

Correlates of sport participation among community-dwelling elderly people in Germany: a cross-sectional study

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Abstract The aims of this study were (1) to analyze the sport participation in a cohort of community-dwelling elderly people in Germany and (2) to evaluate associations between sport participation, sociodemographic factors, cardiovascular risk factors, and health status. In a monitored prospective cohort study (getABI), 6,880 unselected patients ≥ 65 years have been followed up by 344 general practitioners beginning in 2001. As part of the 5-year follow-up telephone interview, a sample of 1,376 participants was interviewed on sport participation. The association between participation in at least one sporting activity (“sporty” yes/no) during the past week (cycling) or month (other sports) and the following parameters was analyzed by logistic regression: age, sex, immigration

background, education, waist circumference, smoking, self-reported health, history of vascular events, diabetes mellitus, lipometabolic disorder, and arterial hypertension. Analysis of activities ($n=1,304$; median age 76 (70–94) years; 55.1% women) showed that 27.6% of participants rode a bicycle during the previous week. During the previous month, 24.9% of participants did gymnastics or strength training, and 16.5% swam. Of all participants, 53.8% were sporty. Multivariate analysis revealed several independent factors to be associated with being sporty ($p<0.05$): younger age, male sex, higher education, nonsmoking, better self-reported health, and not being diagnosed with diabetes. Immigration background, waist circumference, history of vascular events, lipometabolic disorder, and hypertension did not show a statistically significant association ($p\geq 0.05$) with sport participation. Summing up, the most frequently performed sporting activities were cycling, gymnastics or strength training, and swimming. Sport participation was associated with, for example, age and sex.

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Introduction

The population of many industrialized countries is aging. In Germany, the number of people aged 65 and older will rise dramatically within the next decades: while nearly 16 million people (19% of the whole German population) were at that age in 2005, the number will grow to over 22 million people (29% of the whole German population) in 2030 [16]. Regular physical activity is important for the old age group, not only for the beneficial effects on conditions such as diabetes and cardiovascular disease but also for the maintenance of

mobility, independent living, and well-being. A strong body of scientific evidence shows that physical activity can help older people maintain their health [18, 29]. Because of all known benefits, current recommendations encourage physical activity on most or all days of the week. A multidimensional activity program including endurance, strength, balance, and flexibility training is generally considered optimal for older adults [27, 29].

Sporting activities are an important subset of overall physical activity. They are usually structured and performed on a regular basis. Most sporting activities, e.g., swimming, ball games, or cycling, combine endurance, strength, balance, and flexibility training. Cross-sectional and interventional studies support that all those basic motor skills increase by regular training even in very old people and in elderly patients with chronic diseases [15, 21, 22, 24, 28]. Sporting activities may thus contribute toward meeting the physical activity recommendations.

Due to the demographic change, considerable public effort is being devoted to preventing the negative health and economic consequences [32] of sedentary behavior in seniors by promoting sport participation. However, data on sport participation of elderly people in Germany aged over 70 years are scarce. According to the German National Health Interview 2003, participation in at least 2 h of sporting activities per week in the age group of 30–39 years is 45.6% in men and 32.9% in women. In the age group of 70–79 years, participation drops to 29.9% in men and 22.2% in women. Only 15.5% of men and 17.5% of women aged 80 years or older engage in at least 2 h of sports per week [33]. Unfortunately, little is known about the specific aspects of the performed activities (e.g., kind, frequency, intensity, or duration) and about the reasons for nonparticipation.

Consequently, the first aim of this study was to perform an analysis of the participation in sporting activities in a cohort of community-dwelling elderly people in Germany. The second aim was to analyze associations between participation in sporting activities, sociodemographic factors, cardiovascular risk factors, and health status.

