

# Physical Activity and Sudden Cardiac Death in Elders – A Croatian Study

Zijad Duraković<sup>1</sup>, Marjeta Mišigoj Duraković<sup>2</sup>, Josip Škavić<sup>3</sup> and Marija Definis Gojanović<sup>4</sup>

<sup>1</sup> Institute for Anthropological Research, Department of Medical Anthropology and Epidemiology, Zagreb, Croatia

<sup>2</sup> University of Zagreb, Faculty of Kinesiology, Department of Kinesiological Anthropology, Zagreb, Croatia

<sup>3</sup> University of Zagreb, School of Medicine, Department of Forensic Medicine and Criminology, Zagreb, Croatia

<sup>4</sup> University of Split, School of Medicine, University Hospital Firule, Department of Pathology and Forensic Medicine, Split, Croatia

## ABSTRACT

*The paper deals with the sudden cardiac death in elders due to physical activity in Croatia and to compare it to other population groups who practice physical activity. The data are a part of a retrospective study dealing with 59 sudden death due to physical activity in men in Croatia: from January 1, 1988 to December 31, 2008. Fifteen aged 65 to 82 years were recreationally engaged in physical activity: six in swimming, four in tennis, one in driving a bicycle, one in jogging, two in bowling and one died during sexual act. Only one had symptoms of pectoral angina, two suffered from arterial hypertension, and two had congestive heart failure. Eleven were without symptoms before exercise. At forensic autopsy, fourteen had coronary heart disease, seven had critical coronary artery stenosis, three had occluded left descendens anterior coronary artery and four critical coronary stenosis, four had a recent myocardial infarctions, and eleven had myocardial scars due to previous myocardial infarctions. Twelve of them had left ventricular hypertrophy: 15–25 mm. In Croatia, about 7 per cent of the entire male population undertake recreational physical activity, while 13 per cent of them are elders. A sudden cardiac death due to recreational physical activity in elders reached 1.71/100 000 yearly, in the entire male population engaged in recreational physical exercise: 0.75/100 000 ( $p=0.05730$ ), in the total male population aged 15–40 engaged in sports and recreational physical exercise: 0.57/100.0000 ( $p=0.00387$ ), in young athletes: 0.15/100 000 ( $p=0.00000$ ). Medical examination of all elderly persons has to be done before starting of recreational physical activity: by clinical examination, searching for risk factors for atherosclerosis, performing ECG at rest, stress ECG, and echocardiography and to repeat the medical examination at least once a year. Physical activity should start with a warm-up period and with a gradually increasing load, and usually not to exceed 6-7 metabolic equivalents (METs).*

**Key words:** elders, physical activity, sudden cardiac death

## Introduction

The population is becoming older. In 2001, in Croatia 15.6 per cent of the whole population were 65 or older<sup>1,2</sup>. In some parts of the world elderly population reached about 20 per cent of the total population, and by the year 2025, the population aged 65 or over will probably reach more than 30 per cent<sup>3-5</sup>. Physical exercise, if regular, controlled and adapted to the organism, protects the heart from incidents. Elders engaged in physical activity have lower risk for cardiovascular complications than inactive persons<sup>6,7</sup>. In persons with a healthy heart that is trained and functionally fit, health-related incidents are very scarce.

The aim of this study is to analyze causes of sudden cardiac death in elders during or immediately after recreational physical activity and to compare it to other population groups who practice physical activity.

## Sample and Methods

In the period from January 1, 1988 to December 31, 2008, in Croatia were registered 59 sudden and unexpected deaths during or immediately after physical activity in men aged 13–82, who were residents in two largest

**TABLE 1**  
DATA OF ELDERLY MEN DIED SUDDENLY AND UNEXPECTEDLY DURING PHYSICAL ACTIVITY

No	Age (years)	Year of death	Event	Symptoms	Coronary findings at autopsy	LVH (mm)	Heart enlargement
1	65	July 1988	Playing tennis	Pectoral angina, ECG: ST,T changes	CHD generalized, LADCA occluded, AMI anterior wall, biventricular hypertrophy: RV 5 mm	15	yes
2	67	Feb 1992	Playing tennis	No	CHD, diffuse myocardial fibrosis, LADCA occluded	15	yes
3	65	June 1998	Playing tennis	No	CHD, critical coronary stenoses, myocardial scar anterior wall 6x3 cm	25	yes
4	66	April 2000	Sexual activity	No	CHD, critical LADCA stenosis, AMI anterior wall, myocardial scar anterior wall 3x2.7 cm,	21	yes (400 g)
5	69	Sept 2000	Swimming in the sea	No	CHD, myocardial scar anterior wall	18	yes
6	65	May 2001	Jogging	Headache, arterial hypertension	CHD, biventricular hypertrophy: RV 6 mm	16	yes
7	82	July 2001	Swimming in the sea	No	CHD, myocardial scars, chronic pericarditis	23	yes
8	82	July 2001	Swimming in the sea	No	Myocardial fibrosis, pericardial adhesions, coronaries with no changes	19	yes
9	68	Aug 2001	Swimming in a pool	No	CHD, critical stenosis LADCA, large scar of the LV	20	yes
10	73	Dec 2001	Bowling	No	CHD, AMI posterior wall, myocardial scars anterior wall: 2 cm	21	yes (410 g)
11	82	June 2002	Swimming in the sea	No	CHD, myocardial scar anterior wall, diffuse myocardial fibrosis	–	no
12	74	June 2002	Swimming in the sea	No	CHD generalized, myocardial scars posterior wall	–	no
13	72	Aug 2004	Riding a bicycle	Short breath during exercise, arterial hypertension	CHD, critical stenosis LADCA, myocardial scar LV: hydropericardium 40 ml	18	yes
14	66	May 2006	Playing tennis	No	CHD, critical LADCA, AMI anterior wall, large myocardial scars front wall	21	yes (680 g)
15	80	May 2008	Bowling	Short breath during exercise	CHD, LADCA occluded, large front wall myocardial scars, diffuse myocardial fibrosis	–	yes

