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## THE DEVELOPMENT TO SUCCESS IN SWEDISH BIATHLON

**Rolf Carlson**

School of Sport and Health Sciences (GIH)  
Box 5626, S-114 86, Stockholm, Sweden

### Abstract

The purpose of this study was to contribute to an explanation why Swedes of both sexes achieved great international success simultaneously in a small national sport such as biathlon. The elite group consisted of the male and female national team. A control group matched in pairs was identified in variables age, sex and athletic performance. All investigated athletes were products of the Swedish sport academy system (RIG, upper secondary education). Data were collected via interviews with athletes, national coaches and managers. Compared to the controls, elite athletes were more often born early in a year, less injured and less sick during RIG years and experienced coaches more favourable in terms of acting and individualisation.

**Keywords:** *Biathlon, competition, performance analysis, coaching, interviews*

### Introduction

Biathlon is of Scandinavian descent originating from skirmishes between Swedish and Norwegian border patrol units in mountainous areas as far back as the 1700s (Hanstad, 2005). Even if the first competition between the two countries was held in 1767, the first biathlon sport club was founded some 100 years later in 1861, The Trysil Rifle and Ski Club in Norway. Military patrol conducted an exhibition at the 1924 Chamonix Olympic Games as well as in Garmisch 1936 and S:t Moritz 1948. The concept of modern winter biathlon was established in 1955 allowing participation in the 1960 Squaw Valley Games represented by one discipline – 20 km men. Involving the two very different activities, shooting and cross-country skiing, biathlon developed during the years to come to a worldwide recognised winter sport.

The Olympic biathlon program gradually expanded and consists at present of 5 disciplines. The transition in 1978 from large bore 5,6 mm rifles and a shooting distance of 150 m to small bore 5,6 mm specially designed rifles and a 50 m shooting distance along with mechanical falling plate targets revolutionised the sport. It opened up for women and youth thereby gaining wide and international recognition. Biathlon of today is to be regarded an arena sport appealing to media, spectators and sponsors. According to a newly conducted survey biathlon attracted more viewers at nationally televised international championships and world cup events than did traditionally dominating winter sports such as alpine and cross-country skiing (Norstat Sponsor Insight 2009).<sup>1</sup>

The Swedish Sport Confederation (RF) consists of 70 different sports of which biathlon is one of the smallest. Some 500 members are spread out in 32 clubs. In spite of this a number of Swedes achieved great international success over the years starting with winnings in the first world championships in 1958 as well as in the first winter Olympics in 1960. All together, representatives of both sexes achieved some 60 World Cup victories, 12 World Championships, 3 Olympic gold medals and 6 total World Cup triumphs.

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<sup>1</sup> The survey was conducted with a representative sample of 1 000 individuals in variables age, sex and geographic location.

### Purpose

Why is it that a small sport in a small country achieved international success and recognition to the extent that the national team per se along with men and women on an individual basis are ranked among the very top in the world? The main purpose of this study was to contribute to an explanation to the success Swedish biathlon achieved in later years. The following areas were considered to be of particular interest;

- Athletes' background, early experiences and personal characteristics
- Environmental structures and its function in the development to elite
- Interactive processes between the athlete and the surrounding environment

### A Theoretical Frame for Human Development

Based on an ecological model for human development the study analyses roles, activities and perceptions during adolescent and adult years (Bronfenbrenner 2000). This approach (fig. 1) focuses aspects in the immediate environment where the developing person is an important influent in the developing process (*micro* and *meso* levels) as well as more external structures mainly beyond influence and control (*exo* and *macro* levels). The ecological aspect is based on the continual interaction taking place and involving all four levels.

The *micro* level consists of systems in the immediate environment where the developing person is an active participant. Interactive processes involving these structures and the developing person form the *meso* level. The *exo* level includes different influents in the local environment such as neighbourhood facilities and community standards. General societal foundations like economy, democracy and health promotion form the *macro* level thus dictating conditions and terms for sport practice in a wider perspective. The model also holds a phenomenological approach emphasising subjectivity and the impact of personal thoughts and experiences during the developmental process. The horizontal arrow through the model symbolises possible changes in the different levels over time.

