Twinning rates in Chennai, India – A cross-sectional study

Anuradha J Kuppan[1], Victor Samuel[2], Mahesh R[1], P M Jaganath[3], Sukumaran Anil[4,5]

[1]Department of Pediatric Dentistry, Saveetha Dental College, Saveetha Institute of Medical and Technical Sciences, Chennai Tamil Nadu, India, [2]Department of Pediatric Dentistry, SRM Kattankulathur Dental College, SRM Institute of Science and Technology, Potheri, Chennai, Tamil Nadu, India, [3]Department of Neurosurgery and Spine Surgery, Seven Hills Hospitals, Visakhapatnam, Andhra Pradesh, India, [4]Department of Dentistry, Oral Health Institute, Hamad Medical Corporation, [5]College of Dental Medicine Qatar University, Doha, Qatar

ABSTRACT

Context: The city of Chennai is one of the largest metropolitan cities in India where apart from a large traditional population, there has been a continuous migration from rural areas and growing sophistication in lifestyle. Twinning rates trend in the present world would be interesting to study. **Aims:** The aim of the present study was to analyse the twinning rate in the city of Chennai, the distribution amongst various city zones and the present trends in the co-relation between the maternal age of the twins with the zygosity. **Settings and Design:** A population-based study was conducted on twin births in various corporation Zones in the Chennai Metropolitan, between 2010 and 2012. As per the Chennai corporation and Health Department register, there were a total of 2,32,884 births registered in the city of which 4,500 were twin births over the 3 years. Only 1371 pairs were found residing in Chennai at the time of study, and hence, a study was conducted on this population only. **Statistical Analysis Used:** The data were analysed with Epiinfo software. **Results:** A twining rate of 19.3 per 1000 births was observed as per Corporation records. In the present study, the sample of 150 pairs, 34 pairs (22.6%) comprised of monozygotic (MZ) twins and 116 pairs (77.3%) comprised of dizygotic twins giving a ratio of 1:3. The maternal age groups 25–30 and 30–35 years comprised of the maximum twinning rates. Most twin births were of the first order. An analysis of Weinberg's Differential Rule method to determine zygosity showed a significant difference compared to the Questionnaire method. **Conclusions:** The twinning rate observed in Chennai in the present study is interestingly very high, compared to the overall twinning rate reported in the past in the state of Tamilnadu. The Wienberg's Differential method for zygosity determination is again found to be questionable. The zygosity proportion, maternal age and parity relations are not very different from previously available data.

Keywords: Maternal age, twinning rate, zygosity determination

Introduction

Twins have always been an attractive subgroup of population in our society since many years. The similarity in the MZ twins and the cause of difference in dizygotic (DZ) twins further raised the curiosity level.[1] The permutation–combination play of nature also made us analyse various genetic traits, heritability of characteristics and also to reason out the genetic and or environmental causes and implications on various

Address for correspondence: Prof. Sukumaran Anil, Oral Health Institute, Qatar University, Hamad Medical Corporation, Post Box - 3050, Doha, Qatar. E-mail: drsanil@gmail.com

Access this article online

Quick Response Code:

Website: www.jfmpc.com

DOI: 10.4103/jfmpc.jfmpc_1223_21

How to cite this article: Kuppan AJ, Samuel V, Mahesh R, Jaganath PM, Anil S. Twinning rates in Chennai, India – A cross-sectional study. J Family Med Prim Care 2022;11:1450-4.

disease conditions in the body.[2,3] A community study of the demographics of the same helps in following the genetic trends in the population and to probably predict the future trends of various related disease conditions.[4,5]

