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# The aspect of nationality and performance in a mountain ultra-marathon-the 'Swiss Alpine Marathon'

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## ABSTRACT

Eichenberger E, Knechtle B, Rüst CA, Lepers R, Rosemann T, Onywera VO. The aspect of nationality and performance in a mountain ultra-marathon - the 'Swiss Alpine Marathon' *J. Hum. Sport Exerc.* Vol. 7, No. 4, pp. 748-762, 2012. Runners from East Africa and especially from Kenya dominate middle- and long-distance running races worldwide. The aim of the present study was to investigate the participation and performance trends regarding the nationality of runners in a mountain ultra-marathon held in partially high alpine terrain. We hypothesized that Kenyan runners, living and training in the Great Rift Valley, a predominantly hilly, mountainous and altitudinous region like the Alps, would dominate also a mountain ultra-marathon because they are accustomed to high altitudes and mountainous terrains. We examined the participation and performance trends of ultra-marathoners regarding their nationalities in the 78-km 'Swiss Alpine Marathon' including 21 km in high alpine terrain where 12,194 men and 1,781 women finished between 1998 and 2011. A total of 1,682 women and 11,580 men, corresponding to 94.9 % of all finishers, originated from Switzerland, Germany, Denmark, Italy, Sweden, Great Britain, Austria, the Netherlands and Luxembourg where only one male Kenyan runner ever participated. Female runners from Denmark, Great Britain, Germany, Luxembourg, Switzerland and Sweden as well as male runners from Denmark, Great Britain, and Sweden increased their participation significantly. Women from the Netherlands became slower whereas women originating from Great Britain became faster. Men from the Netherlands, Denmark, Germany and Switzerland became slower. The fastest runners originated from Switzerland for both women and men. To summarize, runners from Switzerland dominated the 'Swiss Alpine Marathon'. Paradoxically, and interestingly, the Kenyan runners were not dominating the 'Swiss Alpine Marathon'. Further studies should investigate Kenyan participation and performance in ultra-marathons in Africa such as the 'Comrades Marathon'. **Key words:** ALPINE ULTRA-RUNNING, ULTRA ENDURANCE, ENDURANCE RUNNING, ETHNICITY.



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## INTRODUCTION

An ultra-endurance race is defined as an event where athletes have to compete more than six hours (Zaryski & Smith, 2005). Athletes require special characteristics in anthropometry (Hoffman, 2008; Knechtle et al., 2011a; Knechtle et al., 2011b) physiology (Easthope et al., 2010; Wilmore et al., 2008) and pre-race preparation (Knechtle et al., 2011b) and pacing strategy (Herbst et al., 2011) to successfully finish an ultra-endurance performance.

Besides the aspects of training and race preparation, characteristics of both anthropometry and physiology as well as the nationality of an athlete could also have an influence on the outcome of the performance in an endurance race (Larsen, 2003; Lepers et al., 2011; Rüst et al., 2012b). Regarding the origin of runners, Larsen (2003) reported that in the last two decades a change in the dominance of middle and long-distance running events occurred. In the 1980's, running races were dominated by European runners representing 48.3% of the starting field in contrast to the African athletes accounting for 26.6% of the elite starters. In the last decades, runners from Africa continued to dominate the running distances up to the marathon in the whole world (Baker & Horton, 2003; Hamilton, 2000; Larsen, 2003; Onywera et al., 2004; Scott & Pitsiladis, 2007). African runners account for 85% of the top running athletes in the world with 55.8% of these top-athletes originating from Kenya (Larsen, 2003).

Running, however, is not the only endurance sports discipline that has been dominated by a specific ethnicity and this phenomenon could be observed in other sports. In football, the Brazilian national team won the World Cup more than any other country in the world. In basketball, 85% of the players are of African origin whereas in the 1960, 80% of the athletes were white (Mangan & Andrew, 2004). In the 2000 Olympic Games, Americans dominated swimming defeating even Australian swimmers (Trewin et al., 2004). Recently, the aspect of nationality in ultra-endurance races has been investigated. Regarding ultra-endurance swimming, British swimmers achieved the best performances in the English Channel crossing (Eichenberger et al., 2012). In triathlon, Europeans dominated in the last years both Double and Triple Iron ultra-triathlon races and achieved most of the victories (Jeffery et al., 2012; Lenherr et al., 2012; Rüst et al., 2012b; Rüst et al., 2012c; Sigg et al., 2012). In duathlon, Swiss and German athletes were the most successful participants in the 'Powerman World Championship' held in Zofingen, Switzerland (Rüst et al., 2012a). In 'Ironman Switzerland', athletes of Central Europe dominated the race (Jürgens et al., 2012).

The origin of athletes could have an important influence on their performance in particular sport events. Several studies tried to determine which factors could explain the dominance of a nation in sports. For instance, issues such as genetics, social variables, physiology, psychological variables, nutrition and a culture of sporting excellence (Baker & Horton, 2003; Scott & Pitsiladis, 2007; Iso-Ahola, 1995) and environment (Hamilton, 2000; Onywera et al., 2004; Onywera et al., 2006) have been proposed to justify a dominance of athletes originating from a specific country. It would be interesting to investigate whether only one of the mentioned issues is responsible for a country's dominance in sport or whether a combination of issues is responsible for the dominance of athletes from a specific nation.

Considering running, there are studies about the performance over middle- and long-distance events of athletes coming from specific countries (Larsen, 2003; Onywera et al., 2004; Scott & Pitsiladis, 2007). However, to date, no study has endeavored to analyze the performance between nations in a mountain ultra-marathon on high alpine terrain. One might assume that Kenyans might also dominate a mountain ultra-marathon since they live and train at high altitude (Onywera et al., 2006).

