Dorsal Profile of the Peoples in Ghana Kenya and Morocco

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Abstract Quantified scale of body line on the dorsal profile was applied to three peoples in Africa. Statistical computation was introduced to discriminate the character of body curve. Comparison of means on differentiated division suggested more coherent coincidence between the profiles of Moroccan and Kenyan peoples than that of the Ghanaian. A high and strong concavity of waist in female and adipose round back in both sex were characteristic to the people in Ghana. A muscular back of Kenyan and Moroccan people and flatness of the waist in the people of Morocco were counter to the Ghanaian. The waist height and concavity displayed varied correlation to other anthropometric measurements of the three peoples respectively. Racial trend may be presumable in correlation to subcutaneous thickness and body strength.

For some peoples the outside appearance of body shape is an important character as the racial trait. The shape of body line, however, has been described rather as a categorical character of image impression without distinct scale to discriminate the differences among peoples. Automatic image input device incorporated to computer developed quantification of complex images with the aid of statistical analysis. We shall intend in this paper to introduce a quantification method to discriminate human variation of body

shape on the dorsal profile from the photographic images described in three different regions in Africa; the coastal region of Ghana in West Africa, the tropical high land of Kenya in East Africa, and Morocco, the Northwest corner of Africa.

METHOD AND MATERIALS

Photographic descriptions of standing pose with minimum clothing were collected for one fifth of the subjects in a flow line on the measurement of physique and physical fitness at the high and higher schools near to Cape-Coast in Ghana, and at the schools in Nakuru city of Kenya in 1971, and at the schools in Rabat of Morocco in 1973. The distance to the film plane of camera (NIKON photomic FTN with a standard Nikkor-auto 55mm,

This investigation was a part of research carried by KUMAMOTO UNIVERSITY SCIENTIFIC EXPEDITION FOR THE AFRICAN PHYSICAL CONSTITUTION granted by Japanese Ministry of Education for foreign research in 1971 and 1973.

F 1.2 lense and Nikon Speed Light (a strobo flash)) was three or three and half metres from the center of standing board. The height of camera was decided as to cover frontal bottom line of the standing board in horizontal position, *ca.* 1.1 meter at 3.5m distance. Flaring of the clothes of the subjects was fixed with a bounda-ge fixer or an soft elastic boundage to

get a natural body line. A picture photo-graphed from side was projected on a white magnetic board of a wall, and the dorsal curve of the image of the slide was traced into a drawing line on tracing papaer. A basic line was determined to pass through the tragion and the sphyrion fibrile. The rate of enlargement was about 35 cm from tragion to gluteal flaw.

In this paper the picture, whose dorsal line was tracable in full length from neck to gluteal flaw, above tixteen years old was adopted. The dorsal line from the concavity of neck back to the gluteal flaw was quantified at every one milimeter of basic line as a height by a automatic chart reader (JEOL JAR-CR-114). Value of the height was punched out and checked by plotting, and compiled to match further computing machi-ne by a spectrum com-puter (JEOL R-5). Main culculation and X-Y plott-ing were performed by FACOM 230-25 in the Computing Centre of Ku-mamoto University. The principle of patterning of the body line has been described in a previous paper (IMAI, 1972).: Tribal name and the decimal age of the subjects were

Fig. 1a. The dorsal curve of males drawn in similar length

Table 1.

