Exercises for older cyclists to improve traffic safety[1]

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ABSTRACT

In Germany, about 50 per cent of cyclist casualties are persons who are at least 65 years old. Degenerative phenomena essentially reduce the ability to ride a bike safely. Although chronological age in itself does not allow the physical fitness of a person to be inferred, a general decline in physical abilities can be observed in ageing persons. Many of the declining functions can be trained through regular exercises.

We developed a structured exercise program to improve the basic motor and cognitive skills of older cyclists required during cycling. The six-month intervention started in January 2013 and encompassed a progressive training program. Twice a week, there was a sixty-minute practice session with the focus on balance and the ability to react, on orientating oneself and on combining two or more activities. Additionally, the muscles required during cycling were strengthened and stretched.

140 cyclists participated in intervention groups; 160 cyclists in control groups. All were 60 or older. Before and after the training period, a range of measurements were taken. Participants were asked about physical problems, in general and when cycling, in the fields of motility, cardiovascular system, nerve system, muscle strength, diabetes, vision and hearing. They cycled a course which included tasks like off-side turns and precise breaking. Reported problems and performance before and after the training period were compared in the intervention groups and the control groups. After the training period, physical complaints in the cyclists in the intervention groups had decreased slightly. There was no decrease in the participants of the control groups. The reported difficulties in traffic situations were not affected by the training. The training did not improve general performance in the cycle course. The reported physical problems show that the training was effective in general but that there was no transfer to behaviour relevant to traffic safety. For this reason we propose that sports exercises be combined with exercises where the training effects can be transferred to traffic situations.

Keywords: older cyclists, exercise, training, traffic safety, sports

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1 INTRODUCTION

In Germany, about 50 per cent of cyclist casualties are persons who are at least 65 years old [1]. One reason why this proportion is much higher than might be expected from exposure is the increased physical vulnerability of older persons. [2, 3]

Table 1. Overview of demands, skills, and required abilities of cyclists

Demands in traffic	*Skills*	*Required abilities*
Getting off the bike	• *Precise stopping* • *Movement from sitting to standing* • *Standing one-legged on one pedal* • *Lifting the foot over the frame if necessary*	• *Anticipation* • *Reaction* • *Balance* • *Flexibility in the joints of trunk, hip, and foot* • *Movement coupling*
Cycling in a narrow alley	• *Keeping in lane* • *Cycling straight on*	• *Balance* • *Stability of trunk and shoulders* • *Focus* • *Ability to distinguish movements within the upper body*
Turning	• *Indicating the turn (cycling one-handed)* • *Looking over the shoulder while cycling*	• *Movement coupling* • *Balance* • *Trunk stability* • *Flexibility in shoulders and neck joints* • *Orientation, peripheral vision*

Degenerative phenomena essentially reduce the ability to ride a bike safely. Although chronological age in itself does not allow the physical fitness of a person to be inferred, a general decline in physical abilities can be observed in ageing persons. Many of the declining functions can be trained through regular exercise [4]. Improved physical abilities might help cyclists to avoid single bike accidents, e.g. falling when getting on or off the bike or losing balance at path edges. It might also help to avoid collisions, e.g. collisions caused by not looking over one's shoulder to check for oncoming traffic before an off-side turn. Persons with fewer physical problems can therefore be expected to be able to cycle more safely. Improved physical fitness might also allow persons who like cycling to cycle more because they feel better.

We developed a sports training program aimed at improving the physical condition of cyclists with special regard to the requirements of safe cycling. A requirement analysis was made on the basis of demands on cyclists in traffic. The training program aimed at improving a range of abilities required for cycling. An overview is given in Table 1. The training was purely sports training and took place in gyms, fitness studios and comparable places. There were no training sessions on the bike. The training was not accompanied by traffic safety information or any other attempt to change the behaviour of the cyclists.

First results of this study are presented here.

