

Racial Differences in Sexual Dimorphism as an Explanation for Differences in Olympic Track and Field Achievement

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It is argued that gender-contingent differences in the racial profile of Olympic track and field medalists between 1992 and 2012 are best explained by race-based differences in sexual dimorphism. Alternative hypotheses for the data are examined but found wanting. Future research into these hypotheses is recommended.

Key Words: Race differences; Olympic athletes; Gender.

1. Introduction

It is widely understood that there exist considerable racial differences in success in assorted sports. These differences have been looked at in depth with regard to a variety of sports, including short and long distance running, American football, baseball, and swimming (Sailies, 1998; Entine, 2000; Irving & Charlton, 2010; Epstein, 2013). These differences have been argued to be a reflection of genetic racial differences because races tend to succeed in the sport which requires physical characteristics which those races tend to disproportionately have. In addition, the relevant racial and sporting ability

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differences have been shown to exist at very young ages and sporting ability has been shown to be significantly heritable (Entine, 2000; Epstein, 2013).

However, the published discussions which specifically argue that racial differences in sporting achievement are genetic in origin (e.g. Entine, 2000, Irving & Charlton, 2010, Epstein, 2013) only focus on male differences in sporting achievement. They note, for example, that West Africans possess about 75% fast twitch muscle fibers and highly muscular (mesomorph) bodies resulting in accomplished sprinters. East Africans tend to have 75% slow twitch muscle fibers, a large lung capacity and more ectomorphic (thin, lightly muscled) bodies, explaining their success in endurance events such as long distance running.

The aim of this study is to show, drawing upon widely available data, that there are clear differences in the racial profile of male Olympic medalists and female Olympic medalists in the same sports. It will be argued that racial differences in sexual dimorphism help to explain these data. This hypothesis has never previously been suggested, and indeed this aspect of racial differences in sporting ability has not previous been examined. It is an important area to explore, and the hypothesis is important, because it helps to plug a hole in the argument that genetic racial differences partly predict sporting ability. If they do, they should significantly predict them in men and women and explain, within an evolutionary paradigm, anomalies in this regard. The focus has deliberately been on sports which are very direct tests of physical ability in order to obviate, as much as possible, the possibility that cultural issues might be influencing the direction of the results.

'Race' is employed, in effect, to refer to a breeding population that genetically differs from other such populations as a result of geographical isolation, cultural separation and endogamy. Genetic differences are evidenced

as differences in genome-wide patterns of allele frequencies for a large number of genetic polymorphisms (see Lynn, 2006). In that sporting ability is significantly heritable (i.e. genetic), and races are defined by patterns of genetic variation, it becomes at least likely that racial differences in representation in different sports are partly genetic. Much has been published on the heritability of sporting ability. For example, a study of 37,051 twin pairs from 7 European countries found that engaging in leisure time exercise at all was between 48% and 71% heritable (Stubbe et al, 2006). Numerous studies have shown a significant heritability to traits relevant to athletic performance such as aerobic capacity, anaerobic performance, muscle strength and power, neuromuscular co-ordination, bone density, body size and composition, muscle fiber type, and cardiovascular variables (Costa et al, 2012).

It might be argued at this point that though it is likely that racial differences in sporting ability are at least partly genetic, it is still not proven. It will only be proven once a gene is found which influences sporting ability and which varies in the right direction between races. Such a gene has indeed been found. The SNP (single nucleotide polymorphism) rs1815739 in the gene ACTN3 has been shown to affect sprint performance. ACTN3 codes for the muscle protein α -actinin, isoform 3, which is present in fast-twitch (anaerobic) but not slow-twitch (aerobic) muscle fibers. The ancestral form of rs1815739 results in functional α -actinin, which biases the muscle fibers towards the fast-twitch type. The derived (more recently evolved) form, also known as the R577X mutation, replaces an arginine codon in the sequence of the α -actinin gene by a stop codon. This prevents the formation of the functional protein. Without functional α -actinin, a greater proportion of the muscle fibers develop into the slow-twitch type. Fast twitch fibers are responsible for brief bursts of vigorous activity, as in

sprinting, while slow-twitch fibers are required for endurance, as in long-distance running.

