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Development and Validation of the Biphasic Alcohol Effects Scale

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Alcohol produces stimulant and sedative effects, and both types of effect are thought to influence drinking practices. This article describes the development and preliminary validation of the Biphasic Alcohol Effects Scale (BAES), a self-report, unipolar adjective rating scale designed to measure both stimulant and sedative effects of alcohol. An initial pool of 12 stimulant and 12 sedative items was derived from previous alcohol effect measures, and from descriptors of intoxication generated by subjects during interviews conducted on both the ascending and descending limbs of the blood alcohol curve. This item pool was administered to a sample of sober college students twice, with a 2-week inter-test interval. Items that were difficult to comprehend, or that had high ratings or low test-retest reliability, were eliminated, resulting in a seven-item stimulant subscale and a seven-item sedative subscale. These subscales showed high internal consistency in a sober state, which was not improved by additional item deletion. The data from this study also provided a basis for revising the instructions for the BAES. The new 14-item instrument was then given to 30 male and 12 female nonalcoholics on the ascending and descending limbs of the blood alcohol curve, after the administration of either 0.75 ml/kg alcohol (males) or 0.65 ml/kg alcohol (females). Internal consistency was high for both BAES subscales on both limbs of the blood alcohol curve (Cronbach's alpha = 0.85 to 0.94), and was not improved by additional item deletion. Factor analyses conducted on both limbs of the blood alcohol curve supported the proposed factor structure of the BAES. A predicted interaction of subscale and limb was observed, with stimulant ratings higher than sedative ratings during rising blood alcohol concentrations (BACs), and sedative ratings higher than stimulant ratings during falling BACs. These data provide some initial validation of the BAES as a self-report measure of the stimulant and sedative effects of alcohol.

Key Words: Biphasic Alcohol Effects, Stimulation, Sedation, Limb of Blood Alcohol Curve.

ALTHOUGH ALCOHOL is usually classified as a depressant drug, evidence suggests that it also produces stimulant effects. Stimulant effects usually precede sedative effects during a drinking episode, leading many to describe the effects of alcohol as biphasic. Stimulant effects are generally observed at relatively low blood alcohol concentrations (BACs) on the ascending limb of the blood alcohol curve. Substantial individual variability exists, however, in both the magnitude of such effects and the BACs at which they are observed.[1-3] Stimulant effects have been assessed in human subjects with a variety of behavioral performance, psychophysiological response, and observer rating measures.[2-4] Animal researchers have also used several stimulant measures, including locomotor activation and activity of certain neurotransmitter systems.[2,5] Some current theoretical models hold that stimulant effects reflect reinforcing properties of alcohol and other drugs,[3,6,7] and sensitize (i.e., become greater) over repeated administrations.[8,9] Further, many postulate that the magnitude of stimulant effects will predict drug self-administration and the development of dependence.[7,10]

Sedative effects of alcohol usually occur at higher BACs and on the descending limb of the blood alcohol curve, and are well established in both the human and animal literatures. In human research, investigators have employed many measures of alcohol sedation, including certain EEG patterns and alcohol-induced behavioral impairment. In animal research, alcohol sedation has been assessed using measures such as motor incoordination and the onset and duration of alcohol-induced sleep. A large amount of individual variability exists in the magnitude of the sedative effects of alcohol and the BACs at which they occur. Sedative effects of alcohol are negatively correlated with drinking practices,[1,11] and lower levels of sedation after alcohol consumption may characterize persons at increased risk for the future development of alcoholism.[12] In addition, the development of tolerance to the sedative effects of alcohol is a central clinical and diagnostic feature of alcohol dependence.[13] Tabakoff and Hoffman[8,10] suggest that proneness to develop tolerance to alcohol sedation is involved in mechanisms of heavy alcohol intake.

Given the theoretical importance of the distinction between alcohol's stimulant and sedative effects, and the observation of substantial individual differences in these effects, a valid self-report measure of both stimulation and sedation would prove useful in alcohol administration research. Self-report (or "subjective") alcohol effect measures have been used extensively in human subjects. Subjective alcohol effects have often been measured with ratings of how "intoxicated" subjects perceive themselves.[14-16] Little is known about the relative contribution of perceptions of alcohol's stimulant and sedative effects to ratings of subjective intoxication.

