Acta Genet Med Gemellol 36:373-380(1987)

Alternate Changes in Birth Seasonality of Twins During 1971-1984 in Japan

I. Nakamura[1], Y. Amau[2], K. Nonaka[1], T. Miura[1]
[1]*Department of Hygiene, Teikyo University School of Medicine, Tokyo; and* [2]*The Japanese Association of Twins' Mothers, Tokyo, Japan*

Abstract. Birth dates of 1,536 twin-pairs in 1971-1984 were collected from the members of an association of twins' mothers. The seasonal variation of twinning changed every 2-4 years. Years when twinning rate was higher in the summer-fall season (1971-72, 1976-77, 1982-84) and those when a peak of the rate was not observed (1973-75, 1978-81) appeared alternately. In years with a summer-fall peak, the elevation of twinning in the summer-fall season was detected consistently in both like- and unlike-sexed and in both MZ and DZ twin groups. The twinning seasonality in these years, however, was not evident in twin births of mothers who were born in May-July. These results suggest the possibility that seasonal factors which influence the twinning rate be not multiple-ovulation-inducing but probably abortion-inducing factors and most likely seasonally epidemic microbes.

Key words: Twinning rate, Seasonality, Epidemic factors

INTRODUCTION

Seasonality of twinning has been reported from several countries [2-5,7-11,17]. However, the seasons when the excess of twinning was detected were not consistent among these reports which analysed the seasonality of overall twin births collectively for several years. There have been few secular analyses of seasonality of twinning [5,15]. We analysed twin births for the years 1924-1980 among records of two maternity hospitals and of an association of mothers of twins and revealed that twinning rates were higher, in general, in summer or fall, but this seasonality occasionally disappeared within a few years, as was observed in 1973-1975 [14]. Seasonal excess or reduction of twinning may not be consistent during a long period of time.

In order to confirm this phenomenon, more recent data of twin births were collected from new records of the association of mothers of twins and the seasonal variation was reexamined for every year.

MATERIALS AND METHODS

The data from the voluntary registrations of an association of mothers of twins in Tokyo comprised 1,536 twin pairs born during the years 1971-1984. The members of association lived mostly in Tokyo and its vicinities.

Two kinds of registration form have been used in this association. One kind of registration form includes date of birth, sex and zygosity of twins and birth month of mother. The zygosity was accepted when the diagnosis by an obstetrician at delivery was consistent with the parents' opinion. Another kind of registration form includes only the date of birth and sex of twins, from which we could confirm only the likeness of sexes.

Among the total of 1,536 twin pairs, like-sexed (LS), unlike-sexed (US) and sex-unknown pairs were 1,331, 196 and 9 respectively. All US pairs were grouped as DZ pairs. Among LS twins, MZ, DZ and zygosity-unknown (UZ) pairs were 655, 337 and 339, respectively and among the 9 sex-unknown pairs, 7 were DZ and 2 were UZ.

Monthly distributions of twins' birth are expressed by the relative ratios to the expected distribution estimated from the general births in Tokyo, according to the Vital Statistics issued annually by the Ministry of Health and Welfare of Japan. The seasonality of each group was tested according to the method by Walter and Elwood [18]. The differences in twinning rate between two birth-season groups were tested by chi square tests.

RESULTS

The seasonal distribution of twinning changed every 2-4 years (Fig. 1). Years with a higer twinning rate in the summer-fall season (1971-72, 1976-77, 1982-84) and those with no peak of twinning in any particular season (1973-75, 1978-81) appeared alternately. The seasonality of twinning was significant according to the method by Walter and Elwood ($P < 0.01$) for 1971-72, 1976-77 and 1982-84.

In the years with a summer-fall peak, monthly rates of twinning increased significantly ($P < 0.01$) during July-December (Fig. 2). The seasonality was significant also according to the method by Walter and Elwood ($P < 0.01$). The excess of twinning in the summer-fall season was detected consistently in both MZ and DZ (Fig. 3) and in both LS and US twin groups. Among DZ pairs, the seasonal variation was similar in LS and US pairs (Fig. 4). Significance of seasonality was detected in all six groups (by the method of Walter and Elwood, $P < 0.01$). During years with no summer-fall peak, no peak was detected among any of the above-mentioned twin groups.

