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Longevity and cardiovascular mortality of Polish elite football players

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WHAT'S NEW?

In this paper we investigate life span characteristic of competitive footballers. We provide a complete and exhaustive analysis of longevity and cause-specific mortality structure of Polish footballers who had died between 1990 and 2015 at the age of least 25 years. Moreover we investigate and compare cause-specific mortality structure, especially in the cardiovascular context, of Polish footballers and Polish men population in time, which to the best of our knowledge, has not been analysed so far.

Abstract

Background: Despite the wide popularity of football, there is a paucity of scientific evidence explaining the relationship between being a competitive footballer and life expectancy

Aim: The study analyses and compares cause-specific mortality between Polish elite footballers (men) and the general male population.

Methods: A retrospective method of analysis is employed to study a sample of 455 elite footballers who died between 1990 and 2015. The cause of death was established based on the official statistics of Polish Central Statistical Office. The comparative sample consists of men in the general male population in Poland who died in the sampled period being at least 25 years of age at the time of death.

Results: The mean age at death turned out to be higher for footballers than controls (70.2 vs 67.4 years). Cardiovascular diseases were a more common cause of death among footballers than in the general male population in both the under 65-group and the above- 65-group (46.9% to 32.3% and 61.3% to 53.3%, respectively). A closer analysis of cause-specific cardiovascular mortality revealed that acute myocardial infarction caused more deaths (OR=1.31; CI 95%: [1.02-1.68]) and hypertensive disease less deaths (OR=0.20; CI 95%: [0.05-0.79]) among athletes than in the general male population.

Conclusions: The study results point to excess cardiovascular mortality among Polish elite footballers. A trend analysis has shown, however, that its level is falling.

Key words: cardiovascular mortality, footballers, all-cause mortality, longevity, sports demography

INTRODUCTION

Regular recreational physical activity is reported by researchers to positively correlate with a lower risk of all-cause and cardiovascular mortality [1-4], but the question whether the correlation also holds true in the case of competitive athletes is still a challenge. The public sometimes doubts about whether „sport is good for health”, having learnt about athletes’ premature deaths, especially when sudden. For scientific debates, however, in-depth systemic analysis rather than anecdotal evidence should be a basis for inference [5, 6].

Despite the wide popularity of football, there is a paucity of scientific evidence explaining the relationship between being a competitive footballer and life expectancy. This topic and all-cause mortality rates among footballers have been covered in few publications [8 - 11], which contrasts with the abundance of papers and comparative studies [12] on athletes from other popular disciplines, e.g. Olympic athletes [13], winter sport athletes [14], rugby players [15], cyclists [16], and baseball players [17].

Football is a complex game with non-constant intensity of physical effort during the game or training. Field players should possess high durability whereas goalkeepers need to be characterised by increased flexibility. In terms of cardiovascular load, football is counted among disciplines characterised by high dynamic load (ca. 10 kcal/min) and low static load (IC). This type of physical effort carries a risk of cardiac volume overload and cardiovascular overload, but the likelihood of cardiac pressure overload and cardiovascular overload is low [4, 18]. A German study found that most sudden cardiac deaths of competitive and recreational athletes were associated with football games or running [19].

The research was undertaken to identify and compare the causes of death between footballers (playing in the Polish premium league and/or on Polish national team) and the general male population in Poland.

The study sets out to test the following hypotheses:

- H1: The mean age at death is higher for Polish footballers than for men aged 25 years and older.
- H2: Polish footballers have a lower cardiovascular mortality rate than other men aged 25 years and over.

METHODS

Our study was based on Polish football players (played in national team or more than 50 matches in Polish premium league) who died in 1990-2015. The sample of eligible footballers was compiled from the database at www.wikiliga.pl [20], which holds vital records of the Polish professional football league players. The vital records (date of birth, date of death) were cross-verified with other data sources, including the Polish Football Association, so one can indicate that analysed sample is fully representative for Polish elite footballers community. In the case of 345 (76%) of 455 footballers included in the sample, the cause of death was expressly identified by browsing a database with information about athletes' dates

of birth and dates of death, gender, and the place and cause of death (the lack of data is a result of impossibility of reliable data matching). Specifying cause of death was possible thank to co-operation with Polish Central Statistical Office (GUS) and was mainly established according the data of mentioned institution, but in few cases (about 3%) the data was supplemented by reliable press information.

The comparative general male population was defined based on the 1990-2015 GUS statistics on men who died being at least 25 years of age at the time of death. A single mortality rate for the whole period of analysis (25 years) was constructed as a weighted average using weights proportional to the number of players who died in individual years. To improve the comparability of the study results, men who had died before and after 65 years of age were analysed separately when the specific causes of death were being determined. To make sure that the cause-specific mortality structure was not indirectly affected by the age factor, the footballers' data were standardised with respect to the age-specific mortality structure of controls.

