Doppler at the tricuspid leaflet tips. Using tissue Doppler imaging, RV lateral tricuspid annulus velocity parameters were assessed: s' wave and e' wave. E/e' ratio was calculated.

The RV index of myocardial performance (RIMP) was calculated based on time intervals measured with pulsed wave Doppler, obtained from the lateral tricuspid annulus. It was defined as the sum of the isovolumetric contraction time and isovolumetric relaxation, divided by the RV ejection time.

The GLS of the RV was measured from the RV-focused apical four-chamber view. The automated function imaging application was used for the calculations [12]. After selecting the optimal cardiac cycle, the operator selected the region of interest by placing three points: 1 — on the basal segment of the free wall of the RV; 2 — on the basal segment of the septum, and 3 — on the RV apex. The region of interest was selected with special attention to avoid the inclusion of RV epicardium. Then, the concordance between visually assessed RV contractility and the RV endocardial tracings was checked and corrected by the operator if needed. The RV was divided into 6 standard segments: basal, midventricular and apical for both — free and septal walls [13]. The RV GLS was calculated for all the segments. The peak negative curve was chosen as the RV GLS. The RV free wall GLS was measured analogously and included three free wall segments only (Figure 1).

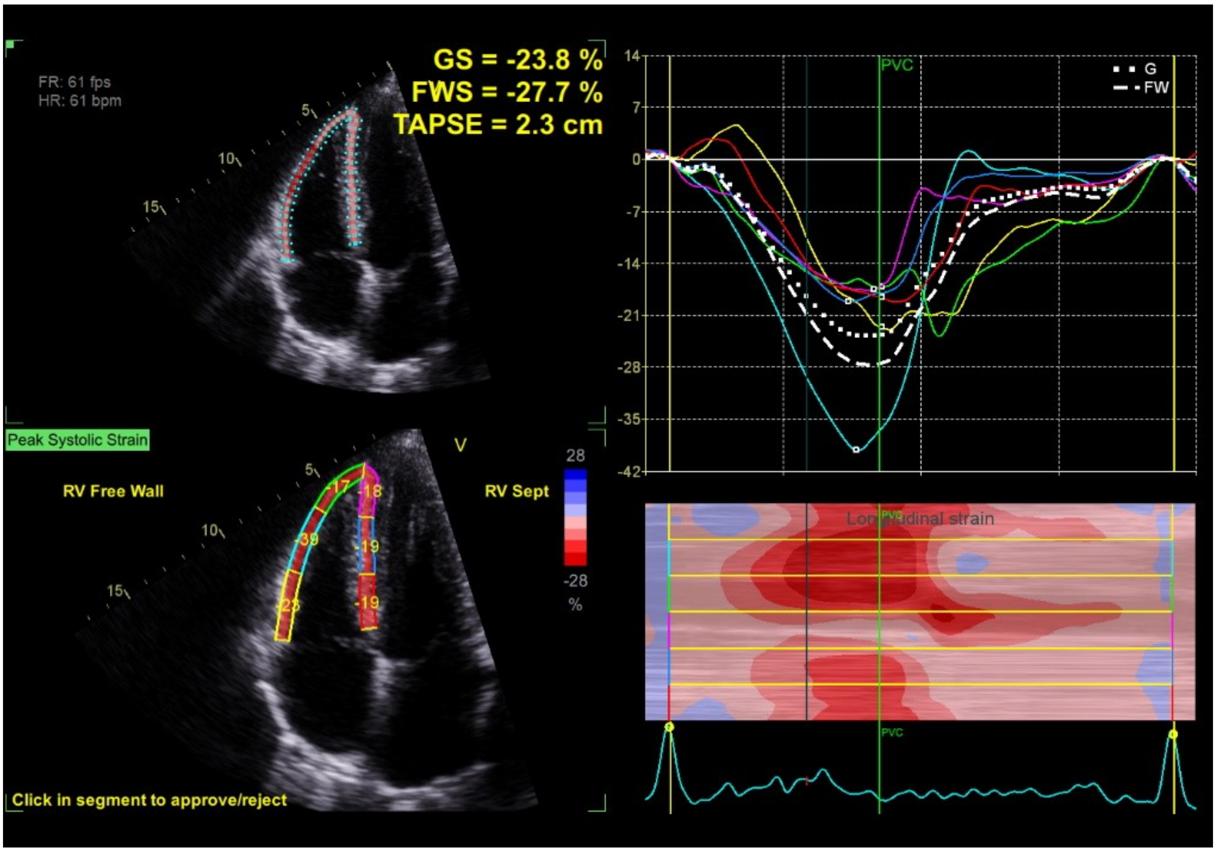

Figure 1. The right ventricular (RV) free wall global longitudinal strain (GLS). The RV-free wall was divided into three segments: basal, midventricular and apical. The peak negative value was chosen as the RV free wall GLS; GS — global strain; FWS — free wall strain; TAPSE — tricuspid annular plane systolic excursion

Statistical analysis

Data analysis was conducted using the R package, version 4.0.5. Calculations are based on a significance level of 0.05. Data are presented as mean and standard deviation (SD) or median (quartile 1 [Q1]; quartile 3 [Q3]), depending on data normality. The normality of distribution was verified with the Shapiro–Wilk test, based on skewness, kurtosis level, and visual assessment of histograms. Comparison of parameters between time points (time point 1 vs. 0 and time point 2 vs. 1) was made with paired tests: t-test or Wilcoxon test, as appropriate. Additionally, the mean or median difference (MD) were calculated between time points, including a 95% confidence interval. Correlation between variables was verified using Pearson’s or Spearman’s correlation, as appropriate.

