



Scand J Work Environ Health 1978;4(2):196-199

<https://doi.org/10.5271/sjweh.2747>

Issue date: 1978

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Key terms: [alcohol consumption](#); [exposure](#); [psychological sign](#); [psychological symptom](#); [styrene](#); [styrene exposure](#); [tolerance](#); [worker](#)

This article in PubMed: www.ncbi.nlm.nih.gov/pubmed/734405



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Alcohol consumption and tolerance of workers exposed to styrene in relation to level of exposure and psychological symptoms and signs

by KARI LINDSTRÖM, Ph.L., HANNU HÄRKÖNEN, M.D., and
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LINDSTRÖM, K., HÄRKÖNEN, H. and MANTERE, P. Alcohol consumption and tolerance of workers exposed to styrene in relation to level of exposure and psychological symptoms and signs. *Scand. j. work environ. & health* 4 (1978): suppl. 2, 196—199. A group of 98 male workers occupationally exposed to styrene was interviewed for information on the amount and frequency of alcohol consumption and changes in consumption frequency and tolerance. Alcohol consumption and changes in consumption were not compared to any reference data, but the changes in tolerance were. The styrene-exposed workers revealed a lowered tolerance somewhat more often than the unexposed group. Neither the duration nor the intensity of styrene exposure was related to any of the alcohol "behavior" variables. The amount of overtime work in exposure had a slight relationship to high alcohol consumption, but the interpretation of this relationship remains undecided. Subjective symptoms, like hand tremor and difficulties in staying asleep, were associated with the alcohol "behavior" variables, but these two symptoms were unrelated to intensity of styrene exposure. Of the psychological functions studied, lowered visuomotor speed showed a slight relationship to high alcohol consumption. Visuomotor inaccuracy, which had proved to be related to a high intensity of styrene exposure, revealed no connection with the alcohol "behavior" variables. It was concluded that alcohol consumption among styrene-exposed workers is not related to the same psychological symptoms and signs as styrene exposure.

According to clinical experience, occupational solvent exposure and alcohol consumption can be combined in very complex ways. People exposed to solvents may have an increased rate of alcohol consumption or a lower tolerance to alcohol because of the solvent exposure. In addition, alcohol use is a potential effect-modifying factor when the neurotoxic effects of solvent exposure are being stu-

died. Further difficulties are involved if one attempts to obtain reliable data on actual alcohol consumption in individual cases. In order to form a more-detailed picture of the situation, we analyzed alcohol consumption, changes in frequency of alcohol consumption, and alcohol tolerance in relation to solvent exposure and psychological symptoms and signs among a group of workers occupationally exposed to styrene. Because an adequate reference group was lacking, the results can only be considered as descriptive.

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MATERIAL AND METHODS

In connection with the styrene project of the Institute of Occupational Health in Helsinki 98 styrene-exposed workers were asked about their alcohol consumption, changes in consumption, and alcohol tolerance (3). These data were based on the subjective evaluations of the workers themselves. Three different measures of styrene exposure were used, i.e., the duration of exposure in years, the mean mandelic acid concentration in urine, and the amount of overtime work in exposure during the past 12 months. A symptom survey, made at the same time, included questions about fatigue, concentration difficulties, irritation symptoms, headache and dizziness, digestive disturbances, vegetative symptoms, sleep disturbances, and symptoms of peripheral neuropathy (2). The psychological functions measured were general intelligence, memory, visuo-motor speed, visuomotor accuracy, vigilance, and psychomotor performance (3). Also the workers were asked about their use of drugs. Table 1 shows the median age and the age range of the study group, as well as the parameters describing exposure. In the statistical analyses the chi-square test, Student's *t*-test and Pearson's *r* were used.

RESULTS

Two independent examiners inquired about alcohol consumption. One asked about the amount of alcohol consumed in one month, and the other about the frequency with which alcohol was consumed to the point that the person felt slightly drunk. These two measures correlated highly ($r = 0.74$, $p < 0.01$). The distribution of the frequency of alcohol consumption is shown in table 2.

Changes in the frequency of alcohol consumption had occurred in 28 % of the 98 cases. In half (14 %) the frequency had increased, and in the other half (14 %) it had decreased.

Alcohol tolerance had become lower in 32 % and higher in 6 % of the 98 workers. They described the lowered tolerance with the facts that a feeling of drunkenness appeared sooner, the after-effects were worse, or a loss of memory was apparent. When these results were compared to those of car painters exposed to a mixture of solvents, about the same frequencies were noticed in tolerance change. In an unexposed reference group (Finnish railroad workers) 20 % reported worse and 9 % better alcohol tolerance (1).

Neither the duration of styrene exposure nor the degree of exposure, measured as mean mandelic acid concentration in urine, was statistically significantly related to alcohol consumption, changes in the consumption, or lowered tolerance. The duration of exposure was somewhat longer among those with increased consumption and those with lowered tolerance, but no significant differences were apparent.

The amount of overtime work in styrene exposure was also used as an indicator of exposure, although its suitability for this purpose can be criticized. Both measures of alcohol consumption correlated nearly statistically significantly with the amount of overtime work ($r = 0.20$

Table 1. Median and range of the age and exposure variables of the study group (N = 98).

Variable	Median	Range
Age	28 years	16—54 years
Duration of exposure	5.1 years	0.5—14 years
Mean mandelic acid concentration	808 mg/l	7—4,715 mg/l
Amount of overtime work	30 h	0—500 h

Table 2. Frequency of alcohol consumption (slightly drunk state).

Frequency	N
Daily	1
Twice a week	22
Once or twice a month	56
Some times in a year	16
Seldom or never	3

and $r = 0.23$, $p < 0.05$). Figs. 1 and 2 present the alcohol consumption of those with 100 or more overtime hours during the past year in comparison to those with

less overtime. The change in alcohol use or the lowered tolerance was not related to the amount of overtime work.