The role of twins in the analysis of human behavioural and physical development was first described by Galton F [1875].[6,7] The classical twin design is to compare the resemblance between MZ and DZ for a trait. MZ twins being more similar in their genetic aspect and brought up in the same environment presenting any difference in them contributes to a strong genetic effect. In the past many decades, there have been few epidemiological studies involving twins in India.[8-12] Over the recent decades with the dynamicity of the populations between the rural and urban areas, the improvement in the health awareness associated with better education opportunities, improving birth rates, advancement in the urban lifestyle with progressive women employment and empowerment, the demographic trends in the society including the twin's subgroup is also changing.[13]

Susceptibility to disease, abilities, personality and other individual characteristics, or phenotypes, are influenced by genetic and environmental factors.[14] Environmental factors, on the other hand, have been found to influence the expression of genes even after birth. Twin studies can be used to assess the switching mechanism between genetic and environmental factors to determine if an individual has a disposition for developing a certain disease.[15]

The last 15 year has seen rapid development in various fields affecting humanity. A curiosity to analyse the twinning trends in this age led us to this study in Chennai. The aim of the present study was to analyse the twinning rate in the city of Chennai, the distribution amongst various city zones and the present trends in the co-relation between the maternal age of the twins with the zygosity.

Subjects and Methods

The present cross-sectional study was conducted in Chennai, capital city of Tamilnadu, India. It is the fourth most populous metropolitan city in India with an estimated population of 4.59 million as of 2010. Chennai is divided into 15 zones according to state council (Chennai Corporation)

http://www.chennaicorporation.gov.in/.[16]

Subject selection

This survey was conducted from May to July in the year 2013. The Twins Database from the year 2010–2012 was ascertained from the Chennai Corporation, a government run Organization concerned with the registration of vital events in the city. Inclusion criteria for the study were twins residing in Chennai. The population census of Tamilnadu and its capital Chennai were obtained from the website of Department of Health and Family Welfare, Govt. of Tamilnadu.[17] The crude birth rate as

per the Census of India (2009-2011)[10] was 15.5% with an Infant Mortality rate of 21%. During the period 2010–2012, a total of 2,32,884 births were registered in the city of Chennai of which 4,500 were twin births. The distribution of twins in various zones of Chennai are shown in Figure 1. One thousand three hundred and seventy-one pairs were found residing in Chennai at the time of study. The subjects were divided as per their addresses and segregated into their respective 15 zones of City Corporation. A multistage sampling design using probability proportion scheme (PPS) was employed for sample selection. A sample size of 150 pairs was selected from the 1371 pairs from nine Zones (Zones 4–10, 12 and 13) of Chennai Municipality. Ethical approval was obtained from the ethical committee at Saveetha University. The study was conducted zone wise, and the addresses in each zone were selected as per the randomization done using Randomizer Software (RANDOM.ORG ©1998-2014). PPS was used to select the twins from their zones.

The addresses were physically verified and if the subjects were still residing at the address provided to the Corporation, they were selected for the study. Parents or subjects were revisited in many of the occasions till the subjects were seen physically. If the address was found to be incorrect, nonexistent or if the family had moved out to a different address, the subject was excluded from the study and a new subject was selected in place using the randomization technique. The same was done for subjects whose parents were not willing to take part in the study. After an informed consent was obtained from a parent of the twins, in the presence of the major caretaker, the study was commenced which included a questionnaire for the parent and examination of physical attributes of the twins.

Questionnaire for zygosity determination

Zygosity classification was determined by a highly accurate questionnaire pertaining to physical similarity between the twins as described by Price TS *et al.*, 2000.[18] The questionnaire consisted of 18 items and were scored numerically. These scores were summed and then divided by maximum possible on those questions that were answered in order to create a Physical Similarity Quotient (PSQ) between zero representing maximal physical
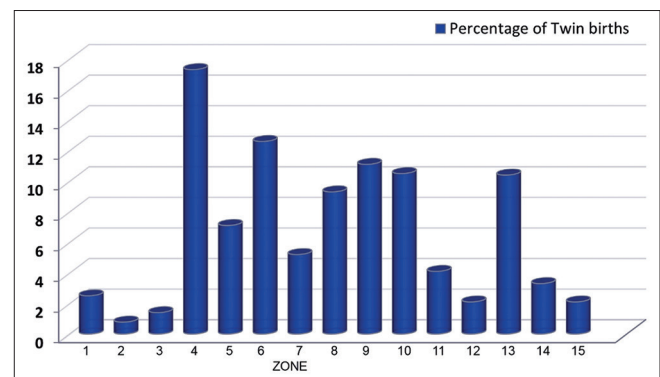