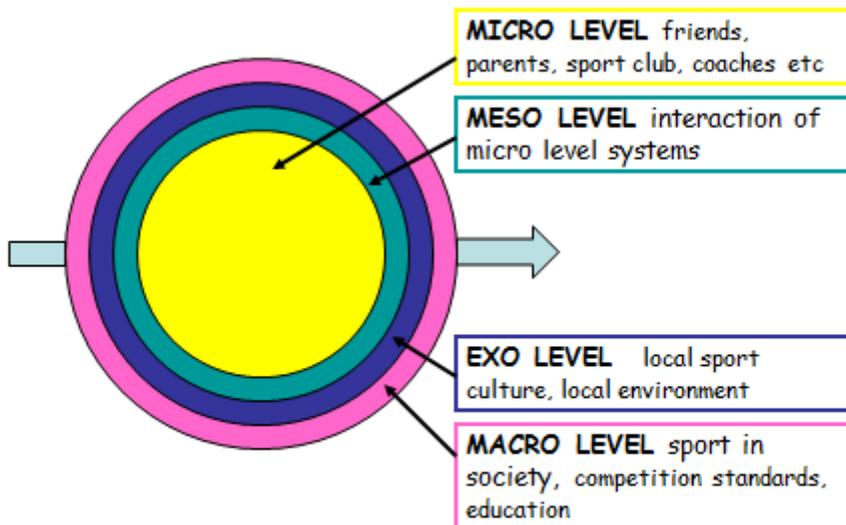


Fig.1 An ecological model for human development (after Bronfenbrenner)

### Material and methods

In order to describe the athletes, the environment and the interaction in between the two, data were collected via interviews and on-site observations during training and competition. Along with coaches and the team manager from the Swedish Biathlon

Federation (SSSF) the investigated group consisted of an elite group with controls. Additional information concerning national sport academies (RIG) on the upper secondary education level was collected from coaches and teachers from the two national biathlon sport academies.

The elite group was the national team consisting of 13 individuals, 7 men and 6 women. All members of the team were products of the national sport academies in biathlon or cross-countrycross-country skiing. The controls were identified and selected among students accepted to and having graduated from RIG but who did not qualify for the national team as adults. The controls were matched in pairs in variables age, sex and sport specific performance. This means that each individual on the national team had an equivalent in the control group of the same age, same sex and equal in sport specific performance during RIG years. The team manager is responsible for all training and competition activities. The two coaches to his disposition are specialised in physical training and shooting respectively. Data were collected during a 4-day pre season training camp and the opening World Cup event in Östersund, Sweden, late November 2009. All interviews were taped and transcribed. Analyses took place in the spring of 2010.

### *Research on biathlon*

A result from later years` increasing popularity is a more intense and varied program in international championships and world cup competitions. Stadiums and arenas do more apply to the interest from media, sponsors and audiences. An analysis from 7 world cup seasons revealed an increased number of travel days, competition days and kilometres raced (Manfredini, et al., 2002). This retrospective study also found biathlon as more demanding based on self-reported stress scores among both sexes. The increase between the easiest season and the most demanding season was more than 100 %.

The combination of physiological endurance and target fixation during competition put high demands on athletes in such events. Ten members of the Canadian biathlon team participated in a study analysing the effects of physiological arousal, cognitive anxiety and gaze control in biathlon (Vickers & Williams, 2007). The prime goal was to determine why some individuals overcome effects of extreme exercise, performance pressure and anxiety whereas others choke under the combined weight of those pressures. In laboratory conditions the biathlon shooters took standing shots to a target after exercising on a bike ergometer at individually prescribed power output levels of their maximum oxygen uptake. Performance pressure was manipulated in counterbalanced conditions such as general testing of target fixation or presence of the national coach telling the athletes that the results would affect team selection. The results indicated that 3 participants were able to perform on a high level in high performance conditions without choking while the remaining 7 athletes performed at a low level and choked. The results showed that those who did not choke changed their target eye fixation from a shorter duration during low pressure conditions to a longer duration during high pressure conditions. The findings support the role of automaticity in performance emphasising external focus rather than internal (Wulf et al., 2002).

