Repeated Alcohol Use and Sober-State Reactive Aggression: The Mediating and Moderating Role of Sober-State Executive Cognitive Functioning

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(Abstract)

This study examined the cumulative, more insidious, impact of repeated drinking on sober-state aggression based on research that has pointed to the negative neural effects of chronic alcohol consumption, especially on frontal lobe functioning. In particular, it examined the relationship between repeated alcohol use and sober-state reactive aggression as it is mediated or moderated by sober-state executive cognitive functioning (ECF), thus expanding upon research that has examined the relationship between acute alcohol intoxication and consequent aggression while under the influence (Giancola, 2000b). It was hypothesized that ECF would mediate the relationship between repeated alcohol use and sober-state reactive aggression in college students in that a history of alcohol use would lower sober-state ECF which in turn would increase sober-state impulsive aggression in individuals. It was further hypothesized with a moderational model that high levels of ECF would offset the more insidious effects of repeated alcohol use on subsequent sober-state aggressive acts. Moreover, those effects would remain after controlling for potential confounds of violence exposure, gender, and intelligence.

Eighty college students, aged 18-23 years, from Virginia Tech were recruited to participate in this study. A self-report measure for aggression, neuropsychological tests for ECF, and a lifetime drinking interview schedule were used to assess the relationship between cumulative alcohol use, sober ECF, and sober aggression. A combination of bivariate and hierarchical regression analyses was used to analyze the data.

The hypotheses of this study were not supported. Instead, the results supported a positive relationship between prior exposure to violence and later escalation of alcohol use and perpetrated violence. Additionally, these results support the presence of a "binge drinking" pattern within the sample.

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I dedicate this paper to my grandfather, George Howard Shumate. Out of an era and place where educational pursuits were not expected nor the norm, he embarked on a lifelong, unquenchable, quest for knowledge. His example and encouragement continue to inspire my endeavors.

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Introduction

Although alcohol use has been studied at great length in its relation to aggression, little research has focused on this relationship as it pertains to college students. This is not to say that alcohol consumption as well as aggression among college students is not prevalent based on epidemiological surveys. Giancola (2002a) reported that between 25-30 percent of male and female college students reported having been involved in a fight while under the influence of alcohol. Other research has indicated that young adults admit to instigating aggressive acts at fairly high rates with 20% of males and 13% of females admitting to initiating some form of aggression regardless of being intoxicated (Leonard, Quigley, & Collins, 2002). Leonard et al. (2002) also reported in the same study that among those college students that admitted to initiating violence, the violence was often of a severe nature. Among the males, 56% admitted to punching or kicking and approximately 4% admitted to using some type of weapon. Among females, 61% reported punching or kicking, while none reported using a weapon.

In addition to aggression, alcohol consumption and use has been documented extensively among college students in that it is viewed as an epidemic with numerous negative outcomes. Wechsler, Lee, Kuo, and Lee (2000) conducted a comprehensive study of alcohol consumption at universities and colleges across the country during the 1990s. They specifically looked at “binge drinking” among college students being defined for males as 5 or more drinks (for females as 4 or more drinks) consecutively in the two weeks preceding the survey. Wechsler et al. found an overall increase in the frequency of binge drinking during the past decade, meaning students are drinking at abusive levels more often. Additionally, they found that not only were students binge drinking in college, but that this pattern was a carryover from high school. Approximately 70% of the students that were binge drinking in college had done so in high school. Finally, when examining the college students as a whole they found on average 20% of the respondents admitted to drinking 10 or more times in the preceding month with approximately 40% of the respondents stating they usually binge drink when drinking at all. On average, 46% percent of the students stated they drink to get intoxicated.

Executive Cognitive Functioning and Aggressive Behavior

Executive Cognitive Functioning (ECF) or Executive Functioning is often described as the ability to develop a response to a complex problem or a "higher order cognitive construct involved in the planning, initiation, and regulation of goal oriented behavior. The cognitive abilities subsumed within the construct include attentional control, previewing, strategic goal planning, temporal response sequencing, self- and social monitoring, abstract reasoning, cognitive flexibility, hypothesis generation, and the ability to organize and adaptively use information contained in working memory" (Giancola, 2000b, p. 582). The prefrontal cortex (PFC) area of the brain is directly related to functions of ECF (Cherek, 2000). This is reflected in studies showing that individuals with ECF deficits do poorly on certain neuropsychological tasks, measuring frontal functioning, such as the Wisconsin Card Sorting Test, Trails B, and the Continuous Performance Test (Giancola, 2000b). Normal ECF is attributed with inhibiting inappropriate, reactive, or impulsive types of behavior with shifts toward other more appropriate behaviors. It has been suggested that after traumatic brain injuries (accidents or assault related) or acquired brain injuries (stroke, tumors, aneurysm) which damage frontal areas of the brain, individuals exhibit a pattern of behavior that has come to be called "frontal lobe syndrome." The syndrome is associated with difficulties in planning, attention, working memory, impulsiveness, and disinhibition among other variables (Sato, Kumada, Koji, & Okaniwa, 2000). As such, people with deficits in these areas are more prone to exhibit reactive aggressive behavior when provoked or otherwise threatened (Hoaken, Assaad, & Pihl, 1998).

Reactive aggression refers to aggression exemplified by necessary provocation (i.e. a perceived or real threat) and "angry outbursts," other researchers have referred to this type of aggression under various labels such as affective, defensive, "hot-tempered," or hostile (Vitaro, Brendgen, & Tremblay, 2002). Reactive aggression stands in comparison to proactive aggression, which is "goal-oriented" and does not stem from anger or provocation. Proactive aggression has also been referred to as instrumental, predatory, offensive, or "cold-tempered" aggression (Vitaro et al.).

Alcohol's Cumulative Effects on ECF

Parsons (1998) found evidence for a "generalized diffuse" hypothesis that cumulative alcohol consumption affects all parts of the brain. Other research has found brain shrinkage and brain tissue damage via magnetic resonance imaging (MRI) and computed tomography (CT) in individuals who meet Diagnostic and Statistical Manual of Mental Disorders (DSM-IV) criteria for alcohol dependence (Oscar-Berman, Shagrin, Evert, & Epstein, 1997). Oscar-Berman et al. also stated that alcohol dependent individuals can suffer brain changes which are measurable by various neuropsychological tests. Interestingly, the most consistent and abundant finding concerning alcohol's effect on the brain have been deficits within the frontal brain region (Oscar-Berman et al.), the same area hypothesized to regulate ECF. Accordingly, the frontal lobe system dysfunction model states that chronic alcohol consumption disrupts the cognitive attributes typically associated with the frontal lobes thus impairing the aforementioned inhibitory control (Evert & Oscar-Berman, 1995). Evert and Oscar-Berman state that this model is based on evidence of frontal system damage from neuroimaging studies as well as from studies comparing cognitive abilities in alcoholics to others who have suffered known frontal lobe damage unrelated to alcohol.

Although much of the research examining cognitive impacts of alcohol on the brain have involved alcoholics with significant problems, there is evidence to suggest the detrimental effects of alcohol can be viewed as working on a continuum. The "continuum hypothesis" states that the deleterious effects on the brain caused by alcohol consumption should be related to the extent of one's alcohol consumption (Evert & Oscar-Berman, 1995). This view would suggest that the amount, frequency, and duration of alcohol consumption during one's life would positively correlate with impacts to the brain in areas such as ECF. Parsons and Nixon (1998) suggest that, with all that is known about the rapid acute effects of alcohol on the brain, there very well may be residual impacts on the various cognitive processes. Certain studies have examined the impacts of alcohol on cognitive functioning in social drinkers and have not found the glaring deficiencies often found in alcoholics or people with a history of abusive alcohol consumption. However, Giancola, Zeichner, Yarnell, and Dickson (1996) looked at a group of white males (age 17 to 30) without severe alcohol problems or other neuropsychological deficits who were considered social drinkers. They found while testing these individuals, while sober, that their cognitive abilities did not show related detriments except in the area of impulse control as measured by several neuropsychological measures. This could suggest that even social drinking to some degree impacts frontal functioning in that impulse control is attributed to this area. Therefore, this may suggest that although social drinking may fall low on the continuum of impairment, they may still experience deficits in the area of impulse control.

