

BACKGROUND

- Low distress tolerance (DT):** Reflects a perceived or actual incapacity to handle aversive states; considered a meta-construct encompassing a myriad of distress domains (e.g., physical vs. psychological); identified as a transdiagnostic cognitive-affective trait associated with psychopathological severity (e.g., addictive, eating, and borderline personality disorders).
 - positively related to coping oriented substance use and use-related problems
 - indicative of poor emotion regulation in bulimia nervosa (BN), and has been shown to moderate the effect of trait-impulsivity on BN symptom severity.
- Current cognitive-behavioral and mindfulness-based therapies aim to increase DT as a means to reduce symptoms and enhance coping
 - CBT: exposure-based therapies induce repeated, systematic distress towards habituation
 - Mindfulness: entails observation, awareness, and acceptance of subjective distress
- Why examine **Hatha Yoga** as an alternative therapy modality for DT?
 - Growing empirical support of yoga interventions for decreasing clinical levels of depression, anxiety, & stress
 - There is room for improvement in current treatments w/those low in DT requiring tailored intervention strategies
 - Yoga is conceptually akin to current empirically supported treatments, thus appears promising

Hypothesis:

- Participants assigned to an 8-week Yoga condition would increase their DT significantly over the course of the intervention relative to those assigned to a waitlist control condition. Changes in DT would mediate subsequent changes in eating pathology.

AIMS

- To examine the efficacy of Hatha Yoga practice for increasing DT within an 8-week intervention.
- To examine levels of DT as a mediator of the effects of a yoga intervention on emotional eating.

METHOD

Participants

52 woman ages 25-45 reporting elevated levels of stress-induced eating (i.e., low in distress tolerance, at risk for clinical eating pathology) randomly assigned to 8-weeks of Hatha Yoga or Waitlist control condition.

Inclusion

- score of ≥ 2.06 on emotional eating (DEES) on the DEBQ; $\geq .50$ on Perceived Stress Questionnaire (PSQ)

Exclusion

- Current yoga/mind-body practice; severe obesity (BMI ≥ 40) or depression (Beck Depression Inventory (BDI) score ≥ 30); BD or Psychotic disorder (assessed through Structured Clinical Interview for DSM-IV-TR)

Yoga Intervention

- Twice-weekly, 8-week, 90-minute Bikram yoga
- Room heated to 104 degrees
- 26 hatha yoga poses
- 2 breathing exercises
- Two savasanas (i.e., relaxation postures)

***Hatha yoga:** Defined as a "moving meditation"; Involves: (1) holding and transitioning through physical postures (asanas); (2) focused attention on breath (pranayama); (3) mindfulness teachings.

Baseline	Yoga (N = 27)		WL (N = 25)	
Variable:	Mean	SD	Mean	SD
DTS	3.22	0.68	3.30	0.85
DEES	3.57	0.80	3.42	0.66
BMI	28.41	4.59	26.30	5.53
Age	31.52*	6.43	35.68*	6.80

Measures

Distress Tolerance

- Distress Tolerance Scale (DTS)** assesses perceived ability to handle broad distress facets: tolerance, appraisal, absorption, & regulation

Psychopathology

- Emotional Eating Subscale (DEES)** of the **Dutch Eating Behavior Questionnaire (DEBQ)**

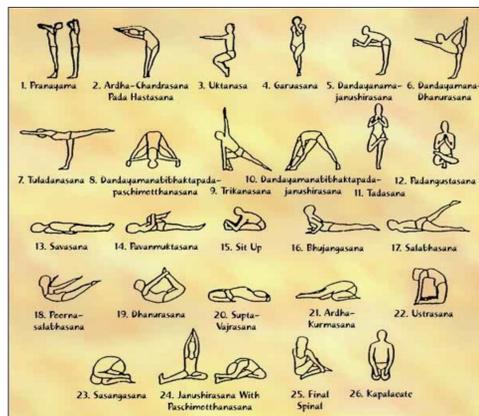
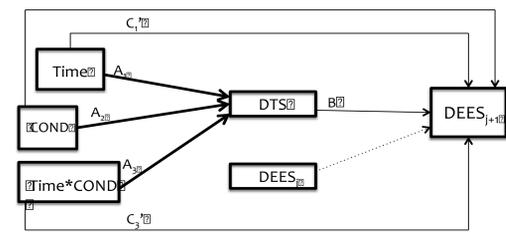
Assessment schedule

