



## Comments on Mpeta et al. (2018): Black living standards in South Africa before democracy

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### KEYWORDS:

height; stature; socio-  
economics; genetics

### HOW TO CITE:

Myburgh J, Steyn M,  
Henneberg M. Comments on  
Mpeta et al. (2018): Black living  
standards in South Africa  
before democracy. *S Afr J  
Sci.* 2018;114(7/8), Art.  
#a0277, 3 pages. <http://dx.doi.org/10.17159/sajs.2018/a0277>

### PUBLISHED:

30 July 2018

Mpeta et al.<sup>1</sup> recently published a paper in which they used secular trends in stature of South Africans to make inferences about living standards. The use of documentation of living standards and the fluctuations thereof as a result of economic growth to explain the secular changes observed in height is a viable approach. The authors gave an excellent review of the history of South Africa and the differences in living conditions that existed between the population groups. However, we believe the biological data were incorrectly used, in order to support inferences regarding the socio-economic situation. The average stature of a population group indeed has a direct relationship with the living conditions and the per capita income of the individuals. For example, decreased stature may be an indicator of nutritional deprivation as a result of a lower income.<sup>2</sup> However, it is important to note that there are many other factors that can influence stature. The size and shape of human bodies vary considerably among population groups across the world and body size is not fixed. Changes in height are continually taking place.<sup>3-5</sup> In this study the authors repeatedly imply that the living standards can be explained by differences and changes in height, e.g. 'by analysing the mean height..., we shed light on the standard of living' (p. 1); 'black living standards as measured by height' (p. 1). Height should not be used simplistically to indicate the standard of living or socio-economic status as it is influenced by too many other variables such as climate, diet, genetics/gene flow, family size and urbanisation.<sup>3,4,6-9</sup> Rather, standard of living should be used, as one of many possible factors, to *explain* the observed differences in height.

Furthermore, the authors did not take into account the normal biological variation and adaptation in height. It is rightfully stated that 'genetic characteristics explain about 80% of stature variation' because heritability is responsible for 75–90% of stature variation<sup>10-13</sup>; however, this factor is not taken into account in this paper even though it explains the majority of the differences in height. The authors state that 'black men are 7 cm shorter than their white counterparts' and that 'this is one of the highest within country differences in the world, but we do not know when it emerged' (p. 1). They further confuse the possible explanations for this difference by asking if genetic inheritance perhaps contributes to the patterns, but then state that the question cannot be answered as gene-level understanding is incomplete. The authors lack an understanding of the genetic variation in South African population groups and the influence of genetic variation on the heights of different population groups. They attempted to answer this question by using societies with similar genetic inheritance, that is, North and South Koreans. North and South Koreans share a similar original gene pool and the differences in their height could possibly largely be explained by differences in living standards. Although this assumption is plausible, they then continue by comparing the height gap in the Koreans to those seen in the South African population groups. Because black and white South Africans do not share a common ancestral gene pool, this comparison is redundant. The genetic origins of South African population groups are well documented. White South Africans are largely descended from colonial immigrants such as Dutch, French, German and other European groups with low frequencies of alleles typically found in KhoeSan and Bantu-speaking individuals.<sup>14-16</sup> Population groups from the northwest of Europe (e.g. the Netherlands) are said to be the tallest individuals in the world<sup>2,3</sup> and their genes within white South Africans account for the taller statures seen in this group. The black South African population mainly arose from Bantu-speaking individuals from the Nigerian/Cameroonian highlands with considerable gene flow from KhoeSan groups.<sup>17,18</sup> The KhoeSan are among the shortest population groups in the world, which may have contributed to the shorter statures observed in black South African groups.<sup>2,17,18</sup> Therefore, the 'gap' between the stature of various South Africans is not solely an indicator of differences in standards of living but rather genetic differences. Similarly, this comparison is made between Māori and white New Zealanders who do not share a common ancestral gene pool. The convergence in stature is mainly explained by the authors as the result of improvement of living conditions and implementation of social policies without the possible effect of adaptation to similar climates or gene flow being considered. Numerous studies<sup>19-24</sup> have observed changes in height with a decrease or increase in socio-economic status. However, it is important to ensure that the different genetic origins of the population group are considered when comparisons are made.

