Biological Features of Women's Alcohol Use: a Review

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Synopsis

Sensitivity to gender issues in the research community has generated a modest but growing amount of data on the biological effects of alcohol consumption on women. Data generally indicate that the same amounts of alcohol have greater effects on women and that women develop more severe alcohol problems than men over shorter drinking histories. Despite a number of studies, however, there are no clear differences between women and men in the impact of alcohol consumption on cognitive processes.

Although the findings are mixed, the data point toward greater physiological deterioration among women as compared with men who have similar drinking histories. These differences may be related to the differences in patterns of social recognition and reaction that occur in instances of alcoholism among women. Such differences are confirmed by other data that indicate greater social isolation and general disorganization among female alcoholics than among male alcoholics.

The risks of fetal alcohol syndrome that are associated with heavy alcohol consumption among women during pregnancy have been established, and a complex of other relationships between alcohol consumption and reproductive-related systems and behaviors exists. Linkages between sexual dysfunction, sexual satisfaction, and alcohol consumption appear to exist, but have not yet become clearly understood.

It appears that alcohol may be used as a self-medication to cope with perceived problems of sexuality. It also appears that heavy alcohol consumption can contribute to sexual dysfunction and dissatisfaction. A growing body of sophisticated experimental research has established relationships between patterns of alcohol metabolism and phases of the menstrual cycle, with this literature offering some of the clearest indications of distinctive differences between the sexes in the biological consequences and correlates of alcohol consumption.

THAT RESEARCHERS HAVE BECOME conscious of women's alcohol-related problems is evidenced by the growing number of studies concerning the sex-specific ramifications of alcohol use. The review that follows is limited to published reports concerning the effects of alcohol consumption on women compared with men.

Physical and Neuropsychological Effects

In addition to reporting higher levels of problems associated with heavy drinking, women also report higher levels of intoxication than men when consuming the same amounts of alcohol. This effect can be explained in part by the differences between the sexes in total body water content. Shortly after alcohol is consumed, it becomes uniformly diffused in both extra- and intra-cellular body water. Since tissue alcohol concentration is directly proportional to tissue water content, persons with lower total body water quantities will have a greater tissue alcohol concentration (*1*).

Smaller and fatter people have smaller body water compartments than larger, or leaner, more muscular people. Because of their higher percentage of fatty tissue, women have smaller body water quantities than men of comparable size, resulting in higher blood-alcohol concentrations in women. Moreover, there is evidence that women develop higher blood alcohol levels for given amounts of alcohol when it is ingested at the time of ovulation or just before menstruating (*2*). These effects are

important considerations in epidemiologic research and in recommendations about safe drinking. Researchers have established that once differences in body water content are considered, there is no evidence of differences in the metabolism of alcohol between the sexes (*3*), nor are there differences in the physiological response to the effects of alcohol ingestion (*4*).

Further, evidence exists that chronic alcohol abuse has a greater physiological impact upon women than upon men. Alcoholic women are more frequently disabled and are disabled for longer periods than male alcoholics—reflecting, in part, the differences in identification processes that, in turn, embody sex-related social norms. The percentages among women alcoholics who die from such causes as suicides, alcohol-related accidents, circulatory disorders, and liver cirrhosis are much higher than among men alcoholics. Several international studies show consistently that female alcoholics have death rates from 50 to 100 percent higher than those of male alcoholics (*5*).

A longitudinal study of 103 American women alcoholics followed for 7 years after their treatment in 1967–68 revealed that nearly a third had died, a rate 4 1/2 times higher than expected. The average life span of these women was decreased by 15 years. Women who were older when they sought treatment, who became alcoholic before age 30, or who had histories of frequent binge drinking were most likely to have died prematurely; those who became abstinent were the most likely to have survived (*6*). Thus, a common finding across many studies is that women have shorter drinking histories but similar or worse consequences than men even though the absolute amount of alcohol consumed during the history may be similar.

Many ramifications of using alcohol are associated with the effects it has on the cognitive and motor functions of both men and women. Given that differences have been found between the sexes concerning other physiological consequences of using alcohol, the amount of attention given to researching the differences in the effects of alcohol on neuropsychological functioning is modest. One study comparing neuropsychological functioning between alcoholic women and men in treatment indicated women to be significantly more impaired (*7*).

