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ANTHROPOLOGICAL PROFILE OF GOALBALL ATHLETES – BRIEF SYSTEMATIC REVIEW

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Systematic review
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Abstract
Introduction: Goalball is a sport designed for persons with an impaired sense of sight. It is one of the most popular sports with the ball in the blind and sight-impaired persons. The body composition with goalball players is crucial for studying due to insufficient physical activity, which aims to characterize persons with sight invalidity issue.
Methods: The articles from the following electronic databases have been studied: PubMed/Medline, Cihnal, Embase, Open-J-Gate, Science Direct and Google Scholar. The articles published between 2004 and 2019 have been studied, with a focus on the anthropological profile of goalball players. The inclusion criteria were divided into four sections: study strategy, study design, type of measurement outcome, exclusion criteria. The procedures were carried out in accordance with the Preferred Reporting Items for Systematic Reviews (PRISMA) statement.
Results: Out of 108 articles collected, 14 articles have been analyzed in detail on the grounds of databases and consequently a conclusion has been provided.
Conclusion: The body height is crucial for contributing to a greater arm span, which means greater space coverage, as well as a percentage of muscle tissue connected to muscle strength.

Keywords: goalball, visual impairment, anthropological profile, body composition.

Introduction

Goalball is the sport for the blind and sight-impaired persons. It was played in Germany first, as a form of rehabilitation intended for veterans and it gained great popularity and, therefore, it was included in the programme of 1976 Paralympic Games (Scherer, et al., 2012). It represents one of the most popular sports with the ball for the blind and sight-impaired athletes. This sport offers a possibility in the development of physical abilities and the development of an organism as a whole (Đorđević, et al., 2018).

The assessment of an anthropological profiles renders data which could be of essential value for obtaining good results (Aguilar et al., 2012, Petroski et al., 2013). The body composition changes under the influence of physical activity and, therefore, it represents one of the essential components of fitness, including a general health condition of an athlete as well (Mazić, 2014). Many studies have investigated the topics of morphological parameters among athletes in various sporting disciplines, with the aim of choosing characteristics which contribute to the creation of the top anthropological profile and top sporting results (Romanov et al., 2017). The body composition of goalball players is essential for investigation, particularly due to insufficient physical activity which tends to characterize sight-impaired persons, considering a low development level of goalball in comparison to other sports in the region (Čolak, et al., 2004). Investigations conducted by (Calıskan, et al., 2011) suggest that conducting goalball program through a longer period has a positive impact on the decrease of the percentage of body mass in boys and girls from 10 to 15-year-olds. Goalball requires a combination of tall, strong and fast athletes in order to obtain a better influence in offence and defense, whereby a body height and arm span are essential for achieving a better result in defense and offence (Scherer, 2012).

Based on a systematic analysis of published scientific investigations, competent conclusions in the aim of contributing to future investigations in

the goalball on this topic can be provided. The objective of this easily-to-be surveyed investigation is a description of the anthropological profile of a goalball.

Method

Study strategy

In order to have access to relevant studies, the following electronic databases were needed to be used: PubMed/Medline, Cihnal, Embase, Open-J-Gate, Science Direct and Google Scholar. The articles published between 2004 and 2019 have been sought after. The following keywords have been used during the investigation: goalball, the blind and sight-impaired, anthropological features, body composition. All procedures relevant for papers' identification were carried out in accordance with the Preferred Reporting Items for Systematic Reviews (PRISMA) statement.

Study Design

The revision has included newspaper articles written in English, Serbian and Spanish language, published during the last 15 years. Scientific articles considered studied the anthropological profile of goalball players.

Type of measurement outcome

Analyzed scientific articles have referred to studies which examined anthropological profile (morphological characteristics, motoric and functional abilities) of goalball players.

Exclusion criteria

Exclusion criteria are the following ones: studies which have not been dealing with an anthropological profile.

