Cardiovascular Disease Risk Profiles in Indonesian Athletes

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Introduction

Cardiovascular diseases (CVDs) can happen to anyone, including young and highly active athletes [1]. Athletes are expected to have a safe cardiovascular profile because of the standard youthful grown-up age and the impact of customary activity programs, which are instinctually accepted to fulfill the healthy model of an athletic way of life [2]. Remarkably, CVD risk factors are expanded and can be related to the specific ways that athletes behave, particularly in sports. For instance, with time-limited goal-seeking intentions and extensive conditioning, they frequently are pitted against the opposition in games that end in what is called “sudden death,” which ultimately can risk the exhausting of their cardio-vascular well-being [3].

Athletes have a high risk of experiencing hypertrophic cardiomyopathy (HCM), coronary anomalies, and arrhythmogenic right ventricular cardiomyopathy, which can cause Sports-related Sudden Cardiac Death (SrSCD) [4]. The incidence of SrSCD reaches 80,000/year in young, competitive athletes in the USA [5]. The incidence of SrSCD in Germany is 500,000 deaths/year in athletes aged >18 years, and another 2.5 million deaths occur in younger athletes [6]. In Asian countries, research regarding SrSCD is scarce and not very thorough. For example, the prevalence of SrSCD in Singapore is only about 86.7%, which was 72 out of 83 patients [7]. Recent research showed that the increased risk of CVDs in athletes is associated with several factors [8].

Athletes’ cardiovascular sickness risk factors are divided into two classes, non-modifiable and modifiable. Non-modifiable risk factors comprise gender, race, age, and family ancestry [9]. A previous study stated that men have a higher risk (0.002% of athletes/year) than women (0.0008% of athletes/year) [10]. In addition, athletes over 35 years of age who experienced SCD were associated with atherosclerosis [11].

Modifiable risk factors associated with cardiovascular disorders in athletes are smoking habits and exercise duration [12]. A high-risk factor for chronic diseases associated with premature death is tobacco...
consumption, both in clove (kretek) cigarettes and e-cigarettes. The nicotine content in tobacco could negatively affect athletes both active and passive smokers [13]. Exercise duration is also a risk factor for CVDs in athletes. Heart rate will increase by 80% of the maximum heart rate during 1 hour of resistance training. There is a possibility that the athlete’s heart will dilate if the exercise is carried out for hours [14]. A study stated that exercise performed for approximately 112 min/week could reduce the risk of cardiovascular disorders, while these benefits will be lost if exercises duration is over 255 min/week [15].

It is important to identify CVDs risk profiles in athletics as early prevention against SrSCD in athletes. Thus, the identification of the CVDs risk profile is not only essential for the athletes but also the trainers and related stakeholders in terms of future planning. Along these lines, we arranged the current review to survey the cardiovascular risk profile of Indonesian athletes, aiming to address the model of a truly dynamic and sound way of life. We looked to evaluate the level and dissemination of the CV risk profile given the athletes’ attributes.

### Materials and Methods

#### Participants

The study participants consisted of 234 Indonesian athletes (163 males and 71 females) aged 18–29 years (with a mean age of 20.78 ± 1.745 years). Participants came from three sports, including football, basketball, and swimming. Each athlete was enrolled based on the sport mastered.

Inclusion criteria involved were at least 18 years old, at least 1 year as an athlete had participated in a national competition in an Olympic sport, and joined a national athletic association. Exclusion criteria were having congenital CVD, not providing an informed consent form, and not fully completing the questionnaire.

#### Measures

The instrument consists of two sections. The principal segment was the information concerning the participant utilizing a demographic characteristics questionnaire. It consists of age, weight, height, heart rate (HR), respiratory rate (RR), sport, length of time being an athlete, duration of exercise per week, and family CVDs history. The second section was the Jakarta Cardiovascular Risk Score adapted from the Framingham Risk Score [16]. The Jakarta Cardiovascular Risk Score contains seven items that aim to identify risk factors for cardiovascular disorders that participants may experience. The items include gender, age, systolic blood pressure, body mass index (BMI), smoking behavior, diabetes, and physical activity. The score obtained is between −7 and 18. The higher the score indicates the higher risk of CVD. Therefore, we classified participants' scores into three categories: −7–1 for low risk, 2–4 for moderate risk, and 5 or above as high risk.

