FEMALE ALCOHOLISM: DIFFERENCES BETWEEN FEMALE ALCOHOLICS WITH AND WITHOUT A HISTORY OF ADDITIONAL SUBSTANCE MISUSE

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Abstract — The purpose of the present study was to investigate personality traits and platelet monoamine oxidase (MAO) activity, as well as occurrence of personality disorder criteria, family characteristics, and criminal activity as related to misuse pattern in a sample of female in-patients with severe alcohol dependence. In accordance with theoretical assumptions and empirical findings of underlying neurobiological correlates of disinhibition in individuals with double or multiple misuse patterns, the female alcoholics were divided into subgroups with: (1) alcohol as their single drug of misuse (ALC; n = 16); (2) a history of additional substance misuse (ALC-DRUG; n = 11). Platelet MAO activity of the female subgroups was studied in comparison to a control group of non-clinical female subjects. Marked differences were obtained between the two subgroups. The ALC-DRUG females scored significantly higher with regard to Karolinska Scales of Personality (KSP) impulsiveness, anxiety-related traits, and non-conformity, displayed higher frequency of depression in first degree relatives, were more frequently involved in criminal activity, and more frequently diagnosed for any personality disorder according to DSM-IV, axis II. Finally, the ALC-DRUG females displayed significantly lower platelet MAO activity than controls. In conclusion, the results support the usefulness of a classification of severe alcoholic female subjects according to having/not having a history of additional substance misuse. The present female alcoholics with a history of additional misuse formed a group of individuals fulfilling the criteria similar for male type 2 alcoholism.

INTRODUCTION

Female alcoholism is not as thoroughly investigated as alcoholism among male subjects. There is, however, empirical evidence of considerable gender differences. Hereditary factors for substance misuse have repeatedly, but not always (Heath et al., 1997), been found to be stronger among males than among females, while female alcoholism is assumed to be more associated with environmental influences or depression (Jang et al., 1997; Moscato et al., 1997; Breitenfeld et al., 1998; van den Bree et al., 1998). If the subjects are classified into types 1 and 2, according to the Cloninger model, the differences between males and females are again clearly shown. Type 2 alcoholism, in contrast to type 1 alcoholism, is described as being limited to males, to be considerably genetically transmitted with an early onset (<25 years of age) and with frequent mixed misuse and social complications (Cloninger et al., 1981). With regard to male alcoholism, in several studies, but not all, it has been shown that type 1 and 2 alcoholics have significant differences in personality traits, which are likely to underlie the clinical differences in their pattern of alcohol misuse. Type 2 male alcoholics are more sensation- and novelty-seeking, more impulsive and less socialized (for review, see von Knorring and Oreland, 1996). Patterns of alcohol use, similar to the type 1/2 concept, have also been demonstrated in monkeys (Higley and Linnoila, 1997). When studies have been performed on female alcoholics, this pattern has, however, not been found, or has been much more unclear (Sandahl et al., 1987; Calhoon-La Grange et al., 1993; Meszaros et al., 1999). Instead, in a number of studies, female alcoholics in general have been shown to differ from controls, both in the direction of increased sensation-seeking and impulsiveness, as was the case with male type 2 alcoholics, and in the direction of increased somatic anxiety (Hallman et al., 1991; Pulkkinen et al., 2000; E. Grigorenko and B. af Klintenberg, unpublished data). However, when attempts have been made to classify them according to the type 1/2 concept, no clear differences have emerged (Hallman et al., 1991).