During the years with a summer-fall peak, the monthly distributions were calculated separately in two groups of mothers born in different seasons (Fig. 5). The mothers born in May-July did not show an excess of twin births in the summer-fall season, in wich the

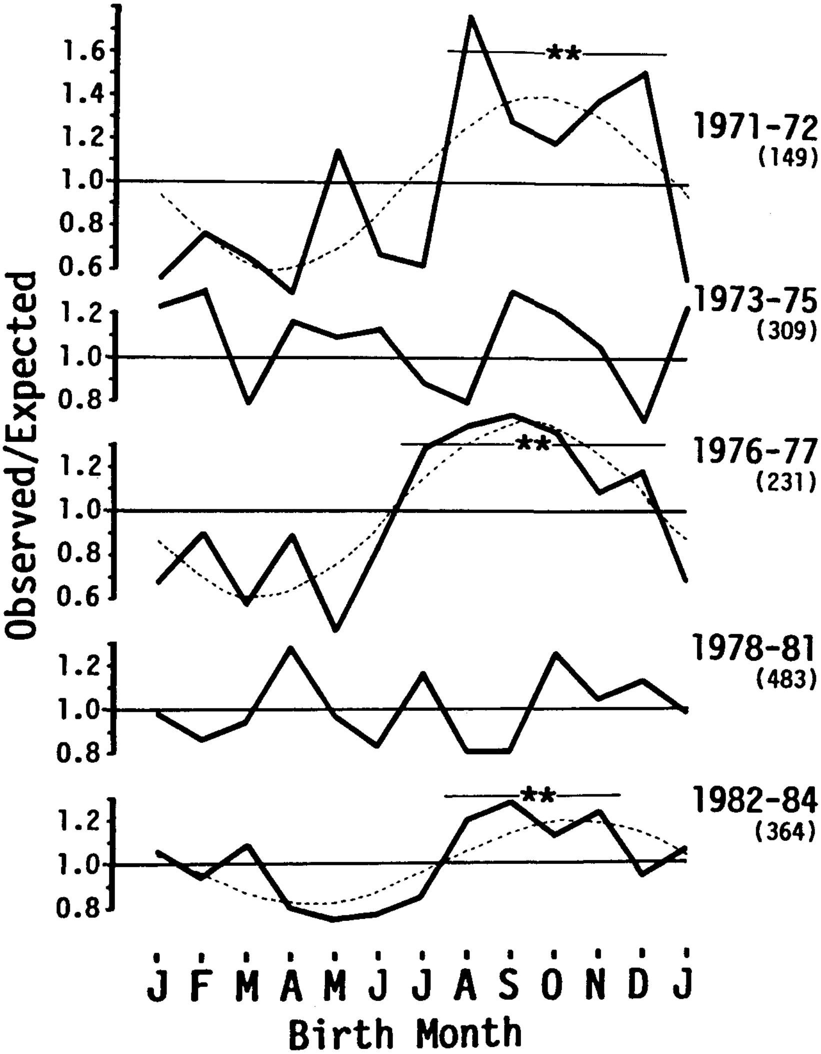

Fig. 1. Monthly distribution of twin births (solid line), 1971-1984. Dotted line: an expected harmonic curve according to the method by Walter and Elwood.

** Significant difference among two birth-month groups ($P < 0.01$).

other mothers showed a significant excess (by the method of Walter and Elwood, $P < 0.01$). The difference in seasonal distribution of twin births between the two groups of mothers was significant ($P < 0.05$) for August-December and the other seasons.

DISCUSSION

In our data, the number of LS pairs was about 6.8 times larger than that of US pairs and

https://doi.org/10.1017/S0001566000006139 Published online by Cambridge University Press

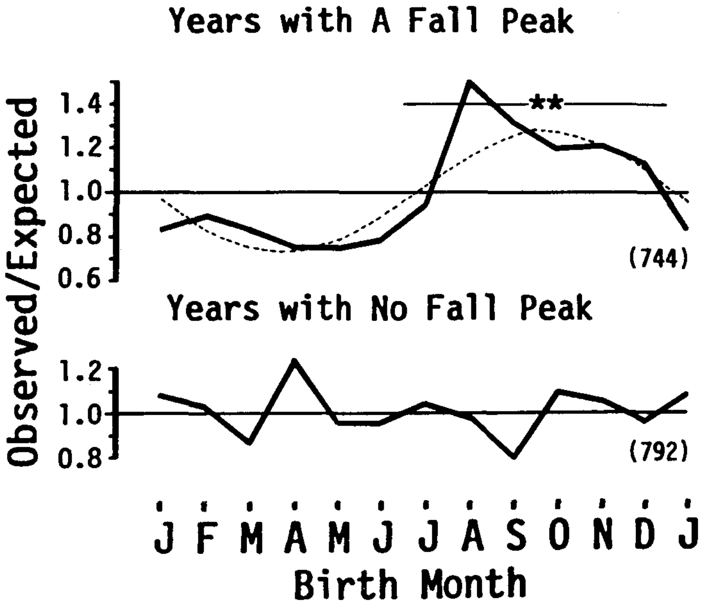

Fig. 2. Monthly distribution of twin births in years with a summer-fall peak and in years with no summer-fall peak. Dotted line: an expected harmonic curve according to the method by Walter and Elwood.
** Significant difference among two birth-month groups (P < 0.01).