Other self-report measures of alcohol effects do not

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directly assess the stimulant and sedative dimensions, and many measures have psychometric problems. These problems include variable baseline (sober) ratings, and response formats which use dichotomous ratings or bipolar scales. Variable sober ratings suggest that reported effects may not be attributed specifically to alcohol, and that ratings after drinking may be dependent on baseline variability. Variability in sober ratings also reduces the ability to measure true individual differences in alcohol effects and necessitates the use of various change score methodologies.[17] Dichotomous ratings fail to capture variation in the magnitude of effects. Bipolar scales assume that more of one effect means less of another; this assumption often lacks empirical support.

While there are numerous measures of subjective alcohol effects in the literature, each has limitations in assessing the stimulant and sedative effects of alcohol. The Sensation Scale[11,18] is a unipolar adjective rating scale with five subscales that measure different physical sensations by alcohol. It is not clear how the subscales relate to stimulant and sedative alcohol effects, although the Sensation Scale includes a "central stimulant" subscale which appears to measure stimulation. This subscale includes adjective items such as "light-headed" and "rapid thoughts." Musty developed the Drug Reaction Scale (DRS), comprised of 46 unipolar adjective items (unpublished results). While many DRS items appear to measure alcohol sedation and stimulation, others do not, and the DRS has never been validated with respect to alcohol.

Judd et al.[19] developed the Subjective High Assessment Scale (SHAS), a unipolar adjective rating scale with 39 items. The SHAS has been used to measure alcohol effects,[15,19] and has adjectives that may be related to the stimulant/sedative distinction (e.g., "tired," "sad," "alert," and "elated"). However, the SHAS has other items not clearly related to stimulation or sedation. The total number of items is large, and items have not been grouped into subscales of factors. Moreover, the SHAS is characterized by baseline variability in adjective ratings, and little is known about its reliability or validity.

Haertzen and colleagues[20] developed the Addiction Research Center Inventory (ARCI), a series of true-false questions with different drug-relevant subscales that discriminated between persons who did and did not consume particular drugs. The ARCI contains an alcohol scale which appears to measure alcohol's sedative effects (e.g., "I feel sluggish"), and a more euphoriant morphine-benzedrine (MBG) subscale that may provide a better measure of stimulant effects. A great deal of care was taken to establish the psychometric properties of this instrument. However, the ARCI alcohol scale has the advantages of having a large number of items, a dichotomous response format, measurement of only alcohol sedation, and variability in baseline ratings.

Some investigators have used mood measures to examine alcohol effects, such as the Profile of Mood States (POMS).[21] The POMS contains some items which appear to measure alcohol stimulation (e.g., "elated," "energetic," "vigorous") and sedation (e.g., "drowsy," "sluggish"). However, the POMS was not developed as a measure of alcohol's biphasic effects, and thus its subscales do not directly reflect such a framework. Many items do not appear to assess either stimulation or sedation (e.g., "lonely", "sympathetic", annoyed"). The POMs also produces substantial variability in baseline ratings. Wilson and Nagoshi[22] and Nagoshi et al.[23] factor analyzed the POMS and obtained a factor related to alcohol stimulation. However, this factor structure has not been cross validated. Generally, the effects of alcohol consumption on mood are complex, depend on baseline state, and involve many variables other than the stimulant and sedative effects of alcohol.[24]

The present paper presents data on the development and preliminary validation of the Biphasic Alcohol Effects Scale (BAES), a unipolar adjective rating scale of alcohol's stimulant and sedative effects. This research was guided by the view that subjective responses to alcohol are an important component of alcohol's effects which are amenable to scientific analysis. Subjective responses to alcohol reflect the experience of intoxication more directly than other measures, are relatively stable across observations within a subject,[25] and are thought to be proximal variables in the self-regulation of alcohol consumption.[26] The reliable and valid measurement of alcohol sedation and stimulation via self-report is important for a number of research questions, including the relation of individual differences in these effects to risk for the development of alcohol abuse and dependence.