Therefore, the aim of the study was to investigate the participation and performance trends of ultra-marathoners of the different nationalities in a mountain ultra-marathon. We hypothesized that Kenyan runners, living and training in the Great Rift Valley, predominantly hilly, mountainous and altitudinous region like the Alps, would participate and dominate also a mountain ultra-marathon such as the 'Swiss Alpine Marathon' because they are accustomed to high altitudes and mountainous terrains. The 'Swiss Alpine Marathon', an ultra-marathon held in high alpine terrain in Switzerland ([www.swissalpine.ch](http://www.swissalpine.ch)) is one of the largest mountain ultra-marathons in the world where more than 1,000 ultra-marathoners finish each year.

## MATERIAL AND METHODS

The data set from this study was obtained from the race website of the 'Swiss Alpine Marathon' ([www.swissalpine.ch](http://www.swissalpine.ch)). The study was approved by the institutional review board of St. Gallen, Switzerland, with waiver of the requirement for informed consent given that the study involved the analysis of publicly available data. The performance (race time) and the nationality of the runners were analyzed for all finishers in every 'Swiss Alpine Marathon' from 1998 to 2011.

The first 'Swiss Alpine Marathon' took place in 1986. The race takes place each year in July in Davos, Switzerland. There are two routes for the 'Swiss Alpine Marathon'. The first one covers a distance of 79.1 km and is called the 'Sertigvariant'. The second covers 78 km and is called 'K78'. Hereafter, we illustrated the second one because the most race data were collected in this variant. The start is in Davos at 1,538 m above sea level. Then, the runners descend to the deepest point in the race in Filisur at 1,019 m above sea level, followed by an ascent to the Keschhütte, the highest point at 2,632 m above sea level and run back to Davos at 1,538 m above sea level. A part of 21 km of the route crosses high alpine area with a highest altitude of ~2,632 m. The athletes have to cover a total ascent of ~2,148 m and the same amount of meters for the descent over the whole race. During the whole running distance, 17 paramedic stations and 31 aid stations with food and drinks such as water and hypotonic sports drinks are offered. In 2011, ~1,000 males and ~200 females finished the race successfully.

Due to the high number of participating countries in combination with the extremely large variability of the number of finishers, we investigated only athletes originating from countries with at least 100 participants in the 'Swiss Alpine Marathon' between 1998 and 2011. The mean overall performance and the performance of the fastest runner were analyzed for both women and men for each selected nation.

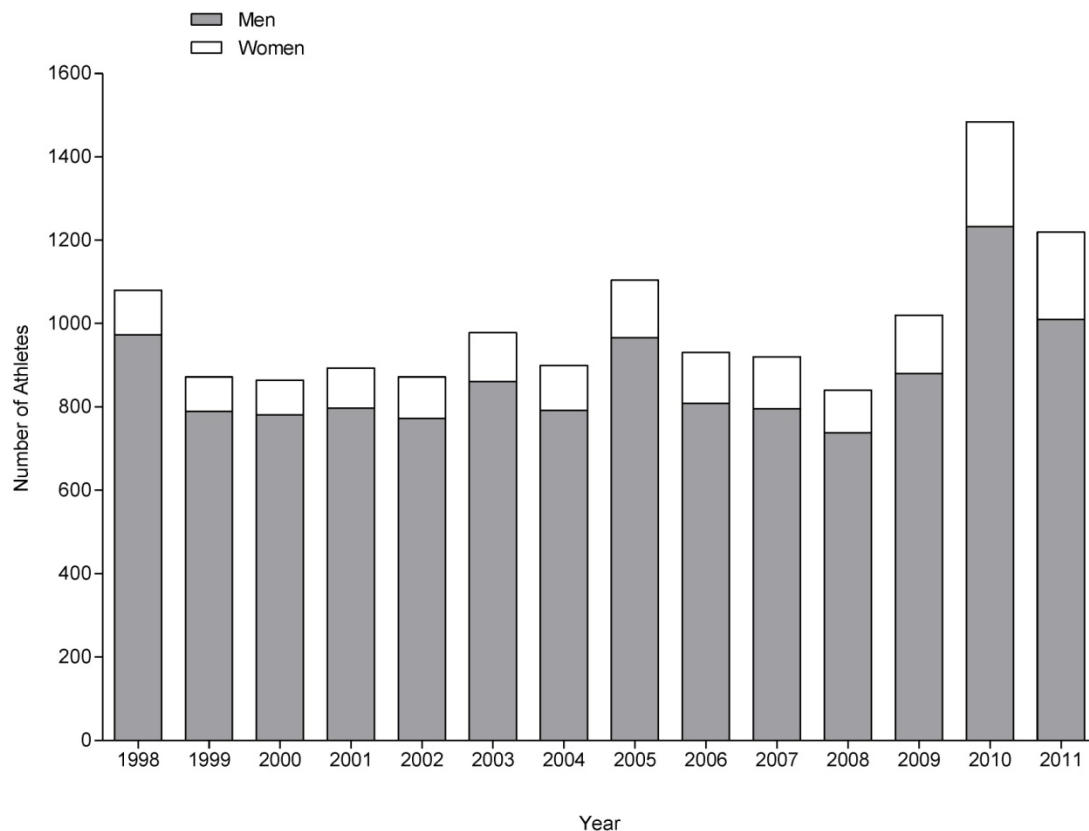
Data in the text are given as mean  $\pm$  standard deviation (SD). To test significant changes in the development of a variable across the years, linear regression was used. A student's t-test was used to find differences in case of two groups and one-way analysis of variance (ANOVA) with subsequent Tukey-Kramer post-hoc analysis in case of more than two groups. Statistical analyses were performed with IBM SPSS Statistics (Version 19, IBM SPSS, Chicago, IL, USA) and GraphPad Prism (Version 5, GraphPad Software, La Jolla, CA, USA). Significance was accepted at  $p < 0.05$  (two-sided for t-tests).

