

https://dspace.org/

A study of the sacrum and some aspects of presacral vertebrae in San (Bushmen) and Southern African and American Negroes

2015-02-20
http://hdl.handle.net/10539/17039

Downloaded from a DSpace repository. https://dspace.org/

the Eskimo sample, Table 10).

TABLE 10

Chi-square Values for Differences in Frequencies of 6-piece Sacra between South African Negroes and Various Population Groups

S.A. Negro males & Females compared with:	Male		Female	
	χ^2 value	P<	χ^2	P<
American Negroes	0,931	0,4	0,548	0,4
Caucasoid (combined samples)	2,613	0,20	1,174	0,20
Japanese	8,713	0,005	1,080	0,30
Eskimo	25,037	0,0005	11,662*	0,001
Australian aborigine	4,637	0,005	7,757*	0,005

*Yates' correction for small samples applied.

Amongst females, the frequency of 6-piece sacra ranges from 4,8% to 23,6%. South African Negro females, like S.A. Negro males, have the highest frequency of 6-piece sacra (23,6%) of all the population groups. This frequency is only slightly higher than that for American Negro females (20,4%) and the difference between the two Negro groups is not significant at the 1% level.

The frequencies for 6-piece sacra in the two San female samples are similar, being 18,2% in the present study and 16.7% in Duparc's study. The weighted frequency for the two samples is 18,1%. Though this is less than that for S.A. Negro female sacra, the difference is not significant at the 1% level of significance.

The frequencies in the female Caucasoid samples vary from 13,8% to 20,0% and 22,4% and the weighted frequency for these three samples is 18,5%. This is less than that for S.A. Negro sacra but the difference is not significant at P< 0,20. The next lowest frequency is that for Japanese female 6-piece sacra (13,5%) and this too is not significantly different from that for S.A. Negro female sacra (P< 0,30). An exceptionally low frequency of 6-piece sacra is present in the Eskimo female sample (4,8%), echoing the finding in the Eskimo male sample, whilst the lowest frequency is found in the sample of female aboriginal sacra (4,2%). The differences in the frequency of 6-piece sacra between S.A. Negroes and these two small samples were tested for significance by Yates' correction applied to the chi-square test and both tests are significant at P< .005 (Table 10).

3. Sex Differences

Table 11 gives the chi-square values for sex differences in the frequencies of 6-piece sacra in various population groups.

(a) S.A. Negro and San

Male-female differences in the percentage frequency of 6-piece sacra range from 4,2% in Natal Nguni and 5,2% in Sotho, to 19,6 in Cape Nguni (Table 7). Chi-square tests (Table 11) show that none of the differences, even that of 19,6% in the Cape Nguni samples, is significant ($P < 0,4$ for N. Nguni, $P < 0,5$ for Sotho, $P < 0,3$ for C. Nguni). In the combined S.A. Negro sample, 6-piece sacra occur in 33,1% of males and 23,6% of females. The difference of 9,5% between male and female frequencies is not, however, significant at the 1% or 2% level of significance ($\chi^2 = 4,473$).

In the San sample of the present study, there is a reversal of the male preponderance of 6-piece sacra which is present in the S.A. Negro: female 6-piece San sacra occur more frequently (18,2%) than male 6-piece San sacra (12,9%). The difference between female and male frequencies for 6-piece sacra (5,3%) suggests little sexual dimorphism in the San and, since the frequency in female San sacra may have been even less (14,3%, see footnote to Table 7), these small samples were not tested for significance.

It was not possible to test reliably any possible sex differences in the frequency of 4-piece sacra in either the S.A. Negro or the San owing to small numbers.

TABLE 11

Chi-square values for Sex Differences in the Frequency of 6-piece Sacra in Various Population Groups

Population or ethnic group. Male - Female	n	χ^2 value	P<
S.A. Negro:			
N. Nguni	139	0,872	0,4
C. Nguni	122	1,347	0,3
Sotho	144	0,177	0,5
S.A. Negro total	405	4,473	0,05
American Negro	500	5,206	0,025
Caucasoid (combined samples)	525	4,067	0,05
Japanese	181	1,917	0,02
Eskimo	179	0,144*	0,5
Australian aborigine	111	4,177*	0,05

n = Total number of Sacra (male and female)
* Yates' correction for small samples applied.

(b) Sex Differences in Other Human Populations

Table 9 shows that 6-piece sacra are found more frequently in males than in females in S.A. Negroes, American Negroes, the San sample of Duparc, Caucasoids, Mongoloids and Australian aborigines. The only sample which shows a female preponderance of 6-piece sacra is the San sample of the present study and it is possible that this may be owing to the sample being unrepresentative.

