

Medical Profile of a Senior World Record Holder

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Abstract

The runner Fokke Kramer is reported on, who won several popular races as well as middle-distance races at the regional level in his youth. Later, he worked as a physical education teacher. He started regular long-distance training at the age of 70 and then participated in various national competitions (from 5km to marathon). His running times improved until the age of 75, after which only a slight decrease in performance was noticeable. In sports medical examinations at the age of 77, he showed good performance on a spiro ergometer (on a stationary bike): Maximum performance 221 watts with a maximum heart rate of 132 beats/minute. The maximum output corresponds to 3.6 watts/kg/ body weight. The ventilation was 14 l/min at rest and 114 l/min at maximum exertion. The maximum oxygen uptake was 37.1ml/kg/min. Orthopaedic problems existed in the knee joints (varus knee osteoarthritis) and in the feet (hallux valgus). Fokke Kramer became German champion several times in the corresponding age groups, later also European champion and gold medallist at the World Championships for seniors in Torun and Gothenburg. Now he is the world record holder (M 85) for 5km and 10km.

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Introduction

While many studies show that sports have a positive impact on the health of younger people, the question for older individuals is whether physical exertion and regular sports can also have positive-or perhaps detrimental effects. In particular, competitive and performance sports among older people could lead to physical problems. Nevertheless, in old persons the importance and enjoyment of competition was reported. The role of competition was found to enable older adults to value sport participation or also to distinguish themselves from older adults who did not play competitive sport [1]. However, extraordinary athletic performances are not to be expected from older people: The age-related decline in speed, in maximum strength, in flexibility and anaerobic performance sometimes is accompanied by degenerative limitations of the musculoskeletal system or by other chronic diseases of the internal organs or by neurological deficits or other health disorders that increase with age. This report now describes an older athlete who started high-performance sports at the age of 70 and has since become a multiple world champion and world record holder in his age group. He is, so to speak, the 'test mouse' that shows what regular training in old age can achieve despite certain physical deficiencies. It is a case study; because a study with a participant group subjected to such training could have dangerous health effects on some participants.

Case Study

An active life into old age is for everyone. Here we describe the profile of a senior world record holder Fokke Kramer (F.K.) who has regularly participated in sports since his youth. The now 87-year-old runner currently holds the world record in his age group for 5000m and 10000m as well as for the 10km road race. In his youth, F.K. was a member of a swimming club for some years; later he also trained handball, soccer, tennis, gymnastics, athletics and skiing. As a teenager, he often ran alone in the woods. He regularly participated in running competitions, achieving times of 2 minutes 43 seconds for 1000m, 4 minutes 17 seconds for

1500m and 9 minutes 27 seconds for 3000m. As a student of sports and English for teaching, he continued to take part in regional races and as a teacher, he ran with his students 1 to 3km several times a week. Additionally, he jogged regularly with his dog for 20-30 minutes, totalling about 10-15km per week. At the age of 69, he began systematic running training and participated for the first time in a longer running event (half marathon). At 70 years old, he completed his first marathon in a time of 3 hours and 51 minutes

(see Table 1). Starting from his 73rd year of life, F.K. ran every other day following a defined training plan from a book, beginning with about 10km per day. He alternated between endurance runs and interval runs. His weekly running distance was at least 40km. He further trained according to a plan for a marathon, which included longer runs (20km, 24km, 30km, up to 32km) every other week (Figure 1).



Figure 1: Fokke Kramer at the age of 84 during the half marathon in “Timmendorf/Germany” in cold wind (Time 1 h 51 minutes).

Table 1: Running times of F.K. at official championships from the age of 70 to 86 years. The times are not exactly comparable due to different conditions (wind, inclines, temperature). For example, during the world record runs (M 85) in “Hamburg” (10,000 on the track) and in “Kiel” (5,000m on the track), the temperatures exceeded 30 °C, which is why these times are worse than the preceding road race in “Kaltenkirchen”. The even poorer time of (56:34) in “Gothenburg” was due to the difficult course with many inclines.

