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Idiographically-determined versus standard absorption periods in alcohol administration studies

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Abstract

BACKGROUND—Effects of alcohol vary depending on blood alcohol level and limb. Some researchers use standard absorption periods (SAPs) to determine when post-drinking experimental protocols should begin. Others use an idiographically-determined absorption period (IDAP) based on criterion breath alcohol concentration (BrAC). We investigated and compared the characteristics of each method.

METHODS—Sixty-eight social drinkers (47% women) consumed a bolus dose of alcohol intended to raise BrAC to .08%. BrACs were recorded every three minutes until beginning to descend. Minutes to reach criterion BrAC (.06%) and between-subjects post-drinking BrAC variability were analyzed.

RESULTS—Mean time to reach .06% BrAC was 22.9 ± 14.6 minutes. Standard deviations in BrAC were four times greater using SAPs compared to IDAPs. Ten percent of participants' BrAC readings were on the descending limb 30 minutes post-drinking and 25% were descending at 45 minutes post-drinking.

CONCLUSIONS—IDAPs result in less BrAC variability and may reduce experimental noise relative to SAPs. Experimental control in future alcohol administration studies may be enhanced by the use of IDAPs instead of SAPs.

Keywords

alcohol administration; absorption period

The effects of alcohol vary with both blood alcohol level and limb of the blood alcohol curve. Although individual differences exist (e.g., Holdstock and de Wit, 1998; King et al., 2002), the ascending limb is associated with euphoria and stimulation whereas the descending limb is associated with dysphoria and sedation (e.g., Martin et al., 1993). Therefore, in studies examining physiological effects of alcohol, it is important to establish both alcohol level and limb.

Many laboratories use a standard absorption period (SAP), e.g., 30 minutes, to allow a bolus dose of alcohol to be absorbed and participants to arrive at the desired breath alcohol concentration (BrAC) before beginning the experimental protocol. Shorter SAPs are used to place participants on the ascending limb whereas longer SAPs are used to place participants

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on the descending limb (e.g., Schweizer et al., 2006). The SAP method may result in large variability in BrACs, and in some cases variability in BrAC limb, during completion of dependent measures. An alternative method is to use idiographically determined absorption periods (IDAPs) – that is, those based on participant's individual BrAC readings – to determine BrAC level and limb. In this approach, participants are breathalyzed at regular intervals until their BrACs reach a criterion and they begin dependent measures (e.g., Giancola and Zeichner, 1997). IDAPs would seem to provide better experimental control than SAPs in regards to both BrAC level and limb, but to our knowledge this has not been demonstrated empirically. Furthermore, given the labor intensive nature of using IDAPs with repeated breath analysis, the question of to what, if any, extent the method is worth using is in need of investigation.

The purpose of the present study is to describe and compare the characteristics of these two experimental methods for allowing for alcohol absorption. We expected less heterogeneity in participants' BrACs using IDAPs compared to SAPs. Moreover, we expected that heterogeneity of BrACs would increase as the length of the SAPs increased.

Materials and Methods

Participants ($N = 68$; 47% women) were ages 21 to 35 years ($M = 25.0$, $SD = 3.4$) and reported consuming between one and 35 alcoholic beverages per week. All participants provided informed consent before participating and all procedures were approved by the university's Institutional Review Board. Participants were 78% European-American, 7% Asian, 6% Latino/a, 3% African-American, and 6% multi-racial or other. Collins et al.'s (1985) Daily Drinking Calendar was used to assess typical weekly alcohol consumption. Men's mean reported number of drinks per week was 11.0 ($SD = 9.1$) whereas women's was 7.4 ($SD = 7.1$). Participants were instructed not to consume food or caloric drinks for four hours before their scheduled appointment. They were asked to confirm that they had adhered to these instructions when they arrived at the laboratory. They were given nine minutes to consume an oral bolus dose based on body weight of 100-proof vodka mixed with orange juice intended to achieve a peak BrAC of .08% (.82 g/kg for men, .69 g/kg for women). Beverages were divided into three cups containing roughly equal portions and participants were instructed to finish one cup every three minutes. BrAC was tested every three minutes using an Intoxilyzer 5000 (CMI Inc., Owensboro, KY). Subjective intoxication was measured by asking participants "On a scale of 1 (no effect) to 10 (extremely intoxicated), how intoxicated do you feel right now?" each time they were breathalyzed. Participants rinsed their mouths with water five times and were breathalyzed until at least three consecutive descending readings below peak BrAC were obtained. Participants were debriefed, paid \$15/hr., and released when BrAC dropped to .03%. Participants' BrACs were analyzed to determine whether BrAC patterns would differ based on whether an SAP or an IDAP was used.

