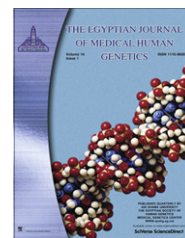




Ain Shams University

The Egyptian Journal of Medical Human Genetics

www.ejmhg.eg.net
www.sciencedirect.com



ORIGINAL ARTICLE

Frequency of twinning in Kwara State, North-Central Nigeria

O.A. Iyiola ^{a,d,*}, F.B. Oyeyemi ^b, U.A. Raheem ^c, F.O. Mark ^a

^a Department of Zoology, University of Ilorin, P.M.B. 1515, Ilorin Kwara State, Nigeria

^b Cell Biology and Genetics Unit, Department of Zoology, University of Ibadan, Ibadan, Nigeria

^c Department of Medical Geography, University of Ilorin, P.M.B. 1515, Ilorin Kwara State, Nigeria

^d Department of Molecular Biology & Biotechnology, University of Sheffield, Firth Court, S10 2TN Sheffield, United Kingdom

Received 22 June 2012; accepted 29 July 2012

Available online 5 October 2012

KEYWORDS

Frequency;
North-Central Nigeria;
Twinning rate

Abstract *Background:* Twin birth prevalence varies widely among the world population. Several factors such as genetic, maternal, socio-economic and environmental have been implicated in its incidence. Although these factors are still the subject of a number of investigations variations do exist in the reported incidence of twinning across the world. There is limited information on the frequency of twinning in Kwara state, North Central Nigeria.

Aims: This study aims to determine the frequency and prevalence of twinning in Kwara state of the North Central Nigeria. We wish to update the current knowledge on the trend and frequency of twinning in North-Central Nigeria and thereby contributing to the demographic studies in the country.

Subjects and methods: We carried out an 11-year retrospective study on the incidence of twin births between 1998 and 2008. Data were collected from the University of Ilorin Teaching Hospital, Ilorin (UITH), Omosebi Hospital, Ilorin (OHI) and Erinle General Hospital, Erinle (EGHE) all in Kwara state, North-Central Nigeria. These data were pooled together and analyzed by year and maternal age groups of 15–19, 20–24, 25–29, 30–34, 35–39, 40–44, and 45–49 years according to the standard method.

* Corresponding author at: Department of Zoology, University of Ilorin, P.M.B. 1515, Ilorin Kwara State, Nigeria. Tel.: +44 7501748696/+234 8038635656; fax: +441142224243.
E-mail addresses: o.iyiola@sheffield.ac.uk, iyiola.oa@unilorin.edu.ng (O.A. Iyiola).

Peer review under responsibility of Ain Shams University.



Production and hosting by Elsevier

Results: Frequencies of twin births of 37.60, 35.01, and 35.9 per 1000 deliveries were recorded for UITH, OHI and EGHE respectively. The overall average frequency of 37.4 per 1000 deliveries for the three hospitals was recorded in the study. The maternal age group of 25–29 years had the highest occurrence of twin births (35.33%), while the lowest was recorded in the 45–49 years age group (1.32%).

Conclusion: This study shows that there is an increase in twinning rate in the Kwara state when compared with previous reports on this subject matter. This is probably due to an increase in awareness and use of ovulation stimulating drugs or multiple embryo transfers among women.

© 2012 Ain Shams University. Production and hosting by Elsevier B.V. All rights reserved.

1. Introduction

The biology of twin births in humans is still largely unclear and is the subject of a number of investigations [1–4]. Twinning rate varies in different ethnic groups of the world. These variations are thought to be influenced by complementary factors such as genetic, environmental, dietary and racial factors [5]. Lots of hypotheses have been drawn and enormous suggestions offered to explain these variations. Generally speaking, twinning rate is 1 out of 100 deliveries and is believed to be more frequent compared to the birth of triplet and quadruplet. Twinning rate is highest among the Yoruba tribe in the southwest Nigeria [6]. Twinning is lowest among the Asian Mongoloids, and intermediate in the Caucasians [7]. Multiple ovulations which is the tendency to release multiple eggs during ovulation in women has been reported to be among the contributory factors influencing the chance to conceive dizygotic (fraternal) twins. Since the major mechanism for fraternal twinning is multiple/hyper ovulations [8], therefore in families where the women have a gene for multiple ovulation, genetic influences could sufficiently explain an increased presence of fraternal twins in the population [9].