#### Procedures

This observational study utilized a cross-sectional design. The participants’ information was collected from December 2020 to March 2021. All participants were enrolled after signing informed consent forms. The Institutional Ethics Committee approved the study with the ethical expediency number KE/FK/1036/EC/2020. We used the Declaration of Helsinki on Biomedical Research Involving Human Subjects as a guideline for this study. In addition, the sphygmomanometer and digital weight scale used in this study have received a health parameters certificate from the Health Laboratory and Calibration of the Health Office of the Special Region of Yogyakarta, Indonesia.

Data collection was conducted in the following way: First, we explained the stages and objectives of the research, and then, we asked about the participants’ willingness to be involved in this research. Next, participants who had signed the informed consent form were asked to sit for 10 min. Afterward, research assistants measured participants’ blood pressure, heart rate, respiratory rate, weight, and height. Next, the research assistant asked participants to fill out the instrument entirely. Finally, the blinded instrument that the participant has completed is given an identity code with a combined letter and number.

#### Statistical analysis

This study used descriptive statistical data analysis. Gender, sport, family CVDs history, and smoking habits were described using frequency distribution and percentage. The mean and standard deviation (SD) were used to display the analysis results of age, HR, RR, systolic blood pressure, and diastolic blood pressure. Variables of the length of time as an athlete, duration of exercise per week, BMI, mean arterial pressure (MAP), and cardiovascular risk scores were shown by a blend of frequency distribution, percentage, mean, and SD. The analyses were performed utilizing the SPSS v.23 (IBM Corp, Armonk, NY).

### Results

#### Participant’s characteristics

Table 1 shows the characteristics of the participants. The majority of participants were male...
(n = 163, 69.66%), with the mean age of 20.78 (SD = 1.745), and range between 18 and 29 years. Most of the participants are soccer athletes (n = 120, 51.28%). Most of the participants have been athletes for less than 10 years (n = 121, 51.71%). The participants’ cardiorespiratory profile showed a mean resting heart rate of 76.27 beats/min (SD = 12,132, min–max= 48–114 beats/min) with a mean respiratory rate of 20.05 beats/min (SD = 3.297, min–max = 13–32 times/min). Furthermore, participants had a mean systolic blood pressure (SBP) of 118.97 mmHg (SD = 10,187, min–max= 90–140 mmHg) and a mean diastolic blood pressure (DBP) of 73.29 mmHg (SD = 9,112, min–max= 50–100 mmHg).

### Table 1: Frequency distribution of respondent characteristics (n = 234)

| Participants' characteristics | Frequency (%) | Mean (SD) | Min–max |
|------------------------------|---------------|-----------|---------|
| Gender                       |               |           |         |
| Male                         | 163 (69.66)   |           |         |
| Female                       | 71 (30.34)    |           |         |
| Age (year)                   |               | 20.78 (1.745) | 18–29 |
| Sports                       |               |           |         |
| Football                     | 120 (51.28)   |           |         |
| Basketball                   | 70 (29.91)    |           |         |
| Swimming                     | 44 (18.81)    |           |         |
| Duration of being an athlete (year) |       | 9.71 (4.175) | 3–22 |
| >1–10 years                  | 121 (51.71)   |           |         |
| >10 years                    | 113 (48.29)   |           |         |
| Cardiorespiratory status    |               |           |         |
| Resting heart rate (HR) (min) | 76.27 (12.132) | 48–114 |         |
| Respiratory rate (RR) (min)  | 20.05 (3.297) | 13–32 |         |
| Blood pressure status        |               |           |         |
| Systolic blood pressure (SBP) (mmHg) | 112.97 (10.187) | 90–140 |         |
| Diastolic blood pressure (DBP) (mmHg) | 73.29 (9.112) | 50–100 |         |

SD: Standard deviation.

Cardiovascular risk profile in Indonesian athletes

This study observed five cardiovascular risk profiles: Weekly exercise duration, MAP, BMI, family CVDs history, and smoking habits. Most of the participants in this study had excessive weekly exercise duration (over 255 min/week) (n = 177 athletes, 75.64%). Twenty-one participants (8.97%) had a higher MAP than normal, and 51 participants (21.79%) had overweight BMI. In addition, 142 participants (60.68%) had a cardiovascular genetic disease from their parents (family history) and most of the participants also were active smokers (n = 150, 64.10%) (Table 2).