This difference was confirmed in research by Acker (*8*), who compared the neurological deficits between female alcoholics and non-alcoholic controls. The expected differences were found, and a comparison of this research with previous studies of male subjects showed that the performance deficits among males were comparable to those among females, even though the drinking histories of the female alcoholics were considerably shorter.

Using a comprehensive battery of cognitive tests, Crawford and Ryder (*9*) reported a British study of 8 male and 8 female alcoholics who had completed treatment in an inpatient unit that revealed similar patterns of cognitive impairment between the men and women. Similarity in cognitive impairment was found despite the significantly shorter history of heavy drinking and lower levels of routine consumption among the females—again indicating greater impact per dosage unit among females as compared with males.

Meier and coworkers (*10*) studied the accuracy of recall of alcohol consumption among men and women college students and found a significantly lower accuracy of recall among the men. The authors explained this unexpected findings on possible differences between men and women in the effect of alcohol on short-term memory or the greater experience in drinking among men, compared with women.

Hesselbrock and coworkers (*7*) reported a significant interaction between the sexes and cognitive performance among alcoholics with antisocial personalities, with women performing cognitive tasks at lower levels than women without antisocial personality diagnoses. A study reported by Carey and Maisto (*11*) of the effects of drinking on cognitive processes of female social drinkers did not, however, confirm an effect of alcohol consumption on cognitive processes. Sixty female drinkers were randomly assigned to abstinence or drinking groups, with the results of a battery of cognitive tests indicating no distinctive differences between the groups. This led the authors to conclude that recent drinking practices were not related to cognitive test performance among this sample of female social drinkers.

In a thorough and detailed review of the relationship between drinking and cognitive functioning, Parsons (*12*) urges caution in drawing conclusions about what many researchers have come to assume is a direct causal effect between drinking and impaired cognitive performance. His review of the research reveals frequent differences between the sexes when both men and women are included in experiments. Also, there are some hints that the emotional state accompanying drinking may affect cognitive outcomes. Such a relationship may explain, in part, the differential effects between the sexes, given a large amount of other data confirm-

ing differences between the sexes in emotional and attitudinal orientations to drinking. At the same time, there is no conclusive biological research to account for possible differences in the cognitive or neurological impact of drinking between the sexes.

In addition, there is growing evidence of differences between the sexes in the physiological impact other than in brain functioning. Evidence from treatment-based research indicates that women may experience greater physiological impairment than men early in their drinking careers, despite having consumed less alcohol than comparable men; advanced liver disease was more frequent (*13*), and alcohol-related illnesses in general were more frequent among women despite drinking histories similar to men in the samples (*14–16*).

Mortality

Mortality data (*6*) for a group of 100 hospitalized women alcoholics (57 percent primary, 8 percent secondary, 25 percent affective disorder, and 7 percent sociopathic alcoholics), who were followed for 12 years after hospitalization, showed that 30 percent of them had died by the end of followup. Based on life expectancy at hospitalization, the women lost an average of 25.9 years because of alcoholism (mean age at depth = 51). One-third of the deaths were due to cirrhosis and one-fifth to unnatural causes (suicide, accidents, and homicide). Forty-one percent of the natural deaths were sudden and occurred unexpectedly. The highest mortality rate occurred in the group diagnosed as sociopathic alcoholics, with over one-half dead at followup (mean age 39.8). Only 1 of the 8 secondary alcoholics died. Mechanisms underlying these differences are unknown, but may be related to estrogen (*17*) or sex-related immune response (*18*).

A long-term followup of 1,312 alcoholic patients referred to a Swedish hospital during 1949–69 was reported to Burglund (*19*). The study included an assessment of causes of death and the relationship of symptoms revealed during treatment to the cause of death. In that study, which comprised 120 women, there were no significant differences between the men and women alcoholics in terms of deaths revealed during the followup research period.