2 METHODS

2.1 Participants

We established contact with sports clubs in Saxony and Saxony-Anhalt in Germany. These clubs were situated in medium-sized towns in areas with a relatively flat topography. The sports clubs were selected according to certain prerequisites. There had to be a trainer who was willing to participate in the preparation course and to provide subsequent training sessions. The club had to have access to a gym or similar room and time available for two one-hour training sessions per week during the training period. The club had to agree with the procedure that selection of clubs for the intervention group and for the waiting-control group would be determined by chance.

Once enough clubs had been found, the training and control clubs were chosen at random from this pool. In the towns where the clubs were situated, participants were recruited via press releases issued by the TU Dresden, by the sports clubs, by all potential contact persons we knew of, and, if necessary, via paid newspaper ads. In one town there were two training groups in different parts of the town; in all other towns there was one group only. This means that in each town there were either only cyclists in a control group or only cyclists in an intervention group. Our intention with this was to minimize contact between the participants of the intervention groups and the control groups. It turned out that in two (rather small) towns with control groups not enough participants could be recruited. For this reason we had to choose two other (larger) towns instead.

All necessary costs for the training program were provided by the German Federal Ministry of Transport, Building and Urban Development, which funded the project. The training was therefore free of charge for the participants. The participants of the intervention groups and the control groups received a 100€ allowance. All participants had to undergo three test sessions (each with sports tests in the gym, a cycling course outside, questionnaires and cognitive testing). Additionally, persons in the intervention groups had to participate in the training regularly.

All participants were persons of 60 and older who did not cycle only for sports purposes but also for utility purposes. The participants were accepted in the order in which they contacted us. The maximum number of participants per training group was 21 persons. One group consisted of 10 persons only as the gymnastics room available for the training was small.

The test sessions took place as follows: Test Session 1 from January 8th to February 15th; Test Session 2 from June 26th to July 25th plus August 13th (due to the Elbe flooding some test sessions had to be postponed); Test Session 3 in September and October 2013. (The data of this session have not yet been analysed.)

Table 2 shows the demographic characteristics of the participants, Table 3 their cycling frequency.

Table 2. Age, proportion of women, persons living alone in a household and level of education per group, Test Session 1.

	Intervention group (N=146)	*Control group (N=167)*
Mean age (years)	*67.48*	*67.62*
Standard deviation of age (years)	*5.15*	*5.28*
Median age (years)	*68.00*	*68.00*
Maximum age (years)	*88.00*	*87.00*
Women	*45.2%*	*35.3%*
Persons living alone in household	*15.9%*	*21.6%*
School 8 years	*25.9%*	*21.6%*
School 9 years	*0.7%*	*0.6%*
School 10 years	*42.0%*	*46.3%*
University entrance exam	*30.8%*	*31.5%*
Other education	*0.7%*	

Table 3. Frequency of bike use per group, Test Session 1.

	Intervention group (N=146)	*Control group (N=167)*
Less than 1-2 times per month	*2.1%*	*3.6%*
1-2 times per month	*2.1%*	*3.6%*
1-2 times per week	*16.4%*	*22.2%*
3-4 times per week	*32.2%*	*22.8%*
Daily or nearly daily	*46.6%*	*51.5%*

2.2 Training

Figure 1. Photographs from the training sessions.

In December 2012 and January 2013 the trainers were given a one-day training session. They were provided with a handbook containing the exercises. The handbook will be available when the study is finished. The training for the participants of the intervention group took place for five months in one-hour sessions held twice a week. Figure 1 gives an impression of the trainings sessions.

2.3 Instruments to assess the effect of the training

Several instruments were used to assess the effect of the training on distance cycled and cycling safety.

2.3.1 Distance cycled. The distance cycled was determined by bicycle computers. The participants were asked to come to the test sessions with the bike they used for utility purposes. If this bike had no bicycle computer, one was mounted on the bike during Test Session 1. If necessary the computer was replaced during Test Session 2. If a participant phoned between the test sessions to report that the computer was out of order or had been lost, he or she was sent a new one by post. Participants could also get a computer for their second bike if necessary. Participants who had more than one bike were asked to record the distance cycled on all installed computers.