Methods

Study design and participants

The “German epidemiological study on ankle brachial index” (getABI) is a large-scale epidemiological trial with a cross-sectional part and a longitudinal part. The methods and design of the study have been described elsewhere in greater detail [14, 19]. Briefly, 34 vascular physicians across Germany trained and supervised 344 representative

general practitioners in their vicinity. An assessment of primary care attendees, irrespective of their reason for seeing the doctor, was conducted in a prespecified week in October 2001. An average of 20 (maximum 25) eligible patients per practice fulfilling the inclusion criteria (age \geq 65 years, patient being legally competent and able to cooperate appropriately, and providing written informed consent) were recruited over this week. The only exclusion criterion was life expectancy \leq 6 months. A total of 6,880 patients were included in the study. Results reported in this paper mostly refer to the cross-sectional part of the 5-year follow-up. As part of the 5-year follow-up telephone interview, a sample of 1,376 participants was interviewed on sport participation. The protocol of getABI was approved by the University of Heidelberg (Germany) Ethics Committee. All patients gave written informed consent. The study was conducted according to the “Good Epidemiological Practice” recommendations issued by the “German Working Group Epidemiology” [2].

Outcome

Sport participation

Participation in sporting activities was assessed as part of the 5-year follow-up telephone interview using a modified version of the “Freiburger” questionnaire [17]. The activities asked and the summarized total time devoted to these activities are listed in Tables 2 and 3. The total time was given in three categories depending on the stated activity (either about 15 min, about 30 min, about 60 min or longer during the last week; or about 1 h, about 2–3 h, about 4 h or longer during the last month).

The main outcome for the logistic regression analysis was the binary parameter sport participation (“sporty”): yes or no. Participants who performed at least one sporting activity during the week (cycling) or the month (other sports) prior to the interview were defined as sporty. The recall of different time periods for cycling and other sports is a limitation of the “Freiburger” questionnaire. Cycling was defined as a sporting activity independent of the purpose (to run errands, for leisure, on bicycle tours, or on a stationary bicycle). This definition was based on the consideration that, for elderly people, cycling is a demanding task that requires not only a certain endurance capacity but also coordination, balance, and reaction speed. Looking at the metabolic requirements, Ainsworth et al. assign 4.0 metabolic equivalents even to “bicycling, <10 mph, to work or for pleasure” [1]. In contrast, walking either for leisure or to run errands was considered an everyday activity (not a sporting activity) because even for elderly people it does not require special motor skills and is usually of less than moderate intensity [1].

Covariables

Sociodemographic variables

The participants' sex and date of birth were documented by the general practitioner at baseline. For the definition of the variable "education level," the participants' highest graduation (no graduation/comprehensive school (*Hauptschulabschluss*)/high school (*Realschulabschluss* or *Mittlere Reife*)/university entrance qualifications (*Fachabitur* or *Abitur*)) was assessed by the general practitioner at baseline. The country of birth was evaluated by telephone interview (5-year follow-up).

Cardiovascular risk factors

Waist circumference was measured in the general practitioner's practice by standard protocol at the 3- and the 5-year follow-up of getABI. Waist circumference at 5-year follow-up was used for analysis. If this value was missing, waist circumference at 3-year follow-up was used. The current smoking status was documented at baseline (non-smoker/former smoker/current smoker).

Health status

Both subjective and objective measures of health status were used: self-reported health status, report of the general practitioner, and blood test results.

Self-reported general health was assessed by telephone interview (5-year follow-up) by the use of the Short-Form 8 Health Survey (SF-8™ 4-week recall version). The instrument yields an eight-part profile of functional health and well-being. Two SF-8 composites can be calculated: the SF-8 physical component score (PCS) and the SF-8 mental component score (MCS). These scores are linear combinations of the eight items based on their respective importance for physical functioning and mental functioning. Higher scores represent better health status. The survey has demonstrated good reliability and validity [38].

The general practitioners documented the following vascular events at the beginning and throughout the trial (until follow-up at 5 years): cardiovascular events (myocardial infarction, cardiac revascularisation), cerebrovascular events (stroke, revascularization at carotids), and peripheral arterial events (amputation, peripheral revascularization, intermittent claudication).

