



NSAID use in endurance events:

A cross-sectional study of NSAID use in two Swedish Multisport Cup Races

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Abstract

Non-doping classified medicines are to a large extent used by athletes to treat injuries, cure illnesses and obtain a competitive edge. NSAIDs are frequently prescribed to athletes to suppress inflammation and pain, yet one in five athletes report adverse effects after such use. **Objective:** To examine the frequency of NSAID use in adventure racing and specifically study whether the length of a race may influence the extent of NSAID use. Further, the study also assesses the reasons for NSAID use and possible adverse effects. **Method:** A cross-sectional study of two Swedish Multisport Cup races. 59 racers participated in the study. **Result:** 1 racer (1.7 %) used NSAID during one of the two races. A total of 42.4 % (n=25) have occasionally used NSAIDs during or between races. 23.7 % (n=14) sometimes use NSAIDs during races. 12.0 % (n=3) of the 25 athletes that sometimes use NSAIDs reported adverse effects. Reasons for NSAID use were diverse. The most common reason was to reduce pain in general during longer races (n=8). **Conclusion:** Results show a clear difference in NSAID use between the shorter races studied here and the longer previously studied adventure race, with NSAID use being much more common in the latter (1.7 % vs. 30 %). NSAID use in longer races is at approximately the same level as NSAID use in other endurance events. Based on the reasons for NSAID use stated in this study, it is clear that athletes have a very limited knowledge and awareness regarding effects, indications for use, and possible adverse effects of the medicine.

Introduction

Non-doping classified medicines are to a large extent used by athletes to treat injuries, cure illnesses and obtain a competitive edge.(1) NSAIDs (non-steroidal anti-inflammatory drugs) are according to two separate studies the second most commonly used drugs by athletes, behind vitamins (1) or anti-allergic medicines.(2) They are frequently prescribed to athletes to suppress inflammation and pain after soft-tissue injuries and after overuse injuries.(3-6) Yet, one in five athletes report adverse effects in conjunction with NSAID use.(2)

Adverse effects in conjunction with NSAID use

All NSAIDs, due to their inhibition of prostaglandin synthesis, can have a wide range of adverse effects.(7-8) 19.2 % (n=42) of Finnish elite athletes using NSAIDs reported drug-related adverse effects. Most common were central nervous system-related (11.0 %) and gastrointestinal-related adverse effects (8.7 %).(2) 18.3 % of the during-race-users in the Brazil Ironman Triathlon reported adverse effects, of which gastro-intestinal problems (7.5 %) were the most common.(9) NSAID-induced gastro-intestinal toxicity is also the most common adverse drug effect reported in the USA in the general population.(10)

NSAIDs have for long been thought to be a risk factor for hyponatremia.(11) This was shown in a study of the 2004 New Zealand Ironman Triathlon, which was the first study to show that NSAID use is associated with an increased incidence of hyponatremia ($p < 0.001$). (12) The authors of that study found that NSAIDs affect renal function during exercise, in line with another similar study.(13)

Renal damage, secondary to exercise-induced rhabdomyolysis in athletes taking NSAIDs, has been reported in several studies.(14-17) The risk of exertional rhabdomyolysis leading to renal failure has been shown to be greatly enhanced when consuming NSAIDs. Seven out of nine runners suffering from acute renal failure from exertional rhabdomyolysis during a marathon race had taken NSAIDs.(18) Four cases of acute renal failure were reported after an ultra-marathon, and all four had ingested NSAIDs.(19)

Many athletes with minor injuries do not take enough time off training or competition to allow proper healing.(1, 20-21) Instead they begin to treat their problems with NSAIDs and continue to exercise. But there is increasing evidence that NSAIDs may have a deleterious effect on the regeneration process in healing, and that the inflammation that NSAIDs are aiming to decrease is in fact necessary for adequate tissue repair.(21-23)

