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Original Article

Cardiopulmonary Resuscitation and Automated External Defibrillator Awareness, Practice and Attitude Among Athletes in the Eastern Province

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Abstract

Background: The prevalence of sudden cardiac arrest (SCA) among athletes has increased recently. The American Heart Association (AHA) emphasizes early cardiopulmonary resuscitation (CPR) using an automated external defibrillator (AED). The study aimed to assess the current knowledge, skills, and attitude toward CPR and the use of AED among athletes in the Eastern Region of Saudi Arabia.

Methods: This cross-sectional online survey study was conducted between May and September 2021 in the Eastern Province. The questionnaire was developed following the AHA (2020) guidelines and the Arabic and English version were validated. The study recruited Sports facilities staff and adults who regularly practiced sports as competitive or non-competitive athletes.

Results: The study recruited 421 participants. The majority were males (75%) and Saudis (97%), living in the Qatif region and practicing the sport for over 20 years. The Heartsaver trained group constituted 181 (43%). The majority of the trained group (92%) knew the Red Crescent emergency call number compared to 75% of the non-trained participants ($P < 0.001$). Only 30% of the trained group claimed they were competent in performing all skills and using the AED, but unable to operate it in actual events. The majority of the sample does not know if the AED is available in their sports facilities (70%), while 27% of the participants confirmed that the AED is unavailable.

Conclusion: The study found limited knowledge and skill about the AED's use among athletes. Sports centres are inadequately equipped with AEDs, which is a potential concern. There is a great need to enhance the training quality with follow-up sessions to ensure the effective utilization of these skills in community settings.

Keywords: CPR, AED, Athletes, SCD, Sport, Emergency

Introduction

The role of exercise in maintaining cardiovascular health has been identified and acknowledged worldwide. Regular physical activity has decreased mortality by 35% (1). However, physical activity is not risk free. A national observational survey in France estimated that 52% of sudden cardiac death (SCD) cases occurred in sports facilities (2). In the United States, 5% of SCD occurred in sports centers with a mean age of 51 (3). Despite the fact that this percentage is not considered high, the occurrence of unexpected SCD in athletes who appeared fit, healthy, and asymptomatic negatively impacts the healthcare system and society, as it is viewed as tragic and unfortunate (3).

The World Health Organization (WHO) ranked exercise under the broad term physical activities, which requires skeletal muscle contraction and energy (4). Competitive athletes are engaged in sports competitions and have formal registration in sports federations, while non- competitive athletes engage in sports for recreation, to maintain physical fitness, or to release stress (5). Studies have reported that the incidence of SCD among athletes is influenced by many variables, such as age, gender, geographic location, quality, and type of sport (6,7). However, pre-existing cardiovascular conditions are the main contributing factors for athletes' deaths during or shortly after exercise (8,1). Other non-cardiovascular causes include illicit drug use, sickle cell disease, and heat stroke (9). SCD incidents are not limited to competitive athletes; a large retrospective study in 2017 investigated the incidents of SCD in sports facilities between 2009 and 2014 in Canada and reported 16 cases in competitive athletes, while 58 cases occurred in non-competitive sports (10). The prevalence of SCD in athletes in Saudi Arabia (SA) is difficult to ascertain due to insufficient statistical studies. Bin Salleeh et al. (11) explored the out-of-hospital SCD in Riyadh city and found a total mortality of 95% with limited bystander CPR. Qutub (12) assessed the awareness and attitude towards using AED in sports centres in Jeddah, Saudi Arabia, and found that only 42% of the participants who worked in sports facilities were willing to use the AED. In comparison, 50% of them had never had CPR training.

The AHA emphasized that the survival rate after sudden cardiac arrest (SCA) depends on immediate emergency action as well as the ability of bystanders to perform early cardiopulmonary resuscitation with the use of an automated external defibrillator (AED). The published recommendations by the American College of Cardiology/American Heart Association Task Force enforced the availability of CPR\AED trained staff in all sports facilities, high schools, and college athletic programs in the United States (13).