The highest sex difference, save for that in the Australian aborigine, is found in S.A. Negroes but this is only significant at the 5% level. The difference of 8,8% in American Negroes, too, is not significant ($P< 0,025$). However, if the two Negro groups are combined and a chi-square test applied to the combined numbers, the male-female difference is significant at $P< .005$ ($\chi^2 = 10,226$). The difference (8,5%) between the weighted frequencies for male and female Caucasoid samples is not significant ($P< 0,5$). There is a marked sex difference in the Australian aborigine (14,8%) but the chi-square test (using Yates' correction due to the small sample size) is not significant ($\chi^2 = 4,177$). There is less sexual dimorphism in Japanese (5,3%) and Eskimoes (1,5%); neither of these differences is significant.

There is thus, in all samples of good size, a male preponderance of 6-piece sacra as compared with females.

Four-piece sacra occur slightly more frequently in males (2,8%) in S.A. Negroes than in females (1,9%) but with equal frequency in the American Negro male and female (1,2%) and with almost equal frequency in the combined Caucasoid samples (males 0,8%; females 0,7%). The differences are small too, in the remaining population groups and a combined weighted frequency for Homo sapiens for 4-piece sacra gives a value of 1,4% in males ($n = 1199$) and 1,3% in females ($n = 782$). This difference is not significant.

C. DISCUSSION

Bornstein and Peterson (1966) have suggested that variation in numbers of presacral vertebrae may be a specific characteristic of any population group. If this suggestion is extended to the sacral vertebrae, the finding of a significantly higher frequency of 6-piece sacra in S.A. Negro males than in Japanese, Eskimoes and Australian aborigines (and a similar finding in females which is, however, only significant for Eskimoes and aborigines) suggests that variation in the numbers of sacral vertebrae, too, may possibly indicate genetic differences between the population groups.

There is a general trend in the populations studied for there to be a greater number of vertebral columns with 6-piece sacra in males than in females. Bornstein and Peterson (1966) have shown a similar trend in presacral vertebrae namely, that there tend to be more males than females with an increase in the number of presacral vertebrae to 25 and, conversely, more females than males with a decrease in PSV to 23. Bornstein and Peterson suggested that this characteristic of an increase or decrease in PSV is sex-dependent rather than sex-linked, in that both males and females have a higher frequency of a particular type of variant of PSV but that there is still a sex difference in the variant. The present study shows that both male and female S.A. Negro sacra show a high frequency of the variant of a 6-piece sacrum - the highest indeed of all population groups - but, that the increase in the number of sacral vertebrae occurs more commonly in males than in females. If Bornstein and Peterson's concept is extended to the sacral vertebrae, it is suggested that the finding of an increased number of 6-piece sacra in both males and females, together with the tendency for a decreased number of 6-piece sacra in females as compared with males, too, may be a sex-dependent characteristic.

Since previous studies have generally examined vertebral numerical variation in either PSV or sacral vertebrae, variation in total number of precoccygeal vertebrae, i.e. presacral plus sacral vertebrae, may provide additional evidence of group inter-relationships and population differences. This is discussed in Chapter 9.

D. SUMMARY AND CONCLUSIONS

Four-piece sacra occur infrequently and are present in 2,8% of S.A. Negro male sacra and 1.9% of S.A. Negro female sacra.

Six-piece sacra occur more frequently, and are present in 33,1% of male and 23,6% of female S.A. Negro sacra. The frequency of 6-piece sacra does not vary significantly among the Natal Nguni, Cape Nguni or Sotho tribal groups which comprise the S.A. Negro sample in either male or female category and the subsets are thus combined to form a single S.A. Negro population.

In the small San sample of the present survey, 4-piece sacra are not found among the male sacra and one 4-piece sacrum is present in the female sample of 21 sacra. Six-piece sacra are present in only 12,9% of male sacra and 18,2% of female sacra. In the San sample of Duparc (1942), however, the frequency of 6-piece sacra in males (31,3%) is much higher

There is a general trend in the populations studied for there to be a greater number of vertebral columns with 6-piece sacra in males than in females. Bornstein and Peterson (1966) have shown a similar trend in presacral vertebrae namely, that there tend to be more males than females with an increase in the number of presacral vertebrae to 25 and, conversely, more females than males with a decrease in PSV to 23. Bornstein and Peterson suggested that this characteristic of an increase or decrease in PSV is sex-dependent rather than sex-linked, in that both males and females have a higher frequency of a particular type of variant of PSV but that there is still a sex difference in the variant. The present study shows that both male and female S.A. Negro sacra show a high frequency of the variant of a 6-piece sacrum - the highest indeed of all population groups - but, that the increase in the number of sacral vertebrae occurs more commonly in males than in females. If Bornstein and Peterson's concept is extended to the sacral vertebrae, it is suggested that the finding of an increased number of 6-piece sacra in both males and females, together with the tendency for a decreased number of 6-piece sacra in females as compared with males, too, may be a sex-dependent characteristic.