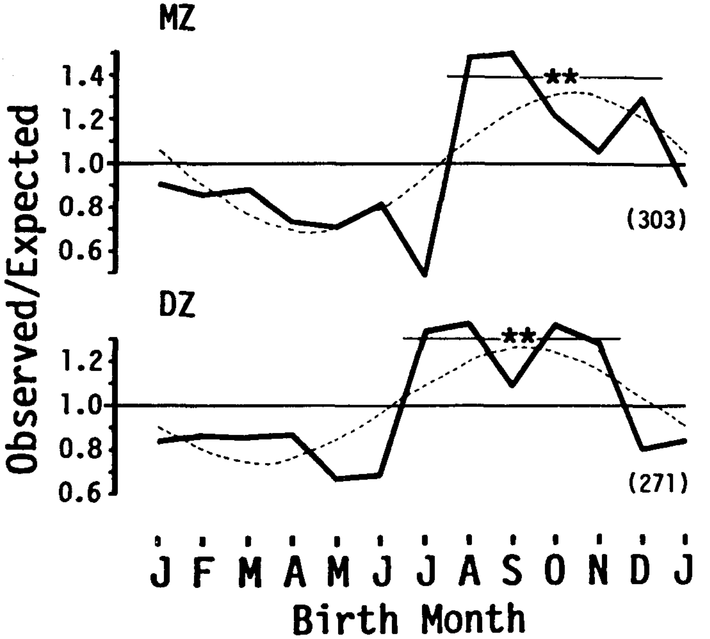

Fig. 3. Monthly distribution of births in MZ and DZ twin groups during the years with a summer-fall peak. Dotted line: an expected harmonic curve according to the method by Walter and Elwood.
** Significant difference among two birth-month groups (P < 0.01).

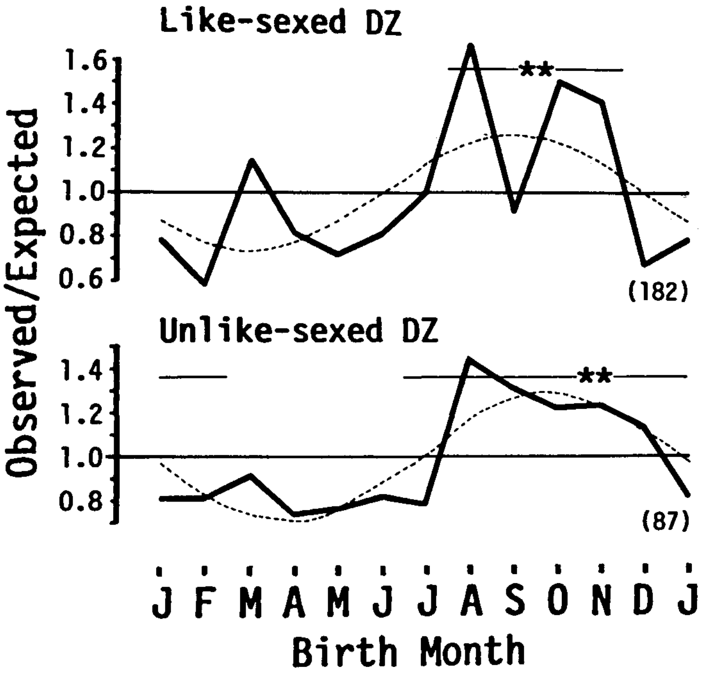

Fig. 4. Monthly distribution of birth in like-sexed and unlike-sexed DZ twin groups during the years with a summer-fall peak. Dotted line: an expected harmonic curve according to the method by Walter and Elwood.