2.3.2 Physical difficulties. In a questionnaire we assessed the cycling habits of the participants, their behaviour in traffic, and their subjective problems. Participants were asked for their physical complaints, in general and when cycling, in the fields of motility, cardiovascular system, nerve system and muscle strength. The answers to these questions were given on a five-point rating scale.

In the questionnaire of Test Session 2, the participants of the intervention groups were asked to describe changes which had resulted from the training.

2.3.3 Difficulties in traffic situations. In the questionnaires we asked whether the participants had difficulties in a range of situations when cycling: getting on the bike; getting off the bike; keeping the handlebar under tight control; steering with one hand and signalling with the other hand at a turn; looking over their shoulder when turning; reacting fast if something unexpected happens; braking with pinpoint accuracy; steering with one hand; cycling on cobblestones; cycling exactly straight ahead; cycling curves; cycling slowly; cycling fast; cycling on ascending slopes; keeping balance on the bike. Here, the answers were also given on a five-point rating scale.

Figure 2. Photographs from the cycle course.

Table 4. Tasks in the bicycle course and their rating.

Task	***Rating***
Slalom	*1-2 faults:* *- leaving out or touching one cone* *- touching the ground with a foot*
Slow cycling within a marked lane	*1-2 faults:* *- touching the line with the front wheel* *- touching the ground with a foot* *plus: cycling time recorded with a stopwatch*
Dismounting to the left into a hula hoop	*1 fault:* *- missing the hula hoop*
Dismounting to the right into a hula hoop	*1 fault:* *- missing the hula hoop*
Narrow alley	*1 fault:* *- touching the line with the front wheel*
Turning to the off-side	*1-4 faults:* *- no turn around the shoulder* *- no hand-sign* *- not naming the number* *- touching the line with the front wheel*
Cycling an 8 with one hand on the handlebar	*1-3 faults:* *- touching the line with the front wheel* *- touching the ground with a foot* *- second hand on the handlebar*
Braking with pinpoint accuracy	*1-3 faults:* *- stopping before or behind the line* *- back wheel fish-tailing* *- jumping off the bike*

2.3.4 Motor competence. We used a cycling course which had been developed to test the motor competences of secondary school children after cycling training [5]. It consists of motor tasks which represent requirements when cycling in traffic. In addition, the course is well documented and has a high level of objectivity. In a pretest we determined that the older cyclists had difficulties getting off and on a bike three times within the predetermined distance. For this reason we reduced the number of times for getting off and on the bike from three to two. The persons who rated the performance of the cyclists in the course took part in a training session before each test session in order to improve the objectivity of their ratings. Table 4 shows the tasks in the cycling course and their rating. A task was rated as correct if no fault was made. Because of lack of space at some test locations the figure eight could not be tested at all locations. Figure 2 shows photographs from the cycle course.

The cycle course took place under very diverse weather conditions. In the first test period there was sometimes snow, sometimes ice and sometimes neither of them. The surface the participants cycled on had been cleared of snow and dirt beforehand and salted if necessary. If there was snow or ice, participants could choose to cycle to the test and back themselves or they and their bikes were driven to the test location by car.

2.3.5 More data sources

The effect of the training was assessed with further instruments. These data have not yet been analysed and are not presented here, but they include performance in a battery of tests of physical ability, questionnaires on the effect of the training on daily life besides mobility, ... Mobility diary: each person filled in a mobility diary twice a week according to a predetermined time scheme.

3 Results

3.1 Distance cycled

In Test Session 1, the participants were asked for the distance they cycled per year. Those who said that they knew the distance were asked for it. The others were asked to estimate the distance per week or per month or per year. The answers were given in five categories. Whenever two categories were chosen for different periods of time the longer period was assumed to be more valid. Estimating the distance cycled has the disadvantage that the estimates are only very rough. Many participants said that they were not able to estimate the distance cycled. Table 5 presents the results. The Man-Whitney U-test showed that the two groups did not differ in the cycled distance in Test Session 1.

Table 5. Estimated cycled distance per year, Test Session 1.