Monoamine oxidases types A and B (E.C. 1.4.3.4; MAO) are flavine-containing enzymes which oxidatively deaminate the neurotransmitters dopamine (MAO-A and -B), norepinephrine and serotonin (preferentially MAO-A), as well as exogenous monoamines. Similarly to the intraneuronal MAO in the central serotonin neurones, platelet MAO is of the B-type. Platelet monoamine oxidase activity is a stable, trait-dependent biochemical measure, which in a large number of studies has been associated with temperament. Thus, low platelet MAO is linked to sensation-seeking, novelty-seeking, impulsiveness and non-conformity. This association, as well as other evidence, has led to the hypothesis that platelet MAO is a genetic marker for trait-dependent properties of the central serotonin system (for review, see Oreland and Hallman, 1995). In several studies, low platelet MAO activity has been associated with type 2 alcoholism (for review, see von Knorring and Oreland, 1996). This finding has been challenged, especially when it was discovered that some component(s) in cigarette smoke has strong inhibitory properties (Anthenelli et al., 1995; Farren et al., 1998; for review, see Oreland et al., 1999) but has been supported recently by results with platelet MAO in non-human primates (Åsberg et al., 1999). Low levels of cerebrospinal fluid 5-hydroxyindoleacetic acid, both in male type 2 alcoholics (Virkkunen and Linnoila, 1993a,b) and in their non-human primate counterparts (Åsberg et al., 1999), support the notion that type 2 alcoholism is associated with reduced central serotonergic function. It has not yet been possible to link platelet MAO activity to type of alcoholism in women (Hallman et al., 1991).

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In early studies, female alcoholics typically misused more prescription drugs, such as minor tranquilizers and sedatives (Celentano and McQueen, 1984). Later studies, however, showed that some psychoactive drugs are negatively associated with drinking, while tobacco and marijuana are positively associated (Wilsnack and Wilsnack, 1995; Ross and Shirley, 1997). Alternating use of drugs was suggested to be a strong predictor of onset of female drinking, while concurrent use (within the same 24 h period) would be more predictive of continued or chronic problem drinking (Wilsnack and Wilsnack, 1995).

Psycho-biological theories assume that there are differences between individuals with regard to their vulnerability to different forms of psychosocial disturbances. Against the background of reported differences in temperament between female alcoholics and controls, and as there is no reliable system for classification of alcoholic women, we postulated that a history of additional substance misuse would form a basis for classification. Such a pattern of misuse might be linked to personality aspects of impulsiveness and non-conformity, as has been found in male type 2 alcoholism, and/or to anxiety-related traits, which have also been associated with non-conformity in females. We also postulated that females with multiple substance misuse might delineate a subgroup of alcoholics, with regard to platelet MAO activity, more clearly than the type 1/2 criteria.

**MATERIALS AND METHODS**

**Female alcoholics and controls**

The subjects in the present study comprised all incoming patients, during the period of 1995–1996, to a compulsory treatment unit for female alcohol dependence, who fulfilled the DSM-IV criteria (American Psychiatric Association, 1994) for alcohol dependence with or without additional substance misuse (n = 27), and who accepted participation in the project (~30%). An inclusion criterion to the treatment unit is that the subjects do not have a brain damage (e.g. Korsakow’s syndrome) making rehabilitation less likely to succeed. Of those ~40 women who did not take part in the investigation for other reasons, ~20 refused to take part because of a negative attitude towards authorities and compulsory treatment in general. The remaining ~20, who did not participate, were excluded by the investigators because of difficulties in reading or filling in forms, or because of co-morbid psychiatric disorders (psychoses, severe eating disorders, etc.).

All subjects were intoxicated at the time of decision to admit them to the treatment unit. The majority of those with a severe intoxication were initially treated at a hospital for detoxification. The women were recruited from all over Sweden and the use of hospital treatment for alcohol intoxication shows regional differences. In some regions, hospital detoxification is not available and the women were admitted to the treatment unit in an intoxicated state. This explains why the blood–ethanol levels varied from 0 to 500 mg/dl at arrival. The age range for the study group was 20–68 years (mean age ± SD = 45 ± 11 years). From the Questionnaire on core criteria for type 1/2 alcoholism (see below) a classification of the women into a group without (ALC, n = 16) and with (ALC-DRUG, n = 11) additional substance misuse could be performed. Additional information was obtained from patient records, including a psycho-social investigation, at the treatment ward. The age range for the ALC group was 31–61 years (mean age = 46 ± 8 years) and for the ALC-DRUG group 20–54 years (mean age = 42 ± 9 years). Some relevant individual data on the subjects are given in Table 1.

