

## IMPLEMENTATION OF THE OSTRC HANDBALL INJURY PREVENTION EXERCISES IN PROFESSIONAL HANDBALL

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Authors' Contribution: A – Study design; B – Data collection; C – Statistical analysis; D – Manuscript Preparation; E – Funds Collection

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### Abstract

**Purpose.** The Oslo Sports Trauma Research Center (OSTRC) handball injury prevention exercise is an evidence-based injury prevention exercise designed to prevent handball injury. This study aimed to assess the implementation of the OSTRC handball injury prevention exercises among professional handball players in the Gulf Cooperation Council (GCC) countries.

**Materials and methods.** A web-based survey to acquire information regarding the implementation of OSTRC handball injury prevention exercises was distributed to 267 professional handball players in six GCC countries.

**Results.** A total of 250 handball players from the GCC countries responded to the survey (response rate 93.6%). The mean ( $\pm$ SD (Standard Deviation)) of the total implementation score was 13 ( $\pm$ 2.558), with no statistically significant difference between the GCC countries, with a P-value of 0.123. The highest mean score was shown from Bahrain at 13.60 ( $\pm$ 2.614), while the lowest was from Qatar at 12.10 ( $\pm$ 2.427).

**Conclusions.** A low implementation level of the OSTRC handball prevention exercises among the handball players in the GCC countries was reported in the current study.

**Keywords:** athletic injuries, surveys and questionnaires, exercises, sports.

### Introduction

Handball is a sports game founded in 1946 and for the first time in the Olympic games in 1972 (Luig et al., 2018). The fame of this sport game has increased in recent years, and currently, worldwide there are 25 million players (Moller, Attermann, Myklebust, & Wedderkopp, 2012), including male, female, senior, and youth players (Alesi et al., 2019). There are multiple beneficial effects derived from handball practice, such as improvements in cardiovascular, metabolic, muscular, and psychosocial health (Engebretsen et al., 2013; Hornstrup et al., 2019; Póvoas et al., 2012), this sport game presents a high injury risk (Kniubaite, Skarbalius, Clemente, & Conte, 2019). Mainly because of high-intensity specific demands, like change in direction, jumps with abrupt landings and repetitive throws, frequent physical contact with other players (Fredriksen, Cools, Bahr, & Myklebust, 2020; Tsigilis & Hatzimanouil, 2005). Low physical fitness, wrong technique, lack of flexibility, and inadequate rehabilitation

treatment of injuries have been reported as risk factors related to the occurrence of injuries (Ekstrand, 2013; Häggglund et al., 2013). Also, the high intensities and training volumes increase the injury incidence (Häggglund et al., 2013). In this regard, injuries are associated with negative results like team success reduction (Bahr & Holme, 2003), costs increased related to treatments (Øiestad, Holm, & Risberg, 2018), and the risk of suffering from new injuries (O'Brien, Finch, Pruna, & McCall, 2019). Besides, injuries have long-term health consequences influencing the quality of life and career (Van Mechelen, Hlobil, & Kemper, 1992). Therefore, a key positive impact for both players' and teams' performance in reducing the injury incidence. To comprehensively address this issue, important to apply injury prevention approach (Roald Bahr, Clarsen, & Ekstrand, 2018). Van Mechelen et al. (Van Mechelen et al., 1992) confirmed that developing effective injury prevention strategies analysis as the first step, analysis several studies of handball players' injury profile, showing the incidence of 4.1 to 12.4 injuries per 1000 hours overall exposure (Giroto, Hespanhol Junior, Gomes, & Lopes, 2017; Olsen, Myklebust, Engebretsen, & Bahr, 2006; Rafnsson,

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Valdimarsson, Sveinsson, & Árnason, 2019) confirming that match injury incidence is significantly higher than training injury incidence. Additionally, the lower extremities injuries more than upper extremities injuries, affecting the ankle, knee, and head, with ligament sprains and muscle strains being the most type of injuries (Giroto et al., 2017; Hopkins, Marshall, Quarrie, & Hume, 2007; Olsen et al., 2006). Despite the good number of epidemiological studies focused on handball players, there is a discrepancy of definitions addressing injuries and data collection procedures, which suggests a requirement to perform a more detailed study of the injury profile in handball to expand and clarify the present knowledge regarding handball injuries.