	Intervention group (N=107)		*Control group (N=117)*	
	Valid percent	*Cumulative percent*	*Valid percent*	*Cumulative percent*
up to 730 km	*14.0*	*14.0*	*15.4*	*15.4*
730-1800 km	*28.0*	*42.1*	*34.2*	*49.6*
1800-3600 km	*38.3*	*80.4*	*34.2*	*83.8*
3600-7300 km	*18.7*	*99.1*	*14.5*	*98.3*
> 7300 km	*.9*	*100.0*	*1.7*	*100.0*

The training did not affect the distance cycled (t-test for independent samples, p = .82). The mean distance cycled was 1,017 km (standard deviation 1,057 km, n = 122) in the intervention group and 918 km (standard deviation 895 km, n = 127) in the control group. The intervention group did not cycle more than the control group after the training.

3.2 Physical difficulties.

Ratings. In all questionnaires the participants were asked about physical problems, in general and when cycling, in four fields which might be affected by the training: motility, cardiovascular system, nerve system, and muscle strength. In addition, we also asked about problems with diabetes, vision, and hearing. Answers were given on five-point scales.

3.2.1 Rated physical difficulties in general.

The extent of reported physical difficulties in the four relevant fields and their mean value is presented in Table 6.

Table 6. Extent of reported physical difficulties in general (g) and when cycling (c) per test session (t1 = Test Session 1, t2 = Test Session 2) and group.

		Intervention group					*Control group*				
		N	*Mean*	*SD*	*Med.*	*Max.*	*N*	*Mean*	*SD*	*Med.*	*Max.*
Motility	*t1 g*	*146*	*2.03*	*1.006*	*2.00*	*5.00*	*162*	*1.91*	*.911*	*2.00*	*5.00*
	t2 g	*133*	*2.13*	*1.033*	*2.00*	*5.00*	*155*	*2.01*	*.993*	*2.00*	*5.00*
	t1 c	*145*	*1.82*	*.984*	*2.00*	*5.00*	*164*	*1.64*	*.798*	*1.00*	*4.00*
	t2 c	*131*	*1.69*	*.840*	*1.00*	*5.00*	*153*	*1.63*	*.910*	*1.00*	*5.00*
Cardio-vascular system	*t1 g*	*145*	*1.57*	*.856*	*1.00*	*5.00*	*168*	*1.48*	*.766*	*1.00*	*5.00*
	t2 g	*134*	*1.51*	*.743*	*1.00*	*4.00*	*156*	*1.43*	*.719*	*1.00*	*5.00*
	t1 c	*144*	*1.31*	*.653*	*1.00*	*4.00*	*168*	*1.26*	*.599*	*1.00*	*5.00*
	t2 c	*133*	*1.24*	*.510*	*1.00*	*3.00*	*155*	*1.21*	*.534*	*1.00*	*4.00*
Nerve system	*t1 g*	*146*	*1.20*	*.571*	*1.00*	*4.00*	*167*	*1.11*	*.411*	*1.00*	*3.00*
	t2 g	*133*	*1.21*	*.565*	*1.00*	*4.00*	*156*	*1.13*	*.517*	*1.00*	*4.00*
	t1 c	*146*	*1.13*	*.459*	*1.00*	*5.00*	*166*	*1.08*	*.388*	*1.00*	*4.00*
	t2 c	*133*	*1.14*	*.479*	*1.00*	*4.00*	*156*	*1.10*	*.437*	*1.00*	*4.00*
Muscle strength	*t1 g*	*147*	*1.93*	*.853*	*2.00*	*5.00*	*168*	*1.82*	*.887*	*2.00*	*5.00*
	t2 g	*134*	*1.62*	*.774*	*1.00*	*4.00*	*156*	*1.79*	*.848*	*2.00*	*5.00*
	t1 c	*143*	*1.60*	*.752*	*1.00*	*4.00*	*164*	*1.60*	*.789*	*1.00*	*4.00*
	t2 c	*131*	*1.40*	*.642*	*1.00*	*3.00*	*151*	*1.51*	*.747*	*1.00*	*4.00*
Mean value of problems	*t1 g*	*147*	*1.69*	*.597*	*1.50*	*4.25*	*168*	*1.58*	*.478*	*1.50*	*3.50*
	t2 g	*134*	*1.62*	*.551*	*1.50*	*3.50*	*156*	*1.59*	*.554*	*1.50*	*3.50*
	t1 c	*147*	*1.46*	*.495*	*1.25*	*3.50*	*168*	*1.39*	*.436*	*1.25*	*3.50*
	t2 c	*134*	*1.37*	*.446*	*1.25*	*3.33*	*156*	*1.36*	*.492*	*1.25*	*3.75*

