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Audiometry and doping control in competitive deaf sport

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ABSTRACT

In the past forty years both the participating countries and the participants at the Summer Deaflympics Games have increased by 2.5-fold. Furthermore, there are approximately fifty European or World sports events organized for the hearing impaired. The aim of the paper was to discuss the procedures and requirements related to doping control in deaf people's competitive sport in the context of the rising number of sports events and the participating athletes.

For the sake of the fair play spirit of the dynamically developing deaf sports, The International Committee of Sports for the Deaf (ICSD) introduced rules governing the participation of hard-of-hearing athletes in sports events. Healthy individuals with a hearing loss of at least 55 dB are allowed. Thus, audiometric examination constitutes the first doping control criterion. Since 2004, ICSD has been cooperating with the World Anti-Doping Agency. The second criterion is, therefore, blood and urine sample control for prohibited substances. The 23rd Summer Deaflympics in 2017 involved 2858 athletes. Overall, 842 (29.5%) participants were randomly subjected to an audiological test; 9 competitors from different countries were disqualified because of non-compliance with the ICSD standards. A total of 300 randomly selected athletes underwent doping control for prohibited substances; 1 was disqualified. The world literature lacks scientific reports on deaf sports, including doping control.

Kulcsszavak
siketek sportolása, audiometria, dopping ellenőrzés, Siketlimpia

Az elmúlt negyven évben 2,5 -szeresére nőtt a nyári Siketolimpiai játékok résztvevőinek és a résztvevő országoknak a száma. Ezzel párhuzamosan körülbelül ötven európai vagy világméretű sporteseményt szerveznek a hallássérültek számára. A cikk célja az, hogy bemutassa a siketek versenysportjában a dopping ellenőrzéssel kapcsolatos eljárásokat és követelményeket, a növekvő számú sportesemény és a résztvevő sportolók összefüggésében.

A dinamikusan fejlődő siket sportok *fair play* szellemisége érdekében a Siketek Nemzetközi Sportszövetsége (International Committee of Sports for the Deaf, ICSD) szabályokat vezetett be, amelyek meghatározzák a nagyothalló sportolók sporteseményeken való részvételét. A legalább 55 dB -es halláskárosodással rendelkező személyek a megengedettek. Ennek megfelelően az audiometriai vizsgálat képezi az első doppingellenőrzési kritériumot. 2004 óta az ICSD együttműködik a Nemzetközi Doppingellenes Ügynökséggel. A második feltétel tehát a tiltott anyagok vér- és vizeletminta-ellenőrzése. A 2017. évi 23. nyári Siketolimpián 2858 sportoló vett részt. Összességében 842 (29,5%) résztvevőt véletlenszerűen vetettek alá audiológiai tesztnek; 9 különböző országból érkező versenyzőt kizártak az ICSD szabványok be nem tartása miatt. Összesen 300 véletlenszerűen kiválasztott sportoló vett részt doppingellenőrzésen tiltott szerek miatt; egyet zártak ki. A szakirodalomból jelenleg hiányoznak a siket sportokkal, köztük a vonatkozó doppingellenőrzésekkel kapcsolatos tudományos elemzések.

Introduction

In accordance with the 2016 data, the World Federation of the Deaf suggests, based on data from national federations (unions) of the deaf, that there are about 70 million deaf and hard-of-hearing people from 133 countries around the world. Statistics estimate that, *e.g.,* approximately 850,000 people aged 15–70 years live in Poland with hearing loss, of whom about 100,000 speak Polish sign language (Ombudsman 2014). Globalization results in sports competitions reaching the farthest corners of the world. Considering the number of people with hearing impairment, it seems natural that deaf people will become more and more interested in amateur and professional sport. It is important to note that there is no category for deaf athletes to compete in the Paralympic Games, another separate disability is required for participation.

The central organization for deaf athletes is the International Committee of Sports for the Deaf (ICSD), the main operator of world sports events for deaf people. At present, the number of national federations participating in ICSD has reached 113. In Europe, European Deaf Championship events are organized by the European Deaf Sport Organization (EDSO), which has been in existence since 1983. EDSO currently associates 40 European countries with 50,000 athletes and about 1000 sports clubs and runs championships in 29 sports disciplines in different age categories.

Each year, ICSD and EDSO arrange *ca*. 40–50 European and world level Championship sports events and, additionally, a dozen or so international events such as club champions' league or veterans' championship. Summer and Winter Deaflympics Games are held every 4 years. ICSD data report a constant increase in the number of countries, athletes (including women), and sports disciplines and competitions during subsequent Summer Deaflympics (Table 1).

