

The Physique of Young Males in East Africa from the Biosocial Point of View

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ABSTRACT

The aim of this study is to show the correlation between the physique of Africans from Kenya, Tanzania, Sudan and the conditions of their biosocial environment. All the young men examined were from Kenya (N=423), Tanzania (N=153) and Sudan (N=154) aged 18 to 30. Based on the taken measurements (height, weight, sitting height, physiognomic leg length and chest, waist, hip, left thigh and left arm circumferences) the following indices were calculated: Body Mass Index (BMI), Rohrer's index and skeletal index. The birth date, the number of children per ménage (in family), and the birth sequence of the examined subject were inquired. The measurement results were elaborated (worked out) statistically in accordance with commonly accepted standards. All the information contained in the collected material within the analysed countries was compared. On the basis of the measured traits and calculated indices it was found that the morphological constitution of the men from Sudan differed. Typical for this group are the largest stature length and the lowest weight and waist measurements. Kenyans are similar to Tanzanians, although the latter have higher weight, hip and thigh measurements and lower chest circumference. The characteristics of the examined Africans' morphological structure were analysed in comparison with the data available in literature and relating to the number of children in family, population density, illiteracy and the growth of income and of the HIV/AIDS problem.

Key words: body mass index, Rohrer's index, skeletal index, morphological structure, East Africa

Introduction

The interest in Africa has been invariable for many generations. The exoticism of the Black Continent has attracted travelers, explorers and people craving for wealth. At the Berlin Congress in 1815, the European countries divided the African continent into different zones of influence. Those decisions from before nearly two centuries have determined the present political situation of Africa and have strongly affected its development and social, economic, ethnic and cultural conditions. Since the state borders and the influence zones were determined arbitrarily, original bio-cultural regions gradually blurred. Ronald Oliver¹, a historian, wrote in his study 'The African Experience' that the division of Africa by European colonizers was actually a brutal unification. The number of countries was reduced from ten thousand to fifty. Many of them are artificial units now, just geographical ideas designed on the maps. The origin of modern states is not the same as tribal origin, the bonds of which are stronger than the state borders². However, the latter element affects biosocial developmental characteristics of inhabitants of each country.

In my anthropological research conducted in Kenya, Tanzania and Sudan I have presented the current state of the physique of those countries' inhabitants. The somatic constitution of the measured representatives is connected with the economic status of an average citizen of the analysed country. The young men that were measured belong to a generation born in an independent country. Disintegration of the colonial system was inevitable and most African countries acquired their independence in the nineteen sixties, after the Second World War. However, the stigma of the colonial era and the events of the last decades have left their traces in the morphological characteristics of those countries' inhabitants.

Material and Methods

This paper is based on my research material collected in 1999 and 2000. Tests were carried out at educational institutions in Kenya (N=423), Tanzania (N=153) and

Sudan (N=154). In accordance with the anthropometric technique described by Martin³, the following measurements were taken: body height (B-v), body weight, sitting height (BS-v), chest circumference (armpit circumference through *axa* and *axp*)⁴, waist circumference, hip circumference (measured through *glutheale* 64; (1)³), maximum left thigh circumference (muscle circumference with the loaded leg) and upper arm circumference relaxed (left). On the grounds of the measurements, the physiognomic leg length was calculated (=body height-sitting height), BMI, Rohrer's index = *body weight (g) / body height³ (cm) x 100* and the skelic index = *physiognomic leg length (cm) / sitting height (cm) x 100*. This selection of traits to be measured was determined by measuring conditions. The measuring procedure could not be embarrassing and could not violate the specific African sense of intimacy. It was also important for me to be able to explain to the local people the reasons for my research and to satisfy their curiosity.

As a result of the conducted inquiries, such data as the birth date, the number of children in family and the position of the examined subjects in the birth sequence in their families were collected. I have chosen the word 'family' to describe the home environment of the tested men. This is connected with the occurrence of polygamy and using the levirate marriage or sororate marriage in case of the death of one of the parents⁵. In the tested men's households there is a father and one or several wives and their children. In a family functioning this way, the progeny has equal rights, with the family hierarchy being established according to age⁶. All the tested young men were aged 18 to 30.