Subjects were defined to have diabetes mellitus if they had been assigned the clinical diagnosis by their physician, if they were receiving any antidiabetic medication (insulin or oral), or if their HbA1c (glycosylated hemoglobin) was $\geq 6.5\%$. Subjects were defined to have a lipometabolic disorder if they had been assigned the clinical diagnosis by

their physician, if they were receiving cholesterol-synthesizing enzyme (CSE) inhibitors or fibrates, if their serum total cholesterol was ≥ 200 mg/dl, or if their serum triglycerides were ≥ 150 mg/dl. Subjects were defined to have arterial hypertension if they had been assigned the clinical diagnosis by their physician or if they were receiving an angiotensin-converting enzyme (ACE) inhibitor or an angiotensin type 1 receptor (AT1) antagonist or diuretics. Diabetes mellitus, lipometabolic disorder, and arterial hypertension classifications were done at baseline.

Statistical analysis

Statistical analyses were performed with SAS version 9.1 (SAS Institute Inc., Cary, NC, USA). A logistic regression analysis (both univariate and adjusted for covariables) was performed to assess the association between the main outcome sport participation (sporty yes/no) and the following binary sociodemographic parameters, cardiovascular risk factors, and parameters of health status: age (\leq / $>$ median age (76 years)), sex (female/male), birthplace (inside/outside Germany), graduation (at least/less than university entrance qualifications (*Fachabitur*)), waist circumference (men \leq / \geq 102 cm; women \leq / \geq 88 cm) [20], smoking status (smoking/not smoking), SF-8 PCS ($>$ / \leq median PCS (48.3)), SF-8 MCS ($>$ / \leq median MCS (55.4)), history of (at least one) cardiovascular event (yes/no or unknown), history of (at least one) cerebrovascular event (yes/no or unknown), history of (at least one) peripheral arterial event (yes/no or unknown), diabetes mellitus (yes/no or unknown), lipometabolic disorder (yes/no or unknown), and arterial hypertension (yes/no or unknown).

Persons with missing values in one of the following variables were excluded from all analyses: sporting activities, age, sex, birthplace, graduation, waist circumference, SF-8 PCS, SF-8 MCS, walking (leisure/errands). In case of contradictory answers, data were analyzed as obtained. The level of significance was set at $p < 0.05$ for all analyses.

Results

Participants

Of the 1,376 participants, 72 were excluded from analyses because of incomplete data. A total of 1,304 participants (median age 76 (70–94) years; 55.1% women) were included in the analyses. Three of the sporty participants answered "yes" when they were asked if they performed a sporting activity (in general) during the past month, but they did not specify any of the activities listed in Table 3 (as well as cycling during the last week). Participant characteristics are shown in Table 1.

Table 1 Participant characteristics at 5-year follow-up

	Number	Percent	Mean \pm SD	Minimum	Median	Maximum
Age (years)	1,304		76.4 \pm 4.5	70	76	94
Median age or younger (\leq 76 years)	726	55.7				
Older than median age ($>$ 76 years)	578	44.3				
Sex	1,304					
Female	718	55.1				
Male	586	44.9				
Birthplace	1,304					
Outside Germany	121	9.3				
Germany	1,183	90.7				
Education level (graduation)	1,304					
Lower than university entrance qualifications ^a	1,080	82.8				
At least university entrance qualifications ^a	224	17.2				
Waist circumference (cm) ^b	1,304		97.8 \pm 11.8	67	98	147
Men $<$ 102 cm; women $<$ 88 cm	503	38.6				
Men \geq 102 cm; women \geq 88 cm	801	61.4				
Currently smoking (baseline)	1,304					
No	1,210	92.8				
Yes	94	7.2				
SF-8 physical component score (PCS)	1,304		46.8 \pm 8.7	10.3	48.3	66.4
Higher than median PCS ($>$ 48.3)	651	49.9				
Median PCS or lower (\leq 48.3)	653	50.1				
SF-8 mental component score (MCS)	1,304		53.2 \pm 7.4	20.5	55.4	66.3
Higher than median MCS ($>$ 55.4)	652	50.0				
Median MCS or lower (\leq 55.4)	652	50.0				
Cardiovascular event ^c	1,304					
No/unknown	1,109	85.0				
Yes	195	15.0				
Cerebrovascular event ^d	1,304					
No/unknown	1,238	94.9				
Yes	66	5.1				
Peripheral arterial event ^e	1,304					
No/unknown	1,161	89.0				
Yes	143	11.0				
Diabetes mellitus ^f	1,304					
No/unknown	1,038	79.6				
Yes	266	20.4				
Lipometabolic disorder ^g	1,304					
No/unknown	207	15.9				
Yes	1,097	84.1				
Arterial hypertension ^h	1,304					
No/unknown	460	35.3				
Yes	844	64.7				
Sporty ⁱ	1,304					
No	602	46.2				
Yes	702	53.8				