## RESULTS

### *Participation trends*

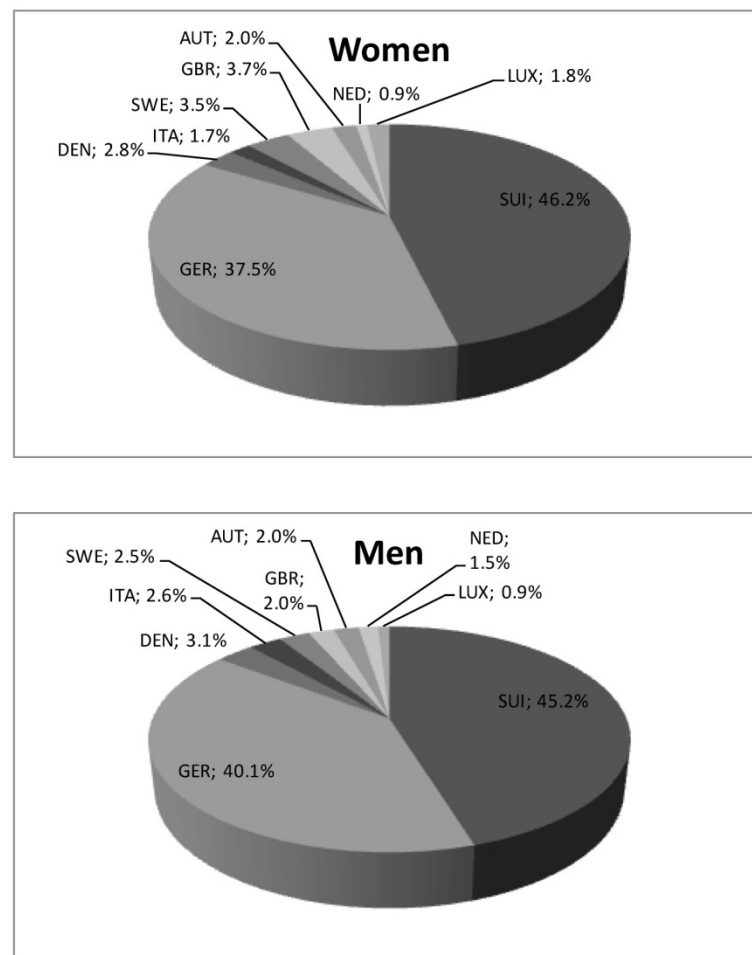
Between 1998 and 2011, the number of both women and men finishers showed no changes ( $p > 0.05$ ) (Figure 1). In total, athletes from 52 nations finished at least once the 'Swiss Alpine Marathon'. The number of athletes per country varied from 1 to 777 for women and from 1 to 5,238 for men, respectively. The nations with  $> 100$  finishers are shown in Figure 2. A total of 1,682 women and 11,580 men, corresponding to 94.9 % of all finishers, belonged to the nine following countries: Switzerland (SUI), Germany (GER), Denmark (DEN), Italy (ITA), Sweden (SWE), Great Britain (GBR), Austria (AUT), the Netherlands (NED)

and Luxembourg (LUX). Most of the participants were originating from Switzerland and Germany for both women and men.