A control group of female laboratory staff members (n = 14) in the same age range (20–55 years) was used for comparison of platelet MAO activity levels. All of the control females were well known to the investigators and none had any ongoing medication, any psychiatric disorder, or had consumed alcohol in quantities larger than corresponding to an occasional glass of wine during the months before the study.

**Personality inventory, SCID Screen and Questionnaire on core criteria for type 1/2 alcoholism**

The Karolinska Scales of Personality (KSP; Schalling et al., 1987) inventory was administered to the subjects. The KSP is based on theories of relationships between specific personality traits and biological markers of vulnerability (Schalling et al., 1983; af Klintberg et al., 1987). The scales included in the inventory have been classified on the basis of factor analyses into four groups: (1) Impulsiveness, Sensation-seeking and Withdrawal scales; (2) Psychopathy vs Conformity scales; (3) Anxiety-related scales; (4) Aggressiveness-related scales. The Anxiety-related scales were based on a two-factor theory of anxiety: Somatic Anxiety referring to physiological symptoms and somatic complaints, and Psychic Anxiety referring to worry and restlessness (Schalling et al., 1975).

The patients were also handed a Swedish version of the SCID (Structured Clinical Interview for DSM Personality Disorders) Screen, which has been shown to be a diagnostic tool comparable to the SCID II interview (Ekselius et al., 1994). A questionnaire used earlier (von Knorring et al., 1985) concerning the use of drugs other than alcohol, as well as on other socio-demographic data for classification of type 1/2 alcoholism (25 questions), was filled in by the staff during the clinical investigation of the patients. The questionnaire also gave information on smoking habits (yes/no). Selected data on the individual subjects are given in Table 1.

**Estimation of platelet MAO**

Platelet MAO activity was measured with the MAO-B-selective substrates 2-phenylethylamine (β-PEA) and tryptamine as described in Hallman et al. (1987). Briefly, during the fourth week of sobriety at the clinic (if needed, the patients were treated for 1 week for withdrawal symptoms after admission), samples of blood (5 ml) were drawn into Vacutainer® tubes and platelet-rich plasma was prepared by low-speed centrifugation. After 4 weeks of sobriety, the rise in platelet MAO, during the early abstinence phase, has been shown to be normalized to the steady state level (Wiberg, 1979; Major et al., 1981). Control samples were collected during the same time period and were handled blindly. The platelet concentrations were counted by a Coulter Counter® (Dunstable, UK) and the plasma samples were frozen at ~70°C until analysis. After collection of the whole series, the samples were thawed, sonicated and estimation of the enzyme activity was performed by incubation at 37°C for 4 min with [14C]tryptamine, final concentration 50 μM, or [14C]β-phenylethylamine, final concentration 50 μM (New England Nuclear, Boston, MA, USA) as
substrate. Both substrates resulted in linear relationships between amount of enzyme and activity under these conditions. The two substrates were used in parallel in order to increase the reliability of the estimation. A correlation coefficient of 0.96 ($P < 0.0001$) between the activities towards the two substrates was obtained and only the results with b-PEA are given, as nmol of b-PEA oxidized/min/10$^{10}$ platelets.

**Statistical methods**

Examinations of group differences with regard to personality traits were carried out by performing one-way analyses of variance (ANOVA), and, when relevant, Scheffé’s post hoc tests of multiple comparisons. Group differences were calculated for differences between female alcoholics with ($n = 11$) or without ($n = 16$) a history of additional substance misuse, as well as for female alcoholics with early (<25 years of age) versus late (>25 years) subjective alcohol problems. In the presentation of the comparisons of these subgroups, the mean personality group scores were transformed into sex- and age-related $T$-scores based on a randomly selected Swedish population (Bergman and Schalling, 1981). Other group differences were analysed with the $\chi^2$-test (using Yates’ correction) or Student’s $t$-tests (two-tailed).