Injuries are considered a complex (Mayer, Rühlemann, & Jäger, 2019) produced by the interaction of multiple risk factors (O'Brien et al., 2019), where players' characteristics (e.g., gender or age) are the foremost influential ones (Nielsen & Yde, 1988), can be explained by different game behaviours and physical contact among players (Rafnsson et al., 2019). Additionally, training load performed by the players during matches and training sessions should be taken into consideration when injury risk factors are analysed (O'Brien et al., 2019) surveyed to analyse the implementation of evidence-based injury prevention exercises to commonest injuries among soccer coaches and players. A significant amount of research was conducted to better understand sports specific injuries, body parts most at risk, how these injuries occur, what causes them and how to prevent them. Therefore, this paper aims to assess the implementation of Oslo Sports Trauma Research Center (OSTRC) handball injury prevention exercises among in professional handball players in the Gulf Cooperation Council (GCC) countries.

## Materials and methods

### Survey Development

To the authors' knowledge, no validated surveys are addressing the implementation of injury prevention exercise among worldwide handball players. Therefore, a survey was developed specifically for the current study. Respondents were prompted to answer every question provided in the survey before the next set of questions was presented. A respondent should answer a maximum of 33 questions categorized into three sections: (1) the study invitation and participation agreement, (2) socio-demographics questions, and (3) the implementation of OSTRC handball injury prevention exercises.

Items were in the form of multiple-choice questions and scoring of each item was dichotomous (correct answer = 1; incorrect answer = 0). The maximum score of the survey is the sum of all items (a score of 27) and transformed into a percentage score for ease of data analysis and data reporting. When questions are answered correctly, higher scores reflect more implementation and knowledge (possible range of correct answers 0–27). The respondents were able to see the total score, correct answers, and the questions they missed immediately after submission. The survey was available in English and Arabic language supported by videos demonstrating each exercise. This project was reviewed and ethically approved by the Biomedical Ethics Committee at Umm Al Qura University. Approval Number. HAPO02K012202010465. A consent was obtained from each participant included in the study

before data collection begins. After obtaining permission from each participant and assuring their confidentiality, the participants were then asked to fill out the questionnaire. All participants were informed that their participation was entirely voluntary and confidential.

### Survey Dissemination

A survey invitation was distributed through the Saudi Arabia, UAE, Kuwait, Bahrain, Oman, and Qatar Handball Federation. The invitation provided a brief background about the survey and encouraged to participate. Once the participants read the scope and aim of the survey, they were asked to provide informed consent and access the survey. The survey was filled anonymously and electronically via a web-based form. Responses were collected from June to October 2020.

### Sample Size and Statistical analysis

Considering a 6% margin of error at a 95% confidence level, 267 professional handball players in six GCC countries were invited to participate.

Responses were organized in Microsoft Excel 2010 (Microsoft Corporation, Redmond, Washington, USA) and analysed using Statistical Package for the Social Sciences (SPSS) version 24.0 (IBM Corp., Armonk, New York, USA). Descriptive statistics were computed to describe the sample characteristics and survey data. One-way Welch ANOVA was used to determine differences in the overall survey score.

## Results

A total of 250 handball players from the GCC countries responded to the survey (response rate 93.6%). The highest percentage of the participants (20.4%) was from Saudi Arabia, while participation from the remaining GCC countries was almost similar (around 16% from each), as shown in table (1).

The rate of implementation of each of the OSTRC injury prevention exercises is shown in table (2). Overall, the implementation rate ranged from 44.8% for the Y fall exercise to 55.6% for the jump and push, and shoulder rotation exercises at 55.6% for each, as shown in table (2).