Alcohol Use, ECF, and Reactive Aggression

Giancola (2000b) discusses various frameworks in which ECF can be tested as either a moderator or a mediator. Giancola mentions that the hypothesis of ECF functioning as a moderator has not been empirically shown, although he posits that there is adequate evidence to uphold such a supposition. The moderation hypothesis suggests that during acute intoxication people with moderate to low sober-state levels of ECF will be more susceptible to aggressing under provocative conditions. As a caveat, Giancola adds that within this hypothesis ECF will exert an inverted U-shaped influence on the alcohol-aggression relationship. In other words, people with very low or very high sober-state ECF will exhibit less aggression that is due specifically to acute alcohol consumption. Sober individuals with very low ECF will already be predisposed to impulsive aggression regardless of alcohol ingestion, while sober individuals with very high ECF will be able to compensate for the influences of alcohol on aggression.

Giancola (2000b) also discusses a separate hypothesis of ECF as a mediator. In this hypothesis, he states that ECF acts as a mediator in that, "acute alcohol consumption leads to a disruption of executive [cognitive] functioning, which leads to a dsyregulation of goal-directed behavior, and this, in conjunction with a provocative environment, will act to increase the probability of an aggressive reaction" (Giancola, 2000b, p. 586).

This study intends to expand on Giancola's (2000b) mediational model. In this study, alcohol will not be examined in the acute sense, but instead studied in relation to how repetitive alcohol use may affect the measured level of reactive aggression in the individual while not intoxicated. Also, this study will expand upon Giancola's (2000b) theory by going beyond the acute effects of alcohol into the more insidious long term effects of repeated alcohol consumption on ECF. ECF will be examined as a mediator, based on the notion that a history of alcohol use will tend to damage the brain and in general lead to decreased ECF (Oscar-Berman et al., 1997). Therefore, a history of alcohol use may affect sober-state ECF which in turn may affect sober-state impulsive aggression in individuals. Because, this study will examine alcohol's effect on reactive aggression when the individual is not intoxicated, it adds to prior research by considering other settings. Finally, the current study will act to bolster Giancola's research in that not only does acute alcohol consumption disrupt real-time ECF but repeated acute alcohol consumption may also act to disrupt and diminish ECF on a more permanent basis.

In addition Giancola's (2000) theorized moderation hypothesis will be expanded upon in this study in a purely exploratory format to examine any moderating effects that sober-state ECF may exhibit on the suggested relationship between repeated alcohol use and sober-state reactive aggression. Giancola suggests moderate levels of ECF may offset the effects of acute alcohol intake on aggression while intoxicated. In the same way, this study proposes that moderate levels of ECF may offset the more insidious effects of repeated alcohol use on subsequent sober-state aggressive acts. The inverted U-shaped curve suggested by Giancola that represents the influence of intoxicated state ECF on aggressive acts, is still be expected to remain in testing the sober-state moderation scenario suggested by this study.

In summary, the purpose of this proposed study is to examine the potential mediating and moderating effects of sober-state ECF on the relationship between repeated alcohol use and sober-state aggression.

Hypotheses

It is hypothesized that ECF will mediate the relationship between repeated alcohol use and sober-state reactive aggression in college students. According to the mediational model discussed by Baron and Kenny (1986) the following predictions are made. First, it is predicted that repeated alcohol use is positively related to reactive, impulsive, aggression when not intoxicated. Second, repeated alcohol use episodes are forecasted to negatively impact sober state ECF. Third, ECF is predicted to be negatively related to aggression. Finally, the mediational construct of ECF will statistically account for and significantly reduce the initial relationship between repeated alcohol use and sober-state reactive aggression.

In relation to the exploratory examination of the moderational hypothesis, the following predictions are made in accordance with Holmbeck (1997, 2002). It is predicted that the moderator variable (ie. sober-state ECF), will interact with the predictor variable (ie. repeated alcohol use), in such a manner as to impact the levels of sober-state aggression (ie. criterion variable). As mentioned earlier the relationship between repeated alcohol use and levels of sober-state reactive aggression is posited to be strongest in cases where individuals possess moderate levels of ECF. Individuals with very low levels of ECF would be prone to sober-state aggression regardless of repeated alcohol intake and individuals with high ECF have enough to "spare" and are able to overcome the effects of repeated alcohol consumption.

Method

Participants

This study recruited Virginia Tech undergraduate students as participants from the Psychology Department's online Sona System subject pool. Both male and female students eighteen years or older were permitted to participate in the study. Via Sona System eligibility requirements, participants with past serious head injuries, diagnosed learning disabilities, or psychotic episode(s) were excluded from participation in the study (Giancola, Moss, Martin, Kirisci, & Tarter, 1996). After completing the informed consent, the participants completed a medical questionnaire and a head injury inventory as a second screening for disqualifying criteria. The participants in this study consisted of 80 adults (20 males, 60 females) who ranged in age from 18 to 23 (M = 19.10, SD = 1.074). Age of the participants broke down as follows: 33.8% were 18, 35.0% were 19, 23.8% were 20, 3.8% were 21, 2.5% were 22, and 1.3% were 23. The participants were also identified by race, with 77.5% (n = 62) Caucasian, 11.3% (n = 9) Asian, 5.0% (n = 4) African-American, 5.0% (n = 4) Other, and 1.3% (n = 1) Hispanic comprising the sample. Males reported drinking an average of 6.3 drinks per drinking occasion and females reported drinking an average of 4.0 drinks per occasion both levels considered binge drinking. Demographic information was obtained with us of a medical questionnaire.

Measures

Lifetime Drinking Quantification (LDH). Alcohol use history was measured using the Lifetime Drinking History (LDH) (Skinner & Sheu, 1982). This structured interview provides quantitative data on patterns of alcohol consumption since the onset of regular drinking. Two scores from the LDH were used for this study: the Lifetime Total Volume - Drinks (LTVD) and the Lifetime Total Volume - g/kg (LTVg/kg). The LTVD estimates the participant's total number of standard drinks over their lifetime. The LTVg/kg estimates the participant's total alcohol consumption (13.6 grams of alcohol equaling one drink) as a factor of their weight in kilograms, thus controlling for weight. Scoring of the LDH was completed using Skinner's (1978) protocol. Skinner and Sheu report test-retest reliabilities for both the LTVD and LTVg/kg as .80.

Aggression (AQ). The Aggression Questionnaire (AQ) (Buss & Perry, 1992) was used to assess for reactive aggression in the subjects. The AQ is a 29-item measure of the subject's self-perceived aggression and anger. The respondents answer each item on a Likert scale from 1 (Extremely uncharacteristic of me) to 5 (Extremely characteristic of me). The measure contains four scales examining physical aggression (PA), verbal aggression (VA), anger (A), and hostility

(H). The total composite (COMP) score, a sum of the aforementioned scores, was used in this study. A higher score on all scales corresponds with greater aggression. The internal reliability ($\alpha = .82$) of the AQ composite score was calculated using Cronbach's alpha.

Executive Cognitive Function - Measure One (Stroop). One of the measures used to assess ECF was the Stroop Color and Word Test (Stroop) (Golden, 1978). Each card in this three card version of the Stroop, has five columns with 20 items in each column. The participants were presented each card in a fixed order. On the first card they read the written names of various colors (blue, green, red, & yellow) that are printed in black ink (word-reading condition). On the second card they named the color of the color patches represented by XXXX of different colors (color-naming condition). Finally, on the last card they named the color of "color-incongruent" words (color-word naming or interference condition). The participants had 45s to complete as many items as they could on each card. The test was computer scored. This study utilized the interference t-score (Stroop interference) which was calculated using a formula comparing the number of items correct between card two and three. A higher t-score indicates higher functioning ECF. Coefficient alpha have been reported for the Stroop interference score in the .70 range (Golden, 1978).

Executive Cognitive Function - Measure Two (WCST). The Wisconsin Card Sorting Test: Computer Version 4 (WCST) was utilized as an alternative measure of ECF (Heaton, 1981). This computer based form of the measure also scored the measure. Giancola, Zeichner, et al. (1996) describe that the subjects are shown two 64 card decks while taking the WCST. Each card has one of four shapes (circle, triangle, cross, or star) as well as one of four colors (red, green, yellow, or blue). The subject is instructed to match each card one at a time to one of four sample cards similarly based on either shape, color, or number of stimuli per card. The subjects are not told what principle by which they should match. After 10 consecutive correct responses by the subject the computer switches the matching principle. This switch is repeated each time the subject gets 10 responses correct until 6 switches have been made or all 128 cards have been used. The WCST measures performance based on the total number correct, the total number of total errors committed, the number of perseverative responses, the number of perseverative errors, the number of nonperseverative errors, and the number of conceptual level responses. Perseveration errors are made when a subject makes an incorrect response that would have been correct in the previous category. The computer computes age based standard scores, T-scores, and percentiles for each of the six categories listed above. The perseverative errors t-score were utilized in this study. A higher t-score indicates higher functioning ECF. Wiedl (1999) reports test-retest reliability of .77 for the WCST.

