

## **Morphometric Status of Human Skeletal Remains From Kodumanal, Periyar District, Tamil Nadu**

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### **INTRODUCTION**

#### **The Site-Location, Excavations and Cultural Finds**

The site of Kodumanal, named after the village of the same name (11° 6'42" N. & 77°30'51E), is situated 225 km. to the west of Thanjavur town and 40 km. from Erode town on the north bank of Noyyal river, a tributary of the Kaveri river, in the Periyar district of Tamil Nadu. The credit of discovering the site first goes to Pulavar S. Raju and Miss. M. Muthaiah. The site extends over an area of about 50 hectares, 15 of which consist of the habitation part and the rest of burial complex. As many as about 300 megalithic tombs of different types and sizes were observed of which 100 of them are still intact. Big cist circles measuring about 15 metres in diameter constitute the most common type of monument. Many of these circles have menhirs in them and some contain even urn burials.

The different types of archaeological evidence, particularly pottery, beads and shell bangles and the Brahmi script on pottery recovered from the habitation deposits and burials suggest that the megalithic communities flourished from about the 2<sup>nd</sup> century B.C. to the 2<sup>nd</sup> century A.D., when the post Megalithic folk succeeded them and continued until or the 4<sup>th</sup> century A.D. The Kodumanal village, historically designated as *Kodumanam*, is referred to in the Sangam literature as an important industrial centre which had links with the Chola port city of Kaveripoompattinam.

Considering the importance of the site and its well preserved nature the Tamil University at Thanjavur carried out large scale excavations on it during two seasons, under the leadership of Prof. Y. Subbarayalu, Professor of Epigraphy. The first season's excavations of a habitation mound, which included a composite pit burial of post-excarnation type, yielded the skeletal remains of three humans. A craniometric account of these has already been published (Rami Reddy and Chandrasekhar Reddy, 1987). During the

second season, a trench called ZJ26 was laid in the northern part of the habitation mound. This represents period II of the site. The second quadrant of the trench yielded two complete adult human skeletons with their skulls intact, the first one from a depth of 45-60 cm. and the second from a depth of 78-90 cm. There was a third specimen of a skull and mandible separated and a few bone fragments found in the III and IV quadrants at a depth of 65 cm. (Fig.1). The first skeleton was in a crouched position with the head placed to the east, the left hand between the legs and the right hand below the right leg. It was devoid of any associated finds. The second skeleton was found in a "padmasana-like" posture in a southeast-northwest orientation with an easterly placed head and up-looking face tending to tilt to the north. The right hand rested on the pelvis while the left hand was bent upwards with the palm placed just below the mandible.

#### **The Skeletal Remains**

The skeletal remains belonging to three individuals have been recovered from the excavations. One skeleton (named Specimen I) was represented by the skull along with mandible, a clavicle and a few bone fragments. Most of the long bones were represented by fragile broken specimens with their missing proximal or distal ends. The second skeleton found in a crouched position has the skull with missing facial and basal portions. Majority of the post-cranial bones were in a fairly good condition with their shafts and proximal and distal ends intact. The third skeleton included the skull and mandible and some postcranial bone fragments which are unsuitable for metric study. The skull was devoid of the entire occipital region. The mandible with the anterior teeth intact was found in a good condition.