This suggestion was recently corroborated by Tanglani-Ribeiro and his colleagues where they gave suggestive genetic influence on the twinning prevalence in a small population in South Brazil implicating founder effect hypotheses as possible explanation for the prevalence [10].

Twins are classified into two types namely monozygotic (MZ) and dizygotic (DZ). MZ (identical) twins are developed when an embryo splits soon after fertilization of an ovum by a spermatozoon. DZ (non-identical) twins occur when two separate oocytes, released during the same menstrual period, are fertilized by separate sperm cells [11]. Previous report on the inheritance of DZ twinning has suggested dominant, recessive and female-limited X-linked inheritance [11].

MZ is found to be rarer than DZ twinning except in Japan [10]. Genetic history of twins birth in the family, maternal age, high body mass index (> 30) of mothers are among several contributory factors to twinning rate [11]. In a quest by geneticists to determine the genes responsible for DZ twinning, a genome-wide linkage scan was performed and some evidences for linkage were found at three regions on human chromosomes II, VII and XVIII [12,13]. New candidate genes are now being identified on DZ twinning which may add further weight to the growing body of evidence that DZ twinning may be a heterogeneous, complex genetic trait.

Genetic analyses have further revealed that in determining fraternal twins, mother's genotype rather than that of the father's is much more important [14,15].

Studies on twinning rates have been carried out by scientists, demographers, anthropologist across the world population. In some countries in Europe, twinning rates as reported by Pison and D'Addato [16] showed the trend as follows; Sweden (15.47), Germany (14.90), Norway (12.08), England and Wales (14.26) and Denmark (17.98) births per 1000 deliveries [16]. Recent work showed that the twinning birth rate in the United States of America rose by 76% from 1980 through 2009, i.e. from 18.9 to 33.3 per 1000 births [17]. In Africa, twinning study carried out by Mosuro and colleagues revealed an incidence of 33.4 and 26.6 twin births per thousand live births for Accra and Kumasi respectively [6]. Twinning incidence in Kenya was estimated to be 20.8 per thousand births [18]. Twinning rate conducted among the Black and White population in Johannesburg, South Africa were estimated to be 12.4 and 10.88 per thousand births [19]. Among the earliest reports on twinning study in Nigeria was Bulmer who reported 44.9 twins per 1000 births in Ibadan, Southwestern Nigeria [14]. Several studies on twinning rate have carried out in other major cities of Nigeria. Twinning among Nigerian population were estimated as follows; 23.1, 28.0, 40.2, 28.0 per thousand births in Maiduguri, Jos, Southwest Nigeria, Enugu and Ilorin respectively [7,15,20–22]. The highest incidence of twin birth in the world was recorded among the Yoruba tribe in Southwestern Nigeria with a twinning rate of 53.8 per 1000 births [7]. This observation was linked with high consumption of yam containing a natural phytoestrogen which may stimulate the ovaries to release egg from each side [23]. Consequence of residual effects of the long-term use of oral contraceptives has also been suggested as a possible reason for rise in twinning rate in most developed and developing nations [24], although Japan and some Asian countries have reported a relatively low twinning birth rate [25]. Previous available data on twinning study in Ilorin, Nigeria have focused much on the mode of delivery, distribution by antepartum and postpartum complications during twin pregnancy. These data were only from the University of Ilorin Teaching Hospital (UITH) alone. There is a need to provide current information on the incidence of twinning in Kwara state, North-Central Nigeria. We believe that data from this study will contribute to the existing body of knowledge on the frequency of twinning in North Central Nigeria.