Executive Cognitive Function - Measure Three (TMTB). As a final measure of ECF, the Trail Making Test - Trails B (TMTB) was given to the participants (Reitan, 1992). Trails B "in particular requires executive functioning with alternating or divided attention"(Moriyama, Mimura, Kato, Yoshino, Hara, Kashima, Kato, & Watanabe, 2002, p. 1240) The participants were instructed to draw lines connecting 25 consecutively numbered and lettered circles in alternating numerical and alphabetical order (ie. 1-A-2-B-3 . . .). A score was given based on the participant's completion time in seconds. A lower score (time) corresponds with increased frontal ability. Dikmen, Heaton, Grant, and Temkin (1999) report a test-retest reliability for the TMTB of .89.

Potential Confounds (Gender, SECV-M & Shipley). Since certain confounds may exist as they impact aggression, three items were examined in this nature. Gender, lifetime exposure to violence, and intellectual ability were examined for possible confounding effects. Regarding lifetime exposure to violence as a possible confound, Farver, Natera, and Frosch (1999) suggest that a segment of children exposed to considerable community violence along their developmental path may be more likely to be aggressive themselves when older as a way of maintaining this accustomed level of arousal. Additionally, another study indicated that 90% of women and men who had entered treatment for substance use disorders had a past history of sexual or physical assault in their life (Dansky, Brady, Saladin, Killeen, Becker, & Roitzsch, 1996). Finally, as mentioned earlier, victimization resulting in a head injury could contribute to "frontal lobe syndrome," possibly impacting ECF (Sato, Kumada, Koji, & Okaniwa, 2000). Lifelong exposure to community violence was examined using a modified version of the Survey of Exposure to Community Violence (SECV) (Richters & Saltzman, 1990). This modified version (SECV-M) (Scarpa, 2001) is a 26-item self-report checklist in which the respondent reported the frequency of having directly experienced or witnessed the following: being chased by gangs or individuals, robbed, threatened with serious physical harm, punched or hit by a family member, punched or hit by a non-family member, mugged, sexually assaulted, exposed to a weapon, seriously wounded by violence, stabbed, shot, and exposed to a dead body. This measure was shortened to include only a checklist of events, as opposed to including questions regarding details of the events. Respondents were asked to rate "how many times have you" and "how many times have you seen someone else" experience each of the violent events. Each item was scored in the following manner: 0 = never, 1 = one time, 2 = two times, 3 = three to four times, 4 = five to six times, 5 = seven to eight times, 6 = once per month, 7 = at least once a week, and 8 = almost every day. All the responses to the victimization items were summed to form a Total index score of lifetime community violence victimization. A coefficient alpha of $\alpha = .82$ was computed for the Total exposure to violence index. Finally, the Shipley Institute of

Living Scale (i.e. Shipley) was used to compute an overall IQ score for each participant (Shipley, 1953). This measure consists of two sections including a Vocabulary and Abstraction subtest. The Vocabulary subtest consists of 40 multiple-choice definitions and the Abstraction subtest consists of 20 fill-in-the-blank analytical problems. The Shipley provided Wechsler Adult Intelligence Scale - Revised (WAIS-R) Full Scale IQ estimates were used in this study, which are computed using the scores from both subtests. Hand scoring was completed using the Shipley Institute of Living Scale - Revised Manual (Zachary, 2000). Zachary reports split-half reliabilities for the Shipley due to its graduated difficulty. Reliability of .84 was reported for the estimated IQs using the Spearman-Brown formula.

Procedures

Participants first reviewed and signed the Informed Consent. Following they were weighed (cm) and measured (kg) by the experimenter. Participants then completed a medical questionnaire and a head injury inventory.

Participants were then administered three neuropsychological measures of ECF. First the TMTB was administered followed by the WCST and Stroop. Then the participants completed a measure of sober-state aggression, the AQ.

The participants were then asked to complete two paper and pencil measures to account for possible confounds in the study, alternate or competing explanations for increased sober-state aggression. First they completed the SECV-M followed by the Shipley. Finally, the experimenter conducted the LDH, an interview of lifetime drinking.

Results

Descriptive and Correlational Statistics

Means and standard deviations for the measures are reported in Table 1 for the entire sample. Means and standard deviations are reported separately for males and females in Tables 2 and 3, respectively. Pearson *r* correlations were computed to examine the relationships among all the measures included in this study (see Table 4). In particular, there was a positive relationship between the SECV-M and LHD-LTVD, $r(80) = .246$, $p = .028$, and a positive relationship between the SECV-M and the Stroop, $r(80) = .324$, $p = .003$. The SECV-M was not significantly correlated with the dependent measure, the AQ, $r(80) = .187$, $p = .097$. Since the SECV-M was not significantly correlated with the dependent variable, reactive aggression, as well as inter-correlated with a independent and moderating variable (i.e. LDH-LTVD and the Stroop) it was not considered further as a confounding variable. Respectively, the Shipley and Gender (0 = males and 1 = females) were positively and negatively correlated with the AQ, the dependent measure, $r(80) = .280$, $p = .012$ and $r(80) = -.280$, $p = .012$. Accordingly, they were both considered as potential confounds and included in later analyses. Finally, Gender was negatively related to the SECV-M, $r(80) = -.398$, $p = .000$ as well as negatively correlated with the Shipley, $r(80) = -.273$, $p = .014$.

Mediational Analyses

Bivariate correlational analyses were conducted to test whether ECF mediated the relationship between lifetime drinking and sober aggression. According to Holmbeck (1997, 2002) and Baron and Kenny (1986), various prerequisite conditions must be met to show that a mediating relationship exists. The first criterion states that a statistically significant relationship has to be established between the predictors (i.e., LDH-LTVD and LDH-LTVg/kg) and criterion variable (i.e., sober-state reactive aggression). If this relationship is not established the remaining steps of the mediational analysis are not warranted. The relationship between lifetime drinking and sober aggression was examined for the entire sample in Table 4. Neither, LDH-LTVD, *r*(80)= .053, *p* = .643, or LDH- LTVg/kg, *r*(80)= -.009, *p* = .939, were significantly correlated with the AQ. Further, analysis examined the relationship by sex to test for any gender effects. In Table 5, the relationship was tested for the male only sample. Neither, LDH-LTVD, *r*(20)= .127, *p* = .594, or LDH- LTVg/kg, *r*(20)= .103, *p* = .667, were significantly correlated with the AQ for this sample. In Table 6 the analysis was repeated for the female sample. Again, neither, LDH-LTVD, *r*(60)= -.007, *p* = .958, or LDH- LTVg/kg, *r*(60)= -050, *p* = .702, were significantly correlated with the AQ. Since the initial and required criterion of mediational analysis was not met for any sample, subsequent analyses were not conducted.

Moderational Analyses

Moderation analyses were conducted to test for the second exploratory hypothesis that ECF acts a moderator within the relationship of lifetime drinking and sober aggression. The analyses were first conducted with the entire sample with no confound entered followed by analysis of entire sample with the confounds, IQ and gender. Afterwards analyses were conducted for each sex separately with confound (IQ) entered. The results are discussed below.

Moderational effects of ECF for the entire sample without confound were examined during step three in Table 7 and 8. LDH-LTVD (see Table 7) and LDH-LTVg/kg (see Table 8) were entered followed with the various ECF measures, along with an interaction term (LDH x ECF measure) that assessed for moderation. For LHD-LTVD (see Table 7) there were two significant interaction terms. The interaction terms were significant for sober-state reactive aggression (LTVD x Stroop) t(76) = 2.731, p = .008 and sober-state reactive aggression (LTVD x TMTB) t(76) = 2.653, p = .010. The interaction term was not significant for sober-state reactive aggression (LTVD x WCST) t(76) = -1.237, p = .220. For LHD-LTVg/kg (see Table 8) there were two significant interaction terms. The interaction terms were significant for sober-state reactive aggression (LTVD x Stroop) t(76) = 2.749, p = .007 and sober-state reactive aggression (LTVD x TMTB) t(76) = 2.890, p = .005. The interaction term was not significant for sober-state reactive aggression (LTVD x WCST) t(76) = -1.285, p = .203. These results do support a moderating relationship between the between lifetime alcohol use, ECF deficits, and sober-state reactive aggression when confounds are not entered into the regression equations, which will be explored later.