### **METHODOLOGY**

The crania and long bones were measured

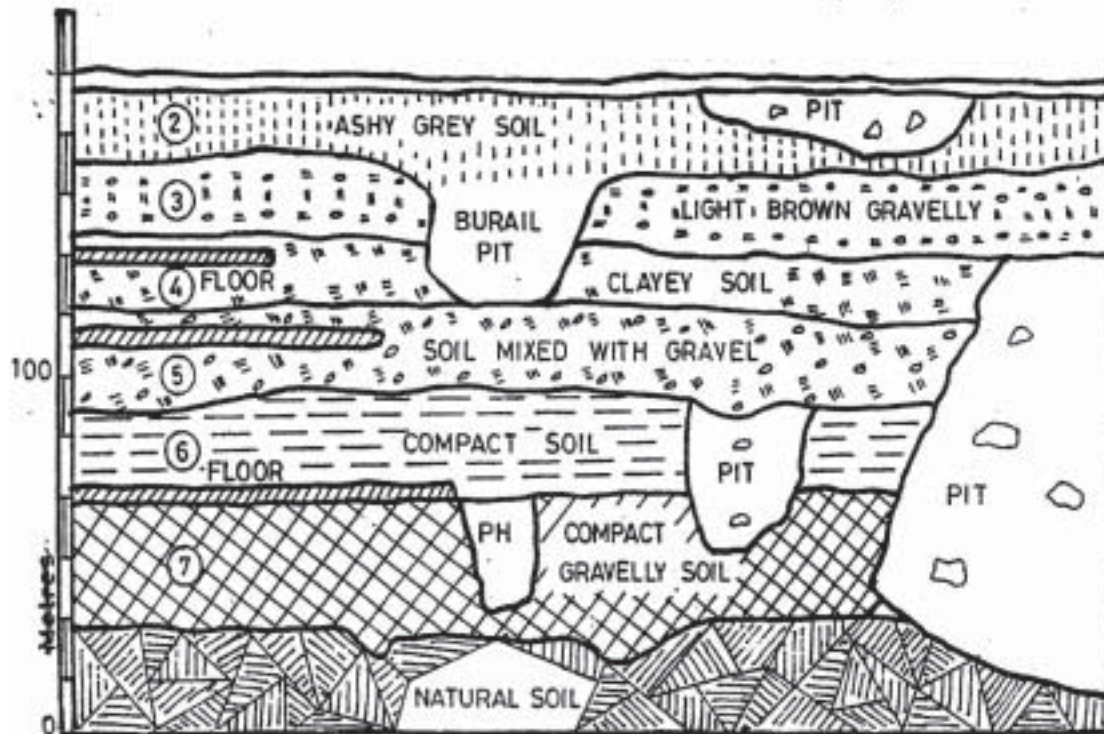


Fig.1: Kodumanal : Trench ZJ 26 Showing Eastern Section

and the possible indices were computed following the techniques developed by Martin and Saller (1956). All measurements are recorded in millimeters and the estimates are given in parentheses.

#### The Crania – Sex, Age and Race

The skull specimens along with the postcranial bones of the three individuals have been examined carefully with a view to identify the sex and age as also to throw some light on their ethnic affinities.

Specimen I is represented almost fully. The cranioscopic type of the skull is ovoides. The lower portion of the frontal bone is straight and shows a high, vertical forehead. The glabellar region and supraorbital ridges are smooth. The orbits are nearly circular with sharp margins. Almost all the sutures are closed. The parietal tuberosities are weakly marked. The occiput is slightly bulged but the muscular ridges on it are not well marked. The maxillary portion is well

preserved with almost all the teeth intact, excepting the lateral incisor and premolar which are missing. The mandible is complete with all the teeth in their sockets except the unerupted third molars. The cranial features suggest that the specimen may be a female. Based on the overall appearance of the skull, and the eruption status as also the crown morphology of the teeth the age of the individuals is estimated to be in the range of 16-18 years at the time of death.

In the case of specimen II the entire facial portion of the skull is missing. The skull when viewed from above is sphenoid in shape. The frontal bone shows a gently sloping forehead. The roof of the right orbit has a somewhat marked supra orbital ridge. The neurocranium is almost complete with the entire basal portion missing. However, a well developed right mastoid process is present. The skull vault is relatively high. The lower jaw represented only by the right posterior portion is massive and shows the three fully erupted molars which are large in size. This specimen appears to be an

adult male as it is large and heavy, with paired frontal bosses and well marked muscular lines/crests on the nuchal region. Considering detailed observations of the cranial features and the large, moderately worn teeth this individual might be + 40 years of age.

Specimen III is represented by an incomplete cranium. It lacks the entire occipital bone and the basal portion. The rest of the cranium consists of the frontal and the two parietal bones as well as the facial region. The nasal bones are straight and the pyriform aperture is some what less broader. Alveolar prognathism is well marked. The upper jaw shows an elliptical dental arch with deeply placed canine fossa. Its four incisors and right and left first molars are well embedded in their sockets. The mandible, which is moderate, is complete with all the teeth preserved except for the canines on either side. The chin is round and the corpora and rami are low. This specimen appears to be female in view of the relatively small skull size, its rounded and smooth surface, weak muscular impressions, straight backwardly sloping lower forehead, a single frontal boss, weakly developed mastoid processes, sharp orbital rims, an obtuse gonial angle and an almost rounded chin. The age of the specimen has been assessed to be 25 + years, an estimate based on the partial eruption of third molars and the occurrence of negligible dental wear.