Age	Place of Competition	5000m	10km/10000m	21.1km	42,2km
70	Salzburg/Austria				3 h 51 min
75	Hamburg/Germany	22 min 35 sec			
76	Hamburg/Germany				3 h 35 min
77	Husum/Germany			1 h 38 min	
78	Ratekau/Germany		45 min 11 sec	1 h 45 min	
80	Uelzen/Germany			1 h 44 min	

	Düsseldorf/Germany				3 h 41 min
	Hamburg/Germany		48 min 42 sec		
81	Torun/Poland		46 min 34 sec *	1 h 44 min *	
	Siegburg/Germany		47 min 56 sec		
	Hamburg/Germany		48 min 33 sec		
	Kiel Altenholz/ Germany		47 min 02 sec		
83	Uelzen/Germany		47 min 26 sec		
	Hamburg/Germany			1 h 44 min	
84	Timmendorf/Germany			1 h 51 min	
85	Hamburg/Germany				3 h 57 Min +
	Kaltenkirchen/ Germany		48 min 57 sec #		
	Hamburg/Germany		50 min 08 sec #		
	Kiel/Germany	23 min 51 sec #			
86	Gothenburg/Sweden	24 min 24 sec *	56 min 34 sec *		

Symbols: * = Gold medal, + = European record, # = World record.

From a table of a book, he estimated a maximum heart rate of 150 beats per minute for himself and maintained a training pulse of 105 to 120 in endurance zone I, up to 127 in endurance zone II and above that in endurance zone III. He does not engage in targeted gymnastics, but every morning he performs stretching exercises for his legs in bed in a supine position for about 20 minutes, especially for the sacroiliac joint and to improve hip rotation. Isometric contractions of the back and trunk muscles for 3x3 seconds follow the stretching. F.K. improved his running times in competitions year after year or was able to maintain his performances over many years. He became German champion several times in the corresponding age groups, later also European champion and gold medallist at the World Championships for seniors in "Torun" and "Gothenburg".

Medical Problems and Orthopaedic Findings

A. Knee: F.K. underwent surgery on the left meniscus at the age of 55. During an orthopaedic examination at the age of 77, a bilateral genu varum (bowlegs) with 6cm distance between the condyles, a more pronounced medial osteoarthritis on the left than on the right knee and a knee extension deficit of 10-15 degrees were diagnosed. At the age of 78, a knee operation was performed on the right due to meniscus damage with cartilage smoothing and the training break lasted for 2 months.

B. Tendon: At the age of 79, right after the mountain run at "Großer Arber", a tear of the anterior tibial muscle occurred with a rupture on the inside of the left foot. A surgery was performed and a plastic boot was applied. After 5 months, F.K. started training again.

C. Calf: At the age of 80, F.K. had to take a two-week break due to a swollen calf and calf pain. The pain occurred during a 5000m race on the track because he wanted to run with spikes for the first time for 50 years. After the race, all the toenails showed bruises. Sono graphically, a thrombosis was ruled out.

D. Spine: In the following years, pain in the sacroiliac joint or in the lumbar spine occurred several times.

E. Feet: His feet showed the following orthopaedic findings: shoe soles worn down at the outside of the heel. The longitudinal arch of the foot was markedly pronounced, almost like a hollow foot, but with only slight splayfoot and some claw toe formation on both sides. Hallux valgus of 20 degrees on the left and 10 degrees on the right. At the medial side of the big toe's base joint was a bony exostosis with slight redness, more on the right than the left. Furthermore: Hallux rigidus bilaterally with limited mobility in the big toe's base joint (10 degrees dorsal extension, 5 degrees flexion), but not painful. No redness or swelling of the other toe joints, no pain with end-range movement. The therapy of the Hallux valgus was conducted with a Hallux valgus night splint and a plastic wedge placed between the first and second toes for daytime use. Additionally, insoles with a retro capital pellet were prescribed, along with a slight elevation of the outer edge by 3mm to compensate for medial knee stress. His running shoes had a sole with a good toe roll, so an additional forefoot roll-on aid or stiffening of the insoles were not necessary.

