SHOULDER INJURY PREVENTION EXERCISES IN OVERHEAD ATHLETES SYSTEMATIC REVIEW

Monika Grygorowicz, Przemysław Lubiatowski, Witold Dudzinski, Leszek Romanowski

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Introduction

4 – 7 % *(Olsen et al. 2006)*

9% *(Langevoort et al. 2006)*

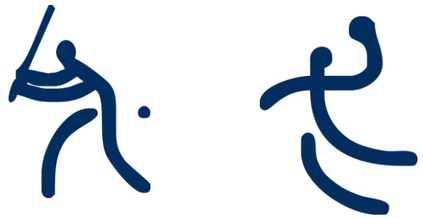
11,1 % *(Piry et al. 2011)*

22%-36% *(Myklebust et al. 2011)*

52% *(Fahlstrom et al 2006)*

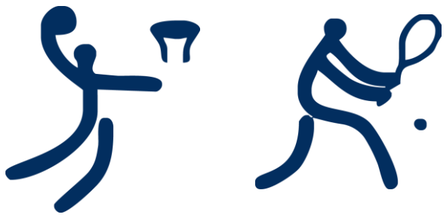
10-57% *(Bahr & Reeser 2003)*

Overhead patterns implicate injuries in athletes *(Wilk et al. 2009)*



40% of the handball players included time lost *(Gohlke et al. 1993)*
50% of professional pitchers have missed 1 start
58 days missed *(Li 2013)*

Assessing of the effectiveness of preventive exercises is crucial *(Bahr & Krosshaug 2005)*



Different prevention approaches are implemented *(Reinold et al. 2009, Reeser et al. 2006, Wilk et al. 2009*

Introduction

(75%) of the volleyball injured players reported to have sustained a previous ankle sprain

Verhagen et al. 2004

In badminton players 52% prevalence of current or previous shoulder pain problems is noted

(Fahlström et al. 2006

Introduction

Previous injury pre-disposes athetes to future injury in overhead sports

Bahr & Bahr 1997

The greatest remaining challenge in the field of sports medicine is to design and implement programs that will reliably prevent injuries from occurring in the first place.

Reeser & Bahr 2006

Introduction

DO NOT ALLOW THEM TO HAPPEN

PRIMARY PREVENTION STRATEGIES

Introduction

„Characteristics of shoulder injury risk factors in throwing disciplines”

3-year project

Funded by the National Science Center based on decision number DEC-2011/01/B/NZ7/03596