### Craniometric Evaluation

A number of measurements were taken on three skulls in order to assess their metric variability and their biological affinities. Specimens I and III have yielded to many significant measurements. The values of measurements given in the parentheses are estimates.

On specimen I alone a maximum of 37 measurements could be taken (Table 1). Its maximum cranial length and breadth measurements are 157 and 115 mm respectively. The cranial index of 73.25 places the skull within dolichocranial type. The distance values between inion-glabella and inion-basion are 154 and 152 mm. respectively. The specimen's basion-bregmatic height is 122 mm. and its vertical index of 77.71 places it within hypsicranial type. The difference between the minimal and maximum frontal breadths is very low which consequently resulted in a higher transverse

vertical index (95.65). The skull belongs to eurymetopic type as suggested by its index (76.52). The sagittal frontal index value of 84.45 characterizes the skull as orthometopic or round type. The individual had a broad nose as revealed by the very high nasal index of 58.97 belonging to hyperchamaerhinae type. The horizontal circumference is 450 mm. whereas the Hauschild's circumference height index is 27.11.

As mentioned earlier in Specimen II a major portion of the splanchnocranium of the skull is missing due to which the measurements on the facial region could not be taken. The cranial length measures 172 mm. Whereas the breadth measures 138 mm. The individual belonged to brachycranial type as indicated by the index of 80.23. The least and greatest frontal breadths measured on the facial region yielded a frontal index of 90.65 which puts it also, as specimen I, under eurymetopic type. The foramen magnum index value of 78.37 indicates the skull as narrow type. From the parietal and occipital chord and arc measurements, the sagittal parietal index (85.27) and the sagittal occipital index (88.00) could be calculated.

Specimen III is represented by the entire frontal portion while the occipital region is missing. The maximum cranial length roughly measures 158 mm. and the breadth measures 127 mm. The cranial index of 80.38 places the skull in brachycranial type as the preceding specimen. The negligible difference of 2 mm. between the least and the greatest frontal breadths leads to larger frontal index characterising the skull as eurymetopic type. The auricular and bizygomatic breadths are 102 and 110 mm. respectively. The nasal index value of 53.33 places the skull, like specimen I, under chamaerhinae (broad nose) type. The palate is of heptostaphylin category as it shows a low palatal index value (68.18). From the frontal chord and arc measurements, the sagittal frontal index calculated characterizes the skull as round category.

### Mandibles

The two mandibles recovered intact along with specimens I and III are somewhat lightly built with less marked inner and outer muscular relief. They have shorter ramus and corpus height (Table 2). The mandible of specimen I is smaller in size than that of specimen III due to difference in age. Both the mandibles are

**Table 1: Cranial measurements (in mm) and indices**

S. No.	Measurements/Indices	Specimen		
		I	II	III
<i>Measurements</i>				
1.	Max. Cranial length	157	172	(158)
2.	Max. Cranial breadth	115	138	127
3.	Glabella-Inion length	154	(156)	(144)
4.	Nasion-Inion length	152	(153)	(142)
5.	Basilo-bregmatic height	122	132	
6.	Auriculo-bregmatic height	(111)	(128)	(124)
7.	Least Frontal breadth	88	97	89
8.	Greatest Frontal breadth	92	107	91
9.	Bimastoid breadth	87	113	99
10.	Biauricular breadth	101	111	102
11.	Nasion-Basion line	119	(102)	
12.	Prosthion-Basion line	77		
13.	Nasion-Prosthion line	54		57
14.	Bizygomatic breadth		(94)	110
15.	Nasal height	39		45
16.	Nasal breadth	23		24
17.	Bimaxillary breadth	74	(76)	65
18.	Outer Biorbital breadth	84		87
19.	Inner Biorbital breadth	81		86
20.	Inter orbital breadth	16		23
21.	Orbital breadth (R)	43		36
22.	Orbital breadth (L)	41		35
23.	Orbital height (R)	33		30
24.	Orbital height (L)	31		32
25.	Maxillo-Alveolar length	17		(18)
26.	Palatal length			44
27.	Palatal breadth			30
28.	Length of Foramen Magnum	(28)	31	
29.	Breadth of Foramen Magnum	(26)	29	
30.	Greatest Occipital Breadth	109	125	
31.	Frontal Chord	94	(98)	105
32.	Parietal Chord	105	110	
33.	Occipital Chord	85	88	
34.	Sagittal Cranial arc	325	(345)	
35.	Transverse Cranial arc	276	285	305
36.	Horizontal Circumference	450		(478)
37.	Frontal arc	110	(118)	125
38.	Parietal arc	116	129	
39.	Occipital arc	98	100	
<i>Indices</i>				
1.	Cranial Index	73.25	(80.23)	(80.38)
2.	Vertical Index	77.71	(83.01)	
3.	Transverse vertical Index	106.09	95.65	
4.	Auriculo vertical Index	(70.70)	(80.50)	(78.48)
5.	Hauschild's circumference height index	27.11	(27.61)	
6.	Sagittal arc Index	46.76	(44.35)	
7.	Transverse Frontal Index	95.65	90.65	97.80
8.	Frontal Index	76.52	70.29	70.08
9.	Sagittal Frontal Index	84.85	(83.77)	84.00
10.	Sagittal Parietal Index	90.50	85.27	
11.	Sagittal Occipital Index	86.73	88.00	
12.	Nasal Index	58.97		53.33
13.	Palatal Index			68.18
14.	Foramen Magnum Index	(92.85)	78.37	