The comparison among the GCC countries with respect to the mean of the total implementation score is shown in table (3). The mean ( $\pm$ SD) of the total implementation score was 13 ( $\pm$ 2.558). Generally, there was no statistically significant difference between the GCC countries in the mean of the total implementation score, with a P-value of 0.123. The highest mean score was shown from Bahrain at 13.60 ( $\pm$ 2.614) followed by the United Arab Emirates (UAE) at 13.34 ( $\pm$ 2.640).

**Table 1.** Frequencies and percentages of all participant from different countries of the Gulf Cooperation Council

Indicators	Frequency	Percent
Saudi Arabia	51	20.4 %
Bahrain	42	16.8 %
Kuwait	42	16.8 %
Oman	34	13.6 %
Qatar	41	16.4 %
United Arab Emirates	40	16.0 %
Total	250	100.0 %

**Table 2.** Percentages and frequencies for different points

Exercises	Frequency (%)
Triangle run	129 (51.6 %)
Run with backwards throws	122 (48.8 %)
Run with foot plant	119 (47.6 %)
Jump & push	139 (55.6 %)
Side lying rotation	114 (45.6 %)
Bow and arrow	134 (53.6 %)
Shoulder external rotation	139 (55.6 %)
Push up passes	119 (47.6 %)
Single-leg deadlift with partner	138 (55.2 %)
Backwards throws	128 (51.2 %)
Forwards speed-skating jumps	131 (52.4 %)
Run and jump: Double-leg landing	133 (53.2 %)
Rotating jump with push: Double-leg landing	124 (49.6 %)
Hip flexors stretch +	116 (46.4 %)
Shoulder press	126 (50.4 %)
Shoulder external rotation+	115 (46.0 %)
Push up passes+	116 (46.4 %)
Drop & catch	121 (48.4 %)
Bounding	119 (47.6 %)
Run and jump: Single-leg landing	132 (52.8 %)
Rotating jump with push: Single-leg landing	114 (45.6 %)
Kneeling lunge with rotation	138 (55.2 %)
Y fall	112 (44.8 %)
Overhead shoulder strength	130 (52.0 %)
Push up + backwards toe walk	126 (50.4 %)
Backwards throwing +	117 (46.8 %)

**Table 3.** Comparison among the Countries of the Gulf Cooperation Council with respect to total score.

Indicators	N	Mean	SD	Median	Min	Max	*P-value
Saudi Arabia	51	12.86	2.615	13	8	20	
Bahrain	42	13.60	2.614	14	7	18	
Kuwait	42	13.02	2.523	13	8	19	
Oman	34	13.06	2.348	14	8	18	0.123
Qatar	41	12.10	2.427	12	7	17	
United Arab Emirates	40	13.43	2.640	13	8	18	
Total	250	13.00	2.558	13	7	20	

Table note: \* One-way analysis of variance (ANOVA).

On the other hand, the lowest implementation rate was found in Qatar at 12.10 ( $\pm 2.427$ ).

The comparison between the GCCs by the implementation of each exercise is shown in table (4). Overall, there were no significant differences between the GCCs in the implementation rates of all the addressed exercises since all P values were  $>0.05$ . A borderline significant difference (0.056) was shown with the run and jump: single-leg landing exercise, being highly implemented in Saudi Arabia at 60.8%, and the lowest in UAE at 37.5%.

## Discussion

This study aimed to assess the level of implementation of the OSTRC handball injury prevention exercises among handball players in the GCCs, and to the best of our knowledge, this is the first study to address this topic. The results revealed low implementation rates of the assessed exercises that ranged from 44.8% to 55.6%.

