

DISCUSSION by H.E. Lehmann, M.D. of the paper

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on

ALCOHOLISM, AGGRESSION AND ANDROGEN FUNCTION

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Alcoholism has a long history. So have the attempts to explain it and fight it, prevent it or cure it, depending on what explanation one had accepted.

There was first the moral approach. According to it, alcohol abuse was an evil habit that was indulged in by weak-willed people. Signing the pledge, praying hard and making a "real effort" would put an end to it. Traces of this perspective are still to be found in Alcoholic Anonymous, one of the most successful modern treatment methods.

Then came the psychological school, based on psychodynamic principles that explained alcoholism as a disease due to complex intrapsychic conflicts and psychosocial stresses. With this thinking, treatment would have to be of psychotherapeutic nature taking into account the alcoholics' milieu. A modern version of the psychological approach is behaviour modification whose techniques are based on learning theory.

Finally, there is the biological model which assumes that there are one or several particular physical substrates that account for the strange behavior of alcoholics and for their illness - a specifically human illness that does not seem to have a natural counterpart in animals.

Dr. Mendelson's paper has given us an example of fine and sophisticated research into the biological nature of some of the phenomena of alcoholism. Dr. Mendelson is no novice at this kind of research, since he and his co-workers have already done some of the definitive work on the functioning of the hypothalamic - pituitary - adrenocortical system under conditions of acute and chronic ethanol intoxication. His studies showed clearly that

there is no intrinsic defect of the pituitary - adrenocortical system in response to ethanol stress in alcoholics, although it is possible that - besides other physical and behavioral tolerance to alcohol - there may also develop a tolerance of the pituitary - adrenocortical axis in ethanol addicts. Their serum cortisol increase following freely chosen amounts of ethanol was not greater than that observed in non-alcoholics, despite a three times higher blood alcohol level in the alcoholic subjects. (Mendelson and Stein, 1966; Mendelson et al, 1971)

In the work Dr. Mendelson presented yesterday, he was able to answer the question whether the frequently observed aggressive behavior of persons intoxicated with alcohol is due to or correlated with an increase of androgens.

A correlation between testosterone levels and aggressive behavior in criminals has been established by various investigators. In human subjects, Persky (1971) reported an association between plasma testosterone levels and ratings on the Buss - Durkee Hostility Scale, a psychometric instrument for the measurement of aggressive attitudes. However, other investigators (Kreuz and Rose, 1972; ^{Doehring et al, 1973} / - most recently Mayer-Bahlburg et al (1974) - have been unable to confirm Persky's findings.

Dr. Mendelson's studies showed that there occurred actually a decrease of testosterone levels under conditions of acute alcohol intoxication, that the hormone levels returned towards baseline levels when alcohol intake stopped and that there was no correlation between testosterone levels and aggressive behaviour. Finally, he found that the distribution of testosterone plasma values was not related to aggressive behavior in alcoholics under conditions of sobriety.

He thus was unable to confirm his first hypothesis, that aggressive behaviour of intoxicated persons is due to increased plasma testosterone levels. Since Dr. Mendelson states that diurnal fluctuations of testosterone levels account for only 20 per cent of the variance, I do not believe that his results would have been essentially different if he had made more frequent assessments of testosterone levels.

His second hypothesis, to some degree opposed to the first, assumed that alcoholics in general have lower than normal testosterone levels which would be consistent with the disturbances of sexual function which are commonly reported for alcoholic men. This hypothesis was not confirmed either by his observations, at least not for the subjects in his sample. I would have been interested, however, in the results of some measures of sexual libido and sexual behaviour of his subjects during the drinking and sobriety periods, in relation to their testosterone levels. Perhaps he can give us some additional data on this point.

Since it may no longer be assumed that aggressive and violent behaviour of intoxicated persons is the result of increased androgen levels, we may ask ourselves: what is causing it? If we want to remain in the biological domain, it might be fruitful to look for other hormones than testosterone to explain an increase of aggressive behaviour under ethanol stress.

It is well established that cortisol levels are increased following alcohol intake. However, corticoid steroids are essentially "defence hormones", helping the organism to avoid flare-ups and remain "cool" in times of stress. They are not known to be related to aggressive behaviour.

On the other hand, some of the biogenic amines are neuro-hormones that have an excitatory action. Noradrenaline and dopamine come to mind here. The catecholamine theory of affective disorders assumes a relative deficiency of these monoamines in depressed patients, and the common clinical association of alcoholism and depression would be consistent with the idea that the euphorising - and immediately antidepressant - action of alcohol may be due to stimulated release or turn-over of dopamine, norepinephrine or serotonin. I am sure, some data on this question are already available, but I know of no systematic study of the problem. Whatever the findings might turn out to be, it is clear from the beginning that alcohol would not be a good antidepressant. It is much too toxic, has too many side-effects and is too likely to produce addiction. Furthermore, as Mendelson (1964) has shown convincingly, alcohol is tension-reducing and euphorising only in small amounts but produces anxiety and general dysphoria when taken habitually.