Other Comparisons

Possible physiological differences between women and men are indicated in a study reported by Connelly and coworkers (*20*). The subjects were 12 female and 12 male nonalcoholic heavy drinkers who were otherwise physically healthy. The data revealed significantly greater glucose intolerance among females, compared with the male subjects. The results suggest that there may be significant differences between women and men in the metabolism of alcohol. A thorough review of the research literature by Dancy and Maxwell (*21*) indicates that there is no strong evidence for differences between the sexes in terms of the effects of alcohol on cardiomyopathy.

In a detailed review of the published literature, Johnson and Williams (*22*) report that it is clear that females develop more severe liver disease at a lower mean daily alcohol intake and after a shorter duration of drinking than do males. They explain this difference on the differences in body composition associated with body size, fluid content, and hormonal distinctions.

Further insight into the differences between the physical consequences of alcohol consumption for men and women is revealed in a study by Mendelson and coworkers (*23*), which focused upon medical disorders among 10,758 consecutive admissions for inpatient alcoholism treatment. The rates of medical problems in addition to alcoholism among men and women were very similar. In terms of specific diseases accompanying their alcoholism, women were somewhat more likely to exhibit neuroses and other psychiatric disorders; men were substantially more likely to display hypertensive disease and other forms of circulatory disorder. Diseases of the liver, gall bladder, and pancreas, as well as cirrhosis, had very similar rates for men and women.

The possibility of differential effects of heavy drinking among men and women receives some support in a study reported by Barrison and coworkers (*24*). In contrast to men, a significant correlation was found between mean corpuscular volume, liver size, and alcohol consumption. The subjects in the study were self-referred heavy drinkers who were members of Drink Watchers and thus were believed to be persons highly concerned about their drinking. Because other physiological characteristics and drinking histories were similar, the researchers were led to conclude that, among heavy drinkers, females were likely to develop liver problems more rapidly than males.

In a study of 99 men and 57 women who had been diagnosed with alcohol-related liver disease, Saunders and coworkers (*25*) found that women were significantly less likely than men to have been

advised by others to reduce their alcohol consumption, to have received previous hospital treatment for alcohol problems, to have received counseling for alcohol problems, or to have been convicted for any alcohol-related offenses. The women were also less likely to have been advised to stop or reduce their drinking by family members, or to have been advised to stop or reduce drinking by a general practitioner, but were equally likely to have attended Alcoholics Anonymous and substantially more likely to have received psychiatric treatment for nonalcohol-related problems. The researchers observed that the alcohol dependence syndrome of most of these patients was relatively mild, but the differences between the sexes in the pattern of identifying the patients' alcohol problems indicate different norms utilized by both the lay public and professional practitioners. The specific focus of the study also indicates that the lower efficacy of social reactions toward alcohol-dependent women may indirectly increase their risk of liver disease.

In a study of the flushing response to alcohol use among Koreans and Taiwanese, Park and coworkers (*26*) found significantly more flushing among Korean women compared with Korean men, but no differences were found between the Taiwanese men and women. The researchers cannot explain these results, but they suggest that differences in body weight may be the key.

Effects on Reproductive System

Alcoholism is associated with high rates of sexual, gynecologic, and reproductive problems among women, paralleling problems of impotence and sterility among male alcoholics. Seventy percent of alcoholic women in one study reported sexual dysfunction (*27*). In another study of 30 alcoholic women, 75 percent reported they experienced decreased sexual satisfaction after drinking became a problem, together with difficulty in many instances of achieving orgasm. Nearly half had become anorgasmic (*28*).

In a recent study of 55 alcoholic women who were matched with 54 nonalcoholic women, it was found that for women alcoholics sexuality and partner relationships are definitely more stressful and conflicting—symptoms categorized by the researchers as "disorders of sexual desire"—than for the nonalcoholics (*29*). The authors suggest that the model of Helen S. Caplan provides a useful explanation. This theory suggests that maternal-related problems, anxiety, and conflicting norms produce phobic avoidance of sexual encounters or the creation by women of destructive erotic atmospheres that, in turn, produce disorders of sexual desire—with all of these processes interacting with the effects of alcohol.