Note. Med. = Median, Max = Maximum. All minimum values were 1. The mean value of problems is calculated as the mean of the values in the four fields motility, cardiovascular system, nerve system, and muscle strength.

For the mean value of the problems in the four fields we expect to be affected by the training there was a significant interaction between test session and group with a very small effect size. Tables 7 and 8 show the results of the GLM analysis. As women and men have different crash risks in traffic, the effect of gender was taken into account. Neither a main effect of gender nor an interaction with training was determined. The same was found for age.

A close look at the four fields in which problems were assessed showed that a significant interaction between group and test session could be found for muscle strength only. Tables 9 and 10 show the results of the GLM analysis for muscle strength. Again, the effect was very small.

3.2.2 Rated physical difficulties when cycling.

No interaction was found for the reported physical problems when cycling, neither for the mean value of the problems in the four fields nor for any of the fields. This means that the participants in the training group did not improve their performance more than the control group.

Table 7. Analysis of the effects on the mean value of physical problems in the fields motility, cardiovascular system, nerve system and muscle strength. Tests of within-subjects effects (Greenhouse-Geisser). Intervention group: N = 134, Control group N = 156.

	Type III Sum of Squares	*df*	*Mean Square*	*F*	*Signifi-cance*	*Partial Eta Squared*
Test session	*.152*	*1*	*.152*	*1.735*	*.189*	*.006*
*Test session * gender*	*.206*	*1*	*.206*	*2.352*	*.126*	*.008*
*Test session * age*	*.115*	*1*	*.115*	*1.319*	*.252*	*.005*
*Test session * group*	*.402*	*1*	*.402*	*4.600*	*.033*	*.016*
Error (test session)	*25.012*	*286*	*.087*			

Note. Answers were given on a rating scale from 1 = not at all to 5 = very much.

Table 8. Analysis of the effects on the mean value of physical problems in the fields motility, cardiovascular system, nerve system and muscle strength. Tests of between-subjects effects (Greenhouse-Geisser). Intervention group: *N* = 134, Control group *N* = 156.

Source	*Type III Sum of Squares*	*df*	*Mean Square*	*F*	*Signifi-cance*	*Partial Eta Squared*
Intercept	*8.817*	*1*	*8.817*	*17.133*	*.000*	*.057*
Gender	*.237*	*1*	*.237*	*.461*	*.498*	*.002*
Age	*.018*	*1*	*.018*	*.034*	*.854*	*.000*
Group	*1.023*	*1*	*1.023*	*1.989*	*.160*	*.007*
Error	*147.187*	*286*	*.515*			

Note. Answers were given on a rating scale from 1 = not at all to 5 = very much.

Table 9. Analysis of the effects on muscle strength. Tests of within-subjects effects (Greenhouse-Geisser). Intervention group: N = 134, Control group N = 156.

	Type III Sum of Squares	*df*	*Mean Square*	*F*	*Signifi-cance*	*Partial Eta Squared*
Test session	*.005*	*1*	*.005*	*.016*	*.900*	.000
*Test session * gender*	*.031*	*1*	*.031*	*.105*	*.747*	.000
*Test session * age*	*.028*	*1*	*.028*	*.095*	*.758*	.000
*Test session * group*	*3.145*	*1*	*3.145*	*10.585*	*.001*	.036
Error (test session)	*84.978*	*286*	*.297*			

Note. Answers were given on a rating scale from 1 = not at all to 5 = very much.

Table 10. Analysis of the effects on muscle strength. Tests of between-subjects effects (Greenhouse-Geisser). Intervention group: *N* = 134, Control group *N* = 156.