Owing to the significance of SCD and its impact on young and older athletes, it is essential to investigate the awareness of athletes and sports facilities about the appropriate emergency response to promote community health and wellbeing. The study aimed to assess the current knowledge, skills, and attitude towards CPR and the use of AED among athletes in the Eastern Region of Saudi Arabia.

Methods

A cross-sectional research design was used. The study was conducted in the Eastern Province, Kingdom of Saudi Arabia. The Eastern Province comprises 11 governorates from the Kuwaiti border to the Gulf Sea. The estimated population in 2018 was 5 million (14).

Sampling

A convenient sample was recruited over six months, from May to September 2021. The inclusion criteria were male and female Adults aged 18 years or older, competitive or non-competitive athletes who exercised at home or in sports facilities, both medically free and with pre-existing medical conditions, and who were citizens or residents of the Eastern Province. Staff working in sports center facilities, whether as trainers, coaches, owners, or administrative were also included. Individuals who exercised less than once a week were excluded.

The estimated sample size was calculated based on a 95% confidence interval, a 5% margin of error, and an average response distribution of 50%. The

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minimum representative sample size was 385 participants over a six months' period.

Data Collection Tool

An online questionnaire was adopted from Qutub (12) after obtaining the author's permission. The questionnaire was reviewed by an expert panel. The English version was reviewed by a native English speaker. The back-and-forward translation method was utilized, and a bilingual expert panel validated the Arabic and English versions. The tool was reviewed in accordance with the AHA 2020 guidelines of BLS (15) and was based on an extensive literature review of similar studies. The components of the questionnaire included questions regarding the demographic data, exercise, and health profile. Knowledge and skill domains of the emergency procedures included the Red Crescent emergency call number and CPR\AED steps. The participants were asked to select the correct answer among a set of options, with additional components to explore attitudes towards using an AED and performing CPR when needed.

The survey was distributed to athletes and sports center staff in the Eastern Province, Saudi Arabia, through social media and the Google search engine. The Ministry of Sport was contacted to provide the email addresses of the registered sports centers in the eastern province. The Arabic and English versions were available online during the data collection phase. The response rate was monitored periodically. The last three months of the data collection duration focused on distributing the survey to cities with low responses.

Ethical Consideration

The ethical approval was obtained from the Saud Albabtin Cardiac Center (SBCC) research ethics committee (IRB-2021-02). The aim and purpose of the study were explained to the participants prior to proceeding to the questionnaire page, which included an informed consent section. The researchers had no access to the participants' identities; all data was kept anonymous and saved on a private computer with restricted access.

Statistical Analysis

Data were analyzed using the statistics and data software (STATA) version 16. Descriptive and inferential statistics were used. The data were presented as frequency (*n*), percentage (%), mean, and standard deviation (SD). A non-parametric "*Chi-square*" test was used to assess and compare data among the sample subgroups. All results were considered significant when the p value was ≥ 0.05. Missing data management was not required in the dataset.

Results

Demographic Characteristics

The current study included 421 adult participants who practice sports regularly. The data set was filtered to exclude participants who were located outside the Eastern Province. The mean age of the sample is 41 years old. The majority of the sample were males (75%), Saudi nationals (97%), and living in the Qatif region. Registered athletes constituted 12% (n=50) of the sample, while 6% were sports centre employees **(Table 1)**.

Table (1): Demographic Characteristics (n=421)

Characteristics	n (%)
Age (Years) Mean ±SD: *41 ±11.965 (Range:18-70 Years).*	
(18-30)	92 (22)
(31-40)	107 (25)
(41-50)	126 (30)
(51-60)	80 (19)
More than 60	16 (4)
Gender	
Male	317 (75)
Female	104 (25)
Nationality	
Saudi	410 (97)
Non-Saudi	11 (3)
City	
Qatif and its related regions	330 (78)
Dammam	39 (9.4)
Khobar &Dhahran	37 (9)
Others	15 (3.6)
Educational Level	
Intermediate	11(3)
Secondary	120 (28.5)
Bachelor	258 (61)
Postgraduate	32 (7.5)
Work Sector	
Education	104 (25)
Private	88 (21)