F. Chronic wound: At the age of 83, F.K. ran 1500m in 6 minutes and 28 seconds. He subsequently noticed a pea-sized callus on the skin located at the medial side of the second toe's base, in contact with the big toe. Probably there was a strong contact between first and second toe during the race. This callus was painful longtime and developed over the next few months into a chronic open wound.

Heart Problems and Cardio Pulmonal Investigation

Heart: At the age of 72, he noticed a high pulse before starting. During an examination, arrhythmias (atrial fibrillation) were diagnosed. At the ages of 75 and 76, an ablation was performed each time. One year later, a stable sinus rhythm has been observed and he was able to discontinue the blood thinner.

At the age of 77, a spiroergometry test (Figure 2) was carried out on F.K. The following data were obtained: Body height 176cm, weight 61kg, BMI 19.7. The heart was unremarkable, resting pulse was 48 beats/minute, blood pressure 110/80mm Hg. The ECG showed a sinus rhythm with pronounced T-waves over the anterior

wall. Lung function: The forced vital capacity of 4.97 l significantly exceeds the age-appropriate norm of 3.93 l. The one-second capacity is 3.42 l/second, corresponding to a one-second capacity of 69%. PEF and MEF 75 were reduced, possibly due to not quite optimal test execution. MEF 50 and MEF 25 were unremarkable.

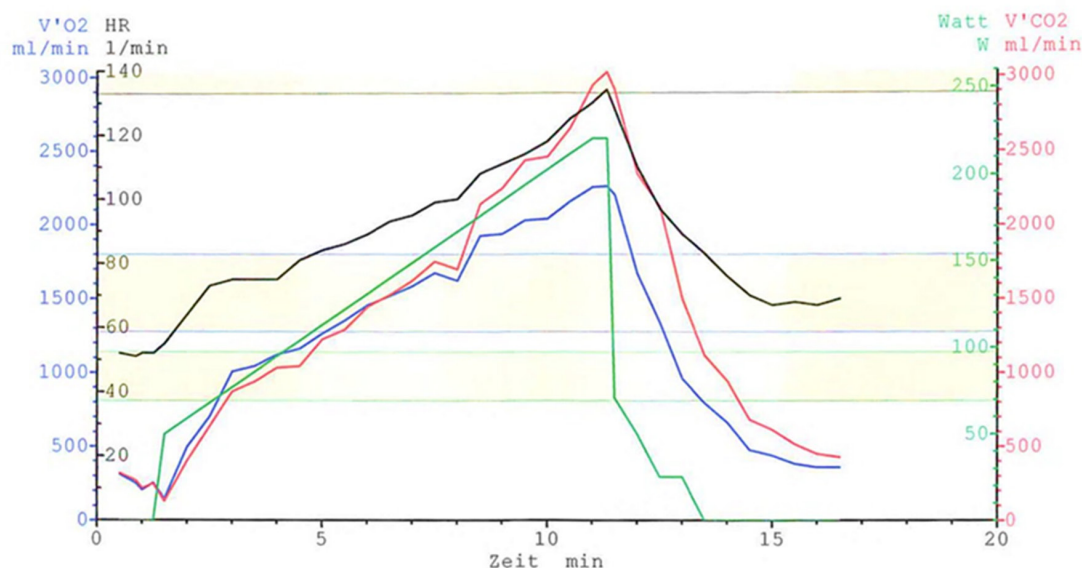


Figure 2: Spiroergometry sitting on a bike of F.K. at the age of 77. Oxygen uptake (blue) and CO₂ release (red) intersect at 6 minutes and 30 seconds, corresponding to the aerobic-anaerobic threshold. It shows that F.K. can produce a lot of lactates with further increases in load, meaning that the athlete can still get really sour despite his advanced age. This capability is actually supposed to decrease with age. But regarding F.K. it is possible that his training in the anaerobic range, which he conducted due to a (as indicated in the table) higher maximum heart rate, has preserved this ability. Black curve: heart rate, green curve: watts.