NSAID use in sports

Because of the risk for adverse effects in athletes using NSAIDs during exercise, it is of interest to study the extent of NSAID use in different sports. Several studies of NSAID use has been conducted during the Olympic Games, and in other unselected populations of athletes. Berglund et al. (24) studied the use of NSAIDs in Swedish Olympic athletes during the games in Atlanta in 1996, Nagano in 1998 and Sydney in 2000. In the Atlanta games, 11.5% of these athletes used NSAIDs, and in Sydney and Nagano the numbers were 7.6 % and 6.7 % respectively. They estimated the NSAID use to be 6-10 times higher in Swedish Olympic athletes than in the general Swedish population of the same age. Among Canadian athletes, NSAID use was 33.0 % and 38.0 % respectively in the Atlanta and Sydney games.(25)

At the Sydney games, athletes of all nationalities selected for doping control were asked “what medications have you taken in the past three days?” All prescription drugs, over-the-counter medications and other substances like vitamins were to be included in the answers. 2758 athletes responded to the question. Of those, 2167 had taken some kind of medication, and 706 (25,6%) had taken NSAIDs, second only in frequency to vitamin use.(1)

The only study that has compared the use of NSAIDs in elite athletes to that of an age-matched control from the general population is that of Alaranta et al.(2) They studied all Finish elite athletes financially supported by the National Olympic Committee (n=494) and found that 49.1 % (n=219) had used physician-prescribed NSAIDs in the previous 12 months. 2.0 % reported daily use and 10.8 % reported monthly use. During the previous seven days before the study, 8.1 % of the athletes, and 2.7 % of the controls had used NSAIDs. In the endurance athletes’ category, the same number was 4.6%.

A study from Belgium analyzed data from 18,645 doping control forms gathered for the years 2002-2005. The prevalence of NSAID use three days before competition varied between 12-13 % for each year.(26) They found that use of NSAIDs was most prevalent in athletics and ball sports, with 20-30 % use in volleyball and 19-25 % in soccer each year, compared to only 4-6 % in cycling.

A high usage among ball sports players was also found in two studies of soccer players. In one study from Italy, 93 % of the players in the major leagues reported a high use of NSAIDs.(27) In a study of American student soccer players, 75 % reported having used NSAIDs in the previous 3 months, and 15 % were daily users.(28)

A few endurance events have been studied in relation to NSAID use. During the 2004 New Zealand Ironman Triathlon, the incidence of NSAID use 24 hours prior to race finish was 30% (100/333 athletes).(12) 20 % of the participants in the Kepler Challenge, a New Zealand ultra mountain-run, had used NSAIDs in the 24 hours before and during the race, and 15 % had used COXIBs (selective cyclooxygenase-2 inhibitors).(29)

Gorski et al. (9) studied the prevalence of NSAID use and the level of awareness regarding NSAID use during the 2008 Brazil Ironman Triathlon. A sample of athletes (327 of 1250) answered a questionnaire after the race about NSAID consumption, reason for use and adverse effects. 59.9 % (n=196) reported use of NSAIDs in the previous three months. 28.5 % (n=93) of the respondents consumed NSAIDs during the race. Among the NSAID users, 48.5 % consumed them without medical prescription, i.e. over-the-counter drugs. Of the 196 racers who had used NSAIDs in the previous three months, 7.7 % reported daily use, and 83.7 % reported use from time to time. The main reasons stated for NSAID consumption was “treatment of injuries” during the previous three months, and “prevention of pain” during the race (62.4 %).

All the above mentioned sports, from soccer to triathlon, have compared to adventure racing very short durations of racing or competition. An adventure race/multisport race¹ may range from 6 hours up to 6 days in duration. The intensity is also different, with adventure racing athletes generally racing at lower heart rates compared to triathlon competitors. Lucas et al. estimated that racers in a 4-5 day adventure race competed at between 41-64 % of HRR (heart rate range)(30), while triathletes tend to race between 83-92 % of HR max. (31-32)

Given the differences in intensity and duration, it is of interest to study the prevalence and effects of NSAID use during extreme endurance events like adventure racing. In a study of NSAID use during the

¹ Adventure race is the English terminology, and multisport is the Swedish equivalent. But multisport is also generally used for shorter races, even in English.