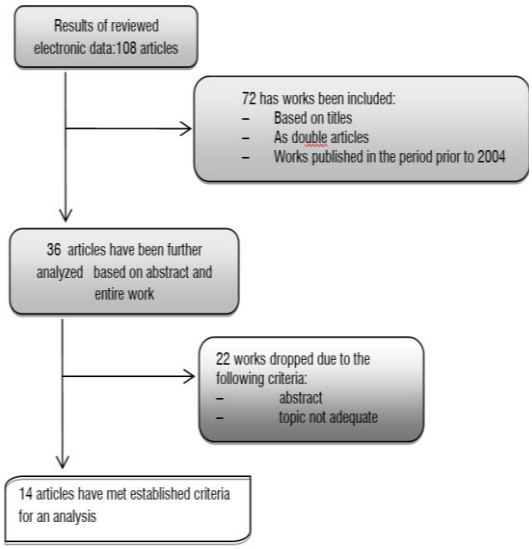
Inclusion criteria

Figure 1. The process of gathering, analyzing and eliminating data gathered has been shown

Data Extraction

Table 1 provides a preview of close analysis 14 studies which have met the foreseen criteria. In accordance with systematic surveys conventions, the table shows the following parameters: author, population, data on participant' sample (number of participants, gender and age group), treatment and results.

Figure 1 The process of gathering, analyzing and eliminating data gathered has been shown



Results

The process of gathering, analyzing and eliminating data gathered has been shown in image 1. According to keywords, 108 articles have been identified, 72 articles have been dropped due to a title, duplicate and articles published prior to 2004. Thirty-six articles have been analyzed based on abstracts and the entire articles, out of which 22 have been dropped due to abstracts which have not been in accordance to the topic, as well as lack of data on an anthropological profile of goalball players. Only 14 articles have met the set criteria and they have been taken for an in-depth analysis. As a consequence of insufficiently studied field of sport in the blind and sight-impaired athletes, fewer articles have been taken for an in-depth analysis. The articles analyzed have been presented according to criteria of a reference (the first letter of an author and a year of publishing), population (a degree of sight-impairment), a sample of an examinee (age, total number of examinees), a treatment, tests and results obtained.

In the study of Gawlik, Zwierzchowska and Rosołek (2015), it has been established that 40,6 % of goalball players have had excessive weight and 9,3% have suffered from obesity. In comparison to a general population, a percentage of the excessive weight of obese persons suffering from an impaired sight has been lower if compared to a general population of men in Poland.

The study carried out by Gawlik, Zwierzchowska and Rosołek (2015) Molik, Morgulec-Adamowicz, Kosmol, Perkowski, Bednarczuk, Skowroński and Szyman (2015) has established that performance of goalball playersin indicators of the game hasn't depended much on an anthropological profile.

The studies carried out by Molik, Morgulec-Adamowicz, Kosmol, Perkowski, Bednarczuk, Skowroński and Szyman (2015) have suggested that performance of goalball players per indicators of the game haven't depended much on the anthropological profile.

Santos and Bastos (2007) have established that an excessive intake of fats and protein has afflicted a body composition of goalball players.

The studies carried out by Romanov, Medović, Stupar, Jezdimirović and Garunović (2017) have shown that a body height has had played great importance for defining an morphological profile of goalball players.

The study carried out by Utvić, Arsenijević and Lilić (2018) has had an objective to examine the relationship of anthropological features and elected motoric abilities with the speed of the shot. The results have shown thatgoalball players having a bigger body mass, fat and those ones who have been more obese have had a better speed of the shot.

The results of the study carried out by Onder, Pamela, Cengiz and Halil (2017) have shown that body weight hasn't had a significant impact on the muscle strength in the early adolescence od goalball players.

The study carried out by Đorđević, Mitrović, Zrnzević, Kudlaček and Jorgić (2018) have suggested of the existence of body spinal deformities in the sagittal and frontal plane, as well as a higher level of fats in a row of variables describing the composition of body at goalball players.

Goulart-Siqueira, Benítez-Flores, Ferreira, Zagatto, Foster and Boullosa (2019) have established that a high percentage of a body mass has had a negative impact on anaerobic abilities.