**Figure 1.** The annual number of male and female finishers in the 'Swiss Alpine Marathon'.

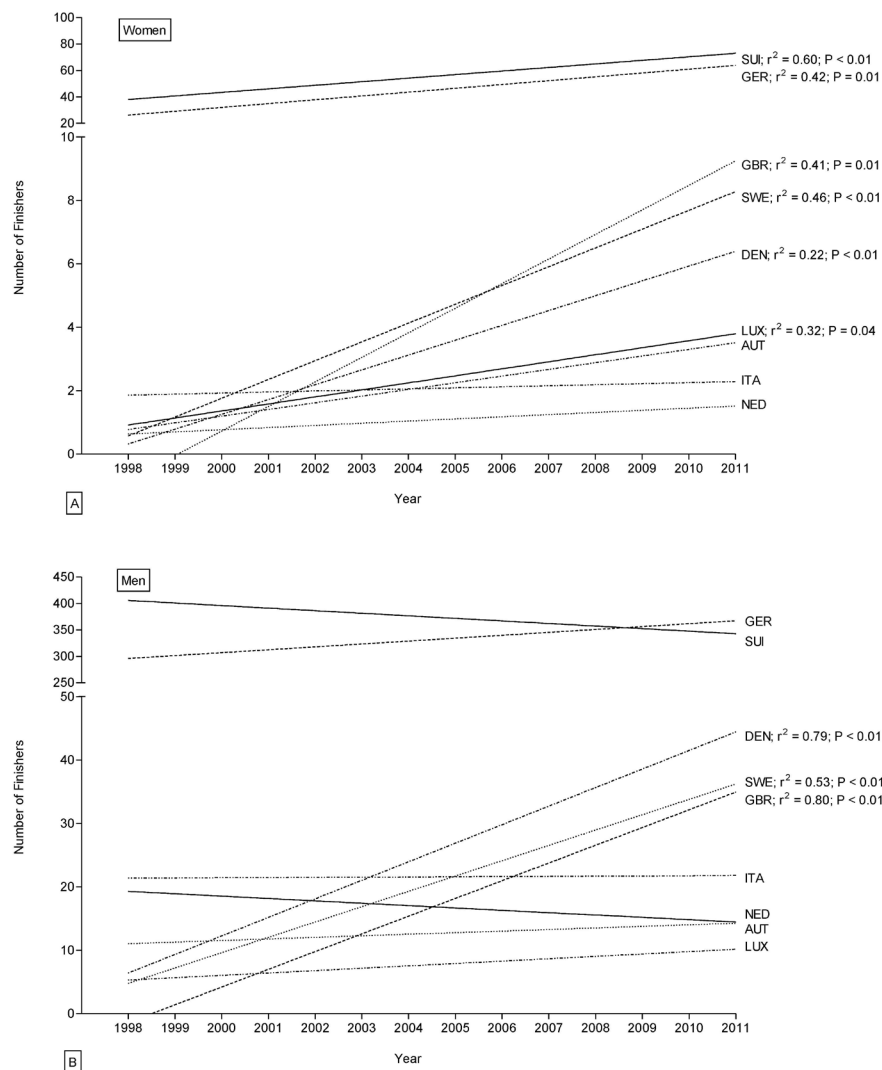
Regarding the development of the annual number of finishers for these nine countries, female finishers from Denmark ( $r^2 = 0.22$ ;  $p < 0.01$ ), Great Britain ( $r^2 = 0.41$ ;  $p = 0.01$ ), Germany ( $r^2 = 0.42$ ;  $p = 0.01$ ) Luxembourg ( $r^2 = 0.32$ ;  $p = 0.04$ ), Switzerland ( $r^2 = 0.60$ ;  $p < 0.01$ ) and Sweden ( $r^2 = 0.46$ ;  $p < 0.01$ ) significantly increased the number of finishers between 1998 and 2011 (Figure 3 A). Finishers from Austria, Italy, and the Netherlands showed no changes. For men, finishers from Denmark ( $r^2 = 0.79$ ;  $p < 0.01$ ), Great Britain ( $r^2 = 0.8$ ;  $p < 0.01$ ) and Sweden ( $r^2 = 0.53$ ;  $p < 0.01$ ) showed an increase in the number of finishers (Figure 3 B), whereas finishers from all other countries showed no change in participation.