Figure 1: Distribution of twin birth in Chennai Zones between 2010 and 2012

similarity and one representing maximum physical dissimilarity. The data were analysed with Epiinfo™ software.[19]

Results

During the period 2010–2012, a total of 2,32,884 births were registered in the city of which 4,500 (1.93%) were twin births, i.e. 19.3 per 1000 deliveries. The national birth rate as per the Indian census in 2011 was 15.5. Figure 1 shows the total percentage distribution of twins distributed in the 15 Zones between 2010 and 2012. The study zones Zone 4 (17.3%), Zone 6 (12.6%), Zone 9 (11.1%), Zone 10 (10.5%) and Zone 13 (10.4%) recorded the largest number of twin births. Zone 6 had the largest percentage of monozygotic twins at 35% and Zones 8 and 13 had the largest percentage of DZ twins at 100%. As per the absolute numbers, Zones 6 and 9 had the maximum MZ with 7 pairs each and Zones 4 and 9 had the maximum number of DZ twins at 24 and 23 pairs each. Table 1 shows the distribution of twins in the nine zones in Chennai which was selected for this study and the respective sample sizes calculated for study.

Total number of MZ twins was 34 (22.6%) and DZ twins was 116 (77.3%) giving a ratio of 1:3. In the MZ group, the mean PSQ value was 0.336 where standard deviation was 0.035, and in the DZ group, the mean PSQ value was 0.738 with standard deviation 0.080 [Table 2]. Figure 2 shows the PSQ values of monozygotic and DZ twins. The zygosity distributions in various zones are shown in Figure 3. The calculated MZ and DZ twins based on Weinberg's differential Rule method are 36 and 64%, respectively. Ninety-four (62.7%) pairs were born at preterm and 56 (37.3%) pairs were born at term. Majority of the deliveries were by C-section [Table 3]. In the age group of 6–12 months, the MZ constitute of 2 (5.9%) and DZ constitute of 9 (7.8%); in 13–24 month group, the MZ were 14 (41.2%) and DZ were 52 (44.8%) and in 25–36 months MZ were 18 (52.9%) and DZ were 55 (47.4%), respectively. Table 4 shows zygosity distribution according to different age groups. The maternal age group range between 25 and 30 years had the largest number of twins at 53.3% [Table 5]. Both MZ and DZ numbers were highest in this age group [Table 6]. The order of birth was also analysed; 93.3% were of first order, followed by second (6%) and fifth.
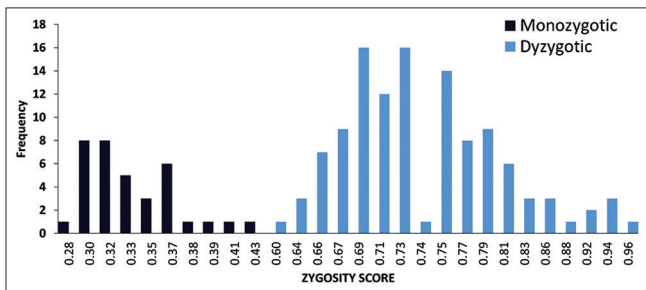
Table 1: Twins distribution and sample size calculated in the study zones