### RESULTS

**SCID Screen personality disorders in female alcoholics with and without a history of additional substance misuse**

The frequency of personality disorders in the female alcohol subgroups is presented in Table 2. There was a significant group difference in the frequency of personality disorders ($P < 0.01$). Ten individuals out of the 11 female alcoholics with a history of additional substance misuse (ALC-DRUG) fulfilled the criteria for any personality disorder. In studying further the personality disorder clusters, Cluster C type disorder was significantly more frequent in the ALC-DRUG group than among the ALC group ($P < 0.01$).

**SCID Screen personality disorder criteria in female alcoholics with and without a history of additional substance misuse**

The frequency of personality disorder criteria in the two subgroups of alcoholic women is presented in Table 3. Generally, the ALC-DRUG females displayed a higher mean number of fulfilled criteria for personality disorder in comparison to the ALC group subjects. The subgroups differed highly significantly on the Cluster B Antisocial Personality

### Table 1. Individual data on 16 female severe alcoholics without (ALC) and on 11 female alcoholics with (ALC-DRUG) misuse of other drugs

<table>
<thead>
<tr>
<th>Group, subjects and age (years)</th>
<th>Liver pathology</th>
<th>Other drugs</th>
<th>Abstinence</th>
<th>Alcoholism in parents</th>
<th>Depression in parents</th>
<th>Age of alcoholism onset/symptoms</th>
<th>Criminality</th>
</tr>
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<tr>
<td>ALC</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
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<td>0</td>
<td>15/19</td>
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</tr>
<tr>
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<td>0</td>
<td>17/44</td>
<td>no</td>
</tr>
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<td>16/41</td>
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<td>12/14</td>
<td>no</td>
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<td>F</td>
<td>0</td>
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<td>0</td>
<td>15/45</td>
<td>no</td>
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<td>yes</td>
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<td>17/36</td>
<td>no</td>
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<td>?</td>
<td>F</td>
<td>0</td>
<td>15/30</td>
<td>no</td>
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<td>M, F</td>
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<td>19/45</td>
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<td>M</td>
<td>17/25</td>
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<tr>
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<td>yes</td>
<td>0</td>
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<td>14/35</td>
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<td>?</td>
<td>?</td>
<td>?</td>
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<td></td>
<td></td>
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<tr>
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<td>yes</td>
<td>M, F</td>
<td>M</td>
<td>21/37</td>
<td>no</td>
</tr>
<tr>
<td>2 (37)</td>
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<td>A, O</td>
<td>yes</td>
<td>M, F</td>
<td>M</td>
<td>15/20</td>
<td>yes</td>
</tr>
<tr>
<td>3 (41)</td>
<td>yes</td>
<td>S</td>
<td>yes</td>
<td>M, F</td>
<td>0</td>
<td>15/30</td>
<td>yes</td>
</tr>
<tr>
<td>4 (32)</td>
<td>yes</td>
<td>S</td>
<td>yes</td>
<td>0</td>
<td>F</td>
<td>14/27</td>
<td>no</td>
</tr>
<tr>
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<td>B</td>
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<td>F</td>
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<td>38/48</td>
<td>no</td>
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<tr>
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<td>0</td>
<td>?</td>
<td>no</td>
</tr>
<tr>
<td>7 (20)</td>
<td>?</td>
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<td>no</td>
<td>F</td>
<td>M, F</td>
<td>15/18</td>
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<td>A</td>
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<td>F</td>
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<td>C, A</td>
<td>yes</td>
<td>F</td>
<td>0</td>
<td>14/30</td>
<td>no</td>
</tr>
<tr>
<td>11 (38)</td>
<td>yes</td>
<td>S, C, A, B</td>
<td>yes</td>
<td>F</td>
<td>F</td>
<td>25/28</td>
<td>yes</td>
</tr>
</tbody>
</table>