Since previous studies have generally examined vertebral numerical variation in either PSV or sacral vertebrae, variation in total number of precoccygeal vertebrae, i.e. presacral plus sacral vertebrae, may provide additional evidence of group inter-relationships and population differences. This is discussed in Chapter 9.

D. SUMMARY AND CONCLUSIONS

Four-piece sacra occur infrequently and are present in 2,8% of S.A. Negro male sacra and 1.9% of S.A. Negro female sacra.

Six-piece sacra occur more frequently, and are present in 33,1% of male and 23,6% of female S.A. Negro sacra. The frequency of 6-piece sacra does not vary significantly among the Natal Nguni, Cape Nguni or Sotho tribal groups which comprise the S.A. Negro sample in either male or female category and the subsets are thus combined to form a single S.A. Negro population.

In the small San sample of the present survey, 4-piece sacra are not found among the male sacra and one 4-piece sacrum is present in the female sample of 21 sacra. Six-piece sacra are present in only 12,9% of male sacra and 18,2% of female sacra. In the San sample of Duparc (1942), however, the frequency of 6-piece sacra in males (31,3%) is much higher

than in the present San sample. The frequency of 6-piece sacra in San females is 16,7% in Duparc's sample and this is similar to that in the present study. The exceptionally low frequency of 6-piece sacra in the present San male series may be owing to the sample being unrepresentative.[1] This is suggested because, not only is the frequency of 6-piece sacra in San males much lower than that in the African series including the San sample of Duparc but, in addition, the San sample is unique (in this study at least) in having a higher frequency of 6-piece sacra in females than in males.

In males, the frequency of 6-piece sacra in the S.A. Negro sample is the highest (33,1%) of all the male population groups. It is closely followed by that for the San sample of Duparc (31,3%) and that for American Negroes (29,2%). The next highest is that for the combined Caucasoid sample (27,0%) which is followed by lower frequencies for the sample of Australian aborigines (19,0%) and Japanese males (18,8%). The lowest frequency is present in the Eskimo sample (6,3%). The frequencies of 6-piece sacra in the aboriginal, Japanese and Eskimo sacra are significantly lower than that in the S.A. Negro (at the 1% level).

The order of frequency of 6-piece sacra is similar in the female groups. The S.A. Negro (23,6%) and the American Negro female samples (20,4%) have the highest frequencies and slightly lower frequencies are present for the combined Caucasoid sample (18,5%) and for both San samples (18,2%, 16,7%). These are followed by a somewhat lower frequency for Japanese (13,5%), whilst the lowest frequencies of 6-piece sacra in females are found in Eskimoes and Australian aborigines. Only the latter two samples have significantly lower frequencies of 6-piece sacra than in the S.A. Negro female sacra.

Six-piece sacra occur more often in S.A. Negro males than in females but the difference is not significant. A similar male preponderance is present in all the population groups, save for the small San sample of the present study. If the two Negro (South African and American) groups are combined, the sex difference in 6-piece sacra is significant at the 1% level.

It is possible that variation in the frequency of 6-piece sacra may indicate genetic differences between some population groups and it would appear that a high frequency of 6-piece sacra is characteristic of the South African and American Negro and, possibly, the San.

---

[1] It is possible that there has been a misdiagnosis of sex in four or possibly five sacra (see addendum, p. 39). These sacra are all, however, of the 5-piece variety and their omission from the sample does not alter the female preponderance of 6-piece sacra.

CHAPTER 5

METRICAL FEATURES OF THE SACRUM IN THE SOUTH AFRICAN NEGRO AND THE SAN

In this chapter, the metrical features of the total sample of sacra (i.e. 4-piece + 5-piece + 6-piece sacra) will be discussed under the following headings:-

A. The Length and Curvature of the Sacrum
   1. The anterior curved length (cL)
   2. The anterior straight length (L)
   3. The height of maximum curvature (hmc)
   4. Length-curvature index A (100 L/cL)
   5. Length-curvature index B (100 hmc/L)
   6. Length-curvature index C (100 pmc/L)

B. The Breadth of the Sacrum
   7. The anterior straight breadth (ASB)
   8. The sacral breadth (GB)
   9. Sacral index A (100 ASB/L)
   10. Sacral index B (100 GB/L)