Moderational effects of ECF for the entire sample with confounds were examined in Table 9 and 10. LDH-LTVD (see Table 9) and LDH-LTVg/kg (see Table 10) were entered followed with the various ECF measures, along with an interaction term (LDH x ECF measure) that assessed for moderation. For LHD-LTVD (see Table 9) there were two significant interaction terms. The interaction terms were significant for sober-state reactive aggression (LTVD x Stroop) t(74) = 3.178, p = .002 and sober-state reactive aggression (LTVD x TMTB) t(74) = 3.102, p = .003. The interaction term was not significant for sober-state reactive aggression (LTVD x WCST) t(74) = -1.726, p = .088. For LHD-LTVg/kg (see Table 10) there were two significant interaction terms. The interaction terms were significant for sober-state reactive aggression (LTVD x Stroop) t(74) = 3.152, p = .002 and sober-state reactive aggression (LTVD x TMTB) t(74) = 3.205, p = .002. The interaction term was not significant for sober-state reactive aggression (LTVD x WCST) t(74) = -1.796, p = .077. These results do support a moderating relationship between the between lifetime alcohol use, ECF deficits, and sober-state reactive aggression when confounds are not entered into the regression equations, which will be explored later.

Moderational effects of ECF for the male sample with confound were examined during step four in Table 11 and 12. LDH-LTVD (see Table 11) and LDH-LTVg/kg (see Table 12) were entered followed with the various ECF measures, along with an interaction term (LDH x ECF measure) that assessed for moderation while controlling for IQ. For LHD-LTVD (see Table 11) there were no significant interaction terms. The interaction terms for sober-state reactive aggression were (LTVD x Stroop) $t(15) = -.266$, $p = .794$, (LTVD x WCST) $t(15) = -.938$, $p = .363$, and (LTVD x TMTB) $t(15) = .323$, $p = .751$. For LHD-LTVg/kg (see Table 12) there were no significant interaction terms. The interaction terms for sober-state reactive aggression were (LTVg/kg x Stroop) $t(15) = -.039$, $p = .969$, (LTVg/kg x WCST) $t(15) = -1.145$, $p = .270$, and (LTVg/kg x TMTB) $t(15) = .388$, $p = .704$. These results do not support a moderating relationship between the between lifetime alcohol use, ECF deficits, and sober-state reactive aggression when confounds are entered into the regression equations for males.

Moderational effects of ECF for the female sample with confound were examined during step three in Table 13 and 14. LDH-LTVD (see Table 13) and LDH-LTVg/kg (see Table 14) were entered followed with the various ECF measures, along with an interaction term (LDH x ECF measure) that assessed for moderation while controlling for IQ. For LHD-LTVD (see Table 13) there were two significant interaction terms for (LTVD x Stroop) and (LTVD x TMTB). The interaction terms for sober-state reactive aggression were (LTVD x Stroop) $t(55) = 3.061$, $p = .003$, (LTVD x WCST) $t(55) = -1.595$, $p = .116$, and (LTVD x TMTB) $t(55) = 3.183$, $p = .002$. For LHD-LTVg/kg (see Table 14) there were two significant interaction terms for (LTVD x Stroop) and (LTVD x TMTB). The interaction terms for sober-state reactive aggression were (LTVg/kg x Stroop) $t(55) = 3.001$, $p = .004$, (LTVg/kg x WCST) $t(55) = -1.675$, $p = .100$, and (LTVg/kg x TMTB) $t(55) = 3.221$, $p = .002$. Taken together, these findings do support a moderating relationship between lifetime alcohol use, ECF deficits, and sober-state reactive aggression when confound is entered into the regression equations for females. This relationship will be explored in the next section.

Post Hoc Moderational Analyses

Post hoc moderational probing was conducted on the various significant interaction terms (Lifetime Drinking x ECF) for sober-state reactive aggression from entire sample (see Tables 7 and 8), from the entire sample with confounds (see Tables 9 and 10) and from the female only sample (see Tables 13 and 14). No significant interaction terms were found for the male only sample. Probing was conducted by use of ModGraph software developed by Paul E. Jose of the Psychology Department at the University of Wellington, Victoria, New Zealand (Jose, 2003). The software follows protocol discussed by Holmbeck (2002) as well as Aiken and West (1991). While eight significant interaction terms were found with this study, this only supports that the relationship between life-time drinking (predictor) and sober-state reactive aggression (outcome) differs across various levels of the moderator (ECF) (Holmbeck, 2002). Without calculating simple slopes and their corresponding significance one can not determine what levels of the moderator (ECF) are significantly or not significantly different from zero. Only when significant slopes are detected can one speak directly to the various level of the moderator (ECF) (Holmbeck, 2002). Using ModGraph software all eight interactions were graphed at three levels of the moderator (high, medium, and, low), while also calculating B (unstandardized regression coefficients) and corresponding significance tests (t). Only three interactions with one or more significant slopes are discussed beyond this point. The remaining interactions either had no significant slopes or had y-axes that were not interpretable, inconsistent with the AQ range of scores.

The interaction (LDH-LTVD x Stroop; see Table 13) for sober-state aggression for the female only sample had two significant slopes for the moderation effect of ECF (Stroop) at both high (High ECF) and low (Low ECF) levels on the Stroop (See Figure 1). Results found were as follows: high levels of the Stroop $t(56) = 2.540$, $p = .013$, medium levels of the Stroop $t(56) = -1.039$, $p = .303$, and low levels of the Stroop $t(56) = -2.700$, $p = .009$. Individuals in the high ECF group show increased sober aggression as lifetime alcohol consumption increases while the low ECF shows the opposite. The medium ECF group was not significant.

The interaction (LDH-LTVg/kg x Stroop; see Table 14) for sober-state aggression for the female only sample had one significant slope for the moderation effect of ECF (Stroop) at the low (Low ECF) level on the Stroop (See Figure 2). Results found were as follows: high levels of the Stroop $t(56) = 1.500$, $p = .139$, medium levels of the Stroop $t(56) = -1.283$, $p = .204$, and low levels of the Stroop $t(56) = -2.430$, $p = .018$. Individuals in the low ECF group show decreased sober aggression as lifetime alcohol consumption increased. The high and medium ECF groups were not significant.

The interaction (LDH-LTVg/kg x TMTB; see Table 14) for sober-state aggression for the female only sample had one significant slope for the moderation effect of ECF (TMTB) at the low (High ECF) level on the TMTB (See Figure 3). Results found were as follows: high levels of the TMTB $t(56) = .275$, $p = .784$, medium levels of the TMTB $t(56) = -1.605$, $p = .114$, and low levels of the TMTB $t(56) = -2.570$, $p = .012$. Individuals in the high ECF group show decreased sober aggression as lifetime alcohol consumption increased. The high and medium ECF groups were not significant. Taken together, these conflicting examples of moderation within the female sample were not consistent with the moderational hypotheses extrapolated from Giancola (2000) and will be explored further in the discussion.

Discussion

The connection between acute alcohol consumption, sober ECF, and aggression while intoxicated has been studied extensively by Giancola (2000b). Specifically, he has found that increased acute alcohol consumption leads to increased intoxicated aggression with sober ECF as a mediator between the two. Giancola states that increased acute intoxication acts to dysregulate ECF leading to decreased inhibition and subsequent increased intoxicated aggression. Further, Giancola extends his research to a theoretical moderational model that he has not tested. Here he states that during acute intoxication individuals with low sober ECF are always risk for aggression without the protective factor of much ECF and should not show a marked increase in aggression while intoxicated. Individuals with high ECF will have enough inhibitory power to spare and be immune to the acute intoxication's effect on intoxicated aggression. Specifically, individuals with moderate ECF will be most likely to show increased aggression during acute intoxication that is due to an interaction between acute intoxication and ECF.