Table 1.: Development of selected aspects of participation in Deaflympics

Host of Deaflympics	Number of countries	Number of athletes	Number of women	Number of gold medals awarded*
Romania (1977)	32	1150	237	106
Bulgaria (1993)	52	1679	384	126
Italy (2001)	67	2208	646	143
Turkey (2017)	86	2873	960	200

* The number of sports competitions concerns *e.g.* running over different distances, swimming in different styles and distances, wrestling in different weight categories, *etc*., separately for women and men.

For comparison, the 15th Summer Paralympics, held in 2016 in Rio de Janeiro, involved 4328 Paralympic athletes (2657 men and 1671 women) from 159 countries (Paralympic Games RIO 2016) The competitions follow the International Paralympic Committee guidelines (International Paralympic Committee, Accessibility Guide 2015, International Paralympic Committee Explanatory Guide 2015). There were 528 gold medals awarded in 22 sports disciplines. As compared with the Deaflympics and Paralympics, the 31st Summer Olympics, held in 2016 in Rio de Janeiro, involved 11,238 athletes from 207 countries. There were 306 final competitions in 28 sports disciplines (International Paralympic Committee 2016).

The increasing level of sports and the growing subsidies for deaf people's sports are turning the sport of deaf people into competitive sport, where it is necessary to employ professional referee services and professional measuring devices. The rising competition in the national and international arena forces organizers of deaf sports events to take action to ensure the spirit of fair play and honesty in sports rivalry among the participants. Medical control, doping control, and hearing impairment testing play a special role in this process.

Material & methods

The authors reviewed the source materials on the internet on audiometry and doping control during sports events of the deaf. No scientific articles covering the aspect of audiometry and anti-doping control in this area were found. The authors reviewed websites of World Anti-Doping Agency (WADA) and The International Committee of Sports for the Deaf and other (e. g.: European Deaf Sports Organization, national deaf sports federations) for keywords "Deaflympics", "deaf anti-doping control", "audiometry control".

Guidelines for the participation of deaf athletes in sporting competitions

Polish Deaf Sport Association (PDSA) requires a certified medical examination to ensure the safety and health of the athlete before they are allowed to compete. PDSA also demands a proof that an athlete is fit and healthy after any injury. In the case of athletes of the Polish deaf national teams, PDSA cooperates with the specialized Center of Sports Medicine in Warsaw (Ordinance of Minister of Health 2016, Ordinance of Minister of Health 2019). At the Center, athletes are subjected to, among others, physical examination, segmental analysis of body composition, and otolaryngological tests. A functional movement screen is performed in the Functional Diagnostics Laboratory. Information on the ability to engage in professional sports is completed by the diagnosis of the Orthopedic Surgery Clinic and ECG examination.

Only deaf or hard-of-hearing athletes with a hearing loss of at least 55 dB in the better ear may participate in the Deaflympic Games and in other international sports competitions for deaf people. The hearing loss classification was presented by Clark (Ordinance of Minister of Health 2019). Moderate hearing loss refers to that of 41–55 dB, and moderately severe hearing loss denotes that of 56–70 dB. The American Speech-Language-Hearing Association distinguished 7 levels of hearing loss (Table 2).

Table 2. Levels of hearing loss

Level of hearing loss	Hearing loss range (dB)
Normal	10–15
Slight	16–25
Mild	26–40
Moderate	41–55
Moderately severe	56–70
Severe	71–90
Profound	91+

The ICSD guidelines on the conditions for deaf athletes' participation in sporting competitions do not cover the timing of the occurrence of the hearing problems or the etiology of internal hearing loss, disease complications, noise, or any other factor (Clark 1981, Anand, Boswell et al. 2012, Irwin 2012, Kuhn, Herman-Ackah et al. 2011).

National sport federations of the deaf worldwide, including PDSA, must carry out their own audiometric surveys among their affiliated athletes. The examination must be performed in accordance with the ICSD guidelines. The official form of the ICSD audiogram includes the personal data of the competitor, the model and type of audiometer, the standard according to which calibration was performed, and measurement tables concerning the results of air conduction and bone conduction tests. The audiogram also involves tables for impedance audiometry: tympanometry and acoustic reflexometry (Parving 1995, Audiogram Regulations 2018, Taylor and Muller 2017).

For deaf athletes, there is no requirement to determine the location of hearing damage but only the level of hearing loss; therefore, subjective audiometry in most often applied, based on air and bone conduction.