Statistical analysis

Differences between age at death between Polish football players and Polish men population were compared with the use of Student's t-test. The p-value for the test of significance was calculated according to Sheskin [21]. All the statistical calculations were performed using the STATISTICA 12 package. The significance level was set at $p < 0.05$.

RESULTS

Statistical analysis was performed on the longevity and cause-specific mortality structure of Polish footballers who had died between 1990 and 2015 at the age of least 25 years (N=455). The mean age-at-death was estimated at 70.2 years for ex-footballers and 67.4 years for the general male population (the ages were obtained with the weighted average; they are not equivalent with expected life expectancy and average further life expectancy, which are calculated in a different way), which means that footballers outlived the general male population (i.e. Polish men who died being at least 25 years old in the years 1990-2015) by three years on average ($p < 0.001$). Around two-thirds of retired players and 60% of the general male population who attained the calendar age of 25 lived to the age of 65; of those, one-third

of athletes (30.3%) and more than one-fifth of controls (22%) reached the age of 80 years. Interestingly, in the age group 30-34 years higher mortality was noted for players than for men generally (2.2% vs. 1.4%, NS; figure 1). The numbers may be indicative of excess premature mortality among ex-footballers, but more research and analysis is necessary to validate the supposition.

Because age is a major factor determining the structure of cause-specific mortality, the results of analysis will be presented for two age sub-groups of persons who died younger than 65 and being at least 65 (a standard approach in epidemiological research). Table 1 provides a comparison of the causes of death between Polish footballers and Polish men in the younger sub-group.

Table 1 shows that excess cardiovascular mortality in Polish footballers is significant, close to 50% according to the standardised data. Excess mortality from cardiovascular diseases also occurs in the subgroup 65+, but it is relatively lower than in the younger subgroup (by ca. 15%, table 2).

In the next step, cardiovascular mortality was investigated more in detail to determine its specific causes. According to the data in table 3, footballers had excess mortality from acute myocardial infarction (I21-I22; OR=1.31; CI 95%: [1.02-1.68]; $p<0.05$) and other ischaemic heart diseases (I20, I23-I25), although the second differences was not statistically significant (OR=1.07; CI 95%: [0.78-1.48]; $p>0.05$). Mortality from hypertensive disease (I10-I13; OR=0.20; CI 95%: [0.05-0.79]; $p<0.05$) and atherosclerosis (I70; OR=0.76; CI 95%: [0.58-1.00]; $p<0.05$) was less frequent, likewise mortality from cerebrovascular diseases (I60-I69; OR=0.85; CI 95%: [0.63-1.15]; $p>0.05$) and chronic rheumatic heart disease (I05-I09; OR=0.76; CI 95%: [0.19-3.08]; $p>0.05$), but the last two were not statistically significant.

It is worth to add, that if we divide footballers into top (played in national team or more than 50 matches in Polish premium league) and non-top players, one can find out, that cardiovascular mortality is statically significant lower for top players in compare to athletes with not so high football achievements (p -value=0.009). Taking into account playing position one can observed that lower cardiovascular mortality characterised goalkeepers and defenders and the highest – forward players. (see: table 4).

Because the excess cardiovascular mortality of elite footballers [3, 22, 23] was a somewhat unexpected finding, it was subjected to a trend analysis performed for three sub-periods: 1990-1995, 1996-2005 and 2006-2015. As expected, its level was consistently declining (from 63.6% to 58.7% and 43.2%). A particularly deep decline was noted for deaths

from acute myocardial infarction (16.4%, 12.4% and 7.6%). Unfortunately, those were also the years of rising mortality from external causes, especially from suicides (2 per 110 deaths in the years 1990-1995; 0 per 122 in the years 1996-2005; and as many as 5 per 111 between 2006 and 2015). If the cardiovascular mortality trend shown by the data in figure 2 continues, it is very likely that its rate among competitive footballers will soon be comparable or even lower than in the general male population.

DISCUSSION

With more than 3.5 billion fans worldwide, football remains one of the most popular sports. Given these findings and the international popularity of football, it is slightly surprising that only few studies have been undertaken to investigate the longevity and causes of death among professional footballers. Among those few studies, investigations into the causes of death of the Italian league players are noteworthy [8, 24]. The standardised proportional mortality ratios that Stefano Belli and Nicola Vanacore estimated for a sample of ca. 24.000 athletes [24] showed that retired footballers had a lower risk of death from cardiovascular, communicable and respiratory diseases, but showed excess mortality from motor neuron disease, mainly amyotrophic lateral sclerosis (ALS, SPMR=1158). The ratios estimated for footballers and the general population were not different from each other (SPMR=1.0). Similar results, pointing to a lower risk of cardiovascular death (SMR = 0.41) and cancers in retired competitive footballers, were also reported by Emmanuela Taioli [8], who also found ex-athletes to run a higher risk of dying in a traffic accident (SMR=2.23). Unlike Belli and Vanacore, however, Taioli concluded that the total mortality rate (standardized for age) was lower for Italian players (SMR = 0.68) than for the general male population in Italy. Ruud H. Koning and Remko Amelink found the same pattern (lower total mortality among footballers than in the general population) in a sample of 371 professional Dutch footballers active from 1970 to 1973 [10].