** Significant difference among two birth-month groups ($P < 0.01$).

this ratio was a little higher than that observed for all Japan in 1974 (about 5.2 times among 12,392 pairs) [6]. However, the number of MZ pairs was not much larger than that of DZ pairs (approximately 1.2 times). This is in contrast with Weinberg's rule, which may be partly attribued to the unknown zygosity (UZ) of a large numbers of LS pairs (339 UZ among 1,331 LS pairs) under the restriction of our registration forms. However, when UZ-LS pairs were assumed to be distributed into DZ and MZ in the ratio of 337 vs 655, the number of LS pairs among DZ was 2.3 times that of US pairs (estimated LS-DZ 452 vs US 196). This estimation is quite close to that reported by Yoshida and Soma [19] which showed twice LS than US pairs in a study of 178 placentas of twin in Tokyo. In Japan, the number of LS-DZ pairs may be actually about twice that of US-DZ pairs. This discrepancy from Weinberg's rule may not be explained until the zygosity of our UZ-LS twins is determined.

The present analysis confirms the excess of twin births in the summer-fall season and its occasional loss in agreement with our previous report [14]. It also shows that the years showing a summer-fall peak and the years showing no distinct seasonality appeared alternately in recent years. This may explain the inconsistent results on the seasonality of twinning between authors who did find it [2-5,7-11,17], and others who did not [16,20]. The factors which cause the seasonality of twinning might not be common to every country and to every year but be changeable ones.

Causes for the seasonality of twinning have rarely been explained. Timonen and Car-

https://doi.org/10.1017/S0001566000006139 Published online by Cambridge University Press

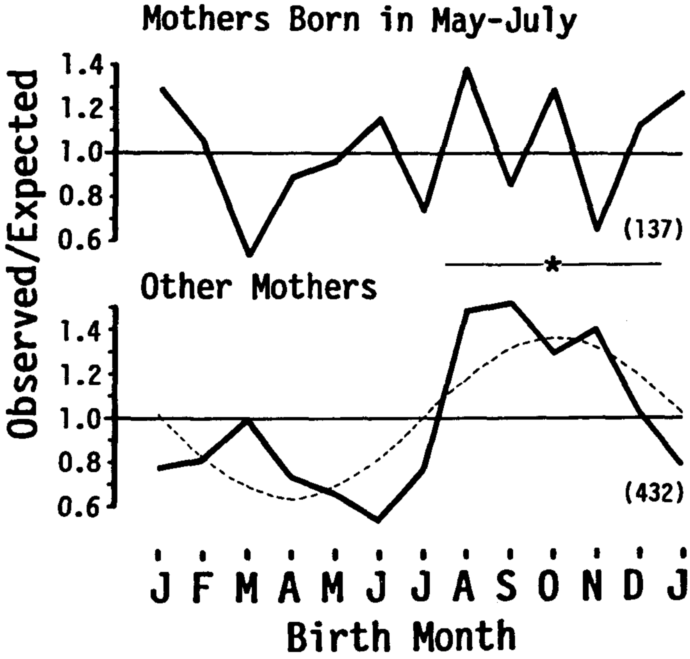

Fig. 5. Twinning rates during the years with a summer-fall peak in mothers born in May-July and in those born in the other months. Dotted line: an expected harmonic curve according to the method by Walter and Elwood.

** Significant difference among two groups of mothers ($P < 0.05$).

pen [17] attributed the extremely higher rate of multiple pregnancy in summer in Finland to a light-induced increment of ovulation caused by the longer sunshine hours. Other authors proposed some meteorological effects such as sunlight [3], rainfall [11] and temperature [10].However, it may be difficult to explain the changing seasonality in this study by these elements, because the seasonal variation of these meteorological elements had not differed among the two year-groups with different seasonalities of twinning. Among other factors proposed, seasonal changes of food consumption [9], for example, also had not changed during this period alternately. Effects of infective microorganisms [1] may be more likely.

Generally, it has been reported that when the seasonality of births had been examined among MZ and DZ twins separately, the seasonal change was not detected in MZ but only in DZ twins [2,4,9]. Most of so far proposed seasonal factors, such as sunlight [3,17], mild climate [10] and food [9], were supposed to have effected multiple ovulation. The cause of seasonality of DZ twinning and that of total twinning in Europe, North America and Africa, where DZ twinning is predominant, might be explained by seasonally induced multiple ovulations. In Japan, where the MZ twinning rate is higer than the DZ twinning rate, however, the seasonality was detected not only in total twinning [10,14] but also in both MZ and DZ twinning separately [7].

The present study also shows a summer-fall peak of twin births in both MZ and DZ twins in years with distinct seasonality of twinning. This suggests that seasonal factors which influence the twinning rate are not multiple-ovulation-inducing but abortion-inducing ones. The effect of these factor seems not to differ according to the pairing of sexes of twins.