With reference to exercise intensity and shooting performance a study involving 13 members of the United States biathlon team indicated minimal effect on shooting accuracy and precision for prone shooting but did affect measures for shooting in the standing position (Hoffman et al., 1992). Bicycle ergometry was chosen as the exercise modality. A similar Soviet study elevating heart rate to comparable levels by ergometry or treadmill did however not demonstrate significant effects on shooting performance in either position (Soldatov, 1983). Shooting performance was only assessed by the number of targets hit. Similar conclusions would have been drawn by Hoffman if the same evaluation measurements would have been used.

An interesting aspect is the influence of shooting result and skiing time on the final result. A study including results from the World Cup and Olympic Games during the 2001/2002 season involved athletes from 65 nations (Cholewa et al., 2005). The results conclude that depending on sports level, the influence of shooting efficiency and the time of the run is varied. Overall results of the run influence the final result to a higher degree than does shooting. Among higher ranked elite biathletes, however, the influence of the time of the run on the final result is smaller than among athletes of lower ranking. Furthermore, shooting efficiency has a significant influence on the end result during individual competition, where shooting occurs 4 times and the possibility of committing mistakes is greater.

Burnout has been characterised by progressive disillusionment and by physical and psychological symptoms that diminish one's self-esteem (Freudenberger 1980, Coakley 1992, Gold & Roth 1993, Henschen 1998, Wiersma 2000, Raedeke & Smith 2004). In a study involving elite winter sports like alpine skiing and biathlon with the purpose to investigate athletic burnout from a social cognitive perspective it was found that maladaptive motivational profile may be a critical factor to underpin athlete burnout (Lemure et al., 2008). This infers that when demonstrating perfectionist qualities where they fear making mistakes and doubt their ability, the risk of experiencing burnout is greatly increased. Reasons behind this could be overtraining or risk of recovery following previous competitions (Kellmann 2002).

### *The concept of competition*

Institutionalised modern competitive sport attracts enormous interest in most cultures and most ages. For children and youth it is a dominant leisure time activity and regarded as an important influent in the socialising process to well functioning members in society (Dunning 1999, Jarvie 2006, Blomdahl & Eloffsson 2006, Bergsgard et al., 2007). The core of competition is the uncertainty of the outcome. The more attractive the winning is and the better the chances for success, the higher motivation and mobilisation of resources and efforts. In order to optimise the attractiveness of the competition, constructed norms and systems vary between sports. (Heinilä 1982, Vuolle 1998, Breivik 2000, Engström 2000, Halberstam 2000, Hertting 2007, Greenwood & Kanters 2009, Johnson et al., 2009, Light Shields & Light Bredemeier 2009). Due to variations in the speed of growth during the adolescent period a division in competition classes is necessary to maintain the attraction to competitive sport. (Lindgren 1989, Carlson 1993, Malina 1996, Musch & Grondin 2001, Cote & Hay 2002, Twist & Anderson 2005, Baker et al 2005). Age is the predominant criteria, in power sports often combined with weight.

In the early 1980s Heinilä (1982) introduced a model for the totalisation process in competitive sport (fig. 2) with reference to an increased level of demands on the athlete in order to succeed. According to this perspective Heinilä identified three interacting components.

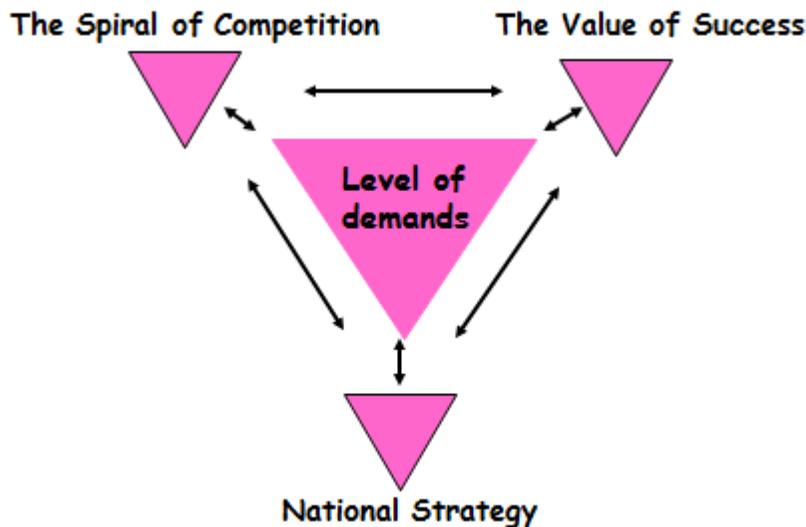


Fig. 2 The totalisation process in competitive sport (after Heinilä)