Results

Characteristics of the group

Characteristics of the study group are presented in Table 1. Of the 50 participants initially included, 45 runners started the half marathon (10% drop) (Figure 2). The study group consisted of 45 persons with a mean age of 32.96 (5.12) years, 18 (40%) were females, and 27 (60%) were males. Each subject had prior half marathon experience and a minimum of three years of regular running training history. All starting participants finished the run.

The athletes were non-smokers, men and women of normal weight (Table 1). The average weekly running distance during the training period was 35.89 (17.78) kilometres run per week. The average result of the half marathon runners was 107.4 (15.75) minutes (1 h 47 min). Dimensions of the LV, left atrium and LV systolic and diastolic function at baseline were in normal ranges. LV ejection fraction was normal.

Body weight and body mass index significantly decreased during the training period (P1 vs. P2). The systolic blood pressure decreased significantly during the training period (P1 vs. P2 and P1 vs. P3). Diastolic blood pressure and resting heart rate did not change during the study. The left atrium dimension increased significantly during the training period (P1 vs. P2). Mitral inflow velocities were normal and did not change throughout the study.

Table 1. Study group characteristics

Characteristic	Pre-training period (P1)	48 hours before the run (P2)	48 hours after the run (P3)
Body weight [kg]	72.15 (12.80)	71.37 (12.11)*	71.39 (12.26)
BMI [kg/m^2]	23.65 (2.92)	23.40 (2.74)*	23.41 (2.77)
Systolic blood pressure [mm Hg]	126.04 (16.57)	119.71 (12.74)*	117.67 (11.79)
Diastolic blood pressure [mm Hg]	68.96 (13.21)	68.58 (8.46)	68.00 (7.67)
Heart rate [bpm]	63.05 (7.61)	61.29 (10.31)	63.20 (12.32)
Training intensity [kilometres run/week]	—	35.89 (17.78)	—
Results of the Half Marathon, duration [min]		107.4 (15.75)	
LVEF [%]	59.96 (5.20)		
LA [mm]	31.87 (4.62)		
MV E/A ratio	1.60 (0.46)		

*$p < 0.05$; data presented as mean (SD); BMI — body mass index; LA — left atrium; LVEF — left ventricular ejection fraction; MV E/A ratio — transmitral E-wave/A-wave ratio