Male	Ghana		Kenya		Morocco	
	Tribe	Age	Tribe	Age	Tribe	Age
01	unknown	25.881	Kalenjin	19.696	Aarb	22.787
02	Akim	19.236	Kikuyu	19.567	Arab	20.772
03	Ashanti	18.092	Kipsigis	19.500	Arab	20.567
04	kwahu	17.990	Meru	19.483	Arab	19.500
05	Ibo	17.782	Kikuyu	19.292	Arab	19.411
06	unknown	17.476	Luo	19.058	Arab	19.312
07	Ashanti	17.202	Kikuyu	18.574	Arab	19.310
08	Ewe	16.986	Luo	18.538	Berber	19.310
09	Twi	16.931	Kikuyu	18.415	Arab	19.310
10	unknown	16.821	Kikuyu	18.344	Arab	19.283
11	Ga	16.819	Luo	18.333	Arab	19.086
12	Ashanti	16.767	Luhya	18.081	Arab	18.924
13	Fanti	16.422	Kikuyu	17.911	Arab	18.891
14	Agona	16.392	Kikuyu	17.333	Arab	18.308
15	Ga	16.359	Luo	17.262	Arab	17.684
16	Ashanti	16.120	Kikuyu	17.150	Arab	17.426
17	Ashsnti	16.019	Abalyuah	17.084	Berber	17.169
18			Luhya	17.042	Arab	16.934
19			Kikuyu	16.939	Arab	16.819
20			Luo	16.906	Arab	16.665
21			Luo	16.865	Arab	16.643
22			Kikuyu	16.862	Arab	16.446
23			Kikuyu	16.668	Arab	16.359
24			Kamba	16.115	Arab	16.304
25					Arab	16.304
26					Arab	16.299
27					Arab	16.299
28					Arab	16.194
Female						
	Tribe	Age	Tribe	Age	Tribe	Age
01	Fanti	28.145	Kikuyu	19.338	Arab	22.694
02	Fanti	28.099	Kikuyu	18.815	Arab	21.878
03	Fanti	18.549	Kikuyu	18.576	Arab	21.728
04	Fanti	18.439	Luhya	18.511	Arab	20.893
05	Ga	18.415	Pokoms	18.371	Arab	19.644
06	Ashanti	18.338	Meru	18.182	Arab	19.206
07	Ashanti	18.026	Kikuyu	17.856	Arab	18.204
08	Fanti	17.949	Kikuyu	17.837	Arab	17.293
09	Fanti	17.785	Luhya	17.769	Arab	17.291
10	Akim	17.596	Kikuyu	17.714	Bebber	17.689
11	Efutu	17.580	Luhya	17.596	Arab	17.662
12	Gambi	17.465	Kipsigis	17.530	Arab	17.656
13	Ahanta	17.240	Kamba	17.459	Berber	17.621
14	Ashanti	17.213	Kikuyu	17.383	Berbre	17.394
15	Efutu	17.205	Kikuyu	17.287	Arab	17.293
16	Dagomba	17.002	Kisii	16.997	Arab	16.846
17	Ga	16.753	Kikuyu	16.879	Arab	16.813
18	Akim	17.668	Meru	16.868	Arab	16.786
19	Fanti	16.652	Kisii	16.868	Arab	16.726
20	Ashanti	16.479	unknown	16.786	Arab	17.635
21	Fanti	16.400	Kamba	16.422	Arab	16.183
22	Ashanti	16.326	Kikuyu	16.329	Arab	16.137
23	Ashanti	16.200	Kikuyu	16.175	Arab	16.134
24			Luhya	16.003	Arab	16.033
25						

as in Table 1.

RESULTS AND DISCUSSIONS

Characteristics of the dorsal curve

The size of the dorsal curve varied each other in original drawing. They

were drawn in similar length from the concavity at the neck back to the gluteal flaw (Fig 1). A manifest change of the dorsal curve was observed as follows:

beginning from the concavity at the neck changing to a convexity at the top of houlder or the upper ridge of the scapula, rather flatness corresponding to the surface of the scapula, a falling down forming a convexity at the lower ridge of the scapula, a low swelling corresponding to the dorsal latissimus muscle body to the waist concavity, a round projection of the hip ending to the gluteal flaw. In a few case a small swelling at the seventh cervical spine could be observed. A swelling by the ilioconstal muscle body in the waist concavity separated waist curve into two concavities in most cases of the Kenyan and the Moroccan males. As the inclination of the standing pose to the basal line involved voluntary factors, and the tendency was not consistent as seen in superimposed lines per sex and country (Fig 2), the comparison of the direct read value of the dorsal line had less meaning. The characteristic of the dorsal line

Fig. 1b. The dorsal curve of females drawn in similar length

had been demonstrated by

Fig. 2. Superimposed dorsal curves

the curvature at the divisions in same height.

Comparison of the dorsal line

The means of the curvatures at the division into two hundred on the dorsal line were culculated and they were compared per sex and country respectively. Fig 3 represented the means and their range in 95 % of reliability and the dangerous rates to differenciate the deviations and the means. A sign of M and D at the both rigde of the figures demonstrated the dangerous rate below 5 % to differenciate the deviations and the means respectively. The computation to comparison depended on TORII *et al.*, 1970. introducing subroutine FQ to determine the dangerous rates from STATISTICAL TABLE. (YAMANOUCHI, 1972)

Differences in the plotting line of the curvatures on the dorsal profile represented that the Ghanaian male had a flatter shoulder top and lacked the swelling of

the iliocostal muscle body on the waist curve displaying a strong convexity of the lower hip just above the gluteal flaw, that the Kenyan male had flatter curve on the lower ridge of the scapula and a small round hip, and that the Moroccan male had less concavity at the lower waist and a flatter hip roundness. The character of the plotting line of the curvatures on the dorsal curve for the Kenyan and the Morocae males was similar trend against the Ghanaian, but the Moroccan male was rather high in the proportion of height of the curve at shoulder and waist against the Kenyan male.