In this paper, results from two studies are reported. In the first study, an initial pool of adjective items was administered to a sample of sober college students twice, with a two-week intertest interval. The data were used to examine test-retest reliability, comprehension, and the magnitude of ratings in a baseline (sober) state, and provided a basis for modifying the instrument's instructions. In the second study, a selected pool of stimulant and sedative items was given to social drinkers on both the ascending and descending limbs of the blood alcohol curve. This second study allowed the assessment of the psychometric properties of the stimulant and sedative subscales in drinking subjects. It was hypothesized that stimulant ratings would be greater than sedative ratings during rising BACs, and that sedative ratings would be greater than stimulant ratings during falling BACs.[2,4]

STUDY 1

An initial pool of 24 adjectives was administered to a sample of sober college students twice, with a 2-week inter-test interval. The psychometric properties of the adjective items and the subscales they comprised were examined. Sober responses to the adjective items were necessary to examine item stability, ease of comprehension, and baseline variability. Ratings close to 0 (no effect) in a sober state, with little between-subject variability, would suggest items with properties desirable for the measurement of the effects of alcohol.

METHOD

Selection of an Initial Pool of Adjective Items

An initial group of 12 potential stimulant and 12 potential sedative adjective items was selected for the purposes of scale development. These items were selected from several sources on the basis of face validity in representing stimulant and sedative effects of alcohol. Some items were derived from the ARCI alcohol scale, the POMS, the DRS, the activation-deactivation adjective checklist,[27,28] the Sensation Scale, and the SHAS. Several other items were generated by the researchers; these items also were derived on the basis of face validity in measuring alcohol's stimulant or sedative effects.

Another source of adjective items was descriptors of intoxication generated by five male and two female subjects after the consumption of alcohol. All subjects were Caucasian. Subjects' mean age was 23.6 (SD = 2.8), and they reported drinking an average of 5.1 standard drinks (SD = 2.3; range = 3 to 9) an average of 9.7 times per month (SD = 3.1; range = 4 to 12). These subjects were tested individually in a quiet, spacious room while seated in a comfortable armchair. During both rising and falling BACs near 0.04%, an interviewer asked subjects to generate words that described their feelings of intoxication. Rising and falling BACs of 0.04% were selected for the generation task in an effort to examine responses when stimulant and sedative effects of alcohol were likely to occur.[2] Responses were tape recorded, content analyzed, and selected for inclusion if they were generated by two or more subjects on the same limb of the blood alcohol curve.

Table 1. Mean (SD) of Baseline Ratings (n = 75), Comprehension Problems (n = 75), and Test-Retest Correlations (n = 41) for the Original 24 BAES Items

Item	Mean rating (S.D.)	Comprehension problems	test-retest r	Significant of r
Bored	3.8 (2.0)	No	0.31	*
Burned out	4.6 (2.7)	No	0.23	NS†
Difficulty concentrating	4.4 (2.6)	No	0.61	**
Down	2.9 (2.3)	No	0.33	*
Drowsy	4.4 (2.7)	No	0.37	**
Dysphoric	2.8 (2.1)	Yes	0.35	*
Elated	3.6 (2.3)	No	0.53	**
Energized	4.0 (2.4)	No	0.45	**
Euphoric	3.3 (2.3)	Yes	0.55	**
Excited	3.6 (2.5)	No	0.33	*
High	2.8 (2.6)	Yes	0.33	*
Heavy head	3.2 (2.5)	No	0.50	**
Inactive	3.3 (2.5)	No	0.57	**
Light-headed	2.6 (2.5)	No	0.23	NS
Rapid thoughts	3.3 (2.8)	Yes	0.62	**
Sedated	2.8 (2.6)	No	0.65	**
Sentimental	4.4 (2.1)	Yes	0.70	**
Slow thoughts	3.0 (2.7)	No	0.49	**
Sluggish	3.8 (2.6)	No	0.62	**
Stimulated	3.6 (2.5)	No	0.58	**
Talkative	4.6 (2.9)	No	0.70	**
Tired	5.3 (2.8)	No	0.47	**
Up	3.9 (2.3)	No	0.38	*
Vigorous	3.6 (2.5)	No	0.50	**

*$p < 0.05$.
**$p < 0.01$.
† NS, not significant.