Source	*Type III Sum of Squares*	*df*	*Mean Square*	*F*	*Significance*	*Partial Eta Squared*
Intercept	*.218*	*1*	*.218*	*.195*	*.659*	*.001*
Gender	*.853*	*1*	*.853*	*.765*	*.383*	*.003*
Age	*8.437*	*1*	*8.437*	*7.561*	*.006*	*.026*
Group	*.018*	*1*	*.018*	*.016*	*.898*	*.000*
Error	*319.156*	*286*	*1.116*			

Note. Answers were given on a rating scale from 1 = not at all to 5 = very much.

3.2.2 Reported training effects in free-form answers.

At the end of the questionnaire filled in at Test Session 2, the participants of the intervention group were asked what had changed as a result of the training and were invited to give free-form answers. These answers were content analysed and showed the following results.

Twenty-one persons said that their motility had improved, three more persons said that it had improved somewhat. Three more persons said that it was easier for them to get on and off the bike; one said that he or she turned round more often before a turn; another person said that turning round had become easier.

Two persons said that their physical state had improved in general; six persons that their endurance had improved. Fifteen persons said that they were fitter; two more persons somewhat fitter. One person said that he or she had developed stronger muscles; one person said that he or she had developed stronger muscles in the neck. One person said that his or her posture had improved, another person that his or her body tension had improved. Fifteen persons said that their balance was better than before, two that it had not decreased. Thirteen persons said that they were safer in general; one person said that he or she was somewhat safer, one in some situations; one felt safe enough to cycle into the town centre. Four persons said that their reactions had become faster.

A number of persons said that nothing had changed. Fourteen persons said that nothing had changed; one person nothing or very little. These persons gave no further explanations. Some persons made comments about why they thought that nothing had changed. Five had already cycled a lot before; five did a lot of sport. One person said that he or she had often not attended the training sessions for health reasons; one person said that the exercises had been too difficult. Three more persons said that little had changed because they had already been very active before.

Eight persons said that they cycled more than before; one person that he or she tried to cycle more. Six persons said that they had more fun when cycling.

Some participants also made remarks about changes which were not intended by the training program. Six persons said that they paid more attention or rode more carefully. Three persons had bought helmets; two of them used their helmets regularly; one person only when going on cycle tours. Two persons said that they respected the traffic regulations more than before; three participants said that they had met nice cyclists at the training sessions.

3.3 Difficulties in traffic situations.

Table 11 shows the difficulties in different traffic situations reported in the questionnaires. No interaction between group and test session was found in the expected direction. The participants in the intervention group did not improve their performance more than those in the control group. The results showed one effect that was the opposite of the expected direction.

The participants in the intervention group reported relatively more difficulties after the training when cycling on cobblestones.

Table 11. Reported difficulties in different traffic situations in Test Session 1 (t1) and Test Session 2 (t2) for the intervention group and the control group.