2008 Nordic Championships in Adventure Racing, 30 % of the racers participating in the study reported NSAID use during the race, which had a median finishing race time of 54.4 hours (range 14).(33). This study is so far the only study of NSAID use in adventure racing, which indicates that our understanding of NSAID use across the sport is quite limited. For example, very little is known about whether, or how, NSAID use changes depending on race length.

Objective

The objective of this study is to examine the frequency of NSAID use in adventure racing; specifically, to study whether the length of an adventure race may influence the extent of NSAID use by comparing two short adventure races to a previously studied longer race, and to other endurance events. Further, the study also assesses the reasons for NSAID use and the possible adverse effects in conjunction with such use.

Method

This paper is based on a cross-sectional study of the elite class competitors in two races in the Swedish Multisport Cup 2009. A post-race survey (see appendix) was emailed to racers following the “Stockholm Adventure Race” in September 2009, and the “Femmans Multisport Race” in Gothenburg in October 2009.

The survey included the following questions;

- 1) Did you take any NSAIDs before this race? Yes or No – if Yes, why?
- 2) Did you take any NSAIDs during this race? Yes or No – if Yes, why?
- 3) Do you usually take NSAIDs during races? Always - Often - Occasionally - Never
- 4) How often do you usually take NSAID between races due to training- or racing-related injuries? Every day - Few times/week - Few times/month - Few times/year – Never
- 5) If affirmative answer on question 3 or 4 – why?
- 6) If you sometimes take NSAID during or between races, do you experience any adverse effects? If Yes – what adverse effects?

The racers were also asked about the level at which they race at (i.e. their goals) and how much they train and rest in a typical week. This information is not further discussed in this article.

The design of the study conformed to the Declaration of Helsinki, and was approved by the Regional Ethics Committee in Stockholm, Sweden.

Stockholm Adventure Race – STAR

A total of 43 racers in the elite class in STAR received the survey through email. Of those, 25 returned the survey, giving a response rate of 58.1 %.

Femmans Multisport Race

A total of 40 teams of two raced in the elite class. An email was sent out to all team captains (n=40) on each team. They were asked to forward the survey on to their teammate. We could not confirm whether the surveys were in fact forwarded. 34 responses were received, giving a response rate of between 47.5 and 85.0 %, depending on whether all or none of the team captains forwarded the

survey to their teammate. Racers who had previously completed the survey following the STAR race were only asked to answer questions number 1 and 2, however none of the repeat respondents sent in a survey following the Femmans Race.

Results

Table 1 summarizes the responses to the survey. 1 racer out of 59 (1.7 %) used NSAIDs during a race. A total of 42.4 % (n=25) have occasionally used NSAIDs during or between races. 23.7 % (n=14) occasionally use NSAIDs during races. 12.0 % (n=3) of the 25 athletes that occasionally use NSAIDs reported adverse effects. 20 % (5/25) of the racers ever having used NSAIDs were women. 20.4 % (12/59) of the total number of respondents were women; therefore no significant difference existed in NSAID use between men and women.²

Question	Before the race	During the race	Occasionally during races	Occasionally between races	Adverse effects	Occasional use, time not spec.
STAR	1 (0) 4.0 %	0 (0) 0.0 %	9 (2) 36.0 %	11 (1) 44.0 %	2 (0) 12.5 %	16 (3) 64.0 %
Femmans	4 (2) 11.8 %	1 (0) 2.9 %	4 (1) 11.8	9 (2) 26.5%	1 (0) 11.1 %	9 (2) 26.5 %
Total	5 (2) 8.5 %	1 (0) 1.7 %	14 (3) 23.7 %	21 (3) 35.6 %	3 (0) 12.0 %	25 (5) 42.4 %

Table 1: Racers, in absolute numbers and in percent, using NSAID at different periods and reporting adverse effects. Numbers in parenthesis are women.