As for air conduction, the examination is intended to determine the threshold of audibility of sounds at the standard frequencies of 125–8000 Hz, for each ear separately. The patient reports whether they can hear the sound generated by the device. The air curve plotted on the audiogram indicates the conductive capacity from the outer ear to the inner ear.

Bone conduction is tested with the use of a bone vibrator placed on the mastoid bone. During the bone conduction test, the frequency range of 250–4000 Hz is employed. The bone curve of the audiogram provides information on the capability of the receptive part of the auditory system.

The other, complementary test is objective audiometry, which does not require active cooperation of the examined person. It can supplement the subjective study

when hearing loss malingering is suspected. In such cases, official ICSD procedures involve impedance audiometry in the form of tympanometry and accompanying acoustic reflexometry. Acoustic reflexometry, that is, measurement of the stapedius muscle reflex, is performed for tone frequencies of 0.5, 1, 2, and 4 kHz (Walker, Cleveland et al. 2013, Babb, Hilsinger et al. 2004). In cases of severe and profound hearing loss and otosclerosis, the stapedius muscle reflex is absent. Information on the procedures applied in audiometry can be found, among others, in the *Audiometry Procedures Manual* (Pellett, Cox, MacDonald 1997).

Fair play rules in deaf sports. I. Audiometry

The spirit of deaf sports involves the celebration of the human spirit, body, and mind, and refers to the following values: ethics, fair play and honesty, health, excellence in performance, character, and education, fun and joy, teamwork, dedication and commitment, respect for rules and laws, respect for self and other participants, courage, community, and solidarity. ICSD provides the essence of Olympism for the deaf population with its own motto: *Per ludos aequalitas*, "Equal through sport" (Parving 1995).

In 1970, ICSD introduced the requirement to provide the athletes' audiograms prior to international competitions, indicating the level of bilateral hearing loss (Audiometry Procedures Manual 2003). Each year, national sport federations must deliver the athletes' audiograms to ICSD to admit players to national and international sporting competitions. In 2020, audiograms of 984 Polish hard-of-hearing athletes were accepted by ICSD, and 6 participants were not allowed to compete owing to an insufficient level of hearing loss. Additionally, national sports federations must deliver the audiograms to the ICSD at least 3 months before the sporting event. If the deadline is not met, the national federation must pay a penalty fee of USD 40; the fee equals USD 100 if the audiogram is received within less than a month after the commencement of the competition. In addition, in any case of violations of ICSD audiogram regulations, a USD 1000 fine is levied on the national sports federation based on the ICSD Executive Board decision (Parving 1995).

As a result of hearing loss malingering attempts during international competitions, any athlete may be subjected to an additional audiological examination. The largest audiological audit of all the Games so far was arranged by ICSD during the 23rd Summer Deaflympics. Overall, the audiological commission randomly examined 842 (29.5%) athletes, of whom 9 competitors from different countries were disqualified because of non-compliance with the ICSD standards (Ammons 2008). Those who were found not to have the required hearing loss level in accordance with the ICSD regulations were not admitted to the competition and cannot resend the audiogram for at least 2 years after receiving the disqualification. According to ICSD

regulations, athletes competing in any event associated to ICSD are required to leave their hearing aids in the cloakroom before starting the competition, otherwise, they are disqualified (Parving 1995).

During the 4th World Deaf Futsal Championships (Winterthur, Switzerland, 2019), owing to the emerging presumptions that some competitors did not have the required hearing loss (no audiometric testing during the competition), ICSD representatives and activists from various countries postulated the need to purchase an audiometer that could be used in international events.

Fair play rules in deaf sports. II. Prohibited substances

During the 31st Summer Olympics, held in 2016 in Rio de Janeiro, 3237 athletes from 137 countries were examined; 4882 doping tests were performed, including 4037 based on urine samples and the remaining ones based on blood samples (World Anti-doping Agency 2016). A total of 28.63% of the Summer Olympics competitors were subjected to the control. A novelty was the use of athlete's biological passports to evaluate long-term changes in the athletes' hematological and steroid profiles (SUEK 2012). The tests revealed the presence of prohibited substances in 20 Olympic athletes. Moreover, the World Anti-Doping Agency re-tested samples from the 2008 Beijing Games and the 2012 London Games; 41 samples were marked positive (World Anti-doping Agency 2016). During the 15th Summer Paralympics, 1394 urine samples and 242 blood samples were examined. Also, 45 samples were checked for compliance with the athlete biological passport. The tests revealed the presence of prohibited substances in 12 Paralympic athletes (SUEK 2012).

