2D:4D FINGER RATIO AMONG THE E BETA THALASSEMA
MALES OF BENGALEE HINDU CASTE POPULATION, WEST
BENGAL, INDIA

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ABSTRACT
Since nearly all biological functions are in some way related to one or other aspect of the physical dimensions, thus bio metric measurements have attracted interest of all sections including anthropology. Well documented prenatal relationship between epidermal ridge formation and bone dimension indicated by the finger lengths might be influenced due to the pleiotropic effect of thalassemia. In order to understand the association between the 2nd and 4th finger digit ratio of the hands and thalassemia, 75 clinically diagnosed E-β thalassemia male patients were compared with 75 apparently healthy male individuals without any family history of thalassemia as control from Bengalee Hindu caste population of West Bengal. The study revealed significantly (p<0.05) lower 2D:4D ratio in thalassemia male patients than the ratio in control males for both hands. Results achieved in the present work might be valuable bio metric measurements and as well as stimulates further research related to bone dimensions in β thalassemia.

KEYWORDS: Digit ratio, E-β-Thalassemia, Bengalee populations.

INTRODUCTION
Over the past 100 years, physical anthropologists and human biologists have measured an enormous range of body dimensions which provide information relevant to various physiological, genetic and other investigations.[1] As the relative lengths of digits are set before birth,[2] therefore, any intra uterine disturbances that affect the limbs in the critical
period of limb formation may also affect normal development of limbs which might reflected through the ratio of the parts of the limb dimensions. Subsequently different disorders genetic or environmental having adverse effect on growth rate might be associated with retardation of limb structure and overall stature as well. Thalassemia being major inherited blood disorder characterised by reduced bone formation rates, delayed bone maturation and focal osteomalacia due to haemopoiesis occurs in the bone marrow.[3] Therefore, deformities in bone formation, for example, finger bones which eventually affect the finger structure as a result of pleiotropic effect of thalassemia could be utilized as distinctive features between the thalassemia patients and normal individuals. Furthermore, in Indian subcontinent the thalassemia carrier rate in different regions varies between 1% and 17%, with a mean of 3.3%. [4] Therefore, any characteristic features among the thalassemia patients might be considered as prognostic criteria among the thalassemia patients. To best of the knowledge the present study is the maiden attempt to understand the association between 2nd and 4th finger digit ratio of the hands on the E- β-thalassemia patients from Howrah district of West Bengal, India.

MATERIALS AND METHODS
The participants of the present study were comprised of 75 clinically diagnosed E- β-thalassemia males and 75 apparently healthy males without having any family history of thalassemia from Howrah district of West Bengal, India. The present work has been approved by the Intuitional ethical committee of University of Calcutta (CU/BIOETHICS/HUMAN/2304/2022, DATED 25.09.2014). The ring finger is the fourth digit (4D) of the human hand and the second most ulnar finger located between the middle finger and the little finger while the index finger is the second digit (2D), located between the thumb and the middle finger and usually the most dexterous and sensitive finger of the hand.[5] The length of the 2D and 4D of both the right and left hand of the each participant were measured with sliding calliper from the tip of the digit to the ventral proximal crease, in the presence of a band of crease at the base of the digit, the most proximal crease was used and the ratio has been calculated.

RESULTS AND DISCUSSION
Analysis of digit lengths (Table 1) of the E- β-thalassemia male patients and controls demonstrated significant difference (p<0.05) indicating decreased 2nd and 4th digits among the thalassemia patients compared to the controls for both hands. Furthermore, examination
of the 2D:4D ratio of the thalassemia patients and controls (Table 2) revealed significant
(p<0.05) bilateral asymmetry among the thalassemia patients and as well as significantly
(p<0.05) decreased 2D:4D ratio value among the thalassemia patients taking together the
both the right and the left hand.

There has been a considerable association between prenatal hormonal level and 2D and 4D
ratio which is sexually dimorphic as well as largely determined prenatally. Moreover, studies also revealed well documented prenatal relationship between epidermal ridge
dimension and bone dimension of the hand, and this intrauterine relationship is greatly
influenced by the pleiotropic effect of thalassemia which includes characteristics like short
stature, delayed puberty and hypogonadism. Though in general it is evident that men have
relatively shorter index finger than the ring finger in comparison to that of the females, the
present study demonstrated significantly (p<0.05) lower 2D:4D ratio among the E- β-
thalassemia patients for both the left and right hand in comparison to the controls and this
result might be the effect of prenatal hand bone deformations associated with the thalassemia.
Since, the 2D:4D ratio were determined in utero and changed little at puberty, therefore, 2D:4D ratio might be additional imperative biomarker for diagnosis of thalassemia.

### Table 1. Distribution of 2nd and 4th digit length among the E- β-thalassemia males and control males

<table>
<thead>
<tr>
<th></th>
<th>2nd digit (Right) Mean± SD</th>
<th>4th digit (Right) Mean± SD</th>
<th>2nd digit (Left) Mean± SD</th>
<th>4th digit (Left) Mean± SD</th>
</tr>
</thead>
<tbody>
<tr>
<td>E- β-Thalassemia</td>
<td>4.57 ±0.53</td>
<td>4.94±0.55</td>
<td>4.66±0.47</td>
<td>5.05±0.49</td>
</tr>
<tr>
<td>Control</td>
<td>7.02±0.54*</td>
<td>7.28±0.57*</td>
<td>6.99±0.56*</td>
<td>7.25±0.55*</td>
</tr>
</tbody>
</table>

*p<0.05

### Table 2. Distribution of 2D:4D ratio among the E- β-thalassemia males and control males

<table>
<thead>
<tr>
<th></th>
<th>Controls</th>
<th>Patients</th>
</tr>
</thead>
<tbody>
<tr>
<td>Right hand</td>
<td>0.97±0.03*</td>
<td>0.93±0.02*</td>
</tr>
<tr>
<td>Left hand</td>
<td>0.96±0.03*</td>
<td>0.92±0.03</td>
</tr>
</tbody>
</table>

*p<0.05

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