The scarcity of similar data in the literature makes comparing the current study findings difficult. However, in line with the current study findings of low implementation rates

of handball injury prevention exercises, previous randomized controlled trials (RCTs) showed that despite the high effectiveness of the evidence-based injury prevention training in reducing musculoskeletal injuries by approximately 40%, such training has limited public health impact (Emery, Roy, Whittaker, Nettel-Aguirre, & Van Mechelen, 2015; Rössler et al., 2014; Soomro et al., 2016). This is mainly because the training is not widely or properly implemented or sustained (Donaldson & Finch, 2013; Finch & Donaldson, 2010).

Unfortunately, the reasons for non-implementation in the current study were not addressed. A recently published study by Ageberg E et al. (Ageberg et al., 2019), suggested that activities to facilitate the implementation of an injury prevention intervention for team handball players should focus on ensuring that both the players and coaches know and understand the principles, importance, and benefits of such training. In addition, Joy EA et al. (Joy et al., 2013) reported that inadequate implementation knowledge is one of the major obstacles for adopting a prevention program for anterior cruciate ligament injury. Therefore, based on the current study results it is highly recommended that the OSTRC handball injury prevention program should reach and involve all stakeholders, including players, coaches, and clubs and governing bodies. Moreover, for promoting the implementation, it is essential to assure understanding of the relevant benefits of the injury prevention exercise program for all stakeholders, enhancing program fidelity, and encouraging maintenance by establishing policies and procedures at the team, club, and governing body levels.

As with any study, the current study has its limitations. Besides handball players, who were invited to participate in this study, coaches and physical therapists are other relevant participants potentially affecting the success of the implementation, however, they were not included in the current study. In addition, implementation of a prevention program is a complex process and the word 'implement,' which was assessed in the current study, is only facet. Therefore, future research should aim to more precisely define and allocate the varied factors contributing to concepts such as program usage, feasibility, or suitability. Despite these limitations, this is the first study in this area, and data was collected from handball players from the whole GCCs, therefore, the result could be generalized to the region.

## Conclusions

Overall, the implementation levels of the OSTRC handball prevention exercises among the handball players in the GCC countries is considered low. Future studies addressing the barriers for non-implementation and how to overcome them are needed.