Note: The figures in parentheses represent approximate values.

however of dolicoostenomandibular type as their mandibular indices are less than 97.9. They do not differ much in their mandibular angles too.

**Table 2: Mandibular dimensions**

S. No.	Measurements (in mm) / Angle / Index	Specimen		
		I	II	III
1.	Bicondylar breadth	(91)		101
2.	Bicoronoid breadth	75		79
3.	Bigonial breadth	68		82
4.	Symphysial height	22		24
5.	Height of Condyle	39		45
6.	Height of Coronoid	45		49
7.	Minimum width of Ramus	29		32
8.	Maximum width of Ramus	25		37
9.	Mandibular length	59		66
10.	Mandibular angle	130		127
11.	Mandibular index	(64.48)		65.35

### Postcranial Skeletal Variations

The postcranial bones available are limited in number. Most of them are fragile and occurred in a fragmentary form. For the purposes of the present study only complete specimens of long bones which were found in a fairly good condition were considered. These include right and left clavicles of specimen I found buried in crouching position and almost all the long bones of specimen II, which occurred in a squatting position. Table 3 gives values of the measurements taken on the long bones and the possible indices derived from them. Specimen I identified as female shows lower values for the clavicle compared to those of specimen II of the present series, owing to the age and sex differences of the individuals. The caliber index value of the specimen II left clavicle (32.35) is slightly higher than its right counterpart (31.06). Similar trends are observed for both cross-section and claviculo-humeral indices. The other postcranial elements which are almost intact also suggest a moderate build of the concerned individual. The maximum length of the humerus (right : 316 mm, left : 314 mm) indicates a moderate build. This build is further reflected in the higher robusticity or caliber index value (right : 18.35, left : 20.70) as compared to the one earlier estimated for an Iron age adult male specimen from S. Pappinayakkanpatti in Tamil Nadu (Walimbe and Selvakumar, 1998). The septal aperture (*fossa olecrani*) appears between medial and lateral epicondyles of both the right and left humeri. The measurements and indices for