In the only study on the longevity of footballers in a Central and Eastern Europe country (Poland) authored by Witold Śmigielski, Janusz Gajda et al. [11], only athletes born after 1920 (the sample included cohorts born between 1905 and 1950; (N=781)) had life expectancy greater than men generally. Different results were obtained by the German researchers who analysed 812 national team footballers active in the period 1908-2006. Kuss et al. concluded that one of the main reasons why professional players had shorter lives than

the general population by an average of almost two years was high mortality in the first half of the observation period due to poorer medical care, loss of life during World War II, and a different distribution of death causes in the 20th century [9].

The authors of a review of articles [12] on mortality among elite athletes of different disciplines concluded that they had a lower risk of dying from cardiovascular disorders. In their opinion, it was one of the main factors explaining why athletes had longer life expectancy than the general population.

Being a competitive athlete (now or in the past) is an important, but not the only, factor influencing an individual's general health, longevity and risk of dying from cardiovascular diseases (or from other causes). Other important determinants include the genetic make-up, family situation, lifestyle (dietary habits, using, or not, tobacco and alcohol), the job one does after retirement, the level of wealth, health awareness and access to medical care [23].

The Finnish authors found retired competitive athletes to pursue healthier lifestyles (they exercised more, consumed less tobacco and alcohol and had better dietary habits (ate more vegetables and fruits and reduced the intake of butter and full-fat milk)). Ex-athletes were also more satisfied with their health than their untrained peers and ran a lower risk of arterial hypertension, diabetes and ischaemic heart disease [22, 25].

Naturally, the results obtained for the elite Finnish athletes are not directly generalizable to people living in other countries, particularly not to Polish and other Central and Eastern Europe populations who have different cultural models and health habits.

Given that sport attracts healthy and physically fit people with the potential to become professional athletes it should not be surprising that athletes' health is primarily determined by their sound genetic makeup. It is also important that athletes have easy access to high-quality medical care and the habit of reporting health problems as they arise. As a result of frequent contacts with health professionals during their careers, also retired athletes have less problem using healthcare services than the general population.

According to what the media and the Polish sports literature suggest, some Polish athletes may consume alcohol hazardously [26, 27]. At the same time, only 13% of them are reported to smoke cigarettes. This rate is 2-3 times lower compared with their non-athlete peers in the corresponding age group (18-34 years) [28, 29].

It can be presumed that at least some athletes face the problem of overweight and obesity after retirement. An Estonian study found that in 60% of ex-athletes competing in master events (inviting contenders older than 35 years) body mass increased in the last 5 years by 3 kg; in every fourth the increase was significant (above 10 kg) [30]. It is likely that in former professional athletes who refrain from physical exercise body mass increases may be even bigger than that, thus making them more prone to diabetes and cardiovascular diseases.

It is also noteworthy that former footballers are more willing take part in physical activity for leisure than men generally. Many of them continue to compete at masters events, e.g. football masters games [21]. While the retired athletes' urge to revive their careers by competing in master events is commendable, it should not be forgotten that sport requires adequate training, medical tests and the self-awareness of the limits of one's physiological capabilities. That the prerequisites are sometimes ignored is evidenced by news in the Polish and international press about sudden deaths of athletes during master events. It is also worrying that many former athletes have not been adequately trained in self-health care and do not know how to manage a sudden chest pain.

An important component of general health is mental wellbeing. Retiring from competitive sport and having to redefine one's professional identity are strong stressors that in some athletes with adaptability problems may induce chronic stress, depression or other mental disorders. International reports show an alarmingly high rate of suicides among former athletes [8, 31, 32]. This study, too, has shown a rising trend in suicides among Polish footballers. Although the sample is too small to allow more general conclusions to be drawn, the problem certainly deserves a careful examination

In the authors' opinion, cardiovascular mortality rate has been declining among Polish footballers because of their increasing awareness of the demands of professional sport, which makes them more willing to comply with the aforementioned healthy lifestyle recommendations. The opinion is based on improving longevity statistics (compared with the general population) and diminishing total mortality rates among the players of the Polish national team who were born in the first half of the 20th c. [11].

Limitations and strengths of study

Main strengths of presented here material comprise of first in Poland and one of the few worldwide analysis of fully representative sample for country elite footballers community with confirmation of the quality of the data from Central Statistical Office.