Based on the Jakarta Cardiovascular Risk Score, the Indonesian athletes who participated in this study had a mean cardiovascular risk of −1.5 (SD = 3.088, min-max= (−7) – 6). Most of the participants had low cardiovascular risk (n = 193, 82.48%). However, some participants had moderate and high cardiovascular risk, 32 (13.67%) and 9 (3.85%), respectively (Table 3).

### Discussion

CVIs in athletes are a “silent killer” whose incidence is increasing every year [17]. Despite their high wellness level, athletes can display raised cardiovascular risk of CVDs. Most athletes determined to have CAD were asymptomatic and knew nothing about their raised cardiovascular risk [18]. Risk factors that can increase the incidence possibility of cardiovascular disease in athletes include high exercise duration, overweight, hypertension, family history (genetic), and smoking habits [19].

This study found that most participants had exercise duration exceeding the recommended duration (over 255 min/week). Exercise for a long duration can increase the workload of the cardiovascular system, especially in the athlete’s cardiac output (CO), which increases continuously and repeatedly. It will increase the hemodynamic load so that it can cause aortic dilatation [20]. A prolonged increase in CO is also associated with decreased function as heart fatigue, leading to decreased athletic performance [21]. In addition, the increased work demands of the cardiovascular system cause the left and right ventricles to enlarge and increase in volume, which is common among athletes [22], [23].

Being overweight is a risk factor for cardiovascular disorders in an athlete [24]. The overweight condition may be caused by excess intake of nutrients. It can also be caused by the restricted activity during the COVID-19 pandemic [25]. The normal BMI ranges from 28.5 to 24.5 Kg/m² [26]. People with BMI above 25 kg/m² can have increased cholesterol levels in the blood and trigger atherosclerotic plaques in blood vessels [27]. The plaque could narrow the blood vessels, thus increasing the possibility of hypertension. Then, hypertension causes heart pump ineffectiveness because the heart muscles have to work harder [28]. In the long term, it will cause heart failure [29]. In addition, the plaque in atherosclerosis can also harm the arterial endothelium. Repeated injuries can cause inflammation and trigger atherosclerosis blockage [30]. As a result,
Smoking is a significant risk factor for cardiovascular disorders [32]. Nicotine, an ingredient in cigarettes, causes damage to the walls of blood vessels or the endothelium by releasing catecholamines and increasing the risk of blood clots [33]. In addition, nicotine in the body can stimulate the adrenaline hormone, increase blood pressure and heart rate, and change fat metabolism. As a result, high-density lipoprotein (HDL) levels decrease, and low-density lipoprotein (LDL) levels increase [34]. Besides the inversion of HDL and LDL, carbon monoxide in the cigarettes can bind to hemoglobin to reduce oxygen flow to tissues, one of which is the myocardium, and increase the risk of atherosclerosis [35]. Smoking is also known to increase the perception of fatigue, which can affect the performance of athletes [36].

The Jakarta Cardiovascular Risk Score assessment shows that most participants in this study are in a low category. Participants with a score in the low category have a probability of having cardiovascular disorders of 10%. Participants in a low category are recommended to maintain good habits or healthy life [37]. On the other hand, some participants had moderate and high cardiovascular risk; 32 people (13.67%) and 9 people (3.85%), respectively. Some of the participants not only have a modifiable CVDs risk factor but also have a family history of CVDs as an unmodifiable risk factor. This study showed that 60.68% of participants have a family history of CVDs. A family history of CVDs reflects a genetic predisposition that underlies the occurrence of cardiovascular disorders. Individuals with a family history of cardiovascular disorders are twice as likely to have cardiovascular disorders [38]. Participants with a score in the medium category have a probability of experiencing CVD of 10–20%. In comparison, the high-risk category has a probability of suffering from CVD of more than 20%. Participants in both categories are encouraged to consult a doctor, address the risk factors for cardiovascular disorders that may be experienced, and change any unhealthy lifestyles [39].

This study has several potential limitations. In this study, only athletes from three sports were involved. In addition, due to the small sample population, the results are not generalizable. Furthermore, the activity restrictions due to the COVID-19 pandemic have made it difficult to enroll more participants. Future studies should be conducted with a larger number of participants and a wider variety of sports involved.

Conclusions

This study showed that the duration of excessive exercise, high blood pressure, excessive BMI, family history of CVDs, and smoking habits are the risk factors that increase the occurrence of CVDs in Indonesian athletes. Furthermore, the Jakarta Cardiovascular Risk Score assessment shows that most participants (82.48%) in this study are in a low category.

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