SD standard deviation

^a Fachabitur

^b Waist circumference at 5-year follow-up is used; if it is missing, waist circumference at 3-year follow-up is used

^c “Cardiovascular event” is defined as the incidence of (at least) one of the following events until follow-up at 5 years: myocardial infarction or cardiac revascularization

^d “Cerebrovascular event” is defined as the incidence of (at least) one of the following events until follow-up at 5 years: stroke or revascularization at carotids

^e “Peripheral arterial event” is defined as the incidence of (at least) one of the following events/symptoms until follow-up at 5 years: amputation, peripheral revascularization, or intermittent claudication

^f Subjects were defined to have diabetes mellitus if they had been assigned the clinical diagnosis by their physician, if they were receiving any antidiabetic medication (insulin or oral), or if their HbA1c (glycosylated hemoglobin) was \geq 6.5% at baseline

^g Subjects were defined to have a lipometabolic disorder if they had been assigned the clinical diagnosis by their physician, if they were receiving CSE inhibitors or fibrates, if their serum total cholesterol was \geq 200 mg/dl, or if their serum triglycerides were \geq 150 mg/dl at baseline

^h Subjects were defined to have arterial hypertension if they had been assigned the clinical diagnosis by their physician or if they were receiving ACE inhibitor or AT1 antagonist or diuretics at baseline

ⁱ Sporty is defined as participation in at least one sporting activity during the week (cycling) or the month (other sports) prior to the interview

Analysis of sporting activities

The analysis of sporting activities showed that 27.6% of all participants rode a bicycle during the week prior to the interview. Of all participants, 12.7% rode a bicycle to run errands, and 18.4% did a bicycle tour or rode on a stationary bicycle. During the previous month, 24.9% of participants did gymnastics or strength training, 16.5% swam, and 6.2% bowled or danced. Every other sporting activity was performed by less than 5% of participants during the previous month (see Tables 2 and 3). Of all participants, 53.8% reported to have performed at least one sporting activity during the week (cycling) or month (other sports) prior to the interview (i.e., were sporty). Of all participants, 83.7% ran errands on foot and 74.3% went for a leisure walk during the previous week.

Logistic regression analysis

The results of the multivariate regression analysis are shown in Table 4. In the adjusted model, age older than median age (odds ratio (OR) 0.58; 95% confidence interval (95% CI) 0.46–0.73) and current smoking (OR 0.43; 95% CI 0.27–0.67) were the only two factors associated with an approximate halving of the chance of being sporty. Other less meaningful factors were diabetes mellitus (OR 0.70; 95% CI 0.52–0.93), as well as low self-reported (SF-8) physical (OR 0.69; 95% CI 0.55–0.87) and mental health (OR 0.76; 95% CI 0.60–0.95). On the other hand, the two factors higher educational level (OR 1.39; 95% CI 1.02–1.90) and male sex (OR 1.34; 95% CI 1.04–1.72) increased the chance of being sporty.

Immigration background, waist circumference, history of vascular events, lipometabolic disorder, and arterial hypertension did not show a statistically significant association with participation in sporting activities.

Discussion

The three most common types of active sport practiced by getABI participants were riding a bicycle, gymnastics or

strength training, and swimming. In the literature, comparable data on activity patterns of elderly people at a population level are scarce. Due to varying evaluation methods, data from different surveys have to be compared cautiously (see Table 5).

