

Longevity and cardiovascular mortality of Polish elite football players

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Abstract

Background: Despite 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 of Polish male elite footballers and the general Polish male population.

Methods: Data regarding of 455 elite footballers who died between 1990 and 2015 were retrospectively analysed. The cause of death was established based on the official data from the Polish Central Statistical Office. The control group consisted of men from the general male population in Poland who died in the sampled period at the age of 25 years or more.

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, both in the subgroup of subjects who died under the age of 65 years and in those who were at least 65 years old at the time of death (46.9% vs. 32.3% and 61.3% vs. 53.3%, respectively). A detailed analysis of cause-specific cardiovascular mortality revealed that acute myocardial infarction caused more deaths (odds ratio [OR] 1.31; 95% confidence interval [CI] 1.02–1.68) and hypertensive disease caused less deaths (OR 0.20; 95% CI 0.05–0.79) among athletes than in the general male population. A trend analysis has shown that the level of cardiovascular mortality among footballers is falling.

Conclusions: The study results indicate excess cardiovascular mortality among Polish elite footballers.

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

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INTRODUCTION

Regular recreational physical activity is reported by researchers to positively correlate with a lower risk of all-cause and cardiovascular (CV) mortality [1–4], but the question of whether this 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 instances of premature deaths among athletes, especially when sudden. For scientific debates, however, in-depth systemic analysis rather than anecdotal evidence should be a basis for inference [5, 6].

Despite wide popularity of football, there is a paucity of scientific evidence explaining the relationship between being

a competitive footballer and life expectancy. This topic as well as all-cause mortality rates among footballers have been covered in few publications [7–10], which contrasts with the abundance of papers and comparative studies [11] on athletes from other popular disciplines, e.g. Olympic athletes [12], winter-sport athletes [13], rugby players [14], cyclists [15], and baseball players [16].

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 show increased flexibility. In terms of CV load, football is counted among disciplines characterised by high dynamic

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load (ca. 10 kcal/min) and low static load. This type of physical effort carries a risk of cardiac volume overload and CV overload, but the likelihood of cardiac pressure overload and CV overload is low [4, 17]. A German study found that most cases of sudden cardiac death in competitive and recreational athletes were associated with playing football or running [18].

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

The study sets out to test the following hypotheses: (1) The mean age at death is higher in Polish footballers than in other men aged 25 years and older; (2) Polish footballers have a lower CV mortality rate than other men aged 25 years and over.

METHODS

Our study included Polish football players (who played in the national team or played more than 50 matches in the Polish premium league) who died between 1990 and 2015. The sample of eligible footballers was compiled from the database available at www.wikiliga.pl [19], which holds vital records of 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 (*Polski Związek Piłki Nożnej* [PZPN]), so the analysed sample can be considered as fully representative for the Polish elite footballer community. In 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 death, sex, and the place and cause of death (the lack of data was due to the impossibility of reliable data matching). In most cases, the cause of death was established based on the data obtained from the Polish Central Statistical Office (*Główny Urząd Statystyczny* [GUS]), but in a few cases (about 3%) the data were supplied by reliable press information.

The general male population used as a control group was selected based on statistical data from GUS on men who died between the years 1990 and 2015 at the age of at least 25 years. A single mortality rate for the whole period of analysis (25 years) was obtained as weighted average using weights that were proportional to the number of players who died in individual years. To improve the comparability of the study results, specific causes of death were analysed separately for subjects who died before reaching the age of 65 years, and for those who were at least 65 years old at the time of death. To make sure that the cause-specific mortality structure was not indirectly affected by the age factor, the data of the footballers were standardised with respect to the age-specific mortality structure of controls.

Statistical analysis

Differences between age at death in Polish football players and the Polish male population were compared with the use

of Student t-test. The p-value for the test of significance was calculated according to Sheskin [20]. All statistical calculations were performed using the Statistica 12 package (Statsoft Inc., Tulsa, OK, USA). The significance level was set at $p < 0.05$.

RESULTS

Statistical analysis was performed on the longevity and the structure of cause-specific mortality of Polish footballers who died between the years 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 age was obtained as weighted average; it is not equivalent to expected life expectancy or 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 at the age of at least 25 years 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 reached the calendar age of 25 years lived to the age of 65 years; 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 group of subjects who died at the age of 30 to 34 years, higher mortality was noted for players than for men in general (2.2% vs. 1.4%, $p = \text{NS}$; Fig. 1). These numbers may be indicative of excess premature mortality among ex-footballers, but more research and in-depth analysis are necessary to validate the supposition.