Other drugs: B, benzodiazepines; A, amphetamine; S, organic solvents; C, cannabis; O, opiates. Pathological liver data (yes/no) and the occurrence of abstinence symptoms (yes/no) were recorded at admission. The occurrence of alcoholism and/or depression in parents (M, mother; F, father), age of alcoholism onset and of subjective symptoms of alcoholism (years) and of criminality other than driving drunk (yes/no) were recorded after the fourth week using a separate questionnaire (see Materials and methods). ‘?’ denotes a missing value.
The ALC-DRUG group differed significantly from the ALC subjects in displaying significantly higher scores on the Impulsiveness scale \((F = 6.77, P < 0.015)\), and on the Anxiety-related scales Somatic Anxiety \((F = 20.37, P < 0.0001)\), Muscular Tension \((F = 19.87, P < 0.002)\), Psychic Anxiety \((F = 10.51, P < 0.004)\), and Psychasthenia \((F = 12.66, P < 0.002)\). This indicates somatic complaints, worry and low psychic strength in the ALC-DRUG group. Furthermore, this group reported significantly higher scores on the Aggressiveness-related scales Irritability \((F = 11.73, P < 0.002)\), and Suspicion, indicating hostility \((F = 6.15, P < 0.02)\), and a tendency to higher Indirect Aggression \((F = 3.99, P < 0.06)\). Finally, the ALC-DRUG group displayed significantly higher non-conformity in terms of low Socialization \((F = 12.49, P < 0.002)\) scores.

Personality scores in female alcoholics with early and late debut of subjective alcohol-related problems

The female group of alcoholics with early subjective alcohol problems \((n = 5)\) tended to differ from alcoholic females with late subjective alcohol problems \((n = 17)\) in showing lower scores on Socialization \((F = 3.02, P < 0.10)\), Social Desirability \((F = 3.13, P < 0.10)\), and the hostility scale Guilt \((F = 2.95, P < 0.10)\). There were no differences between the groups on the Impulsiveness, Sensation-seeking and Withdrawal scales, nor on the Anxiety-related scales.

Family characteristics of the female alcoholics with and without additional substance misuse

In the examination of family characteristics, there was a significant over-representation of fathers of the ALC-DRUG group subjects having been treated for depression \((\chi^2 = 4.05, P < 0.05)\). Furthermore, the ALC-DRUG group tended to have subjective alcohol problems at an earlier age \((<30\) years) than the ALC group \((\chi^2 = 3.32, P < 0.10)\). They were also significantly over-represented among those who were younger \((< 20\) years for the series) at the first treatment contact for alcohol problems \((\chi^2 = 4.79, P < 0.03)\), and had more frequently been arrested because of alcohol misuse \((\chi^2 = 4.57, P < 0.04)\). Finally, it was significantly more common in the ALC-DRUG group to have been involved in criminality, other than driving under the influence of alcohol \((\chi^2 = 7.95, P < 0.005)\), and to have been treated for psychiatric disorders other than substance misuse \((\chi^2 = 8.84, P < 0.003)\). There was no difference in smoking habits between the groups; they were all smoking cigarettes.

Platelet MAO in female alcoholics with and without a history of additional substance misuse

Significant differences were found between the two groups of alcoholic women and controls \((F = 5.54, P = 0.009)\) (Fig. 2). The Scheffé post-hoc test showed that the ALC-DRUG group \((\text{mean} \pm \text{SD} = 8.12 \pm 3.4)\) differed significantly from the control group \((\text{mean} \pm \text{SD} = 12.49 \pm 1.8)\), \((P < 0.05)\). The two female alcohol groups, however, did not differ significantly from each other in the post-hoc test, nor did the ALC group \((\text{mean} \pm \text{SD} = 10.35 \pm 3.6)\) differ significantly from the controls.