C. The Base of the Sacrum
   11. The antero-posterior diameter of the body of S1 (ap.bo.S1)
   12. The transverse diameter (width) of the body of S1 (tr.bo.S1)
   13. Sacral base index (100 ap.bo./tr.bo)
   14. Corporo-basal index (100 tr.bo/GB)
   15. The promontory angle

D. Intertribal and Intergroup Relationships

E. Metrical Features of the Sacrum in Other Population Groups

F. Summary and Conclusions

The means, standard errors and ranges for the measurements and indices for male and females are set out in tables 12 to 26. The corresponding t values are set out in table 12a and 12b to 26a and 26b. All measurements are expressed in millimetres and are to the nearest whole millimetre. The promontory angle is measured in degrees.

In all tables, 'n' indicates the number of sacra.

A. THE LENGTH AND CURVATURE OF THE SACRUM

The length and curvature of the sacrum are expressed by means of four measurements and three indices derived from them. The measurements are the anterior curved length, the anterior straight length, the height of maximum curvature and the position of the maximum height line.

The length-curvature indices derived from these measurements are as follows:-

(a) Length-curvature A:

$$\frac{\text{anterior straight length}}{\text{anterior curved length}} \times 100 \quad \frac{L \times 100}{cL}$$

(b) Length-curvature index B:

$$\frac{\text{height of maximum curvature}}{\text{anterior straight length}} \times 100 \quad \frac{hmc}{L} \times 100$$

(c) Length-curvature index C:

$$\frac{\text{position of maximum curvature}}{\text{anterior straight length}} \times 100 \quad \frac{pmc}{L} \times 100$$

1. The Anterior Curved Length (cL) (Tables 12, 12a, 12b)

Male Sacra: The means of the anterior curved length for the three S.A. Negro chiefdom samples vary from 109,5 in N. Nguni to 112,8 and 113,0 in C. Nguni and Sotho respectively (Table 12). The mean for the combined S.A. Negro sample is 111,6, the individual values ranging from 78 to 146. The mean curved length for the San sample is 103,0, the top of the range of individual values (132) being considerably smaller than that for the S.A. Negro sample (146).

Table 12a shows that there are no significant differences among the three chiefdoms, although the difference of the means for N. Nguni and Sotho males (3,5 mm) comes close to a real difference ($\underline{t}$ = 2,024 for a combined sample of 136 sacra).

San sacra are significantly shorter in curved length than those of each of the three chiefdoms and also than those of the combined S.A. Negro sample, at $\underline{t}$ = 2,500 with a 1% confidence limit.

Female Sacra: The means of the anterior curved length in the three S.A. Negro samples vary from 104,7 in N. Nguni to 107,4 and 108,1 in Sotho and C. Nguni respectively. The mean for the combined S.A. Negro sample is 106,6, the range of individual values being slightly less

TABLE 12

The Anterior Curved Length of 4-5-6-piece Sacra (total sample) in the S.A. Negro and the San

Chiefdom or Racial Group	MALES			FEMALES		
	n	Mean ± S.E.	Range	n	Mean ± S.E.	Range
N. Nguni	76	109,5 ± 1,026	88-134	42	104,7 ± 1,328	92-134
C. Nguni	59	112,8 ± 1,691	87-146	28	108,1 ± 1,938	84-134
Sotho	60	113,0 ± 1,392	78-135	50	107,4 ± 1,687	89-130
S.A. Negro Total	195	111,6 ± 0,782	78-146	120	106,6 ± ,957	84-134
San	29	103,0 ± 1,971	88-132	18	99,5 ± 2,525	77-126

TABLE 12a

t-values for Intertribal and Interracial Differences in Anterior Curved Length of 4-5-6-piece Sacra in the S.A. Negro and the San

	MALES				FEMALES			
	N. Ng,	C. Ng.	Sotho	San	N.Ng.	C. Ng.	Sotho	San
N. Nguni	-	1,668	2,024	2,925	-	1,447	1,258	1,823
C. Nguni	-	-	0,913	3,774	-	-	0,272	2,702
Sotho	-	-	-	4,146	-	-	-	2,602
S.A. Negro Total				4,054				2,629

TABLE 12b

t-values for Sex Differences in Anterior Curved Length of 4-5-6-piece Sacra in the S.A. Negro and the San

	Difference of means Male - Female	t-value
N. Nguni	4,8	2,861
C. Nguni	4,7	1,827
Sotho	5,6	2,561
S.A. Negro Total	5,0	4,025
San	3,5	1,092

than in the male, namely 84 to 134. The mean curved length in the San sample is 99,5, the individual values varying from 77 to 126.