Based on the study carried out by Calıskan, Pehlivan, Erzeybek, Kayapınar, Agopyan, Yukseland Dane (2011), an application of goalball in the blind and sight-impaired children has been established to have been able to decrease the incidence of obesity and atherosclerotic diseases.

The objective of the Stamenković, Živković and Aleksandrović's study (2017) has been to establish whether transversal dimensionality of the skeleton has had an impact on the speed of the shot. The results have shown a positive impact of transversal dimensionality on the speed of the shot. In their study, Utvić, Vranesić-Hadžimehmedović, Kozomara & Aleksandrović (2018) have found a relationship between body composition and flexibility on the speed of the shot.

Table1 Summary of characteristics of all studies which meet inclusion criteria

References	Population	Age	Treatment	Tests	Results
Santos et al. (2007)	The blind and VI athletes (B2 and B3)	(n=35 m) 17-66 years old	Measurement of body composition, subcutaneous fatty tissue, nourishment processing, plus version 7.0	ST; GT; BM	Results have shown that examined goalball players have had greater body weight and greater fatty tissue percentage.
Calıskan et al. (2011)	The blind and VI athletes (B2 and B3)	(n=12 m) 10-15 years old	Measurement of anthropological characteristics	TH; BM; PMT;CL; GT	Results have shown that application of goalball players has positively impacted the decrease in body fats in both genders.
Scherer et al. (2012)	The blind and VI athletes (B1,B2 and B3)	(n=46 m) 34 ± 12.85 years old	Measurement of anthropological characteristics	BM; THHW; KW; SW	Goalball players have been taller than other athletes and have had a better mesomorphic profile, as ACESA athletes have had a greater body fat.
Gawlik et al. (2015)	The blind and VI athletes (B1 and B2)	(n=32 m) 20-45 years old	Body height, body composition, blood sample	TH;BM;CB; TA;TC; LDL; HDL; TG	Overweight has been found at 40,6% of athletes, whereby obesity is at a level from 9,3 %.
Molik et al. (2015)	The blind and VI athletes (B1,B2 and B3)	(n=44m) 20-60 years old	Measurement of anthropological characteristics, a Personal Questionnaire Form, camera	TH;BM;	Performances of goalball players expressed in game indicators have not been directly hit by anthropometric variables.
Đorđević et al. (2017)	The blind and VI athletes (B1 and B2)	(n=38 m) 15-45 years old	Body composition, Assessment of postural spinal pillar	TA; SM	There has been a correlation between scoliotic curve in thorax part of the spinal pillar with weight, index of body mass, a percentage of body fat and a quantity of body fat.

Romanov et al. (2017)	The blind and VI athletes (B1 and B2)	(n=22 m) 24-54 years old	Morphologic characteristics	TV;TM;PBF; PMM;CA;HW SECA;TA; CT	It has been concluded that a body height is crucial for defining of a morphologic profile of goalball players.
Stamenković et al. (2017)	The blind and VI athletes (B1 and B2)	(n=13 m) 18-38 years old	Measurement of anthropological characteristics, the speed of the shot	TH; BM; CFA; CUL;CLL;CA; SV;HV; KW; SW;CFA; CLL; CA	Transversal dimensionality of skeleton statistically importantly impacts the speed of shot in the goalball.
Onder et al. (2017)	The blind and VI athletes (B3)	(n=13 m) 13.54 ± 1.27 years old	Assessment of body composition, assessment of muscle strength	HD; Belly exercises in 30 sec; Push-ups in 30 sec;	Body weight doesn't impact significantly muscle strength in early adolescence age of goalball players.
Aslan et al. (2018)	The blind and VI athletes (B1,B2 and B3)	n=38 m	Body composition, body height	TA	Body composition doesn't have an impact on the tournament success in the goalball.
Alves et al. (2018)	The blind and VI athletes (B1,B2 and B3)	(n=20 m) 13-19 years old (n=20f) 13-19 years old	Assessment of participants; fat measurement, flexibility, running or walking	BPFT;CL; DBB;TE; PU	There is a difference between genders in passing tests of one km running or walking
Utvić et al. (2018)	The blind and VI athletes (B1 and B2)	(n=9 m) 16-38 years old	Anthropometric characteristics, motor abilities, the speed of the shot	TH;BH; PBF; PMM, BMI; BAZ;VISC; SMJ;FBT;ST; PA; PT;SE; TMBPC;SV	Goalball players have a greater body mass, fats and obesity have a greater shot strength.
Utvić et al. (2018)	The blind and VI athletes (B1 and B2)	(n=21 m) 24- 39 years old	Body composition, flexibility, The speed of the shot	TH;BH; PBF;PMM; BMI;BAZ; VISC;DBB;TE; SRT;SV	There is a correlation between t. composition and speed flexibility of the shot in the goalball.
Goulart-Siqueira et al. (2019)	The blind and VI athletes (B1,B2 and B3)	(n=7 m) 25-32 years old (n=4 f) 25-30 years old	Body composition, maximum isometric power vertical jump, ball speed, test yo-yo.	HD; SR; Yo–Yo IE1	An increase of physical fitness is negatively influencing anaerobic abilities.

