

Three Norwegian brothers all European 1500 m champions: What is the secret?

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Abstract

The aim of this study was to analyse the performance development and training structure of three Norwegian brothers, HI, FI and JI who are all European 1500 m champions, and to examine to what extent training, environment and family support has been decisive in their development. Their performance development and training from the age of 13 was examined through analysis of the Norwegian Athletic Federation (Norges Friidrettsforbund) all-time best results for boys in 800 m and 1500 m; analysis of training diaries; observation of training sessions; and dialogue with the three runners, their father and coach and their mother. All three were very physically active from a young age, and they have taken part in different sports. In the preparation period leading up to the 2018 and 2019 seasons, these three athletes ran an average of 140–160 km·week⁻¹, with 23–25% at and above anaerobic threshold pace. Training intensity was monitored and controlled via blood lactate measurements taken during all interval sessions. Throughout childhood and adolescence, the boys were highly motivated and strongly encouraged to take part in sport and training by their close family. All the three were coached by their father. An active childhood, a gradual progression in training volume, strong family support, mental toughness, a high volume of training at and above anaerobic threshold, and mindful monitoring and regulation of training intensity have brought these brothers to a top international level in distance running.

Keywords

Family support, mental toughness, parents, principles of training, siblings, talent development, track-and-field coaching

Introduction

A 17-year-old Norwegian boy (JI) winning the 1500 m and the 5000 m in the European Athletic Championships in Berlin in August 2018 was both unexpected and sensational. In the international sports press, great interest has arisen around the fact that two of his older brothers are also former European 1500 m Champions and at top international level in distance running. So what is the secret behind the training and the athletic development of these three brothers?

Performance in distance running events is influenced by multiple physiological factors, such as maximal oxygen uptake (VO_{2max}),^{1–3} utilization of maximal oxygen uptake,^{4,5} running economy,^{2,6,7} velocity at the anaerobic threshold,^{8,9} velocity at VO_{2max} ,^{3,10,11} anaerobic power, muscular strength and neuromuscular characteristics.¹² How to develop the above-mentioned physiological factors and performance is a topic of much discussion.^{13,14} It is also debated whether long-term success in elite sports can be predicted from performance in youth competitions,^{15,16} and to what extent genes¹⁷ or environment plays the most important

role in talent development.¹⁸ According to Simonton,¹⁹ talent emerges from a multidisciplinary, multiplicative and dynamic process and is likely to operate as a complex system beyond the environmental and gender debate. Simonton¹⁹ based the analysis of talent or giftedness on a mathematical model that explained the development of talent. Different factors in the model were weighted by relevance and included genetic dispositions (e.g. endurance capacity), environmental (e.g. social and family support) and development constraints (e.g. structure of training and competition program). However, ‘...to what extent a specific gift

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operates according to emergenic inheritance and epigenetic development is, however, far more prodigious than implied by most dictionary definitions'.²⁰

Johnson et al.²¹ provided support for a four-factor model explaining elite athletic development based on a study of 8 elite and 11 sub-elite swimmers, confirmed by data from coaches and parents. According to the four-factor model, talent defined as (1) physical and psychological predispositions, has to interact with (2) high and appropriate workloads, (3) a supportive environment and (4) facilitative coping strategies. The four-factor model is in line with factors that Mallett and Harrahan²² associated with elite track and field athletes who were found to have high motivation with personal goals and achievement, high self-belief and athletics being a central part of the athletes' lives.

The aim of this study was to analyse the performance development and training structure during adolescence of the above-mentioned brothers and to examine to what extent training milieu and family support have been decisive for their development.

Methods

The present study was approved by the Regional Committees for Medical and Health Research Ethics in Norway.

Subjects

HI. HI became European 1500 m Champion in 2012; he finished second in the 1500 m in the European Championship in 2014 and third in 2016 when his brother FI won. In the European Championship in 2018, he finished fourth in the 1500 m and second in the 5000 m. In 2012, he was fifth in the 1500 m at the Olympic Games. He became under (u) 23 years European Champion in cross country in 2012 and u23 European Champion in 5000 m in 2013. In 2018, he was the fastest European 5000 m runner with the time 13:16.97. He was third in the 3000 m in the European Indoor Championship in 2019. He has seven medals in indoor (3) and outdoor (4) European Championships.