According to data of the US “Behavioral Risk Factor Surveillance System” (BRFSS) of the Centers for Disease Control and Prevention 2004, 36% of people 75 years or older do not participate in any leisure time physical activity [10]. The BRFSS of the year 2000 asked adults aged 65 years and older to report the two physical activities or exercises that they had participated in the most during the past month. Nearly 70% of physically active respondents reported walking as the type of physical activity or exercise they had spent the most time doing during the past month. The next most common activities in older adults in the USA were gardening (reported by 9.6% of people), cycling (3.9%), home exercises (3.3%), and golf (2.8%). About 12% of older adults reported participating in other types of activities, which included aerobics classes, swimming, weight lifting, running/jogging, and playing tennis [9]. At first sight, the participation in sporting activities seems to be lower in older US adults than in the getABI cohort. However, this may be due to the fact that the US adults were only given the possibility to report the two physical activities that they had participated in the most. This can lead to an underestimation of participation in activities. In the getABI cohort, all sporting activities were recorded.

Zizzi et al. [39] studied the physical activity habits in a community sample of older adults ($N=470$) in Appalachia (USA). The participants were asked whether they had performed the respective activity in a typical week during the past month. The comparison to the getABI sample reveals that cycling seems to be more popular in Germany and that brisk walking for exercise and playing golf seem to be more popular in Appalachia. Older people in Germany seem to like walking for leisure, but walking briskly for exercise is not common at all. In Australia, 53.4% of all persons aged 65–74 and 35.7% of all persons aged 75 and over walked for exercise in the 2 weeks prior to the National Health Survey interview 2004/2005. In both age

Table 2 Participation in “riding a bicycle” during the week prior to the interview and summarized duration ($n=1,304$; 586 males (m); 718 females (f))

Kind of activity	Sex	Participation (%)	About 15min (%)	About 30min (%)	About 60min or longer (%)
Riding a bicycle	m	34.5	27.6	Not further specified	
	f	22.0			
Riding a bicycle to run errands	m	15.2	12.7	0.6	3.8
	f	10.7			
Riding a stationary bicycle or on bicycle tours	m	24.4	18.4	2.0	3.2
	f	13.5			

Table 3 Participation in activities during the month prior to the interview and summarized duration ($n=1,304$; 586 males (m); 718 females (f))

Kind of activity	Sex	Participation (%)	About 1h (%)	About 2–3h (%)	About 4h or longer (%)																																																																				
Gymnastics or strength training	m	20.5	24.9	2.5	5.1	17.3																																																																			
	f	28.6					Swimming	m	18.4	16.5	6.1	5.4	5.1	f	14.9	Dancing or bowling	m	8.9	6.2	0.7	2.6	2.9	f	4.0	Brisk walking	m	2.7	2.8	0.3	0.5	2.1	f	2.9	Jogging or running	m	2.0	1.0	0.5	0.2	0.4	f	0.1	Ball games like tennis or football	m	4.1	2.2	0.4	0.7	1.2	f	0.7	Skiing (downhill or cross country)	m	1.5	0.8	0.0	0.3	0.5	f	0.3	Other strenuous sports	m	2.2	1.3	0.2	0.2	0.9	f	0.6	Other less strenuous sports	m	2.6	2.3
Swimming	m	18.4	16.5	6.1	5.4	5.1																																																																			
	f	14.9					Dancing or bowling	m	8.9	6.2	0.7	2.6	2.9	f	4.0	Brisk walking	m	2.7	2.8	0.3	0.5	2.1	f	2.9	Jogging or running	m	2.0	1.0	0.5	0.2	0.4	f	0.1	Ball games like tennis or football	m	4.1	2.2	0.4	0.7	1.2	f	0.7	Skiing (downhill or cross country)	m	1.5	0.8	0.0	0.3	0.5	f	0.3	Other strenuous sports	m	2.2	1.3	0.2	0.2	0.9	f	0.6	Other less strenuous sports	m	2.6	2.3	0.3	0.5	1.5	f	2.1				
Dancing or bowling	m	8.9	6.2	0.7	2.6	2.9																																																																			
	f	4.0					Brisk walking	m	2.7	2.8	0.3	0.5	2.1	f	2.9	Jogging or running	m	2.0	1.0	0.5	0.2	0.4	f	0.1	Ball games like tennis or football	m	4.1	2.2	0.4	0.7	1.2	f	0.7	Skiing (downhill or cross country)	m	1.5	0.8	0.0	0.3	0.5	f	0.3	Other strenuous sports	m	2.2	1.3	0.2	0.2	0.9	f	0.6	Other less strenuous sports	m	2.6	2.3	0.3	0.5	1.5	f	2.1													
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	f	2.1																																																																							

groups, about 60% of the persons who walked for exercise did so more than seven times within those 2 weeks [3].