**Figure 2.** The nations with at least 100 finishers in the 'Swiss Alpine Marathon' from 1998 to 2011.

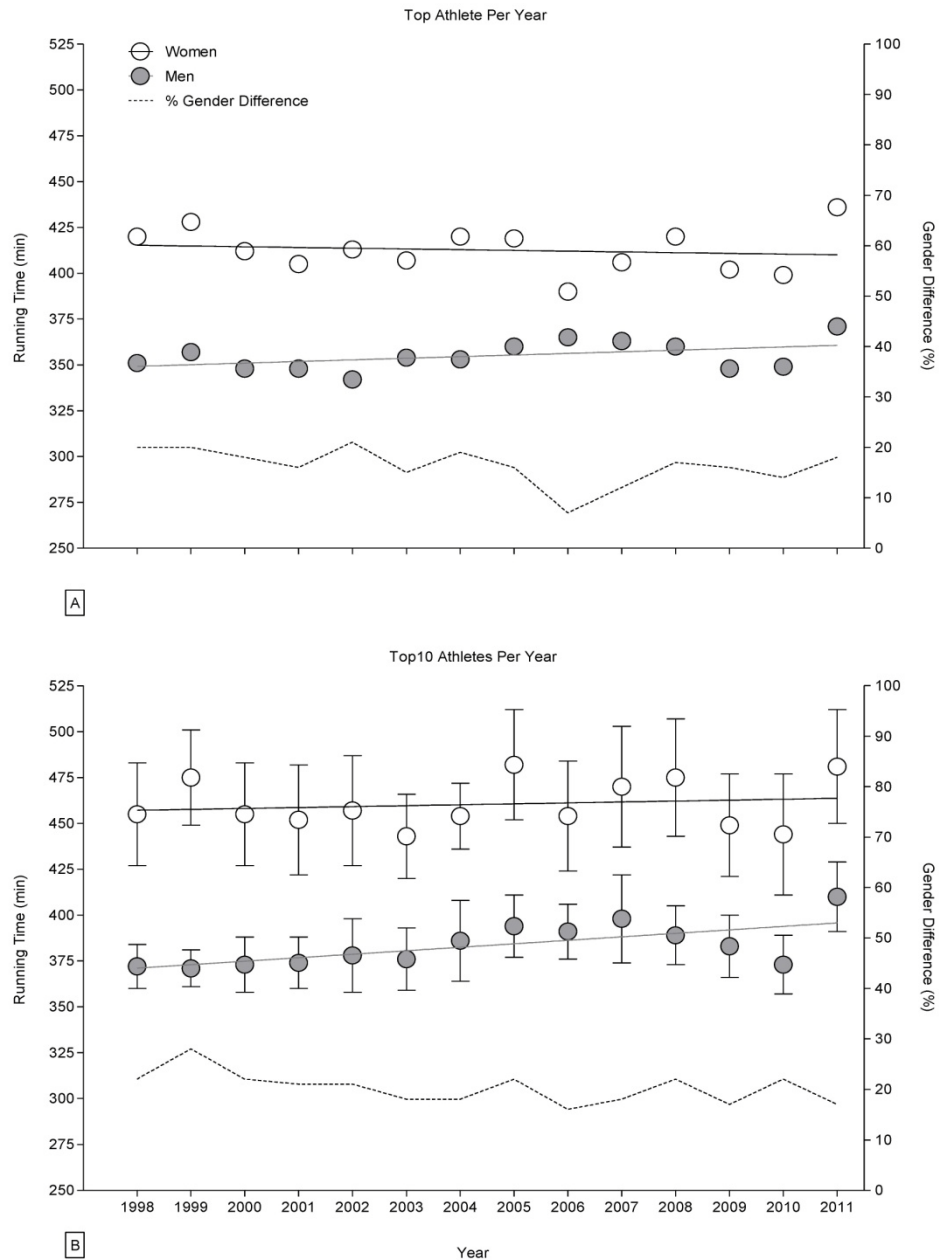
#### Performance trends

The running time of the male and female winners was  $412.6 \pm 12.19$  min for women and  $354.9 \pm 8.07$  min for men, respectively. The gender difference for the winners was  $16 \pm 3$  %. The gender difference remained unchanged across time (Figure 4 A). The overall top ten women and men runners achieved a mean running time of  $460.4 \pm 13.4$  min for women and  $383.4 \pm 11.7$  min for men, respectively. The gender difference for the top ten was  $20 \pm 3$  %. The top ten men showed a significant decrease ( $r^2 = 0.45$ ;  $p < 0.01$ ) in their performance during the studied period while the top ten women showed no change in performance across time (Figure 4 B).



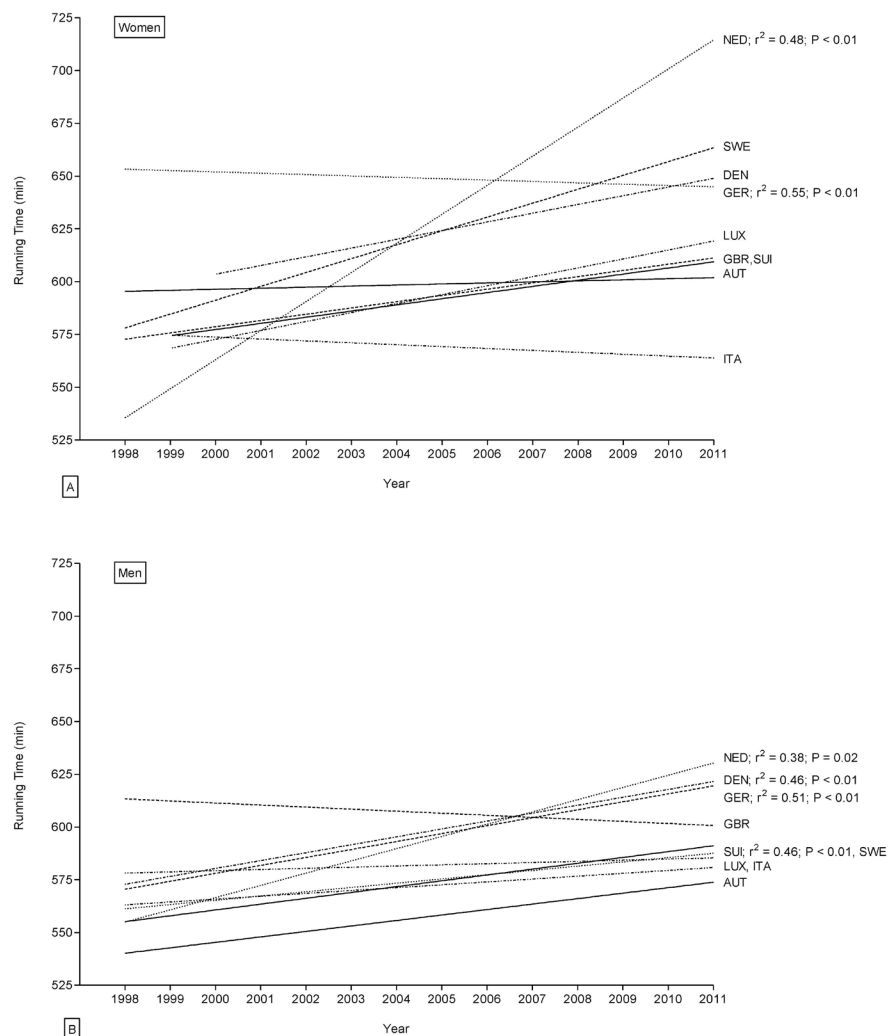
**Figure 3.** The number of annual finishers separated by country in the 'Swiss Alpine Marathon' for women (Panel A) and men (Panel B).

Figure 5 shows the overall race time per year for all finishers per country for women in Panel A and for men in Panel B, respectively. Women from the Netherlands became significantly slower ( $r^2 = 0.49$ ,  $p < 0.01$ ) whereas women from Germany ( $r^2 = 0.55$ ,  $p < 0.01$ ) became faster. For men, ultra-marathoners from the Netherlands ( $r^2 = 0.38$ ,  $p = 0.02$ ), Denmark ( $r^2 = 0.46$ ,  $p < 0.01$ ), Germany ( $r^2 = 0.51$ ,  $p < 0.01$ ) and Switzerland ( $r^2 = 0.46$ ,  $p < 0.01$ ) became slower.