The ancestral allele has an 89% frequency amongst West Africans, but only 57% amongst Asians and Europeans (Costa et al., 2012). This is as expected in light of racial differences in sprinting ability. West Africans tend to outperform other races in sprinting because they have around 75% fast twitch muscle fibers, a predictor of sprinting ability. East Africans have around 75% slow twitch fibers, a predictor of endurance, while the distribution in many other races is around 50-50 (Entine, 2000). This helps to explain the superior athletic endurance of Asians and Europeans in relation to West Africans, as slow and fast twitch fibers predict opposite abilities (Caneparo et al, 2010). As such, a gene has been found which proves the genetic case, rendering a purely environmental explanation untenable.

The main body types are endomorph (fat, short extremities), ectomorph (skinny, long extremities), and mesomorph (muscular, long extremities) (Carter & Heath, 1990). The main races, in terms of body type and other relevant factors, can be categorized as follows:

1. *West Africans*. This is the most mesomorphic of the races, with long limbs, short torso, heavy skeleton, a well-muscled body and very little body fat (high lean mass). Usually, West Africans have around 75% fast twitch muscle fibers (Hochachka, 1998). This aids bursts of speed and power but means that West Africans have low endurance. Most African Americans and West Indians are racially West African (Epstein, 2013).

2. *East Africans*. This is the most ectomorphic race. East Africans have long limbs, low body fat, and are not very well-muscled. They also have around 75% slow-twitch fibers and a large lung capacity (Hochachka, 1998), meaning they have very high endurance. For example, Roberts and Bainbridge (1963) conclude that the Nilotic peoples, based on a sample

of Dinka, have an average somatotype of 1.6-3.5-6.2 (endo-meso-ecto), which makes them extreme ectomorphs. 'Southern Africans' are between east and west Africans, but closer to east Africans.

3. *East Asians*. This race is the most endomorphic. The modal East Asian has short arms and legs, a large trunk, and a high level of body fat (adiposity), around 5% more than Europeans (Hu, 2008). They have relatively light skeletons (Weber, 2007) and are the least muscular of the main races (Rushton, 2003). Their slow and fast twitch muscle fiber distribution is about equal (Entine, 2000).

4. *Europeans*. This race is relatively endomorphic but less so than East Asians. Europeans can be said to fall between West Africans and East Africans with regard to lung capacity, muscle fiber distribution (Ama et al., 1986), and to some extent also body type. This race is stockier than the East or West Africans and has a greater amount of body fat. A strong upper body, broad shoulders, a longer and thicker trunk, and shorter extremities result in a lower centre of gravity (Wagner & Heyward, 2000). As such, Europeans can be seen as closer to the endomorph body type in these respects, but less so than the East Asian.

These differences predict differences in sporting ability because sports are associated with specific somatotypes, degrees of flexibility and thus muscle-fat ratio, and muscle fiber ratio, amongst other factors. The purely sociological explanations for these differences leave important questions unanswered. For example, it has been suggested that American blacks only achieve in sprinting because of tacit encouragement to sprint by whites, such that a stereotype of black animalism (due to high physical prowess) can be proven correct. However, long distance running and weight lifting ability would also prove these stereotypes, but American blacks do not excel at these sports, as predicted by their modal body

type (Entine, 2000). By contrast, East Africans do excel at long distance running, as their body type would predict.