The Ghanaian female had flat shoulder top and high waist concavity. The lower hip just above the gluteal flaw among the females was contradict to the trend in the males, the Ghanaian female had the most tight lower hip and the Kenyan female the most projected conture in the

Fig. 4. The means of curvature of the dorsal curve dichotomized from the waist concavity and the comparisons between countries

lower hip. The flatness corresponding to the surface of the scapula was characteristic in the Kenyan and Moroccan female. The waist concavity had varied height in the Ghanaian and the Moroccan female. Therefore the plotting line of the curvatures at the waist curve had dual mounds for the mean of them. If the height of the waist concavity was determined by loading weight to the least four waist curvatures, the curvature at the height of the waist concavity of the Ghanaian female was most acute and the Moroccan female was flattest. Fig. 4. represented the curvature of upper back and hip at the divisions into 120 and 60 parts respectively dichotomized from the waist height. A difference at the upper hip between the Kenyan and the Ghanaian females disappeared and the flatness of the upper hip of the Moroccan female became apparent. The characteristic in the dorsal curve among the female was exaggerated in Fig.4.

The correlation of the waist shapes

The correlation coefficients of the waist height determined by the method above mentioned and the least value of the curvature at the waist had been calculated against the other measurements of the physical fitness. They were varied per country and per sex. The correlation coefficients and the probability to deny the lineality of the regression curve were listed in Table 2. The waist concavity of the Ghanaian male correlated highly

Table 2-1.

		Waist concavity						Waist height rate					
		Male			Female			Male			Female		
		Ghana	Kenya	Moroc	Ghana	Kenya	Moroc	Ghana	Kenya	Moroc	Ghana	Kenya	Moroc
Body weight	R	-31	-24	-35	7	16	-39	-4	11	4	17	19	17
	Pr. %	22.5	26.7	6.7	75.0	46.2	6.0	87.0	60.6	82.2	46.4	37.6	42.0
Sitting height	R	-8	-24	-11	-28	-4	-44	-28	-36	24	12	-3	8
	Pr. %	76.1	26.4	57.4	22.2	85.2	3.1	28.1	8.3	21.9	60.2	88.7	72.2
Stature	R	8	0	-13	-17	-1	-22	-4	-6	40	-4	-4	-3
	Pr. %	74.9	98.2	51.9	46.9	98.2	29.5	86.6	77.2	3.3	85.7	84.0	88.6
Bi-acromial diameter	R	-18	-1	-23	-13	34	-25	-7	0	7	-4	13	23
	Pr. %	49.7	97.0	24.4	58.8	11.3	28.1	79.1	99.0	71.2	87.7	54.1	32.7
Bi-iliac diameter	R	-30	1	1	34	39	-35	-23	19	18	3	1	21
	Pr. %	23.8	97.6	94.3	12.7	6.7	9.2	38.4	38.2	37.1	88.9	95.5	31.8
Chest width	R	-44	-19	-33	1	12	-22	21	6	9	22	13	21
	Pr. %	7.9	37.4	9.0	97.0	58.9	29.9	40.7	79.8	64.0	34.8	55.3	33.2
Chest depth	R	-56	18	-21	-1	-1	-19	8	45	9	-1	11	2
	Pr. %	2.0	39.6	27.3	97.2	97.3	37.5	75.8	2.6	64.4	97.6	61.4	94.2
Chest girth	R	-50	-1	-29	-4	28	-36	20	27	8	5	27	16
	Pr. %	4.2	97.9	13.7	85.3	19.4	8.8	44.2	19.9	69.4	84.2	20.7	44.6
Upper arm circum.	R	-41	-52	-43	11	25	-27	6	4	-14	9	32	31
	Pr. %	10.0	0.9	2.2	64.5	24.9	20.3	82.6	84.3	47.8	71.4	13.3	14.5
Forearm circum.	R	-32	-35	-46	19	14	-23	-10	10	-1	-3	13	29
	Pr. %	21.2	9.0	1.4	39.8	51.5	28.9	68.9	63.0	96.4	88.3	56.1	17.0
Hand circum.	R	-34	-22	-52	-24	-6	3	15	34	-2	-3	6	13
	Pr. %	18.6	29.6	0.4	28.7	80.2	89.8	55.7	10.3	90.6	90.7	79.3	54.8
Thigh circum.	R	-42	-19	-36	-2	32	-28	-8	-11	-6	28	21	29
	Pr. %	9.5	38.5	5.8	92.8	14.3	19.1	75.3	61.4	77.7	22.1	32.6	17.6
Calf circum.	R	-17	-49	-37	-12	7	-29	-30	-6	-13	31	6	13
	Pr. %	50.3	1.5	5.2	61.0	74.1	17.1	23.8	78.8	51.5	17.0	77.2	53.3
Triceps subcut.	R	-42	-11	13	28	11	-11	-15	13	14	-5	23	26
	Pr. %	9.0	60.2	50.6	21.1	60.7	60.1	56.1	54.2	47.2	84.5	28.5	22.6
Subscapular subcut.	R	-47	-22	-10	25	28	-27	-11	6	12	9	10	39
	Pr. %	5.4	30.2	63.0	27.7	19.5	20.4	67.2	78.0	53.6	71.1	65.5	6.0
Biceps subcut.	R	-78	1	4	31	29	-10	-14	27	12	-6	4	26
	Pr. %	0.0	94.9	84.7	16.9	17.3	63.6	58.9	20.2	53.4	79.2	86.7	22.6
Forearm subcut.	R	-44	20	-2	33	36	-8	35	24	2	-10	1	24
	Pr. %	7.7	35.8	91.9	15.0	9.5	72.5	17.2	26.6	94.0	65.6	96.8	26.0
Paranavel subcut.	R	-68	1	-4	2	54	-37	0	21	14	0	5	25
	Pr. %	0.3	97.4	82.6	94.3	0.8	7.2	99.1	32.0	48.9	99.7	83.3	23.4