Because age is a major factor determining the structure of cause-specific mortality, the results of the analysis are presented separately for two age subgroups of persons: those who died at the age of less than 65 years old (Table 1) and those who were at least 65 years old at the time of death (Table 2) (a standard approach in epidemiological studies).

In the younger subgroup, excess CV mortality in Polish footballers was significant, and reached close to 50% according to the standardised data (Table 1). Excess mortality from CV diseases among footballers also occurred in the 65+ subgroup, but the difference between the athletes and other men was smaller than in the younger subgroup (by ca. 15%, Table 2).

As a next step, CV mortality was investigated in more detail to determine its specific causes (Table 3). Footballers had excess mortality from acute myocardial infarction (I21-I22; odds ratio [OR] 1.31; 95% confidence interval [CI] 1.02–1.68; $p < 0.05$) and other ischaemic heart diseases (I20, I23-I25), although for the latter the difference was not significant (OR 1.07; 95% CI 0.78–1.48; $p > 0.05$). Mortality from hypertensive disease (I10-I13; OR 0.20; 95% CI 0.05–0.79; $p < 0.05$) and atherosclerosis (I70; OR 0.76; 95% CI 0.58–1.00; $p < 0.05$) was less frequent, as was mortality from cerebrovascular diseases (I60-I69; OR 0.85; 95% CI 0.63–1.15; $p > 0.05$) and chronic rheumatic heart disease (I05-I09; OR 0.76; 95% CI 0.19–3.08; $p > 0.05$), but for the last two the differences were not significant.

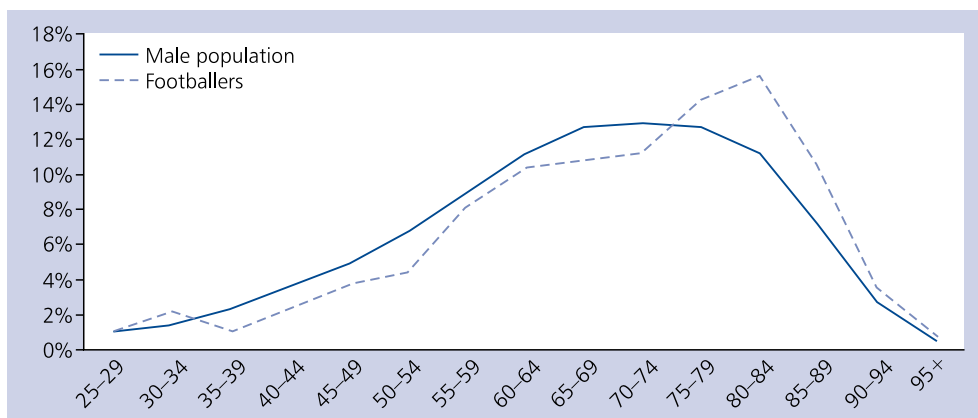


Figure 1. Age-mortality structure of ex-footballers and Polish men in general in the years 1990–2015. Source: data from the Polish Central Statistical Office (men) and data compiled by the authors (footballers)

Table 1. Cause-specific mortality of Polish footballers and Polish men who died at the age of 25 to 65 years, between 1990 and 2015. Source: developed by the authors on the basis of Polish Central Statistical Office data

Cause of death	General population (Men, 25–64 years)	Footballers		OR (95% CI)	p
		Raw	Standardised		
CVD	32.3%	41.7%	46.9%	1.86 (1.50–2.29)	< 0.0001
Cancer	24.8%	20.0%	18.0%	0.66 (0.50–0.87)	0.0036
Other diseases	26.1%	21.7%	22.7%	0.83 (0.64–1.1)	0.1412
External cause of death	16.8%	16.5%	12.5%	0.71 (0.51–0.97)	0.0324

CI — confidence interval; CVD — cardiovascular disease; OR — odds ratio

Table 2. Cause-specific mortality of Polish footballers and Polish men who died at the age of at least 65 years, between 1990 and 2015. Source: developed by the authors on the basis of Polish Central Statistical Office data

Cause of death	General population (Men, ≥ 65 years)	Footballers		OR (95% CI)	p
		Raw	Standardised		
CVD	53.3%	62.1%	61.3%	1.38 (1.11–1.71)	0.0036
Cancer	23.4%	22.0%	23.3%	0.99 (0.77–1.27)	0.9262
Other diseases	20.4%	15.0%	14.5%	0.66 (0.49–0.89)	0.0070
External cause of death	2.8%	0.9%	0.8%	0.30 (0.10–0.95)	0.0405

Abbreviations — see Table 1

Of note, when footballers were divided into top (those who played in the national team or played more than 50 matches in the Polish premium league) and non-top players, CV mortality was significantly lower for top players in comparison to athletes with lower football achievements ($p = 0.009$). Taking into account the playing position, it can be observed that lower CV mortality was found in goalkeepers and defenders, and the highest was seen in forward players (Table 4).

