ALCOHOL CONSUMPTION PROFILE BY TIME IN MIDDLE-AGED MEN: A LONGITUDINAL STUDY BASED ON THREE DIFFERENT DIAGNOSTIC INSTRUMENTS

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Abstract — This longitudinal study aimed at comparing aggregate measures of heavy or problem drinking and their variations across time among the same subjects. We examined middle-aged men participating in a health survey over a 5-year interval. Of the 133 consecutive men in the whole age group interviewed as 40-year-olds in 1989, 114 were reached and re-interviewed in 1994. Alcohol consumption was measured by self-report, Malmö-modified Michigan Alcoholism Screening Test (Mm-MAST), and serum carbohydrate-deficient transferrin (CDT). Self-reported alcohol consumption decreased with years (142 vs 105 g/week, \( P < 0.01 \)), as did CDT (16.9 vs 14.4 U/l, \( P = 0.02 \)), but there was no change in the Mm-MAST results. There was no significant difference in the number of heavy drinkers (either Mm-MAST score \( \geq 3 \), or by self-reported alcohol consumption \( \geq 280 \) g/week, or by CDT \( \geq 20 \) U/l) at 40 and 45 years of age (37 and 47% respectively). At the individual level, alcohol consumption both increased and decreased with age. At 45 years of age 5/114 (4%) of the men reported that they had increased their alcohol consumption by more than 80 g/week and 25/114 (22%) said that they had reduced their drinking by the same amount. The remaining 84 (74%) reported drinking the same amount as 5 years earlier (± 80 g/week). This indicates that alcohol drinking habits are not stable in middle age. Most heavy drinkers in both age groups were detected by Mm-MAST and this proportion increased with age while the proportion of positive self-reports and CDTs decreased. Thus, the social consequences, measured here by the Mm-MAST, may be more readily experienced with years even at smaller consumption levels.

INTRODUCTION

Although there are longitudinal studies confirming that there is no tendency for men to reduce their alcohol consumption levels nor for drinking problems to decrease with age (Gillis and Stone, 1977; Glynn et al., 1985; Temple and Leino, 1989), findings to the contrary have also been published indicating that many people change their alcohol consumption in one way or another (Clark and Calahan, 1976; Fillmore, 1987). According to a study by Schulenberg et al. (1996), 30% of the population exhibit behavioural discontinuity in respect of drinking patterns. There would thus appear to be a need for information on how diagnostic tests on heavy drinking vary with age in relation to alcohol consumption and drinking habits.

There are three commonly used means to detect heavy drinking. (1) By interview usually including questions on alcohol consumption amounts. Self-report can be elicited in several ways, for example quantity–frequency, time period, or time line follow-back methods (Straus and Bacon, 1953; Sobell et al., 1988). (2) By the use of structured questionnaires (Kitchens, 1994), for example the CAGE (Ewing and Rouse, 1970), the Michigan Alcoholism Screening Test (MAST; Selzer, 1971) or its modifications, for example the Brief MAST (Pokorny et al., 1972), the Short MAST (Selzer et al., 1975), and the Malmö modified (Mm-MAST) (Kristenson and Trell, 1982) may be included. The structured questionnaires usually include questions on problems and awareness of them. The latest, the Alcohol Use Disorders Identification Test (Babor et al., 1989) also includes structured
questions on drinking amounts. (3) The use of laboratory markers to detect heavy drinking (Saunders and Conigrave, 1990; Stibler, 1991). Unfortunately, none of these methods has so far proved ideal. The fact that they measure different aspects of heavy drinking, i.e. alcohol consumption, problems, and the physical consequences of drinking, may indicate that their efficiency differs at different ages. This might open up new perspectives on the early detection of heavy drinking.

The present study was conducted among middle-aged men, the group most in danger of somatic complications due to heavy drinking. The aim was to compare aggregate measures of heavy or problem drinking and their variations across time among the same subjects. From the three categories of diagnostic tests (self-report, questionnaires, and laboratory markers), the time period self-report, the Mm-MAST questionnaire, and serum carbohydrate-deficient transferrin (CDT) were used.

SUBJECTS AND METHODS

In 1989, we examined 133 consecutive 40-year-old men participating in an annual health screening arranged by the City of Tampere. The screening was aimed at the whole age group (n = 1536) and performed by experienced nurses; the participation rate was 71% (Seppä et al., 1990). The 133 men included in the present study represent a random sample of the population invited in alphabetical order according to first initial of surname. In addition to the customary questions concerning health and diet, questions on alcohol consumption were added. These included items on alcohol consumption during the past 2 months (period estimate), and the Mm-MAST. The cut-off point for heavy drinking was either $\geq 280$ g absolute alcohol/week according to self-report or $\geq$three positive answers according to the Mm-MAST (Seppä et al., 1990). Additionally, a blood sample for serum CDT was drawn and serum was frozen to $-70^\circ$C. Subsequently, serum CDT was measured using CDTect (Pharmacia AB Diagnostics, Uppsala, Sweden). The recommended cut-off level of $\geq 20$ U/l was used.

