Effects of alcohol reduction on blood pressure: a meta-analysis of randomized controlled trials


Authors' objectives
To assess the effects of alcohol reduction on blood-pressure (BP).

Searching
MEDLINE was searched from 1966 to 1999. The search terms included 'alcohol,' 'alcohol drinking,' 'alcohol reduction,' 'alcohol restriction' and 'blood pressure'. In addition, the reference lists from original and review articles were searched manually. Only full-length original journal articles were considered; no attempt was made to include abstracts or unpublished studies.

Study selection
Study designs of evaluations included in the review
Randomised controlled trials with either a crossover open design or a parallel open design were included.

Specific interventions included in the review
Studies were included in which alcohol reduction was the only intervention difference between the active and control treatment groups. The intervention was a low-alcohol beer substitute in eight trials (n=376), while in the remaining seven trials (n=1,858), behavioural interventions were used as a means to encourage a reduction in alcohol consumption. The duration of the intervention had to be greater than or equal to one week.

Participants included in the review
The participants were adults, mostly men, who drank three or more alcoholic drinks per day. The age range was 27 to 57 years.

Outcomes assessed in the review
The outcome measured was a change in the diastolic and/or systolic BP.

How were decisions on the relevance of primary studies made?
Studies that met the defined criteria were included in the review. The literature search and article review were conducted independently by three of the authors.

Assessment of study quality
Study quality was assessed using the scale described by Chalmers et al. (see Other Publications of Related Interest no.1). Three reviewers independently performed the quality assessment.

Data extraction
Three reviewers used a standard protocol to extract the following information: sample size, participant characteristics, study design, intervention methods, duration, and treatment results. Any disagreements were resolved by input from one of the other authors.

For individual studies, each study was weighted by the reciprocal of the variance for BP change. The variances for the net BP changes were not reported for most of the studies, and were subsequently calculated from confidence intervals (CIs), t statistics, the probability value, or individual variances for the intervention and control groups. For parallel trials, in which the variance for paired differences was reported separately for each group, a pooled variance for net change was calculated using standard methods. When the variance for paired differences was not reported, it was calculated using the variances at baseline and the end of follow-up, based on the methodology of Follman et al.
Methods of synthesis
How were the studies combined?
Fixed-effect and random-effects models were used to estimate the overall effects of alcohol reduction on BP. Potential publication bias was examined using a funnel plot that related sample size to the effect size, and a correlation analysis between the sample size and standardised BP. Kendall's tau correlation coefficients between sample size and standardised systolic and diastolic BP reduction were calculated and tested for statistical significance.

How were differences between studies investigated?
Homogeneity of effect size across the studies was tested by means of Q statistics. The results from the fixed-effect model were reported because no statistically-significant heterogeneity was found among the studies. To explore the influence of covariates on the net change in BP, a series of pre-stated subgroup analyses were performed. The pooled effects for each subgroup were calculated using the fixed-effect model, and the statistical significance was tested by analysis of variance. The effect of various study characteristics on the net change of BP, weighted by the inverse of its variance, was estimated using meta-regression analysis.

Results of the review
Fifteen randomised trials (n=2,234) were included: 8 trials (n=293) had a crossover design and 7 trials (1,941) had a parallel open design.

Alcohol reduction was associated with significant reductions in the mean systolic and diastolic BPs of 3.31 mmHg (95% CI: -2.52, 4.10) and 2.04 mmHg (95% CI: -1.49, 2.58), respectively (P<0.0001 for both). The meta-analysis identified a significant and positive relationship between the mean percentage of reported alcohol reduction and the corresponding net reduction in both systolic and diastolic BP (P=0.003 and P=0.03, respectively). The mean net changes in systolic and diastolic BP were, respectively, 3.91 (95% CI: -4.96, -2.86) and -2.10 (95% CI: 2.7, 1.4) in the low-alcohol substitute group (n=8), and 2.52 (95% CI: -3.73, 1.32) and -1.90 (95% CI: 2.85, 0.95) in the counselling group (n=7).

In the subgroup analyses, there was also a significant and positive relationship between the average pre-treatment BP and mean reduction in systolic BP (P=0.008). Approximately 78.6% of the variation in systolic BP, and 50% of the variation in diastolic BP net change were explained by the five variables: age, alcohol reduction, pre-treatment of BP, duration of the trial and sample size. A dose-response relationship was observed between the mean reduction in the reported consumption of alcohol and the net change in both systolic and diastolic BP.

In testing for publication bias, it was found that the net change in BP tended to be larger for studies with the smallest number of participants; there was trend for the variation in net change to diminish with increasing sample size. Kendall's tau correlation coefficients between the sample size and standardised systolic and diastolic BP reduction were 0.096 (P=0.345) and 0.088 (P=0.337), respectively. Thus, the totality of the evidence failed to document the presence of publication bias.

Authors' conclusions
The findings indicated that a 67% reduction in alcohol intake among heavy drinkers (at least 3 drinks per day) significantly reduced their systolic and diastolic BP. Both low-alcohol beer substitutes and counselling interventions significantly lowered BP, demonstrating similar effects on BP reduction. Therefore, both approaches can be used to lower BP in heavy alcohol drinkers. However, only one of the included trials contained women; this study, therefore, provided little direct evidence regarding the effect of alcohol reduction on BP in women. The authors noted another limitation surrounding the level of alcohol consumption of participants who were classed as fairly heavy drinkers. The lack of detail meant that they were unable to examine the effect of moderate alcohol consumption on BP. The study suggests that alcohol reduction should be recommended as an important component of lifestyle modification for the prevention and treatment of hypertension among heavy drinkers.
CRD commentary
This was a useful review, highlighting an important area. A clear review question was addressed by the stated inclusion criteria. The literature search was limited: only one database was searched, few additional searches were conducted, and the authors freely acknowledged that they did not seek out unpublished studies or any other aspects of the grey literature. Details were given on some aspects of the review methodology, such as the number of reviewers who extracted the data and performed the validity assessment. The method of analysis was appropriate to the data collected. Heterogeneity was tested for using a Q statistic. The authors acknowledged the limitations of the study, particularly in relation to generalising to women and to moderate drinkers (i.e. those who drink less than 3 alcoholic drinks per day).

The authors’ conclusions appear to follow from the results presented, but should be interpreted with caution given the limitations mentioned.

Implications of the review for practice and research
Practice: The authors state that alcohol reduction should be recommended as an important component of lifestyle modification for the prevention and treatment of hypertension among heavy drinkers.

Research: The authors state that further research is needed on the effects of alcohol reduction on BP in moderate drinkers and in women.

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