The spiroergometry exercise was performed sitting upright on a cycle ergometer with a ramp-like increase in intensity (9 watts increase every 30 seconds), starting at 50 watts up to a maximum output of 221 watts with a maximum heart rate of 132 beats/minute. The blood pressure rose to a maximum value of 201/81mm Hg. The maximum output corresponds to 3.6 watts/kg body weight. The discontinuation of the spiroergometry was due to knee pain and exhaustion of the athlete (Borg scale 19). The ventilation was 14 l/min at rest and 114 l/min at maximum exertion. The maximum oxygen uptake was 37.1ml/kg/min.

The aerobic-anaerobic transition was reached after 6 minutes and 30 seconds at a load of 140 watts (during which the heart rate was 94 beats/minute). The respiratory quotient (RER) rose from 0.98 at rest to 1.34 at maximum load. After the load was discontinued, even a RER of 1.58 was reached. After 5 minutes of recovery, this value fell to 1.19. The 12-lead ECG showed no signs of ischemia or arrhythmias. Only the amplitude of the T-waves increased slightly and during the recovery phase, occasional ventricular extrasystoles occurred. According to the age-appropriate normal curve, the athlete F.K. exceeds the watt output by 165%, the oxygen uptake by 47%, and the minute ventilation by 40% of the target value.

Discussion

Generally, anaerobic performance is decreasing with age [2]. Specifically, it appears that morphological (decreased muscle mass, type II muscle fiber atrophy), muscle contractile property (decreased rate of force development) and biochemical changes (changes in enzyme activity, decreased lactate production) may explain the decreased anaerobic performance in master athletes. The age-related decrease in both anaerobic work performance measured using cycle ergometry and sports performance in master athletes may be due to changes in one or more of the factors that influence anaerobic performance [2]. The reduction in anaerobic work capacity and subsequent performance may largely be the result of physiological changes that are an inevitable result of the aging process, although their effects may be minimized by continuing specific high-intensity resistance or sprint training [2].

But the middle-distance to marathon runner F.K., who has been regularly running longer distances for 7 years, did not perform any strength or sprint training. His high anaerobic values at the age of 77 during spiroergometry (RER over 1.58 after the end of exercise) are very unusual. However, F.K. primarily trained his long-term endurance while running, but he also integrated

sometimes anaerobic training sessions: At the age of 78, he wanted to participate in a mountain run and therefore ran a slope of 21 meters in altitude over 200 meters every other day for three months, starting with 10 repetitions until he eventually reached 35 repetitions after a few weeks. Then he won the German Mountain-Running Championship in the M75 age group at the "Großer Arber/Germany" in 1:36:20 hours. This 13.8 km course included a height difference of 887 meters.

Ultimately, it remains unclear why F.K. exhibits a high anaerobic capacity at his age: Likely, alongside factors of heredity and consistent training, biochemical factors (substrate availability, efficiency of metabolic pathways, aerobic energy system contribution, accumulation of reaction products [2]) could also play a role in his outstanding performances. There may be effects of regular, lifelong training, that there are no age-related differences of young (18-33 years) and older (53-77 years) national and international level sprint runners in fiber type distribution when comparing the types I, IIA and IIB fiber composition [2]. These data agree with earlier findings where no significant difference in fiber composition was observed between chronically (>35 years) trained sprint- or endurance-trained masters runners and training volume and body mass-matched younger runners [2].