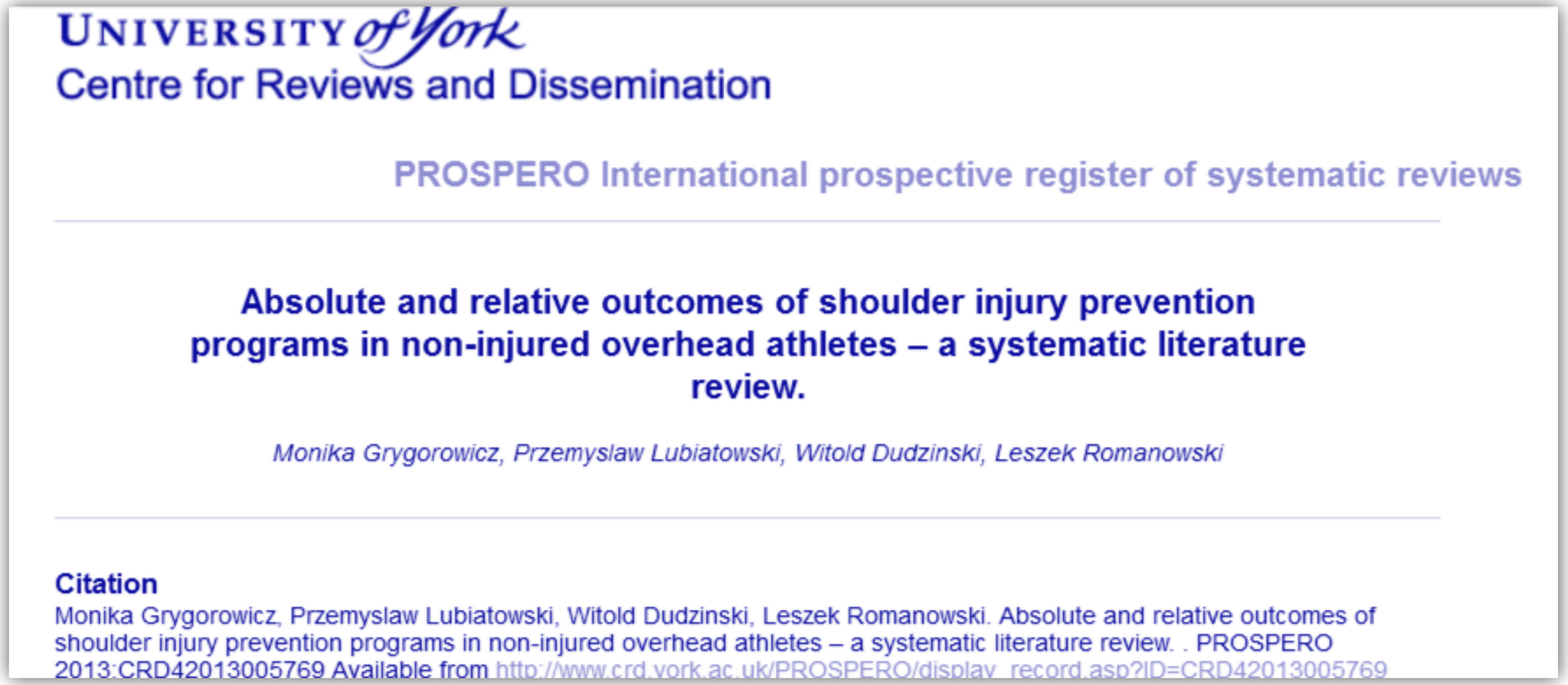
Objective

was to analyze the effectiveness of primary shoulder injury prevention programs in non-injured overhead athletes based on absolute and relative outcomes

Methods

Study design

This systematic review was prepared according to the guidelines of the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA).



UNIVERSITY of York
Centre for Reviews and Dissemination

PROSPERO International prospective register of systematic reviews

Absolute and relative outcomes of shoulder injury prevention programs in non-injured overhead athletes – a systematic literature review.

Monika Grygorowicz, Przemyslaw Lubiatowski, Witold Dudzinski, Leszek Romanowski

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Methods

Defining the review question

What kind of primary shoulder injury prevention programs are most effective in reducing shoulder injury rate or in shouder functional improvement in overhead athletes?

Methods

P

Non-injured overhead athletes

handball, swimming, pitchers, volleyball, tennis, basketball, baseball, softball, badmintom, cricket, lacrosse, football, golf, gymnastic, netball, javelin

I

Prevention program

Proprioception, strength, prophylaxis, prevention, stretching, taping, splinting, orthosis, physiohterapy, physical therapy, core, endurance, conditioning, sensory, resistance, stability, season, plyometric, balance, board, elastic, theraband

Training, exercise, program, threrapy, performance, intervention, appraoch, practice, workout, activity, strategy, regiment

weeks, days

O

Absolute outcomes

Shoulder, overhead, hand, girdle, upper, overarall, scapula, arm, clavicula, glenohumeral, stern, acromion, rotators

Injury, contusion, dislocation, cuff, instability, pain, impigment, fatigue , damage, harm, hurt, disability, affliction

Limitation, minimize, reduction, decrease, drop, depression, downscale, lowering, rate, index

Relative outcomes

Proprioception, strength, isokinetic, isometric, isotonic, rate, flexibility, elasticity, velocity, throwing, emg, electromiography, pain, ratio, resistance, range, ROM, movement, dynanometers, time, torque, endurance, power, work, fatigue, dynamic, motion, stability, efficacy, effectiveness, success, improvement, function