In a national survey of 917 women, Klassen and Wilsnack (*30*) report that heavy drinking is correlated with dysfunctional sexuality and hypothesized that this may be a vicious circle, which some of their respondents apparently escaped by abstention. They also found that suppressed and traditional sexuality is more frequent among those who are lighter drinkers and abstainers. Most women drinkers reported that drinking lessens their sexual inhibitions and helps them feel close to others; this consequence occurred most frequently among women who drink heavily. More than half the sample reported that they have been targets of other drinkers' sexual aggression while drinking. A sexual dysfunction index reveals that moderate drinkers scored significantly lower than both lighter and heavier drinkers. The heaviest drinking women had the highest rates of sexual disinterest over their life time and also were most likely to report the lack of orgasm. The researchers also reported that nontraditional sexual behaviors were more likely to occur among heavier drinkers. The potential efficacy of drinking in its relationship to sexual behavior is indicated by elevated sexual dysfunction rates among women who were abstainers but who had substantial drinking histories.

Harvey and Beckman (*31*) studied the relationship between alcohol consumption and female sexuality by having 69 women maintain logs of drinking and sexual behavior. The data indicate that female-initiated sexual activity was greater with less alcohol use, although the questionnaire data indicated that the study subjects believed alcohol enhanced their sexual desire, enjoyment, and activity. In terms of risk-taking behavior, the data indicated that alcohol consumption prior to sexual intercourse did not significantly alter the use of contraceptives.

An examination of the relationship between drinking and reported sexual behavior in a comparative study of alcoholic and nonalcoholic women revealed that the alcoholic women were significantly more likely to report enjoyment of sex while drinking, were more likely to engage in intercourse after drinking, but overall reported a lower level of sexual satisfaction (*32*). A review of literature related to sexuality notes a paradox between the physiological depressive effects of alcohol on sexuality coupled with women alcoholics' apparent increase in subjective arousal. Reviewing the exten-

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sive materials on alcoholic women's sexual dysfunctions, the author concludes that women may use alcohol to self-medicate the sexual difficulties they experience (*33*). A comparative study of 34 alcoholic and 34 nonalcoholic women revealed that the alcoholics reported more guilt related to sexual activity and significantly less control over their sexual lives (*34*).

Thus the empirical evidence indicates an association between alcohol consumption and sexual function, but the direction of the relationship is unclear. The available evidence definitely points toward a circular pattern of causality, with alcohol affecting sexual function and reactions to sexual dysfunction possibly encouraging increased use of alcohol, or situation-specific use of alcohol vis-à-vis sexual encounters. In addition to these interactions, there are likely interactions between women's sexual activities in relation to alcohol and those of male partners who also may be consuming alcohol; this subject remains to be investigated extensively.

In terms of gynecologic dysfunction, a 1981 national survey revealed a positive correlation between women's drinking levels and their reports of dysmenorrhea, heavy menstrual flow, and premenstrual discomfort (*35*). There was a particularly strong association between these disorders and the report of at least one 6-drink-or-more episode per week. Women who averaged three or more drinks per day or who experienced at least five events of six drinks or more per week had higher rates of most types of gynecologic surgery. Finally, a history of miscarriage or stillbirth, premature birth, birth defects, and infertility was found to be associated with highest levels of alcohol consumption.

It may not be correct to conclude that there is an overarching relationship between gynecologic- and reproductive-related functions and alcohol consumption. Working to measure the effects of moderate amounts of alcohol on cognitive and physiological functions during different phases of the menstrual cycle, Brick and coworkers (*36*) found no significant differences in behavioral effects across different menstrual phases.

However, Youcha (*37*) summarizes the data dealing with the relationship between drinking and the menstrual cycle: after a drink, women's reactions are slower just before her flow begins, at the midpoint, and during the flow than they are during the rest of the month.

Influence of the menstrual cycle on drinking behavior is confirmed by the study of 69 normally menstruating women reported by Harvey and Beckman (*38*). Through subjects' personal monitoring of drinking behavior, the researchers found that frequency of alcohol use did not vary among the five phases of the menstrual cycle but that quantity of alcohol consumption significantly fluctuated and peaked during the luteal phase of the cycle. Although there is substantial evidence from other research that there may be interaction between hormonal fluctuations and reactions to alcohol consumption, these investigators suggest that such metabolic differences may influence the choice behavior of women regarding drinking at different phases of the menstrual cycle.