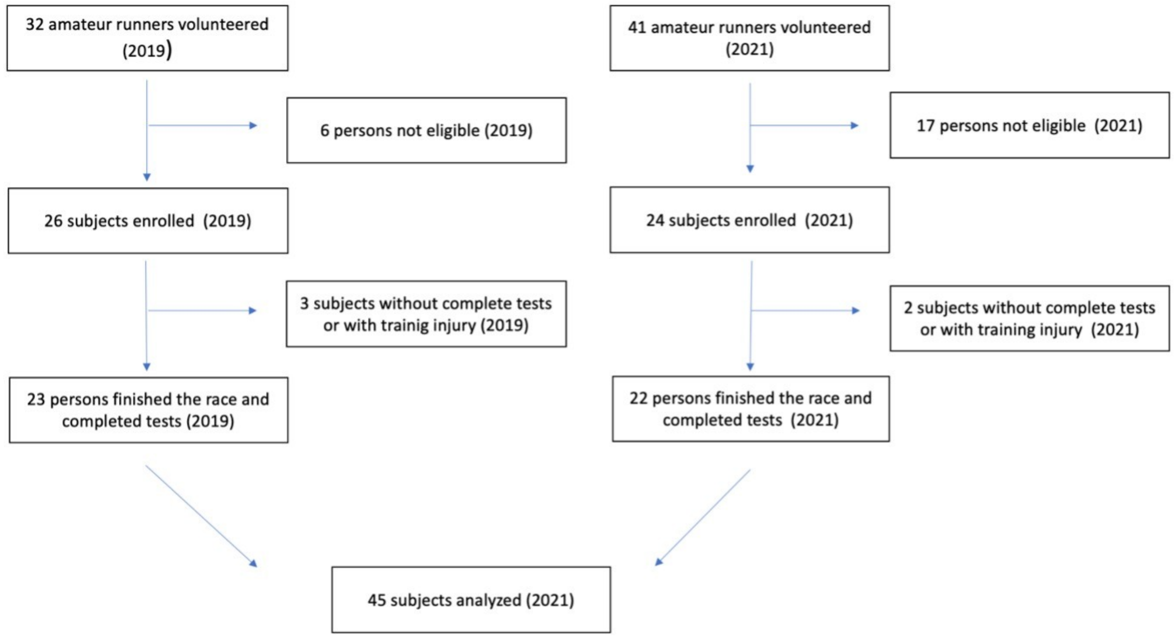

Figure 2. Study participation diagram

Correlation between the training intensity and the result of half marathon performance

Athletes who trained more intensively before the competition (according to the declared training intensity expressed in kilometres run per week) achieved significantly better half marathon results (r = –0,4; p ≤ 0.05) (Figure 3).

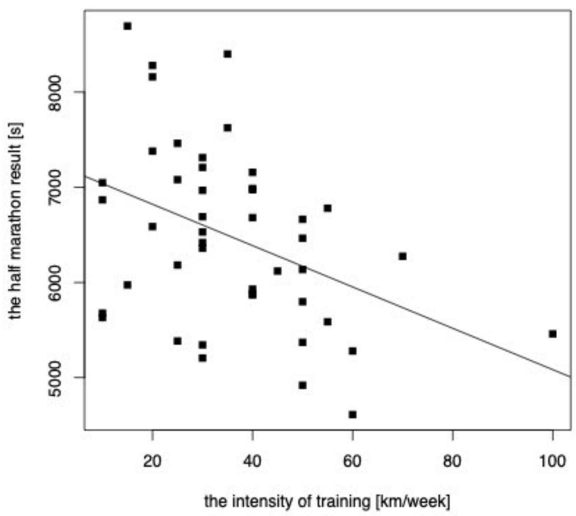

Figure 3. Correlation between the intensity of training before the half marathon run and the result of half marathon performance

Influence of training on echocardiographic parameters of the right ventricle

RVOT dimension increased significantly during the training period (Table 2). The training before the half marathon run did not significantly impact the RV basal diameter, RV wall thickness and RV FAC. No significant differences were found between pre-training and post-training measurements of the GLS for either the RV or the RV-free wall. The tricuspid annular systolic velocity and tricuspid annular plane systolic excursion did not change. The E/e' ratio remained constant during training for the run. A significant increase was observed in the RIMP after the training period.