Subjects

Subjects were 75 social-drinking college student volunteers in a psychology class at a public New England university. Forty-one of these subjects (those who attended both class sessions) were tested again after a 2-week inter-trial interval. The magnitude of baseline ratings and the reliability of subscales was computed for the first wave of data (n = 75). Test-retest reliabilities for the adjective items were examined in the 41 subjects who completed the BAES during both waves of data collection. Of the 75 subjects who completed the first assessment, 16 (21.3%) were male and 59 (78.7%) were female. These subjects reported drinking an average of 3.8 drinks (SD = 2.7) an average of 13.2 times per month (SD = 4.4).

Procedure

Subjects reported the averaged quantity and frequency of alcohol consumption using an instrument adapted from Cahalan et al.[29] Subjects were then asked to complete an instrument entitled, "Alcohol Effects Scale." The following instructions were provided at the top of the form: "The following adjectives describe feelings that some people have after drinking alcohol. Please rate the extent to which each of these adjectives describes your feelings at the present time." Below the instructions, the 24 adjective items were listed in alphabetical order. For each item, subjects were required to circle a number from 0 (labeled "not at all") to 10 (labeled "extremely") that best described their present feelings.

It is important to note that the instructions described the adjectives as feelings commonly produced by alcohol. However, the instructions did not specify any conditions on the source of feelings reported in the adjective ratings. Instead, subjects were simply asked to report the extent to which adjectives described present feelings, regardless of the perceived cause.

RESULTS

Table 1 presents the 24 adjective items used in the initial version of the BAES. For each item, the mean and standard deviation of ratings during the first wave of testing is provided (n = 75). The test-retest correlation (Pearson r) is provided for the 41 subjects who completed the BAES during both waves of testing. If more than one subject asked about the meaning of an item, it was considered to have comprehension problems. This information is also provided in Table 1. Based on the information provided in Table 1, items were deleted from both the stimulant and sedative subscales of the BAES. The items "dysphoric," "euphoric," "sentimental," and "rapid thoughts" were eliminated due to comprehension problems. While all subjects understood the item "high," several indicated that it did not describe effects of alcohol, or could not be understood in terms of feelings that could be rated. Therefore, "high" was also eliminated.

There were no significant gender differences in the magnitude of ratings for any of the remaining items. Therefore, data were collapsed across gender for subsequent analyses of item properties. First, the items "burned out" and "light-headed" were eliminated due to nonsignificant test-retest correlations. Second, the remaining items were ranked with regard to a composite index of test-retest correlations (scored positively) and the magnitude of baseline ratings (scored negatively). For example, the item "sedated" had a mean baseline rating of 2.8, and a test-retest correlation of 0.65. The baseline mean was divided by 10, and the resultant value of 0.28 was scored negatively. Then, the values 0.65 and −0.28 were added, for a composite score of 0.37. The three items with the worst (i.e., lowest) composite scores ("bored," "drowsy," and "tired") were eliminated. This resulted in a 14-item BAES, comprised of a seven-item stimulant subscale and a seven-item sedative subscale.

The psychometric properties of the two seven-item subscales were examined in the ratings of subjects during the first wave of testing ($n = 75$). To examine the internal consistency of the items within their subscales, Cronbach's alpha values were computed. There were no significant differences among alphas computed separately for men and women; therefore, collapsed data are reported here. For the stimulant subscale, the mean item-total correlation was 0.81 (range = 0.77 to 0.86), and Cronbach's alpha was 0.94. For the sedative subscale, the mean item total correlation was 0.65 (range = 0.58 to 0.80), and Cronbach's alpha was 0.87. For both subscales, alpha was not increased with additional item deletion.