Analyses of the “Allied Dunbar National Fitness Survey” and the “Health Education Authority National Survey of Activity and Health” (UK, $N=3,078$) revealed that “exercises”, cycling, social dancing, and swimming were the four most popular sporting activities among adults aged 50 years and above. Of those activities, exercises showed the least decrease with age [36].

The “Taking Part: England’s Survey of Culture, Leisure and Sport” is a national survey of private households in England. The survey examined the participation in active sport in 2005/2006 [34]. For the annual report 2005/2006, Rowe and Bibby defined participation as physical engagement in at least one type of active sport during the past 12 months. The data showed that 69% of all adults had participated in an active sport. The participation decreased with age, dropping from 82.6% in the age group 25–44 years to 45.3% in the age group 65–74 years and to 21.8% in the age group 75 years and older. Males (74.4%) had higher rates of participation than females (64.5%). Of those who had not participated in any active sport during the past 12 months, “health isn’t good enough” was the main reason for nonparticipation. In August 2008, further more detailed data on sport participation from the “Taking Part” survey 2005/2006 have been published on the internet [13]. These data also include the types of sports and the participation during the past 4 weeks, which makes the data comparable to the getABI data. Among all adults in the “Taking Part” survey, the most common type of active sport participated in during the past 4 weeks was swimming or

diving indoors (15.7%), followed by health, fitness, gym or conditioning activities (13.8%), and recreational cycling (9.7%). Unfortunately, the participation in different sports is not presented separately for different age groups in the report of the “Taking Part” survey. By comparing the preferred activities of England’s adults with those of the getABI cohort, it can be stated that the three most popular sporting activities in both populations are swimming, cycling, and conditioning activities.

A logistic regression analysis in the getABI cohort showed that more elderly men than women participate in sporting activities. This is in line with findings of previous investigations [10, 33].

Participation in sporting activities was negatively associated with poor self-reported health status and with the diagnosis “diabetes mellitus”. An association with previous vascular events, with the presence of a lipometabolic disorder or arterial hypertension, could not be shown. Due to the cross-sectional character of the study, no conclusions on any causality or the direction of the causality between participation in sporting activities and health status can be drawn. On the one hand, there is evidence that a fit and active way of life improves and preserves health and function in older individuals [5]. On the other hand, limited health is known to be the most important barrier to sport participation in elderly people [12, 26, 34].

In the present study, age has been demonstrated to be independently associated to participation in sporting activities. Older people seem to stop participating in activities independent of their health status even after the age of 70 years. In this context, it might be useful to consider old

Table 4 Multivariate analysis of association between sport participation, sociodemographic factors, cardiovascular risk factors, and health status ($n=1,304$)