The above body type comparisons will not necessarily mean that the racial profile of a particular sport is the same in both the male and the female competitions. The reason why men are generally superior at most sports is because, in all races, they differ significantly from women in the same ways. In particular, they tend to be physically stronger, more muscular with less fat mass, have relatively longer extremities, narrower hips, and be taller. They also have larger hearts and higher lung capacity (Epstein, 2013). This gender-based difference in ability is very considerable. For example, the current male javelin record, set in 1996, is the 98.48 mark whereas the female record, set in 2008, is 72.28 (throwing a lighter javelin). The women's 100m record, set in 1988, is 10.61 seconds whereas the male record, set in 2009, is 9.58 seconds. In effect, this means the less feminine a woman is, the better at many sports she is likely to be.

However, genetic bodily differences between men and woman are not uniform across all races. Wells (2012) drew upon anthropometric data on 96 non-industrialized populations across the world and found: 'The magnitude of dimorphism was not randomly distributed across global regions.' It was 'lowest in African and Asian populations and greatest in Arctic populations. There was a negative correlation across populations between lean mass dimorphism and adiposity dimorphism, independent of temperature. With decreasing temperature, dimorphism in both lean mass and adiposity increased. Dimorphism increased in fatter but not taller populations, independently of temperature.' This means that European women are more physically different from European men than African women are from African men or than Asian women are from Asian men. In addition, Wells emphasizes that women in cold environments invest disproportionately more in 'lean mass' than do men, and that

differences in dimorphism will be predicted by a combination of genetic and environmental factors. It should be noted that though many of Wells' individual samples were small (in some cases around 30), the differences that he found along racial lines were statistically significant.

As such, West African men would be poorly represented in tests of upper body strength and balance, such as hammer throwing, while West African women would be relatively well represented. The reason for this is that West African women, competing against European women, would be effectively like European men in a number of respects that would make them better at hammer throwing. In many cases these differences might be sufficient to obviate their genetic disadvantages. The same may be true, to a lesser extent, in relation to Asians who are, likewise, less sexually dimorphic than Europeans. For example, Northeast Asian women, because they invest disproportionately in lean mass (as they are evolved to a particularly cold environment) would be expected to compete better in tests of strength against European women than Northeast Asian men would against European men. And, in general, they would be more similar to Northeast Asian men than European women would be to European men. Accordingly, European men may dominate events such as hammer throwing but European women will do so in a less pronounced way, even if they are still relatively dominant. Put simply, the body types of women of different races will be more bunched towards the mean than the equivalent male body types and this will be reflected in racial differences in sporting ability. Race differences in body type are smaller in women than men.

2. Method

Battinelli (2007) has conducted a meta-analysis of 'high level' (international level) sporting body types from a number of further meta-analyses, upon which conclusions will be drawn, as well as the qualitative analyses of the skills necessary

for each sport. For actual racial data, the race of Olympic medalists in a given sport between 1992 and 2012 will be used. Data will be used from the 1992 Olympic Games as doping became more strongly controlled around this time. This study examines track and field events because they are strong tests of physical differences, as the rules are very simple. The race of participants has been identified by the first author through a visual and biographical analysis. Where the race of an athlete is not the majority race of their country it has been stated in brackets.

3. Results

Shot, Discus and Hammer

Battinelli (2007, p.20) observes that the modal somatotype in these events is 3.0-7.0-1.0 for men and 5.5-5.5-1.5 for women. In other words, these tests of strength involve a very low degree of ectomorphy. The men are endo-mesomorphs, with very high mesomorphy, while the women are equal in mesomorphy and endomorphy. However, the kind of strength involved is quite specific, rendering the sportsmen quite similar to rugby players. These three events require a combination of balance, flexibility and upper-body strength, to lift and propel a relatively heavy object (Santos & Shannon, 1989, p.255). As such, they would select against Africans (who would lack flexibility and upper body strength) and against East Asians (who would lack strength relative to Europeans).

Macedonio and Dunford (2009, p.38) summarize that the thrower requires a combination of strength, weight (including some excess body fat because it increases weight and flexibility), and a large body. This being the case, it would be expected Europeans, and especially Europeans of a more endomorphic kind, reflecting adaptation to cold environments, to dominate these events amongst men. Amongst women, differing levels of sexual dimorphism would probably lead to a less racially clear result.