To further examine the convergent validity of items within their subscales, and to establish the divergent validity of the two subscales, a factor analysis was conducted on the data from the first wave of testing ($n = 75$). The solution was constrained to two factors. Principal components were used for factor extraction; oblique rotation was employed. The first factor was termed "stimulant," had an eigenvalue = 5.28, and accounted for 37.7% of the variance. The second factor was termed "sedative," had an eigenvalue = 4.11, and accounted for an additional 29.4% of the variance. Inspection of the factor loadings revealed that the proposed BAES factor structure and item placement was supported. All items loaded more highly on their proposed subscale (range = 0.68 to 0.90; mean = 0.81) than on the other subscale (range = −0.18 to 0.22; mean = 0.001). The correlation between the two factors was 0.03 in this analysis.

STUDY 2

The results of Study 1 suggest that the two seven-item BAES subscales have high internal consistency (Cronbach's alpha), and that the data are consistent with the proposed two-factor model, as measured in a sober state. However, the magnitude of baseline ratings in a sober state were well above 0, and there was considerable individual variability in these ratings. Alcohol response instruments which yield a low level of variability in baseline ratings are desirable, as variability in baseline scores reduces the ability to measure true individual differences in responses to alcohol.[18] Moreover, while positive and significant, the test-retest correlations were in the medium range. The non-repeatable variation suggested by the correlations is of concern, as it suggests that adjective ratings might change over multiple testings due to factors other than alcohol (e.g., subjects may feel more "sluggish" due to the amount of time they have spent in the experiment).

Thus, the data from study 1 provided a basis for modifying the BAES instructions to produce less variability in baseline ratings. Instructions were modified such that subjects were asked to rate the extent to which *alcohol* had produced the feelings described by each adjective. The new instructions for the BAES were as follows: "The following adjectives describe feelings that some people have after drinking alcohol. Please rate the extent to which drinking alcohol has produced these feelings in you at the present time." No other changes were made in the format of the BAES. The use of the new instructions was based on the assumption that persons are able to perceive and rate the extent to which alcohol has produced different feelings and sensations.

Subjects

Subjects were 30 male and 12 female social drinkers recruited from the Providence, RI, community who were paid for their participation. Subjects were excluded from this experiment if their responses yielded a score above 8 on the Michigan Alcoholism Screening Test,[30] or if they reported any sought or obtained treatment for an alcohol or drug problem. The mean age of the sample was 29.8 years (SD = 11.1). Female subjects were given a pregnancy test prior to participating in the experiment. Subjects reported drinking an average of 3.6 drinks (SD = 2.4; range = 1 to 9) an average of 7.8 times per month (SD = 7.5; range = 1 to 30).

Procedure

Subjects were tested individually in the early to late afternoon. Testing occurred in a spacious quiet room, and subjects were seated in a comfortable armchair. Subjects were required to abstain from eating or drinking anything but water for 4 hr, and to use no alcohol or other drugs for at least 24 hr, before the beginning of the experiment. After arriving at the laboratory, subjects provided a breath sample for analysis (IR-3000; Intoximeters, Inc.), to ensure that their BAC was 0. Subjects reported the average quantity and frequency of alcohol consumption over the past 12 months, using an instrument adapted from Cahalan et al.[29] Next, subjects read the BAES instructions. Then, the experimenter read the BAES instructions aloud, and emphasized that subjects were to rate the extent to which alcohol produced the feelings described by the adjective items.*

Next, subjects consumed either 0.75 ml/kg (males) or 0.65 ml/kg (females) of absolute alcohol, delivered as 95% alcohol mixed with five parts chilled fruit juice. Subjects consumed the entire dose in 15 to 20 min, and then rinsed with room temperature water. After a 7-min waiting period, subjects were given breath alcohol tests every 2 to 4 min until they reached a rising BAC between 0.03% and 0.06%. At this time, subjects completed the BAES. Multiple breath tests were administered until subjects reached a descending BAC which corresponded to the ascending BAC at which they had been initially tested. Subjects then completed the BAES a second time. Data were used only if the subject reached a peak BAC at least 0.01% higher than the BACs at both the ascending and descending limb measurements; this criterion was met for all subjects.