Table *2.* Measurements of the right ventricle in the pre-training period (P1) and before the half marathon (P2)

Variable	Pre-training (P1)	48 hours before the run (P2)	MD (95% CI)	p-value
RVOT [mm]	27.98 (5.46)	30.07 (4.90)	2.09 (0.74; 3.44)	0.003*
RV basal diameter at end-diastole [mm]	36.71 (4.53)	35.67 (4.10)	–1.04 (–2.20; 0.11)	0.075
RV free wall thickness [cm]	0.43 (0.13)	0.42 (0.14)	–0.01 (–0.04; 0.02)	0.569
TV E-wave velocity [m/s]	0.63 (0.11)	0.62 (0.09)	0.01 (–0.02; 0.03)	0.756
TV A-wave velocity [m/s]	0.39 (0.30; 0.44)	0.36 (0.32; 0.40)	–0.03 (–0.05; 0.02)	0.388
TV E/A ratio	1.72 (0.39)	1.73 (0.34)	0.03 (–0.11; 0.17)	0.663
RV FAC [%]	46.80 (7.25)	44.53 (8.59)	–2.27 (–4.83; 0.30)	0.082
RV GLS [%]	–20.22 (2.15)	–19.76 (1.86)	0.47 (–0.12; 1.06)	0.118
RV free wall GLS [%]	–26.27 (3.58)	–25.89 (3.08)	0.38 (–0.88; 1.64)	0.548
TV s' [m/s]	0.16 (0.02)	0.15 (0.02)	–0.01 (–0.01; 0.003)	0.212
TAPSE [mm]	25.24 (3.73)	25.31 (3.23)	0.07 (–1.25; 1.38)	0.919
TV E/e'	4.66 (1.02)	4.47 (0.88)	–0.19 (–0.44; 0.06)	0.136
TV a' [m/s]	0.14 (0.04)	0.13 (0.05)	–0.004 (–0.02; 0.01)	0.606
RIMP	0.36 (0.29;	0.39 (0.33; 0.52)	0.06 (0.01;	0.017*

	0.45)		0.12)	

*p < 0.05; data presented as mean (SD) or median (Q1; Q3), depending on normality of distribution; MD — mean/median difference between time points with a 95% confidence interval (CI). Time points compared with paired t-test or Wilcoxon test; FAC — fractional area change; GLS — global longitudinal strain; RIMP — right ventricular index of myocardial performance; RV — right ventricular; RVOT — proximal right ventricular outflow tract; TAPSE — tricuspid annular plane systolic excursion; TV — tricuspid valvular; TV a' — tricuspid annular A-wave velocity; TV E/e' — tricuspid valvular E-wave velocity/tricuspid annular early diastolic velocity ratio; TV s' — myocardial systolic excursion velocity at the tricuspid annulus

Influence of half marathon run on echocardiographic parameters of the right ventricle

Running a half marathon had no significant impact on the RVOT and RV basal diameter (Table 3). The thickness of the RV wall remained unchanged immediately after the run. (P2 vs. P3) A significant difference in RV FAC values after the run was not observed compared to 48 hours before the start. The RV GLS remained unchanged after the start, but the absolute value of the RV free wall GLS increased significantly. No significant changes in tricuspid annulus velocities immediately after the half marathon were observed. The RV index of myocardial performance remained constant.

Table *3*. Measurements of the right ventricle before the half marathon (P2) and within 48 hours after finishing the run (P3)

Variable	48 hours before the run (P2)	48 hours after the run (P3)	MD (95% CI)	p-value
RVOT [mm]	30.07 (4.90)	29.71 (4.54)	–0.36 (–1.07; 0.36)	0.32
RV basal diameter at end-diastole [mm]	35.67 (4.10)	36.00 (4.56)	0.33 (–0.92; 1.59)	0.59
RV free wall thickness [cm]	0.42 (0.14)	0.44 (0.14)	0.02 (–0.02; 0.05)	0.41
TV E-wave velocity [m/s]	0.62 (0.09)	0.62 (0.10)	–0.01 (–0.04; 0.02)	0.50
TV A-wave velocity [m/s]	0.36 (0.32; 0.40)	0.35 (0.31; 0.41)	–0.01 (–0.03; 0.03)	0.78
TV E/A ratio	1.73 (0.34)	1.71 (0.39)	–0.03 (–0.18; 0.12)	0.66
RV FAC [%]	44.53 (8.59)	44.64 (8.74)	0.11 (–3.17; 3.39)	0.95
RV GLS [%]	–19.76 (1.86)	–20.09 (1.92)	–0.33 (–0.85; 0.18)	0.20

