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DIGIT RATIO AND AUTISM: A BRIEF REPORT

BISWARUP DEY, PIYALI DAS, DIPTENDU CHATTERJEE AND ARUP RATAN BANDYOPADHYAY

ABSTRACT

Previous studies have revealed relationship between autism and high concentrations of prenatal testosterone. The ratio of second and fourth digit (2D:4D) of hand is usually used as a proxy for prenatal testosterone. The present study being the first report from India attempted on 2D:4D from India among the 67 clinically diagnosed autistic males and 55 control males. The study revealed significantly ($p<0.05$) lower 2D:4D ratio in autistic males than the ratio in control males for both hands. Results achieved in the present work might be valuable biomarker and as well as stimulates further biological and psychological approaches in neurocognative research and diagnosis of children with autism.

Keywords: 2D: 4D, Autism, Bengalee population.

INTRODUCTION

Autism is well known as a complex nuro-developmental disorder characterized by significant disturbances in neuro social communicative and behavioural functioning. Various studies (Manning *et al.,* 2001; de Bruin *et al.,* 2006) focused on neurobiological features and relationship of autism to prenatal testosterone. Digital 2D:4D has been reported as a reliable marker for prenatal testosterone (McIntyre, 2006), which causes prolongation of the fourth digit relative to the second digit of the hand. Furthermore, it has also been reported that prenatal androgens affect digit ratio (Breedlove, 2010). Since there was the publication on hand dimension (Baker, 1888) but it was not until 1998 that the 2D:4D ratio was linked to sex steroids by the observation that men with lower 2D:4D ratios have higher serum testosterone levels (Manning *et al.,* 1998). The value of 2D:4D

Biswarup Dey, Former Research Scholar, Department of Anthropology, University College of Science, Technology & Agriculture, University of Calcutta, 35 Ballygunge Circular Road, Kolkata-700019, West Bengal, India, E-mail: biswa.anth@gmail.com; **Piyali Das (Corresponding Author),** Assistant Professor, Department of Anthropology, Dinabandhu Mahavidyalaya, Bongaon-743235, West Bengal, India, E-mail: piyalidas24@gmail.com; **Diptendu Chatterjee,** Associate Professor, Department of Anthropology, University College of Science, Technology & Agriculture, University of Calcutta, 35 Ballygunge Circular Road, Kolkata-700019, West Bengal, India, E-mail: dip_cu@rediffmail.com; **Arup Ratan Bandyopadhyay,** Professor, Department of Anthropology, University College of Science, Technology & Agriculture, University of Calcutta, 35 Ballygunge Circular Road, Kolkata-700019, West Bengal, India. E-mail: arup_cu@rediffmail.com

is lower in males due to the higher intrauterine androgen levels and correlation between 2D:4D ratio and variations in the androgen receptor gene (Manning *et al.,* 2002) has previously been reported.

Extensive studies on the 2D:4D ratios as an index of prenatal hormone exposures have found correlations between digit ratios and a variety of physiological and psychological conditions (Williams *et al.,* 2000; Hönekopp *et al.,* 2007). These evidenced as linking digit ratios to differences in androgen and estrogen during development is indirect and based on correlation studies in humans after birth. Lower number of CAG repeats in gene for androgen receptors was found in autistic individuals (Breedlove, 2010). Since the publication on 2D:4D ratios of autism (Manning *et al.,* 1998), contemporary studies (Manning *et al.,* 2001; Noipayak, 2009; Krajmer *et al.,* 2011; Aksu *et al.,* 2013) revealed and corroborated to shorter 2D:4D ratio among the autistic patients compared to their control peers. Referring to the earlier works, the present study has been undertaken to compare the 2D:4D ratios (as indicator of prenatal testosterone) among the Bengalee Hindu caste population of Kolkata (India), which is, to the best of our knowledge, the first attempt from India.