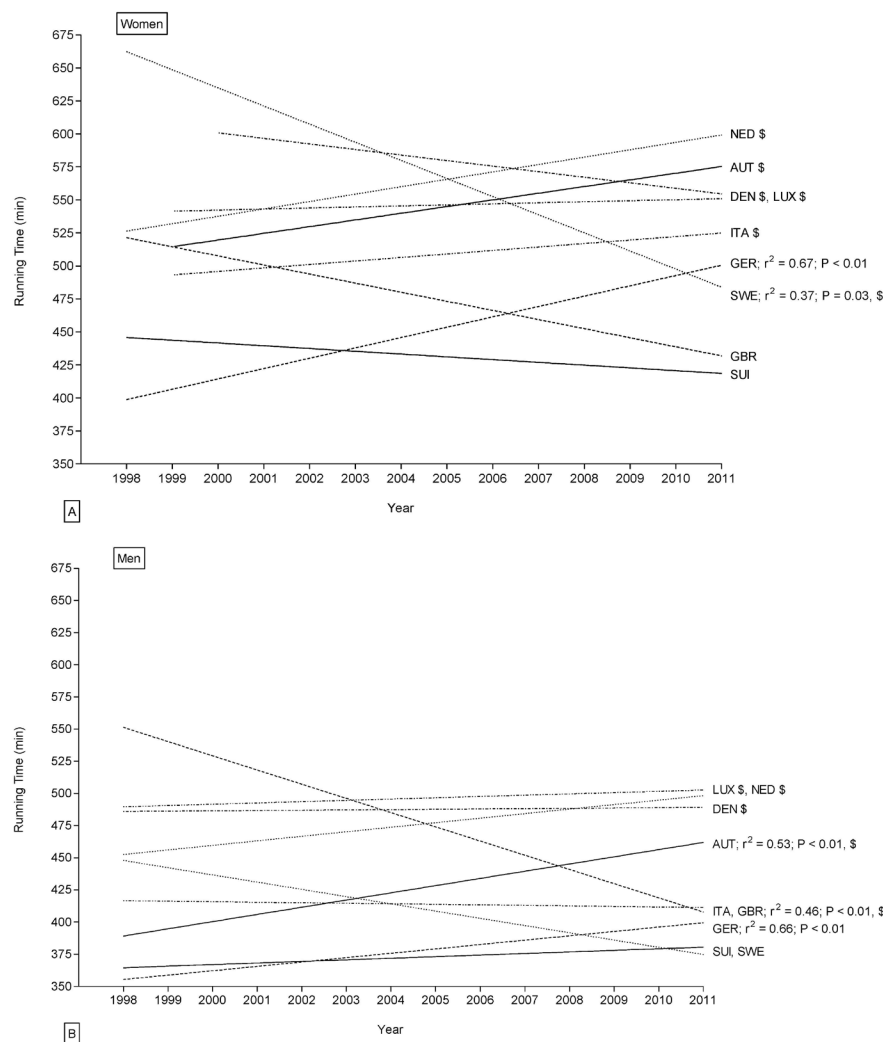
**Figure 4.** Changes in running performance of the male and female winners (Panel A) and the top ten male and female finishers (Panel B) from 1998 to 2011. The dashed line represents the gender difference in time.





**Figure 5.** The overall annual performance by country at the 'Swiss Alpine Marathon' for women (Panel A) and men (Panel B).

Regarding the annual fastest runner per country, the fastest male ultra-marathoners originated from Switzerland with a running time of  $372.6 \pm 15.3$  min, followed by athletes from Germany with  $377.5 \pm 17.49$  min and then athletes from Sweden finishing within  $411.4 \pm 47.11$  min (Figure 6). The slowest male runners originated from Luxembourg and Denmark. The fastest female race time was also achieved by Swiss athletes with an average running time of  $432.2 \pm 19.9$  min. Women from Great Britain placed behind the female athletes from Switzerland. The bottom-placed nation was Denmark followed by athletes from Sweden.



**Figure 6.** The performance of the annual fastest runners of each country at the 'Swiss Alpine Marathon' for women (Panel A) and men (Panel B). \$ indicates athletes from countries significantly slower than the Swiss athletes as fastest runners overall.

Female top runners from Sweden became faster ( $r^2 = 0.37$ ;  $p = 0.03$ ) whereas female top runners from Germany ( $r^2 = 0.67$ ;  $p < 0.01$ ) became slower. In men, ultra-marathoners from Austria ( $r^2 = 0.53$ ;  $p < 0.01$ ) and Germany ( $r^2 = 0.66$ ;  $p < 0.01$ ) became slower whereas British runners ( $r^2 = 0.46$ ;  $p < 0.01$ ) became faster. Athletes from all other countries showed no significant changes in performance.

Considering Kenyan participation and performance, one Kenyan runner, a 48-year old male, participated in the 'Swiss Alpine Marathon' between 1998 and 2011. The athlete finished the race within 636 min, equal to 186 % of the course record, set by the Russian Grigori Mursin in 2002 with 342 min.

## DISCUSSION

The aim of this study was to explore the nation-related participation and performance trends in the 'Swiss Alpine Marathon' from 1998 to 2011, a mountain ultra-marathon held in high alpine terrain. We hypothesized that Kenyan runners living in hilly and mountainous regions like the Alps would also dominate the 'Swiss Alpine Marathon' as they do marathons since they are accustomed to high altitudes and mountainous terrains. For both women and men, however, most of the participants were originating from Switzerland and Germany. Also, the fastest athletes originated from Switzerland in both sexes. Surprisingly, the Kenyan runners rarely participated in this event with only one participant ever and no Kenyan runner ever won the 'Swiss Alpine Marathon'.