Miura and Shimura [12] reported that the birth seasonality of offspring was different among groups of mothers born in different season, May-July and the other months, and suggested that the effect of some seasonally epidemic abortion-inducing factors can be different among two groups of mothers born in different season. It was hypothesized that mothers born in May-July, who could have been infected and immunized at their own prenatal stages, were resistant to this factor even in much later years when they had become pregnant [13].

In the present study, in agreement with the previous report [14], the mothers born in May-July did not show a peak of twinning in the summer-fall season, while the other mothers showed an excess in that season. To explain this phenomenon, we can also hypothesize immunogenic effects of the above-mentioned seasonally epidemic factors. Certain seasonally epidemic factors may prevail to cause the seasonality of twinning, its alternate changes and the different effect on mothers according to their month of birth. To cause all these phenomena, microbes may be most probable both to prevail for some years under certain conditions and to disappear from the environment for other years.

However, no seasonal variations of abortion have been reported in these years. But the supposed abortion may have occurred so early in the gestational stage that mothers might not recognize it and/or only the fetuses in twin pregnancy were affected. In the latter case seasonal changes in the occurrence of unrecognized "vanishing twins" might be explainable.

Acknowledgement: This study was supported by Grant-in-Aid for Scientific Research # 60480/83 of the Ministry of Education, Science and Culture.

REFERENCES

1. Burch PRJ (1981): The age distribution of dizygotic twinning in humans and cattle: etiologic implications. In Gedda L, Parisi P, Nance WE (eds): Twin Research 3.A: Twin Biology and Multiple Pregnancy. New York: Alan R Liss, pp. 115-122.
2. Czeizel A (1974): Unexplainable demographic phenomena of multiple births in Hungary. Acta Genet Med Gemellol Suppl 22: 214-218.
3. Edwards J (1938) Season and rate of conception. Nature 142: 357.
4. Elwood JM (1978): Maternal and environmental factors affecting twin births in Canadian cities. Br J Obstet Gynaecol 85:351-358.
5. Hoffmann F (1978): Die jahreszeitlichen Schwankungen der Häufigkeit von Mehrlingskonzeptionen in Wandel zweier Jahrhunderte. Gerburtshilfe Frauenheilkd 38: 125-130.
6. Imaizumi Y, Inouye E (1979): Analysis of multiple birth rates in Japan. 1. Secular trend, maternal age effect, and geographical variation in twinning rates. Acta Genet Med Gemellol 28: 107-124.
7. Imaizumi Y, Asaka A, Inouye E (1980): Analysis of multiple birth rates in Japan. 5. Seasonal and social class variations in twin births. Jpn J Hum Genet 25: 299-307.
8. James WH (1976): Seasonality in twin births. Ann Hum Biol 3: 193-195.
9. James WH (1980): Seasonality in twin and triplet births. Ann Hum biol 7: 163-175.
10. Kamimura K (1976): Epidemiology of twin births from a climatic point of view. Br J Prev Soc Med 30: 175-179.

11. Knox G, Morley D (1960): Twinning in Yoruba women. J Obstet Gynaecol Br Commonw 67: 981-984.
12. Miura T, Shimura M (1980): The relation between seasonal birth variation and the season of the mother's birth. Arch Gynecol 229: 115-122.
13. Miura T Shimura M (1980): Epidemic seasonal infertility. A hypothesis for the cause of seasonal variation of births. Int J Biometeorol 24: 91-95.
14. Miura T, Nakamura I, Shimura M, Nonaka K, Amau Y (1984): Twinning rate by month of mother's birth in Japan. Acta Genet Med Gemellol 33: 125-130.
15. Ritcher J, Miura T, Nakamura I, Nonaka K (1984): Twinning rates and seasonal changes in Görlitz, Germany, from 1611 to 1860. Acta Genet Med Gemellol 33: 121-124.
16. Selvin S, Janerich DT (1972): Seasonal variation in twin births. Nature 237: 289-290.
17. Timonen S, Carpen E (1968): Multiple pregnancies and photoperiodicity. Ann Chir Gyneacol Fenn 57: 135-138.
18. Walter SD, Elwood JM (1975): A test for seasonality of events with a variable population at risk. Br J Prev Soc Med 29: 18-21.
19. Yoshida K, Soma H (1984): A study of twin placentation in Tokyo. Acta Genet Med Gemellol 33: 115-120.
20. Zahalkova M (1974): Multiple births in Sothern Moravia. Acta Genet Med Gemellol Suppl 22: 210-213.

Correspondence: Dr Izumi Nakamura, Department of Hygiene, Teikyo University School of Medicine, Kaga, Itabashi-ku, Tokyo 173, Japan.