RUNNING HEAD: Alcohol Use Outcomes

CBT for High Anxiety Sensitivity: Alcohol Outcomes

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Abstract

Introduction: High anxiety sensitivity (AS) has been associated with greater alcohol consumption and alcohol-related problems as well as greater sensitivity to the anxiety-reducing effects of alcohol and greater risky negative reinforcement motives for drinking. The present study reported on the alcohol-related outcomes of a telephone-delivered cognitive behavioural treatment (CBT) designed to reduce high AS. **Methods**: Eighty individuals with high AS (*M* age = 36 years; 79% women; 76% Caucasian) seeking treatment for their AS-related concerns participated in the study and were randomly assigned to an eight week telephone CBT program or a waiting list control. Participants completed measures of drinking motives and problem drinking at pre- and post-treatment. **Results**: Multilevel modeling showed the treatment was successful in reducing AS. The treatment also resulted in specific reductions in drinking to cope with anxiety motives as well as physical alcohol-related problems. Mediated moderation analyses showed treatment-related changes in AS mediated changes in drinking to cope with anxiety motives. Changes in drinking to cope with anxiety motives mediated changes in physical alcohol-related problems. **Conclusions**: Results of the present study suggest that an AS-targeted intervention may have implications for reducing risky alcohol use cognitions and behaviours. Further research is needed in a sample of problem drinkers.

Keywords: anxiety sensitivity; alcohol use; CBT; drinking motives; problem drinking

CBT for High Anxiety Sensitivity: Alcohol Outcomes

1. Introduction

Anxiety sensitivity (AS) is an enduring fear of arousal-related body sensations (e.g., rapid heart rate) arising from the tendency to interpret these sensations catastrophically (Reiss, 1991; Reiss & McNally, 1985). Research has linked high AS to problematic alcohol use (Norton, 2001; Stewart, Samoluk, & MacDonald, 1999). Individuals high (vs. low) in AS report more frequently drinking to excess (Stewart, Peterson, & Pihl, 1995), endorse more alcohol problems (Watt, Stewart, Birch, & Bernier, 2006), and develop alcohol disorders at higher rates (Schmidt, Buckner, & Keough, 2007).

Motivational theories of alcohol use propose that specific personality characteristics (e.g., AS) are associated with differential activation of brain motivation systems and susceptibility to certain drug reinforcement properties (Conrod, Pihl, Stewart, & Dongier, 2000). High AS individuals may thus be motivated to use alcohol to reduce, control, and/or avoid their fear of aversive arousal sensations and the sensations themselves (McNally, 1996; Stewart et al., 1999). Notably, high (vs. low) AS individuals are more sensitive to alcohol's anxiolytic effects (MacDonald, Baker, Stewart, & Skinner, 2000; Zack, Poulos, Aramakis, Khamba, & MacLeod, 2007). In addition, AS is related to negative reinforcement motives associated with problem drinking (Martens et al., 2008), including coping and conformity motives (DeMartini & Carey, 2011; Stewart, Zvolensky, & Eifert, 2001). Recent evidence shows the AS–alcohol problems link to be mediated through anxiety symptoms and in turn coping motives (Allan, Albanese, Norr, Zvolensky, & Schmidt, in press).

Research has also shown that high AS can interfere with substance use treatment, by increasing risk of dropout (Lejuez et al., 2008) and/or relapse (Zvolensky et al., 2007). Without

addressing high AS, individuals' fear of somatic sensations – a contributor to their substance use – may persist, serving as a diathesis for relapse to cope with this fear (Otto, Safren, & Pollack, 2004) or with aversive withdrawal sensations (Johnson, Stewart, Steeves, & Zvolensky, 2012). Recently, researchers have incorporated AS reduction into substance use interventions (Conrod, Stewart, Comeau, & Maclean, 2006; Tull, Schulzinger, Schmidt, Zvolensky, & Lejuez, 2007).

This study investigated the alcohol use outcomes of an AS reduction intervention. Comprehensive details of the RCT testing this intervention are described elsewhere (Olthuis, Watt, Mackinnon, & Stewart, 2014). A brief form of this intervention (Watt et al., 2006) showed decreases in problem drinking and conformity-motivated drinking in high AS university women. We hypothesized our AS-focused intervention would reduce negative reinforcement drinking motives and problem drinking.