### *European dominance in participation*

Most of the finishers were originating from Switzerland and Germany for both women and men. Female runners from Denmark, Great Britain, Germany, Luxembourg, Switzerland and Sweden increased their participation. Similarly, male ultra-marathoners from Denmark, Great Britain, and Sweden, but not from Switzerland and Germany, also increased their number of finishers. Runners from Denmark, Sweden as well as from Great Britain increased their participation in both genders. Probably athletes originating from these countries located in northern Europe discovered a trend to mountain ultra-endurance running. We assume that they have not so high mountains in their countries as Switzerland has with the Alps. Another explanation for the increase in their participation could be that athletes from these countries can raise enough money for the participation. Athletes have to buy a train or air ticket to travel to Switzerland; they need to pay for accommodation and for the participation which cost an athlete ~500 Euros. Another possible reason for the increasing participation could be that athletes from these countries prefer this kind of ultra-endurance challenge and are looking for a special thrill.

Athletes from countries in the north of the Alps had a higher participation rate in the 'Swiss Alpine Marathon' than athletes from countries located in the south of the Alps such as Spain, Greece, Portugal, or Turkey. Probably, runners from southern countries are poorer than athletes originating from northern Europe and therefore were limited to participate due to economic reasons ([www.nationsonline.org/oneworld/GNI\\_PPP\\_of\\_countries.htm](http://www.nationsonline.org/oneworld/GNI_PPP_of_countries.htm)). Another explanation could be that the runners from the south of Europe do not prefer the cool weather in the Alps. This assumption might explain why athletes from northern Europe such as Denmark, Great Britain, Germany, and Luxembourg increased their participation. Olds, Tomkinson, Léger, and Cazorla (2006) mentioned a worldwide variation in performance of children and adolescents which could be important for the education of ultra-runners. These authors described that the best performing children were from the Northern European countries and the worst performing children were from USA, Italy, Portugal, and Greece. In addition, Olds, Tomkinson, Léger, and Cazorla (2006) expressed the evidence that performance could be negatively related to overweight and to a country's average temperature.

French athletes did not belong to the nine countries with the highest participation in the 'Swiss Alpine Marathon', although the race in Switzerland is very close for French athletes. Also Italy and Austria as direct neighbors to Switzerland represented a very low percentage of ~3% of finishers. Maybe athletes originating from France, Italy and Austria are more interested in other ultra-endurance events such as ultra-swimming, ultra-cycling and ultra-triathlon (Sigg et al., 2012) or they prefer rather flat running trails for competing. Otherwise, both French and Italian ultra-runners may preferably compete in other ultra-marathons in their countries such as the 'Ultra-trail du Mont Blanc' ([www.ultratrailmb.com](http://www.ultratrailmb.com)) located in France near to Italy or the 'Tor des Géants' ([www.tordesgeants.it](http://www.tordesgeants.it)) located in Italy near to France.

Regarding Austrian ultra-marathoners, they probably have enough races in their country ([www.ultrarunningaustria.com](http://www.ultrarunningaustria.com)). A further explanation could be the low prize money or the moderate worldwide prestige of the 'Swiss Alpine Marathon' compared to other ultra-endurance races such as the 'Ultra-trail du Mont Blanc', the 'Marathon des Sables', the 'Comrades Marathon', or the 'Tor des Géants'. Another explanation could be the language spoken in Davos since German is the main language in Switzerland and German athletes speak and understand Swiss German spoken in Switzerland.

#### *European dominance in performance*

The fastest athletes came from Switzerland in both the female and the male runners. Maybe Swiss ultra-marathoners had home advantages because the 'Swiss Alpine Marathon' takes part in the Alps of Switzerland and thus the Swiss athletes could train in multiple high alpine terrains that are very similar to the race condition. A significant decrease in running performance was recorded for female athletes from Germany and for male runners from Austria and Germany. Perhaps, mountain running races were less developed in these countries compared to Swiss or athletes from Germany had no trainings course which were similar to the 'Swiss Alpine Marathon' route. For the athletes from the other countries, there must be another explanation because neither the males nor the females showed a decrease in performance. Probably, the other athletes improved their performance and the runners from Austria missed to improve their own performance with more effective training. Another explanation could be that they had a lot of athletes who participated for the first time in the 'Swiss Alpine Marathon' and therefore had not the required experience (Knechtle et al., 2011b; Herbst et al., 2011; Lepers et al., 2011). An analysis of training habits of runners originating from Switzerland, Germany and Austria relating to mountain running would be helpful.

Recent studies showed that Europeans dominated in triathlon and duathlon in races held in Europe (Jürgens et al., 2012; Rüst et al., 2012a) but also in races held overseas (Jeffery et al., 2012; Lenherr et al., 2012; Rüst et al., 2012b; Rüst et al., 2012c; Sigg et al., 2012). One might assume that Europeans might also dominate in ultra-marathons held outside of Europe. An actual analysis of participation and performance in the 'Marathon des Sables' held in Morocco showed that most of the competitors originated from Europe but local athletes from Morocco won most of the races (Knoth et al., 2012). Therefore, local conditions such as the heat in the desert might have been an advantage for the local runners although more competitors originating from Europe started than Moroccan runners.