Of the subjective symptoms, hand tremor and tiredness and listlessness were statistically significantly or nearly significantly related to high alcohol consumption, as well as to a high frequency of alcohol consumption (table 3). Also difficulties in staying asleep and irritability were related to the amount of alcohol consumption (table 3).

When compared to the subgroup with no change in alcohol consumption, the subgroup with increased consumption was characterized by difficulties in staying asleep ($\chi^2 = 4.29$, $p < 0.05$) and straying of thoughts ($\chi^2 = 3.92$, $p < 0.05$). The use of drugs was also more frequent in this group ($\chi^2 = 4.74$, $p < 0.05$).

Hand tremor was statistically significantly more frequent in the group of workers whose alcohol tolerance had decreased ($\chi^2 = 7.80$, $p < 0.01$) in comparison to the one with no change in tolerance.

Of the psychological functions, lowered visuomotor speed was slightly related to high alcohol consumption. Left-hand performance on the Santa Ana Dexterity Test ($r = 0.23$, $p < 0.05$) and simple reaction time (right hand $r = 0.24$, $p < 0.05$; left hand $r = 0.26$, $p < 0.05$) were the two visuomotor variables that correlated with high alcohol consumption. The frequency of alcohol consumption showed no relation to psychological functions. Nor did the other alcohol variables correlate with the psychological functions.

DISCUSSION

The consumption of alcohol was slightly related to one of the measures of styrene exposure, i.e., the amount of overtime work in exposure. Neither the duration nor the intensity of styrene exposure had a statistically significant relation to alcohol consumption or to an increase in alcohol consumption or to lowered alcohol

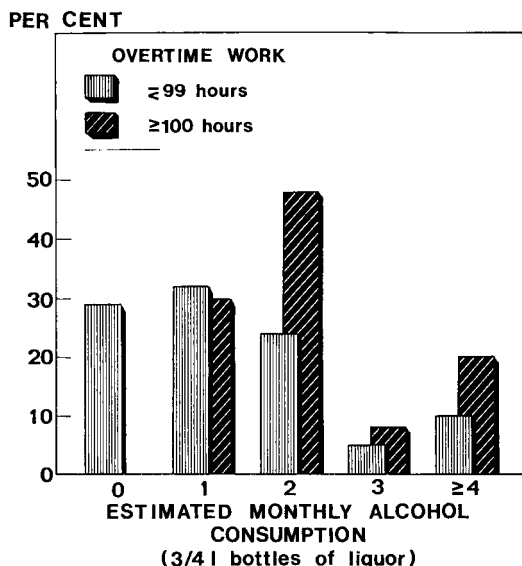


Fig. 1. Percentage distribution of alcohol consumption in groups with a low (≤ 99 h/year) and high (≥ 100 h/year) amount of overtime work.

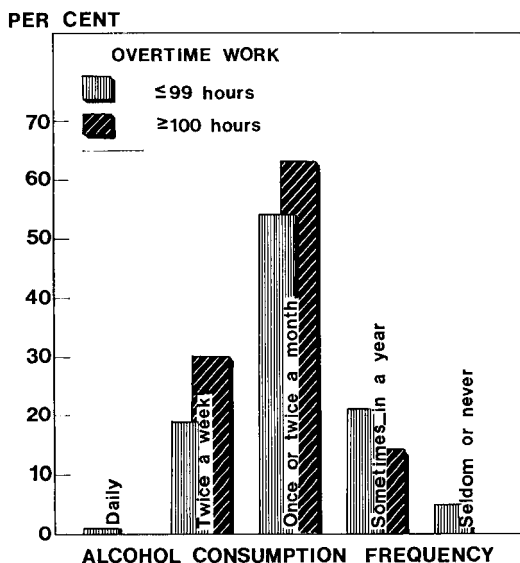


Fig. 2. Percentage distribution of alcohol consumption in groups with a low (≤ 99 h/year) and high (≥ 100 h/year) amount of overtime work.

Table 3. Relationship between alcohol consumption and subjective symptoms (Pearson's r).

Symptoms	Amount of alcohol consumption	Frequency of alcohol consumption
Hand tremor	0.35	0.20
Tiredness and listlessness	0.23	0.25
Difficulties staying asleep	0.20	NS ^a
Irritability	0.22	NS ^a

^a NS $p > 0.05$.

tolerance. The amount of overtime does not necessarily describe only greater exposure to styrene or a greater work load, however; it can also indicate avoidance behavior, just as alcohol consumption itself can. Therefore, assumptions about the relationship between styrene exposure and alcohol behavior were not confirmed in this study, but the same may not necessarily be the case with other samples or with other types of solvent exposure.

Analyses of subjective symptoms and alcohol consumption, and increase in consumption and alcohol intolerance, revealed that some symptoms are associated with alcohol measures. Hand tremor was related to both high consumption and alcohol intolerance, while difficulties in staying asleep were related to alcohol consumption and an increase in alcohol use. Although a comparison between this styrene-exposed group and an unexposed group revealed many clear differences with regard to subjective symptoms, there was no difference for these two symptoms (2). Other symptoms related to the alcohol "behavior" variables were tiredness,

listlessness, irritability, and straying of thoughts.

Of the psychological functions, visuomotor speed was slightly related to the amount of alcohol used. But this psychological function was not the one that was related to a high intensity of styrene exposure (3), namely, visuomotor accuracy. Therefore we have concluded that the psychological symptoms and signs related to alcohol behavior variables are not related to styrene exposure.

ACKNOWLEDGMENTS

The authors wish to thank Ms. P. Fahlström for performing the statistical calculations.

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