The results of measurements taken in the analysed countries were processed statistically in accordance with the accepted principles. To compare differences between particular traits and indices with different variability, from an international perspective, I also used Standard Deviation Score

$$SDS = (X_x - X_y) : SD_y$$

where: X_x – is an arithmetic average for a given trait in the country analysed, X_y – is an arithmetic average for a given trait for all the people analysed (N=730), SD_y – is an average standard deviation of a trait for all the people analysed (N=730).

It allowed me to avoid using different units of measure (kg, cm, etc.) and to compare all traits as a uniform set.

TABLE 1
THE AVERAGE NUMBER OF CHILDREN PER FAMILY AND THE BIRTH SEQUENCE OF THE EXAMINED MEN IN RESPECTIVE COUNTRIES

Country	Average number of children in family	Average birth sequence in family
Kenya	5.7	3.3
Tanzania	5.5	3.2
Sudan	5.3	2.8
Altogether	5.6	3.1

Source: own material

Results and Discussion

The students of the schools where the tests were carried out came mostly from numerous families, of medium economic position typical for a given country (Table 1).

Some of them helped actively in bringing up their younger siblings when they were young children or teenagers themselves. Such a situation is common among African families⁶. Many of the tested men described their childhood as hard because they were forced to work hard to earn a living or had to live on streets. It is often a reason of delay in their vocational training. The childhood and adolescence of the tested men happened in the days of difficult economical and political conditions typical for both the region and the Africa itself. A high birth rate is an essential issue for the region described (Table 2). Despite high death rate, which was the result of various factors, the rate of population growth in native societies was so high that demographers called it a »demographic explosion«.

The schools, where the tests were carried out, had verified candidates taking into account the large number of children in family (Table 1). In all the three countries the average number of children per woman tends to decrease. The tested men were born when that average was over 6.5 for each of the three countries. For a comparison, the average number of children per woman in Poland, Germany and the USA in the same period of time was much less, as seen in Table 3.

The body height and weight are considered to be ecosensitive and undergo variations, depending also on the family structure⁸⁻⁹. The findings show differences in this respect, which not only depend on natural environ-

TABLE 2
POPULATION FOR THREE ANALYSED COUNTRIES (THOUSANDS)⁷

Country	Years						
	1950	1960	1970	1980	1990	2000	2005
Kenya	6,077	8,115	11,273	16,282	23,430	30,689	34,256
Tanzania	7,650	10,013	13,594	18,858	26,231	34,763	38,329
Sudan	9,190	11,513	14,699	19,970	26,066	32,902	36,233

TABLE 3
TOTAL FERTILITY RATE (CHILDREN PER WOMEN). CONSTANT FERTILITY VARIANT⁷

Period	Country					
	Kenya	Tanzania	Sudan	Poland	Germany	USA
1970–1975	8.00	6.75	6.67	2.25	1.64	2.02
1975–1980	7.60	6.73	6.29	2.26	1.52	1.79

TABLE 4
COEFFICIENTS OF CORRELATION BETWEEN THE NUMBER OF CHILDREN AND THE BIRTH SEQUENCE IN THE FAMILY AND THE BODY HEIGHT AND WEIGHT IN THE STUDIED AFRICANS

Traits	Number of children in the family (p=0.05)	Birth sequence in the family (p=0.05)	Number of children in the family (p=0.01)	Birth sequence in the family (p=0.01)
Body weight	0.099	0.012	0.098	0.011
Body height	0.016	-0.065	0.016	-0.065

ment, but also on the socio-economic situation of a given region or country¹⁰. Attention is also paid to the family model in a given environment and culture¹¹ and to implications resulting from it. Depending on the family model shaped, family economic status relies on »singular effort of individual« or the whole family is a »production unit«. Wolański⁸ points out in his study that in certain environments traditionally large families (e.g. Japanese and Korean) create better conditions of development for their progeny than the so called modernized families, even as the income and education level in these traditional families is lower. Differences are determined by civilization distinct features (ethnic traditions and cultural customs), including the organization and the role of family in society¹². In Africa, the next family member is not only a burden for a poor income, but also an additional work force in a family.

In the analysed material there is no correlation between the body height and weight of the tested Africans and the number of children in their families or the birth sequence. The obtained coefficients of correlation between the number of children in a family and the body height and weight are statistically insignificant. For $p=0.05$ and $p=0.01$ the values were very similar. A similar lack of correlation was found for the birth sequence in a family and the body height and weight (Table 4).