In a study of acute response to equal dosages of alcohol among 11 male and 13 female social drinkers (*39*), females were found to consistently achieve higher blood alcohol levels. This result was explained mainly by the preponderance of the women being in the middle stage of the menstrual cycle. Women not using birth control medication also attained higher blood alcohol levels than the males. Very few cognitive or psychomotor distinctions were found between the two groups, with the exception of the men recovering memory function more quickly on the descending limb of the blood alcohol curve. The stage of the menstrual cycle was not found to affect psychomotor or cognitive performance while the women were intoxicated.

In an experimental study of 16 men and 18 women, Wilson and Nagoshi (*40*) reported differences between the men and women in the consistency of data on alcohol metabolism, sensitivity to alcohol, and acute tolerance to alcohol, indicating significantly more day-to-day variability in reactions to alcohol among women, as compared with men. That study did not indicate significant effects of menstrual cycle phases on the alcohol metabolism data.

In a carefully designed double blind study, Mendelson and coworkers (*41*) found significant effects of alcohol on female hormone secretion, controlling for the phase of the women's menstrual cycle. The findings indicate that repeated or sustained

episodes of alcohol intoxication may suppress hormonal activity in women.

Substantiation of the difference in ethanol metabolism was found in an experimental study of 63 women and 75 men reported by Cole-Harding and Wilson (*42*). The data showed that women metabolized alcohol faster than men regardless of the phase in their menstrual cycle and whether or not they were taking oral contraceptives. The researchers concluded that these data indicate a lack of effects of female hormones on ethanol metabolism, leaving the explanation of male and female differences to other factors.

In a detailed study of the relationship between alcohol intoxication and the menstrual cycle, Sutker and coworkers (*43*) reported that differences in alcohol metabolism were found across different phases of the menstrual cycle among women who had ovulated during two previous cycles. Shorter elimination times, reduced areas under the blood alcohol time curve, and faster disappearance rate characterized the midluteal phase of the menstrual cycle compared with the early follicular and ovulatory phases—indicating that elimination was facilitated during the midluteal phase. Since this was the first study to measure serum level of estradiol progesterone and other hormonal levels over two consecutive menstrual cycles on each day of acute alcohol intoxication, the distinctive effects of the menstrual cycle on alcohol metabolism appear strongly confirmed.

These effects may not be sustained across the life cycle, however. Gavaler (*44*) underlines the importance of studying the effects of alcohol on endocrine function in postmenopausal women. She points out the associations between hormonal functions and alcohol consumption and the associations between hormonal functions and disorders that are most prevalent at postmenopausal ages, including cancers and osteoporosis. In her review of an extensive number of studies, Gavaler concludes that the effects of alcohol during the postmenopausal phase of life have not been adequately specified or understood and that considerable more research is needed.

More recently, however, Valimaki and coworkers (*45*) reported an experimental study of the effects of hormonal secretion of alcohol ingestion among postmenopausal women. Ten women were included in the study. The results indicated that there were no acute effects of alcohol ingestion on the secretion of the major gonadotropins in women. The authors interpret these findings as consistent with previous research.

Thus, although gynecologic, obstetric, and sexual problems appear to be linked to both alcoholism and alcohol abuse, the mechanisms of these associations are unclear. Both biological and psychosocial causes are probably involved. Impaired sexual functioning may be both a cause and a consequence of excessive drinking, underlying depression, and poor interpersonal relationships. Ironically, excessive drinking does offer a means of coping with inadequate sexual response and the anxiety surrounding it. This vicious circle may come into play in response to gynecologic and obstetric difficulties, as well as affecting sexual activity. The evidence of significant interactions between hormonal levels and alcohol consumption is compelling, and the sophistication of research that is focused on these relationships is increasing. At present, it appears that research does not offer clear guidance for women's drinking behavior relative to the menstrual cycle or to possible adverse impacts that may be associated with drinking in the postmenopausal period of life.