Middle-aged men are generally screened at 5-yearly intervals in the city of Tampere. Of the original group of 133 men aged 40 years, 19 (14\%) did not attend 5 years later. These 19 consisted of 11/67 former moderate drinkers (16\%) and 8/66 former heavy drinkers (12\%). Of these 19 men, 10 had moved from the city, six former moderate drinkers did not attend, two former heavy drinkers refused to participate in the study, and one former moderate drinker was excluded because of failure to obtain a blood sample. Thus, 114 men were contacted again in 1994, making the participation rate 86\%. These men were interviewed mainly by the same experienced nurses as 5 years earlier. Again, self-reported alcohol consumption (period estimate) as well as the Mm-MAST were registered. A blood sample for CDT was drawn and measured as above. For technical reasons, CDT values were available from 107 men as 40-year-olds and 110 as 45-year-olds.

The following describes the Mm-MAST: (1) Do you take a drink before going to a party? (2) Do you usually drink a bottle of wine or corresponding amounts of alcohol over the weekend? (3) Do you drink a couple of drinks (or beers) a day to relax? (4) Do you tolerate more alcohol now than you did 10 years ago? (5) Have you difficulties not drinking more than your friends? (6) Do you fall asleep after moderate drinking without knowing how you got to bed? (7) Do you have a bad conscience after drinking? (8) Do you take a drink (a beer) the day after a party? (9) Do you try to avoid alcoholic beverages for a determined period of time, e.g. a week?

Statistical analyses were performed using BMDP Statistical Software (Dixon et al., 1990). The different parameters were compared within and between the two groups of men (the same men at 40 and at 45 years) using analysis of variance (ANOVA) and 95\% confidence intervals (CI; numeric values) or Pearson’s $\chi^2$ (categorical values). Welch’s approximation for ANOVA was used when the variances differed significantly according to Levene’s test. P-values $<$0.05 were considered statistically significant.

The study was approved by the Ethics Committee of the City of Tampere and was undertaken according to the principles of the Helsinki Declaration.

RESULTS

The mean values of the three parameters (self-reported alcohol consumption, CDT or Mm-
MAST) in the 114 men examined as 40-year-olds in 1989 and again as 45-year-olds in 1994 showed only minor changes. The self-reported alcohol consumption was significantly smaller for the later year (142 vs 105 g/week, $P \approx 0.01$) at a 95% CI interval from $-9$ to $-63$ g/week. Likewise, the CDT value was smaller (16.9 vs 14.4 U/l, $P \approx 0.02$) at a 95% CI from $-0.6$ to $-4.4$ U/l. No significant difference was seen in the total score of the Mm-MAST.

A closer look at the Mm-MAST gave similar results in the two age groups. The percentage of men giving a 0 score in the Mm-MAST was 27% in 1989 and 25% in 1994. Similarly, no significant difference was found in the number of positive answers to the individual Mm-MAST questions over the 5-year interval. Most positive answers in 1989 and 1994 were given to question (2) enquiring about weekend drinking (46 vs 52%) and (9) enquiring about efforts to avoid alcoholic beverages (35 vs 44%).

The results of the three different methods of enquiring about possible heavy drinking, namely Mm-MAST, self-report, and CDT, are presented in Table 1. The methods were not in firm agreement in either of the age groups; all three or different combinations of two of them were seldom simultaneously positive among both the 40-year-old and 45-year-old men. If the criterion of heavy drinking was considered when at least one of the three methods yielded positive results, the percentages became higher (47 vs 37%, $P > 0.05$).

Of the three methods if positive alone or in combination with the other methods, Mm-MAST was best, and self-report poorest, in detecting heavy drinkers (Fig. 1). The number of pathologic results was not significantly different between the age groups according to any of the three methods, although the trend in both pathologic CDT values and self-reports was decreasing and increasing in

<table>
<thead>
<tr>
<th>Pathologic value or value combination</th>
<th>40-year-old (%)</th>
<th>45-year-old (%)</th>
<th>Significance ($P$)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mm-MAST and CDT</td>
<td>9</td>
<td>4</td>
<td>n.s.</td>
</tr>
<tr>
<td>Mm-MAST and self-report</td>
<td>6</td>
<td>4</td>
<td>n.s.</td>
</tr>
<tr>
<td>CDT and self-report</td>
<td>2</td>
<td>0</td>
<td>n.s.</td>
</tr>
<tr>
<td>Self-report and Mm-MAST and CDT</td>
<td>3</td>
<td>1</td>
<td>n.s.</td>
</tr>
<tr>
<td>Mm-MAST alone (self-report and CDT normal)</td>
<td>11</td>
<td>27</td>
<td>0.002</td>
</tr>
<tr>
<td>CDT alone (self-report and Mm-MAST normal)</td>
<td>5</td>
<td>8</td>
<td>n.s.</td>
</tr>
<tr>
<td>Self-report alone (Mm-MAST and CDT normal)</td>
<td>1</td>
<td>3</td>
<td>n.s.</td>
</tr>
<tr>
<td>Self-report or Mm-MAST or CDT</td>
<td>37</td>
<td>47</td>
<td>n.s.</td>
</tr>
</tbody>
</table>

Pathologic values are as follows: CDT ≥20 U/l, Mm-MAST ≥3, self-reports ≥280 g/week. CDT was missing from seven of the 40-year-old men and four of the 45-year-old men. n.s., $P > 0.05$.