This suggests that the African environment has its own regularities, which are different from the European and the American ones.

Morphological characteristics of the inhabitants of the three countries were compared and the comparison of the analysed traits is presented in Figure 1.

The Kenyans have the smallest body height, the smallest leg length, the lowest skelic index and the largest chest circumference. The Tanzanians have the largest body weight and the largest hip, thigh and arm circumferences. Their Rohrer's index and the BMI are also the largest, which proves that they are less slender and the best nourished in comparison with the tested men

from Kenya and Sudan. The men from Sudan have the smallest body weight and the smallest circumferences measured. However, they have the largest body height, the longest torsos and the longest limbs, and consequently by the largest skelic index. Their Rohrer's index and the BMI are the lowest, which means that they are the most slender. The value of the skelic index is of importance for the size of BMI. The analysis of coefficient of correlation of the BMI in comparison with the skelic index for the whole population ($N=730$) points at negative correlation of a medium intensity and amounts to $r=-0.428$ ($p<0.01$). The analysis made with division into groups from respective countries leaves them within the same negative zone of medium intensity, with the lowest correlation of BMI in respect to the skelic index showed by the Kenyan group $r=-0.321$ ($p<0.01$), and the largest by the Sudanese one $r=-0.437$ ($p<0.01$). The intermediate groups is represented by the analysed men from Tanzania, for whom the coefficient of correlation of the BMI in respect to the skelic index is $r=-0.339$ ($p<0.01$). The tested Sudanese are also the rarest among the overweight people (only 1.9% of all examined subjects). The largest group of overweight people comes from Tanzania (29.4%). The people of slender (leptosomatic) body constitution live most often in Sudan (51.9%). The stocky (pyknic) type is the most frequent among people from Tanzania (24.8%) and the most seldom among the Sudanese (2.6%). As it results from the comparison of the morphological characteristics of the tested groups, the most different body constitution is that of the Sudanese. Their length measurements are much larger and their circumferences of the measured body parts are the smallest. The people from Kenya have the smallest length measurements, medium circumferences of the measured parts of the body, except for the chest – its circumference is the largest. The examined young people from Tanzania are similar to the men from Kenya, although the Tanzanians are statistically heavier, have a significantly smaller chest circumference and larger hip and thigh circumferences.

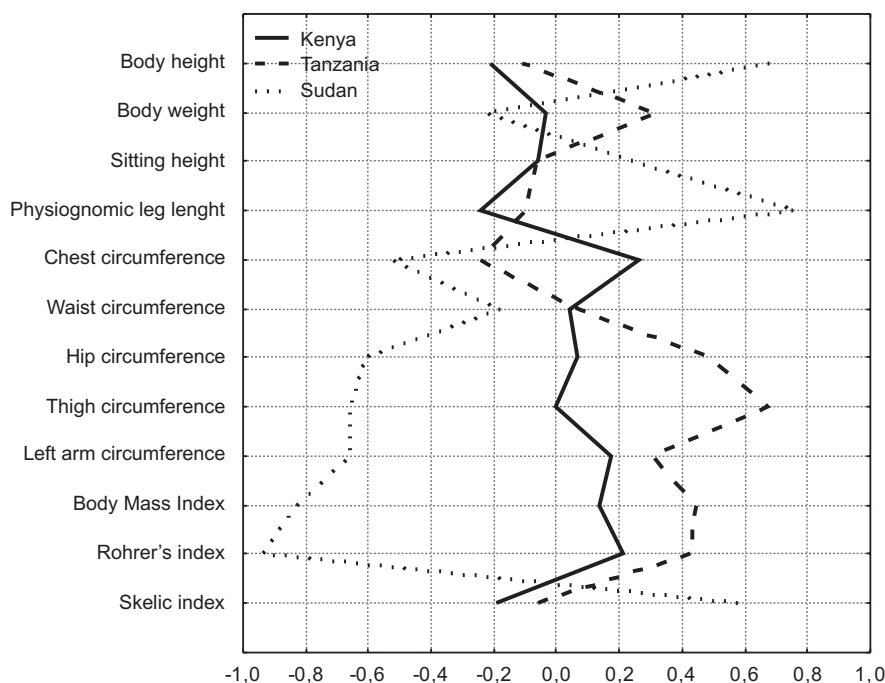


Fig. 1. International comparison of the analysed traits and calculated indices.

