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EFFECTS OF NUTRITIONAL STATUS ON FERTILITY IN RURAL GUATEMALA

EFFETS DE LA NUTRITION SUR LA FECONDITE DANS LE GUATEMALA RURAL

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I. INTRODUCTION

The notion that nutrition affects the fertility of women is repeatedly encountered in the demographic and medical literature. Perhaps the best known findings are the substantial reductions in birth rate associated with periods of food deprivation. In historical studies of 17th and 18th century European populations, a close correlation between the price of grain and rates of conception has been observed (LeRoy Ladurie, 1969; Meuvet, 1946; Wrigley, 1969). Similarly, birth rates reached a minimum nine months after famines in recent world wars (Antoniov, 1947; LeRoy Ladurie, 1969; Stein, 1975). Unfortunately, these findings provide little insight into the possible mechanisms involved. Any or all of the following factors could be important: a physiological change in a woman's ability to ovulate, conceive, or complete pregnancy due to malnutrition; a disturbance of the reproductive system resulting from the psychological stress associated with famine conditions; an involuntary reduction in coital frequency due to physical weakness, lack of interest, or separation of spouses; and a voluntary control of fertility through abstention, induced abortion, or contraceptive practice.

Additional evidence for a nutrition-fertility link is available in studies relating nutrition to various intermediate factors that affect fecundity.

1. Nutrition and menarche.

In an analysis of age at menarche among a group of Alabama girls, Frisch (1972) found that malnourished girls reached menarche an average of two years later than their well-nourished counterparts. Indirect evidence supporting this finding is provided by the negative correlation between socio-economic status and age at menarche reported in a variety of societies (Chinnathamby, 1962; Laska-Mierzejewska, 1970; Zacharias, 1969) and by the secular decline in age at menarche in European populations over the past century, a decline that is attributed to improving diets (Tanner, 1968).

2. Nutrition and menopause

Different studies of this relation are often conflicting. MacMahon and Worcester (1966) report that lean women reach menopause slightly earlier than average, but Jaszmann (1969) is unable to find any relationship between age at menopause and anthropometric measures. In a study of Ceylonese women, Chinnathamby (1962) estimates that urban women attained menopause an average 2.4 years later than rural women. Other investigators report no significant effect of socio-economic status on age at menopause (Jaszmann et al,, 1969; McKinley et al., 1972; MacMahon and Worcester, 1966). A rising secular trend in age at menopause is found among Polish women (Wolansky, 1972) but not among women in England (McKinley et al., 1972). Further study of this topic is clearly necessary before any definite conclusions can be drawn.

3. Nutrition and postpartum amenorrhea

The postpartum amenorrhea period is longer for malnourished, lactating women than for their wellfed counterparts (Chavez et al., 1973; Delgado et al., 1975; Mayer, 1966; Sacton, 1969). In part, this may be the consequence of more intense and prolonged breastfeeding among poorly nourished women, who tend to have undernourished infants (Chen et al., 1974). Postpartum amenorrhea among lactating women has also been found to be negatively related to socio-economic status (Bonte et al., 1974; Mayer, 1966; Solien de Gonzalez, 1964).

4. Nutrition and intra-uterine mortality

Although caloric intake during pregnancy is known to be one of the determinants of birth weight (Lechtig et al., 1975), the effect of current nutrition on intra-uterine mortality is less clear. A negative relationship between socio-economic status and intra-uterine and perinatal mortality is now well-established (Agualimpia 1969; Baird, 1966; Nortman, 1974; Soangra et al., 1975), but this appears to be due to factors other than current nutrition (Baird, 1966). Experimental studies in animals, however, have shown that severe nutritional deprivation does affect the survival of the fetus (Moustgaard, 1972; Nelson et al., 1953).

5. Nutrition and fecundability (probability of conception)

Conception is dependent on the production of viable ova and sperm as well as on the occurrence of intercourse. All these factors are apparently

affected by severe restrictions in dietary intake. Menstruation and ovulation stop when a woman suffers severe weight loss (Frisch, 1975; Lev-Ran, 1974) and many women become amenorrheic during famine (LeRoy Ladurie, 1969). Chronic severe malnutrition disturbs the function of the endocrine system, resulting in atrophy of the gonads, hypopituitarism, and reduction in urinary gonadotropins (Zubiran, 1953). In starving males, semen volume, sperm count, and sperm mobility are significantly reduced and interest in sexual activity markedly declines (Keys et al., 1950). American prisoners of war in a Japanese concentration camp showed universal loss of libido, an absence of nocturnal emissions, and other indications of androgen suppression (Jacob, 1946).

On the basis of the above evidence, it seems safe to conclude that nutrition has some influence on fecundity, but the magnitude of the overall effect and the relative importance of each of the fecundity components remains uncertain. It is the aim of the present study to contribute towards a resolution of these issues. For this purpose, an analysis will be made of a set of detailed nutritional and reproductive data collected from 400 married women in four rural Guatemalan villages during the five-year period 1970-74.

II. THE STUDY AREA

In the late 1960s the Division of Human Development of INCAP (Instituto de Nutricion de Centro America y Panama) initiated a prospective study of the physical and mental development of infants in four villages in the mountainous province of El Progreso located in the northeast of Guatemala. During the course of this study extensive demographic and nutritional information was gathered. The four study villages were selected on the basis of their similarity with respect to demographic, ethnic, socio-economic, and nutritional characteristics. Additional criteria for selection included low population mobility, social isolation, and the unlikelihood of substantial socio-economic change.

The ethnic background of the population is Ladino (a mixture of Spanish and Indian), and Spanish is the principal language. Virtually all household heads (97 percent report their religion as Roman Catholic. Of the population aged 7 and over, 53 percent are illiterate and only 2 percent have had some secondary education. Agriculture is the dominant economic activity,