Research on the relationship between alcohol consumption and reproduction has had a rather intense but singular focus. The fetal alcohol syndrome (FAS) has received a great deal of attention during the past decade. Care should be taken when identifying this as a women's alcoholism issue. Media coverage, in particular, appears to place FAS responsibility on women, ignoring the barriers and difficulties that women may have in finding or receiving assistance for an alcohol problem. Further, the issue is often structured as if pregnancy were solely the responsibility of the pregnant female. Since other research clearly shows that people of both sexes are influenced by the drinking behavior of their spouses and interactional partners, it is clear that males have major responsibilities in controlling the effects of alcohol during a spouse's or partner's pregnancy. Furthermore, many cases of FAS involve symptoms that extend beyond the direct effects of the mother's drinking, especially the resources and care directed toward the infant in the postnatal period. Thus, care should be taken to avoid "blaming the victim" in considerations of FAS.

Adverse effects of alcohol ingestion by pregnant women and their offspring were first clinically suspected over 200 years ago, but only recently have those effects been more precisely specified. FAS neonates have three characteristics that have been associated with maternal alcohol use: growth retardation before or after birth; abnormal features of the face and head, such as unusually small head

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circumference and flattened facial features or both; evidence of central nervous system abnormality, such as mental retardation. Whether FAS is the leading cause of mental retardation in the Western world (*46*) has been argued recently. Aside from the personal impacts, the social and economic costs are dramatic over the lifespan of the FAS victims.

Beyond those mentioned, other effects that have been identified as associated with maternal drinking during pregnancy are termed "fetal alcohol effects" (FAE). FAE include a range of congenital abnormalities such as eye and ear defects, heart murmurs associated with defective development of the heart chamber wall, genitourinary defects, hemangiomas, and fingerprint and palmar crease abnormalities.

Evidence based on animal and human research leaves little doubt that serious birth anomalies can result from alcohol ingestion, but the frequency with which they occur and the level of alcohol use that can cause them in humans is by no means certain.

Estimates of the worldwide prevalence of FAS have been centered at 1.9 per 1,000 live births (*46*). In the United States, epidemiologic research has revealed especially high prevalence among American Indian groups, ranging in one study up to 9.8 per 1,000 live births for certain Plains Culture tribes, this being the highest rate found anywhere in the world (*47*). Alcohol-related effects of lesser severity in the infants of heavily drinking women may occur as often as in 69 percent of live births. Little reported a 91-gram decrease in birth weight associated with about two drinks (1 oz. of pure alcohol) per day consumed by the mother before she knew she was pregnant. A 160-gram deficit was found in infants of women who drank that much during the seventh to ninth months of pregnancy (*48*). A more recent study found that drinking an average of two or more drinks a day tripled the likelihood of preterm delivery (*49*).

Unfortunately, there are many problems with such dose-effect estimates. Alcohol dependent women may be inclined to understate the amount of their drinking. This may be especially true if they feel guilty about drinking while pregnant. Other factors such as lifestyle, smoking, other drug use, poor diet, or poor general health may both cause and interact with alcohol use during pregnancy in producing problems that may affect neonatal health. Paternal drinking is known to reduce sperm counts and sperm motility and to produce other sperm abnormalities. That the father's drinking may also contribute to fetal abnormalities cannot be dismissed, although the limited studies that have been done have not found such an effect (*50, 51*). Experimental administration of alcohol doses to pregnant women while carefully controlling for other possible factors is not, of course, ethically possible.

The significance of maternal abstinence during pregnancy is underlined by research reported by Coles and coworkers (*52*). These investigators examined the behavior of 103 neonates born to three groups of women: those who drank a mean of 12 oz. of alcohol per week throughout pregnancy, those who drank a mean of 14 oz. per week but stopped during the second trimester, and those who never drank during pregnancy. The research population was composed primarily of black women of low socioeconomic status.

The data revealed that infants exposed to alcohol any time during gestation had significant alterations in reflexive behavior, less mature motor behavior, and an increased activity level. Compared with infants whose mothers did not stop drinking during pregnancy, neonates whose mothers had stopped during the second trimester were superior to those whose mothers continued to drink in terms of need for stimulation, motor tone, tremulousness, and problems in reflexive behavior. The authors conclude that exposure to alcohol during any phase of pregnancy affects the neonate, although cessation clearly reduces those effects.