2. Subjects and methods

The data used for this study were collected from three different hospital viz., University of Ilorin Teaching Hospital, Ilorin (UITH); Omosebi Hospital, Ilorin (OHI) and Erinle General Hospital, Erinle (EGHE) all in Kwara state, Nigeria. The data

were used to create information on birth records which include all live single and multiple birth, sex at birth and maternal age. The data consist of 26,709 live births (single and multiple births). The data consist of single, multiple birth and maternal age for the period between 1998 and 2008 (11 years). UITH has served as a major referral hospital in Kwara State for over 30 years. It provides specialist outpatient and inpatient medical care in obstetrics and gynecology, pediatrics, general and orthopedic surgery and internal medicine. A total of 23,799 of the total data were collected in UITH, this makes up 89% of the sample size. These were analyzed by year and maternal age group. Seven maternal age groups, viz., 15–19, 20–24, 25–29, 30–34, 35–39, 40–44, and 45–49 years, were considered for the possible influence of mothers' age on twinning rate. All sets of data were not analyzed for type of twins delivered, i.e., whether monozygotic (identical) or dizygotic (fraternal), because of inadequate records. This is not expected to affect the results obtained in this study. The number of single births (x), the number of twin births (y), and the number of single births for every twin delivery (x/y) were determined. The number of twin births in every 1000 deliveries was simply calculated by dividing the number of twin deliveries (y) by the number of total deliveries (z) and then multiplying by 1000 as thus.

$$\frac{\text{Twin deliveries}(y)}{\text{Total deliveries}(z)} \times 1000$$

3. Results

Table 1 below shows the annual incidence of twin birth in the UITH Ilorin, Kwara state from 1998 to 2008. The highest twin births (42.1 for every 1000 births) was recorded in 1999 and 2006, while the lowest (30.0 for every 1000 births) was recorded in 2002. The highest number of single birth for each twin birth was 32.3 for the year 2002 while the lowest was 22.8 for both 1999 and 2006. The average number of twin births observed for the period was 37.6 for every 1000 deliveries and the average number of single births for each twin deliveries was 25.6.

Table 2 below shows the annual incidence of twinning in UITH by maternal age. The highest incidence of twinning rate as seen in UITH occurred in (25–29) maternal age group followed by (30–34) maternal age group while the lowest

incidence of twin birth was among the 45–49 years age group also followed by 15–19 maternal age group.

Table 3 shows the annual twinning rate in OHI from 1998 to 2008. The highest twinning rate of 58.8 per 1000 single births was recorded in 2002, while the lowest occurred in 2004 (18.7 per 1000 single births). The highest single births for each twin deliveries of 48.0 were recorded in 2004, while the lowest (16.0) was recorded in 2004. The average of 35.0 per 1000 births was recorded for the period, while an average of 27.6 single for each twin deliveries was also recorded for the period under consideration.

Table 4 below shows the annual incidence of twinning in OHI by maternal age. The highest incidence of twinning rate as seen in OHI occurred in (25–29) maternal age group while both (30–34) and (35–39) maternal age groups have the same twinning rate (3). The lowest incidence of twin birth was among the 15–19 years age group. There was no incidence of twin birth encountered in the 45–49 maternal age group throughout the period of this study.

Table 5 shows the annual incidence of twin births recorded in EGHE, showing the highest of 42.5 twins births per 1000 deliveries in 2001 and the lowest twins births (28.1 twins birth per 1000 deliveries) in 2002. The highest single birth for each twin deliveries (34.6) was obtained in 2002, while the lowest was obtained in 2001 with a value of 22.5 of single birth for each twin deliveries. The average values of 35.9 and 26.9 per 1000 deliveries was recorded for twin and single births per 1000 deliveries respectively. The highest value of twin births obtained was (11) and it occurred in the year 2001 while the highest value of single births obtained was (242) and it occurred in the year 2002.

Table 6 shows the maternal age groups in EGHE. In these data; we observed the highest value of twin birth (30) in the maternal age group 25–29 while the lowest value (3) occurs in the age group of 45–49.

The total number of 26,709 births were obtained for the three hospitals between January 1998 and December 2008.

Fig. 1 below shows the overall trends in twinning rate per 1000 births as seen Kwara state, Nigeria for the period of study. The highest incidence of twin births (41.73) occurred in the year 2000 and closely followed by 41.37 recorded in 2007 while the lowest value of 27.10 was recorded in 2004. The average number of twin birth in all the hospitals for the period under study was 37.4 twin births per 1000 deliveries,

Table 1 Annual incidence of twin and single births in UITH.

