The Mellanby Effect

A systematic review of the evidence for acute tolerance to alcohol – the "Mellanby effect"

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ABSTRACT

Objective: To review the evidence for "the Mellanby effect", that is, whether the response to a given blood alcohol concentration (BAC) is more marked when BAC is rising than at the same concentration when BAC is falling.

Methods: We systematically searched the databases EMBASE, Medline, and Scopus up to and including December 2016 using text words "tolerance", "ascending", "descending" or "Mellanby" with Medline term "exp *alcohol/" or "exp *drinking behavior/" or equivalent. Articles were identified for further examination by title or abstract; full text articles were retained for analysis if they dealt with acute (within dose) alcohol tolerance in human subjects and provided quantitative data on both the ascend-ing and descending parts of the BAC–time curve. Reference lists of identified works were scanned for other potentially relevant material. We extracted and analyzed data on the subjective and objective assessment of alcohol effects.

Results: We identified and screened 386 unique articles, of which 127 full-text articles were assessed; one provided no qualitative results, 62 involved no human study, 25 did not consider acute tolerance within dose, and 13 failed to provide data on both ascending and descending BAC. We extracted data from the 26 remaining articles. The studies were highly heterogeneous. Most were small, examining a total of 770 subjects, of whom 564 received alcohol and were analyzed in groups of median size 10 (range 5–38), sometimes subdivided on the basis of drinking or family history. Subjects were often young white men. Doses of alcohol and rates of administration differed. Performance was assessed by at least 26 different methods, some of which measured many variables. We examined only results of studies which compared results for a given alcohol concentration (C) measured on the ascending limb (Cup) and the descending limb (Cdown) of the BAC-time curve, whether in paired or parallel-group studies. When subjects were given alcohol in more than one session, we considered results from the first session only. Rating at Cdown was better than at Cup for some measures, as expected if the Mellanby effect were operating. For example, subjects rated themselves less intoxicated on the descending limb than at the same concentration on the ascending limb in 12/13 trials including 229 subjects that gave statistically significant results. In 9 trials with a total of 139 subjects, mean difference could be calculated; weighted for study size, it was 29% [range 24–74%]. Willingness to drive was significantly greater in 4 of 6 studies including a total of 105 subjects; weighted mean difference increased by 207% [range 79–300%]. By contrast, measure of driving ability in three groups of a total of 200 trials in 57 subjects showed worse performance by a weighted mean of 96% [range 3–566%]. In three trials that tested inhibitory control (cued go or no-go response times), weighted mean performance was 30% [range 14–65%] worse on the descending limb.

Conclusions: The "Mellanby effect" has been demonstrated for subjective intoxication and willingness to drive, both of which are more affected at a stated ethanol concentration when BAC is rising than at the same concentration when BAC is falling. By contrast, objective measures of skills necessary for safe driving, such as response to inhibitory cues and skills

measured on driving simulators, were generally worse on the descending part of the BAC-time curve for the same BAC.