*The spiral of competition* refers to the core of competition, the uncertainty of the outcome. The more important the winning and relevant chances to succeed, the greater mobilisation of efforts by the athlete. If the strive to win is strong enough without reaching the goal a risk for use of unpermitted substances might occur. Hence, the input of variations in the speed of growth during puberty as well as criteria for the dividing in competition class must be considered. *The value of success* refers to the recognition of athletic performance. Few, if any, achievements in institutionalised domains receive the attention sport performances most often do. Rewards in terms of status and materialism as a result of Olympic medals, international championships etc are good examples. The appearance of African long distance runners starting in the 1960s and the attention and nations like Kenya, Tanzania and Ethiopia received did no doubt improve international recognition and trade. *National strategy* is exemplified by initiatives to develop athletic talents with governmental support. The system of national sport academies on the upper secondary education level as well as equivalent local initiatives at low or intermediate levels are some examples.

### *Biathlon competition*

One explanation to the expansion of biathlon and its increased popularity in later years is the organisation of the competition system. There are great variations in events, different shooting positions, different numbers of bouts of shootings, different target dimensions giving instant feedback after each shot. Distances vary from 6 to 20 km with stops at a shooting range to shoot two or four times depending on ski distance and type of competition. The competitor starts at a start line, skis one course loop, comes to the range and shoots, skis another loop and shoots and so on and then finishes with a ski loop to the finish line after the last bout of shooting. Five rounds are fired in each bout at five targets except in Relay competition where the competitor has three spare rounds for each bout. The two shooting positions, prone and standing, are done in sequence depending on the competition in question. Target diameters are very small, 115 mm for standing and 45 mm for prone shooting. The clock is running during the entire competition without time-outs for shooting. Time penalties are imposed for each missed target, either as one minute of added time for individual competitions, or as a 150 m penalty loop (takes about 21 to 26 seconds to complete) immediately after each bout of shooting for all other competitions.

There are 8 different competitions, The Individual, The Sprint, The Pursuit, The Mass Start, The Relay, The Mixed Relay, Supersprint Qualification and Supersprint Final. In Individual and Sprint competitions the starting procedure takes place with a 30 second interval between the competitors. In Pursuit competition starts are based on time intervals from a qualifying competition. In Mass Start all competitors start simultaneously. In the Relay competition the first member of all teams start simultaneously. After completing their part they tag the next member to start them off. Relays are mixed and non-mixed. In the first case female biathletes have to complete the first two rounds.

### *The concept of talent*

In competitive sport talent is generally regarded as a developmental process from childhood to adult age emphasising interactional processes between the individual and the developing person (David 2005, Czikscentmihalyi 1993, Mageau&Vallerand 2003, Turman 2003, Kincer 2005, Gould et al 2002, Cotè& Hay 2002, Soberlak&Cotè 2003, Augustsson 2007, Wolfenden& Holt 2005, Cotè et al., 2006, Carlson 2009). In this process (fig. 3) a number of influents have been identified (Carlson 2007). The extent of influence depends of the sport in question, societal structures or cultural identity patterns.