Table 1. Olympic Medalists – Field Events, 1992-2012

Shotput		1992	1996	2000	2004	2008	2012
Male	Gold	USA	USA	Fin	USA	Pol	Pol
	Silver	USA	USA	USA	Den	USA	Ger
	Bronze	Rus	Ukr	USA	Spa	Bel	USA
Female	Gold	Rus	Ger	Bel	Cuba ³	NZ	NZ
	Silver	Chi	Chi	Rus	Ger	Bel	Rus
	Bronze	Ger	Rus	Ger	Rus	Bel	Chi
Hammer							
Male	Gold	Rus	Hun	Pol	Jap ¹	Slo	Hun
	Silver	Rus	USA	Ita	Tur	Bel	Bel
	Bronze	Rus	Ukr	Bel	N/R	Bel	Jap ¹
Female	Gold	-	-	Pol	Rus	Bel	Rus
	Silver	-	-	Rus	Cuba ³	Cuba ³	Pol
	Bronze	-	-	Ger	Cuba ³	Chi	Ger
Discus							
Male	Gold	Lit	Ger	Lit	Lit	Est	Ger
	Silver	Ger	Ger	Ger	Hun	Pol	Iran
	Bronze	Cuba ²	Bel	S. Af ²	Est	Lit	Est
Female	Gold	Cuba ³	Ger	Bel	Rus	USA	Cro
	Silver	Bul	Rus	Gre	Gre	Cuba ³	Chi
	Bronze	Aus ⁴	Bel	Bel	Cze	Ukr	Cuba ³

Aus=Australia; Bel=Belarus; Bul=Bulgaria; Chi=China; Cro=Croatia; Cze= Czech Republic; Den=Denmark; Est=Estonia; Fin=Finland; Ger=Germany; Hun=Hungary; Ita=Italy; Jap=Japan; Lit=Lithuania; NZ=New Zealand; Pol=Poland; Rus=Russia; S. Afr.=South Africa; Slo=Slovenia; Spa=Spain; Tur=Turkey; Ukr=Ukraine.

N/R=disqualified;

¹ Half Hungarian – *Kofi Morofushi*; ² European; ³ Black; ⁴ Romanian born.

Unless stated, competitor is from nation's largest ethnicity.

Shot Put

Shot put, using a 7.2kg ball for men, requires competitors to throw it as far as they can. The most recent 10 records can be seen below for male shot put. For reasons already discussed, female records are unreliable. As predicted, every single male medalist in shot put is European, with all but one of northern European origin.

The female shot put medalists were slightly different in their racial profile, and in line with our predictions based on sexual dimorphism. It is interesting that Europeans dominated shot put less amongst women than men. This is as predicted.

Hammer Throwing

It would be expected that the results for hammer throwing are slightly different from shot put. The hammer, in the male event, is 125cm long and weighs 7.25kg. Competitors must simply throw it as far as they can. Hammer throwing relies, to an even greater extent than shot put, on balance and the ability to 'move with the hammer' (Santos & Shannon, p.253), in other words, flexibility. This is because the hammer is on a chain and is thrown only after spinning it round at considerable speed. This being the case, we might expect even more pronounced European dominance of hammer throwing.

In the 2012 Olympics the hammer throwing medalists were Hungarian, Slovenian, and the Japanese (though half Hungarian) Koji Morofushi, whose mother is from Romania's Hungarian minority. Thus, as expected, Europeans dominate hammer throwing. The only other non-European is a Turk, which is close to European. This part-European origin may provide the optimum balance of flexibility, balance, and strength.

The women's hammer throw is less dominated by Europeans and the different somatotype for women in these sports has been noted. As expected, there are West African and Chinese medalists, reflecting racial differences in sexual dimorphism. The event began at the 2000 Summer Olympics.