The use of different types of data sets (as was the case in the Mpeta et al.<sup>1</sup> paper) to make comparisons needs to be approached with caution and all biases, limitations and all other possible influences need to be considered. Although the patterns in height may be accurately represented, direct comparisons in height using data sets obtained in different ways should not be made because of the inherent errors associated with each type of data set. The authors state that the World War II data set possibly had a 'preference for men of a certain height' but that 'the use of average height is unaffected' if the 'truncation is not skewed' (p. 2). Making use of a data set that pre-selects individuals of a certain height renders all comparisons with other data sets that do not select for this variable impossible. The World War II data are therefore biased towards a certain height which is not necessarily represented by other data sets. Similar bias arises when the Cape Mounted Police and South African Constabulary data are used. The use of cadaver heights or lengths from the Raymond A. Dart Collection (University of the Witwatersrand) is particularly concerning. These heights are notoriously inaccurate and are often nothing more than estimates by the morgue staff – as the authors themselves state, one finds many unlikely statures (e.g. a stature of 139 cm) among these records. Although the authors mention skeletons (p. 3) when they refer to the Dart Collection data, we assume they have used lengths recorded in the cadaver books and not statures reconstructed from skeletons. The number of bodies donated to the Dart Collection significantly increased from 1958 onwards, especially among white groups. Whereas the black South Africans in the collection were mostly unclaimed bodies, and thus presumably of lower socio-economic status, the white South African bodies were often donated and of higher socio-economic status. Additionally, the well-known measurement difference of approximately 2.5 cm between cadavers and living stature<sup>25</sup> is not mentioned as a

possible misrepresentation of height. Lastly, the sources of the data from the Demographic and Health Survey and National Income and Dynamic Study are based on surveys and the height values need to be approached with caution as a result of known errors in the accuracy and reliability of using self-reported height data.<sup>26</sup>

It is disappointing to note that the authors did not refer to any of the numerous studies on stature and secular trends that have previously been done in South Africa. Different secular patterns in height were reported during the late 19th and early 20th century in black and white South African groups. Negative and null secular trends have been observed by Kark<sup>27</sup>, Tobias<sup>28-31</sup>, Tobias and Netscher<sup>32</sup>, Price et al.<sup>33</sup>, and Louw and Henneberg<sup>34</sup>, while limited positive trends were observed by Tobias<sup>35</sup>, Henneberg and van den Berg<sup>36</sup>, Steyn and Smith<sup>37</sup> and Myburgh<sup>38</sup>. For these studies, different data sets with various birth cohorts were used in order to show the different patterns in secular trends. The results from these papers explain the differences in stature between the population groups and provide theories on the possible reasons for the different patterns of change in height. Mpeta et al.<sup>1</sup> state that the observed decline in the stature of white men and the increase seen in black men may be a result of insufficient sample sizes. However, previous studies using larger sample sizes have observed a similar trend.<sup>34,36,38,39</sup> Henneberg<sup>40</sup> also observed instances in which the secular trend did not follow the socio-economic change in the country. He suggested that other factors, for example causative agents which affect the relevant stature-determining genes, may also be responsible for secular changes in height.<sup>40,41</sup> Therefore, it would appear that the major determinant of the direction and magnitude of secular changes may not only be because of the general improvement of living conditions, but rather distinct factors which are specific to the population group.<sup>40,41</sup> This indicates that other factors – for example urbanisation and the associated change in diet, levels of physical labour and access to health care – may also have played a role in both white and black South African groups.

We would also like to comment on terminology; the terms 'whites', 'blacks' and 'white stature' are commonly used throughout the Mpeta et al.<sup>1</sup> paper. These are sensitive and emotionally charged terms and are not scientifically correct. The correct terminology would be, for example, white South Africans, black South Africans or white/black males/females. As M.S. is associated with the School of Anatomical Sciences at which the Raymond A. Dart Collection is housed, we would like to express our disappointment that the use of the collection was not mentioned in their Acknowledgements.

In summary, we believe that the Mpeta et al.<sup>1</sup> paper would have benefited from a better understanding of biology and human variation. While their attempts to make inferences on past living standards are to be lauded, their conclusions are simplistic and tend to follow popular beliefs rather than scientific facts. Secular trends within the same group may be indicative of economic change, but trends between groups need first a genetic explanation before other variables can be considered. The reality is far more complex, as was also demonstrated by Myburgh<sup>38</sup> and Myburgh et al.<sup>39</sup>, and needs in-depth analysis.

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