S

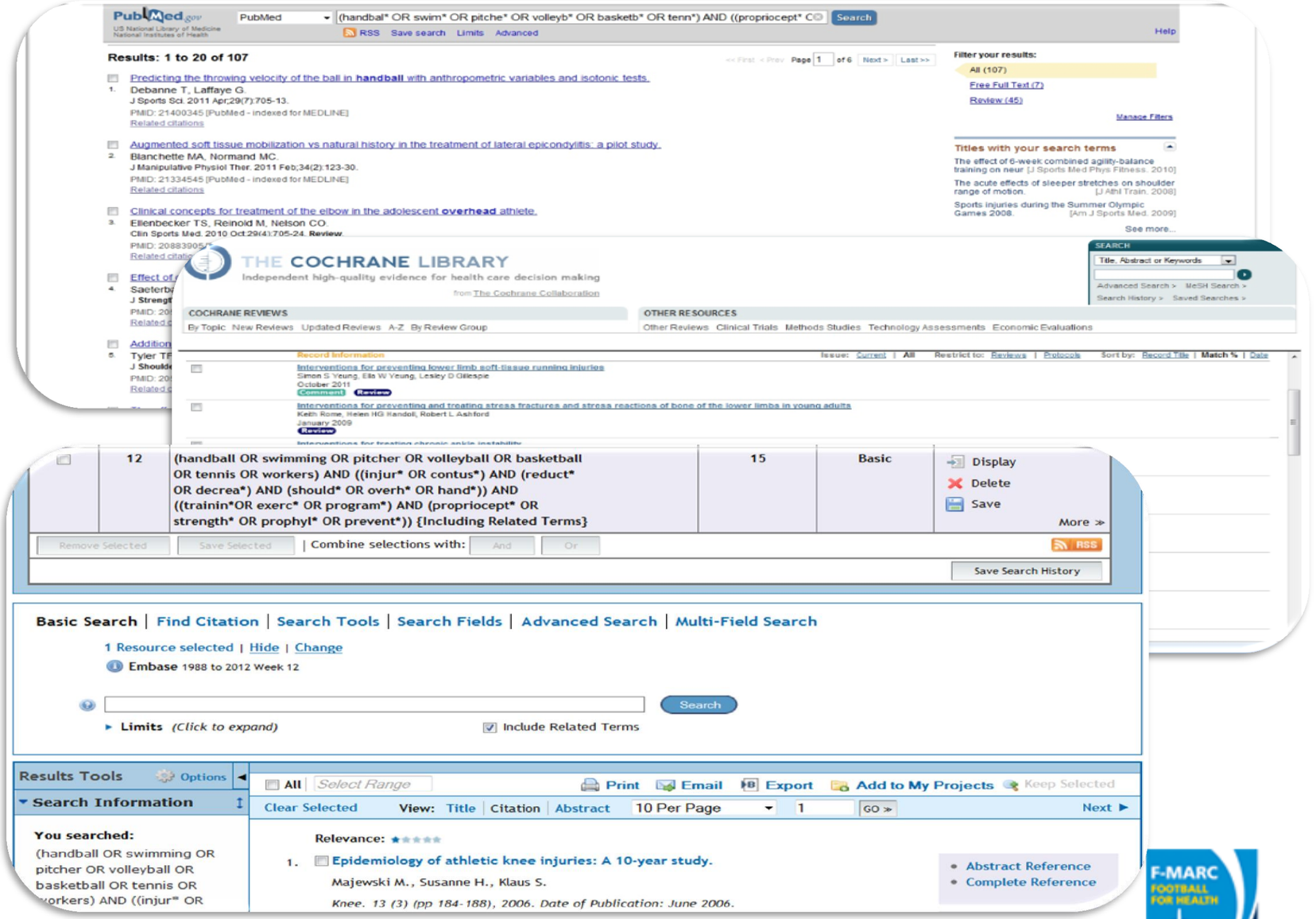
Controlled clinical trials, randomized controlled trials

Methods

Search strategy

Identification of studies

Databases:
MEDLINE, PubMed, PEDro, CINAHL, SPORTDiscus™, the Cochrane Central Register of Controlled Trials (CENTRAL).