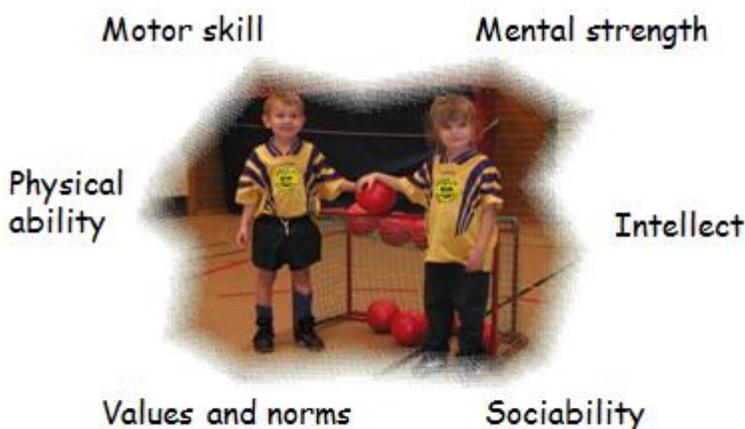


Fig. 3 Influents on talent development (after Carlson)

Great efforts are often devoted to the identification of talents at a very early age. Selections are based on performances achieved before or during puberty. This infers great difficulties and risk of increased drop-out rate. Early developers are favoured while late developers are left out due to factors beyond their own influence (Lindgren 1989, Malina 2009). Many youngsters deserve a second chance – a kind of talent recycling (Veyens et al., 2009). Research does furthermore indicate that internationally successful athletes were involved with several sports on a parallel basis and during early adolescence and got involved with their main sport to be in the mid teens or later (Baker et al., 2005, Carlson 2007).

## **Results**

### Athletes` background, early experiences and personal characteristics

The division in competition classes during adolescence is usually based on age. The same goes for biathlon. Using quadruples of a year as a mean for determining time of birth the investigated group was to a far extent born early in a year compared to late (table 1). Furthermore, the elite group was more often born early in a year compared to the controls (table 2) as well as men compared to women (table 3).

Table 1

**Time of birth in a year (%), quadruples (N=26)**

1	2	3	4
31	38	19	12

Table 2

**Time of birth in a year (%), quadruples, elite group (E, N=13) and control group (C, N=13)**

	1	2	3	4
E	39	15	31	15
C	22	62	8	8

Table 3

**Time of birth in a year (%), quadruples, men (M, N=14) and women (W, N=12)**

	1	2	3	4
M	54	38	8	--
W	8	46	23	23

During childhood and early adolescence slight differences appeared between the investigated groups concerning early-life sport involvement. All but a single few were involved with several sports. Cross-country skiing and soccer was a common combination. The local environments offered good opportunities for sportive engagement for both groups. Sport was a dominating leisure time activity. The areas of Sweden where the majority of athletes grew up offered the highest proportions of sport clubs measured per capita, 36 clubs per every 10 000 residents. Sport involvement was a family activity. In every family there were former competitors – elite group parents however more frequent than control group parents. With one exception all competitors had at least one brother or sister. All of those were or had been involved with competitive sport. All but one of the investigated athletes grew up with both biological parents indicating the strong impact of family identity and influence on the development of sportive habits.

Only one member of the elite group and two among the controls started out with biathlon, the rest as cross-country skiers. The number of biathlon clubs was very limited and the rifles not well adapted to children. As cross-country is a very big and popular sport with high demands to reach national level, there is also a possibility that those who did not make it to this level turned to biathlon instead. All investigated athletes were successful cross-country skiers during adolescence, most of them just below national level. Half of them were introduced to biathlon by friends or family with access to a club in the local environment. The 6-time world champion Magdalena Forsberg, a former member of the national cross-country team, also served as an important role model. The most important influent, no matter group identity in the study, was however the possibility to get accepted to RIG. The facilities offer excellent training conditions and highly skilled coaches. There is high trust in RIG and a common belief that the chances to reach national level increase a lot if accepted. Previous research reveals that all but one member of the national cross-country team were former RIG students (Carlson 1993).

**Environmental structures and its function in the development to elite**

Initiated by RF in 1972 the concept of RIG first involved 5 sports. The purpose was to combine sport specific training and upper secondary education for talented young athletes. Supported by the government and the national school board a certain amount of time was devoted to training within the curriculum. RIG was an immediate success and a number of

sports joined the program during the years to come. The program has been cut since the mid 1990s but engages at present some 36 sport in 60 communities throughout the nation. Roughly 140 coaches are involved training 1 300 athletes. In the 2010 Vancouver Olympics 85 % of the Swedish participants in winter sports cross-country skiing, freestyle and biathlon were former RIG students.