The physique versus social and economic situation

The conclusion based on the available statistical data would prove that the richest country in the discussed region is Sudan. However, the living standards of inhabitants of those countries do not reflect the data and indices as seen in Table 5. Because of the social structure, national goods are divided utterly disproportionately thus reflecting deep African contrasts⁶. Despite environmental differences in the three countries discussed, the employment rate in agriculture is similar (about 80% of the total number of the working people). The major part of inhabitants of Kenya, Tanzania and Sudan earn their living in agriculture and live in the country. Economies of those countries depend to a large extent on the situation in the agricultural sector. That situation is illustrated by proportional shares in Gross Domestic Products (GDP) income, 2003 (agriculture, industry, services). In Kenya: agriculture – 24%, industry – 13%, services – 63%. In Tanzania: agriculture – 48.1%, industry – 15.4%, services – 36.5%. In Sudan: agriculture – 43%, industry – 17%, services – 40%^{13,14}.

The armed conflicts in Sudan have been affecting the whole country for nearly 30 years. Expenditures connected with them are very high compared with the economic situation of the country and take up a significant part of the country's income. Many people have been forced to immigrate to the adjoining countries as a result of military operations. As it results from United Nations High Commission for Refugees (UNHCR) data for the year 2002, there are over 508¹⁵ thousand refugees from Sudan. The long-standing military operations have been

the cause of social and economic destabilization, a poor education system and illiteracy of inhabitants of this biggest country in Africa. Kenya and Tanzania have significantly reduced their expenditures on armaments recently. In Kenya there have been a dozen or so local conflicts caused by ethnic problems. However, not only the need for domination of one of the tribes but also the will to acquire more fertile agricultural areas have been motivated those conflicts. As a result, the population has migrated and the tourist industry, which has been the source of substantial income, has been reduced. The social situation in Tanzania is the most stable in comparison with the two other analysed countries of East Africa. There were no major internal ethnic conflicts since the independence had been regained. The only conflicts have been connected with the claims of Muslims concerning the political dependence of Zanzibar on the central government. Social disturbances in the adjoining countries (Uganda, Burundi, Rwanda) have not had an imposing effect on the internal situation in Tanzania. The aid offered by international organizations has been very important. In the nineties of the last century Tanzania reduced its expenditures for armaments 26 times as a result of advantageous political changes. The relatively peaceful social situation has an advantageous influence on the economic development, thus leading to a slow but constant improvement of living conditions in Tanzania.

The discussed factors and other causes influence the level of the biosocial development of the young generation. The differences between particular morphological characteristics of the representatives of different countries are presented in Figure 1. The physique of young

TABLE 5
SELECTED DATA ILLUSTRATING DIFFERENCES IN GIVEN COUNTRIES⁷

Country	GDP per capita \$ (2001)	Military expenditure (as % of GDP, 2001)	Adult literacy rate %, age 15 and above, (2001)	People living with HIV/AIDS (adults, % age 15–49, 2001)	Public expenditure on education (as % of GDP, 1998–2000)
Kenya	980	1.8	83.3	15.01	6.4
Tanzania	520	1.3	76.0	7.83	2.1
Sudan	1,970	3.0	58.8	2.60	no data

Similar data concerning three other countries are presented below for comparison of the existing disproportions.

Poland	9,450	1.9	99.7	0.10	5.0
Germany	25,350	1.5	99.9	0.10	4.6
USA	34,320	3.1	99.9	0.61	4.8

GDP – Gross Domestic Product

men from Kenya and Tanzania is similar, although the men from Tanzania are heavier and the circumferences of the measured body parts are larger. The better nutrition of the men in Tanzania may be a result of better use of natural environment conditions and the long-standing social peace. The physique of the inhabitants of Kenya, Tanzania and Sudan differs not only in morphological characteristics¹⁶. Each country is a mosaic of many aboriginal tribes with specific languages, customs and clothes, forms of body decoration and scarification, etc⁵. In this paper the problem of differentiation of the somatic constitution in various tribes is not discussed. It is focused on the relationship between the physique and the social and economic situation of the countries, where the examined men live. Thus, it may not be correct to use the BMI to evaluate the nutrition state of the inhabitants of the East African countries. The slender build of the Sudanese is determined genetically¹⁷. Their leptosomatic build is the result of adaptation to excessive heat disposal from the body.