FI. FI became European Champion in the 1500 m in 2016 and third in 1500 m in the World Championships in 2017. In December 2018, he became European Cross Country Champion. He was ranked as number one in the European statistics and number three in the World statistics in 1500 m in 2018.

Jl. Jl, the 2018 European 1500 m and 5000 m Champion, is five times European Junior (u20 years) Champion (three times in cross country and two times on the track). He finished second in the 1500 m and third in the 5000 m in the World Junior Championship in 2018. He is ranked second in the

Table 1. Best times in different distance on the 31st of July 2019 for HI, FI and Jl.

	800 m	1500 m	Mile	3000 m	5000 m
HI	1:48.09	3:31.46	3:50.72	7:36.85	13:15.38
FI	1:47.79	3:30.01	3:49.60	7:49.70	13:11.75
Jl	1:49.40	3:30.16	3:51.30	8:00.01 ^a	13:02.03

^aJl has not taken part in 3000 m races in 2018 and 2019 up to the time of writing.

European statistics and fourth in the World statistics in 1500 m in 2018. He was first and second in the European Indoor Championship in 2019 in the 3000 m and 1500 m, respectively. At the time of writing (end of July 2019), he holds the world u20 years indoor record in 1500 m and the European outdoor u20 years 1500 m record with the times 3:36.02 and 3:30.16, respectively. By running 5000 m in 13:02.03 in London on the 20th of July 2019, he set a European u20 years record also on this distance.

Personal best times

Their personal best times on the 31st of July 2019 for the distances 800 m, 1500 m, 3000 m and 5000 m are shown in Table 1.

Athletic development from the age of 12 years

The Norwegian Athletic Federation (Norges Friidrettsforbund – NFIF) registers all-time best results for boys and girls in all athletic events from an age of 13. The best results at different ages for each of the brothers are from these lists.

Training registration

The frequency of running training session (sessions·week⁻¹) and the average weekly running distance (km·week⁻¹) were recorded in their training diaries. The training loads (km·week⁻¹) were also classified according to the prescribed intensity zones in Table 2. Their father and coach (GI) has during their athletic career systematically measured and registered heart rate in all running session. Blood lactate levels have been measured using Lactate Pro 1 (from 2010 to 2015) and Lactate Pro 2 (from 2015 to present) during all interval sessions. The author of this article has observed these runners during both training and competitions during the last seven years.

Family support

To what extent these three runners have gained an advantage from being siblings and from the support

Table 2. Five-zone intensity scale: intensity zones, running speed and type of training, blood lactate during exercise (determined using a Lactate-Pro 2 Analyzer, Arkray, Netherlands), heart rate (HR) in % of HR_{max} and presumed physiological effects of the training.²³

Intensity zone	Type of training	Lactate (mmol/L)	HR in % av HR ^{max}	Physiological adaptation
1	Easy and moderate continuous running	0.7–2.0	62–82	Recovery and improved running economy
2	Threshold training	2.0–4.0	82–92	Increase vAT and VO _{2max}
3	Intensive aerobic intervals	4.0–8.0	92–97	Increase VO _{2max}
4	Anaerobic training, mainly at 800 m and 1500 m pace	>8.0	>97	Increase anaerobic Capacity
5	Sprint			Increase speed

received from their family have been examined by observation and conversations with the three runners and with their parents.

Results

Performance development

Performance development for each of the three athletes determined as season best times at different ages in the 800 m and 1500 m are listed in Tables 3 and 4.

Training development

Training volume. HI. From the age of 10–14 years, HI played football. From the age of 13–17 years, he competed in cross-country skiing during the winter season and in distance running during the summer season. In 2008, at the age of 17, he became Norwegian junior cross-country skiing champion in his age group. During the winter season, at the age of 17 years, his average training load differed from one week to another depending on to what extent he was doing cross-country ski training. The ski training sessions were normally longer than the running sessions. In a ‘typical running week’ in February and at the beginning of March, he ran an average of 111 km. From the age of 17–21 years, he gradually increased his total weekly training load from an average of 100–110 km·week⁻¹ to an average of 156 km·week⁻¹.²³ His average weekly training volume in the preparation period (November–March) leading up to the 2018 and 2019 seasons was 150–160 km·week⁻¹.

