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Rapid Communication

The male/female ratio of spontaneous fetal deaths and low birthweight in Japan

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The male/female ratio of births has been observed to be decreasing during the past few decades both in Europe and the USA, and in Japan.[1,2] This decrease is considered to be the result of the increased sex ratio of fetal deaths.[3] Exposure to toxic agents, such as dioxin and methylmercury, stress and parental periconceptional smoking, have been suggested as causes of the declining sex ratio of births.[4] These agents might cause deterioration of the intrauterine environment and thus make the relatively vulnerable male fetus more likely to die.

At the same time, an increase in term low-birthweight neonates due to intrauterine growth retardation has been reported in Japan.[5] Maternal smoking and excessive dieting were proposed as the major factors involved in this trend. These factors might also aggravate the intrauterine environment for fetal growth.

In order to determine what was happening in the uterus, we studied vital statistics with the specific purpose of ascertaining the timing of male fetal death and the relationship between growth retardation and sex.

Methods

Trends in the male/female ratio of spontaneous fetal deaths for strata of gestational age, and of normal and low-birthweight neonates among singleton live births, were

analyzed using vital statistics provided by the Japan Ministry of Health, Labor and Welfare. Trends in percentages of low birthweight according to sex and gestational age were also assessed.

Results

As shown in Fig. 1(a), the increase in the male/female ratio of spontaneous fetal deaths was significant only at an early stage of gestation. The ratio of spontaneous fetal death at 12–15th weeks of gestation to all births (live births and stillbirths) has been increasing for male fetuses, while for female fetuses it has been decreasing (Fig. 1c). This trend shows that the actual number of male fetuses being lost during the period in question is increasing. Furthermore, spontaneous fetal deaths have been shifting to an earlier stage of gestation (Fig. 1e).

The decline in the male/female ratio of births was significant only among low-birthweight neonates (Fig. 1b). Trends in percentages of low-birthweight neonates according to sex and gestational age demonstrate that the increase in the proportion of low-birthweight neonates consisted mainly of female term and post-term neonates (Fig. 1d,f).

Discussion

The trends demonstrated in the present study suggest a progressive deterioration of the intrauterine environment in which vulnerable male fetuses were lost at an early stage of gestation, and relatively less vulnerable female fetuses survived, but were not able to grow sufficiently. Since the 1970s both an increase in the prevalence of smoking and a decrease in the body mass index of young women, especially those in their 30s, have been observed in Japan.[5]

In order to reduce the influence of artificial abortion and multiple births, we assessed only spontaneous stillbirths and singleton live births. Fetal sex was identified on routine examination of external genitalia, which might explain the unexpectedly high proportion of fetuses with undetermined sex in Japan, especially at an early stage of gestation. Considering the relatively stable trend in the percentages of undetermined sex at an early stage of gestation, however, this uncertainty does not seem to contradict the increasing trend in the male/female ratio of spontaneous fetal deaths at an early stage of gestation.

Fukuda *et al.* claimed a reduction in the frequency of male conception with the periconceptional smoking of parents, but they studied the smoking habits of parents only from 3 months before the last menstruation, not during the entire period of

pregnancy.[4] In Japan mothers tend to stop smoking on confirmation of pregnancy, but Fukuda *et al.* provide no data regarding smoking during the period between conception and confirmation of pregnancy. In addition, fathers are not generally willing to give up smoking, so the results of Fukuda *et al.* study would not appear to contradict the present assumption that the intrauterine environment might deteriorate progressively.

In previous studies, investigators tended to pay attention only to reasons for why male fetuses did not survive in the uterus and/or to the reduced frequency of conception by the male gamete. We propose that changes in lifestyle or the surrounding environment could be involved in the progressive deterioration of the intrauterine environment that has affected neonates of both sexes during the past few decades in Japan.