2. Material and Methods

2.1 Participants

We used newspaper and flyer advertisements to recruit participants from the community who were high in AS and were interested in seeking treatment for AS-related concerns. Participants were not recruited on the basis of drinking-related behaviours. To be eligible, individuals had to: be ≥18 years, have access to a telephone, and score ≥23 on the Anxiety Sensitivity Index–3 (ASI-3; Taylor et al., 2007), which is one standard deviation above the population mean (M=12.8, SD=10.6; Reiss, Peterson, Taylor, Schmidt, & Weems, 2008). Exclusion criteria were: contraindications to exercise, current psychotherapy, new pharmacotherapy in the last three months, or current psychosis or suicidal ideation.

Overall, 182 individuals expressed interest, 109 were eligible, and 80 consented (M age = 36.3, SD = 11.3; 79% women; 76% Caucasian; 38% concurrent pharmacotherapy) and were

randomized ($n = 40$ to the intervention and $n = 40$ to the control). Structured Clinical Interviews

for DSM-IV-TR (SCID; First, Spitzer, Gibbon, & Williams, 2002) conducted at pre-treatment

revealed that 67.5% of participants qualified for a primary diagnosis of an Anxiety Disorder,

10% a primary Mood Disorder, 5% a primary Adjustment Disorder, 1.3% a primary diagnosis of

Hypochondriasis, and 16.3% did not qualify for a current DSM-IV Axis I diagnosis. Thirty-four

participants had at least one comorbid diagnosis. Only 3.8% of participants qualified for a

current Alcohol Use Disorder (AUD) while 1.3 % qualified for an AUD in partial remission and

21.3% qualified for an AUD in full remission. Participant flow details are presented in Figure 1

(the full PRISMA diagram is published in Olthuis et al., 2014).

2.2 Procedure

Participants were randomized using an online number generator. Measures were

completed at baseline, eight and twelve weeks.

Intervention (CBT). Participants received eight weeks of telephone-delivered cognitive

behaviour therapy (CBT) for high AS based on a brief empirically-validated intervention (Watt

et al., 2006; Watt & Stewart, 2008). A therapist provided weekly 50-minute telephone sessions

encompassing psychoeducation, cognitive restructuring, interoceptive exposure via physical

exercise, and prevention of relapse of high AS. Participants continued interoceptive exposure

four weeks after telephone therapy concluded. All aspects of the CBT program were aimed at

reducing high AS. Alcohol use was only addressed briefly, in terms of: (1) psychoeducation

around the link between high AS and alcohol use problems, and (2) a brief discussion about the

use of alcohol as a maladaptive coping strategy for AS-related concerns.

Waiting List Control (WLC). Participants received no treatment. After the waiting list

period had concluded, participants in the WLC were offered the CBT intervention, if interested.

2.3 Materials

Anxiety Sensitivity Index – 3 (ASI-3; Taylor et al., 2007; derived from Peterson & Reiss, 1992). The ASI-3 is a self-report measure of AS. Participants indicate the extent to which they agree or disagree with 18 items (0 = *very little* to 4 = *very much*). The ASI-3 has good internal reliability and criterion validity (Taylor et al., 2007).

Modified Drinking Motives Questionnaire – Revised (MDMQ-R; Grant, Stewart, O'Connor, Blackwell, & Conrod, 2007). The 28-item self-report MDMQ-R measures social, enhancement, coping-with-anxiety, coping-with-depression, and conformity drinking motives. Participants indicate how often they drink for each reason (1 = *never/almost never* to 5 = *almost always/always*). The MDMQ-R has good test-retest reliability and concurrent and predictive validity (Grant et al., 2007).

Short Inventory of Problems – Recent (SIP-R; Miller, Tonigan, & Longabaugh, 1995). The SIP-R was used to assess problem drinking. Participants indicated how often they experienced each of 15 alcohol problems in the past month[1] across five subscales: physical, interpersonal, intrapersonal, impulse control, and social responsibility problems. SIP-R subscale scores have modest internal consistency and test-retest reliability (Miller et al., 1995; Feinn, Tennen, & Kranzler, 2003).