- Baseline (BL/week 0), weeks 1-8 (intervention period), Post-Treatment (PT/week 9)

Statistical Analysis

Cross-lagged Mediation using Multilevel Modeling (MLM)

- Effect of Time, Cond, Time*Cond predicting outcome
 - Controlling for Age and BMI
 - AR(1) covariance matrix
 - Time modeled as loglinear [Ln(time) transformation]
- Mediation: MacKinnon et al.'s distribution of products test of the mediated (indirect) pathway (A_3^*B) at the 95% CI; Proportion mediated (PM= A^*B/C) as effect size



RESULTS

The Effect of Yoga on Self-Reported Distress Tolerance

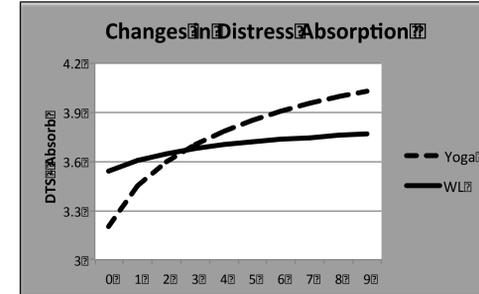
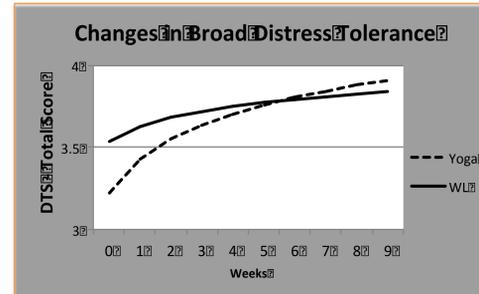
- Main effect of Time significantly predicted DTS for both Yoga ($b = .3, t(134) = 5.27, p = .000$) and WL ($b = .13, t(130) = 2.2, p = .029$). Main effect of COND was not significant ($b = .32, t(80) = 1.25, p = .216$)
- COND*Time interaction significantly predicted DTS such that the relative rate of improvement was greater for Yoga ($b = -.17, t(132) = -2.05, p = .043$)
- Effect size of interaction

RESULTS (CONT'D)

Post-Hoc: Subscales of DTS:

COND*Time interaction predicted:

- Distress Tolerance** ($b = -.23, t(152) = -2.19, p = .03$) & **Absorption** ($b = -.26, t(141) = -2.58, p = .011$); Did not predict Regulation, ($b = -.11, t(124) = -.94, p = .352$) or Appraisal ($b = -.08, t(143) = -1.01, p = .316$)

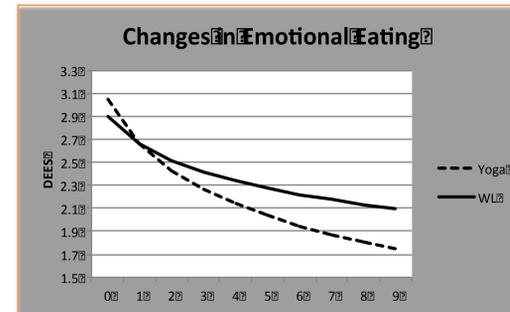


The Effect of Yoga on Emotional Eating Symptoms

- Main effect of Time significantly predicted DEES for both Yoga ($b = -.57, t(108) = -9.47, p = .000$) and WL ($b = -.34, t(105) = -5.68, p = .000$). Main effect of COND was not significant ($b = .15, t(77) = .55, p = .587$)
- COND*Time interaction significantly predicted DEES such that the relative rate of improvement was greater for Yoga ($b = -.22, t(107) = -2.54, p = .013$)