		Intervention group					*Control group*				
Traffic situation		*N*	*Mean*	*Med.*	*SD*	*Max.*	*N*	*Mean*	*Med.*	*SD*	*Max.*
getting on the bike	*t1*	*145*	*1.24*	*1*	*.627*	*4*	*167*	*1.35*	*1*	*.975*	*5*
	t2	*133*	*1.34*	*1*	*.602*	*3*	*155*	*1.34*	*1*	*.649*	*5*
getting off the bike	*t1*	*145*	*1.22*	*1*	*.546*	*4*	*167*	*1.27*	*1*	*.615*	*4*
	t2	*133*	*1.33*	*1*	*.560*	*3*	*154*	*1.32*	*1*	*.644*	*4*
keeping handlebar under tight control	*t1*	*145*	*1.09*	*1*	*.470*	*5*	*167*	*1.09*	*1*	*.326*	*3*
	t2	*133*	*1.10*	*1*	*.298*	*2*	*155*	*1.08*	*1*	*.341*	*3*
steering with one hand and signalling with the other hand at a turn	*t1*	*145*	*1.19*	*1*	*.514*	*4*	*167*	*1.20*	*1*	*.533*	*4*
	t2	*133*	*1.22*	*1*	*.541*	*4*	*155*	*1.25*	*1*	*.596*	*4*
looking over shoulder when turning	*t1*	*145*	*1.94*	*2*	*1.072*	*5*	*167*	*1.90*	*2*	*1.062*	*5*
	t2	*133*	*1.93*	*2*	*.855*	*4*	*155*	*1.97*	*2*	*.983*	*5*
reacting fast if something unexpected happens	*t1*	*145*	*1.57*	*1*	*.752*	*4*	*166*	*1.60*	*1*	*.831*	*5*
	t2	*133*	*1.51*	*1*	*.658*	*4*	*155*	*1.46*	*1*	*.705*	*5*
braking with pinpoint accuracy	*t1*	*142*	*1.34*	*1*	*.640*	*4*	*167*	*1.34*	*1*	*.587*	*4*
	t2	*133*	*1.40*	*1*	*.651*	*3*	*155*	*1.37*	*1*	*.684*	*5*
steering with one hand	*t1*	*144*	*1.35*	*1*	*.640*	*4*	*167*	*1.45*	*1*	*.876*	*5*
	t2	*133*	*1.40*	*1*	*.748*	*5*	*155*	*1.42*	*1*	*.780*	*5*
cycling on cobblestones	*t1*	*143*	*1.66*	*1*	*.796*	*4*	*167*	*1.79*	*2*	*.891*	*5*
	t2	*133*	*1.90*	*2*	*.878*	*5*	*155*	*1.69*	*1*	*.826*	*4*
cycling exactly straight ahead	*t1*	*143*	*1.27*	*1*	*.593*	*4*	*167*	*1.24*	*1*	*.551*	*4*
	t2	*133*	*1.34*	*1*	*.602*	*4*	*155*	*1.30*	*1*	*.648*	*5*
cycling curves	*t1*	*144*	*1.33*	*1*	*.657*	*4*	*167*	*1.24*	*1*	*.529*	*3*
	t2	*133*	*1.40*	*1*	*.651*	*4*	*155*	*1.32*	*1*	*.611*	*4*
cycling slowly	*t1*	*144*	*1.26*	*1*	*.645*	*5*	*166*	*1.24*	*1*	*.625*	*5*
	t2	*133*	*1.29*	*1*	*.561*	*4*	*155*	*1.22*	*1*	*.526*	*4*
cycling fast	*t1*	*144*	*1.39*	*1*	*.740*	*4*	*166*	*1.36*	*1*	*.732*	*5*
	t2	*133*	*1.38*	*1*	*.682*	*4*	*155*	*1.28*	*1*	*.598*	*4*
cycling on ascending slopes	*t1*	*144*	*1.88*	*2*	*.974*	*5*	*166*	*1.78*	*1*	*.985*	*4*
	t2	*133*	*2.04*	*2*	*.924*	*5*	*155*	*1.93*	*2*	*1.001*	*5*
keeping balance on the bike	*t1*	*145*	*1.26*	*1*	*.575*	*4*	*167*	*1.22*	*1*	*.542*	*4*
	t2	*133*	*1.24*	*1*	*.510*	*4*	*155*	*1.18*	*1*	*.503*	*4*

Note. Answers were given on a rating scale from 1 = not difficult to 5 = very difficult. Note. Med. = Median, Max = Maximum. All minimum values were 1.

3.4 Motor competence.

Table 12 shows the results of the cycling course. There was no significant interaction between test session and group, neither for the performance in general nor for a single task. This means that the participants in the intervention group did not improve their performance more than the control group.