2.4 Data Analytic Plan

Multilevel modelling with HLM 7.0 software (Scientific Software International, Inc., Lincolnwood, IL) was used to accommodate unequal time points between assessments (Gueorguieva & Krystal, 2004), use a maximum likelihood approach for missing data (Graham, 2009), and account for repeated measures (Garson, 2013). A two-level model was specified with repeated measures (level 1) nested within people (level 2). We estimated separate models for

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[1] Typical time reference is 3 months.

each outcome variable using restricted maximum likelihood estimation. Time was a predictor at level 1 and was coded as 0 (pre-treatment), 2 (8 weeks), and 3 (12 weeks) to capture the unequal time between assessments. We tested a linear growth curve with random slopes and random intercepts and quadratic growth curves using fixed slopes and random intercepts with orthogonal contrast coding[2]. Treatment group was a predictor at level 2 (WLC=0; CBT=1). We also tested a time*group interaction by including a cross-level effect between time at level 1 and group at level 2. The equations for analyses are provided elsewhere (Olthuis et al., 2014).

We probed significant cross-level interactions using simple slopes (Preacher, Curran, & Bauer, 2006). We used the formula for Cohen's d adapted for use in growth-curve models as a measure of effect size of the pre-post change (Feingold, 2009). To test mediated moderation, we calculated significance of indirect effects using a Monte Carlo method with 20,000 resamples (Preacher & Selig, 2012). We used percent mediation (P_M; ratio of the indirect effect to the direct effect, calculated by ab/[ab+|c'|]) as an effect size for the indirect effect.

3. Results

ANOVAs and chi-squares showed the groups did not differ on sex, age, or medication use (Olthuis et al., 2014). We log_{10} transformed skewed scores ($>\pm1.00$).

Mean ASI-3 scores at pre-treatment (Table 1) were as high as levels found in panic disorder (*M*=32.6) and social phobia (*M*=31.4; Reiss et al., 2008). Mean coping-with-anxiety motives were somewhat elevated and mean enhancement motives somewhat reduced relative to undergraduate norms (Grant et al., 2007). While mindful of the discrepant time parameters used, SIP-R scores were lower than those among treatment-seeking alcoholics (Feinn et al., 2003) but similar to undergraduate drinkers (Stahlbrandt, Johnsson, & Berglund, 2007).

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[2] At least four measurement occasions would be required for random slopes in a quadratic growth curve (Mroczek & Griffin, 2007).

3.1 Multilevel Models

Anxiety sensitivity. When predicting ASI-3 scores, there was a significant quadratic time*group interaction, with a medium-large effect size (Table 2). The WLC showed a small linear reduction in AS over time while the CBT group had a quadratic change consisting of a sharp linear reduction in AS from pre-treatment to eight weeks that was maintained to 12 weeks.

Drinking motives. When predicting coping-with-anxiety motives, there was a significant linear time*group interaction, with a small-medium effect size (Table 2). The CBT group's coping-with-anxiety motives declined in a linear fashion over time while the WLC group's did not change. No significant interactions were found for the remaining motives.

Problem Drinking. We found a significant linear time*group interaction of moderate effect size for physical alcohol-related problems[3] and a marginally significant linear time*group interaction for intrapersonal alcohol-related problems (Table 2). For both, the CBT, but not WLC, group's problems decreased over time.

3.2 Mediation Analysis

We investigated whether the time*group interaction predicted reduced AS, which in turn predicted decreases in alcohol variables. Because there should ideally be direct effects when testing mediation, we only tested AS as a mediator for coping-anxiety motives and physical alcohol-related problems.

The indirect effect of the linear time*group interaction on coping-anxiety motives through AS was significant, 95% CI [-0.20, -0.01], P_M=.35. That is, the treatment reduced AS,

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[3] At pre-treatment, the CBT group had a significantly higher SIP-R physical score than the WLC. We conducted a supplemental analysis after removing outliers from the CBT group. (We removed the three highest scores at pre-treatment, which were from two participants who did not complete eight or 12 week assessment measures and one participant who reported alcohol use problems in the past month but no alcohol use.) After removing these outliers, pre-treatment scores were no longer different between groups and the time*group interaction for SIP-R physical remained significant.

which induced reductions in coping-anxiety motives. However, the indirect effect of the linear time*group interaction on physical alcohol-related problems through AS was not significant, 95% CI [-0.02, 0.005], P_M=.15. Exploratory analyses examined whether changes in coping-anxiety motives mediated the linear time*group interaction for physical alcohol-related problems. We found a significant indirect effect, 95% CI [-0.03, -0.01], P_M=.29, suggesting therapy-induced reductions in alcohol-related problems were mediated by reductions in coping-anxiety motives.