Let me now briefly refer to a few problems that have been raised with regard to the epidemiological findings on aggressive and violent behaviour during alcohol intoxication. While there is evidence from several independent sources that about 50 percent of persons arrested for homicide reported heavy alcohol use prior to committing the offence, one must, of course, remain doubtful of the reliability of such reports which may have been offered in the hope that they might serve as mitigating circumstances. But Shupe (1954) obtained urine or blood samples from persons arrested for criminal violence and detected alcohol in 84 percent of 163 persons arrested for such offences. Although this provides more direct evidence for the association of alcohol with assaultive behaviour, it remains still limited by the lack of a control group, equally at risk regarding heavy drinking, but not charged with violent behaviour.

Borkenstein et al (1964) and Zylman (1968) who have studied the connection between drinking and driving accidents have actually compared their data with a natural control group of drivers selected randomly at the places and times of previous accidents, i.e. under conditions of similar risk, and / Tinklenberg (1973) points out that similar control observations could be made for persons arrested for violent behaviour, for example in public places where alcohol is served and where, in one sample, 28 percent of the homicides occurred.

Tinklenberg / also points out that both alcohol use and violence occur most frequently among close acquaintances, so that one would expect an association between these two factors.

Moreover, it has been established (Campbell, 1971; Haberman, 1972) that /more than half the pedestrians killed by automobiles had been recently drinking.

Similarly, many of the homicides committed under the influence of alcohol may have been victim-induced, if the victims provoked the crime because of their own intoxicated behaviour which may have been the primary causative factor, rather than the aggressive behaviour of the person committing the offence.

Social expectations of aggressive behaviour while drinking might also play an important role as a self-fulfilling prediction. In our society such expectations prevail, but Bacon (1973) cites examples of other expectations and behaviour under drinking/^{conditions} in other societies. For instance, among the Bolivian Camba alcohol serves a socially integrative function to increase rapport between people who are normally isolated and introverted. The Camba can drink very large amounts of alcohol and remain relatively sober (Heath, 1958). Even more surprising, Savard (1968) observed among Navaho men that excessive use of alcohol was actually related to the suppression of anger.

Another largely unresolved question concerns the part the original personality structure plays in the aggressive behaviour of subjects under the influence of alcohol. Robins (1966), in a 30-year follow-up study of children seen initially in a child guidance clinic, found that children diagnosed as neurotic usually grew up to lead normal lives, but children diagnosed as antisocial had a much greater probability of staying sociopathic for the rest of their lives. Most of these sociopathic and antisocial adults had become serious problem drinkers, and a large number had been arrested for assaultive behaviour. It would appear, then, that persons who from childhood on are inclined to manifest antisocial and aggressive behaviour, later are predisposed to become heavy alcohol users, implying that alcohol is often associated with violent behaviour but not necessarily

causally related to it. Such persons drink because they have violence-prone personalities, rather than being violent because they drink.

Furthermore, having one or two alcoholic parents increases substantially the chances for individuals to become antisocial and assaultive later in life, as well as to become alcoholics.

However, there is little doubt that alcohol by itself does increase the tendency to react impulsively and in an aggressive fashion. Shupe's study, already referred to earlier, shows clearly that the number of arrests for assaultive behaviour increases sharply after a blood alcohol level of 0.09 percent has been reached, attains its peak at blood levels between 0.20 and 0.29 and then decreases as the blood level passes 0.30 percent and the subjects become increasingly stuporous.

There are also many anecdotal reports on the peaceful, agreeable behaviour of a person stoned on cannabis and the irritable, often bellicose behaviour of the same person drunk on alcohol.

In an intriguing study Melges and Harris (1970) have observed that persons with a distorted perspective of time, i.e. being primarily focussed on the present rather than on the past and future, are prone to violence. They are impaired in their ability to utilize past experience and to consider future consequences and thus tend to act impulsively. Such distorted, primarily present-focussed perspective is often also produced by alcohol (Smart, 1968; Vogel-Sprott, 1967) and thus leads to impulsive and assaultive behaviour.

In addition to distorting the perspective of time orientated behaviour, alcoholism, like all minor tranquilizers, changes the perception of rewarding and aversive stimuli by diminishing the negative aspects of experiences while leaving the rewarding perceptions undiminished. Experimentally, this

has been demonstrated repeatedly by several investigators in the form of increased conflict behaviour, as follows:

A rat is conditioned to receive food, at one end of a Skinner box, following a certain signal (tone or light); later the food reward is paired with an electric shock, and now the rat no longer goes regularly to the feeding place when given the signal. However, under the influence of meprobamate, chlordiazepoxide, barbiturates or alcohol - but not under chlorpromazine or other major tranquilizers - the rat will again feed on signal disregarding the electric shocks that it will receive. This drug-altered response pattern is referred to as increased conflict behaviour.

We have been able to demonstrate a similar phenomenon in human subjects: volunteers were required to hold down a lever as long as possible and were paid for the time they would hold on. At certain intervals, following a buzzer signal, they would receive mild electric shocks from the lever they were holding. After the subjects had received minor tranquilizers - under double-blind conditions - they increased their conflict behaviour, i.e. held down the lever longer, than after receiving placebo or major tranquilizers. They acted as though they felt no longer threatened by the electric shocks.