		All (n)	Sporty ^a (%)	OR univariate (95% CI)	OR multivariate (95% CI)	p value multivariate
Age	Median age or younger (≤ 76 years)	726	59.8	Reference		
	Older than median age (> 76 years)	578	46.4	0.58 (0.47–0.73)	0.58 (0.46–0.73)	<0.001
Sex	Female	718	50.1	Reference		
	Male	586	58.4	1.39 (1.12–1.74)	1.34 (1.04–1.72)	0.022
Birthplace	Outside Germany	121	47.9	Reference		
	Germany	1,183	54.4	1.30 (0.89–1.89)	1.30 (0.89–1.92)	0.180
Education level (graduation)	Lower than university entrance qualifications ^b	1,080	52.2	Reference		
	At least university entrance qualifications ^b	224	61.6	1.47 (1.09–1.97)	1.39 (1.02–1.90)	0.036
Waist circumference ^c	Men < 102 cm; women < 88 cm	503	57.1	Reference		
	Men \geq 102 cm; women \geq 88 cm	801	51.8	0.81 (0.65–1.01)	0.93 (0.73–1.19)	0.563
Currently smoking (baseline)	No	1,210	54.9	Reference		
	Yes	94	40.4	0.56 (0.36–0.86)	0.43 (0.27–0.67)	<0.001
SF-8 physical component score (PCS)	Higher than median PCS (> 48.3)	651	60.1	Reference		
	Median PCS or lower (≤ 48.3)	653	47.6	0.61 (0.49–0.75)	0.69 (0.55–0.87)	0.002
SF-8 mental component score (MCS)	Higher than median MCS (> 55.4)	652	58.1	Reference		
	Median MCS or lower (≤ 55.4)	652	49.5	0.71 (0.57–0.88)	0.76 (0.60–0.95)	0.018
Cardiovascular event ^d	No/unknown	1,109	54.4	Reference		
	Yes	195	50.8	0.87 (0.64–1.17)	0.82 (0.58–1.15)	0.256
Cerebrovascular event ^e	No/unknown	1,238	54.1	Reference		
	Yes	66	48.5	0.80 (0.49–1.31)	0.88 (0.53–1.48)	0.640
Peripheral arterial event ^f	No/unknown	1,161	53.9	Reference		
	Yes	143	53.1	0.97 (0.68–1.37)	1.35 (0.92–1.96)	0.125
Diabetes mellitus ^g	No/unknown	1,038	55.7	Reference		
	Yes	266	46.6	0.70 (0.53–0.91)	0.70 (0.52–0.93)	0.013
Lipometabolic disorder ^h	No/unknown	207	57.0	Reference		
	Yes	1,097	53.2	0.86 (0.64–1.16)	0.99 (0.72–1.36)	0.943
Arterial hypertension ⁱ	No/unknown	460	58.3	Reference		
	Yes	844	51.4	0.76 (0.60–0.95)	0.84 (0.66–1.08)	0.168

OR odds ratio as a result of a logistic regression (multivariate odds ratios were adjusted for all other variables in the table), CI confidence interval

^a Sporty is defined as participation in at least one sporting activity during the week (cycling) or the month (other sports) prior to the interview

^b *Fachabitur*

^c Waist circumference at 5-year follow-up is used; if it is missing, waist circumference at 3-year follow-up is used

^d “Cardiovascular event” is defined as the incidence of (at least) one of the following events until follow-up at 5 years: myocardial infarction or cardiac revascularization

^e “Cerebrovascular event” is defined as the incidence of (at least) one of the following events until follow-up at 5 years: stroke or revascularization at carotids

^f “Peripheral arterial event” is defined as the incidence of (at least) one of the following events/symptoms until follow-up at 5 years: amputation, peripheral revascularization, or intermittent claudication

^g Subjects were defined to have diabetes mellitus if they had been assigned the clinical diagnosis by their physician, if they were receiving any antidiabetic medication (insulin or oral), or if their HbA1c (glycosylated hemoglobin) was $\geq 6.5\%$ at baseline

^h Subjects were defined to have a lipometabolic disorder if they had been assigned the clinical diagnosis by their physician, if they were receiving CSE inhibitors or fibrates, if their serum total cholesterol was ≥ 200 mg/dl, or if their serum triglycerides were ≥ 150 mg/dl at baseline

ⁱ Subjects were defined to have arterial hypertension if they had been assigned the clinical diagnosis by their physician or if they were receiving ACE inhibitor or AT1 antagonist or diuretics at baseline

Table 5 Participation in sporting activities (%) in different developed countries