Discus

This is a heavy lenticular disc which competitors must throw as far as possible. The results show that male discus is entirely European, with the exception of Iran. Of the 17 Europeans, 16 are with little doubt Northern European. This is not necessarily the case with the European Cuban. The female results saw representation from Northeast Asians and West Africans, as predicted. Thus, gender differences in the racial profile of the winners of these events can be explained by differences in sexual dimorphism between races.

Table 2. Olympic Medalists - Track Events, 1992-2012

100m sprint		1992	1996	2000	2004	2008	2012
Male	Gold	UK ¹	Can ⁵	USA ¹	USA ¹	Jam	Jam
	Silver	Nam	Nam	Tri	USA ¹	Tri	Jam
	Bronze	USA ¹	Tri	Bar	Por ⁴	USA ¹	USA ¹
	Gold	USA ¹	USA ¹	N/R	Bel	Jam	USA ¹
Female				Gre/Jam (jointly awarded)			
	Silver	Jam	Jam		USA ¹	Jam	Jam
	Bronze	Rus	USA ¹	Jam	Jam	Jam	Jam
10,000m							
Male	Gold	Mor	Eth	Eth	Eth	Eth	UK ³
	Silver	Ken	Ken	Ken	Eth	Eth	USA
	Bronze	Eth	Mor	Eth	Eri	Ken	Eth
Female	Gold	Eth	Por	Eth	Chi	Eth	Eth
	Silver	S.Af ²	Chi	Eth	Eth	Tur	Ken
	Bronze	USA	Eth	Por	Eth	USA	Ken

Bar=Barbados; Bel=Belarus; Can=Canada; Chi=China; Eri=Eritrea; Eth=Ethiopia; Gre=Greece; Jam=Jamaica; Ken=Kenya; Mor=Morocco; Nam=Namibia; Por=Portugal; Rus=Russia; S.Af=South Africa; Tri=Trinidad; Tur=Turkey; N/R=disqualified;

¹ Black; ² White; ³ Somali; ⁴ Nigerian; ⁵ Jamaican.

Unless stated, competitor is from nation's largest ethnicity.

Sprinting (100m)

West Africans and those of West African descent dominate male short distance running and this is as expected, based on the previous discussion of racial body types. Sprinting ability requires bursts of power and speed as a result of a relatively muscular body and a preponderance of fast-twitch fibers (Entine, 2000).

This is precisely as predicted based on previous discussions. Of the 18 medals noted in Table 2, 16 (88%) have been won by West Africans and the remaining 2 have been won by the same Namibian (Frankie Fredericks). All of the gold medals have been won by West Africans (see Table 2). The advantage of a preponderance of fast twitch fibers is obvious. But, in addition, West Africans are relatively mesomorphic and the typical somatotype of a 'specialist' high level male sprinter has been estimated at 1.5-5.5-3.0 (Batinelli, p.20). In other

words, they are extremely high in mesomorphy, even if they are ecto-mesomorph overall.

The typical somatotype of female high level sprinters, interestingly, is significantly different from that of male sprinters and is much more balanced. It has been estimated at 2.5-4.0-3.0 (Battinelli, 2007, p. 20). Thus, female high level sprinter mesomorphy is less pronounced than among male colleagues. It would be still predicted that there would be strong representation from West Africans, due to mesomorphy and FT fibers. However, the higher level of endomorphy typical of higher level female sprinters is likely to mean that the representation of West Africans is less overwhelming than in the male data. Wells' data would predict that women from colder environments would have higher lean mass, relative to men's lean mass, which would aid running.

Of the 18 female 100m medals, only 15 have been won by sub-Saharan Africans (all West African), with 3 won by Europeans. This difference is as we would predict, based on racial differences in sexual dimorphism.