Of the three racers reporting adverse effects, one reported gastro-intestinal problems, one reported increased swelling and edema, and one reported lower heart rate level during races in conjunction with NSAID use.

The reported reasons for NSAID use were diverse. The most common reason was to reduce pain in general during longer races (n=8). The second most common reason was an existing injury that otherwise would have prevented the racer from racing, or at least reaching the finish line (n=7). Other reasons for NSAID use were “to sleep better after racing and not feel the soreness”, “to recover better and reduce the soreness after racing”, “just in case, so I wouldn’t panic over possibly not being able to finish the race”, and “to stay alert and not let the pain take over”. The one person that had used NSAID during one of these races did so because “an overstretched hamstring muscle caused pain at the back of the knee”.

Discussion

NSAID use by athletes, during races and in training, is wide spread across different sports.(1-2, 9, 12, 24-29, 33) The prevalence is higher in ball sports, 19-93 %, (26-28) than in endurance sports, 1.7-59.9 %.(2, 9, 12, 29, 33) But the prevalence is still very high in endurance events, and the potential for adverse effects as a result of the wide spread use is a cause for concern.

² Chi-2 test was used to test for significance

The frequency of NSAID use in the four endurance events previously studied is consistently around 30 % (table 2). However, in the present study of the Swedish Cup races, the reported use of NSAIDs was significantly lower during racing compared to the other four events.

Race	During race	NSAID use from time to time
Kepler Challenge (29)	35 %	-
Brazil Ironman (9)	28.5 %	59.9 %
New Zealand Ironman (12)	30 %	-
Nordic Champs in AR (33)	30 %	-
Swedish Cup races	1.7 %	42.4 %

Table 2: Summary of NSAID use in endurance events

All events in table 2 share a common characteristic: long duration. Duration ranged from 5+ hours in The Kepler Challenge, 5-15.5 hours in the Swedish Cup, around 12 hours in the Ironman Triathlons, to almost 60 hours in the Nordic Championships in AR. However, one key difference is that the Kepler Challenge exclusively involved running. Running puts more stress on the musculoskeletal system compared to biking, paddling and swimming, which are parts of adventure racing and triathlon. Further, the relatively short race time increases the intensity level. Intensity increase resulting in increasing stride length has been shown to increase shock attenuation (34) and thereby the eccentric phase of running. Eccentric loading has also been shown to increase markers of muscle damage more than concentric loading.(35) An increased level of muscle damage might lead to an increase in perceived or anticipated pain, and therefore lead the racers to increase their NSAID use. This is one possible explanation of the high relative use of NSAIDs in the Kepler Challenge.

Although longer than the Kepler Challenge, Ironman Triathlons are also raced at a high intensity, (31, 36) which could explain the frequency of NSAID use. Although the two Swedish Cup races are similar in intensity and overall race time, one difference is the relative proportion of running, which is approximately one third of total race time. Although a change of exercise modes takes place during both Ironman and multisport races (swimming or paddling, biking and running), the running takes place on asphalt during Ironman Triathlons, which increases the shock attenuation more than running on forest trails, as is the case during the Swedish Cup races. This may explain why NSAID use is quite low in these races.

The Nordic Championships in Adventure Racing is the longest of these five events. The intensity during long adventure races decreases over time.(30) Instead musculoskeletal injuries, which are commonly reported in endurance events (37-39) are most likely the reason for NSAID use, not muscle damage due to a high intensity.