RESULTS

The time between the ascending and descending limb assessments ranged from 71 to 149 min. The mean ascending BAC at the time of assessment was 0.52% (SD = 0.011); the mean descending BAC was 0.049% (SD = 0.009). The ascending and descending BACs were very similar within subjects (mean ascending − descending difference = 0.003%, SD = 0.006). The mean peak BAC was 0.064% (SD = 0.012). Men and women did not differ in peak BACs or the rising and falling BACs at which data were collected.

Stimulant and sedative subscale scores were computed by adding together the rating value for each of the seven items in that subscale. The psychometric properties of the seven-item stimulant and sedative subscales were first examined via item-total correlations and internal consistency (Cronbach's alpha), computed separately for the

* *Previous to this experiment, the new instructions were pilot tested in a sample of sober subjects to ensure that ratings in a sober state were 0 (no effect). Ratings were at 0 for all items for all subjects ($n = 7$).*

ascending and descending limbs of the blood alcohol curve. Alpha values did not differ significantly between men and women; therefore, data were collapsed across gender for subsequent psychometric analysis. Table 2 gives Cronbach's alpha and item-total correlations for each subscale on each limb of the blood alcohol curve. The subscales showed high internal consistency and item-total correlations for both rising and falling BACs. Alpha values ranged from 0.85 to 0.94. The alpha-if-items-were-deleted values reveal that deletion of any item would decrease alpha on one or both limbs of the blood alcohol curve. Therefore, no items were deleted from either subscale.

To further establish the convergent validity of items within their subscales, and to examine the divergent validity of the two subscales, factor analyses were conducted separately for the two limbs of the blood alcohol curve. Each analysis constrained the solution to two factors, using principal components for factor extraction and oblique factor rotation.

In each case, the proposed factor structure of the BAES, including the placement of items within subscales, was supported. For the ascending limb data, factor 1 ("stimulant") had an eigenvalue of 6.18, and accounted for 44.1% of the variance. Factor 2 ("sedative") had an eigenvalue of 2.92 and accounted for an additional 20.9% of the variance. Every item loaded more highly on its own subscale (range = 0.46–0.97; mean = 0.78) than on the other subscale (range = −0.20–0.40; mean = 0.04). The two factors correlated 0.27 in this analysis.

For the descending limb data, factor 1 ("simulant") had an eigenvalue of 6.76, and accounted for 48.3% of the variance. Factor 2 ("sedative") had an eigenvalue of 3.32 and accounted for an additional 23.7% of the variance. Once again, every item loaded more highly on its own subscale (range = 0.57–0.97; mean = 0.82) than on the other subscale (range = −0.24–0.23; mean = 0.03). The factors correlated 0.28 in this analysis.

Effects of limb of the blood alcohol curve, BAES subscale, and gender on the magnitude of ratings were then examined. It was predicted that stimulant ratings would be higher than sedative ratings during rising BACs, and that sedative ratings would be higher than stimulant ratings during falling BACs. The data were analyzed using a 2 (BAES subscale) × 2 (ascending vs. descending limb of the blood alcohol curve) × 2 (gender) repeated-measures ANOVA. There was neither a main effect of scale, $F(1,40) = 0.18$, $p > 0.6$, nor of gender, $F(1,40) = 0.14$, $p > 0.7$. A significant main effect of limb was obtained, $F(1,40) = 8.69$, $p < 0.01$, such that ratings were higher on the ascending compared with the descending limb of the blood alcohol curve. However, this main effect is best understood in the context of two significant two-way interactions described below.

A significant interaction of gender and limb was obtained, $F(1,40) = 8.26$, $p < 0.01$. Post-hoc Tukey tests revealed that men's ratings did not differ on the two limbs, whereas women's ratings were higher on the ascending compared to the descending limb ($p < 0.01$). Most pertinent to the present hypotheses, a significant interaction of limb and subscale was also obtained, $F(1,40) = 18.96$, $p < 0.001$. Planned comparisons revealed the predicted differences, with stimulant ratings higher than sedative ratings on the ascending limb of the blood alcohol curve (22.7 vs. 15.3, $p < 0.001$, one-tailed test), and sedative ratings higher than stimulant ratings on the descending limb of the blood alcohol curve (19.4 vs. 14.7, $p < 0.05$, one-tailed test). No other interactions were significant. Figure 1 shows mean ratings for each subscale on each limb of the blood alcohol curve.