Long Distance Running

The typical somatotype of high level, male long distance runners (10,000m and marathon) has been estimated to be 1.5-4.0-3.5. (Battinelli, p. 20). This means that such runners are either ecto-mesomorph or equally ectomorph and mesomorph. Clearly, they have very low endomorphy and they are much lower in mesomorphy than are sprinters. As such, the reason for the extent to which long distance running is dominated by East Africans is not their body build in itself, but their modal combination of ectomorphy and mesomorphy combined with a preponderance of slow twitch fibers and a large lung capacity. This reflects adaptation to a highland environment, which it is documented for East Africans (Entine, 2000).

It can be seen that, of the 18 medals in male 10,000m at the Olympics, 15 (including 5/6 golds) are held by East

Africans. Two of the records are held by Moroccans (who are from high altitude as well), and one is held by a European. As expected, none of the medals have been won by West Africans.

Table 2 shows that East African dominance is less pronounced with the women than with the men but still East Africans make up 55% of the medalists and 83% of the gold medalists. The wins for China and Turkey are likely to be predicted by large lung capacity, and the lower representation of East Africans, when compared to the male sample, would seem to reflect differences in sexual dimorphism. Women are not differing in lean mass in the same way as men, and this is boosting the representation of those evolved to colder environments.

4. Discussion

These data provide a sound case for the hypothesis that gender differences in the racial profile of achievement in different sports can be explained, at least to some extent, by racial differences in sexual dimorphism. There are alternative ways of explaining these data and there are a number of future research possibilities raised.

Cultural conservatism towards women pursuing certain sports at all, in particular sports regarded as masculine, such as combat sports, is likely to cause European women to be over-represented, for example, in relation to women from Iran. Indeed, it might be argued that cultural conservatism is likely to skew any kind of representation away from less developed countries. However, as these data attest, women from more culturally conservative China are actually better represented in the female events than the male events, which would not be in line with this hypothesis. There is no sound reason to think that cultural differences somehow entirely explain the difference.

A second possibility is that there are differences in the length of painfulness of menstruation between races and this helps to explain the data as the races with worse menstrual

cramps will presumably train less. However, no evidence for this proposition has been found and, in general, the evidence indicates that black runners, for example, train significantly less than white ones (at least amongst men) and are still dominant (Entine, 2000).

A third possibility is that there exist gender-contingent psychological differences between races in intelligence and personality. It has been argued that differences in these respects exist between genders and it is essentially uncontested with regard to personality (Nyborg, 2013). There is indeed evidence that high level athletes are higher than control groups in the Big 5 personality factors of Agreeableness (altruism) and Conscientiousness (impulse control) (e.g. Talayabee et al, 2013). In addition, there is some evidence that gender differences exist in Agreeableness across cultures and that they are strongest among Europeans and weaker among Asians and Africans, although many samples are convenience samples or are small, and there are only 2 black African samples included (Costa et al, 2001). This might, in part, help to explain the greater European representation in certain female events. However, it seems unlikely to be the whole explanation as the events we have examined are relatively strong tests of physical ability, and as a complete explanation it would put racial differences in sexual dimorphism down to coincidence. Moreover, it would not help to explain the greater representation of African women in some of the events we have examined as they would be predicted to be, relatively speaking, lower in Agreeableness than European women.

A fourth possibility is that sexual dimorphism differences as outlined by Wells explain the field data, but not the track data. Rushton (1997) has noted that West Africans have more pronounced secondary sexual characteristics than Europeans. Thus, it may be that these characteristics on West African women (which are essentially excess weight) assist in explaining the gender-differences in the sprinting results. It is

possible that this difference would also explain differences in the long distance running data. By contrast, East Asian women would have relatively small breasts and buttocks. Again, this may be part of the explanation, but as a complete explanation it would put the relationship noted here down to coincidence. But, nevertheless, a useful issue for further research would be an examination of differences in breast and buttock size between East and West Africans and what affect this might have on our predictions.

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