RV free wall GLS [%]	–25.89 (3.08)	–27.20 (3.42)	–1.31 (–2.26; –0.36)	0.008*
TV S' [m/s]	0.15 (0.02)	0.16 (0.02)	0.004 (–0.003; 0.01)	0.30
TAPSE [mm]	25.31 (3.23)	25.31 (3.65)	0.0 (–0.98; 0.98)	> 0.99
TV E/e'	4.47 (0.88)	4.50 (0.92)	0.03 (–0.17; 0.22)	0.776
TV annular A-wave velocity [m/s]	0.13 (0.05)	0.14 (0.04)	0.002 (–0.01; 0.01)	0.71
RIMP	0.39 (0.33; 0.52)	0.40 (0.33; 0.54)	–0.01 (–0.07; 0.04)	0.56

Data presented as mean (SD) or median (Q1; Q3), depending on the normality of distribution; MD — mean/median difference between time points with a 95% confidence interval (CI). Time points compared with paired t-test or Wilcoxon test; FAC — fractional area change; GLS — global longitudinal strain; RIMP — right ventricular index of myocardial performance; RV — right ventricular; RVOT — right ventricular outflow tract; TAPSE — tricuspid annular plane systolic excursion; TV — tricuspid valvular; TV E/e' — tricuspid valvular E-wave velocity/tricuspid annular early diastolic velocity ratio; TV S' — myocardial systolic excursion velocity at the tricuspid annulus

Correlations between right ventricular echocardiographic parameters, the intensity of training before the half marathon and the result of half marathon performance

The more intensive the training, the higher the RVOT dimension after the training period and immediately after the half marathon run (at P2 and P3) (Table 4) ($r = 0.36$; $p = 0.02$ and $r = 0.3$; $p \leq 0.05$) In athletes who had larger RV basal diameter before the half marathon run (at P2) and after the run (at P3), the significantly better half marathon result was observed ($r = –0.3$; $p = 0.049$ and $r = –0.34$; $p = 0.02$). Subjects who trained more intensively had significantly larger RV basal diameter dimensions immediately after the half marathon competition ($r = 0.39$; $p = 0.008$). Recreational runners with higher RV FAC immediately after the run achieved significantly worse half marathon results ($r = 0.39$; $p = 0.008$). No significant change in diastolic function of the RV based on the E/e' parameter was observed both after the training period and after the half marathon performance.

Table *4*. Correlations between RV ECHO parameters, the intensity of training before the half marathon and the results of half marathon performance

RV ECHO parameters	Training intensity, kilometres	Results of the half marathon,

	run/week (r)	duration (r)
RVOT (P2)	0.36*	–0.24
RVOT (P3)	0.3*	–0.26
RV basal diameter at end-diastole (P2)	0.24	–0.3*
RV basal diameter at end-diastole (P3)	0.39*	–0.34*
RV FAC (P3)	0.01	0.39*
TV E/e' ratio (P2)	0.16	–0.08
TV E/e' ratio (P3)	0.1	–0.05

*p < 0.05; r = correlation coefficient; FAC — fractional area change; RV — right ventricular; RVOT — right ventricular outflow tract; TV — tricuspid valvular

Discussion

This study investigated whether the training period and participation in half marathon distance run impacted the morphology and function of the RV of recreational runners. The major findings are as follows: (1) the amateur training affected both the anatomy and function of the RV of the amateur athletes; (2) opposite to the training, the half marathon run did not affect the anatomy of RV, but what was observed was the improvement of the GLS of the RV-free wall immediately after the run; (3) the results of this study indicate that amateur athletes with RV remodelling achieve significantly better results in completing a half marathon run.

Right ventricular function

D'Ascenzi et al. [7] analysed the cohort of 1009 professional athletes practising various sports disciplines and confirmed the most significant impact of endurance sport (such as long-distance running) on the RV remodelling, including significant enlargement of RVOT. The present study shows that amateur training with a mean weekly distance of 35.89 (17.78) kilometres has a similar effect on the RV dimensions.