Table 12a shows that in females, the San sacra are significantly shorter in curved length than those of the Cape Nguni, the Sotho and the combined S.A. Negro sample. There are, however, no significant differences among the three Negro subsets.

Sex Differences: In each of the three Negro subsets, the mean curved length is greater in males than in females. The differences between the male and female means are 4,7 in the C. Nguni, 4,8 in the N. Nguni and 5,6 in the Sotho (Table 12b). The latter two differences are significant at the 2,500 limit of significance. In the combined S.A. Negro sample the mean curved length is significantly greater in the male than in the female series (t = 4,025 for a combined sample of 315 sacra). In the San sample the difference between males and females is 3,5 mm but this difference is not significant (t = 1,092 for the combined sample of 47).

2. The Anterior Straight Length (L) (Tables 13, 13a, 13b)

Male Sacra: The means of the anterior straight length for the three S.A. Negro series vary from 98,6 in N. Nguni to 101,3 and 101,4 in C. Nguni and Sotho respectively (Table 13). The mean for the combined S.A. Negro sample is 100,3, the individual values varying from 73 to 137. The mean straight length for the sample of San sacra is very much less than any one of the Negro means, namely 93,8. The values range from 77 to 120 and the longest San sacrum is some 17 mm shorter than the longest Negro sacrum, although the minimum values in the two groups are similar.

Table 13a shows that the differences among the S.A. Negro subgroups are not significant. The San male sacra are, however, significantly shorter in anterior straight length than those of both the C. Nguni and Sotho as well as those of the combined S.A. Negro male sample at 2,500 with 1% confidence limit.

Female Sacra: The means of the straight length for the three Negro chiefdom samples vary from 94,4 in N. Nguni to 97,9 and 96,1 in C. Nguni and Sotho respectively (Table 13). The mean for the combined S.A. Negro sample is 95,9, the individual values varying from 71 to 127. The corresponding mean for the San sacra is 91,4. The values range from

TABLE 13

The Anterior Straight Length of 4-5-6-piece Sacra (total sample) in the S.A. Negro and the San

Chiefdom or Racial Group	MALES			FEMALES		
	n	Mean ± S.E.	Range	n	Mean ± S.E.	Range
N. Nguni	75	98,6 ± 1,114	76-123	42	94,4 ± 1,498	77-111
C. Nguni	59	101,3 ± 1,749	75-137	28	97,9 ± 1,755	80-118
Sotho	60	101,4 ± 1,441	73-124	50	96,1 ± 1,616	71-127
S.A. Negro Total	194	100,3 ± 0,817	73-137	120	95,9 ± 0,946	71-127
San	30	93,8 ± 2,047	77-120	18	91,4 ± 2,869	62-120

TABLE 13a

t-values for Intertribal and Interracial Differences in Anterior Straight Length of 4-5-6-piece Sacra in the S.A. Negro and the San

	MALES				FEMALES			
	N.Ng	C. Ng	Sotho	San	N.Ng.	C. Ng.	Sotho	San
N. Nguni	-	1,302	1,538	2,060	-	1,516	0,772	0,927
C. Nguni	-	-	0,044	2,785	-	-	0,755	1,933
Sotho	-	-	-	3,036	-	-	-	1,428
S.A. Negro Total				2,949				1,488

TABLE 13b

t-values for Sex Differences in Anterior Straight Length of 4-5-6-piece Sacra in S.A. Negro and San

	Difference of means Male - Female	t-value
N. Nguni	4,2	2,251
C. Nguni	3,4	1,372
Sotho	5,3	2,448
S.A. Negro Total	4,4	3,482
San	2,4	0,680

62 to 120, the shortest San sacrum being some 9 mm less than the shortest Negro sacrum.

Table 13a of t values shows that the small differences among the S.A. Negro subgroups are not significant in the female sacra. The San female sacra, though shorter than those of each of the Negro subgroups as well as of the combined Negro sample, are not significantly so on these smallish samples.

Sex Differences: In each of the three S.A. Negro subgroups, the mean straight length is greater in males than in females. The differences between the male and female means are 3,4 in the C. Nguni, 4,2 in the N. Nguni and 5,3 in the Sotho (Table 13b). However, only the t value for the difference between Sotho male and female sacra approaches the limit of significance (t = 2,448). In the combined S.A. Negro sample, analysis of straight length confirms the results from curved length, namely, that the male sacrum is longer than the female sacrum. The difference of the S.A. Negro male and female means is 4,4, giving a t value of 3,482 (significant at the 2,500 limit). In the small San sample the corresponding difference is only 2,4 mm, giving a t value of 0,680. Sexual dimorphism in sacral length is thus less in the San than in the S.A. Negro, for both straight and curved length.