FI. From the age of 10, FI played football, competed in cross-country skiing and did some track and field training. From the age of 17, he focused more and more on distance running. His weekly training volume gradually increased from an average of 70–80 km·week⁻¹ at an age of 17 to 120–130 km·week⁻¹ at an age of 20. The average training volume in the preparation period

Table 3. Best results in 800 m for HI, FI and JI at an age from 13 to 18 years.

Age	13	14	15	16	17	18
HI	–	2:04.56	1:58.89	1:54.63	1:52.51	1:51.34
FI	–	–	–	–	1:56.74	1:50.80
JI	2:04.09 (2)	2:05.02	1:52.60 (1)	1:51.07 (1)	1:49.40 (1)	1:48.63 (1)

The number within parentheses indicates the number on the all-time best list in Norway for the age group.

Table 4. Best results in 1500 m for HI, FI and JI at an age from 13 to 18 years.

Age	13	14	15	16	17	18
HI	4:30.36	4:22.48	4:04.16 (9)	3:54.08 (4)	3:50.63 (4)	3:44.53 (2)
FI	–	–	4:14.68	4:08.67	–	3:51.70
JI	4:21.90 (1)	4:15.87 (1)	4:05.49 (1)	3:48.37 (1)	3:42.44 (1)	3:39.92 (1)

The number within parentheses indicates the number on the all-time best list in Norway for the age group.

(November–March) leading up to the 2018 and 2019 seasons was 150–160 km·week⁻¹.

JI. JI started to train in the same track and field club where his older brothers were members at the age of 7 years. He competed in sprint, hurdling and jumping. At the age of 7, he ran 60 m in 10:36. He also competed in cross-country skiing at regional level until the age of 12. At 10 years old, he completed an 8.2 km local park race in 29:56 and had a VO_{2max} just above 70 ml/kg/min. JI was 12 years old when HI became European 1500 m Champion. This was the point when he decided that he also was going to become European Champion one day and says himself: ‘since then I have trained and lived like an elite athlete’. At the age of 12, he trained daily, one session per day. He gradually increased his weekly

training volume and the number of training sessions per week year by year. At the age of 17–18, in the preparation period leading up to the 2018 season, he ran an average of 130–140 km·week⁻¹ distributed over 13–14 weekly training sessions. The volume during the preparation period leading up to the 2019 season has been 150–160 km·week⁻¹, the same volume as his older brothers.

Training frequency and intensity distribution. All three brothers have followed a training regime with a relatively high weekly volume of intervals at and above the anaerobic threshold (20–25% of the weekly volume). Their father and coach, GI, underlines that during adolescence the primary focus was on aerobic capacity training. The volume of intensive anaerobic training during adolescent was very limited. Most of the interval training has been performed in 10,000 m and 5000 m race pace as threshold training in zone 2 (Table 2).

From the age of 16–17, they have trained between 10–14 sessions per week. During the preparation period leading up to the 2018 and 2019 seasons, these three runners carried out 23–25% of weekly volume as interval training at and above the anaerobic threshold. Morning sessions consist of continuous running or longer intervals in zone 2 (Table 2). According to Billat, Lepretre²⁴ threshold pace is the pace an elite runner can sustain for approximately 1 h, which is close to half-marathon pace. The runners in the present study do repetitions over distances from 2000 m to 3000 m at this pace. However, when these runners do repetitions over distances from 1000 m to 400 m with lactate and heart rate in zone 2 (Table 2) they run at paces between 10,000 m and 5000 m race. The volume of a zone 2 session is between 8 and 12 km.

In the pre-competition period and during the competition-season, they do sessions on the track at race pace, while the volume of training at anaerobic threshold is reduced. In addition to these running sessions, they also do drills, some sprints, jumping exercises and general strength training during the preparation period.