Methods

Inclusion criteria

- Subjects were healthy amateur or professional overhead players without any orthopaedic surgery, no shoulder pain and no rehabilitation in previous history
- Effectiveness of prevention and/or functional improvement programs was documented separately for the control and intervention groups, with diagnosis criteria as defined in individual trials
- Effectiveness of prevention and/or functional improvement programs was based only on shoulder related outcomes
- The intervention program was performed at least for the 4-week period of the study.

Methods

Exclusion criteria

- The study design was inappropriate, e.g. papers designed as case-series study
- Subjects were not non-injured athletes; e.g. they were students, or they were professional athletes with previous history of shoulder injury and shoulder therapy
- Subjects were over 50 years old; e.g. amateur golf players aged 60-80 years old
- Intervention program was shorter than 4-weeks
- Effectiveness of prevention and/or functional improvement programs was based on non shoulder related outcomes; e.g. ACL injury rate
- Short communications published only as abstracts in post-conference/post-congress book
- Papers designed as academic dissertation.
- Studies that duplicated patient populations from the same authors

Methods

Quality assessment

PEDro
PHYSIOTHERAPY EVIDENCE DATABASE

Eligibility criteria
Random allocation
Concealed allocation
Baseline comparability
Blind subjects
Blind therapists
Blind assessors
Adequate follow-up
Intention-to-treat analysis
Between-group comparisons
Point estimates and variability

Study selection

Two reviewers (MG and PL) independently applied the inclusion criteria to select the potentially relevant papers

Data extraction

Details were extracted from each study: target population, intervention content, evaluation methods and results.