3. Height of Maximum Curvature (hmc) (Tables 14, 14a, 14b).

Male Sacra: The means of the heights of maximum curvature for the three S A. Negro samples vary slightly from 18,2 to 19,6 (Table 14). The mean for the combined S.A. Negro sample is 19,0, the individual measurements having a wide range from 5 to 35 (n = 194). The mean for the San sample is 16,1, the range extending from 6 to 23 (n = 28).

Table 14ashows that the S.A. Negro intertribal differences in hmc of male sacra are not significant. However, the mean hmc's for sacra belonging to the C. Nguni (19,6), the Sotho (19,3), as well as the combined S.A. Negro sample (19,0), are significantly greater than those for the sample of San sacra (16,1) at 2,500 with a 1% confidence limit. In addition, the t value of 2,160 for the San/N. Nguni comparison indicates a possible real difference between these two groups.

Female Sacra: The mean hmc's in the three S.A. Negro subsets vary very slightly from 17,4 to 17,8 (Table 14). The mean for the combined S.A. Negro sample is 17,6, the individual values varying from 5 to 29.

TABLE 14

The Height of Maximum Curvature of 4-5-6-piece Sacra (total sample) in the S.A. Negro and the San

Chiefdom or Racial Group	MALES				FEMALES		
	n	Mean	S.E.	Range	n	Mean ± S.E.	Range
N. Nguni	75	18,2	0,5783	7-29	42	17,5 ± 0,6239	10-25
C. Nguni	59	19,6	0,7006	10-35	28	17,4 ± 0,6730	7-23
Sotho	60	19,3	0,6627	5-32	50	17,8 ± 0,6961	5-29
S.A. Negro Total	194	19,0	0,5640	5-35	120	17,6 ± 0,3929	5-29
San	28	16,1	0,7816	6-23	18	14,9 ± 1,091	4-21

TABLE 14a

t-values for Intertribal and Interracial Differences in Height of Maximum Curvature of 4-5-6-piece Sacra in the S.A. Negro and the San

	MALES				FEMALES			
	N.Ng.	C. Ng.	Sotho	San	N, Ng.	C. Ng.	Sotho	San
N. Nguni	-	1,541	,250	2,160	-	0,109	0,321	2,070
C. Nguni	-	-	0,311	3,336	-	-	0,413	1,952
Sotho	-	-	-	3,122	-	-	-	2,243
S.A. Negro Total				3,009				2,330

TABLE 14b

t-values for Sex Differences in Height of Maximum Curvature of 4-5-6-piece Sacra in the S.A. Negro and the San

	Difference of means Male - Female	t-value
N. Nguni	0,7	0,823
C. Nguni	2,2	2,264
Sotho	1,5	1,561
S.A. Negro Total	1,4	2,037
San	1,2	0,895

The corresponding mean for the San sample is smaller, namely 14,9, the range extending from 4 to 21.

Table 14a shows that in females, as in males, the small intergroup differences among the S.A. Negro sacra are not significant. Though the depth of curvature is greater in each of the Negro sub-groups, as well as in the combined S.A. Negro sample, than in the San series, these differences in the female sacra do not reach the 2,500 limit of significance, though the t values of 2,243 for the San/Sotho comparison and 2,330 for the San /S.A. Negro comparison suggest that real differences may exist between these groups.

Sex Differences: In each of the three S.A. Negro sub-groups and in the combined S.A. Negro sample, male sacra exhibit a greater depth of curvature than do female sacra. The differences between the male and female means are 0,7 in the N. Nguni, 2,2 in the C. Nguni, 1,5 in the Sotho and 1,4 in the combined S.A. Negro sample. None of these differences, however, reaches the 2,500 limit of significance; neither does the corresponding difference in the San series (Table 14b).

4. Length-Curvature Index A (100 L/cL) (Tables 15, 15a, 15b)

Male Sacra: The means of length-curvature index A for the series from the three S.A. Negro chiefdoms show virtually no variation; the mean for the N. Nguni is 89,9, the means for the C. Nguni and the Sotho are the same, namely 89,7. The mean for the combined S.A. Negro sample is 89,8, and individual values range from 76,2 to 98,1. The mean index for the sample of San sacra is 90,8, the individual values varying from 84,2 to 96,6 (Table 15). In other words the San sacra are on the average slightly straighter than are the S.A. Negro sacra.