The primary goal of this study was extend these two models to the relationship between chronic alcohol use, sober ECF, and sober aggression with the idea that chronic alcohol use has insidious negative impacts on ECF. Specifically, it was predicted that a mediational relationship would exist where sober ECF would mediate the relationship between chronic alcohol use and sober aggression. It was also predicted that the relationship between chronic alcohol use and sober aggression would be moderated by sober ECF with the interaction being most significant in individuals with moderate levels of sober ECF. Additionally, both of these relationships were predicted to hold when controlling for gender and IQ.

This study did not support its proposed hypotheses. Criterion for mediation were not supported for the sample as a whole, nor for the male and female only sample. Additionally, this study did not support a moderational model that was an extension of Giancola's (2000b) proposed, yet not substantiated moderational model.

Some past findings were substantiated with this study. This research did find positive correlations between past exposure to violence (SECVM) and increased lifetime drinking and a trend for increased sober aggression. The positive relationship between past exposure to violence and increased violence in later life has been shown by Scarpa et al (2001). In that modeling past experiences often influences future behavior, this finding is of concern in relation to the study of criminology and the arena of public policy. Further, the positive relationship between past exposure to violence and increased drinking later in life has been shown before such as Giancola (2002a). This could suggest a component of self-medicating as a way of dealing with life's cumulative negative experiences or a manner of reducing anxiety, especially in relation to reactive aggression.

Finally, some moderation of the relationship between lifetime drinking history and sober aggression by ECF were found for females after post hoc probing. While these findings were not consistent with Giancola's proposed moderation model, they were interesting. While no interactions were found with female's possessing moderate levels of ECF, this may be a factor of college students as a whole being of above average intelligence and falling more into the high ECF group. Overall, the interactions showed a level of convergence of all three groups towards equal levels of sober aggression as lifetime drinking history increased. It may be that high prevalence of violence on college campuses as reported by Wechsler et al. (2000) overpowers the interaction influence of ECF with time. In other words, the overall homologous levels of ECF in college students, are not significant enough to clearly moderate the relationship between lifetime drinking and sober-aggression. Further, sober aggression may be more strongly influenced by factors other than lifetime drinking in college students, especially among females. Finally, it may be that ECF acts as a proxy variable (e.g. stress or depression) in its interaction with lifetime drinking history. Meaning the convergence of sober aggression levels may be a factor of the prevalent and uniform levels of some other variable such as stress or anxiety that females experience with increasing magnitude during their time in school.

Limitations of the Current Study

There are various limitations related to the findings of the current study. First, the measure of ECF in high functioning college students was likely affected by the threshold theory as discussed by Satz (1993). The heart of this theory involves the concept of brain reserve capacity (BRC). BRC is often conceptualized by IQ as discussed by Satz. Greater BRC (i.e. IQ) is related to greater redundancy of the neuronal networks in the brain. Neuropsychological tests are less sensitive on these individuals and unlikely to detect subtle brain deficits, which would be sub-threshold for the measures. Satz adds that most neuropsychological tests were originally designed to detect gross deficits in clinical populations - not the case in this study. Accordingly, the moderational effects found in this study may simply have been a factor of not overly meaningful variations in ECF.

A second limitation of this study involved the impact of chronic alcohol consumption on the brain (i.e. ECF). Most substantiated evidence of brain assault related to lifetime alcohol use has been studied in older populations with substantial drinking histories, often alcoholics. Jernigan (2002) states studies have found a disproportionate loss of brain volume in the frontal areas of older alcoholics compared to younger ones and adds the frontal regions may be particularly vulnerable in older drinkers, which supports the difficulty of substantiating ECF deficits in younger drinkers. Page and Linden (1974) examined 20 hospitalized alcoholics in their first week of recovery on the WAIS, Trail Making Test (TMT), and the Benton Visual Retention Test. They also did longitudinal follow-up testing at later weeks. Ultimately, they found recovery during the first two weeks of abstinence in areas of short-term memory, reasoning, coordination, etc. In that older abstinent alcoholics can rebound in the area of ECF, it is likely that the younger participants in this sample had quite resilient brains adding a protective factor to their ECF.

Another limitation to this study surrounded that fact that it tested a moderational hypothesis that was extrapolated from an untested theory of Giancola's (2000b). The moderational hypothesis discussed by Giancola may or may not actually exist or may only exist in relation to acute alcohol intoxication and its effects on aggression while under the influence.

The examination of gender effects was limited by reduced sample size. Accordingly, the study could have been strengthened via a larger sample size with a more equal proportion of males and females.

Finally, the study was limited in that it examined a high functioning college sample comprising of a female majority with an average age of 19. Examining an older clinical (i.e. alcoholic) population with more equal proportions of gender would have possibly increased the chances of significant findings.

Despite these limitations, this study did bolster the finding that past individual exposure to violence is a valid predictor of the future aggression by the individual. This has implications for applied research as to finding ways to remediate this relationship. Additionally, this study supported the literature surrounding past exposure to violence and later increased lifetime drinking volume. In that past violence exposure may lead to an increase in society's overall drinking later in life, a significant public health concern is raised.

Finally, this study substantiates the fact that college students are continuing to binge drink - defined as males drinking 5 or more and females drinking 4 or more drinks per occasion - with this study finding 6.3 (males) and 4.0 (females) drinks per occasion. A factor of concern discussed at length by Wechsler et al. (2000) as it has far reaching impacts on health, quality of education, and reported levels of person directed violence.

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Table 1

Sample Means and Standard Deviations

Measure	Mean (SD)
LDH - LTVD (n = 80)	865.32 (1189.00)
LDH - LTVg/kg (n = 80)	170.33 (234.95)
Stroop - Interference t-score (n = 80)	54.64 (6.75)
WCST - Perseverative Errors t-score (n = 80)	51.99 (11.28)
TMTB - Seconds (n = 80)	70.10 (30.19)
AQ - Composite Score (n = 80)	64.85 (16.17)
SECVM - Total Exposure (n = 80)	22.65 (13.27)
Shipley - IQ (n = 80)	108.84 (6.09)

Note: LDH - LTVD = Lifetime Drinking History - Lifetime Volume Drinks; LDH-LTVg/kg = Lifetime Drinking History - Lifetime Volume in Grams per Kg of Body Weight; WCST = Wisconsin Card Sorting Test; TMTB = Trail Making Test Part B; AQ = Aggression Questionnaire; SECVM Total Exposure = Survey of Exposure to Community Violence - Modified with witnessing and exposure to violence.

Table 2

Sample Means and Standard Deviations - Males

Measure	**Mean (SD)**
LDH - LTVD (n = 20)	1108.38 (1094.50)
LDH - LTVg/kg (n = 20)	189.16 (192.90)
Stroop - Interference t-score (n = 20)	56.47 (7.15)
WCST - Perseverative Errors t-score (n = 20)	53.05 (8.43)
TMTB - Seconds (n = 20)	67.60 (18.51)
AQ - Composite Score (n = 20)	72.65 (14.17)
SECVM - Total Exposure (n = 20)	31.75 (13.88)
Shipley - IQ (n = 20)	111.70 (5.68)

Note: LDH - LTVD = Lifetime Drinking History - Lifetime Volume Drinks; LDH-LTVg/kg = Lifetime Drinking History - Lifetime Volume in Grams per Kg of Body Weight; WCST = Wisconsin Card Sorting Test; TMTB = Trail Making Test Part B; AQ = Aggression Questionnaire; SECVM Total Exposure = Survey of Exposure to Community Violence - Modified with witnessing and exposure to violence.

Table 3

Sample Means and Standard Deviations - Females

Measure	**Mean (SD)**
LDH - LTVD (n = 60)	784.30 (1218.01)
LDH - LTVg/kg (n = 60)	164.07 (248.54)
Stroop - Interference t-score (n = 60)	54.03 (6.56)
WCST - Perseverative Errors t-score (n = 60)	51.95 (12.18)
TMTB - Seconds (n = 60)	70.93 (33.27)
AQ - Composite Score (n = 60)	62.25 (16.06)
SECVM - Total Exposure (n = 60)	19.62 (11.68)
Shipley - IQ (n = 60)	107.88 (5.97)

Note: LDH - LTVD = Lifetime Drinking History - Lifetime Volume Drinks; LDH-LTVg/kg = Lifetime Drinking History - Lifetime Volume in Grams per Kg of Body Weight; WCST = Wisconsin Card Sorting Test; TMTB = Trail Making Test Part B; AQ = Aggression Questionnaire; SECVM Total Exposure = Survey of Exposure to Community Violence - Modified with witnessing and exposure to violence.