Suprailiac subcut.	R	-47	-10	15	35	57	-36	-19	6	13	22	-6	25
	Pr. %	5.6	63.0	45.9	11.7	0.4	8.4	46.3	79.5	50.1	34.0	79.7	23.8
Thigh subcut.	R	-14	0	7	10	28	5	-19	35	-16	20	17	38
	Pr. %	58.7	98.8	73.7	66.3	18.9	82.8	46.1	9.1	42.0	37.6	43.2	6.4
Calf subcut.	R	-6	22	32	-17	15	-6	-11	18	-8	34	-29	13
	Pr. %	82.9	29.4	10.2	46.8	50.7	79.0	68.7	40.0	67.8	12.8	18.4	53.6
Vital capacity	R	-29	35	-28	-40	-12	-19	7	0	8	32	33	23
	Pr. %	25.4	9.0	14.3	7.5	59.9	36.5	80.2	99.0	68.1	16.0	12.2	28.5
Age	R	-19	-14	-28	-24	-26	5	0	-10	-1	58	-16	47
	Pr. %	45.8	51.2	14.5	30.3	23.6	82.5	99.1	64.6	97.6	0.6	46.9	2.2

Table 2-2.

		Waist concavity						Waist height rate					
		Male			Female			Male			Female		
		Ghana	Kenya	Moroc	Ghana	Kenya	Moroc	Ghana	Kenya	Moroc	Ghana	Konya	Moroc
Grip strength	R	-28	-33	-51	-40	-17	-16	-8	19	-10	22	12	-20
	Pr. %	27.2	11.0	0.6	7.5	43.0	45.2	75.2	38.2	62.5	33.4	58.0	35.2
(Right)	R	-16	-25	-50	-29	-18	-4	-15	10	-12	18	8	-12
	Pr. %	53.5	23.2	0.7	19.7	40.6	83.9	57.4	64.3	54.2	44.5	72.1	58.0
(Left)	R	-39	-34	-48	-46	-11	-26	-1	26	-5	22	11	-29
	Pr. %	12.4	10.1	0.9	3.8	60.9	22.5	97.2	22.2	78.8	33.3	62.4	17.0
Back strength	R	-10	-30	-51	-29	11	-23	26	31	1	23	29	-27
	Pr. %	69.0	15.2	0.5	19.5	61.1	26.9	32.1	14.5	94.1	31.8	18.2	21.0
Forward flexion	R	0	4	-4	-30	-26	-33	25	9	-7	4	-10	17
	Pr. %	98.6	86.2	84.9	18.8	22.5	11.3	34.1	68.2	73.3	85.5	64.9	42.4
Sit ups	R	2	32	14	-28	12	2	39	18	5	-4	-12	32
	Pr. %	92.5	12.6	47.3	22.2	59.5	94.3	11.7	40.6	78.4	85.9	57.6	13.1
50 m sprint	R	-6	30	39	11	25	-6	-3	8	16	15	14	-36
	Pr. %	91.4	17.2	4.3	62.0	25.9	78.9	94.9	72.3	41.7	50.5	51.3	8.7
Standing long jump	R	18	1	-36	7	-4	-27	-26	-6	9	26	4	18
	Pr. %	73.9	95.1	5.9	76.9	86.9	20.6	61.7	79.9	63.4	25.7	87.2	40.4
Pull ups	R	67	-6	5	***	***	***	16	17	-8	***	***	***
	Pr. %	14.8	79.0	78.7	***	***	***	75.7	44.5	66.9	***	***	***
Flexing arm hung	R	7	-12	-20	3	30	-5	32	10	-18	8	-3	38
	Pr. %	90.2	59.2	30.2	89.2	16.9	80.4	53.5	64.2	36.0	73.9	90.3	7.0
Shuttle run	R	27	25	17	-20	4	18	-5	8	14	-24	-17	-6
	Pr. %	60.8	24.8	38.6	40.3	85.1	40.8	92.8	71.2	48.8	31.5	43.1	79.7
Sargent jump	R	4	-18	-14	-32	-18	20	-2	-7	17	17	33	43