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Governmental & industrial	59 (14)
Healthcare	52 (12.4)
Unemployed and retired	48 (11)
Students	45 (10.6)
Sport Sector (Coaches and Admin)	25 (6)

The exercise profile showed that more than 30% of the sample were exercising 4-6 days per week, for over 20 years, for more than 30 minutes per session **(Table 2)**. The majority of the sample were non-smokers (73.6%). Heart diseases were reported by 6% of the participants, while 28% reported other non-cardiac conditions such as diabetes, hypertension, and haematology disorders. Other diseases such as endocrine conditions, autoimmune, and GIT disorders were reported by 2.7% of the sample**,** while 66% were healthy athletes **(Table 3).**

Table (2): The distribution of the sample according to the exercise profile (n=421)

Item	n (%)
How many times per week sport is performed?	
Daily	68 (16)
4-6 days	157 (37)
3 days	80 (19)
1-2 days	116 (28)
Since when you are practicing sport? *Mean ±SD= (15.942±12.487)*	
≤1 year	73 (17)
>1 - 5 years	89 (21)
6 - 10 years	49 (12)
11- 15 years	43(10)
More than 15 years	167 (40)
Where are you practicing sport?	
Sport centers, and public areas	355 (84.3)
At home only	63 (15)
At work only	3 (0.7)
Duration of sport/ Day	
≤ 30 min	127 (30)
> 30 min	276 (66)
≥ 2 hrs.	18 (4)
Level of Intensity	
Low	161 (38)
Moderate	147 (35)
High	27 (6.4)
Mixed (Moderate to High)	86 (20.4)
Types of sport	
Walking & running	157 (37)
Resistance & weightlifting	41 (10)
Aerobic exercises combined with resistance & weightlifting	180 (43)
Others (Ex, football, cycling, triathlon)	43 (10)

Table (3): The distribution of the study sample according to the health profile

Item	n (%)
Body mass index (BMI) Mean ±SD=26.653± 4.855 (Range:16-55)	
<18	10 (2.4)
18.5 - 25	159 (37.8)
Overweight	166 (39.4)
Class 1	64 (15.2)
Class 2	17 (4)
Class 3	5 (1.2)
Smoking and drug history	
Smoking	111 (26.3)
Alcohol	7 (2)
Analgesic, Steroids, and stimulants	10 (2.3)
Medical history	
Chronic conditions (Diabetes, hypertension, & dyslipidaemia)	72 (17)
Heart diseases	26 (6)
Haematology disorders	35 (8.3)
Other diseases	11 (2.7)
Healthy participants	277 (66)
Witnessed SCD within family members	**110 (26)**
Witnessed SCD in sport centres	**25 (6)**

Knowledge, skills and attitude toward CPR and AED usage

The study compared the knowledge, skills, and attitude domains among CPR/AED trained participants (group 2) (n = 181,43%) and non-trained participants (group 1) (n = 240,57%). The majority of the CPR/AED trained group (92%) knew the Red Crescent emergency call number compared to 75% of the non-trained, with a statistically significant difference ($P < 0.001$) **(Table 4)**. The majority of the sample claimed that they were competent in performing one or two CPR skills, such as chest compression, opening the airway with rescue breath, checking pulse, and applying the AED pads only. 30% of the trained group claimed that they could perform all skills and were able to use the AED. However, only n = 18 (33%) of those 30% said they could use an AED in

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emergency events. Among the non-trained group, 64% stated that they could perform chest compressions during emergencies **(Table 4).** AED knowledge domains revealed variable results. Although 39% of the trained group stated that they knew what the AED is compared to 15% in the non-trained group with a statistically significant difference (P <0.001), both groups had limited knowledge about the AED's function and purpose, as more than 60% of each group responded with 'I do not know' or with preserving brain blood supply rather than restoring normal heart rhythm.