Conclusion

The results of my study have been compared with the works of other authors^{18–22}. As it results from my research, the examined inhabitants of East Africa are taller and heavier than those who were measured in the sixties of the 20th century. It may be a result of a secular trend. Jan Czekanowski²³ found that the body height of Africans is strongly related to the contrasting living conditions of the examined populations, which proves that this trait is highly ecosensitive.

On the grounds of the comparison of my findings and the data presented in the literature it is possible to state that nearly all individual characteristics exceed the earlier data, which means that the studied individuals are taller, have greater body weight and larger circumferences. However, there is not enough comparative data concerning Africa to enable recording of the rate of changes in the body dimensions. Although the study results used in the comparison do not present the complete

TABLE 6
NUMERICAL CHARACTERISTIC OF THE ANALYSED TRAITS OF THE MEN

Traits	Kenya (N=423)		Tanzania (N=153)		Sudan (N=154)		Altogether (N=730)	
	X	SD	X	SD	X	SD	X	SD
Body height (B-v)	170.93	6.90	171.75	8.64	178.05	7.49	172.60	7.94
Body weight	60.30	6.55	62.82	8.52	58.97	6.47	60.55	7.11
Sitting height	84.42	3.67	84.40	3.61	85.53	3.67	84.65	3.68
Physiognomic length of legs	86.50	5.20	87.35	6.66	92.57	5.45	87.96	6.08
Chest circumference	87.26	4.72	84.74	5.46	83.28	4.03	85.95	5.05
Waist circumference	76.69	4.66	76.88	5.91	75.56	5.94	76.49	5.24
Hip circumference	90.11	4.49	92.42	6.09	86.38	5.28	89.75	5.56
Thigh circumference	50.86	3.35	53.50	3.68	48.28	3.95	50.87	3.93
Upper arm circumference	27.01	2.05	27.31	2.38	25.10	1.94	26.61	2.29
Body mass index	20.62	1.78	21.27	2.14	18.61	1.85	20.34	2.09
Rohrer's index	1.21	0.006	1.24	0.14	1.05	0.12	1.18	0.14
Skelic index	102.61	7.01	103.57	7.75	108.34	6.65	104.02	7.44

state in the past, it seems possible that the improvement in the economic situation of inhabitants of the analysed region in the last four decades has caused the advantageous secular trend. Continuous cultural and economic

transformations cause irrevocable changes in those original communities. At present, ethnic differences are being blurred and the passage of time makes studying the life of aboriginal peoples impossible.

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TJELESNE ODLIKE MLADIĆA U ISTOČNOJ AFRICI S BIOSOCIJALNE TOČKE GLEDIŠTA

SAŽETAK

Cilj je ovog istraživanja prikazati korelaciju između tjelesnih odlika Afrikanaca iz Kenije, Tanzanije i Sudana, kao i uvjeta njihovog bio-socijalnog okoliša. Svi ispitanici mladići bili su iz Kenije (N=423), Tanzanije (N=153) i Sudana (N=154) starosti od 18 do 30 godina. Na temelju uzetih mjera (visina, težina, visina u sjedećem položaju, duljina nogu te obujam prsa, struka, bokova, lijevog bedra i lijeve ruke) izračunati su sljedeći indeksi: indeks tjelesne mase (BMI), Rohrerov indeks i omjer dužine nogu i trupa. Subjekti istraživanja ispitani su o datumu rođenja, broju djece u obitelji i redoslijedu rođenja u obitelji. Rezultati mjerenja bili su obrađeni statistički u skladu s općeprihvaćenim standardima. Uspoređeni su svi podaci sadržani u prikupljenom materijalu iz istraživanih zemalja. Na temelju izmjerenih svojstava te izračunatih indeksa, utvrđeno je da se morfološka konstitucija muškaraca iz Sudana razlikuje. Tipične za ovu skupinu jesu najveća visina te najmanja težina i obujam struka. Kenijci su slični Tanzanijcima, iako ovi posljednji imaju veću tjelesnu težinu, veći obujam bokova i bedara te manji obujam prsa. Karakteristike morfoloških obilježja ispitanih Afrikanaca uspoređene su i s podacima dostupnima u literaturi, kao i u odnosu na broj djece u obitelji, gustoću populacije, nepismenost, porast prihoda te probleme vezane uz HIV/AIDS.