In the pre-competition period (April–May), the weekly training structure differed more from week to week than during the preparation period. In some weeks, the number of zone 2 sessions was reduced due to more sessions performed in zone 3. In the competition period, the training structure and number of sessions in zone 2 (10,000 m and 5000 m pace), zone 3 (3000 m pace) and zone 4 (800 m and 1500 m pace) differed from one week to another depending on the competition structure.

Family support

HI, FI and JI are number two, three and five in a family of six brothers and one sister. The eldest brother and

brother number four have also competed in athletics at club level. The fourth brother is, at the time of writing, a football player at regional level. Their sister (age 13 at the time of writing) is also training for distance running. She is also coached by her father and is part of the same training group as her brothers. The youngest brother made his debut as a cross-country runner at the age of 5, and their mother (TI) also takes part in a recreational races.

HI, FI and JI say that, from early childhood, they have been strongly encouraged to take part in sport and competition by their parents, especially their father. HI:

When we were in primary- and comprehensive school and competed in cross-country skiing during the winter season and running during the summer, we asked our father for permission to do some morning sessions in addition to the afternoon sessions. We were allowed, but our father said that we should not tell this to our teachers, they would worry and think he was pushing us too hard.

FI:

Our mother has also been an extremely important part of the family team. She always had food ready when we came home from training, and she has washed thousands of kilos of sweaty training clothes during the years. She, our siblings, our wives and girlfriend also come with us when we are in St. Moritz doing altitude training in the summer. The whole family was at the stadium and supported us at the World Championship in London in 2017 and the European Championship in Belin in 2018.

HI, FI and JI to a great extent follow the same training structure. JI says that he has trained with HI and JI from the age of 12.

The first years I ran shorter intervals and fewer reps than my older brothers, I also ran fewer kilometers on the long runs. When, at the age of 16–17 I was able to follow them on most interval sessions, I knew that I was an international top-level junior runner. During the winter 2017–2018, leading up to the 2018 season, I felt I was as strong as them.

All three underline the importance of training together. FI: 'We are competitors, brothers and good friends. We push each other during training'. HI:

In 2017 I was injured and had to go through surgery. It was hard to start the training for the 2018 season. When I could follow FI and JI on the interval sessions during the spring 2018, I knew I was able to fight for a

medal in the 2018 European Championship. It was a great moment to finish second behind my brother in the 5000 m in Berlin.

Their mother and father both underline that these three brothers have always been extremely mentally tough, that they love to compete and that they have very high self-confidence. They have always had an ability to set high, but realistic goals and are driven by achievement and goals. Their mother says: 'They have been told from an early age by their father that there is no easy way to the top. They never take shortcuts, they train every day. Even on their wedding days HI and FI did their training sessions'. HI and FI told a story from when they competed in cross-country skiing as boys, which exemplifies this 'no easy way to the top' attitude. Many of their competitors prepared their skis (with much help from their fathers) with expensive ski glider which provided better gliding ability than the ordinary ski wax they used. When they confronted their father about this he said: 'Don't focus on that. You are much better trained than them, you will beat them anyway'.

Discussion

Performance development

As can be seen from Tables 3 and 4, HI, FI and JI have undergone very different performance development processes during adolescence and have followed different routes to the top in international distance running.

HI is among the 10 all-time best in 1500 m in Norway in the age groups 15, 16, 17 and 18 years. During childhood, he took part in football, cross-country skiing and distance running. When he, at the age of 18, ran 1500 m in 3:44.53, this was the fastest ever time for this age group (JI is now faster).

FI, who was the fastest 1500 m runner in Europe in 2018 with the time 3:30.01, is not among the top 10 in Norway at any age from 13 to 18 years (Tables 3 and 4). He played football from the age of 7 until the age of 16. From the age of 14, he sporadically took part in running competitions. As a boy from 10 to 14 years, he also competed in cross-country skiing. From the age of 17 years, he has had focused fully on distance running. In 2012 (age 19), he was Norwegian junior champion over 1500 m, and in 2013, he was Norwegian senior champion over the same distance.

JI has been the best runner in Norway in all age groups from the age of 13 years and has been labelled as extremely talented from an early age. JI, as his older brothers, also took part in cross-country skiing competitions up until the age of 14. He did not play football, but from the age of 7 years he took part in all kinds of

athletic competitions, including jumping, sprinting, hurdling and distance running.