The enlargement of RVOT is one of the most characteristic echocardiographic changes occurring in the heart of endurance athletes [7]. However, heart pathology should be considered an alternative explanation for RVOT enlargement in amateur athletes. In the UK, 13% of sudden cardiac death in young athletes is attributed to arrhythmogenic RV cardiomyopathy (ARVC) [14]. In pre-screening before significant physical exertion such as a half marathon run, ARVC should be excluded. This can be done by using the Task Force Criteria (TFC) [15], which include the echocardiographic assessment of RV structure and function (RVOT enlargement, tricuspid annular plane systolic excursion reduction, RV FAC reduction, RV ejection fraction reduction), electrocardiogram repolarization abnormalities, MRI tissue characterization and family history. Qasem et al. [16] analysed 214 elite male athletes, of which 34 met the TFC and had an enlarged RVOT. These same individuals had significantly lower global RV strain compared to participants who did not meet the TFC. Among this study participants, RVOT enlargement after the training period (in P2) met the minor TFC. However, other necessary ARVC criteria were not met in any study subject.

The RIMP is useful in estimating pulmonary vascular resistance [17]; its increase indicates a global impairment of the systolic and diastolic function of the RV. Alsafi et al. [18] examined the group of 32 female elite athletes and compared them to a control group of 34 sedentary subjects, assessing the myocardial performance index for both — LV and RV. The study showed no significant difference in RIMP among athletes and the sedentary group; the myocardial performance index was significantly higher in LV compared to RV in both groups. Nevertheless, the present study showed a significant increase in RIMP after the preparation for the half marathon period (at P2), which indicates the impairment of global RV function under the influence of running training. It is consistent with the analysis made by Lewicka-Potocka et al. [19], who investigated that the two-week preparation for the marathon run period and marathon performance among 34 male amateur runners resulted in a significant increase in RIMP.

We did not observe a significant change in RV diastolic function expressed by the tricuspid valvular E/e’ ratio after the training period and a half marathon run. The present results align with Teske et al. [20], who analysed 269 subjects among whom amateur, regular, and professional athletes were present. The endurance training did not result in RV diastolic function changes in any group. Simsek et al. [21] compared the group of 44 long-distance runners with 30 sedentary controls and involved them in a regular exercise program. They did not prove any diastolic alteration among athletes and controls.

The echocardiographic assessment of the RV ventricle is challenging because of its complex geometry and highly trabeculated inner wall contour [10]. The speckle-tracking echocardiography turns out to be a useful tool in this evaluation. According to recent studies, RV GLS is the more preferred echocardiographic method for clinical assessment of the RV function than the conventional 2D echocardiographic parameters [22]. Research shows that RV GLS is significantly higher among athletes practising low-intensity exercise compared to healthy sedentary subjects [23]. Yaman et al. [23] analysed the group of 84 sports practitioners (who practised static and dynamic exercise for three months) and compared them to 82 sedentary subjects. RV GLS was significantly higher in athletes, and the RV free wall GLS tended to be higher among the sportive population but was not statistically significant. The present analysis proves the significant increase of the RV free wall GLS absolute value and the non-statistically significant tendency to increase RV GLS immediately after the half marathon run. In the context of the results presented by Yaman et al. [23], the present study suggests that the half marathon distance does not induce acute RV dysfunction in amateur runners.

On the other hand, increased RV free wall GLS after a half marathon run may probably be caused by the physiological decrease of pulmonary vascular resistance occurring in exertion and described in the literature [24, 25]. However, the authors lack the direct data to prove this statement (such as the mean pulmonary artery pressure value) since invasive diagnostics with the right heart catheterization were not performed.

The correlations between the intensity of training, the results of the half marathon performance and the echocardiographic parameters

The more intensively the subjects of this study trained, the better finishing race time they achieved (Figure 3). It was demonstrated that the RV remodelling influenced by training for a half marathon distance run results in better finishing times. At the same time, the authors did not observe significant correlations between the systolic echocardiographic parameters such as RV s', tricuspid annular plane systolic excursion and RV GLS and the intensity of training and the run finishing time. It proves that among amateur runners, the RV remains a thin-walled, volumetric chamber that can not be provoked to contract better during the preparation for the half marathon run. Moreover, the paradoxical impairment of systolic function in better-trained and faster participants of this study, depicted by the significant higher RV FAC among these athletes who achieved worse finishing race results, probably comes from the fact that the RV in amateur runners remains the low-pressure chamber. Thus, it compensates for an increased inflow during exertion by the rise of the end-diastolic volume without the rise of the systolic volume.