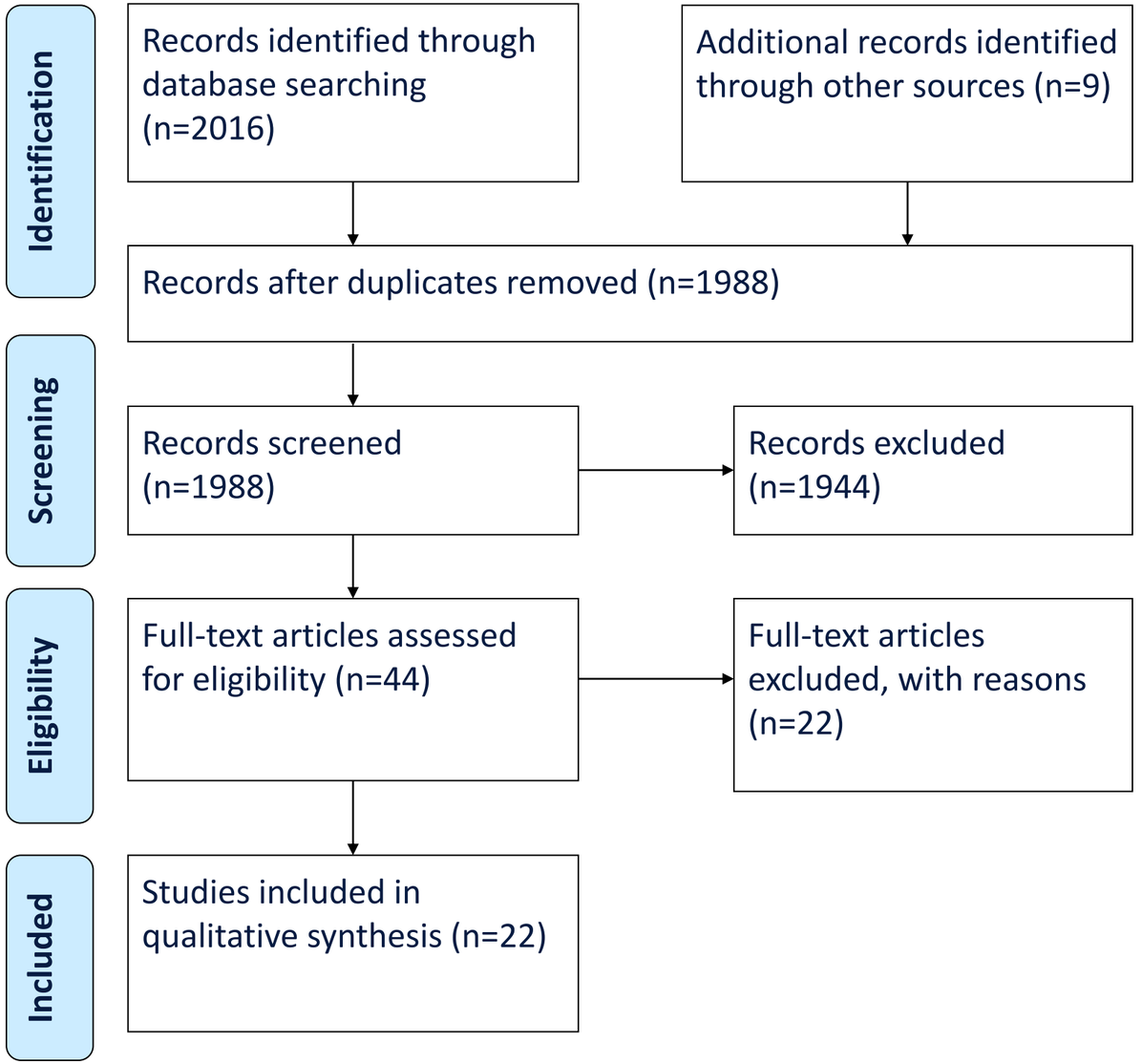
Data sythesis

There was considerable heterogeneity of research methods, so it was not possible to perform quantitatively analysis

Risk of bias

was reduced by having two assessors critically appraise the articles.

Results


Identification
Records identified through database searching (n=2016)
Additional records identified through other sources (n=9)
Records after duplicates removed (n=1988)
Screening
Records screened (n=1988)
Records excluded (n=1944)
Eligibility
Full-text articles assessed for eligibility (n=44)
Full-text articles excluded, with reasons (n=22)
Included
Studies included in qualitative synthesis (n=22)

The effects of proprioceptive neuromuscular facilitation stretching on shoulder range of motion in overhand athletes

P. V. DECICCO[1], M. M. FISHER [2]

Effects of Dumbbell Torque and Tennis Playe

Frank A. Treiber,*†‖[a b]

The Effects of Plyometric, Tennis-Drills, and Combined Training on Reaction, Lateral and Linear Speed, Power, and Strength in Novice Tennis Players

Konstantinos Saloníkidis and Andreas Zafeiridis

Department of Physical Education and Sport Sciences, Aristotelio University of Thessaloniki, Serres, Greece

Four-W… Interve… Perform…

Sonja L. Herma…

Corey E. Anderson, Gary A. Sforzo, and John A. Sigg

Exercise and Sport Sciences, Ithaca College, Ithaca, New York

Closei… Improv… Divisio…

Max P. Prok…
Glenn A. Ga…

Exercise Physiolog…

Functional … and Functi…

Christian J. Thompson, …

The effe… forwarc… elite sw…

Stephanie S I…
Darin Padua[3]

Mark J. Rowinski, PhD, PT

Results

Population

Results

Age

< 15.5 yrs

(Szymanski 2007, Escamilla 2010, Wooden 1992, Santos 2008, Guillot 2010)