CHD = coronary heart disease; LADCA = left descending anterior coronary artery; AMI = acute myocardial infarction; RV = right ventricle; LVH = left ventricle hypertrophy

cities: Zagreb in the interior of the country and Split at the coast. Similar incidents were not observed in women. In all a forensic autopsy were performed.

## Results

Sudden cardiac death occur in fifteen men aged 65 to 82 years, during or immediately after recreationally physical activity: in six during swimming, in four during tennis, in one during driving a bicycle, one died while jogging, two during bowling and in one during sexual act. Only one of them had symptoms of pectoral angina, two suffered from arterial hypertension, one accompanied by headache, and two had short breath during exercise due to congestive heart failure. Eleven were without symptoms before exercise. At forensic autopsy, fourteen had coronary heart disease, seven had critical coronary artery stenosis,

four of them had recent myocardial infarction, and twelve had myocardial scars due to previous myocardial infarctions. Twelve of them had left ventricular hypertrophy: 15–25 mm. Their characteristics are presented in Table 1.

The mortality rates in elders and younger men who have died suddenly during physical activity are presented in Table 2. The statistical difference was calculated by using the  $\chi^2$ -test and Poisson rates. In Croatia, about 7 per cent of the entire male population undertake recreational physical activity (315 000 of 4 500 000) and 13 per cent of them are elders (40 950 of 315 000). The reported deaths show that recreational physical activity in elders reached 1.71/100 000, a higher incidence than the entire male population engaged in recreational physical activity: 0.75/100 000 yearly, but the difference is not significant ( $p=0.05730$ ). That is a higher incidence than in the

**TABLE 2**  
MORTALITY RATES IN ELDERS AND YOUNGER MEN WHO DIED SUDDENLY DURING PHYSICAL ACTIVITY (1988–2008)

Ages and type of physical exercise	Died during physical activity	Died per 100 000
1 Men aged 65–82 involved in recreational physical exercise	15 of 859 950	1.71
2 Total of men aged 15–40 involved in sports and recreational physical exercise	15 of 2 763 433	0.57
3 The entire male population involved in recreational physical exercise	11 of 1 543 794	0.75
4 Men athletes aged 15–29	6 of 3 930 000	0.15

Poisson Rates: 1 vs. 2  $p=0.00387$ ; 1 vs. 3  $p=0.05730$ ; 1 vs. 4  $p=0.00000$

total male population aged 15–40 engaged in sport and recreational physical activity: 0.57/100.0000, and the difference is significant ( $p=0.00387$ ), and this incidence is also higher than in young athletes: 0.15/100 000, and the difference is significant ( $p=0.00000$ ).

## Discussion

The most frequent cause of sudden death during physical activity in elders is coronary heart disease<sup>1,2,8-10</sup>. Exercise training is useful in preventing sudden cardiac death, it can protect the individual against numerous chronic diseases of old age, and it maximizes residual function. In some instances, biological age could be reduced by as much as 20 years in elderly persons who practice physical exercise<sup>7</sup>. Life expectancy is increased, partial and total disability is delayed, and there are major gains in quality-adjusted life expectancy. Exercise is thus a very important component of healthy living for the elderly.

People engaged in physical activity have a lower risk of cardiovascular complications than inactive persons. It has been evidenced that physical activity positively affects maintenance and promotion of health. Physical activity should be controlled, regular and adapted to the health state. If the principles of physical training are observed,

possible complications can be avoided<sup>6</sup>. That is why medical check-ups before physical activity are essential, as well as medical control over persons taking exercise<sup>11-14</sup>.

Twelve of presented elders had left ventricular hypertrophy. It seems that the thickness of the left ventricular wall increases the risk of untoward cardiovascular events in persons without symptoms.

To avoid possible harmful effect of physical exercise, medical screening is necessary before such activities. Our data show that the usual underlying cause of sudden cardiac death during or immediately after physical activity is coronary heart disease in elders. More than 50% of elders have at least one risk factor, and about 10% of them have more than two risk factors for atherosclerosis. More efficient medical screening systems will be needed to cope with the increasing numbers of participants in physical activity<sup>7</sup>.