Table 4

Pearson r Correlations Among Measures (N = 80)

	1	2	3	4	5	6	7	8	9
1. LDH - LTVD	1								
2. LDH - LTVg/kg	.978**	1							
3. Stroop - Interference t-score	.086	.086	1						
4. WCST - Perseverative Errors t-score	-.049	-.034	-.020	1					
5. TMTB - Seconds	.125	.095	-.020	-.038	1				
6. AQ - Composite Score	.053	-.009	-.145	.076	-.011	1			
7. SECVM - Total Exposure	.246*	.170	.324**	-.107	-.006	.187+	1		
8. Shipley - IQ	.047	.012	.023	-.093	-.039	.280*	.080	1	
9. Gender	-.119	-.047	-.200+	.114	.125	-.280*	-.398*	-.273*	1

Note: LDH - LTVD = Lifetime Drinking History - Lifetime Volume Drinks; LDH-LTVg/kg = Lifetime Drinking History - Lifetime Volume in Grams per Kg of Body Weight; WCST = Wisconsin Card Sorting Test; TMTB = Trail Making Test Part B; AQ = Aggression Questionnaire; SECVM = Survey of Exposure to Community Violence - Modified; Gender (0 = male, female = 1).

*$p \leq .05$. **$p \leq .01$. +$p \leq .10$. (2-tailed significance).

Table 5

Pearson r Correlations Among Measures - Males (N = 20)

	1	2	3	4	5	6	7	8
1. LDH - LTVD	1							
2. LDH - LTVg/kg	.991**	1						
3. Stroop - Interference t-score	.111	.157	1					
4. WCST - Perseverative Errors t-score	.000	-.005	.333	1				
5. TMTB - Seconds	.104	.104	-.095	-.398+	1			
6. AQ - Composite Score	.127	.103	-.460*	-.302	.224	1		
7. SECVM - Total Exposure	.574**	.583**	.492*	-.059	.446*	.103	1	
8. Shipley - IQ	.393+	.403+	-.063	.116	-.003	.322	.057	1

Note: LDH - LTVD = Lifetime Drinking History - Lifetime Volume Drinks; LDH-LTVg/kg = Lifetime Drinking History - Lifetime Volume in Grams per Kg of Body Weight; WCST = Wisconsin Card Sorting Test; TMTB = Trail Making Test Part B; AQ = Aggression Questionnaire; SECVM = Survey of Exposure to Community Violence - Modified. *p≤.05. **p≤.01. +p≤.10. (2-tailed significance).

Table 6

Pearson r Correlations Among Measures - Females (N = 60)

	1	2	3	4	5	6	7	8
1. LDH - LTVD	1							
2. LDH - LTVg/kg	.980**	1						
3. Stroop - Interference t-score	.296*	.314*	1					
4. WCST - Perseverative Errors t-score	-.041	-.031	-.074	1				
5. TMTB - Seconds	.158	.109	.184	-.052	1			
6. AQ - Composite Score	-.007	-.050	-.179	.129	.024	1		
7. SECVM - Total Exposure	.098	.045	-.068	-.081	.045	.080	1	
8. Shipley - IQ	-.088	-.096	-.089	-.075	-.006	.193	-.066	1

Note: LDH - LTVD = Lifetime Drinking History - Lifetime Volume Drinks; LDH-LTVg/kg = Lifetime Drinking History - Lifetime Volume in Grams per Kg of Body Weight; WCST = Wisconsin Card Sorting Test; TMTB = Trail Making Test Part B; AQ = Aggression Questionnaire; SECVM = Survey of Exposure to Community Violence - Modified. $*p \leq .05$. $**p \leq .01$. $+p \leq .10$. (2-tailed significance).

Table 7

Summary of Hierarchical Regression Analyses for Alcohol Use (Drinks), Executive Cognitive Function, and Reactive Aggression Without Confounds Entered (N =80)

Variable	**B**	**SE B**	**ß**
R^2 = .112 (p = .03)			
LTVD	-.001	.002	-.065
Stroop	-.924	.331	-6.392*
LTVD x Stroop	.001	.000	6.261*
R^2 = .028 (ns)			
LTVD	.001	.002	.061
WCST	-.002	.012	-.020
LTVD x WCST	-.000031	.000	-.171
R^2=.088 (ns)			
LTVD	-.001	.002	-.092
TMTB	-.015	.010	-.203
LTVD x TMTB	.0000097	.000	.384**

Note: LTVD = Lifetime Drinking History - Lifetime Volume Drinks; WCST = Wisconsin Card Sorting Test; TMTB = Trail Making Test Part B. *$p \leq .05$. **$p \leq .01$.

Table 8

Summary of Hierarchical Regression Analyses for Alcohol Use (g/kg), Executive Cognitive Function, and Reactive Aggression Without Confounds Entered (N =80)

Variable	**B**	**SE B**	**ß**
R^2 = .103 (p = .04)			
LTVg/kg	-.007	.008	-.105
Stroop	-.433	.158	-2.998**
LTVg/kg x Stroop	.003	.001	2.878**
R^2 = .027 (ns)			
LTVg/kg	.000	.008	.005
WCST	.002	.010	.026
LTVg/kg x WCST	.000	.000	-.154
R^2=.099 (p = .05)			
LTVg/kg	-.009	.008	-.137
TMTB	-.016	.010	-.220
LTVg/kg x TMTB	.000059	.000	.406**

Note: LTVg/kg = Lifetime Drinking History - Lifetime Volume in Grams per Kg of Body Weight; WCST = Wisconsin Card Sorting Test; TMTB = Trail Making Test Part B; AQ = Aggression Questionnaire. *p≤.05. **p≤.01.

Table 9

Summary of Hierarchical Regression Analyses for Alcohol Use (Drinks), Executive Cognitive Function, and Reactive Aggression With Confounds Entered (N =80)

Variable	**B**	**SE B**	**ß**
R^2 = .163 (p = .000)			
Shipley	.500	.276	.188
Gender	-11.217	3.978	-.302**
LTVD	-.002	.002	-.115
Stroop	-1.008	.308	-6.975**
LTVD x Stroop	.001	.000	6.784**
R^2 = .172 (p = .014)			
Shipley	.696	.297	.262*
Gender	-8.211	4.126	-.221*
LTVD	.000	.001	.027
WCST	.000	.011	-.004
LTVD x WCST	-.0000405	.000	-.227
R^2 = .225 (p = .002)			
Shipley	.613	.283	.231*
Gender	-8.933	4.016	-.241*
LTVD	-.002	.002	-.151
TMTB	-.013	.009	-.176
LTVD x TMTB	.0000106	.000	.420**

Table 9, Continued

Note: Gender (0 = male, female = 1); LTVD = Lifetime Drinking History - Lifetime Volume Drinks; WCST = Wisconsin Card Sorting Test; TMTB = Trail Making Test Part B; AQ = Aggression Questionnaire. *$p \leq .05$. **$p \leq .01$.

Table 10

Summary of Hierarchical Regression Analyses for Alcohol Use (g/kg), Executive Cognitive Function, and Reactive Aggression With Confounds Entered (N =80)

Variable	**B**	**SE B**	**ß**
R^2 = .262 (p = .000)			
Shipley	.530	.276	.200
Gender	-11.229	3.964	-.303**
LTVg/kg	-.009	.007	-.128
Stroop	-.488	.146	-3.376**
LTVg/kg x Stroop	.003	.001	3.195**
R^2 = .175 (p = .013)			
Shipley	.705	.297	.266*
Gender	-8.270	4.101	-.223*
LTVg/kg	.000	.007	-.004
WCST	.005	.010	.059
LTVg/kg x WCST	.000	.000	-.205
R^2 = .231 (p = .001)			
Shipley	.609	.281	.229*
Gender	-8.514	3.967	-.229*
LTVg/kg	-.011	.008	-.159
TMTB	-.014	.009	-.188
LTVg/kg x TMTB	.0000615	.000	.422**

Table 10, Continued

Note: Gender (0 = male, female = 1); LTVg/kg = Lifetime Drinking History - Lifetime Volume in Grams per Kg of Body Weight; WCST = Wisconsin Card Sorting Test; TMTB = Trail Making Test Part B; AQ = Aggression Questionnaire. $^{*}p \leq .05$. $^{**}p \leq .01$.