4. Discussion

This study investigated the alcohol outcomes of an AS-targeted CBT intervention. Findings showed a significant time*group interaction when predicting high AS suggesting that the intervention (vs. WLC) significantly reduced high AS. Results also revealed a significant linear time*group interaction in predicting coping-with-anxiety drinking motives. Simple slopes showed a significant linear reduction in coping-with-anxiety motives in the CBT group but not in the WLC. This unique interaction for coping-with-anxiety motives reflects the intervention's specificity. Changes in coping-with-anxiety motives may have stemmed directly from treatment-related reductions in AS, as treatment-related AS reductions significantly mediated changes in coping-with-anxiety motives. Reducing coping-with-anxiety motives is important, as they have been linked to alcohol-related problems (Grant et al., 2007; Martens et al., 2008).

No significant interactions were found for the remaining drinking motives. Though a brief form of this intervention led to reduced conformity motives (Watt et al., 2006), this may not have emerged here due to sample differences (college students vs. community sample) or the use of measures with different factor structures (DMQ; Cooper, 1994 vs. MDMQ-R).

A significant linear time*group interaction emerged for physical alcohol-related problems as did a marginal linear time*group interaction for intrapersonal problems. For both, simple slopes revealed a linear reduction for the CBT, but not WLC, group. These two subscales in particular may reflect AS physical and psychological concerns, respectively. Unexpectedly, given the interpersonal nature of AS social concerns, no interactions emerged for interpersonal problems. However, because AS is associated with social phobia (Norton, Cox, Hewitt, & McLeod, 1997), high AS individuals might avoid situations in which such social alcohol-related problems would arise. No interaction emerged for impulsivity problems, unsurprising, given that high AS is not associated with externalizing problems (Olatunji & Wolitzky-Taylor, 2009), nor for social responsibility problems, which may not be a concern for high AS individuals.

Overall, the reductions in physical and intrapersonal alcohol-related problems mirror previous work showing a reduction in problem drinking after AS-targeted interventions (O'Leary et al., 2010; Watt et al., 2006). While we did not find a mediating role of AS for alcohol-related problems, coping-with-anxiety motives in turn mediated the reduction in physical alcohol-related problems. This aligns with prior research linking drinking to cope and alcohol-related problems (Kuntsche, Stewart, & Cooper, 2008; Martens et al., 2008). Overall, the results suggest "chained mediation" (Taylor, MacKinnon, & Tein, 2008) where the intervention led to reductions in AS which in turn led to reductions in coping-with-anxiety motives which ultimately led to reductions in problem drinking.

Results should be considered in light of several limitations. First, we relied on self-report measures vulnerable to inaccurate reporting. Second, participants were selected for high AS as opposed to drinking-related behaviours, limiting variability in our sample; the intervention should be investigated among high AS problem drinkers. Third, our sample size (N=80) and

missing data may have limited our ability to detect small effects. Fourth, we compared the

intervention to a waiting list rather than another active intervention; while this was a suitable

starting point for the present study, it will be informative to compare the intervention to other

active interventions in the future. Fifth, given the skew and poor reliability of some of the SIP-R

subscales (Table 1), SIP-R results should be interpreted with caution. Finally, it is important to

note that the treatment-related changes in drinking motives and alcohol-related problems noted in

the present study are not directly linked to changes in absolute levels of drinking. Future research

is needed to investigate the impact of the intervention on drinking quantity and frequency,

particularly among a sample with patterns of problematic alcohol use.

Nevertheless, our findings have important clinical implications. Results presented here

and elsewhere (Olthuis et al., 2014) show that the present intervention reduced AS, coping-with-

anxiety drinking motives, physical and intrapersonal alcohol-related problems, as well as panic,

social anxiety, and posttraumatic stress symptoms. Taken together, these findings suggest that an

AS-targeted intervention may address an underlying vulnerability contributing to comorbid

anxiety and alcohol problems.