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## Conflict of interest

The author(s) declared no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

**Table 4.** Comparison among the Countries of the Gulf Cooperation Council with respect to different points.

Indicators	Countries						P-value
	Saudi Arabia	Bahrain	Kuwait	Oman	Qatar	U.A. E	
	(n = 51)	(n = 42)	(n = 42)	(n = 34)	(n = 41)	(n = 40)	
Triangle run	25 49.0%	24 57.1%	25 59.5%	14 41.2%	21 51.2%	20 50.0%	0.664
Run with backwards throws	25 49.0%	19 45.2%	19 45.2%	16 47.1%	23 56.1%	20 50.0%	0.928
Run with foot plant	25 49.0%	26 61.9%	22 52.4%	13 38.2%	13 31.7%	20 50.0%	0.097
Jump & push	29 56.9%	23 54.8%	20 47.6%	22 64.7%	17 41.5%	28 70.0%	0.111
Side lying rotation	26 51.0%	20 47.6%	15 35.7%	14 41.2%	17 41.5%	22 55.0%	0.508
Bow and arrow	26 51.0%	21 50.0%	20 47.6%	22 64.7%	24 58.5%	21 52.5%	0.689
Shoulder external rotation	26 51.0%	24 57.1%	27 64.3%	15 44.1%	23 56.1%	24 60.0%	0.564
Push up passes	28 54.9%	20 47.6%	18 42.9%	18 52.9%	18 43.9%	17 42.5%	0.777
Single-leg deadlift with partner	26 51.0%	25 59.5%	26 61.9%	18 52.9%	19 46.3%	24 60.0%	0.670
Backwards throws	31 60.8%	28 66.7%	20 47.6%	15 44.1%	17 41.5%	17 42.5%	0.089
Forwards speed-skating jumps	25 49.0%	19 45.2%	24 57.1%	17 50.0%	22 53.7%	24 60.0%	0.775
Run and jump: Double-leg landing	23 45.1%	29 69.0%	17 40.5%	20 58.8%	20 48.8%	24 60.0%	0.081
Rotating jump with push: Double-leg landing	24 47.1%	22 52.4%	17 40.5%	21 61.8%	22 53.7%	18 45.0%	0.510
Hip flexors stretch +	23 45.1%	23 54.8%	20 47.6%	11 32.4%	18 43.9%	21 52.5%	0.461
Shoulder press	25 49.0%	22 52.4%	24 57.1%	13 38.2%	20 48.8%	22 55.0%	0.660
Shoulder external rotation+	25 49.0%	22 52.4%	17 40.5%	19 55.9%	16 39.0%	16 40.0%	0.534
Push up passes+	18 35.3%	19 45.2%	20 47.6%	19 55.9%	19 46.3%	21 52.5%	0.493
Drop & catch	22 43.1%	16 38.1%	22 52.4%	20 58.8%	17 41.5%	24 60.0%	0.218
Bounding	27 52.9%	18 42.9%	21 50.0%	17 50.0%	15 36.6%	21 52.5%	0.621
Run and jump: Single-leg landing	31 60.8%	24 57.1%	24 57.1%	22 64.7%	16 39.0%	15 37.5%	0.056
Rotating jump with push: Single-leg landing	26 51.0%	20 47.6%	22 52.4%	12 35.3%	15 36.6%	19 47.5%	0.507
Kneeling lunge with rotation	27 52.9%	23 54.8%	18 42.9%	23 67.6%	23 56.1%	24 60.0%	0.391
Y fall	21 41.2%	13 31.0%	26 61.9%	17 50.0%	15 36.6%	20 50.0%	0.064
Overhead shoulder strength	25 49.0%	25 59.5%	23 54.8%	16 47.1%	22 53.7%	19 47.5%	0.854
Push up + backwards toe walk	22 43.1%	23 54.8%	22 52.4%	18 52.9%	21 51.2%	20 50.0%	0.906
Backwards throwing +	25 49.0%	23 54.8%	18 42.9%	12 35.3%	23 56.1%	16 40.0%	0.368

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## ВПРОВАДЖЕННЯ ВПРАВ OSTRC З ПОПЕРЕДЖЕННЯ ТРАВМ У ПРОФЕСІЙНОМУ ГАНДБОЛІ

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Авторський вклад: А – дизайн дослідження; В – збір даних; С – статаналіз; D – підготовка рукопису; Е – збір коштів

Реферат. Стаття: 6 с., 4 табл., 29 джерел.

**Мета дослідження.** Вправи по запобіганню гандбольних травм – це науково обґрунтовані вправи, запропоновані Центром досліджень спортивного травматизму в Осло (OSTRC). Це дослідження мало на меті оцінити реалізацію вправ OSTRC щодо запобігання травматизму серед професійних гандболістів у країнах Ради співпраці країн Перської затоки (GCC).

**Матеріали і методи.** Інтернет-опитування з метою отримання інформації щодо виконання вправ OSTRC із запобігання травматизму в гандболі було розповсюджено серед 267 професійних гандболістів у шести країнах GCC.

**Результати.** Загалом в опитуванні взяли участь 250 гандболістів із країн GCC (рівень відповіді 93,6%). Середнє значення ( $\pm$ SD (стандартне відхилення)) загальної оцінки впровадження становило 13 ( $\pm$ 2,558), без статистично значущої різниці між країнами GCC, значення P становило 0,123. Найвищий середній бал був показаний в Бахреїну в 13,60 ( $\pm$ 2,614), тоді як найнижчий був у Катару в 12,10 ( $\pm$ 2,427).

**Висновки.** У поточному дослідженні повідомлялося про низький рівень виконання вправ OSTRC з гандболу серед гандболістів у країнах GCC.

**Ключові слова:** атлетичні травми, опитування та анкетування, вправи, спорт.

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