Table 15a shows that there are no significant intertribal differences among the S.A. Negro sacra in respect of length-curvature index A, neither are the differences between the combined S.A. Negro sacra and the San sample significant.

Female Sacra: The means of length-curvature index A for the three Negro subsets show slight variation from 89,4 to 90,7 (Table 15). The mean for the combined S.A. Negro sample is 90,0, the individual values extending from 80,7 to 98,2. The mean index for the San sample is 91,6, the range of individual values being similar to that for the

TABLE 15

Length-Curvature Index A (100 L/cL) for 4-5-6-piece Sacra (total sample) in the S.A. Negro and the San.

Chiefdom or Racial Group	MALES n	MALES Mean ± S.E.	MALES Range	FEMALES n	FEMALES Mean ± S.E.	FEMALES Range
N. Nguni	76	89,9 ± 0,482	79,4-97,1	43	90,2 ± 0,584	80,8-98,2
C. Nguni	59	89,7 ± 0,552	76,2-98,1	28	90,7 ± 0,398	88,6-95,1
Sotho	60	89,7 ± 0,563	76,9-97,4	50	89,4 ± 0,533	80,7-96,8
S.A. Negro Total	195	89,8 ± 0,296	76,2-98,1	121	90,0 ± 0,317	80,7-98,2
San	29	90,8 ± 0,598	84,2-96,6	18	91,6 ± 0,970	80,5-99,0

TABLE 15a

t-values for Intertribal and Interracial Differences in Length-Curvature Index A for 4-5-6-piece Sacra in the S.A. Negro and the San

	MALES N. Ng.	MALES C. Ng.	MALES Sotho	MALES San	FEMALES N.Ng.	FEMALES C. Ng.	FEMALES Sotho	FEMALES San
N. Nguni	-	0,273	0,270	1,172	-	0,707	1,011	1,237
C. Nguni	-	-	-	1,351	-	-	1,953	0,858
Sotho	-	-	-	1,339	-	-	-	1,987
S.A. Negro Total				1,498				1,567

TABLE 15b

t-values for Sex Differences in Length-Curvature Index A for 4-5-6-piece Sacra in the S.A. Negro and the San

	Difference of means Male - Female	t-value
N. Nguni	-0,3	0,396
C. Nguni	-1,0	1,468
Sotho	0,3	0,387
S.A. Negro Total	-0,2	0,461
San	-0,8	0,702

TABLE 15

Length-Curvature Index A (100 L/cL) for 4-5-6-piece Sacra (total sample) in the S.A. Negro and the San.

Chiefdom or Racial Group	MALES			FEMALES		
	n	Mean ± S.E.	Range	n	Mean ± S.E.	Range
N. Nguni	76	89,9 ± 0,482	79,4-97,1	43	90,2 ± 0,584	80,8-98,2
C. Nguni	59	89,7 ± 0,552	76,2-98,1	28	90,7 ± 0,398	88,6-95,1
Sotho	60	89,7 ± 0,563	76,9-97,4	50	89,4 ± 0,533	80,7-96,8
S.A. Negro Total	195	89,8 ± 0,296	76,2-98,1	121	90,0 ± 0,317	80,7-98,2
San	29	90,8 ± 0,598	84,2-96,6	18	91,6 ± 0,970	80,5-99,0

TABLE 15a

t-values for Intertribal and Interracial Differences in Length-Curvature Index A for 4-5-6-piece Sacra in the S.A. Negro and the San

	MALES				FEMALES			
	N. Ng.	C. Ng.	Sotho	San	N.Ng.	C. Ng.	Sotho	San
N. Nguni	-	0,273	0,270	1,172	-	0,707	1,011	1,237
C. Nguni	-	-	-	1,351	-	-	1,953	0,858
Sotho	-	-	-	1,339	-	-	-	1,987
S.A. Negro Total				1,498				1,567

TABLE 15b

t-values for Sex Differences in Length-Curvature Index A for 4-5-6-piece Sacra in the S.A. Negro and the San

	Difference of means Male - Female	t-value
N. Nguni	-0,3	0,396
C. Nguni	-1,0	1,468
Sotho	0,3	0,387
S.A. Negro Total	-0,2	0,461
San	-0,8	0,702

female S.A. Negro sample, namely 80,5 to 99,0. As in the males, the female San sacra are slightly straighter than the female Negro sacra, but the differences are not significant (Table 15a). Likewise, the slight S.A. Negro sub-group differences are not significant.