Because excess CV mortality of elite footballers [3, 21, 22] was a somewhat unexpected finding, it was subjected to

a trend analysis performed for three subperiods: 1990–1995, 1996–2005, and 2006–2015. As expected, the level of CV mortality was consistently declining (from 63.6% to 58.7% and 43.2%, respectively). A particularly deep decline was noted for deaths from acute myocardial infarction (16.4%, 12.4%, and 7.6%, respectively). Unfortunately, these periods were also characterised by rising mortality from external causes, especially from suicide (two per 110 deaths in the years 1990–1995; 0 per 122 in the years 1996–2005; and as many as five per 111 in the years 2006–2015). If the trend depicted in Figure 2 continues, it is very likely that CV mortality rate

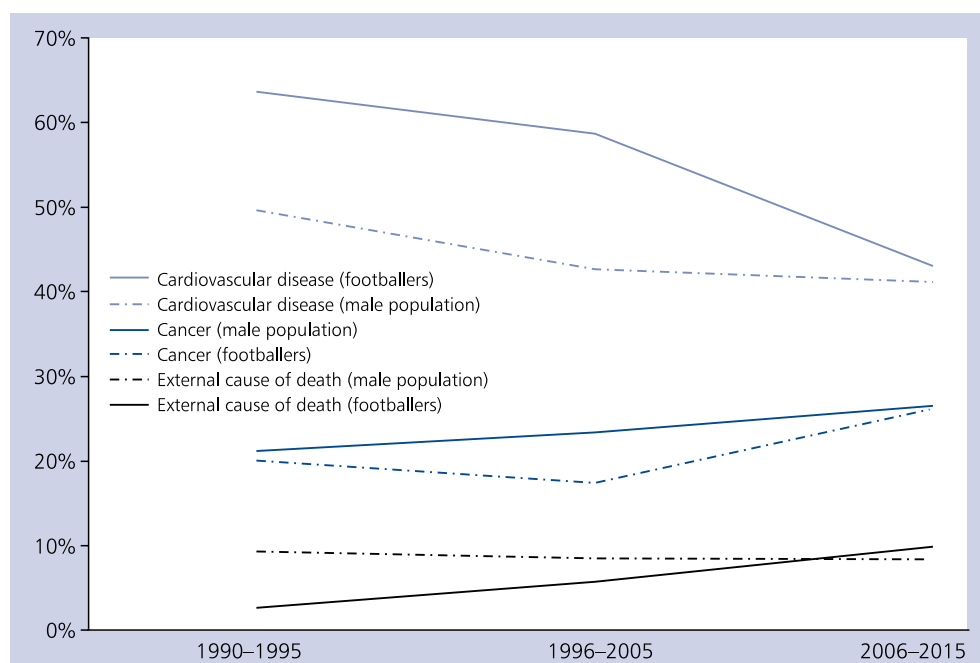
Table 3. Cause-specific cardiovascular mortality of Polish footballers and Polish men, between 1990 and 2015. Source: developed by the authors on the basis of Polish Central Statistical Office data

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

ICD-10 — International Statistical Classification of Diseases and Related Health Problems; IHD — ischaemic heart disease; MI — myocardial infarction; RHD — rheumatic heart disease; other abbreviations — see Table 1

Table 4. Structure of cause-specific mortality by the level of achievement and playing position. Source: developed by the authors on the basis of Polish Central Statistical Office data

Cause of death	All players (n = 345)	Classification		Playing position			
		Non-top (n = 238)	Top (n = 107)	Goalkeeper (n = 46)	Defender (n = 64)	Midfielder (n = 77)	Forward (n = 147)
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%

**Figure 2.** Cause-specific mortality structure of Polish footballers and Polish men who died aged 25 years or older in the years 1990–1995, 1996–2005, and 2006–2015. Source: developed by the authors on the basis of Polish Central Statistical Office data

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. In light of these findings and the international popularity of football, it is surprising that so few studies have been undertaken to investigate the longevity and causes of death among professional footballers. Among these few studies, investigations into the causes of death of Italian league players are noteworthy [8, 23]. The standardised proportional mortality ratios estimated by Belli and Vanacore [23] for a sample of ca. 24,000 athletes showed that retired footballers had a lower risk of death from CV, communicable, and respiratory diseases, but revealed excess mortality from motor neuron disease, mainly amyotrophic lateral sclerosis (standardised proportional mortality ratio [SPMR] = 1158). The ratios estimated for footballers and the general population were not different from each other (SPMR = 1.0). Similar results, indicating a lower risk of CV death (standardised mortality ratio [SMR] = 0.41) and cancer in retired competitive footballers, were reported by Taioli [7], who also found ex-athletes to run a higher risk of dying in a traffic accident (SMR = 2.23). Unlike Belli and Vanacore [23], however, Taioli [7] concluded that the total mortality rate (standardised for age) was lower for Italian players (SMR = 0.68) than for the general male population in Italy. Koning and Amelink [9] 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.

