Smoking and Pregnancy

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The harmful effects of smoking on the developing child were commented on as early as the seventeenth century by no less an authority than Francis Bacon, generally credited with introducing modern scientific methodology. Bacon remarked that just as a pregnant woman's diet could be expected to affect her unborn child, so too could tobacco be expected to alter the child's development (Bacon 1626). A few years later in 1669, Dr. E. Maynwaring, a prominent London physician, condemned tobacco outright because of its adverse effects on the conceptus. Tobacco, he wrote, "causeth an unfirm generation, by debilitating the parents . . . and makes a diseased issue" (Brooks 1937). In other parts of Europe, there was also considerable concern expressed about the possible damage to pregnant women from smoking. In Holland, a Dutch author wrote in 1692 that there was no doubt whatsoever that smoking could cause miscarriages, and in 1698, the townspeople of Saragossa, Spain, petitioned the Spanish Tobacco Monopoly Administration to reconsider its plan to erect a tobacco factory in the area because of the possibilty that odors from the factory might endanger pregnant women (Brooks 1937).

The earliest clinical study to direct contemporary medical attention to the possibly harmful effects of smoking on the developing fetus was Sontag and Wallace's report (1935) that maternal smoking produced a "definite and real" increase in the heart rate. It was not until the late 1950's, however, that scientific interest came to be focused on smoking's effects on embryo/fetal development. The first such study was reported by Simpson (1957) and was based on a study of over 7,000 women in California. Simpson found that the incidence of low birth weight (< 2,500 g) was almost twice as great among women who smoked as it was among nonsmokers. In addition, she noted that the incidence of low birth weight was dose related to the number of cigarettes smoked per day. Two years later, Lowe (1959) documented a similar relation between smoking and birth weight in England and showed that this relation was not mediated by indirect effects, such as maternal age, parity and prepregnant weight.

This review article will summarize current knowledge about the proven and suggestive effects of maternal smoking during pregnancy on embryo/fetal, neonatal and postneonatal outcomes. Some of the controversies concerning interpretation of these data will also be noted and, finally, efforts at identifying the mechanism(s) by which smoking produces its effects will be examined. Because it would be difficult to review the more than 1,000 individual articles that have now been published concerning smoking and reproduction, only general trends will be summarized and only individual articles that seem worthy of special attention will be commented on.

TOBACCO AND ITS CONSTITUENTS

Tobacco (*Nicotiana tabacum* L.) smoking is ubiquitous and has been linked to increased mortality and

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1984