Table 11

Summary of Hierarchical Regression Analyses for Alcohol Use (Drinks), Executive Cognitive Function, and Reactive Aggression With Confounds Entered (Males) (N =20)

Variable	**B**	**SE B**	**ß**
R^2 = .305 (p = .03)			
Shipley	.600	.632	.240
LTVD	.002	.006	.182
Stroop	.296	1.220	4.669
LTVD x Stroop	.000	.001	-5.135
R^2 = .264 (ns)			
Shipley	.948	.607	.380
LTVD	-.001	.003	-.082
WCST	-.623	.391	-.356
LTVD x WCST	-.001	.001	-.217
R^2 = .161 (ns)			
Shipley	.790	.656	.317
LTVD	.000	.003	-.014
TMTB	.097	.300	.127
LTVD x TMTB	.0000708	.000	.126

Note: LTVD = Lifetime Drinking History - Lifetime Volume Drinks; WCST = Wisconsin Card Sorting Test; TMTB = Trail Making Test Part B; AQ = Aggression Questionnaire. *p≤.05. **p≤.01.

Table 12

Summary of Hierarchical Regression Analyses for Alcohol Use (g/kg), Executive Cognitive Function, and Reactive Aggression With Confounds Entered (Males) (N =20)

Variable	**B**	**SE B**	**ß**
R^2 = .301 (ns)			
Shipley	.657	.645	.263
LTVg/kg	.006	.030	.079
Stroop	-.009	.518	-.135
LTVg/kg x Stroop	.000	.004	-.321
R^2 = .285 (ns)			
Shipley	.983	.601	.394
LTVg/kg	-.009	.018	-.121
WCST	-.717	.397	-.410
LTVg/kg x WCST	-.004	.003	-.265
R^2 = .166 (ns)			
Shipley	.817	.657	.327
LTVg/kg	-.004	.019	-.052
TMTB	.086	.297	.112
LTVg/kg x TMTB	.001	.001	.150

Note: LTVg/kg = Lifetime Drinking History - Lifetime Volume in Grams per Kg of Body Weight; WCST = Wisconsin Card Sorting Test; TMTB = Trail Making Test Part B; AQ = Aggression Questionnaire. *$p \leq .05$. **$p \leq .01$.

Table 13

Summary of Hierarchical Regression Analyses for Alcohol Use (Drinks), Executive Cognitive Function, and Reactive Aggression With Confounds Entered (Females) (N =60)

Variable	**B**	**SE B**	**ß**
R^2 = .203 (p = .01)			
Shipley	.435	.327	.162
LTVD	-.002	.002	-.165
Stroop	-1.046	.366	-.427**
LTVD x Stroop	.001	.000	.529**
R^2 = .100 (ns)			
Shipley	.671	.355	.249
LTVD	.000	.002	.031
WCST	.000	.011	.003
LTVD x WCST	.0000392	.000	-.255
R^2 = .188 (p = .02)			
Shipley	.499	.329	.185
LTVD	-.003	.002	-.226
TMTB	-.014	.009	-.219
LTVD x TMTB	.0000115	.000	.530**

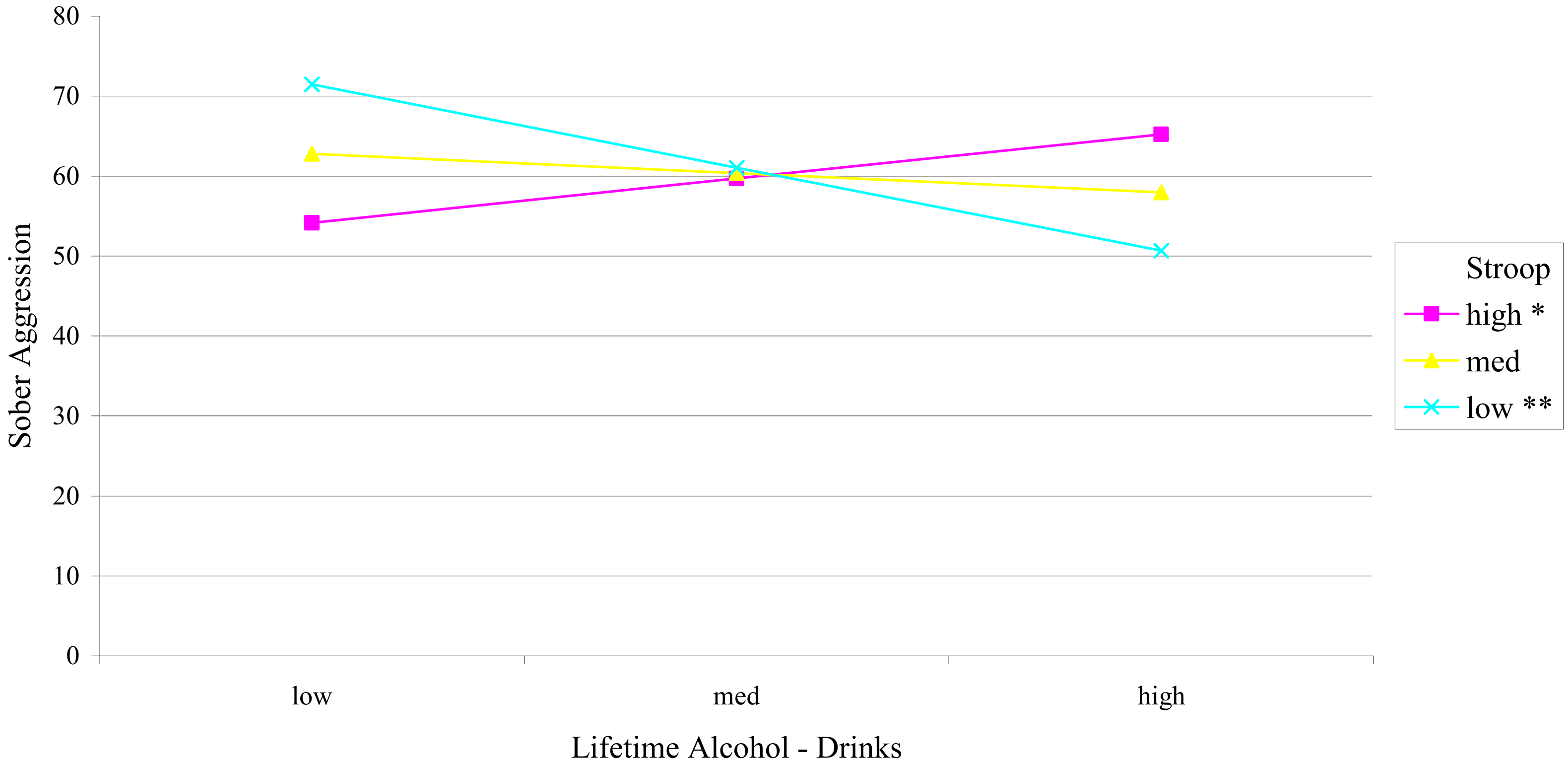
Note: LTVD = Lifetime Drinking History - Lifetime Volume Drinks; WCST = Wisconsin Card Sorting Test; TMTB = Trail Making Test Part B; AQ = Aggression Questionnaire. *$p \leq .05$. **$p \leq .01$.