FI's and to some extent HI's development is in accordance with the findings of Anderson and Mayo²⁵ who report that many elite athletes specialized late in their sports, following diversification in other sports during their youth. JI on the other hand, focused on distance running from an early age. According to findings in a review article by Coutinho et al.,²⁶ there is considerable evidence in the literature that both early specialization and diversified experience in other sports can lead to elite development.

Despite the fact that these three brothers during childhood and adolescence have followed different pathways of running performance development, all three have been active in sport from an early age with a high volume of training, especially from an age of 16/17 years.

Training volume and training distribution

The average weekly running volumes in the preparation period leading up to the 2019 season were 150–160 km·week⁻¹, distributed over 13–14 sessions. This is in accordance with weekly training volumes and number of sessions previously reported for international distance runners.²⁷

During the preparation period, these three runners carried out 23–25% of weekly volume as interval training at and above the anaerobic threshold. Most of the interval training was performed as threshold training in zone 2 (Table 2). The big amount of training conducted by these runners in zone 2 is along with the findings shown in a very recent article by Casado et al.²⁸ which described the training conducted by some of the best long-distance runners of the world. The high volume of zone 2 training conducted by these runners was highly correlated to their performance. The only difference is that the runners in the study by Casado et al.²⁸ did continuous 'tempo runs' as zone 2 training while the runners in the present study do interval training.

Their coach and father, GI, highlights the importance of building a good aerobic capacity during the preparation period, and to maintain this capacity during the pre-competition and the competition season. With more training in zone 3 (3000 m pace) and zone 4 (800 m and 1500 m pace) incorporated in the pre-competition and competition period, the athletes train over a broad range of paces over the course of the year, in line with the recommendation of Martin and Coe.²⁹

The reduction in training volume as a result of more high-intensity training in the competition season, particularly in the weeks leading up to the major competitions, is in accordance with recommendation given by

Shepley et al.³⁰ who examined the effect of three different tapers in highly trained middle distance runners.

The optimal distribution of training at different intensities for elite athletes in endurance events is debatable. According to Seiler and Tønnessen,³¹ a training distribution with 80% as low-intensity training (below the anaerobic threshold) and 20% as high-intensity training (at and above the anaerobic threshold) gives excellent long-term results. The 23–25% of training at and above the anaerobic threshold performed by the runners in the present study in the preparation period leading up to the 2018 is a little above this recommendation. According to GI, successful incorporation of such a high percentage of high-intensity training requires strict intensity control of every training session.

The importance of being siblings and family support

The three brothers in the present study are competitors and training partners who learn from each other and inspire each other. This is in agreement with the findings of Taylor et al.³² regarding how siblings were found to influence each other in talent development. Even if they are rivals, siblings cooperate through physical and verbal communication, which leads to skill development.³³ All three also highlight the importance of strong family support, which is in line with the mathematical talent development model of Simonton¹⁹ and the four-factor model of Johnson et al.²¹ The way their parents describe their high self-confidence and the ability to set high, but realistic goals and that they are driven by achievement and goals are in line with the findings in a study by Mallett and Harrahan²² of five female and five male international top-level track and field athletes from Australia.

Conclusion

The three brothers and international level distance runners in the present study have followed different athletic developmental pathways. JI has been the all-time best 1500 m runner in all age groups in Norway from the age of 13 to 18 years. HI is among the 10 best ever in 1500 m in Norway in the age groups 15, 16, 17 and 18 years, while FI, on the other hand, has not been among the top 10 over any distance as a junior. Despite the differences in athletic development, they have, all three, had an active childhood and from an early age competed in different sports. From the start of their distance running career, they have, year by year, gradually increased their weekly training volume. Their father and coach have based their training on an aerobic capacity-based training regime. Most of the interval training has been performed at the

anaerobic threshold, and the training intensity has been tightly controlled via measures of heart rate and blood lactate concentration during all interval sessions. Together with an appropriate training regime, strong family support and mental toughness have brought these brothers to a top international level in distance running.

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