***Table 12**. Proportion of participants accomplishing a task in the cycle course correctly for Test Session 1 (t1) and Test Session 2 (t2) per group.*

Task	*Test session*	*Intervention group*		*Control group*	
		N		*N*	
Slalom	*t1*	*140*	*74 %*	*157*	*73%*
	t2	*130*	*63 %*	*150*	*65%*
Slow cycling within a marked lane	*t1*	*140*	*86 %*	*157*	*92%*
	t2	*131*	*89 %*	*150*	*94%*
Dismounting to the left into a hula hoop	*t1*	*140*	*69 %*	*160*	*67%*
	t2	*130*	*72 %*	*150*	*72%*
Dismounting to the right into a hula hoop	*t1*	*138*	*71 %*	*158*	*74%*
	t2	*129*	*82 %*	*150*	*80%*
Narrow alley	*t1*	*140*	*71 %*	*159*	*74%*
	t2	*131*	*61 %*	*150*	*75%*
Turning to the off-side	*t1*	*137*	*61 %*	*159*	*43%*
	t2	*131*	*69 %*	*150*	*64%*
Braking with pinpoint accuracy	*t1*	*140*	*74 %*	*159*	*69%*
	t2	*131*	*79 %*	*150*	*73%*

4 CONCLUSIONS

The preliminary analysis of the data indicates that sports training without accompanying measures leads to an improvement in the physical state of older cyclists. But sports training cannot be expected to improve the safety of persons who already cycled a lot before the training program.

Training had no effect on the distance cycled. This may be due to the fact that all persons already cycled quite a lot before the study started. In this respect most persons were probably close to their personal ceiling. The free-form answers of only few persons indicate that they now cycle more than before. Some stressed that they had already been very active cyclists. On the other hand, these persons are probably representative for potential participants of a training program for cyclists. Persons who cycle relatively little probably do not feel attracted by such an offer.

The ratings in the questionnaire show that the training had a very small effect on the mean of reported physical problems in general and on the reported problems with muscle strength in general. There was no effect on physical problems when cycling.

The free-form answers present a different and much more positive picture. Ten to twenty per cent of the participants felt that their motility or their fitness had improved. This shows positive effects but these cannot be found in the ratings. There might be several reasons for this discrepancy. The ratings of physical complaints were already very low in Test Session 1. They might generally be influenced by an optimistic self-perception and self-presentation [6]. The free-form answers which did not ask for an "absolute" rating but for a development might be more suitable to assess the perceived effects. Statements about positive changes might be more compatible with a view of one's own competence than negative state ratings. We tried to take this reasoning into account in the assessment Test Session 3.

Our sample felt relatively healthy. This may be due to self-selection effects. Only relatively healthy persons are willing to participate in a study which demands three test sessions within a year. Older persons who cycle might be relatively healthy in general, partly as a consequence of cycling [7], partly because severe physical problems are a reason to give up cycling. The participants might also have a rather positive view of their state of health.

All reported difficulties - in general, when cycling, and in different traffic situations – are relatively small. This shows that the cyclists feel relatively unimpaired and relatively competent. Such positive self-perception is also typical for older drivers [8]. A positive attitude towards one's own competence can also be found in the bias that drivers typically consider themselves to be better-than-average drivers [e.g. 9]: The vast majority of car drivers consider themselves to be better-than-average drivers. Considering the positive self perception of the participants of the study, it is surprising how many faults were registered in the cycle course.

Performance in the cycle course was not improved by the training. In contrast to the cycled distance and the relatively small reported problems, performance in the cycle course was far enough from a performance ceiling to leave room for improvements as a result of training. At present, it can only be speculated that the participants were not motivated or not able to improve their performance in the cycle course. If they are subjectively unimpaired in traffic and successful why should they bother to look over their shoulders properly in traffic?

Questions which remain open are: What leads to cyclists reporting physical complaints when cycling? Under which conditions do they feel less safe in traffic because of these complaints? What motivates them to transfer improvements of their physical state to behaviour in traffic?

The preliminary analysis of the data showed some benefits of the training for the physical condition of the cyclists. In order to also achieve benefits for traffic safety, some extra measures should be considered for further training programs. For example, cyclists might be given explicit feedback on their performance in the cycle course.

Even if the training improves the general well-being of cyclists, it does not necessarily improve their traffic safety. If this aim is to be achieved, additional measures are required. After initial sports training, additional training sessions on the bike which concentrate on transfer in traffic might be useful. Cyclists cannot be expected to transfer improvement in physical fitness into safer behaviour in traffic without further encouragement and training.

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