Country Cohort Reference	Germany getABI	Appalachia/US community sample [21]	US BRFSS [20]	England "Takingpart" [25]	UK ADNFS/HEANSAH [23]	Australia National HealthSurvey [22]
Year of data collection	2006	2002/2003	2000	2005/2006	1990/1991	2004/2005
Activity participation	Participation in the activity during the past week (cycling only) or month? (%)	Participation in the activity in a typical week during the past month? (%)	The two activities participated in the most during the past month? (%)	Participation in the activity during the past 4 weeks?	Participation in the activity during the past 4 weeks?	Participation in the activity during the past 2 weeks?
Age group	≥ 70 years	≥ 65 years	≥ 65 years	All adults	70–79 years (men/women)	≥ 75 years
Bicycling	27.6 (during the past week) 24.9	16.8	3.9	9.7	4/0	
Gymnastics or strength training		16.6 light strength training 11.5 moderate to heavy strength training 11.3 using aerobic machines (i.e., rowing, stepper)	3.3 home exercises	13.8 health, fitness, gym or conditioning activities 3.3 weight training	11/10 exercises –/0 yoga	
Swimming	16.5	8.4 swimming gently 4.7 swimming moderately or fast 8.7 water exercises		1.5 weight lifting 2.5 yoga 1.3 martial arts 15.7 swimming or diving indoors 4.0 swimming or diving outdoors	5/3	
Dancing or bowling	6.2	2.9 aerobics or aerobic dancing 5.4 dance		6.9 keep fit, aerobics or dance exercise 3.6 tenpin bowling 1.1 bowls indoor 1.3 hill trekking or back packing	5/6 social dancing –/3 keep fit –/0 aerobics 4/2 rambling	35.7 walking for exercise
Brisk walking	2.8	34.9 walk fast or briskly 22.2 walk uphill or hike uphill 4.9				
Jogging or running	1.0			5.1	–/–	
Ball games	2.2	1.1 doubles tennis 0.7 singles tennis 0.9 basketball, soccer or racquetball		7.0 football outdoors 3.0 football indoors 2.9 badminton 2.8 tennis	–/–	

Other sports	0.8 skiing 1.3 other strenuous sports 2.3 other less strenuous sports	6.9 golf 0.7 skate	2.8 golf About 12% participated in other sports including aerobics classes, swimming, weight lifting, running/jogging, and playing tennis	1.7 cricket 1.5 table tennis 1.4 squash 1.4 basketball 8.0 snooker, pool or billiards 5.6 golf 3.4 darts 2.0 angling or fishing 1.8 water sports 1.2 horse riding 10.7 other sports	6/- snooker 4/0 golf 4/- darts 4/1 bowls 1/0 fishing
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– not among the ten most frequently mentioned activities

age as involving not one but several life phases that exhibit different qualities. In the face of demographic changes, different proposals have been made to distinguish, e.g., between the “third age” and the “fourth age” [4, 25] or between the “young old,” the “old,” and the “oldest old” [30, 37]. It might be of interest whether the detected disparity in sport participation between different phases of old age is caused by a lack of opportunities or by undocumented medical reasons.

In the getABI cohort, elderly people with higher education level were more likely to participate in sporting activities than people with lower education level. Several other studies have shown an association between socioeconomic factors (education, income) and activity behavior [6, 11, 31]. A limited access for people of lower socioeconomic status to sports facilities might be one reason for the disparities. Cross-sectional [8] and longitudinal studies [23, 35] have shown that access to sports facilities (e.g., fitness centers, swimming pools) is positively correlated with sport participation in adults. A study by Brownson et al. [7] suggests that access to community walking trails may be beneficial in promoting physical activity particularly among people of lower socioeconomic status.

The strengths of the present study include the large sample size compared to other cohorts of elderly people and the integrity of the dataset due to the sampling method “telephone interview.” Due to the recruitment method, this study refers to a cohort of community-dwelling elderly people who are still able to visit their primary care physicians. These elderly people are the ones who are still receptive to public offers of leisure time and sporting activities. Patients who had moved to a nursing home during the follow-up period were no longer able to participate. Furthermore, it can be assumed that the willingness and ability to continue to participate in a longitudinal trial and in particular in the telephone interview after 5 years might be higher in healthier persons. Therefore, there probably is a selection towards the younger and fitter patients from baseline to the 5-year follow-up in the getABI cohort. Problems of bias (e.g., recall bias) are a general limitation to epidemiological studies using self-report measures. “Socially desired answers” can lead to an overestimation of the participation in sporting activities. Despite the mentioned limitations, this study delivers reliable and relevant data on the participation in sporting activities of community-dwelling elderly people for which there was little information at a population level in Germany so far.

Conclusions

Only a small percentage of older community-dwelling adults did sporting activities other than cycling, gymnastics, strength training, swimming, bowling, or dancing. The

study identified several independent factors (e.g., age, sex, self-reported health) to be associated with sport participation. Tailoring sports programs to the needs and abilities of specific subgroups (e.g., highly aged, women) might help to reduce the presented disparities. The effects of such measures should be evaluated.

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