In a study of drinking practices among pregnant women, Stephens (*53*) found that more frequent high maximum drinking and increased drinking during pregnancy were primarily found among blacks and among teenage mothers, indicating that the risk for adverse fetal outcomes may be particularly high in the subgroup with both of these characteristics.

In another report from that study of 311 metropolitan prenatal patients (primarily black) in a southern city, Stephens (*54*) reported that "social support" was significantly associated with decreased alcohol consumption during pregnancy.

Disaggregating social support, the researcher reported that specific pregnancy support worked directly against drinking that might have damaged the fetus, whereas other social support, involving friendship networks, might operate to enhance drinking activities. Thus, caution should be exercised in recommending social support as a means of facilitating appropriate drinking behaviors among pregnant women. A similar pattern indicating the particularly strong influence of friends, spouses, and sexual partners on the drinking behavior of black women was reported in a study by Fernandez-Pol and coworkers (*55*).

Smith and coworkers (*56*) collected data from 267 women before and after they gave birth to ascertain the predictors of those who continue to drink and those who stopped drinking during pregnancy. The data revealed that the offspring of the women who continued to drink were found to exhibit a higher frequency of growth retardation and neurobehavioral and structural consequences compared with the infants of nondrinkers or of mothers who discontinued using alcohol during pregnancy. Many of the infants showed evidence of withdrawal syndrome. The data comparing the two groups revealed strong distinctions on the extent to which the women who continued to drink were characterized by definable drinking problems. The findings suggest that women who continue to drink during pregnancy may be appropriate targets for intervention focused on alcohol abuse, and that this continuing behavior may reflect their being embedded in alcohol problem syndromes rather than being unresponsive to information indicating the risk associated with drinking during pregnancy.

It is critical to point out, however, that the number of FAS cases falls far short of the estimated numbers of pregnant women who drink abusively (*57*). This statistic indicates the possibilities of both physiological protectors and vulnerabilities that are the continuing focus of investigation. "Social" drinking is not without its impacts, however. A carefully designed study in which 84 drinking pregnant women were included only if their consumption remained within typical "social" norms revealed distinctive decrements in their children in terms of language and verbal comprehension (*58*). On the positive side, a recently reported study indicates that women are increasingly conscious of the possible adverse effects of drinking during pregnancy and reduce or terminate their consumption accordingly. Although many recommendations center on abstinence during pregnancy, that study found that fewer than two drinks weekly had no detectable adverse effects on the fetal outcome (*59*).

As with other teratogens, the question of just how much is needed to affect the fetus at different points in development is also unclear. Taken at a point of maximum fetal toxicity, alcohol may kill the fetus, resulting in a spontaneous abortion that may go undetected (or unreported) in the individual case. At other points, either because the individual fetus is genetically more resistant to damage or the stage of development makes damage less likely, there may be no detectable alcohol-related anomalies.

Animal studies provide some indications of possible human effects. One such study designed to resemble human "binge drinking" used the animal equivalent of two large doses of alcohol given on a single day during gestation. The resulting damage to the mouse fetuses closely resembled that found in cases of human FAS (*60*). Other animal studies of alcohol's effects have duplicated such behavioral abnormalities in human offspring as hyperactivity and learning problems presumably caused by alcohol use during pregnancy (61–63).

Summary

There is some evidence that biological differences between the sexes may lead to the greater effect that alcohol has on women than men, both in terms of more rapid intoxication and in terms of deterioration that accompanies histories of alcoholic drinking. The menstrual cycle appears to interact with alcohol metabolism and, thus, with the behavioral effects of drinking. There is an impact of alcohol on women's gynecologic functioning, with much more to be learned about the mechanisms involved and their implications. FAS is a major problem associated with women's drinking behavior. Women's drinking during pregnancy can affect their offspring, although the prevalence of the FAS is notably lower than the rates of heavy and abusive drinking among pregnant women. Further research may substantiate current findings that even modest alcohol consumption during pregnancy may be correlated with adverse outcomes during later phases of child development.

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