n – a number of examinees; m –male; f –female; m/y – younger male; m/f – younger female; *AC* anthropometric characteristics, *TH* body height, *BM* body mass, *SMM* skeletal muscles mass, *FF* fat free mass, *BMI* body mass index, *BAZ* basal metabolism, *VI* visual impairment, *VF* visceral fat, *SV* the shot velocity, *CA* circumferences abdomen, *CB* circumferences body, *CMJ* vertical jump, *CL* caliper, *CLL* circumferences lower leg, *CUL* circumferences upper leg, *CT* centimeter tape, *CFA* circumferences fore arm, *VO2*max: estimated maximum oxygen consumption, *DBB* deep bend on the bench, *KW* knee width, *MHGF* maximal handgrip isometric force, *PT* plate tapping, *SBJ* standing broad, *SE* stick exercises, *SECA* stadiometer, *SR* sport radar, *SRT* seat and reach test, *SM* spinal mouse, *TE* trunk extension, *SU* sit up, *TG* triglycerides, *TMBPC* tossing a medical ball from the position of chest, *HDL* high-density lipoprotein, *HDL:LDL* cholesterol ratio, *HD* Handle Dynamometer, *FBT* flamingo balance test, *HW* hip width, *SW* shoulder width, *Yo–Yo IE1* Yo–Yo intermittent endurance test level 1, *TA* tanita TBF 300

Discussion

Studies conducted in Poland on 32 goalball players aged from 20-45 years have had an objective of assessing lipids profile and a nutritive status of male goalball players. Assessment of a lipid profile has been conducted by standards of Heart Association Assessment (2010). Besides a lipid profile, measurements of height, weight and body range, as well as an assessment of inner fats have been conducted. Body composition assessment scale has been used for assessing inner fats (Tanita Viscan AB-140). Final results have shown that 40,6% of goalball players have had an o overweight and 9,3% obesity, which still doesn't pose a grave problem given that studies conducted by Utvić, Arsenijević and Lilić (2018) have shown that goalball players who have had a greater body mass, fat and those ones who have been more obese have had a better speed of the shot. It has been increasingly likely that a fatty tissue and obesity haven't been crucial for the

speed of the shot in the goalball, it is the most likely that learning of techniques and experience have had a greater impact on the speed of the ball. In the second investigation (Utvić et al., 2018) a link between body composition and flexibility on the speed of the shot has been noted.

These results have to be accepted with limitation and precaution due to a lesser number of examinees. Body weight doesn't substantially impact muscle strength in early adolescence of goalball players who suffer sight impairment. However, body composition and BMI have been a determinant for some strength measurements, there by restricting a movement due to gravitation when fatty tissue indexes and body mass index have grown (Onder, et al., 2017).

At the Paralympics in London, 2012 studies have been conducted (Molik, et al., 2015) with an objective to assess whether game performances have been linked to the anthropologic profile of goalball players. Results have shown that the performance of goalball players expressed in indicators of the game doesn't depend on anthropologic profile much.