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Table 1

Means and Standard Deviations for Study Variables

Measure	Group	Pre M (SD)	8 Week M (SD)	12 Week M (SD)	r
1. ASI-3	WLC	36.83 (13.67)	31.31 (13.71)	28.56 (13.16)	.74
	PT	39.93 (13.50)	23.57 (13.44)	24.54 (14.71)	
2. MDMQ-R social	WLC	2.36 (0.90)	2.45 (1.05)	2.45 (1.13)	.73
	PT	2.64 (1.16)	2.56 (1.07)	2.37 (1.04)	
3. MDMQ-R enhancement	WLC	2.09 (1.02)	1.88 (0.92)	1.82 (1.05)	.84
	PT	2.19 (1.07)	2.08 (1.04)	1.93 (1.08)	
4. MDMQ-R coping-anxiety	WLC	1.94 (0.95)	1.75 (0.88)	1.86 (1.07)	.84
	PT	2.37 (1.14)	2.08 (1.03)	1.98 (1.16)	
5. MDMQ-R coping-depression	WLC	1.35 (0.48)	1.31 (0.52)	1.23 (0.51)	.70
	PT	1.83 (1.03)	1.60 (0.81)	1.60 (0.99)	
6. MDMQ-R conformity	WLC	1.25 (0.34)	1.30 (0.52)	1.19 (0.32)	.84
	PT	1.39 (0.72)	1.18 (0.35)	1.23 (0.55)	
7. SIP-R physical	WLC	0.36 (0.91)	0.48 (0.89)	0.41 (0.98)	.61
	PT	1.23 (1.95)	0.87 (1.52)	0.52 (1.42)	
8. SIP-R interpersonal	WLC	0.21 (0.66)	0.16 (0.58)	0.22 (0.66)	.57
	PT	0.68 (1.80)	0.39 (1.67)	0.32 (1.25)	
9. SIP-R intrapersonal	WLC	0.74 (1.33)	0.45 (0.93)	0.78 (1.36)	.76
	PT	1.50 (2.55)	0.96 (1.61)	0.72 (1.43)	
10. SIP-R impulse control	WLC	0.54 (1.02)	0.26 (0.63)	0.38 (0.75)	.34
	PT	0.93 (1.72)	0.39 (0.99)	0.44 (0.87)	
11. SIP-R social responsibility	WLC	0.46 (1.00)	0.35 (0.84)	0.28 (0.81)	.46
	PT	0.80 (1.95)	0.74 (1.48)	0.52 (1.48)	

Note. r = 12 week test-retest reliability in the WLC. WLC = waiting list control; PT = phone therapy; MDMQ-R = Modified Drinking Motives Questionnaire-Revised; SIP-R = Short Inventory of Problems – Recent. All means above are raw means (i.e., transformed data is not described above).

Table 2

Hierarchical Linear Modeling Results

	Time x Group Interaction				Intervention Group Only				Control Group Only				
	Lin B	Lin t_{df}	Quad B	Quad t_{df}	Lin B	Lin t_{df}	Quad B	Quad t_{df}	Lin B	Lin t_{df}	Quad B	Quad t_{df}	$d_{GMA\text{-}raw}$
ASI-3	-4.35	-2.98_{109}*	2.57	2.88_{109}***	-7.82	-5.80_{45}***	2.89	3.47_{45}*	-3.39	-4.51_{64}***	0.29	0.65_{64}	0.77
MDMQ-R Social	-0.15	-1.76_{76}	-----	-----	-0.08	-1.38_{47}	-----	-----	0.06	1.20_{67}	-----	-----	-0.43
MDMQ-R Enhance	-0.03	-0.38_{76}	-----	-----	-0.08	-1.54_{47}	-----	-----	-0.07	-2.14_{67}*	-----	-----	-0.09
MDMQ-R Cop-anx	-0.15	-2.21_{76}*	-----	-----	-0.17	-3.22_{47}**	-----	-----	-0.02	-0.70_{67}	-----	-----	-0.43
MDMQ-R Cop-dep^	-0.01	-0.83_{76}	-----	-----	-0.02	-1.94_{47}+	-----	-----	-0.01	-2.12_{67}*	-----	-----	-0.27
MDMQ-R Conform^	-0.01	-1.15_{76}	-----	-----	-0.01	-1.95_{47}+	-----	-----	0.00	-0.88_{67}	-----	-----	-0.38
SIP-R Physical^	-0.05	-2.63_{77}*	-----	-----	-0.04	-2.84_{47}**	-----	-----	0.00	0.33_{66}	-----	-----	-0.64
SIP-R Inter^	-0.03	-1.54_{77}	-----	-----	-0.03	-1.76_{47}	-----	-----	0.00	-0.19_{66}	-----	-----	-0.48
SIP-R Intra^	-0.03	-1.75_{77}+	-----	-----	-0.04	-2.26_{47}*	-----	-----	0.00	-0.37_{66}	-----	-----	-0.34
SIP-R Impulse^	-0.01	-0.61_{77}	-----	-----	-0.03	-1.62_{47}	-----	-----	-0.02	-1.25_{66}	-----	-----	-0.14
SIP-R Social^	0.00	0.09_{77}	-----	-----	-0.01	-0.80_{47}	-----	-----	-0.01	-1.34_{66}	-----	-----	0.00