	Pr. %	87.9	41.0	48.9	15.2	40.7	35.0	92.9	75.7	37.7	46.5	12.4	3.7
Hand ball	R	18	7	-15	-54	-36	-1	18	-14	-14	2	2	27
	Pr. %	73.2	75.7	45.2	1.1	9.4	96.0	73.4	51.4	48.3	93.1	93.6	20.6

to fatty somatomorph, the Moroccan male to muscular type, strength of the muscle and the speed of sprinting, and the Kenyan male to muscular type. On the contrary the waist concavity of the Kenyan and the Moroccan females correlated to fatty types and the Ghanaian female to the muscle strength and throwing. The height of the waist concavity had less correlation to the other values of the measurements. The Ghanaian and the Moroccan female had high correlation between the waist height and age, but the males and the Kenyan female displayed no correlation within the subjects investigated.

CONCLUSIONS

The dorsal profile may reveal some trait of regional variation of the humal group, considering the different trend between the Ghanaian and the Kenya-Moroccan somatomorphs. Reversed appearance of dorsal profile and correlation to the waist concavity between sexes in respective country were too consistent to interpret as accidental phenomena. The refinement

of the method to patternize the curve and the establishment to determine basic points on the body line may be the first demand to develop such an analysis of the body curves in future.

ACKNOWLEDGEMENT

Author was deeply acknowledged to each person supporting this project in the countries investigated, and for the willing performance of a vast number of repeating calculation to the member in the Computer center in Kumamoto University.

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(received January 14, 1975)

ガーナ・ケニアおよびモロッコ現地人の背部プロフィール

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アフリカの表記三ヶ国で得られた現地人の立位側面写真から、16才以上の男女につき背体表シルエット曲線を求め、自動読取機によって曲線細分点を座標化し(約300分点)、等倍図にプロットして曲線型の特徴を検討した。地域相互の違いを数量的に把握するため、体の傾きや基軸のとり方に支配されない曲率の平均値について、体曲線そのものを性別に比較した。

ガーナでは上背曲線がなだらかであるに対し、ケニア・モロッコでは骨・筋隆の体表型への表出がある。殿曲線型もガーナとケニア・モロッコ型があり男女で逆の特徴を示す。

腰のくびれの曲率と体型・体力測定値との相関ではガーナ男性、ケニア・モロッコ女性では皮下脂肪と、ガーナ女性、ケニア・モロッコ男性とは筋・筋力の発達に相関がある。なお、腰のくびれの高さと年齢的相関がガーナとモロッコの女性に認められた。

背曲線型と体型・体力との相関から、背表曲線の曲率は人類集団の変異特性としての可能性が強いことが認められる。