![Fig. 1. Different criteria for heavy drinking met by the same men as 40-year-olds and 45-year-olds.](image)
At the individual level, men of 45 years of age, 5/114 (4%) reported that they had increased their alcohol consumption by more than 80 g/week and 25/114 (22%) reported having reduced their drinking by the same amount. The rest, 84 men (74%), reported drinking the same amount as 5 years earlier (±80 g/week).

According to the CDT, more men had reached the normal value than lost it at 5 years (Fig. 2A). The same was true with self-report (Fig. 2B). By contrast, the Mm-MAST produced a different result; there was a shift of 16/114 (14%) men from moderate to heavy drinking, but of only 8/114 (7%) from heavy to moderate drinking (Fig. 2C).

**DISCUSSION**

The present study compared aggregate measures of heavy or problem drinking among the same men after a 5-year interval. To supplement self-reported alcohol consumption, we included CDT as a marker of heavy drinking and Mm-MAST to measure alcohol-induced problems.

The participation rate for the original screening was 71%. It could be argued that the men who participated either had more health problems or showed more than average commitment to healthy habits and might have consumed less alcohol than this community at large. We do not know whether the health problems or health habits of the non-participants are comparable to those in the community at large. However, the present results show that, compared to epidemiological alcohol consumption data on the Finnish population and to Finnish alcohol statistics, the consumption argument does not hold (Alcohol Statistical Yearbook 1994, 1995; Simpura, 1987). Even those not participating the second time did not, based on the information gathered about their drinking habits, bias the results. The 2-month period estimate for alcohol consumption was adopted for optimal comparison with CDT. Annual consumption was not investigated, because of its uncertain reliability. Current use, which was likewise not asked for, may have an impact on marker values. On the other hand, it is known that about 70% of Finnish heavy drinkers binge drink at the weekend, but remain sober during the week (Seppälä et al., 1990).

In the present study, the self-reported amounts clearly decreased with age, in contrast to findings in some other longitudinal studies (Gillis and Stone, 1977; Glynn et al., 1985; Temple and Leino, 1989). The commonly known tendency for pathologic Mm-MAST scores.

![Fig. 2. Changes in alcohol consumption over 5 years measured by CDT (A), self-report (B) and Mm-MAST (C).](image-url)
underestimation in self-reporting (Orrego et al., 1979; Barrison et al., 1980; Froede and Gordon, 1980; Midanic, 1988) must be considered as a possible bias. The question is whether it is similar in both age groups, indicating that consumption really has decreased, or whether the underestimation increases with age, indicating no change in real consumption. The latter alternative seems somewhat unrealistic, considering that the health survey personnel were the same at both interviews and that the trend in CDT values was also decreasing. The finding of a real decrease with age would also be in accordance with observations indicating that the prevalence of alcohol consumption or drinking problems decreases with age (Clark and Calahan, 1976; Fillmore, 1987), and with the official Finnish drinking statistics whereby consumption of absolute alcohol decreased from 1989 to 1994 by about 11/year inhabitant aged 18 years or more (Alcohol Statistical Yearbook 1994, 1995). The decrease in the present study was about twice as large. Thus, the decrease, while partly reflecting the period effect, also shows a real age-related shift.

The present results show that the number of men who have problems or risks due to their alcohol consumption based on Mm-MAST, self-report or CDT, did not change in middle-age over 5 years. This is in good accord with Glynn et al. (1985), indicating that a birth cohort including 40-year-old men showed no change in problems with drinking over a period of 9 years. However, heavy drinking was more frequently revealed in a positive Mm-MAST in 45-year-old men compared to 40-year-old men, even though the older age group reported drinking smaller amounts. Mm-MAST measures consequences of drinking in daily life and consumption-related behaviour. This may indicate that, with increasing age, even if drinking amounts are smaller, these consequences and alcohol-based social problems are more readily experienced. A further contributing factor may be the increasing awareness of alcohol problems in society offsetting the decrease in per capita consumption.

Our study showed that, with increasing age, Mm-MAST is the most sensitive of the three instruments studied to detect heavy drinking via observation of alcohol-induced problems. With CDT and self-report, the specificity of heavy drinking is high in both middle-aged groups, but by using these two methods alone several alcohol-related problems may remain undetected especially with increasing age (Fig. 1). This would indicate that, in clinical work, a reasonable combination of all these methods should be considered.

Although the number of heavy drinkers remained stable in 40-year-old to 45-year-old men, individual changes were considerable. Measured by any of the instruments used, heavy drinkers at the age of 40 and 45 years were not the same men (Fig. 2), which implies that alcohol drinking habits are not stable and that alcohol consumption varies even in middle age. This underscores the importance of both primary and secondary prevention in the population and in health care. As part of health screening, all men should be given at least minimum information about the detrimental effects of heavy consumption and on the limits of heavy drinking (Gaziano and Hennekens, 1995; Jackson and Beaglehole, 1995).

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REFERENCES