Product-moment correlations between platelet MAO and personality scale scores, as estimated by the KSP, indicated for the total group significantly negative associations with the
Aggression scale Irritability and the Hostility scale Suspicion ($r = -0.44$, $P < 0.03$; $r = -0.33$, $P < 0.10$ respectively). Low MAO activity subjects have been reported to be high in those aggressiveness-related scales and thus one-tailed tests of significance were applied (see af Klinteborg et al., 1987; Schalling et al., 1988).

**DISCUSSION**

**Subgroups of severe female alcoholics**

The possibility of distinguishing between two major forms of male alcoholism has been demonstrated by several research groups (von Knorring et al., 1985; Virkkunen and Linnoila, 1993a; Cloninger et al., 1996). Although there are differences with regard to details of the clinical criteria between different authors, the classifications usually share some common features. Common both for type 2 alcoholism as defined by von Knorring et al. (1985) and by Gilligan et al. (1988), and for type B alcoholism as defined by Babor et al. (1992) are: (1) debut of alcohol misuse at an early age; (2) personality traits predisposing to antisocial behaviour. This classification is closely related to the one suggested by Schuckit et al. (1990), in which they proposed that type 2 problem drinkers are more likely to suffer from primary antisocial personality disorder. Application of criteria constructed for male alcoholism has, however, been largely unsuccessful when used on series of female alcoholics (Hallman et al., 1990, 1991; Meszaros et al., 1999). Recently there have been reports indicating that gender differences might not be that pronounced (Johnson et al., 1997; Sannibale and Hall, 1998). The main finding in the present study is that among severe female alcoholics, a history of use of drugs other than alcohol, much stronger than age at onset of alcohol-related problems, delineates a sub-group of women with personality traits and personality disorder criteria resembling male type 2 or type B alcoholism.

**Personality disorders, psycho-social disturbances and personality traits**

A high percentage of personality disorders was found, especially among females with a history of additional substance misuse (90.9%; Table 2). This is not surprising, however, in view of the high frequency of co-morbidity (~90%) of alcoholism and Cluster B personality disorders, especially among patients with mixed misuse (Tomasson and Vaglum, 1995). Furthermore, such co-morbidity seems to be more frequent among female, than among male, alcoholics (Brandell and Ekslius, 1995; Ross, 1995). Although withdrawal from
alcohol was not likely to confound the assessment of personality disorders, it cannot be excluded that a late withdrawal/protracted withdrawal from, for example, benzodiazepines might have contributed to some extent.

In studies on control groups, female subjects are repeatedly found to score higher on anxiety-related personality scales than males, and male subjects to score higher on detachment (af Klinteberg et al., 1990; Pulkkinen et al., 2000). Furthermore, low socialization has, in females, been reported to be associated with anxiety, whereas in male subjects it has been found to be strongly associated with impulsiveness and sensation-seeking traits. Thus, in the present study, the high scores in anxiety-related personality traits only in the group of females with multi-drug misuse (Fig. 2) might indicate that females differ from males with regard to which personality traits are of importance for the development of a type 2-like alcoholism.

Is low platelet MAO a marker of impulsive female alcoholism?

With regard to platelet MAO activity, significant differences were found between the female alcoholics with a history of additional substance misuse and the control group (Fig. 2). This is in agreement with results of several previous studies on male alcoholics, where type 2 alcoholism has been associated with low platelet MAO activity and low 5-HIAA levels in the CSF (Virkkunen and Linnoila, 1993a). However, the two female alcohol groups did not differ significantly from each other with regard to platelet MAO activity, nor did the female pure alcoholics (ALC) differ from the controls. None of the women could have used any illicit drug during a minimum period of 4 weeks before blood was withdrawn for analysis of platelet MAO activity and no medication affecting the enzyme was prescribed.