Table 14

Summary of Hierarchical Regression Analyses for Alcohol Use (g/kg), Executive Cognitive Function, and Reactive Aggression With Confounds Entered (Females) (N =60)

Variable	**B**	**SE B**	**ß**
R^2 = .196 (p = .02)			
Shipley	.462	.328	.172
LTVg/kg	-.012	.009	-.184
Stroop	-.382	.313	-.156
LTVg/kg x Stroop	.004	.001	.414**
R^2 = .104 (ns)			
Shipley	.674	.355	.250
LTVg/kg	.000	.008	-.003
WCST	.005	.010	.073
LTVg/kg x WCST	.000	.000	-.233
R^2 = .112 (p = .03)			
Shipley	.499	.328	.186
LTVg/kg	-.014	.009	-.215
TMTB	-.015	.009	-.230
LTVg/kg x TMTB	.00000641	.000	.512**

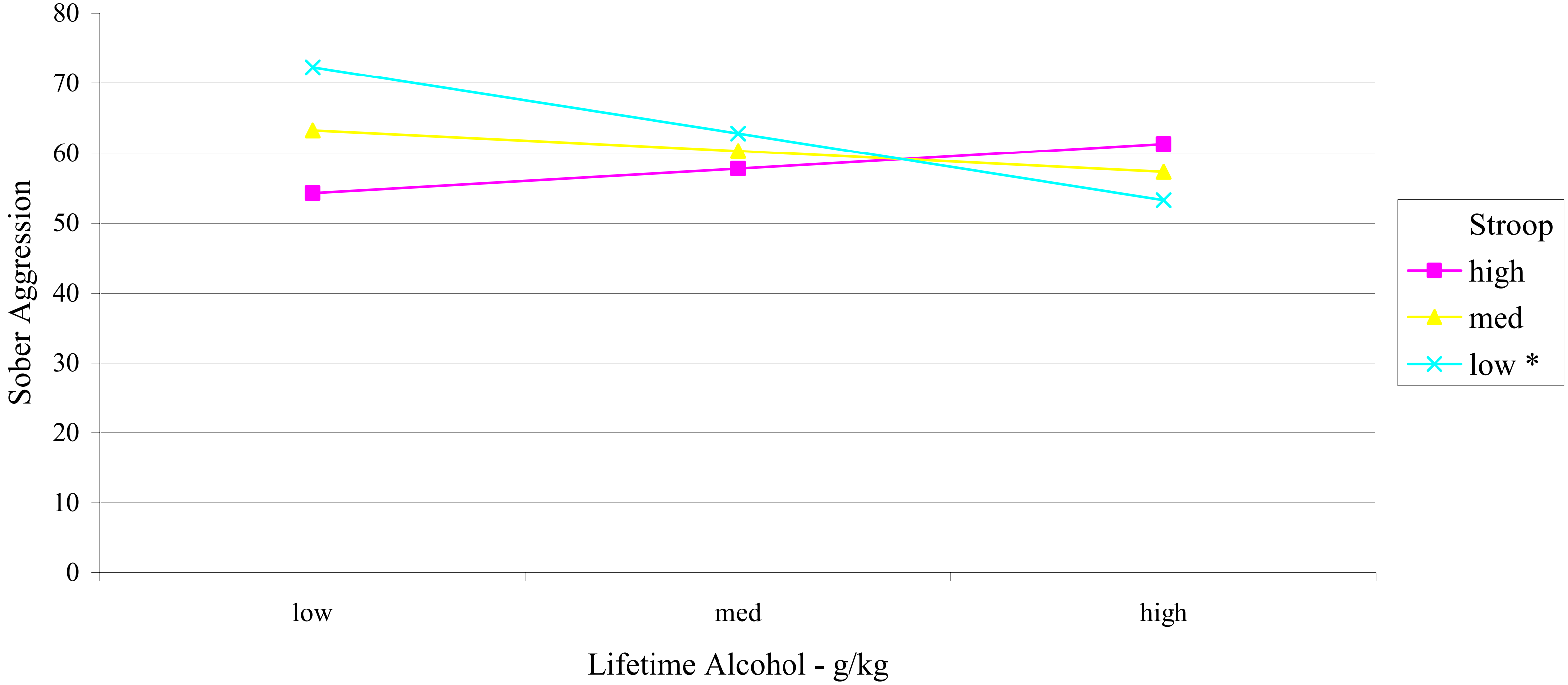
Note: LTVg/kg = Lifetime Drinking History - Lifetime Volume in Grams per Kg of Body Weight; WCST = Wisconsin Card Sorting Test; TMTB = Trail Making Test Part B; AQ = Aggression Questionnaire. $*p \leq .05$. $**p \leq .01$.



Note: Stroop High = High ECF, Stroop Med. = Average ECF, Stroop Low = Low ECF. *$p \leq .05$. **$p \leq .01$.

Figure 1

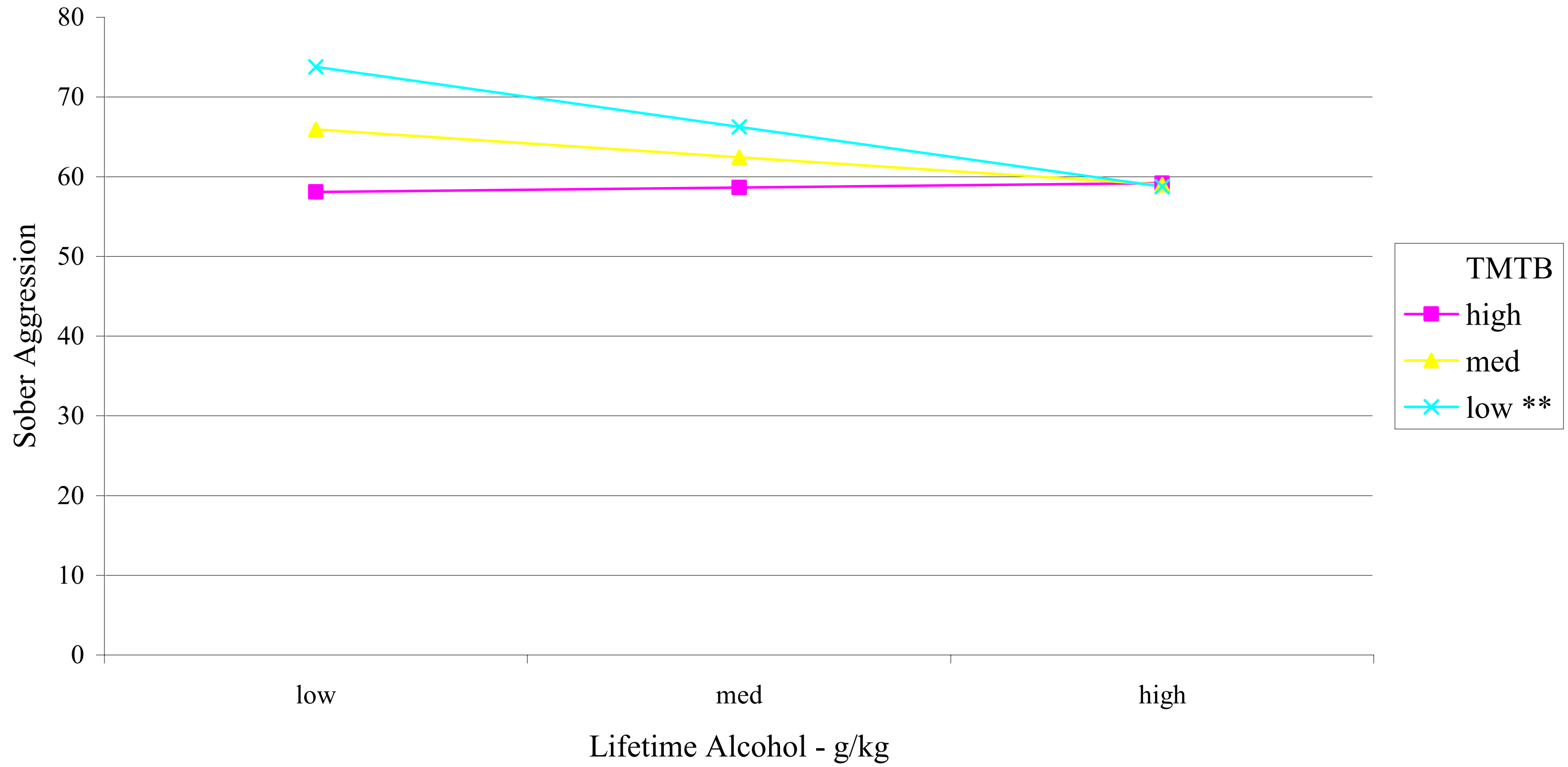
Moderation of the Effect of Lifetime Alcohol (Drinks) on Sober Aggression by ECF (Stroop) - Females



Note: Stroop High = High ECF, Stroop Med. = Average ECF, Stroop Low = Low ECF. *p≤.05. **p≤.01.

Figure 2

Moderation of the Effect of Lifetime Alcohol (g/kg) on Sober Aggression by ECF (Stroop) - Females



Note: TMTB High = Low ECF, TMTB Med. = Average ECF, TMTB Low = High ECF. *p≤.05. **p≤.01.

Figure 3

Moderation of the Effect of Lifetime Alcohol (g/kg) on Sober Aggression by ECF (TMTB) - Females