Note. When quadratic models are not reported, the quadratic slope with fixed slopes and random intercepts was not significant and so the linear model with random slopes and random intercepts is reported instead. SIP-R = Short Inventory of Problems – Recent. *$p<.05$, **$p<.01$, ***$p<.001$, +$p\leq.08$; ^Scores have been $\log_{10}$ transformed to address skew. $d_{GMA\text{-}raw}$ = Cohen's d adapted for use with growth curve models.

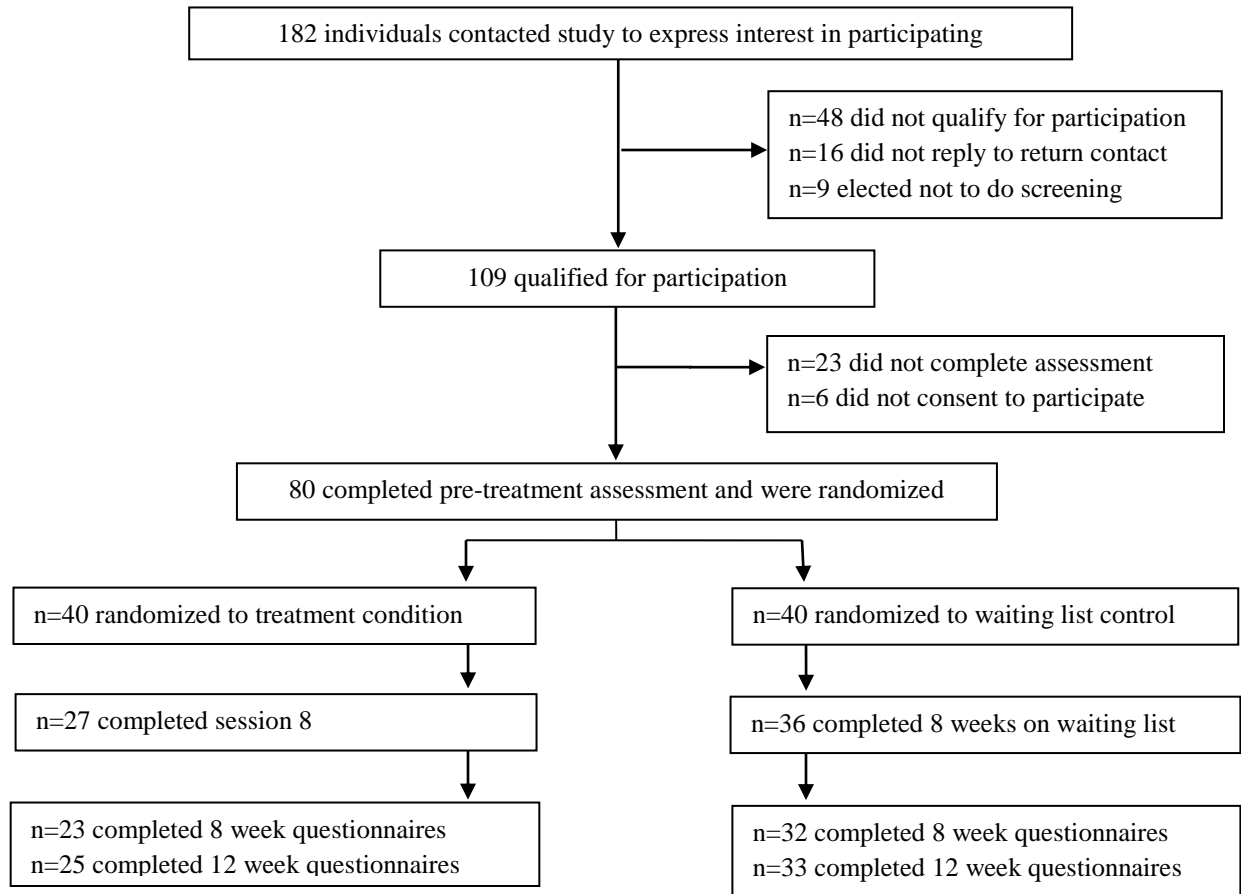*Figure 1*. Abbreviated PRISMA diagram of participant flow through the trial. Adapted from Olthuis et al. (2014).