The exaggerated focussing on the present time with a diminished appreciation of past experiences and future consequences and the selectively diminished perception of aversive stimuli, which alcohol produces, are probably important factors in the production of greater risk-taking and increased self-assertive behaviour, both characteristic effects of alcohol. Greater risk-taking and increased self-assertion under those conditions reflect loss of judgment as well as of self-critique and of inhibitions, and these losses manifest themselves as reckless behaviour.

In persons predisposed to aggressive actions, such alcohol-induced recklessness might manifest itself as assaultiveness, in others as accident proneness, uncalled-for sexual advances or undisciplined language.

All of this is, of course, nothing else than a more articulate formulation of the time-honored cortical disinhibition concept that is traditionally held responsible for most of the alcohol-induced behavioural changes - at least those occurring in the first phase of the biphasic action of alcohol, the phase of disinhibition or pseudo-stimulation, as I like to refer to it, which occurs before the generalized depressant effects of alcohol on the CNS have appeared. However, as long as we have only succeeded to find very few answers to our many questions about the physical action - mechanisms of alcohol, which are responsible for the behavioural changes that alcohol produces, we will have to remain content with the partial explanations that theoretical and experimental psychology can give us today.

REFERENCES

- Bacon, M.K.: Cross-cultural studies of drinking. In: Alcoholism: Progress in Research and Treatment, P.G. Bourne and R. Fox (eds.), 171-194. Academic Press, New York, 1973.
- Borkenstein, R.F. et al: The Role of the Drinking Driver in Traffic Accidents, A. Dale (Ed.). Indiana University, Police Administration Dept., Indiana, 1964.
- Campbell, E.O'F: Alcohol involvement in fatal motor vehicle accidents, 1966-1969. Modern Medicine of Canada 26: 7-10, 1971
- Doehring, C.H., Brodie, H.K.H., Kraemer, H., Becker, H. and Hamburg, D.A.: Plasma testosterone levels and psychologic measures in men over a two-month time span. Paper from conference on Sex Differences in Behavior. International Institute - Study of Human Reproduction. Tuxedo, N.Y., September 30 - October 3, 1973.
- Haberman, P.W. and Baden. M.M.: Alcoholism and violent death. Unpublished manuscript, Columbia University School of Public Health, New York, 1972.
- Heath, D.B.: Drinking patterns of the Bolivian Camba. Quarterly Journal of Studies on Alcohol 19: 491-508, 1958.
- Kreuz, L.E. and Rose, R.M.: Assessment of aggressive behaviour and plasma testosterone in a young criminal population. Psychosomatic Medicine 34: 321-332, 1972.
- Mayer-Bahlburg, H.F.L.: Aggressiveness and testosterone measures in man. Psychosomatic Medicine 36: 269-274, 1974.
- Melges, F.T. and Harris, R.F.: Anger and attack: A cybernetic model of violence. In: Violence and the Struggle for Existence, D.N. Daniels, M.F. Gilula and F.M. Ochberg (eds.) 97-127. Little Brown, Boston, 1970.
- Mendelson, J.H. et al: Experimentally induced chronic intoxication and withdrawal in alcoholics. III. Psychiatric Findings. Quarterly Journal of Studies on Alcohol Suppl. 2: 40-52, 1964.

- Mendelson, J.H., Ogata, M. and Mello, N.K.: Adrenal function and alcoholism: I. Serum Control. In: Recent Advances in Studies of Alcoholism, N.K. Mello and J.H. Mendelson (eds.), 123-139. U.S. Govt. Printing Office, Washington, 1971.
- Mendelson, J.H. and Stein, S.: Serum cortisol levels in alcoholics and non-alcoholic subjects during experimentally induced ethanol intoxication. Psychosomatic Medicine 28: 616-625, 1966.
- Persky, H., Smith, K.D. and Basu, G.K.: Relation of psychologic measures of aggression and hostility to testosterone production in man. Psychosomatic Medicine 33: 265-277, 1971.
- Robins, L.N.: Deviant Children Grow Up. Williams & Wilkins, Baltimore, 1966.
- Savard, R.J.: Cultural stress and alcoholism. A study of their relationship among Navaho alcoholic men. Ph.D. Dissertation, University of Minnesota, 1968. Univ. Microfilms No.69 - 1532.
- Shupe, L.M.: Alcohol and crime. Journal of Crim. Law Criminol. 44: 661-664, 1954.
- Smart, R.G.: Future time perspectives in alcoholics and social drinkers. Journal of Abnormal Psychology 73: 81-83, 1968.
- Tinklenberg, J.R.: Alcohol and violence. In: Alcoholism: Progress in Research and Treatment, P.G. Bourne and R. Fox (eds.). Academic Press, New York, 1973.
- Vogel-Sprott, M.D.: Individual differences in the suppressing effect of punishment on a rewarded response in alcoholics and non-alcoholics. Quarterly Journal Stud. Alc. 28: 33-42, 1967.
- Zylman, R.: Accidents, alcohol, and single-cause explanations. Lessons from the Grand Rapides Study. Quarterly Journal of Studies on Alcohol Suppl. 4: 212-233, 1968.