Interestingly, the two BAES subscales correlated, albeit at a low level, on both the ascending limb ($r = 0.34$, $p < 0.05$) and the descending limb ($r = 0.33$, $p < 0.05$). This suggests that those who experience more alcohol stimulation also tend to experience more alcohol sedation. If replicated, these results have important implications for understanding individual differences in responses to alcohol, although it must be remembered that one subscale explains only about 11% of the variance in the other subscale in the present data.

The average quantity of alcohol consumption was correlated −0.41 ($p < 0.01$), and the average number of drinks consumed per month was correlated −0.32 ($p < 0.02$) with ratings on the sedative subscale during ascending BACs. Alcohol consumption variables were not signif-

Table 2. Psychometric Properties of the BAES Stimulant and Sedative Subscales, Provided Separately for the Ascending and Descending Limbs of the Blood Alcohol Curve.

Ascending limb				Descending limb			
Stimulant subscale Alpha = 0.94		Sedative subscale Alpha = 0.85		Stimulant subscale Alpha = 0.94		Sedative subscale Alpha = 0.91	
Item	Item-total r	Item	Item-total r	Item	Item-total r	Item	Item-total r
Elated	0.73	Difficulty concentrating	0.63	Elated	0.76	Difficulty concentrating	0.73
Energized	0.84	Down	0.49	Energized	0.89	Down	0.54
Excited	0.83	Heavy head	0.61	Excited	0.75	Heavy head	0.70
Stimulated	0.77	Inactive	0.57	Stimulated	0.73	Inactive	0.71
Talkative	0.73	Sedated	0.61	Talkative	0.79	Sedated	0.71
Up	0.88	Slow thoughts	0.71	Up	0.84	Slow thoughts	0.78
Vigorous	0.85	Sluggish	0.63	Vigorous	0.91	Sluggish	0.92

Cronbach's alpha is provided by subscale and limb. For each item, item-total correlations are provided.

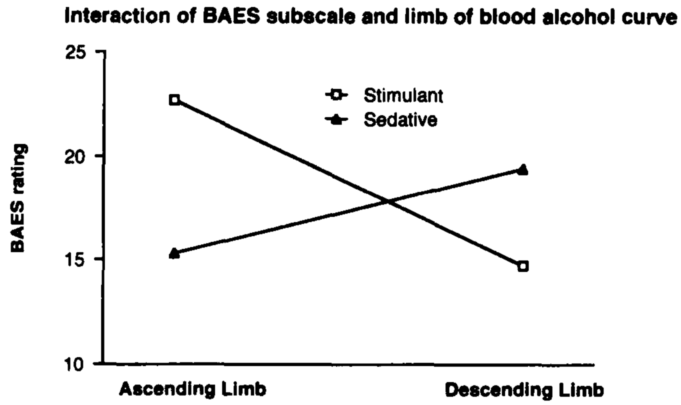

Fig. 1. The magnitude of ratings on the stimulant and sedative subscales of the BAES on the ascending and descending limbs of the blood alcohol curve. Data are mean values across 30 male and 12 female social drinkers.

icantly correlated with sedative ratings during descending BACs, or with stimulant ratings on either limb of the blood alcohol curve. The data are cross-sectional and do not lend themselves to causal inferences, but suggest some type of relationship between alcohol consumption and reduced sedative effects of alcohol during ascending BACs.