## Acknowledgements

This study was supported by Croatian Ministry of Science, Education and Sport. No.196034-0342282-0291 and 034-0342282-2325.

## REFERENCES

1. DURAKOVIĆ Z, MIŠIGOJ DURAKOVIĆ M, VUORI I, ŠKAVIĆ J, BELICZA M, J Sports Med Phys Fitness, 45 (2005) 532. — 2. DURAKOVIĆ Z, MIŠIGOJ DURAKOVIĆ M, Coll Antropol, 30 (2006) 213. — 3. DURAKOVIĆ Z, MIŠIGOJ DURAKOVIĆ M, Anthropology of aging, Encyclopaedia of life support system (EOLSS) (UNESCO, Eolss Publ. Oxford, UK, 2006). — 4. JAUL E, Harefuah, 142 (2003) 841. — 5. MCGINNIS JM, Am J Health Promot, 18 (2003) 146. — 6. VUORI I, Kinesiology, 2 (2004) 123. — 7. AJISAKA R, Int J Sports Health Sci, 4 (2006) 370. — 8. MORSE CE, SMITH EL, Physical activity programming for the older adults. In: SMITH

EL, SERPASS RC (Eds) Exercise and aging: The scientific basis (Enslow, Hallside NJ, 1981) — 9. SHAH CP, THAKUR RK, IP JH, XIE B, Cardiac Electrophys Rev, 1 (2004) 283. — 10. SHEPHARD RJ, Internet Society of Sports Science. Available from: URL: <http://sportsci.org>. Accessed on March 7, 1998. — 11. ARAMPATZIS A, PEPER A, BIERBAUM S, J Biomech, 44 (2011) 52. — 12. LIU CJ, LATHAM N, Arch Phys Med Rehabil, 91 (2010) 1471. — 13. MIDDLETON LE, BARNES DE, LUI LY, YAFFE K, J Am Geriatr Soc, 58 (2010) 1322. — 14. PODEWILS LJ, GUALLAR E, Ann Intern Med, 144 (2006) 135.

Z. Duraković

Institute for Anthropological Research, Ljudevita Gaja Street 32, 10000 Zagreb, Croatia  
e-mail: [zdurakovic@inantro.hr](mailto:zdurakovic@inantro.hr)

## REKREACIJSKA TJELOVJEŽBA I NAGLA KARDIJALNA SMRT U OSOBA STARIJE DOBI U HRVATSKOJ

### S A Ž E T A K

U vremenu 1988.–2008. u Hrvatskoj je zabilježeno 59 naglih i neočekivanih smrtnih ishoda za vrijeme ili neposredno nakon tjelesnog vježbanja (<1 sat) u muškaraca u Zagrebačkoj i Splitskog regiji. Petnaest muškaraca dobi 65–82 godine bavili su se rekreacijskom tjelovježbom: 6 plivanjem u moru, 4 tenisom, 1 je vozio bicikl, 2 rekreacijskim trčanjem, 2 kuglanjem, a jedan je preminuo za vrijeme seksualnih aktivnosti. Samo je jedan imao simptome angine pektoris, dva su bolovali od arterijske hipertenzije, a dvojica simptome kroničnog popuštanja crpne funkcije srca. Jedanaest nije imalo simptoma prije tjelovježbe. U 8 provedene su mjere reanimacije, neuspješno. Sudsko-medicinskom obdukcijom, 14 imalo je bolest vjenačnih krvnih žila srca: 5 kritično vjenačno suženje, 2 od njih uz recentni infarkt mišića srca prednje stijenke, 3 su imali začepljenu prednju silaznu vjenačnu arteriju, jedan od njih uz akutni infarkt mišića srca prednje stijenke, 12 imalo je ožiljke mišića srca nakon preboljelih infarkta, jedan je imao difuznu fibrozu mišića srca. Dvanaest je imao zadebljanje lijeve stijenke srca 15–25 mm. U Hrvatskoj se oko 7% muškaraca bavi rekreacijskom tjelovježbom, a od njih oko 13% kronološki su starije dobi. U muškaraca starije dobi u Hrvatskoj stopa smrtnosti iznosi 1,71/100 000 godišnje, što je više nego u ostalog muškog pučanstva koje se bavi rekreacijskom tjelovježbom 0,75/100 000 godišnje, iako razlika nije značajna ( $p=0,05730$ ). To je viša incidencija nego u pučanstva muškaraca dobi 15–40 godina, koji su uključeni u rekreacijsku tjelovježbu: 0,57/100 000 godišnje ( $p=0,00387$ ), i viša je nego u takmičarskih mladih sportaša: 0,15/100 000 ( $p=0,00000$ ). Prije odluke o rekreacijskom vježbanju u svih osoba starije dobi treba provesti liječnički klinički pregled, analizu čimbenika ateroskleroze u perifernoj krvi, elektrokardiograma u mirovanju, tijekom i nakon pokusa opterećenjem, analizu ehokardiograma, kao i periodične preglede najmanje jednom godišnje.