No.	Zone	No of twins		Twin sample size
Zone 4	Tondairpet	189	13.8%	30
Zone 5	Royapuram	100	7.3%	10
Zone 6	Thiruvika nagar	175	12.8%	20
Zone 7	Ambattur	66	4.8%	10
Zone 8	Anna nagar	123	9.0%	10
Zone 9	Teynampet	160	11.7%	30
Zone 10	Kodambakkam	146	10.7%	20
Zone 12	Alandur	31	2.3%	10
Zone 13	Adyar	147	10.7%	10
	Total	1371		

Table 2: Mean PSQ value by zygosity determination. Independent samples *t*-test to compare the mean zycosity scores

Zygosity	*n*	Mean	Std. deviation	*P*
Zygosity score				
Monozygotic	34	0.3368	0.03574	<0.001
Dizygotic	116	0.7385	0.08064	

Table 3: Birth events

Time of delivery	Monozygotic	Dizygotic	Normal Delivery	C-Section	Total
Preterm	22 (14.7%)	72 (48%)	7 (4.7%)	87 (58%)	94 (62.7%)
Term	12 (8%)	44 (29.4%)	7 (4.7%)	49 (32.7%)	56 (37.3%)

Table 4: Age group and zygosity

Zygosity	Age group							
	0-12 months		13-24 months		25-36 months		Total	
	n	%	*n*	%	*n*	%	*n*	%
Monozygotic	2	5.9	14	41.2	18	52.9	34	100.0
Dizygotic	9	7.8	52	44.8	55	47.4	116	100.0
Total	11	7.3	66	44.0	73	48.7	150	100.0

Figure 2: Distribution of the physical similarity quotient (PSQ) score
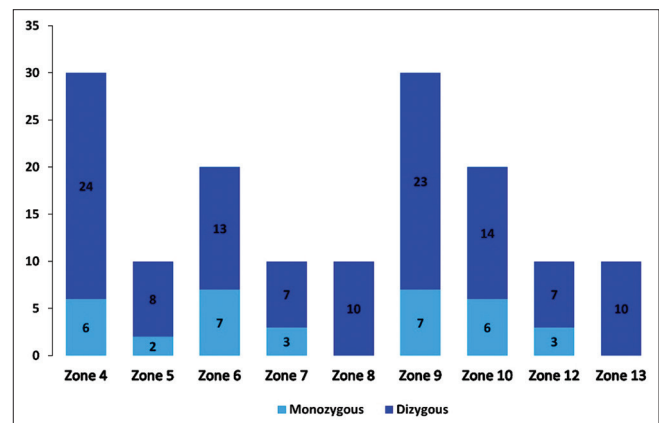
Figure 3: Zygosity distribution in the nine study zones

Table 5: Maternal age distribution and twinning rates					
Age of mother	Total twins delivered	Monozygotic		Dizygotics	
		Number	%	Number	%
<25	5 (3.3%)	2	1.3	3	2
25-30	80 (53.3%)	21	14	59	39.3
30-34	62 (41.3%)	14	9.3	48	32
>35	3 (2%)	0	0	3	2

Table 6: Birth order and twinning rates					
Order of birth	Total twins delivered	Monozygotic		Dizygotics	
		Number	%	Number	%
1	140 (93.3%)	28	18.7	112	74.7
2	9 (6%)	3	2	6	4
3	0	0	0	0	0
4 or more	1 (0.67%)	1	0.67	0	0

Discussion

Research on twins provide a valuable source of information for researchers as their unique relationship allows researchers to pull apart and examine genetic and environmental influences.[1] Twinning rates have been found to be varied across the world, and over the century, there has been some change in the trends regarding the overall incidence and zygosity distribution.[20,21] This may be probably due to the rapid urbanisation in the recent decades, lifestyle changes, changes in the environment and changing birth patterns. This probably is being reflected in the twinning rates in various developing and developed countries. This might be just one of the factors affecting the recent trend.[22]