Year	Single deliveries (x)	Twins deliveries (y)	Total deliveries (z)	Single for each twin deliveries (x/y)	Twins birth per 1000 deliveries
1998	1607	63	1670	22.5	37.7
1999	1752	77	1829	22.8	42.1
2000	1958	79	2037	24.8	38.8
2001	2481	101	2582	24.6	39.1
2002	2421	75	2496	32.3	30.6
2003	2208	89	2297	24.8	38.7
2004	1956	64	2020	30.6	31.7
2005	2178	85	2263	25.6	37.6
2006	2116	93	2209	22.8	42.1
2007	2353	92	2445	25.6	41.6
2008	1874	77	1951	24.3	39.5
Total	22,904	895	23,799	25.6	37.6

Table 2 Annual incidence of twinning in UITH by maternal age.

Year	15–19	20–24	25–29	30–34	35–39	40–44	45–49
1998	–	4	17	23	19	–	–
1999	2	8	37	19	10	1	1
2000	–	10	45	20	16	1	1
2001	2	8	40	38	20	3	–
2002	1	6	36	17	13	2	–
2003	–	9	24	22	13	1	–
2004	2	11	21	22	7	1	–
2005	1	6	37	26	15	–	–
2006	1	12	27	33	19	–	–
2007	–	10	46	26	7	2	3
2008	–	8	38	14	16	1	–
Total	9	92	365	260	155	12	5

Table 3 Annual incidence of twin and single births in OHI.

Years	Single deliveries (x)	Twin deliveries (y)	Total deliveries (z)	Single for each twin deliveries (x/y)	Twins birth per 1000 deliveries
1998	22	1	23	22	43.5
1999	26	1	27	26	37.0
2000	20	1	21	20	47.6
2001	48	1	49	48	20.4
2002	32	2	34	16	58.8
2003	60	2	62	30	32.2
2004	52	1	53	52	18.7
2005	75	3	78	25	38.5
2006	25	1	26	25	38.5
2007	23	1	24	23	41.7
2008	58	2	60	24	33.3
Total	441	16	457	311	35.0

Table 4 Incidence of twinning in OHI by maternal age.

Years	15–19	20–24	25–29	30–34	35–39	40–44	45–49
1998			1				
1999	1						
2000			1				
2001					1		
2002				1	1		
2003		1			1		
2004						1	
2005			1	2			
2006		1					
2007						1	
2008			2				
Total	1	2	5	3	3	2	–

while the average number of single births for each twin deliveries was 25.74.

Fig. 2 below shows the incidence of twin births recorded in the three hospitals in Kwara State, Nigeria between 1998 and 2008 analyzed by maternal age. The age group of 25–29 years had the highest number of twin births (35.33%) and occurred in UITH while the age group of 45–49 years had the lowest (1.32%) at OHI.

4. Discussion

We observed approximately similar values of twin births [35.9 and 35.01] per thousand births from EGHE and OHI respectively. We observed the highest incidence of twin birth in UITH (37.6/1000). From the three hospitals used for this study, we obtained a total value of 37.4 per 1000 live births for the period of our study. Our data are quite consistent with the twinning

Table 5 Summary of the annual incidence of twin births recorded in EGHE and analyzed yearly for single deliveries and twin births per 1000 deliveries.

Years	Single deliveries (X)	Twin deliveries (Y)	Total deliveries (Z)	Single for each twin deliveries	Twins deliveries per 1000 birth
1998	167	6	173	27.8	34.7
1999	175	7	182	25.0	38.5
2000	198	8	206	23.6	38.8
2001	248	11	259	22.5	42.5
2002	242	7	249	34.6	28.1
2003	228	9	237	25.3	37.9
2004	196	6	202	32.7	29.9
2005	278	9	287	30.2	31.4
2006	211	8	219	26.4	36.5
2007	235	10	245	23.5	40.8
2008	187	7	194	26.7	36.1
Total	2365	88	2453	26.9	35.9

Table 6 Annual incidence of twinning in EGHE by Maternal age.