Results

Analyses were conducted using Statistical Package for the Social Sciences, version 15. A hypothetical criterion of .06% BrAC was set as the point at which ascending-limb participants would move on to dependent measures. This was chosen as an IDAP/SAP comparison point because it has been used in the past to ensure that participants were on the ascending limb of intoxication while completing dependent measures (e.g., Davis et al., 2009; George et al., 2009). Participants were classified as having met criterion if they had two ascending BrAC readings at .06 or above. Descriptive statistics are in Table 1. Participants took a mean of 65.2 minutes post-drinking to reach their highest BrAC reading ($SD = 28.8$, minimum = 23 min, maximum = 161 min). Using an IDAP, the mean ($\pm SD$)

time to reach criterion (.06% BrAC) was 22.9 ± 14.6 minutes. IDAPs ranged from 6.0 to 76.0 minutes (Figure 1). SAP SDs were approximately 4 times greater than was the IDAP SD (Figure 1). To evaluate whether variability in IDAP BrAC remained low after subjects reached criterion BrAC, we analyzed BrAC readings using IDAP at 15 minutes post-criterion (IDAP+15) and found a mean of $.078 \pm .012$, slightly over one-half the SD associated with SAPs. At 15 minutes post-drinking, 0% of participants had reached peak BrAC. At 30, 45, and 60 minutes post-drinking, 10.4% ($n = 7$), 25.4% ($n = 17$), and 52.2% ($n = 35$), respectively, of participants' BrAC had peaked or begun descending.

Discussion

These findings suggest that, compared to idiographically-determined absorption periods (IDAPs), using standard absorption periods (SAPs) to determine when participants should begin experimental protocols introduces a significant amount of variance in subjects' BrACs and may result in the misclassification of BrAC limb, especially as SAPs increase. Comparatively lower variance associated with IDAPs persisted over time. Fifteen minutes after reaching criterion BrAC, the standard deviation in subjects' BrACs remained below the standard deviations associated with SAPs, implying that subjects completing dependent measures immediately post-criterion BrAC would continue to maintain similar BrACs. In addition, a notable minority (10%) of participants were already on the descending limb 30 minutes post-drinking. Subjective ratings of intoxication did not appear to vary significantly depending on absorption period protocol; however, this may be due to the range (1-10) of the data, which was limited in comparison to BrAC readings.

Variability in subjective intoxication did not differ significantly depending on whether an idiographic or standard absorption period was used. Although many researchers use BrACs instead of subjective intoxication as their primary measure of intoxication, the importance of subjective intoxication, controlling for BrAC, in predicting post-drinking perceptions, performance, behaviors, and other outcomes remains open to investigation. Because the present study examined subjective intoxication and BrAC as dependent variables, rather than as independent variables predicting some outcome, it cannot speak to the relative importance of subjective versus objective measures of intoxication.

Maintaining homogeneity of participant limb when assessing dependent measures is crucial in light of research indicating that subjective effects and behavior differ with regard to whether an individual's BrAC is on the ascent or has peaked and begun falling. For example, individuals on the ascending limb of intoxication exhibit more aggressive behavior than those on with similar BrACs on the descending limb (Giancola & Zeichner, 1997). These effects have been observed in a range of dependent measures, including those relating to motor skills, cognition, and sexuality (Schweitzer et al., 2006; Holdstock & de Wit, 1998). Thus, reducing the variance in BrAC may decrease the likelihood of Type II errors, as variability in other dependent measures is likely to decrease if methods ensure that participants complete them on the same limb.

The primary compromise in using IDAPs is increased variance in post-drinking time before dependent measures. This potential threat to internal validity can be eliminated by using yoked control subjects (e.g., Giancola and Zeichner, 1997), such that each no-alcohol subject is assigned to undergo the same waiting period and number of breath tests as a corresponding alcohol subject. Further research should include direct comparisons of behavioral dependent measures based on whether idiographically-determined or standard absorption periods are used and assess whether subjective or objective measures of intoxication differ in their capacity to predict behavior across the biphasic curve of

intoxication. However, the current findings indicate that use of IDAPs reduces BrAC variance and ensures that BrAC limb is accurately identified.

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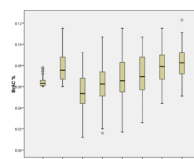


Figure 1.

Box plot showing the variability resulting from varying hypothetical idiographically determined versus standard absorption periods. IDAP = idiographically determined absorption period (criterion BrAC = .06%). IDAP15 = IDAP + 15 minutes. SAPx = standard absorption period of x minutes. Median values denoted by horizontal line in each box. Whiskers indicate minimum and maximum values. Box lengths indicate interquartile range. Circles indicate outliers (> 1.5 interquartiles away from the box).

Table 1

Descriptive statistics for breath alcohol concentrations and subjective intoxication ratings achieved using hypothetical waiting periods.

	M	SD	Min	Max
Peak	.091	.013	.055	.123
IDAP	.065	.005	.060	.082
SI	5.4	1.8	2.0	9.0
IDAP+15	.078	.012	.060	.120
SI	6.6	2.1	2.0	10.0
SAP15	.056	.018	.012	.095
SI	5.0	1.9	1.0	9.0
SAP20	.064	.020	.016	.107
SI	5.5	2.0	1.0	10.0
SAP25	.067	.019	.017	.115
SI	6.1	2.0	1.0	10.0
SAP30	.072	.018	.026	.107
SI	6.3	2.0	1.0	10.0

Note. IDAP = idiomatically determined absorption period based on a criterion BrAC of .06%. Peak = mean highest BrAC reading. SAPx = standard absorption period of x minutes. "SI" = subjective intoxication rated on a 1-10 scale and assessed concurrently with BrAC.