#### *Why do Kenyans not participate in mountain ultra-marathons such as the 'Swiss Alpine Marathon'?*

We hypothesized that Kenyan runners, living and training in the Great Rift Valley, predominantly hilly, mountainous and altitudinous region like the Alps, would participate and dominate also a mountain ultra-marathon such as the 'Swiss Alpine Marathon' because they are accustomed to high altitudes and mountainous terrains. However, only one Kenyan runner, a 48-year old male, participated in the 'Swiss Alpine Marathon' finishing the race within 636 min, equal to 186 % of the course record.

Kenyan runners dominating the middle- and long-distance running distances worldwide for over four decades do not belong to any of the nine nations with at least 100 finishers over the studied period (Larsen, 2003; Baker & Horton, 2003; Hamilton, 2000; Scott & Pitsiladis, 2007; Onywera et al., 2006). Indeed, only one Kenyan ultra-marathoner ever participated in the 'Swiss Alpine Marathon'. This was paradoxical given that Kenyan athletes account for 85% of the top running athletes in both the middle- and long-distance events worldwide (Larsen, 2003). Kenyan runners normally live and train at altitudinous areas and therefore should be habituated to high altitudes and races such as the 'Swiss Alpine Marathon' (Drust & Waterhouse, 2010). Elite Kenyan runners have a distinct ethnic and environmental background compared with general population from Kenya (Onywera et al., 2006). The best Kenyan runners belong to the Kalenjin tribe. The

Kalenjin tribe is a large language family of the Kipsigis, Nandi, Sabaot, Tugen, Elgeyo, Marakwet, and Pokot indigenous people altogether. The Nandi sub-tribe has particularly produced a disproportionately large number of Kenyan runners (Onywera et al., 2006) despite accounting only 2% of the whole Kenyan population (Larsen, 2003). Elite Kenyan athletes covered a long distance to and from school. They mostly ran as a means of transport to and from school. This has been proposed to have partially contributed to the Kenya's running prowess (Onywera et al., 2006).

Another explanation why the Kenyan athletes were sparsely represented in the 'Swiss Alpine Marathon' could be that Kenyan elite runners only compete in flat running races ([www.realendurance.com](http://www.realendurance.com)) because their bodies are trained for flat courses and not for mountain events. Drust and Waterhouse (2010) mentioned that Kenyan runners live in natural high lands and therefore should be accustomed for hilly trails. However, it is possible that the Kenyan runners have a problem with the continuous up-and-down of a mountain ultra-marathon route. Probably, the Kenyan runners participate in ultra-marathons in Africa such as the 'Comrades Marathon' ([www.comrades.com](http://www.comrades.com)) or the 'Marathon des Sables' ([www.darbaroud.com](http://www.darbaroud.com)) because the world-wide prestige for the 'Swiss Alpine Marathon' might not enough high for Kenyan runners.

A further explanation for the very low Kenyan participation in the 'Swiss Alpine Marathon' might be the low prize money. The first three winners in the 'Swiss Alpine Marathon' gain 4,000, 2,000, and 1,000 Swiss francs, respectively ([www.swissalpine.ch](http://www.swissalpine.ch)). However, the winner in the 'Boston Marathon' earns 100,000\$ ([www.bostonmarathon.org](http://www.bostonmarathon.org)) and in the 'London Marathon', the fastest runners obtain 55,000\$ ([www.virginlondonmarathon.com](http://www.virginlondonmarathon.com)). Economic reasons are the motivation for both national and international athletes from Kenya to become a competitive athlete. They need the sports to get money to help their families (Onywera et al., 2006). Regarding this aspect, the amount of the money prizes is very important.

Apart from these considerations, financial aspects need to be discussed. Kenya has established herself as a source of international distance running talents. However, due to the economic inequality and other factors, a global migration of athletes is on the increase. One notable example is that of athletes born in Kenya, who have moved abroad to represent other countries. Initially, the trend was to move to the USA, Europe or Japan, but of late the Middle East countries of Qatar and Bahrain became more popular destinations (Njororai, 2012). The dominance by Kenyan athletes and the scarcity of talent in other countries that would want to gain international recognition have created a new dispensation. The new dispensation is that of sports labour migration from Africa to the oil-rich but talent-starved countries of the Middle East and other countries keen on raising their international profiles (Njororai, 2010). Most probably Kenyan athletes prefer to migrate to the Middle East instead of going to Europe.

### *Limitations*

This retrospective data analysis is limited since variables with an effect on ultra-marathon performance such as body mass, body mass index, body fat and training were not integrated (Hoffman, 2008; Knechtle et al., 2011a; Knechtle et al., 2011b; Knechtle et al., 2010; Knechtle et al., 2010). Also pre-race experience (Knechtle et al., 2011b; Herbst et al., 2011), food (Onywera et al., 2004) and fluid intake (Knechtle et al., 2011), weather conditions (Parise & Hoffman, 2011; Wegelin & Hoffman, 2011) and overuse injuries of the lower limbs (Scheer & Murray, 2011) were not included in the analysis.

## CONCLUSIONS

To summarize, most of the participants in the 'Swiss Alpine Marathon' were originating from Switzerland and Germany. Male runners from Great Britain, Denmark, and Sweden as well as female runners from Denmark, Germany, Great Britain, Luxembourg, Switzerland and Sweden significantly increased their participation. The fastest runners, however, originated from Switzerland in both genders. Although Swiss and Germany runners were the two largest groups, Swiss ultra-marathoners were faster than German ultra-marathoners. Interestingly, Kenyan runners did not dominate an ultra-marathon such as the 'Swiss Alpine Marathon'. Future studies should investigate participation and performance of Kenyan runners in other mountain ultra-marathons and ultra-marathons in Africa such as the 'Marathon des Sables' or the 'Comrades Marathon'.

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