DISCUSSION

The present data suggest that the BAES holds promise as a self-report measure of the stimulant and sedative effects of alcohol. An initial item pool was derived from multiple sources. Items which were retained showed reasonable stability, no observed problems with comprehension, high internal consistency, and were consistent with the proposed factor structure, as measured in a sober state. In persons who consumed alcohol, the stimulant and sedative subscales had high internal consistency and were consistent with the proposed factor structure, on both limbs of the blood alcohol curve. Importantly, the magnitude of ratings on the two BAES subscales interacted with limb of the blood alcohol curve in the predicted pattern. Alcohol consumption variables were negatively correlated with sedative ratings during ascending BACs. Taken together, these data provide some initial validation of the BAES.

There are several limitations to the present data. One limitation is that dose-response effects were not assessed. The present doses of 0.75 ml/kg alcohol (males) and 0.65 ml/kg alcohol (females) were designed to produce equivalent BACs in the two genders and were chosen because they are thought to produce both stimulant and sedative effects in most social drinkers over the course of the blood alcohol curve.[2,4] It is well known, however, that drug effects can be nonlinear or discontinuous across doses, and therefore it is important to characterize dose-response characteristics of the BAES subscales. Given the literature on dose-response characteristics of alcohol stimulation and sedation in animal and human research, sedative effects should become greater than stimulant effects as the dose of alcohol increases, although such effects should interact with point of assessment on the blood alcohol curve.

Another limitation is that only two points on the blood alcohol curve were assessed. It is important to understand how stimulant and sedative effects change over time across the blood alcohol curve. However, such an approach requires that multiple administrations of the BAES do not produce any repeated-measures effects. The possibility of order effects exists in the data from study 2, as a within-subjects design was used, and subjects always were tested during ascending BACs before descending BACs. A between-subjects design is needed to address this issue, in which subjects complete the BAES only during ascending or descending BACs. This approach was not chosen in our initial validation study due to the large individual variability which is known to exist in responses to alcohol.

In addition, the BAES was not validated using multimodal assessment. BAES subscales should covary with items from other self-report measures that appear to measure alcohol stimulation and sedation. Further, subscale ratings should covary with other behavioral and psychophysiological patterns related to stimulant and sedative effects, and stimulant effects should relate to perceived reinforcement from alcohol.[31]

Caveats must be made with regard to the current BAES instructions. In study 2, care was taken to clearly explain the BAES instructions to subjects. The properties of the instrument may be compromised if subjects do not understand that they are to rate the extent to which alcohol has produced the feelings described by the adjective items. Moreover, the current BAES instructions assume that subjects can perceive and rate the extent to which alcohol has produced feelings and sensations described by the adjective items. This assumption is similar to that of researchers who measure subjective intoxication ratings, as subjects who report intoxication levels must perceive and rate cues which reflect alcohol's effects rather than other causes. However, this assumption is even more important for the BAES, as it measures more specific effects using a variety of linguistic descriptors.

One empirical approach to test subjects' ability to report effects due to alcohol is to correlate baseline ratings to the adjectives with responses to the BAES after alcohol consumption. At baseline, subjects would report the extent to which they were experiencing feelings and sensations, regardless of the perceived cause. If BAES responses are not dependent on ratings of feeling states while sober, this would be consistent with the idea that subjects can report effects which are due to alcohol. In retrospect, we realized that we should have employed this approach in study 2 to examine issues of baseline dependence. Baseline ratings of feeling states using the same adjectives are currently being collected in a second validation study.

It should also be noted that, as for many measures of responses to alcohol, nothing is known about repeatabilities (test-retest correlations) of the BAES subscales under conditions of alcohol consumption. Many psychomotor and pharmacokinetic responses to alcohol show very low repeatabilities,[32] although repeatabilities are higher for subjective responses to alcohol.[25] Repeatabilities should be established for the BAES subscales, as low repeatabilities can obscure individual and group differences in responses to alcohol.

If its psychometric properties are further established, the BAES will be an important addition to many human alcohol administration experiments. The BAES could help researchers examine individual differences in conceptually different types of alcohol effect which in turn have different consequences for behavior. The BAES may also be valuable in studies of chronic tolerance and chronic sensitization to the stimulant and sedative effects of alcohol.[33] Further data on biphasic alcohol effects hold promise for examining the relation between responses to alcohol and risk for the future development of alcohol problems.

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