However did not have access to information of lifestyle factors (such as smoking, alcohol consumption, weight gain, and eating habits) or social status (socioeconomic status, other than soccer occupational activity, marital status, and level of education). Hence, the potential impact of these factors on cardiovascular mortality and longevity should be a matter of further studies.

Conclusions

The study showed a higher frequency of deaths from cardiovascular diseases among Polish top-league footballers than in men generally. Because of similar vascular mortality rates between the last cohort of athletes (2006-2015) and the general male population it can be presumed that the difference is gradually disappearing. A closer analysis of the causes of cardiovascular mortality revealed that compared with controls footballers died more frequently from ischaemic heart disease (especially acute myocardial infarction) and less frequently from hypertensive diseases. That the mean age at death was higher for footballers than for controls is also noteworthy. It is likely that in coming years the advancing professionalization of Polish sport will further reduce cardiovascular mortality among athletes, as it happened in other developed countries.

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Conflict of interest: none declared.

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Table 1. Cause-specific mortality of Polish footballers and Polish men who died younger than 65, 1990-2015.

Cause of death	Population (Men, 25-64)	Footballers		OR	p-value
		Raw	Standardized		
Cardiovascular disease	32.3%	41.7%	46.9%	1.86 CI 95%: [1.50-2.29]	< 0.0001
Cancer	24.8%	20.0%	18.0%	0.66 CI 95%: [0.50-0.87]	0.0036
Other diseases	26.1%	21.7%	22.7%	0.83 CI 95%: [0.64-1.1]	0.1412
External cause of death	16.8%	16.5%	12.5%	0.71 CI 95%: [0.51-0.97]	0.0324

Source: developed by the authors from GUS data

Table 2. Cause-specific mortality of Polish footballers and Polish men who died being at least 65, 1990-2015.

Cause of death	Population (Men, 65+)	Footballers		OR	p-value
		Raw	Standardized		
Cardiovascular disease	53.3%	62.1%	61.3%	1.38 CI 95%: [1.11-1.71]	0.0036
Cancer	23.4%	22.0%	23.3%	0.99 CI 95%: [0.77-1.27]	0.9262
Other diseases	20.4%	15.0%	14.5%	0.66 CI 95%: [0.49-0.89]	0.0070
External cause of death	2.8%	0.9%	0.8%	0.30 CI 95%: [0.10-0.95]	0.0405

Source: developed by the authors from GUS data

Table 3. Cause-specific cardiovascular mortality of Polish footballers and Polish men, 1990-2015.

Disease	ICD-10	Male	Footballers	OR	p-value
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		population	Raw	Standardized	(95% CI)	
Chronic rheumatic heart disease	I05-I09	0.76%	0.5%	0.6%	0.76 CI 95%: [0.19-3.08]	0.7054
Hypertensive disease	I10-I13	2.89%	0.5%	0.6%	0.20 CI 95%: [0.05-0.79]	0.0216
Acute myocardial infarction	I21-I22	18.97%	22.3%	23.4%	1.31 CI 95%: [1.02-1.68]	0.0337
Other ischaemic heart disease	I20, I23-25	11.71%	13.3%	12.5%	1.07 CI 95%: [0.78-1.48]	0.6643
Cerebrovascular diseases	I60-I69	16.93%	14.9%	14.7%	0.85 CI 95%: [0.63-1.15]	0.2889
Atheromatosis	I70	22.76%	20.7%	18.4%	0.76 CI 95%: [0.58-1.00]	0.0474
Other cardiovascular diseases	Other codes I	25.98%	27.7%	29.7%	1.20 CI 95%: [0.95-1.51]	0.1303

Source: developed by the author from GUS data

Table 4. Cause-specific mortality structure by sports achievement and position.

Cause of death	All players	Top players		Position			
		Non-top	Top	Goalkeepers	Defender	Midfielder	Forward
Cardiovascular disease	54.8%	59.7%	43.9%	47.8%	51.6%	53.2%	58.5%
Cancer	21.4%	19.7%	25.2%	28.3%	18.8%	16.9%	23.1%
Other diseases	17.7%	14.3%	25.2%	19.6%	20.3%	20.8%	15.0%
External cause of death	6.1%	6.3%	5,6%	4.3%	9.4%	9.1%	3.4%
Number of players	345	238	107	46	64	77	147

Source: developed by the authors from GUS data

Figure 1. Age-mortality structure of ex-footballers and Polish men generally, years 1990-2015

Source: GUS data (men) and data compiled by the authors (footballers)

Figure 2. Cause-specific mortality structure of Polish footballers and Polish men who died aged 25 years or older, 1990-1995, 1996-2005 and 2006-2015.

Source: developed by the authors from GUS data