**Table 3: Measurement (in mm) and indices on long bones**

<i>Bone/Measurements</i>	<i>Specimen</i>					
	<i>I</i>		<i>II</i>		<i>III</i>	
	<i>L</i>	<i>R</i>	<i>L</i>	<i>R</i>		
<i>Clavicle</i>						
Maximum Length	85	136	132			
Vertical diameter in middle	6	7	12	13		
Spatial diameter in middle	5	6	11	12		
Girth in middle	20	22	44	41		
<i>Humerus</i>						
Maximum length			314	316		
Total length			312	314		
Maximum diameter in middle			22	21		
Minimum diameter in middle			18	17		
Girth in middle of shaft			67	61		
Least girth of shaft			65	58		
<i>Radius</i>						
Maximum length			266	266		
Physiological length			251	252		
Transverse diameter of shaft			16	16		
Sagittal diameter of shaft			12	12		
Least girth of shaft			44	43		
<i>Ulna</i>						
Maximum length			(260)	(272)		
Physiological length				(245)		
Height of olecranon			18	18		
Dorso-volar diameter			21	22		
Transverse diameter			18	19		
Least girth of shaft			34	35		
<i>Femur</i>						
Maximum length				460		
Physiological length				458		
Sagittal diameter of middle of shaft			28	29		
Transverse diameter of middle of shaft			27	28		
Girth in the middle of shaft			87	85		
Upper transverse diameter of shaft			24			
Upper transverse diameter of shaft			33			
<i>Tibia</i>						
Total length			(386)	403		
Maximum length				409		
Maximum diameter in the middle			28	26		
Transverse diameter in the middle			20	20		
Girth of shaft in the middle			83	82		
Minimum girth of shaft			73	72		
<i>Fibula</i>						
Maximum length				(377)		
Maximum diameter in the middle			13	13		
Minimum diameter in the middle			12	12		
Girth in middle			40	41		
Minimum girth of shaft			32	32		
<i>INDICES</i>						
<i>Clavicle</i>						
Caliber index				32.35	31.06	
Cross section index	120.00	25.88	109.09	108.33		
Clavicula-Humeral index		116.67	43.3	41.77		
<i>Humerus</i>						
Cross section index of shaft			81.89	80.95		
Robusticity caliber index			20.70	18.35		
<i>Radius</i>						
Caliber index			16.54	16.17		
Cross section index of shaft			75.00	75.00		
Caliber index				(14.28)		
<i>Ulna</i>						
Length depth index				(111.02)		
Cross section index of shaft			116.67	115.79		
<i>Femur</i>						
Length thickness index				18.56		
Robusticity index				12.45		
Pilastric index			103.70	103.57		
Platymeric index	72.70					
<i>Tibia</i>						
Cross-section index in the middle	71.43	76.92				
Length-thickness index		20.34				
<i>Fibula</i>						
Cross section index in middle	92.3	92.31				
Caliber index		(8.49)				



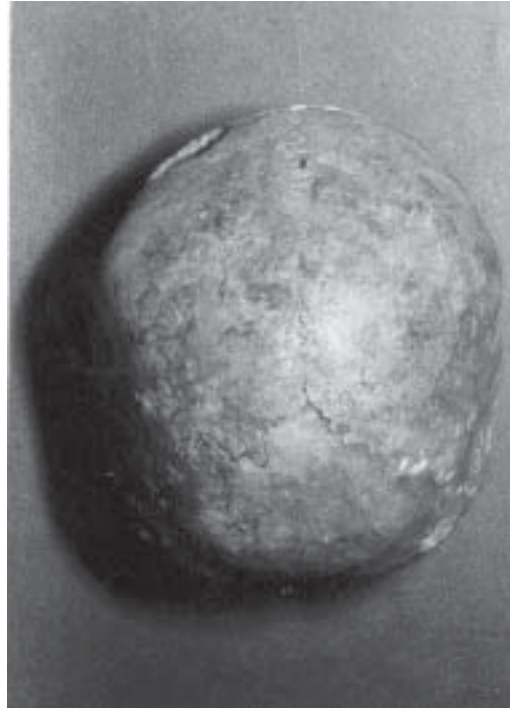
**Specimen I : Frontal**



**Specimen II : Occipital**



**Specimen III : Frontal**



**Specimen II : Vertical**

radius and ulna further support the observation of moderate build of the individual. The femur is somewhat robust in appearance with prominent greater trochanter and marked lineae aspera. The right femur which is intact measures 460 mm in its maximum length whereas its physiological length (458 mm.) is slightly lower than the former. Its robusticity index value (12.45) is slightly more than that reported for the Burzahom male series (Basu and Pal, 1980). The pilastric index values (right: 103.57, left : 103.70) show the presence of a pilaster on the bone. The femur is within hyperplatymetric category, as shown by its platymetric index (72.73), a condition, which is considered "primitive".

The femoral head has an oval-shaped *fovea capitis*. The tibia also seems to be somewhat robust with well marked tuberosities and sharp anterior borders. The right tibial measurements (409 mm. and 403 mm.) differ considerably in their maximum and total lengths. The platycnemic index value (76.92) places the bone in the eurycnemic category and indicates a very high ratio for the sagittal to transverse diameter. The squatting facets occurring at the distal ends of the tibiae, are observed to be well marked on tibiae of the Kodumanal people.