The Chi-Squared test revealed statistically significant differences between the two groups in the knowledge domain of initiating resuscitation steps when witnessing an unconscious person. The majority of group 2 (58.5%) answered the question correctly, compared to 38% in group 1. Incorrect answers included initiating first chest compression, calling an ambulance, and opening the airway instead of checking consciousness, pulse, and breathing.

There were statistically significant differences in the attitude domain concerning the importance of having an AED in public areas and its role in reducing cardiac death. The Heartsaver trained group supported these views, which indicates an effective change in knowledge and attitude towards CPR and AED. The non-trained group showed less interest in registering for CPR training programs than the previously trained group, with a significant p value of <0.001.

A 41% of the group (1) believes that performing CRP/AED in public areas would offend the SA society, compared to 33% in the group (2). However, the majority of the study sample among the two groups believes that performing CPR/AED in public would not infringe on cultural beliefs in Saudi Arabia, which indicates a positive attitude in the athletic community **(Table 5).**

Table (4): Skills domain of CPR and AED utilization

Question	Group 1= non-trained n= 240 (57%)	Group 2= BLS/heart saver trained n= 181 (43%)	P value
Chi square test was not conducted as the aim of the question was descriptive only to list the skills			
Partial CPR skills (without AED use)	213 (89)	124 (69)	
AED application/use with all CPR Skills	3 (1.0)	55 (30)	
None of the skills	24 (10)	2 (1)	
Skills/attitude domain (Linked Q): *Ability to perform chest compression during emergencies*			
	n= 213	**n=124**	
Yes	136 (64)	107 (86)	<0.001*
No	77 (36)	17 (14)	
Chi square test was not conducted due to limited sample size in each group			
	n= 3	**n=55**	
Yes	0	18 (33)	
No	3 (100)	37 (67)	

P – Value < 0.05 is statistically significant

77% of the participants reported knowledge and skill barriers that prevented them from performing the learned skills in real emergencies. These barriers included a lack of experience and skills, or an expired certificate, while other participants stated that "*the course did not prepare me well*". Attitude-related barriers were reported by 23% of the participants. The mentioned barriers were a lack of confidence, fear of hurting the patient, or fear of legal accountability if the patient dies.

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Table (5): Knowledge, and attitude towards CPR and AED utilization			
Question	Group 1= non-trained n= 240 (57%)	Group 2= BLS/heartsaver trained n= 181 (43%)	X2 P value
Knowledge domain: *Do you know the Red Crescent emergency call number?*			
Yes	180 (75)	166 (92)	<0.001
No	60 (25)	15 (8)	
Knowledge domain: *What is the first step that should be done when you see unconscious person?*			
Correct answer	90 (38)	104 (57.5)	<0.001
Invalid answers	150 (63)	77 (42.5)	
Knowledge domain: *Do you know what the automatic external defibrillator is?*			
Yes	36 (15)	71(39)	<0.001
No	184 (77)	95 (52)	
I am not sure	20 (8)	15(8)	
Knowledge domain: *Why should AED be used as soon as possible when sudden cardiac death occurs?*			
Correct answer	83(35)	71 (39)	0.555
Invalid answers	10 (4)	58 (32)	
I don't know	147 (61)	52 (29)	
Knowledge/attitude domain: *Is there AED in the sport centre that you are visiting?*			
Yes	2 (1)	11(6)	<0.001
No	50 (21)	65 (36)	
I don't know	188 (78)	105 (58)	
Knowledge/attitude domain: *Do you think it's important to have an AED in the sport centre and public area?*			
Yes	146(61)	127 (70)	0.047
No	7 (3)	25 (14)	
Maybe	87 (36)	29 (16)	
Knowledge/attitude domain: *From your point of view, providing AED in sports centres and public places, such as Cornish & shopping mall, will help reduce death from heart attacks outside hospitals?*			
Yes	96 (40)	117(65)	<0.001
No	3 (1)	0 (0)	
Maybe	141 (59)	64 (35)	
Attitude domain: *Do you feel that performing CPR/ AED in public would infringe on cultural beliefs in KSA?*			
Yes	99(41)	60 (33)	0.090
No	141(59)	121 (67)	
Attitude domain: *If you see an announcement for a training course that qualifies you for basic life support, will you register?*			
Yes	138 (57)	145 (80)	<0.001
No	102 (43)	36 (20)	