Since the 1980s, summer sports doping control among hearing athletes has demonstrated the use of prohibited substances in nearly 900 participants at the highest sports level, 260 of which came from Russia, 250 from the USA, and 73 from Ukraine. In years 1984–2017, doping tests revealed prohibited substance intake in 284 Summer Olympic Games competitors (Doping cases at Olympic Games 2020, Doping cases by nationality 2020, Doping cases in athletes 2018).

The use of prohibited substances in the competitive sport of hearing people and Paralympic athletes, as well as the dynamic development of competitive deaf sports have forced the ICSD to counteract these tendencies in deaf people's competitive sport.

In July 2004, ICSD became a signatory of WADA (Audiometry Procedures Manual 2003).

In 2015 and 2016, 119 and 94 doping tests, respectively, were performed. The presence of prohibited substances was detected in 4 (1 in basketball, 1 in cycling, 1 in ice hockey, 1 in athletics) and 1 (in athletics) cases, respectively (Doping cases in athletes 2018, WADA 2015). In 2017, during the 23rd Summer Deaflympics, 15

doping control experts were employed, supported by volunteers from the doping control section. A total of 300 randomly selected athletes were subjected to doping control, including randomly selected winners of 731 Olympic medals. Doping control was also applied in almost all competitors setting new world and Olympic records. Among the 300 athletes selected to doping control, 35% came from the Russian Federation, 20% from Ukraine, 14% from Turkey, 9% from China, and 22% from other countries. Overall, *ca*. 10.5% of the participants of the Deaflympics Games underwent doping control. Out of these, only a Russian female athlete achieved a positive result of the doping test and was disqualified for a period of 2 years (Ammons 2008). According to the WADA report, in 2017 and 2018, a total of 397 samples related to events organized by ICSD and EDSO were analyzed. In 2017, 3 cases of prohibited substance application were detected (2 in athletics, 1 in handball) (WADA 2016). All anti-doping measurements were based on urine samples and followed the WADA guidelines.

Since 2019, ICSD has obliged deaf competitors to provide, before the sports event, information on the use of prohibited substances for therapeutic purposes (Therapeutic Use Exemption, TUE). The declaration is filled in by the competitor and the relevant physician on the basis of TUE, which constitutes a mandatory international standard developed as part of the World Anti-Doping Program.

Conclusion

There is an increasing need for the scientific analysis of the sports habits, infrastructural and financial background of people with disabilities (Kosztin and Balatoni 2015, Varga and Balatoni 2020). In particular, only few researchers decide to engage in research on the hearing impaired (Al-Rahmneh, Dababseh, Eston 2013, Kurkova 2015, Szulc, Busko et al. 2017, Tzanetakos, Papastergiou et al 2017, WADA 2017, Szulc 2019, Szulc 2020, Szulc, Soto-Rey et al. 2021).

The number of hard-of-hearing athletes taking part in competitive deaf sports is dynamically increasing. In the last twenty years, the number of Summer Deaflympics participants has risen by 29% (by 45% among women). In total, several thousand hard-of-hearing athletes take part in international sports events every year. With the increasing popularity of sport and the increasing financial resources assigned to this group of athletes, a growing pressure on sports performance is observed.

It should be noted that the Olympic and Paralympic sport of hearing athletes bears the consequences of the pursuit of records at all costs. As a result, the doping scandals have eliminated many hearing and Paralympic athletes from sports competitions.

In order to avoid similar trends in deaf sport, it is necessary to increase doping control during competitions. It is estimated that annually, less than 10% of all

participants in international competitions are examined, which is probably due to the high costs of anti-doping tests. For this reason, the scale of the phenomenon is not entirely known. Organizers of the biggest sports events for the deaf (ICSD, EDSO) should have their own audiological control equipment for occasional control of the level of players' hearing loss during the competition to ensure equal opportunities and fair play. A method of providing equal chances for athletes may be to raise the lower limit of hearing loss entitling to participate in sporting competitions. With reference to doping tests, one should consider the words of Baron Pierre de Coubertin: 'Look far ahead, speak openly, act with determination' to eliminate problems with no-fair play rules in deaf sport.

Ethical approval and consent to participate

Not required.

Human and animal rights

No animals were used in this study. All humans research procedures performed in the current study were in accordance with the ethical standards of the institutional and/or national research committee and with the 1964 Declaration of Helsinki and its later amendments or comparable ethical standards.

Consent for publication

Not required.

Conflict of interest

There are no conflicts of interest to declare.

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