There are two RIG biathlon offering 24 athletes 3-4 years of education and training. 2/3 of the athletes graduated from RIG biathlon, the rest from RIG cross-country skiing. Both sites offered excellent training facilities and the combination of both sports. An interesting finding is the fact that representatives from both investigated groups in the study were accepted among a large number of applicants as cross-country RIG students, elite group in particular. Experiencing difficulties to fulfil high expectations they dropped out in favour of RIG biathlon.

#### Interactive processes between the athlete and the surrounding environment

The athletes spent their late teens at RIG. After 3-4 years of studies and training they graduated at the ages of 19 or 20. During this period in life they had access to the best of facilities and coaches. However, some made it to the national team but some did not. The results revealed the following differences between the two groups.

#### *Injuries and sickness*

All athletes had been involved with a number of sports during childhood, team sports as well as individual sports. Just a very few took part in contact- or power sports with normally greater risks for injuries. There are good reasons to assume that this wide sportive engagement favoured good motor and health development. None of the elite group members experienced injuries or sickness to the extent that training was inhibited or strongly negatively influenced. However, four members of the control group – two males and two females, almost 1/3 of the entire group – clearly stated that this was the case. Enduring injuries or sickness were considered strong influents on their unfavourable sportive development.

#### *Training*

To achieve a national level in cross-country skiing or biathlon requires a full time engagement and a positive attitude to hard and intensive training. This philosophy or mental approach was more obvious among the elite athletes who more profoundly balanced hard training with daily life realities and routines. Hence, controls more often experienced difficulties in training and to live up to their own and others expectations. With ambitions to succeed, motivation decreased and injuries appeared. This development was explained in terms of too much training or deindividualised content in training. Some experienced difficulties to adapt prescribed training or to conduct summer training. Strong efforts to catch up often resulted in daily life stress with further risks for negative training effects. Lack of motivation affected patience and trust in personal capacities.

#### *Coaches*

The investigated athletes all had experiences from cooperation with coaches prior to RIG. Expectations on RIG coaches, well educated and sport specific trained were extremely high and the athletes were all anxious to cooperate with the coaches. However, 8 of the 13 controls suggested that planning, content and the conducting of the training were not fully in line with their own expectations. This was primarily an individualisation issue as well as perceptions of malfunctioning reciprocity in the communication between athlete and coach. In its turn, this was an issue of focusing evaluation, continuous dialogue and follow-up issues on training effects.

## Discussion

An analysis of time of birth in a year based on quadruples revealed that about every 3<sup>rd</sup> athlete was born January through March compared to about every 10<sup>th</sup> being born October through December. Furthermore, elite group members were more often born early compared to controls. The finding is well in line with previous research and stresses the impact of criteria for the division in competition classes during the period of growth (Carlson 1993, Cobley et al. 2008a, Cobley et al. 2008b, Wattie 2008). Sports with high demands on technique and body dimensions like weight, length or oxygen transport capacities are often more affected than others. Variations in growth spurt are most obvious during the ages 9 to 14 (Malina 2009). During this period the age interval for competitions in biathlon is two years. This infers that the prevailing system favours early developers and misfavours late developers of reasons beyond their own influence (Engström 2000). Most of the investigated athletes were however competing in cross-country skiing during this age. As the division classes in this sport are based on one year age intervals as well as two year the problem still exists. Given these differences between the investigated groups and the fact that all athletes had been RIG students, there are good reasons to believe that early developers more easily could adapt to hard and intensive training at RIG. This in its turn could be referred to as one reason for later national team qualification.

The impact of coaches' actions and influence during RIG has been referred to as a major explanation to future development. Coaches at RIG were often former competitors on a national level, highly competent and sport specific educated. Still, differences between the investigated groups occurred. The results revealed that sport specific criteria were highly satisfactory among coaches but lack of reciprocity in communication was a decisive aspect often referred to among the control group members. The findings are well in line with previous research stressing the relevance of quality in relations between coach and athletes (Chelladurai 1990, Mageau & Vallerand 2003, Kincer 2005, Bartholomew et al. 2009, Thelwell et al. 2010).