Discussion

This study aimed to explore the current knowledge, skills, and attitude towards performing CPR and using AED among athletes in the Eastern Region of Saudi Arabia. The sample consisted of participants with a CPR/AED approved training program (43%) and a non-trained group (57%). Similar studies assessed the CPR/AED knowledge and skills among different candidates and settings. Qutub (12) found a similar CPR/AED training rate across the sports centers in the Western Province (Jeddah), Saudi Arabia, with a total of 136 (46.4%) Heartsaver trained participants. However, the study sample size was inadequate to cover the Jeddah 's population, as it is considered one of the largest cities in the Kingdom. The study conducted by AlHaliq et al. (16) in the Eastern Province, Saudi Arabia, focused on assessing the CPR knowledge among security personnel and the AED availability in seven shopping malls. The study reported that more than 70% of the mall's workers, including security personnel and administrators, did not receive any CPR training. Despite the differences in the participant's types between our study and other research, it could indicate the need for increased training missions among different groups and settings in the community.

Variable training rates were observed in other countries. Lower rates were found in Jordan (28%) (17), while 29% was reported in Oman (18). Studies in other countries reported higher training rates in comparison to our findings. Bray et al. (19) reported

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68% in Australia, and 79% in King County in the United States (20). Higher rates in some countries could be related to the fact that first aid training is mandatory, while the rule in Saudi Arabia currently does not mandate this type of training in many public sectors, including sports centers, shopping malls, and schools. Adequate CPR training in communities could improve SCA survival rates outside hospitals (21).

A comparison was made between the CPR/AED trained and non-trained athletes to explore the current knowledge, skills, and attitude towards performing CPR and using an AED when needed. The study found that 107 (86%) of the trained group stated that they could perform CPR during emergencies, in comparison with 136 (64%) of the non-trained group, with a statistically significant difference that indicates the effectiveness of training. However, the evidence of successful training was limited in AED use and application. Only N = 55 (33%) of the certified trained group reported confidence in using and applying the AED during emergencies, compared to none in the non-trained group. It is unknown whether the media or the internet were the sources of training for the non-trained group. The majority of BLS/Heartsaver certified participants had limited knowledge of the AED's indication, importance, and purpose, as the most commonly selected answer was to protect the brain's blood supply rather than to restore the normal heart rhythm. The majority stated that they do not know what AED is, which is a concerning finding. Although the AED is not yet commonly available in public, the community must be ready to use it when it is available in sports centres and other public areas. Therefore, an emphasis on AED use must be highlighted during training programs.

Batt et al. (22) reviewed the incidents and characteristics of OHCA in the Gulf Cooperation Council countries and found low rates (3 to 30%) of bystander cardiopulmonary resuscitation among the reviewed studies. Other reported challenges included the lack of AED availability, inadequate training, and cultural restraints when females are arrested outside hospitals, which were dominant factors (22-24). Our study explored the knowledge, attitude, and skill barriers that prevent athletes from performing CPR or using an AED when available. The majority of participants (77%) stated that a lack of knowledge and skills, as well as inadequate training, were the main causes. Attitudes related factors were reported by 23% of the sample and included fear of hurting the patient, lack of confidence, and a fear of legal accountability. These reasons could be overcome if structured and continued training was available to the community of athletes and non-athletes.

Additionally, participants were asked if performing CPR/AED in public would infringe on Saudi cultural beliefs. 41% of the non- trained group believed it would affect Saudi culture, compared to 33% of the trained athletes who believed the same. Although the comparison was not statistically significant, it could indicate a potential challenge and the need for more focused training and positive media influence that acknowledges these attitude barriers.