The stature was estimated from the maximum length of femur using Trotter's (1970) formula for White males. It is 170.9 cm. suggesting that the male individual was tall. This finding and also the higher diameter and circumference values of several of the long bones speak of the stout build of the Kodumanal man although his stature is somewhat less than that estimated for the Iron age man from S. Pappinayakkanpatti (173.13).

#### DISCUSSION AND COMPARATIVE EVALUATION

Of the three skulls studied, the age of the specimen I was estimated to be less than 18 years and hence is not considered for comparison with other Iron age specimens of peninsular India. The other two specimens, the specimen II male and specimen III female, yielded quite a good number of craniometric measurements with the help of which an attempt is made to discern the phenotypic affinities of the Iron age inhabitants of Kodumanal. In their cranial length and breadth, both specimens fall within the range reported

for male and female series from Adittanalur Iron age site which is about 450 km. to the southeast of the Kodumanal. But in the matter of head shape the people of these sites differed; the two specimens of our series belong to a brachycranial form whereas a majority of the Adittanalur specimens are dolichocranial. A male skull from S. Pappinayakkanpatti site, situated at a some what closer proximity to Kodumanal, with a cranial index of 77.7 nearly approximates that of our series indicating affinity between the two. This particular observation is of significance as it lends support to Sarkar's (1960) thesis that the broad-headed Brahmagiri Megalithic people were apparently a unique race of cultural bearers responsible for a sudden replacement of the dolichocranic Neolithic inhabitants of the region. Specimens from other sites of peninsular India such as Nagarjunakonda (Gupta et. al. 1970) and Yelleswaram (Gupta and Dutta, 1962) also tend to fall within the brachycranic fold. The Bronze age sites in the northwestern part of the Indian sub-continent and beyond, such as Mohenjo-daro (Sewall and Guha, 1931), Harappa (Chatterjee and Kumar, 1963a) and Lothal (Chatterjee and Kumar, 1963b), where the great Indus Valley civilization flourished, the brachycranic element was reported in the skeletal record. Of course the cranial length-breadth index alone cannot be taken as a diagnostic character for race determination although the importance it has assumed in earlier theories cannot be underrated in view of its consideration in most anatomical descriptions of crania.

The specimen II female of our series with full complement of bones of the facial region is characterized by certain characters such as alveolar prognathism, low vertical forehead, chamaerhine nose, depressed nasal root, lower minimum frontal breadth, etc which have been ascribed to be of primitive nature are interestingly preserved still by the contemporary tribal populations of Southern India. These two specimens markedly differ in respect of many other craniometric traits even from the other two specimens earlier reported from the same site (Rami Reddy and Chandraasekhar Reddy, 1987). Heterogeneity of similar kind was also observed in Adittanalur skulls characterized by a mixture of Veddid, Australoid and Mediterranean characters.

The different types of evidence provided by the assemblages of iron implements and tools,

the large quantity of slag and other indications of steel manufacture, the close contacts of Kodumanal with the Chola port city of Kaveripoompattinam and above all, the reference given to the place in the Sangam literature strongly view that Kodumanal was a flourishing industrial centre for a considerable time period in the past. This view may be strengthened further by the possibility of Kodumanal having been inhabited by people of diverse ethnic backgrounds, although it is unequivocally agreed that this hypothesis may not be closer to reality due to the constraint of limited skeletal material on hand. But the 100 or more burial structures located on the sprawling site of Kodumanal, if exposed carefully, may yield a rich treasure of human skeletons to understand the biological history and affinities of the people responsible for the different life ways.

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**KEYWORDS** Kodumanal. Megaliths. Anthropometry. Physical Affinities.

**ABSTRACT** This paper presents the morphological and metric descriptions of three human skeletons, two females and one male, recovered from a pit burial in the excavations at the megalithic-cum-early historic site of Kodumanal in the Perundurai taluk of Periyar district, Tamil nadu. Apart from

the study of three crania, the post-cranial bones of the male individual have been subjected to a good number of measurements, a detailed analysis and discussion. The findings of the study have been comparatively evaluated with those reported earlier on the skeletal remains of the megalithic period, with a view to understanding the physical affinities of these people.

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