Between 15.5 – 19.5 yrs

(Saeterbakken 2011, Cronin 2001, Gabbett 2008, Lynch 2010, Coutts 2004, Anderson 2008)

Between 19.5 – 22.5

(Petersen 2004, Kilinc 2008,Hoffman 2009,Treiber1998, Prokopy 2008, Fradki 2004)

> 29 and older

(Fletcher 2004, Deicoo 2005)

Not provided

(Ghigiarelli 2009, Ellenbecker 1988)

Prevention and/or performance program

- Isotonic strength training (n=8)
- Isokinetic concentric and/or eccentric strength training (n=2)
- Elastic resistance (n=2)
- Power training (n=1)
- Core strength training (n=3)
- Specific warm-up (n=1)
- Stretching/Flexibility (n=2)
- Plyometric training (n=2)
- Sport specific conditioning games (n=1)

Programs varied:

•by their intensity and duration (4-12 weeks)
•athletes exercised from two to five times a week
•Session period differed in relation to the type of training: from several repetitions for strength and/or power and/or resistance training up to 60, 75 and 90 minutes for stretching/flexibility, core stability, and for combined resistance work and plyometric training, respectively.

Results

Absolute

No article gave an absolute number of athletes' shoulder injury rate that had changed as a result of prevention program based on the entire season(s) observation

e.g. 2.4/1000h ➔1.8/1000h

Relative

- Strength (isokinetic, isometric, isotonic) (n=11)
- Explosive strength (isokinetic) (n=1)
- Total work (isokinetic) (n=1)
- Power (isokinetic, medicine ball throw) (n=5)
- Velocity (throwing velocity, serves velocity, club head speed, driving distance, bowling speed) (n=10)
- ROM (shouler ROM) (n=1)
- Flexibility (shoulder flexibility) (n=1)

Results

Methodological quality	*Mean ± SD (95%CI)*
PEDro Scale	5.0 ± 0.8 (4.6 – 5.4)
Internal validity score (IVS)	2.9 ± 0.6 (2.6 – 3.3)
	4 – moderate quality *(max. 7 – Treiber 1998)*

		Eligibility criteria	Random allocation	Concealed allocation	Baseline comparability	Blind subjects	Blind therapists	Blind assessors	Adequate follow-up	Intention-to-treat analysis	Between-group comparisons	Point estimates and variability	PEDro (max. 10)	(IVS - max. 7)	IVS
1	Cronin 2001	1	1	1	1	0	0	0	0	1	1	0	5	3	limited quality
2	Ellenbecker 1988	1	1	1	0	0	0	0	0	1	0	1	4	3	limited quality
3	Fradkin 2004	1	1	1	1	0	0	0	0	1	1	0	5	3	limited quality
4	Lynch 2010	1	1	1	1	0	0	0	0	1	1	1	6	3	limited quality
5	Santos 2008	1	1	1	0	0	0	0	0	1	1	1	5	3	limited quality
6	Escamilla 2010	1	1	1	0	0	0	0	0	1	0	1	4	3	limited quality
7	Prokopy 2008	1	1	1	0	0	0	0	1	1	1	1	6	4	moderate quality
8	Saeterbakken 2011	1	0	1	1	0	0	0	0	1	0	1	4	2	limited quality
9	Szymanski 2007	1	1	1	0	0	0	0	0	1	1	1	5	3	limited quality
10	Wooden 1992	1	1	1	0	0	0	0	0	1	1	1	5	3	limited quality
11	Fletcher 2004	1	1	1	0	0	0	0	0	1	0	1	4	3	limited quality
12	Coutts 2004	1	0	1	1	0	0	0	0	1	1	1	5	2	limited quality
13	Kilinc 2008	1	0	1	1	0	0	0	0	1	1	1	5	2	limited quality
14	Hoffman 2009	1	1	1	0	0	0	0	0	1	1	1	5	3	limited quality
15	Gabbett 2008	1	1	1	1	0	0	0	0	1	1	1	6	3	limited quality
16	Gouillot 2010	1	0	1	0	0	0	0	0	1	1	1	4	2	limited quality