An analysis of an anthropological profile has been conducted by (Scherer, et al., 2012), with an objective of the study to establish and compare a profile of goalball players from. The association of adapted sport (ACESA) with goalball players of the Brazilian national team. It has shown that the Brazilian national goalball players team have been taller than others and that they have had a better ecto-mesomophormic profile, while ACESA goalball players have had bigger body fat and a more balanced mesomorphic profile. In this study (Calıskan, et al., 2011) it has been stressed that a three-month goalball program implementation has had a positive impact on the decrease of a bodily mass in 10-15 years old boys and girls. Goalball implementation program has foreseen three pieces of training a week, it is to say, 36 working days and 54 hours.

It means that by application of goalball in the blind and sight-impaired children an incidence of obesity and atherosclerotic diseases can be prevented. The study conducted in Brazil has shown that goalball players have had a bigger bodily weight and a big fat percentage which has been a consequence of inappropriate nourishment. Their food intake has been a deficient one when it goes about coal hydrates, while fats and proteins intake has been above daily needs. Imbalanced food intake does negatively impact on a body composition of goalball players (Santos, et al., 2010).

A high level of body fat can be detrimental for anaerobic abilities of goalball players, proved by study of (Goulart-Siqueira, et al., 2019) examining abilities of top goalball players in various physical tests. Physical fitness has been linked to a vertical jump and a distance covered with a yo-yo intermittent test of recovery 1.

Based on the analyzed results obtained, and through a study of a connection between certain morphological parameters to indicate at a status of body mass of goalball players and results of competition obtained among goalball teams, it has been concluded that a body height is crucial for defining a morphological profile in goalball players (Romanov, et al., 2017).

In addition to body height, indicators showing a nutritive status during defining of a morphological profile in goalball players can be taken into account (a percentage of body fat, a percentage of muscle tissue and an index of body mass). In a study conducted by (Stamenković, et al., 2017) a transversal dimensionality has significantly influenced the speed of the shot. The studies have had limitation issue due to a lesser number of examinees, but it has been a favourable starting point for future studies on this topic. Given the analyzed results, it can be noted that, as of relation to the position of the team, the index value of body mass has had a greater impact than the distribution of a value of fatty tissue. Đorđević, Mitrović, Zrnzević, Kudlaček and Jorgić (2018) have studied the connection between parameters of body composition and a postural status of goalball players. An instrument called „Spinal Mouse" has been used for assessment of body composition. The results obtained have suggested a high level of body spinal deformity in the sagittal and frontal plane, as well as an existence of slightly higher fat levels in a row of variables describing a body composition of goalball players. Moreover, a correlation between an inadequate posture (scoliosis) in the chest part and variables which assess body fat has been noted, and authors ascribe a specificity of the sport or a technique of the shot towards a goal being the reason for it. The goalball is a game of importance for the blind, sight-impaired children and adolescents because it influences a level of a physical activity, which eventually results in an improved level of general health condition (Alves, et al., 2018). The evidence of body composition of goalball players not having an impact on the success of a particular tournament competition has been proven in this study (Aslan, et al., 2018). This study has concluded that no relation between the success at a particular tournament and a body composition of goalball players does take place.

Conclusion

Based on analyzed articles which have investigated the anthropologic profile of goalball players it can be concluded that a majority of goalball players have had problems with body mass, it is to say, with an excess of fatty tissue which is a consequence of improper nourishment. It can subsequently negatively lead to anaerobic and motored abilities. With balanced nourishment, goalball playing can have a positive and a long-term period impact on the decrease of fatty tissue. Determining anthropological profiles has continued to be revised and adapted to sporting growth and development dynamics. It can be said that a body height is crucial because it contributes to a greater arms span which entails a greater space coverage, as well as the percentage of a muscle tissue which is in relation to muscle strength. As of success in goalball, body composition has been established not to have had an impact on achieving good results at a tournament competition level. It has been very likely that a technique and some motoric abilities have had a greater impact on the success in the goalball. Having into account that there hasn't been much investigation from goalball to have been dealing with an anthropological profile of goalball players, this is one of the rare studies in which systematic review of the topic has been conducted, and therefore, it provides necessary data which can be useful to future researchers.

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