Another explanation of the difference in NSAID use could be cultural. According to Berglund et al.(24) only 7.6 and 11.5 % of the Swedish Olympic athletes used NSAIDs in the Atlanta and Sydney Olympic Games, compared to 33.0 and 38.8 % of the Canadians.(25) The Italian soccer players are the most frequent users of NSAIDs at 93 %.(27) There might be a difference in attitude towards the use of NSAIDs among athletes due to cultural differences. In countries without pharmacy monopolies and those that have a more liberal view on medications, it might be easier for athletes to obtain NSAIDs without prescriptions. For example, 48.5 % of the athletes using NSAIDs during the Brazil Ironman did so without medical prescription.(9)

But at the same time, occasional NSAID use among Swedish endurance athletes is similar to that of athletes from other countries. 42.4 % of the respondents in this cross-sectional study report occasional NSAID use, compared to 59.9 % of the respondents in the Brazil Ironman Triathlon. This

may be due to the fact that lower doses of NSAID are sold without prescriptions but with a warning for adverse effects from long-term use.

Adverse effects in the present study are reported at a slightly lower level compared to previous studies. 12.0 % (n=3) of the 25 athletes that occasionally use NSAID reported adverse effects, compared to 19.2 % in the study by Alaranta et al.(2) and 18.3 % in the study by Gorski et al.(9) But due to the relatively small numbers (n=3) in the present study, it is difficult to conclude which is the most common adverse effect because the three athletes all state different effects.

The most common reasons for NSAID use stated in this survey are reduction of general muscle pain during races (n=8) or suppression of pain from a previous injury in order to be able to finish the race (n=7). Reduction of general muscle pain is also the main reason for NSAID use in the study of the Brazil Ironman Triathlon.(9) Other reasons for NSAID use according to the respondents of this survey are “to sleep better after racing and not feel the soreness”, “to recover better and reduce the soreness after racing”. These reasons support the speculations made by Page et al. (29), who suspect that athletes running a mountain marathon and using NSAIDs are trying to reduce delayed-onset muscle soreness (DOMS) brought on by the large variations in altitude during a mountain marathon, and therefore the eccentric muscle contractions and subsequent increase in muscle damage.(35) However, the majority of the studies focusing on NSAIDs’ effectiveness in treating DOMS have failed to demonstrate a beneficial effect.(40-42)

Other reasons for NSAID use stated by the athletes in this study are “just in case, so I wouldn’t panic over possibly not being able to finish the race”, and “to stay alert and not let the pain take over.” These stated responses, together with the above reasons regarding DOMS, seem to indicate that athletes have a very limited knowledge and awareness regarding the effects and side-effects of NSAIDs, which is consistent with speculations by Gorski et al.(9)

It is interesting that such a small number (n=1) of the athletes in this study used NSAIDs during one of the races. However, 14 of them state that they sometimes use NSAID during races, and 25 that they do occasionally consume NSAIDs, during or between races. There is clearly a division of NSAID use between shorter and longer adventure races. Reasons might be those speculated above. But more research is needed to establish whether a clear difference exists between NSAID use in shorter and longer races, and where the line between “short” and “long” is drawn. Further, future studies should focus on whether or not a higher level of adverse effects occurs during longer races, and what effects NSAID use has on an athlete’s body and performance.

Due to the relatively small number of athletes in the present study it is impossible to draw any positive conclusions regarding the most common adverse effects. Even though the response rate is relatively high, not all racers responded to the survey. Although 47.5-85.0 % of the surveys were returned, there remains a risk that the non-responders may use NSAIDs to a greater extent than the responders, which would bias our analysis.

Conclusion

This study indicates that there is a clear difference in NSAID use between short and long adventure races, with NSAID use being more common in longer races (1.7 % vs. 30.0 %). NSAID use in longer races lies at approximately the same level as NSAID use in other endurance events such as Ironman Triathlons and ultra mountain-runs. Adverse effects stated by the athletes in the present study are at a slightly lower level than adverse effects found in other studies. But due to the relatively small number of athletes in the present study it is impossible to draw any conclusions regarding the most common adverse effects. Our results indicate that athletes have a very limited knowledge and

awareness regarding effects, indications for use, and possible adverse effects of NSAID use. Due to the high usage of NSAIDs during and between races in endurance events, the limited knowledge among athletes, and the high risk for adverse effects, further research should focus on the effects of NSAID use on an athlete's body and performance.

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