Methodological quality

- Participant blining
- Intervention provider blinding
- Assessor blinding
- No information about the number of subjects initially allocated to groups and the number of subjects from whom key outcome measures were obtained
- No presentation of baseline data of measured outcomes

Prevention and/or performance program

Strengthening plus stretching or strength/power exercises versus control

n=14 swimmers	No significant main effects for group (p>0.05) were found in strength measures and self-assessment of shoulder pain and function.
n=7 netball	No significant differences were noted between the groups on throwing velocity measurements after six weeks of training.
n=10 baseball	There were also no details regarding comparability of analysed parameters at the baseline.

Lynch 2010, Cronin 2001, Wooden 1992

Prevention and/or performance program

Isokinetic concentric versus eccentric exercises

n=11
tennis

Due to the lack of information about baseline comparability and between-group comparison (besides small sample size) we concluded that there is no evidence that eccentric training was more effective than concentric mode improve strength and serve throwing velocity in tennis athletes.

Ellenbecker 1988

Prevention and/or performance program

Supervised versus no-supervised resistance training

n=21
rugby

Authors stated that the direct supervision of resistance training in young rugby league players results in garter training adherence and increased strength gains that does not unsupervised training. But it did not influence sprint and jumping abilities.

Coutts 2004

Prevention and/or performance program

Resistance training versus control

n=11 tennis

Follow-up analysis indicated that the intervention group presented significantly grater increase in peak and average velocity of serves and in internal and external shoulder rotation torque in elite tennis players

Treiber 1998

(n=11, moderate quality)

n=51 football players

There were no significant differences between those three groups.

Hoffman 2009

Prevention and/or performance program

Medicine ball training versus control

n=25
baseball

However, the main limitation of the study was no information about comparability of analysed parameters at the baseline, no information about subject, therapist, assessor blinding and no adequate follow-up information.

Szymański 2007

Prevention and/or performance program

Core training (closed kinetic chain) versus control

n=14 handball

No between-group comparison (besides small sample size) is the main limitation of the study, so we concluded that there is no evidence for the effectiveness of SET training versus only standard handball training to improve throwing velocity.

Saeterbakken 2011

n=7 softball

We concluded, that due to the small sample size and low statistical power there is limited evidence for the confidence with which the results if this study can be recommended for a training population.

Prokopy 2008

Prevention and/or performance program

Conditioning/skill-based/modified training versus control

n=25 baseball

There was no time X intervention result in control grouthere is no valid data regarding statistical significance in post-training parameters between two analysed groups.

Escamilla 2010

n=16 volleyball

Significant positive differences were reported in overhead medicine ball throw, vertical jump, agility and VO_2max after 3 months of training: 3M_AT (mean differences ± standard error) between control group and intervention groups was:

Gabett 2008

Summarizing

Conflicting evidence has been found.

In majority papers pre-training outcomes (such as strength, power, throwing velocity) were significantly lower compared to post-training scores

However, usually there were no significant differences between tested groups.

Summarizing

Limited evidence was found for increase isotonic and isokinetic strength with elastic resistance training and core stability exercises versus control group with traditional strength training.

Closed kinetic chain exercises were more effective than open kinetic chain in increasing of throwing velocity.

Supervised resistance training exercises results in higher improvement of bench strength values compared to unsupervised resistance training.

There is a limited number of reliable publications where relative outcomes are used to assess the effectiveness of prevention and/or functional improvement programs in non-injured overhead athletes

Due to a lack of papers regarding absolute injury outcomes further RCT are needed to investigate the efficacy of programs aimed at reducing injury risk

Literature research performed with other key words and methodology might reveal articles with an absoulte number of reduced shoulder injuries in overhead athletes within the entire sport season

I am looking for your help to find the answer

?

rehasport® clinic

Thank you for your attention

monika.grygorowicz@rehasport.pl

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