There is, however, strong evidence showing that cigarette smokers have lower platelet MAO activity than controls. This, in turn, has been found to be a combined effect of inhibitory components in the smoke (Norman et al., 1987; Yu and Boulton, 1987; Mendez-Alvarez et al., 1997) and of personality traits associated both with smoking and low platelet MAO (for a review, see Orelan et al., 1999). However, although all female alcoholics in the present study were smokers, it cannot be excluded that smoking is a confounding factor, especially when comparing them with the controls. Even though cigarette consumption was not registered, it seems unlikely that the ALC and the ALC-DRUG should differ in this regard. In two recent reports, the well-known association between smoking and alcohol use/misuse has been suggested to explain all of the association between alcoholism and low platelet MAO activity in male alcoholics. However, in one of these studies, no difference between genders was found, which is usually a most reproducible finding (Farren et al., 1998), and in the other study (Anthenelli et al., 1998), although including a large number of individuals, probably a rather different type of client was studied. Recently, the association between low platelet MAO and alcoholism in males has been supported by the finding that spontaneous ethanol intake in male Rhesus monkeys is inversely correlated to their platelet MAO activity (Åsberg et al., 1999).

One explanation for the absence of a difference in platelet MAO activity between subgroups of female alcoholics might be that there is a larger proportion of subjects with anxiety among female severe alcoholics, than in corresponding series of male alcoholics. Anxiety-related personality traits (somatic anxiety aspects in male groups and cognitive–social anxiety aspects in female groups), as well as hostile and schizoid traits, have indeed been found to be positively associated with platelet MAO activity (af Klinteberg et al., 1987; Schalling et al., 1987). In the present female alcoholic groups, there were large standard deviations for the MAO activity, in comparison with the control group. Both low and high platelet MAO activities, reflecting different kinds of personality deviance, have previously been considered risk indicators for psychosocial disorders (Schalling, 1993).

Female alcoholics with a history of additional substance misuse: characterized by psychiatric disorder and crime

The present results indicated an over-representation of fathers having been treated for depression of the female alcohol subjects with additional substance misuse (ALC-DRUG). This is noteworthy, in view of the significantly higher frequency of personality disorders among the present female ALC-DRUG group subjects, and the recently reported findings of childhood misuse and neglect being likely to contribute to the onset of some personality disorders (Johnson et al., 1997). The ALC-DRUG females had been treated for psychiatric disorders other than substance misuse more frequently than the pure alcoholic (ALC) females, and they had also been involved more often in criminality other than driving under the influence of alcohol. Among males, criminal offenders have been characterized by low MAO activity (af Klinteberg, 1996), and evidence concerning low serotonergic turnover has repeatedly been found in personality-disordered male violent offenders (Virkkunen and Linnoila 1993b; Virkkunen et al., 1995).

In conclusion, the results in the present study suggest that it is meaningful to sub-group severe female alcoholics according to having/not having an additional substance misuse. The female alcoholics with such additional misuse formed, in the present study, a group of individuals fulfilling several core criteria similar for male type 2 alcoholism. This finding should, however, be considered with caution, because of some methodological limitations. First, there was a modest number of participants in our sample. Second, the present study was performed on a patient group of severe alcoholic females and has to be replicated on other female alcoholic groups. Since earlier studies have reported a paucity of type 2 characteristics in females, it is noteworthy that our results indicated that female alcoholics with additional substance misuse were younger at first treatment contact for alcohol problems, displayed a higher frequency of depression in first degree relatives, showed a higher frequency of complications in terms of criminal activity and a higher frequency of criteria/higher scores for personality disorders than female alcoholics without additional substance misuse. Accordingly, they exhibited a personality pattern characterized by higher impulsiveness, non-conformity, and anxiety-related traits, especially somatic anxiety, and by higher hostility, as compared to the female alcoholics without additional substance misuse. Furthermore, in comparison to the control subjects they had significantly lower platelet MAO activity — an indicator often found in male type 2 alcoholism. More work in larger numbers of
patients is, however, needed to examine this hypothesis as well as the potentially confounding influence of tobacco smoking.

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