Years	15-19	20-24	25-29	30-34	35-39	40-44	45-49
1998	-	1	3	1	1	-	-
1999	-	2	2	1	1	1	-
2000	1	1	3	2	-	1	-
2001	-	3	3	3	2	-	-
2002	1	1	4	-	1	-	-
2003	-	-	5	1	2	1	-
2004	-	1	2	3	-	-	-
2005	1	1	3	4	-	-	-
2006	1	-	2	1	2	1	1
2007	-	1	2	3	2	1	1
2008	-	1	1	2	1	1	1
Total	4	12	30	21	12	6	3

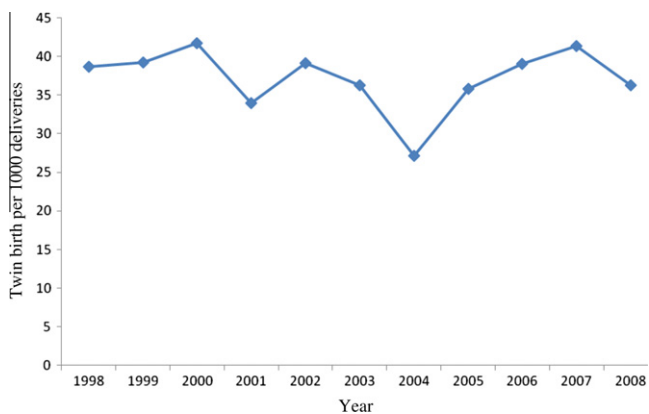


Figure 1 Annual incidence of twin births recorded in three hospitals in Kwara State, Nigeria between 1998 and 2008.

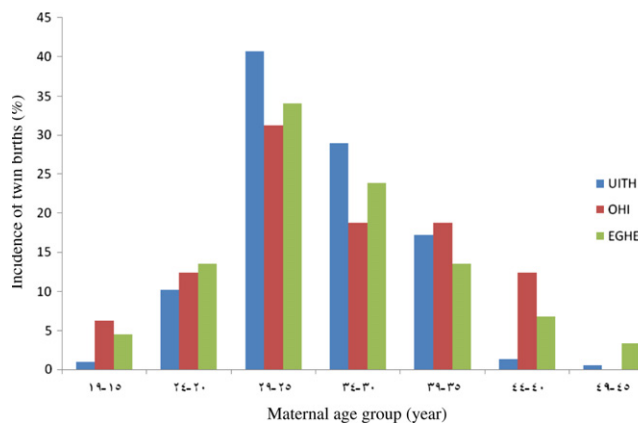


Figure 2 Incidence of twin births recorded in three hospitals in Kwara State, Nigeria between 1998 and 2008 analyzed by maternal age.

gestation data from Ilorin previously reported by Isiaka-Lawal and colleagues who obtained 33.3 per 1000 deliveries [22]. The strong correlation between the data we obtained in this study and the data obtained by Isiaka-Lawal and colleagues [22] supports the reliability of this study in defining twinning rate in Kwara state, Nigeria. In a similar study carried out in Southwest Nigeria with the data for the period 1995 by Akinboro

et al. [20] to 2004, twinning rate was estimated to be 40.2 per 1000 deliveries. Twinning rate obtained by Akinboro and colleagues was slightly higher than our own probably because they carried out their study in the southwest geo-political zone of Nigeria where highest number of twins in the whole world has been reported [20]. Similar studies in Jos and Maiduguri,