In the only study on the longevity of footballers in a Central and Eastern European country (Poland), authored by Śmigielski et al. [10], only athletes born after 1920 (the sample included cohorts born between 1905 and 1950; $n = 781$) had life expectancy greater than men in general. Different results were obtained by German researchers who analysed 812 national team footballers active in the period between 1908 and 2006. Kuss et al. [8] 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 causes of death in the 20th century.

The authors of a review of articles [11] on mortality among elite athletes of different disciplines concluded that they had a lower risk of dying from CV 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 CV diseases (or from other causes). Other important determinants include the genetic

makeup, family situation, lifestyle (dietary habits, smoking, alcohol consumption), occupation after retirement, economic status, health awareness, and access to medical care [22].

Finnish authors found retired competitive athletes to pursue a healthier lifestyle — they exercised more, consumed less tobacco and alcohol, and had better dietary habits (they ate more vegetables and fruit 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 [21, 24].

Naturally, the results obtained for the elite Finnish athletes are not directly generalisable to people living in other countries, particularly not to Polish and other Central and Eastern European 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 to note 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 contact with health professionals during their careers, retired athletes also have less of a 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 [25, 26]. At the same time, only 13% of them are reported to smoke cigarettes. This rate is from two to three times lower than in their non-athlete peers from the corresponding age group (18–34 years) [27, 28].

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 masters events (inviting contenders older than 35 years) body mass increased in the last five years by 3 kg; in every fourth the increase was substantial (above 10 kg) [29]. It is likely that in former professional athletes who refrain from physical exercise, increase in body mass may be even greater than that, thus making them more prone to diabetes and CV diseases.

It is also noteworthy that former footballers are more willing to take part in physical activity for leisure than men in general. Many of them continue to compete at masters events, e.g. football masters games [20]. While the retired athletes' urge to revive their careers by competing in masters events is commendable, it should not be forgotten that sport requires adequate training, medical tests, and self-awareness of the limits of one's physiological capabilities. The fact that these prerequisites are sometimes ignored is proven by news in the Polish and international press about sudden deaths of athletes during masters 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 sudden chest pain.

An important component of general health is mental well-being. Retirement from competitive sport and the necessity 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 suicide among former athletes [8, 30, 31]. This study, too, has shown a rising trend in suicide among Polish footballers. Although the sample is too small to allow more general conclusions to be drawn, the problem certainly deserves careful examination.

In the authors' opinion, the CV mortality rate has been declining among Polish footballers because of their increasing awareness of the demands of professional sport, which make 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 decreasing total mortality rates among the players of the Polish national team, who were born in the first half of the 20th century [10].

The main strengths of the material presented herein comprise the first in Poland, and one of the few worldwide, analysis of a fully representative sample for the country's elite footballer community, with confirmation of the quality of the data from the Central Statistical Office.

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

In conclusion, the study showed a higher rate of deaths from CV diseases among Polish top-league footballers as compared with men in general. Because of similar vascular mortality rates between the most recent cohort of athletes (2006–2015) and the general male population, it can be presumed that the difference is gradually disappearing. A more in-depth analysis of the causes of CV mortality revealed that, compared with controls, footballers died more frequently from ischaemic heart disease (especially acute myocardial infarction) and less frequently from hypertensive diseases. Of note, the mean age at death was higher for footballers than for controls. It is likely that in the coming years the advancing professionalisation of Polish sport will further reduce CV mortality among athletes, as has happened in other developed countries.

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Conflict of interest: none declared

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WHAT IS NEW?

In this paper we investigate the lifespan characteristics of competitive footballers. We provide a comprehensive analysis of longevity and cause-specific mortality structure of Polish footballers who died between 1990 and 2015 at the age of least 25 years. Moreover, we investigate and compare the structure of cause-specific mortality, especially in the cardiovascular context, of Polish footballers and general Polish male population in time, which, to the best of our knowledge, has not been analysed so far. The study results indicate excess cardiovascular mortality among Polish elite footballers.