The complexity of biathlon competition requires certain abilities to cope with stress emphasising cross-country skiing and shooting (Soldatov 1983, Hoffman 1992, Manfredini et al 2001, Vickers & Williams 2007, Lemure 2008). All investigated athletes got involved with skiing at an early age, often as the debut sport. Few were involved with organised shooting during early adolescence. Biathlon as such was not available for children due to the construction of weapon. Hence, only three of the investigated athletes were involved with shooting at a young age. The sole elite group member among the three later turned out to be the most successful of all investigated and also proved very able to cope with stress in high level competitions. The study on world cup participants representing 35 nations revealed that 71 percent got involved with the two sports simultaneously (Cholewa et al 2005). Hence, involvement in cross-country skiing parallel to shooting at an early age or the sport of biathlon itself and if appropriate weapon were at stake seems to increase a favourable development in adult age.

Those few involved with shooting at an early age were influenced by family members or close friends. Sport was a dominating leisure time and family activity, in particular in the elite group. Parents of both sexes were often former competitors in sport, in particular elite group parents. An interesting finding was the fact that all but one of the investigated athletes grew up with both biological parents in areas with good access to organised or non-organised sport. Parental influence and environmental structures strongly influenced the athletes' sport development. They grew up in competitive sport surroundings and experienced competition as a social arena with predominantly positive perceptions comparable to the concept of deliberate play (Cote & Hay 2002, Baker et al., 2003).

With reference to Bronfenbrenner's ecological model for human development the results indicate references to all four levels.

*Micro level.* Parents concern and their experiences from competitive sport contributed to develop in interest for sport participation and acceptance of sportive values. Cross-country skiing was the most common sport. Athletes had most of their friends in sportive contexts and developed sport to a daily life routine. Sport clubs existed at close range in the immediate environment and served as an important arena for social development and interaction with leaders and coaches.

*Meso level.* Micro level structures were dominant during the early adolescence and found in the immediate environment. They served as strong influents in the entire upbringing process. All involved, athletes, parents, friends, coaches etc interacted to make sport participation an important arena for a favourable future development and well being in a wider perspective – a lifestyle. Thus, the core of the meso level – interaction between micro level systems – was obvious.

*Exo level.* The RIG academies attracted many and were a goal to reach for the athletes. These schools were in most cases located in the near environment and well known to the athletes. The proportion of sport clubs measured per capita in local areas were the overall highest in the country. Cross-country ski clubs were common in the neighbourhood as well as favourable facilities to practise ski sports.

*Macro level.* RF serves an umbrella institution for organised sport with 70 different sport association members. The organisation was established in 1903 sponsored by governmental funding and private enterprise. The Swedish Biathlon Federation (SSSF) is one of its members. Members are often connected to international associations who formulate competition standards and guarantee international recognition. In 2002 SSSF formulated a new goal document which served as a guide document.

The micro level content strongly influenced the athletes' development during early adolescence and formed an important base for the future to come. The meso level served as a well functioning joint structure during this period. With respect of the macro framework, the upper secondary education years during the late teens (RIG), was however identified as the strongest influent in this study. Hence, the exo level is referred to as the prime indicator for the development to elite in biathlon.

## **Conclusion**

The investigated athletes were involved with different sports during early adolescence. They grew up in areas with several sport clubs in the near surroundings. To take part in organised sport became a dominating leisure time activity with parents and friends involved. With one exception, all athletes grew up together with both biological parents. Cross-country skiing was the dominating debut sport and the activity the athletes spent most of their time taking part in. Acceptance to a RIG academy was a prime goal and a believed gateway to later competitive success. The 3 or 4 years spent there turned decisive for the future development. The system of RIG has a long tradition. Supported by the government, RF and local communities, the best of facilities and coaches offer excellent conditions to those accepted.

Elite group athletes differed from control group athletes in the following aspects;

- Parental experience and involvement in sport competition. Parents of both sexes had more often been involved with competitive sport.
- With reference to quadruples of a year, a higher proportion were born early thus indicating the impact of variations in speed of growth and criteria for the dividing in competition classes during adolescence.

- More positive experiences from relationships with coaches during RIG years with reference to reciprocity in communication and individualisation in terms of training activities.
- Sickness and injuries occurred less frequently during RIG years thus facilitating training and competition

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