Nigeria by Aisien et al. [15] and Kullima et al. [7] were 28.0, 23.2 per 1000 births. These data on twinning rate are not in agreement with what was obtained in Enugu by Onah and Ugwu [21] who reported no increase in twin deliveries from 1985–2005 and in Calabar by Bassey and colleagues [26] who found twinning rate to be 26.5 per 1000 births. However a potential source of little discrepancy between our data and those obtained from other studies could be that our data were obtained from both Ilorin city and Erinle (a rural area) where artificial reproductive technology (ART) was not a common practice. ART has been reported to have a positive impact on twinning rate [21]. Twinning rates in UITH Ilorin (37.6/1000 births) were higher than what was observed in EGHE (35.9/1000 births), this is quite consistent with the result from Gan et al. [27] in China where DZ twinning rates in urban areas were higher than in rural areas. Bulmer [14] estimated the twinning rate to be 44.9 per 1000 births in Ibadan while 68.1 per 1000 births were obtained for Igbo-Ora by Mosuro [28]. The reason which seems plausible to explain the deviation in twinning rate reported in this study and those from the studies conducted at Ibadan and Igbo-ora in Oyo state might be due to the fact that Kwara state comprises of people of different tribes like Hausa, Fulani, Nupe and Yoruba. The location, weather condition and serenity of the state make it a safe haven for immigrants. These further give way to interbreeding resulting in admixture of genes and hence the decrease in twinning rates reported in this study. Another possibility for slight variation might also be due to modification of environmental and genetic influences by inter-ethnicity and migration.

Consistent with the general belief that maternal age influences twinning, our data from UITH,EGH and OGH showed that the peak in twinning was observed in maternal ages 25–29 followed by 30–34. The lowest twinning rate being in maternal age ranges from 15–19 and followed 45–49 maternal age range. The observed peak in twinning between the ages of 25–34 was because women within this age group are sexually active and still within the scientifically possible and culturally permissible child-bearing age unlike in the maternal age 15–19 where majority are not married and so have not started childbearing and in age 45–49 when they have either stopped child-bearing or have reached the age of menopause. Twinning studies by Akinboro et al. [20], Gan et al. [27] and Igberase et al. [29] all agreed with the general argument that maternal age also influences twinning rate.

5. Conclusion

We believe the twinning rate has positive correlation with long-term use of various kinds of contraceptives probably due to residual effect. This might also be probably attributed to increase awareness and use of artificial reproductive technology in Kwara state, Nigeria. There is every possibility of growing frequency of multiple births especially in the developed and developing countries where fertility treatments are predominantly used. There is also growing and compelling evidences supporting the roles of some candidate genes in influencing the chance of giving birth to twins. Many more genetic influences are yet to be elucidated. Our belief is that an understanding of how these factors interact will be important before this body of knowledge can be fully exploited. In near future, we hope to investigate the correlation between mother's height,

weight so as to be able to analyze the effect of the mother's body mass index (BMI) on the twinning incidence.

Source of support

None declared.

Acknowledgments

The authors wish to thank the authorities of the University of Ilorin Teaching Hospital, Ilorin (UITH), Omosebi Hospital, Ilorin (OHI) and Erinle General Hospital, Erinle (EGHE) all in Kwara state, North-Central Nigeria for their technical support and access to birth records used for this study.