However, the thigh and calf muscles of F.K. are exceedingly thin, corresponding to his low body weight, so that training-induced muscle hypertrophy is unlikely in his case. The spiroergometry data also showed that F.K. showed slightly lower performance in longer distances (marathon). After conducting the spiroergometry, it was found that F.K. had been training in a too high load range in previous years, because his measured heart rate at peak exertion was only 132 and not, as he had previously estimated from tables, 150 beats per minute. This shows that the tables only represent a statistical average and provide incorrect values for at least 30-40 percent of athletes. As a result, F.K. trained in a more intense area for several years, particularly enhancing or at least maintaining his anaerobic capacity, which is the ability to produce lactate. On the other side, for many older persons it could be dangerous to train in high performance levels, especially if they have unknown heart problems. Therefore, it is necessary to point out that even older athletes should undergo cardiopulmonary examinations regularly. Therefore, a stress ECG or spiroergometry would be very beneficial for every ambitious athlete-especially those over 40 years old.

An important note in this article is the heart problem (i.e. the atrial fibrillation) of F.K., which occurred after the onset of his intensive training. Atrial fibrillation is more common in endurance athletes than in non-athletes, especially as they age. Many causes for the occurrence of atrial fibrillation are described [3,4]. One cause may be that the atria of the heart do not have as many muscle layers as the ventricles; and with increasing hypertrophy, the walls of the atria could then become 'stretched out'. On the other hand, athletes tend to not interrupt their training programs even during infections. The consequence of this behaviour can be a myocarditis, which also affects the nerve fibers embedded in the endocardium. The outstanding running performance of F.K. is mainly due to his

genetic predisposition, but also to his regular physical activity and to a consistent training discipline. Special attention must be paid to his low body weight (61kg): This not only contributes to his performances but also ensures that the joints can withstand the running strain of several thousand kilometers per year. In particular, his knee joints that suffer from a varus deformity, from a missing meniscus, from a limitation of extension and additionally from noticeable cartilage wear, have withstood the mechanical peak loads for many years due to the low body weight.

When considering a metanalysis, the overall prevalence of hip and knee Osteoarthritis (OA) is 13.3% in competitive runners, 3.5% in recreational runners and 10.2% in controls [4]. But also, the period of the training influences an arthrosis: the exposure to running of less than 15 years is associated with a lower association with hip and/or knee OA compared with controls. Especially recreational runners have a lower occurrence of OA compared with competitive runners-and even lower compared with unsporty controls [5]. Regarding F.K., this could be consistent with his lower training volume (compared to high-performance runners) and with the relatively late start of his competitive career at the age of 70.

It has to be mentioned, that a marathon run itself does not appear to cause a damage to the knee joint [6]. The MRI scans showed no cartilage damage after the race, apart from some retro patellar changes [7,8]. It should be noted that F.K. is a forefoot runner, not because he has chosen to be, but because the extension deficits of the knee joints make heel running impossible. This means a stronger forefoot load. But F.K. was also able to compensate for his foot deformities with his sports shoes and insoles. Especially the toe roll (an integrated forefoot rolls typically found in sports shoes) helps him: it allows him to compensate for the limited mobility in the big toe joint. Only when F.K. participated in track competitions and wore flat spike shoes (that do not have a toe roll), he complained about severe foot pain and discomfort.

Conclusion

Many people smile when they hear about an 85-year-old world record holder. However, in a 10km race, when they are overtaken by this athlete, they gain respect. Therefore, this case of F.K. is an example of how regular training, along with maintaining a slim body weight-in addition to genetic predispositions-can help sustain high performance in old age. Especially for older people, maintaining mobility and the ability to perform tasks is important to prevent the need for care. Therefore, it is especially recommended for older people to engage in regular endurance, strength and flexibility training. They should be monitored by doctors and undergo regular physical examinations. Any potential impairments should be treated and possible physical risks minimized. Poor health as a limitation to participation is a unique determinant for this age group and needs to be taken into consideration. As such, to enable older adults to derive the health benefits sport can provide, age-appropriate playing opportunities are required, especially in more exertive sports, to accommodate for older adults who may have age related reduced physical capabilities. However, previous research has highlighted that many sports do not prioritise older adults

specifically, but there is an opportunity for sport to be promoted as a novel intervention for health promotion in older adults [1].

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