We did not observe any significant correlations between the RV diastolic function parameters, such as the E/e' ratio (dependent on the ventricular filling pressure) and the intensity of training or the result of the run. Therefore, it is concluded that the physical effort over the half marathon distance and preceding preparations do not affect the diastolic function of the RV of amateur runners.

Limitations

There are certain limitations of this analysis. This study included a relatively small group of athletes with varying training intensities. Since the participants of this study were recreational runners, their training period was not strictly planned and was difficult to control. Nevertheless, data on the weekly distance run was collected at baseline, confirmed and updated during the study period.

Recent echocardiographic European Association of Cardiovascular Imaging guidelines consider proximal RVOT in PLAX to be dependent on imaging plane position and less reproducible than distal RVOT in PLAX. There is a risk of underestimation or overestimation if the RV view is obliquely oriented concerning the RV outflow tract. Limited normative data on proximal RVOT in PLAX is available. However, a relatively young, non-obese study group resulted in good quality echocardiographic images allowing high reproducibility.

As RIMP presents the relation of the isovolumetric time to ejection time, it is useful for describing RV's systolic and diastolic function but has its limitations. It depends on elevated right atrial pressures and loading conditions [10, 26].

Conclusions

In summary, remodelling of the RV under amateur training for the half marathon run expressed as increased RVOT is related to a better finishing time. The effort in the training period and 21.0975 kilometres run itself does not improve or worsen the diastolic RV function in recreational runners. The RV systolic function expressed by the RV free wall GLS improves immediately after the half marathon run, probably due to a decrease in pulmonary vascular resistance in exertion.

Conflict of interest

None declared.

Funding

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Streszczenie

Wstęp. Biegi długodystansowe mogą prowadzić do przebudowy serca. Niewiele jest danych na temat zmian w prawej komorze u sportowców amatorów biegających na dystansach krótszych niż maratoński.

Celem pracy było wykazanie, czy trening i ukończenie półmaratonu wpływają na anatomię i funkcję prawej komory u biegaczy amatorów oraz czy zmiany te wpływają na osiągany przez sportowca wynik.

Materiał i metody. Badaniem objęto 45 biegaczy amatorów w średnim wieku 32,96 (5,12) lat, w tym 27 mężczyzn. Echokardiografię wykonano przed 10-tygodniowym okresem treningowym oraz przed i po biegu półmaratońskim. Analizie poddano parametry morfologiczne i czynnościowe prawej komory. Wykonano echokardiografię dwuwymiarową, dopplerowską i stosowano technikę śledzenia plamki akustycznej.

Wyniki. W okresie treningowym droga odpływu prawej komory (27,98 [5,46] *vs.* 30,07 [4,90]; p = 0,003) oraz wskaźnik sprawności prawej komory (0,36 [0,29; 0,45] *vs.* 0,39 [0,33; 0,52]; p = 0,017) wzrosły znacząco i nie stwierdzono zmian dla E/e'. Po półmaratonie wartość bezwzględna globalnego podłużnego odkształcenia wolnej ściany prawej komory istotnie wzrosła (–25,89 [3,08] *vs.* –27,20 [3,42]; p = 0,008). Sportowcy, którzy w okresie treningowym trenowali intensywniej, osiągnęli istotnie lepsze wyniki w półmaratonie (r = –0,4; p ≤ 0,05).

Wnioski. Silniejsza fizjologiczna przebudowa prawej komory serca pod wpływem ćwiczeń u sportowców amatorów skutkuje lepszym czasem ukończenia półmaratonu. Okres przygotowań i przebiegnięcie 21,0975 km nie wpływa na funkcję rozkurczową prawej komory u biegaczy rekreacyjnych. Funkcja skurczowa prawej komory poprawia się natychmiast po ukończeniu półmaratonu.

Słowa kluczowe: sportowcy amatorzy, echokardiografia, globalne odkształcenie podłużne, prawa komora, odkształcenie prawej komory

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