MATERIALS AND METHODS

The participants for the present study consisted of 67 clinically diagnosed (according to DSM-IV-TR - American Psychiatric Association, 2000) Autistic boys and 55 apparently healthy normally developed boys, without having any family history of autism, of the same area and population. Mean age of the autistic patients was 22.54 (SD 1.96) years, while the mean age of the controls was 23.01 (SD 1.68) years. The 2D:4D ratio was determined by measuring the index and ring fingers of both hands using sliding calipers nearest to 1.0 mm, starting from the proximal baseline on the palmar side of the metacarpophalangeal joint to the fingertip. All the data were analyzed using SPSS (version 16.0) for descriptive and inferential statistics. Cut off value was set as $p = 0.05$.

RESULTS

Examination of the 2D:4D ratio of the autistic patients and control (Table-1) revealed significant ($p<0.05$) decreased value for the autistic patients for both the right and the left hand.

Table 1: Distribution of 2D: 4D ratio among the autistic males and control males

GROUP	n	Mean ± SD	
		2D: 4DRIGHT HAND	2D: 4DLEFT HAND
Autistic patients	67	0.96±0.04*	0.96±0.04*
Controls	55	0.98±0.05	0.98±0.05

*$p<0.05$

DISCUSSION

The present study is the first report from the Indian population (Bengalee Hindu Caste Population) regarding the comparison between age/sex matched autistic patients and the controls. The significantly ($p<0.05$) lower 2D:4D ratio in autistic patients is in corroboration with other studies reported in different populations (Manning *et al.,* 2001) and as well as contemporary studies (Noipayak, 2009; Krajmer *et al.,* 2011; Aksu *et al.,*2013). A surge of reports demonstrated 2D:4D ratio as a correlate for the evidence of prenatal androgens affect for many neurobiological feature deficit disorders including autism. Earlier studies (Manning *et al.,* 2001; Noipayak, 2009) demonstrated that greater prenatal androgen stimulation contributes to the higher incidence of autism in males than in females, as the organizational hypothesis would predict, then individuals with autism should have more masculine digit ratios, which also indicate high sensitivity to the androgen receptors (Krajmer *et al.,* 2011). The present study also revealed significantly ($p<0.05$) lower 2D:4D ratio among the autistic patients for both the left and right hand in comparison to the controls. Moreover, alleles of androgen receptor with low numbers of CAG repeats respond to testosterone with high transactivational activity, while high numbers of CAG's are associated with increased insensitivity to testosterone (Manning *et al.,* 2002). However, the number of CAG repeats does not alter the binding of testosterone to the androgen receptor but it affects the binding of the hormone receptor complex to DNA. Thus, CAG length is negatively related to sensitivity to testosterone (Vermeersch *et al.,* 2010). It has been reported (Manning *et al.,* 2002) that there is a correlation between variations in androgen receptor genes and the 2D:4D hand ratio and also the 2D:4D ratio was lower in males with highly sensitive androgen receptors. Study by Krajmer *et al.* (2011) revealed that autism might occur as a result of a high concentration of prenatal testosterone. Since, the 2D:4D ratio were determined in utero and changed little at puberty (Manning *et al.,* 1998), therefore, 2D:4D ratio might be imperative biomarker for early diagnosis of autism. Therefore, the significantly ($p<0.05$) lower 2D:4D ratio noticed in the present study from India envisaged that, lower 2D:4D ratio could be additional biomarker for early diagnosis of autism.

Autism has become a subject of many disciplines including anthropology, disability studies, education, epidemiology, genetics, neuroscience, occupational science, philosophy, and psychology (Solomon, 2010). Although diverse theories and methods are embraced by those working in these fields, and interdisciplinary collaborations are increasingly common. Research on autism tends to cluster around or move between two analytic poles: firstly, basic science and clinical intervention research that focuses on autism as a neuro-developmental disorder, and secondly, ethnographically informed social science research focusing on autism as a personal, family, and community/social group experience as evidenced through the analyses of social interactions. These two analytic polarities, one a biomedical view of autism, another a social science view, fall roughly into the emic/etic, experience-near/ experience-far dichotomy (Greetz, 1983).

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