References

- [1] Hall JG. Twinning: mechanisms and genetic implications. *Curr Opin Genet Dev* 1996;6:343–7.
- [2] Lummaa V, Haukioja E, Lemmetyinen R, Pikkola M. Natural selection on human twinning. *Nature* 1998;394:533–4.
- [3] Beemsterboer SN, Homburg R, Gorter NA, Schats R, Hompes PG, Lambalk CB. The paradox of declining fertility but increasing twinning rates with advancing maternal age. *Hum Reprod* 2006;21:1531–2.
- [4] Steinman G. Can the chance of having twins be modified by diet? *Lancet* 2006;367:1513–9.
- [5] Steinman G, Verni C. *Womb mates: a modern guide to fertility and twinning*. New York: Baffin Books; 2007.
- [6] Mosuro AA, Agyapong AN, Opoku-Fofie M, Deen S. Twinning rates in Ghana. *Twin Res* 2001;4:238–41.
- [7] Kullima AA, Audu BM, Geidam AD. Outcome of twin deliveries at the University of Maiduguri Teaching Hospital: a five year review. *Niger J Clin Pract* 2011;14(3):345–8.
- [8] Millham S. Pituitary gonadotrophin and dizygotic twinning. *Lancet* 1964; ii:566.
- [9] Montgomery GW, Crawford AM, Penty JM, Dodds KG, Ede AJ, Henry HM, et al. The ovine Booroola fecundity gene (Fecb) is linked to markers from a region of human chromosome 4q. *Nat Genet* 1993;4:410–4.
- [10] Tagliani-Ribeiro A, Oliveira M, Sassi AK, Rodrigues MR, Zagonel-Oliveira M, Steinman G, et al. Twin town in South Brazil: a Nazi's experiment or a genetic founder effect? *PLoS One* 2011;6(6):e20328. <http://dx.doi.org/10.1371/journal.pone.0020328>.
- [11] Hoekstra C, Zhao ZZ, Lambalk CB, Willemsen G, Martin NG, Boomsma DI, et al. Dizygotic twinning. *Hum Reprod Update* 2008;14:37–47.
- [12] Painter JN, Willemsen G, Nyholt D, Hoekstra C, Duffy DL, Henders AK, et al. A genome wide linkage scan for dizygotic twinning in 525 families of mothers of dizygotic twins. *Hum Reprod* 2010;25(6) 1569–1580, Advanced Access publication on April 8, 2010 doi:<http://dx.doi.org/10.1093/humrep/deq084>.
- [13] Derom C, Jawaheer D, Chen WV, McBride KL, Xiao X, Amos C, et al. Genome-wide linkage scan for spontaneous DZ. *Twinning Eur J Hum Genet* 2006;(14) 117–122.
- [14] Bulmer MG. The twinning rate in Europe and Africa. *Ann Human Genet* 1960;24:121–5.
- [15] Aisien AO, Olarewaju RS, Imade GE. Twins in Jos Nigeria: a seven-year retrospective study. *Med Sci Monit* 2000;6:945–50.
- [16] Pison G, D'Addato AV. Frequency of twin births in developed countries. *Twin Res Hum Genet* 2006;9:250–9.
- [17] Martin JA, Hamilton BE, Osterman M JK. "Three Decades of Twin Births in the United States, 1980–2009". National Center for Health Statistics Data Brief, January 2012; No. 80.

- [18] Musili F, Karanja JG. Multifoetal pregnancies at a maternity hospital in Nairobi. *East Afr Med J* 2009 Apr;86(4):162–5.
- [19] Hain FM, Kromberg JG. Trends in the twinning rate in Johannesburg, South Africa, 1969–1989 and estimated twinning rates for 1990. *Twin Res* 1998;1(2):57–64.
- [20] Akinboro O, Azeez MA, Bakare AA. Incidence of twinning in Southwest Nigeria. *Indian J Hum Genet* 2008;14 (2):41–47.
- [21] Onah HE, Ugwu GO. Trends in the twinning rate in Enugu, Nigeria. *J Obstet Gynaecol* 2008;28(6):590–2.
- [22] Isiaka-Lawal S, Adesina KT, Saidu R, Ijaiya MA, Jimoh AAG, Aderibigbe SA. A review of twin gestation in a Tertiary Health Institution in North Central Nigeria. *Res J Med Sci* 2009;3(6): 198–201.
- [23] Wikipedia. Twin. Available from: <http://en.wikipedia.org/wiki/twin>. (last accessed on 27.05.12).
- [24] Colletto GMDD. Twinning rate trend in a population sample from the city of São Paulo, Brazil. *Genet Mol Biol* 2003;26(3):245–8.
- [25] Smits J, Monden C. Twinning across the developing world. *PLoS ONE* 2011;6(9):e25239. <http://dx.doi.org/10.1371/journal.pone.0025239>.
- [26] Bassey EA, Abastsiattai AM, Udoma EJ, Asuquo EE. Outcome of twin pregnancy in Calabar Nigeria. *J Med Sci* 2004;3:13–5.
- [27] Gan JP, Wu, ZH, Tu, ZM, Zheng J. The comparison of twinning rates between urban and rural areas in China. *Twins Res Human Gent* 2007;10(4):633–7.
- [28] Mosuro AA. Twinning rates in southwest Nigeria. *Nig J Sci* 1996;30:39–45.
- [29] Igberase GO, Ebeigbe PN, Bock-Oruma A. Twinning rate in a rural mission tertiary hospital in the Niger delta Nigeria. *J Obstet Gynaecol* 2008;28(6):586–9.