The twinning rate in the present study is 19.3 per 1000 deliveries during the period 2010–2012. This is surprisingly high compared to 8.7 reported in 1983 from Tamilnadu.[7] A study conducted by Das-Chaudhuri *et al*.[11] reported a twinning rate of 20.48 among the Muslim community in Bengal. A hospital-based study by Jaya *et al*.[12] reported a twinning rate of 17.33 per 1000 births. Even study in developing countries across the world showed a much lower twinning rate compared to India.[23] The twinning rate observed in Chennai city area is higher compared to various low- and middle-income countries.[24,25] The observation is significant since the Chennai has relatively low birth rate compared to some of the other states in India.[3,26]

Although the present study was conducted in 9 out of 15 major zones of Chennai, the sample population was well distributed. This is the first zone wise study within a large metropolitan, where there seems to be a predominance of certain socioeconomic state groups in specific zones. The highest twinning rate was seen in Zone 4 (Tondairpet) when the predominant community belong to a very low socioeconomic income group.[27,28] Various studies have shown higher twinning rates with maternal age greater than 30 years.[29,30] However, in this study, the age groups 25–30 years had the highest twinning rate (53.3%) followed by 30–34 years age group (41.3%). The

commonest order of birth was first order at 93.3%. Only one MZ pair in this study had a birth order of 5. Here too the finding deviates from the findings that twinning is the highest in the age group lower than 35 and between 30 and 35 years and commonest birth order being the higher ones.[23,31-33]

The zygosity was tested using a highly accurate questionnaire pertaining to physical similarity between the twins.[18] This method has been found to have a 95% accuracy at 18 months and 96% at 3 years age. In the present study, 34 MZ pairs formed 22.7% of the twins studied as opposed to 116 DZ pairs of 77.3%. The DZ twinning was much higher than found in other Indian studies where analysis was done using Wienberg's Differential method.[8-11] The number of like twins were 102 (68% – MZ-34, DZ-68) and unlike twins were 48 (32%). Using the Weinberg's method in the present study, MZ can be calculated to 54 (36%) and DZ 96 (64%). There is, hence, a substantial difference of more than 10% in each group using the latter technique. Even if the accuracy error in the questionnaire method is taken into consideration, this difference is quite significant. This again leads to the question of relevance of that method in twinning studies like other studies.[34]

Most of the twin-based studies were conducted on hospital and other health care-based records. The present study was conducted in a population-based field study in Chennai metropolitan city by its various zones. In an old city like Chennai where the population is diverse and occupation and socioeconomic status is varied, there is a tendency of community distribution based on the latter. This might have somehow reflected on the twinning rate within the city due to the differences in the microenvironment. There should be a detailed Twin Registry in the country in the present age where communication has been simplified by various modes. This would only encourage more community-based twin studies and to analyse various health conditions associated by this ever-intriguing population subgroup.

Conclusion

The twinning rate observed in Chennai in the present study is interestingly very high, compared to the overall twinning observed in the past in the state of Tamilnadu. This interesting finding may also be attributes to the fact that this is one of the first time that a population-based twinning study has been conducted in a large metropolitan unlike other rural healthcare/Hospital-based studies. The Wienberg's Differential Method for zygosity determination is again found to be questionable. Emphasis on a development of a comprehensive Twin Registry throughout the country is made more relevant here. The zygosity proportion, maternal age and parity relations are not very different from previously available data.

Data availability statement

The data sets during and/or analysed during the current study available from the corresponding author on reasonable request.

Declaration of patient consent

The authors certify that they have obtained all appropriate patient consent forms. In the form, the patient (s) has/have given his/her/their consent for his/her/their images and other clinical information to be reported in the journal. The patients understand that their names and initials will not be published and due efforts will be made to conceal their identity, but anonymity cannot be guaranteed

Key Messages

The twinning rate observed in Chennai in the present study is interestingly very high, compared to the overall twinning rate and that is reported in the past from the state of Tamilnadu.

Financial support and sponsorship

Nil.

Conflicts of interest

There are no conflicts of interest.

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