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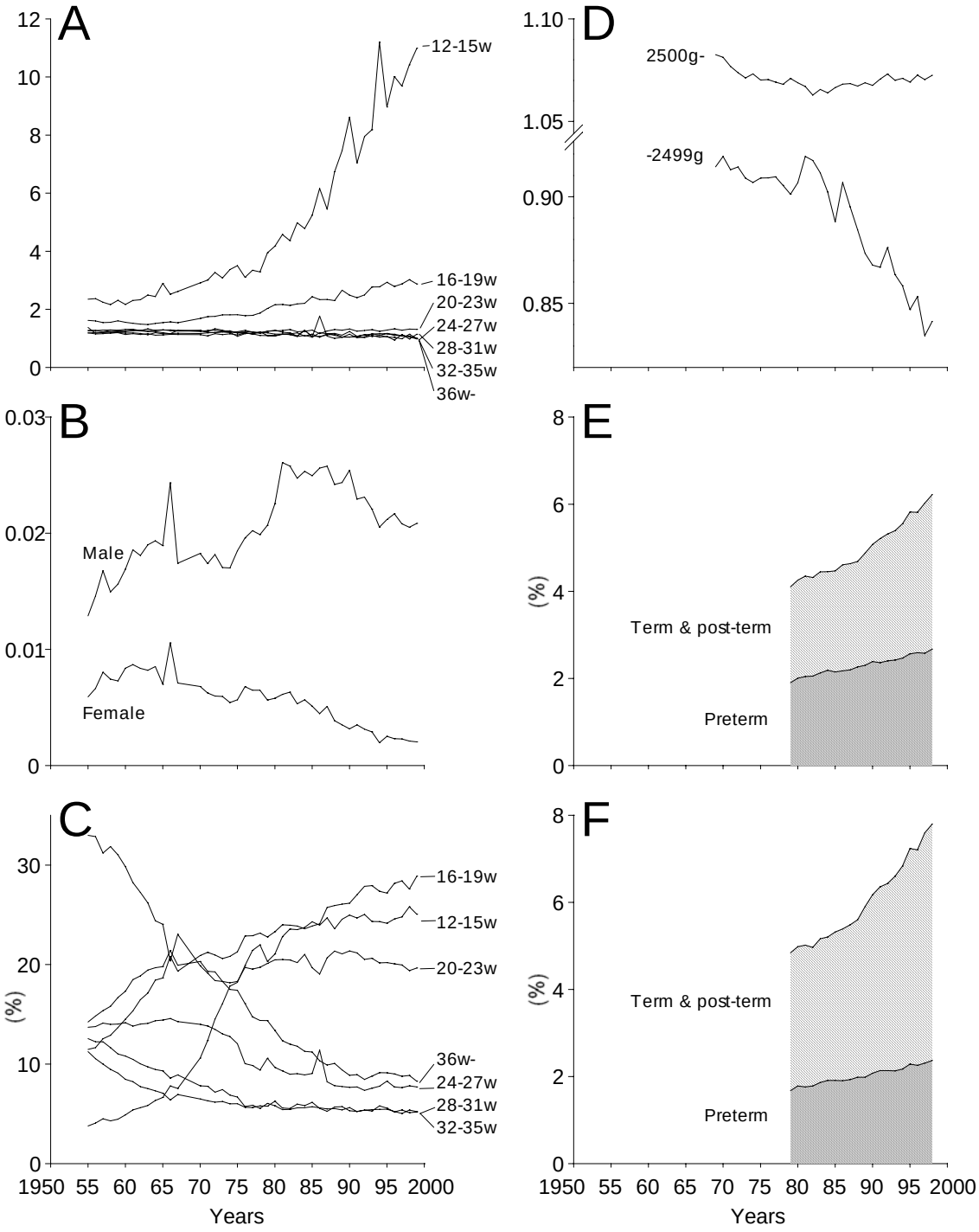
Fig. 1. Trends of fetal death and birth weight in Japan. **(**a) Male/female ratio of spontaneous fetal deaths for strata of gestational age. (c) Ratio of spontaneous fetal death among male and female fetuses during 12–15th weeks of gestation to all births (live births and stillbirths). (e) Percentages of spontaneous fetal deaths for strata of gestational age. (b) Male/female ratio of births for normal birthweight and low-birthweight neonates among singleton live births. Values prior to 1968 were not available in vital statistics. (d) Percentages of low birthweight according to gestational age among male singleton live births. Values prior to 1979 were not available in vital statistics. (f) Percentages of low birthweight according to gestational age among female births.

Figure 1.


A
12-15w
16-19w
20-23w
24-27w
28-31w
32-35w
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B
Male
Female
C
16-19w
12-15w
20-23w
36w-
24-27w
28-31w
32-35w
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Years
D
2500g-
-2499g
E
Term & post-term
Preterm
(%)
F
Term & post-term
Preterm
(%)
Years