Sex Differences: Differences of the means between male and female sacra for length-curvature index A are small among the three S.A. Negro sub-groups and range from a male preponderance of 0,3 in the Sotho to a female preponderance of 0,3 in the N. Nguni, 1,0 in the C. Nguni, 0,2 in the combined S.A. Negro sample and 0,8 in the San sample. None of these differences, however, is significant at the 2,500 limit of significance. In other words, the curvature of the sacrum, as assessed by this index, does not distinguish male from female sacra in Negroes or San.

Categories of Sacral Curvature: The distribution of the sacra in terms of categories of length-curvature index A (Table 15c) reveals that, in males, 36,9% of S.A. Negro sacra and 44,8% of San sacra fall into the category of marked curvature (85-89,9%) and 39,5% of S.A. Negro sacra and 44,8% of San sacra fall into the category of moderate curvature (90-94,9%). Thus, the majority of male sacra are either markedly or moderately curved. There are relatively more S.A. Negro male sacra (12,3%) than San (3,4%) with a strong curvature, but also a larger percentage with slight curvature among S.A. Negro males (11,3%) than among San males (6,9%). A chi-square test does not show any significant differences on these distributions.

In females, 27,8% of San sacra are slightly curved (> 95%), whereas only six S.A. Negro female sacra or 4,9% lie in this category. The position is reversed for the strongly curved sacra, there being 5,6% of San females but 8,3% of S.A. Negro females in this category. Most of the S.A. Negro female sacra are moderately or markedly curved (52,1% and 34,7% respectively). In the San females, however, somewhat fewer sacra are moderately (38,8%) or markedly (27,8%) curved, while as many as 27,8% have a slight curvature. Thus, in female sacra, there is a tendency for curvature to be less in the San than in the S.A. Negro. A chi-square test on the numbers for the category of slightly curved sacra as compared with the three categories of moderate, marked, and strongly curved sacra combined shows the San/Negro difference in females to be significant ($P < .001$ with one degree of freedom).

TABLE 15c

Categories of Sacral Curvature (100 L/cL) in 4-5-6 piece S.A. Negro and San Sacra

			Strong		Marked		Moderate		Slight	
			< 85,0%		85-89,9%		90-94,9%		> 95%	
		n	n	%	n	%	n	%	n	%
S.A. Negro	Male	195	24	12,3	72	36,9	77	39,5	22	11,3
	Female	121	10	8,3	42	34,7	63	52,1	6	4,9
San	Male	29	1	3.4	13	44,8	13	44,8	2	6,9
	Female	18	1	5,6	5	27,8	7	38,8	5	27,8

Analysis of Table 15c for the distribution of categories of sacral curvature in males and females shows, that in the S.A. Negro sample, slightly more females than males fall into the categories of moderate and slight curvature combined (females 57,0%, males 50,8%) but the difference is not significant at the 1% level. In the San too, there are more female sacra in the moderate and slight categories of sacral curvature (66,6%) than male sacra (51,7%) but the difference is not significant at P< 0,01. These results confirm the analysis of means of length curvature index A, namely, that it is not possible to sort the sacra into male and female groups on the basis of this index. Nevertheless, there is a tendency for female sacra to be less strongly curved than male sacra and this is evident in both the S.A. Negro sacra and the San sacra.

5. Length-Curvature Index B (chord height index, 100 hmc/L)
(Tables 16, 16a, 16b)

Male Sacra: The means of length-curvature index B (which expresses the height of curvature of the sacrum relative to its straight length) for the three S.A. Negro samples vary from 18,8 to 20,8 (Table 16). The mean for the combined S.A. Negro sample is 19,6, the individual values ranging widely from 7,0 to 48,5. The mean index for the San sample is 17,5, the individual values varying from 7,3 to 24,7. Table 16a shows that for relative height of curvature, the N. Nguni sacra are the flattest, though the intergroup differences are not significant. When the sample of San sacra is compared with each of

Author De Beer Kaufman P M
Name of thesis A study of the sacrum and some aspects of presacral vertebrae in San (Bushmen) and Southern Africa and American Negroes 1975

PUBLISHER:
University of the Witwatersrand, Johannesburg
©2013

LEGAL NOTICES:

Copyright Notice: All materials on the University of the Witwatersrand, Johannesburg Library website are protected by South African copyright law and may not be distributed, transmitted, displayed, or otherwise published in any format, without the prior written permission of the copyright owner.

Disclaimer and Terms of Use: Provided that you maintain all copyright and other notices contained therein, you may download material (one machine readable copy and one print copy per page) for your personal and/or educational non-commercial use only.

The University of the Witwatersrand, Johannesburg, is not responsible for any errors or omissions and excludes any and all liability for any errors in or omissions from the information on the Library website.