Variable responses were found among the two groups concerning the first step when witnessing an unconscious adult. 42.5% of the trained athletes selected different answers, such as contacting an ambulance or opening the airway, instead of checking for responsiveness, followed by pulse and breathing. Statistically significant differences were found between trained and non-trained participants, as 38% of the latter group selected the correct response. Although 57% of the trained athletes answered correctly, it still indicates the need for a more effective and follow-up training process.

Another factor of limited CPR/AED performance is the lack of AED availability, which is also highlighted by Batt et al. (22) study in the Gulf Council countries. This finding is consistent with the current study. The results have shown a major limitation in AED availability, as only 7% of the sample stated that AED was available, while 57% were sure that AED was not available in their facilities, which could be the next improvement mission for sports centers. Additionally, our study found that the majority of the sample across the two groups did not know if the AED was available or not

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in their sports center facilities. More worryingly, 49% of the total sample believed that AED has a limited or no role in preventing death from cardiac arrest. Of this percentage, 31% are BLS trained. This finding suggests that athletes and sports center administrators are unaware of the importance of AED. A similar finding was found in Oman, where almost 60% of the participants believed that CPR has no role in saving unconscious children (25).

A gap was noted among the participants' skills abilities, as only 55 (30%) of the trained group were able to perform all resuscitation related skills, including CPR, opening the airway, and operating the AED, as per their self-report. The majority of the study sample reported that they were able to perform chest compression with checking pulse and breathing only, while 18% were able to open the airway and provide rescue breath via mouth/mask. This finding is similar to the study of Qara et al. (26), who found that 29.5% could provide rescue breath among a sample of non-medical staff in Jeddah. These findings could question the quality of the attended program and the possible need for follow-up training. Fortington et al. (27) highlighted that almost half of the participants could not locate the AED in their sports centres after six months of mandatory governmental training and recommended a follow-up training protocol.

A positive attitude towards learning and training was observed among the study sample, as the majority were willing to register for CPR training courses upon announcement. 80% of trained participants were willing to register again, compared to 57% of the non-trained group, which indicates a change in attitude in response to previous training. A positive community attitude towards learning CPR/AED is a major contributing factor to successful community education and resuscitation in the pre-hospital setting (18).

Conclusion

The study explored the current knowledge, skills, and attitude towards performing CPR/AED among athletes in the eastern province of KSA. The study found limited knowledge and skills about the AED, its purpose, use, and application among CPR\AED trained groups. There is a great need to enhance the quality of training with follow-up sessions to acknowledge all training objectives and to ensure the effective utilization of these skills by athletes and sports facilities. Sports centres are inadequately equipped with AEDs, which is a potential concern.

The study was limited by an inadequate sample representing other cities in the Eastern Province. Most of the participants were clustered in Qatif related cities, which could affect the generalizability of the results. Further research is recommended to investigate the research question in different settings.

Disclosure

Statement:

The authors declared no conflicts of interest or any financial relationship.

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None

Ethical Consideration

This paper is an original work of the listed authors and has not been published previously. The manuscript is not currently being considered elsewhere. All listed co-authors participated and contributed to the research project design and integrity, data collection, revising the scientific content, checking the similarity index, and approving the final version of the manuscript. The ethical approval was obtained from the Saud Albabtin Cardiac Center (SBCC) research ethics committee (IRB-2021-02)

Data availability:

The presented data in this paper represents the main objective of the current study. There is supplementary data that serves as a sub-objective, and it will be presented as a conference paper. The Data collection tool can be provided by the corresponding author upon request.

Author Contribution:

ZAD supervised all processes of the study, including the planning and execution, edited the first

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proposal draft, analyzed and interpreted the data, wrote the results and discussion sections, and edited the final draft of the article. AAJ Conceived the study question, wrote the first proposal draft and participated in writing the final article draft, established the electronic survey, and led the survey distribution process. ZAQ and MAH participated in writing the first proposal draft, collected and organized the data set, completed the final data filtering and coding, and distributed the survey electronically.

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