OPINION

Poor semen quality may contribute to recent decline in fertility rates

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During past decades, we have witnessed a remarkable decline in fertility rates (number of births per 1000 women of reproductive age) in the industrialized world. It seems beyond doubt that the enormous social changes of our societies play the major role in this decline, but can it be attributed to changing social structures alone or is a reduced fecundity in the population also a factor? To address this we have focused on trends in teenage pregnancies (which to a large extent are unplanned). During the period in question fertility rates among 15–19 year old Danish women have been falling and the decline in fertility rate is not counterbalanced by an increase in the rate of induced abortion. When seen together with recent results from Denmark, which have shown that more than 30% of 19 year old men from the general population now have sperm counts in the subfertile range, we argue that this fall may not be attributable to social factors, changes in contraceptive practices or diminished sexual activity alone. It seems reasonable also to consider widespread poor semen quality among men as a potential contributing factor to low fertility rates among teenagers. Due to the concern caused by the low sperm count among younger Danish men, the Danish Ministries of Health and Environment have launched a surveillance programme which includes an annual examination of the semen quality in 600 young Danes from the general population. We propose that researchers in other countries with low and falling fertility rates among young women should consider the possibility that semen quality of their younger male cohorts may also have deteriorated.

Key words: Denmark/fecundity/fertility rates/semen quality

During past decades we have witnessed a remarkable decline in fertility rates (number of births per 1000 women of reproductive age) in the industrialized world (United Nations, 1997; Kaufmann et al., 1998; Pearce et al., 1999). In most areas, including several European countries and Japan, women have an average of less than two children (Central Intelligence Agency, 2001) which is too low to sustain the population at the current level; in Spain and Italy this figure is as low as 1.2 (Bosch, 2000). Most demographers and social scientists believe that the decline is caused by the changing social structures of the western world. It seems beyond doubt that the enormous social changes of our societies play the major role. Women (couples) benefit from more effective contraception to delay childbearing due to education and they often take active part in the labour force before considering having a family. In Denmark the average age of a woman at birth of first child is 28 years at present and fertility rates are declining among women aged 15–24 years but increasing among older women (Figures 1 and 2) (Knudsen, 1999).

The question is whether the decreasing number of births can be attributed to changing social structures alone. It appears that we should also consider the possibility that decreased fecundity (ability to conceive) may contribute to the decreasing fertility rate. A Danish questionnaire study of young women showed that the desired average family size was two children (Bertelsen and Ussing, 1974), but nevertheless when the women born in the same years as those who answered the
questionnaire were followed in registers, the cohorts had given birth to fewer children than this desired number (Knudsen, 1993). And indeed, infertility treatment has become an increasing part of the health care system. In Denmark in 1997, 2.6% of all children were born after the use of assisted reproductive technology (Nygren and Andersen, 2001). In addition, an established 1.3% of all children are born after artificial insemination with donor or husband semen. Furthermore, most recent data from the Danish Fertility Society (A.Nyboe Andersen, personal communication) have shown that the number of pregnancies after assisted reproductive technology has increased by 19% from 1997 to 1999 and the number of children born after assisted reproductive technology may therefore approach 5% of all births. This increase could be due to an increase in the number of infertile couples but could also be caused by more couples seeking treatment and even better success rates. Indeed, some population studies have reported no decline or even an increase in fecundity with calendar time (Mosher, 1985; Templeton et al., 1990; Akre et al., 1999; Joffe, 2000). However one study among 400 000 pregnant Swedish women (Akre et al., 1999) did not take into account truncation bias at both ends of the study period, which occurs when a calendar-time cut-off date is imposed (e.g. when data were collected), after which pregnancies are no longer included. This bias has the effect of artificially overestimating fecundity in the most recent category (Jensen et al., 2000).

A crucial question, however, seems to be whether there is any relationship between the recent controversial reports on declining semen quality (Carlsen et al., 1992; Auger et al., 1995; Olsen et al., 1995; Bujan et al., 1996; Fisch et al., 1996; Irvine et al., 1996; Paulsen et al., 1996; Swan et al., 1997) and the observed decrease in fertility rates. Theoretically, fecundity may be unaffected by a reduction in sperm concentration until a certain lower threshold is reached. However, it appears from a Danish study of 18–20 year old men from the general population that we may have reached that threshold level. In the study which included 708 Danish men from two cities (Copenhagen and Aalborg), 21% had sperm counts $<20 \times 10^6$/ml (lower WHO limit) (World Health Organization, 1992) and 43% $<40 \times 10^6$/ml (Andersen et al. 2000). The
latter number is noteworthy because another study indicated that men with sperm counts $<40 \times 10^9$/ml had reduced fecundity (prolonged waiting time to pregnancy) (Bonde et al., 1998a).

In addition, evidence is emerging that semen quality is lower among younger cohorts. A meta-analysis of semen quality of normal Danish men suggested a birth-cohort related decline in semen quality (Bonde et al., 1998b) and the trend seems to continue as the younger cohorts born around 1980, had the lowest sperm counts of all cohorts examined (Figure 3) (Andersen et al., 2000).

If the average younger man has a lower fecundity than the average older man, we might begin to see this reflected in the fertility rates. Perhaps this is what we are now witnessing. Generally, female partners are of the same age or younger and there is no evidence of a decline in fertility rates. Perhaps this is what we are now witnessing.

1993). We argue that this fall may not be attributed to decreasing among teenagers (Figure 4). It is worth noticing abortion rates and the pregnancy rate (number of abortions in Denmark (which has been legal since 1973). Both abortion rates and the pregnancy rate (number of abortions and births per 1000 in the relevant population) have been decreasing among teenagers (Figure 4). It is worth noticing that the national Danish data are valid and complete (Knudsen, 1993). We argue that this fall may not be attributed to social factors alone or changes in contraceptive practices. The ‘morning after’ pill has been advertised more during the last 25 years, has also been falling in last 20 years. The decline in birth rates among female teenagers is particularly interesting as they re

Nevertheless, in Denmark fertility rates among teenagers are unchanged (Frederiksberg Kommunes Sundhedsafdeling, 1999). Neither is it likely that diminished sexual activity is the cause (Frederiksberg Kommunes Sundhedsafdeling, 1999). It therefore seems particularly important to follow the younger cohorts to see whether their future fertility rates will be affected. Perhaps we may already be seeing some impact on the fertility, as the pregnancy rate among 20–24 year olds, in contrast to those $>25$ years, has also been falling in last decade (Figure 1).

Conclusion

Recent trends towards lower fertility rates in Denmark, particularly among the youngest women are not fully explained. It seems reasonable, besides social factors, also to consider the recently reported low semen quality among young men as a potential contributing factor.

Due to the concern caused by the low sperm counts among younger Danish men, the Danish Ministries of Health and Environment have launched a surveillance programme which includes an annual examination of the semen quality in 600 young Danes from the general population. We propose that researchers in other countries with low and falling fertility rates among young women should consider the possibility that semen quality of their younger male cohorts may also have deteriorated.

References