Effect Size

- Raudenbush & Xiao Feng (2001) estimate, given our sample size, substantial power (.90-.95) to be able to detect a Cohen's D effect of -1.19 at $p < .05$ (i.e., large effect for group differences)



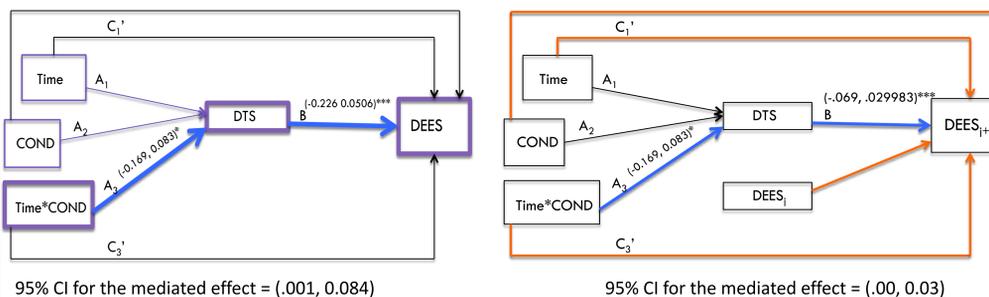
Test of Mediation

DTS – Average Total Score

- When testing the A^*B product without accounting for directionality (i.e., not cross-lagged) the 95% CI for the mediated effect = (.001, 0.084) revealed significant mediation; PM= 17.6%
- When employing a cross-lagged strategy examining DTS as a mediator of subsequent changes in DEES (i.e., accounting for temporal order of the effect) mediation was not significant (95% CI= 0.0, .03)

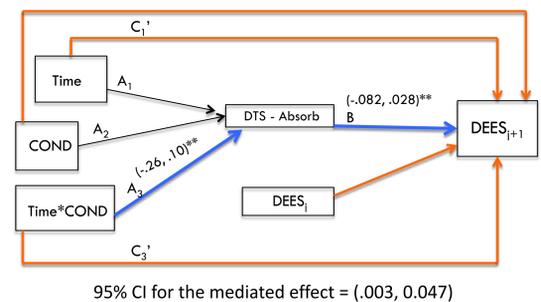
DTS – Absorption Subscale

- Cross-lagged test of **Absorption** scale revealed significant mediation 95% CI (.003, .047) of DEES ; PM= 11.5%



95% CI for the mediated effect = (.001, 0.084)

95% CI for the mediated effect = (.00, 0.03)



95% CI for the mediated effect = (.003, 0.047)

CONCLUSIONS

- Our RCT on yoga for distress tolerance and emotional eating in a stress-vulnerable population at-risk for eating pathology add to the growing body of research supporting yoga for mental health. Importantly, our study employed a "high-intensity" form of hot hatha yoga for which effects are under-researched
- Consistent with our hypothesis, we found that practicing 8-weeks of hatha yoga (as compared to WL) increased levels of DT as measured by the DTS, and emotional eating, as measured by the DEES.
- Post hoc analyses reveal yoga effectively targets facets related to the evaluative tolerability/aversiveness (tolerance) of distress, as well as for tendencies of becoming consumed by distress (absorption).
 - Yoga impacts cognitive-behavioral DT components tied to the "distress reaction" (e.g., resulting disruption of functioning; imagined ability to handle) rather than its emotional appraisal or regulation
- Upon initial analysis, it appeared that changes in total DT mediated reductions in emotional eating; when enhancing the sophistication of statistical methods employing a "cross-lagged" strategy to determine temporal order, DTS no longer mediated changes in DEES. Because the effects of yoga on DT appeared driven by the Absorption subscale, we tested Absorption as an alternative mediator. Indeed, changes in distress absorption through yoga preceded and mediated changes in emotional eating.
- Results suggest that yoga may reduce emotional eating at least-in part by counteracting maladaptive behavioral avoidance and goal-stifling tendencies, which poses as promising for disorders associated with high rates of maladaptive coping
- Our findings add empirical support for interventions that aim to increase low DT and for the use of mind body interventions such as hatha yoga for this aim

Limitations & Future Directions

- Due to our lack of an active control condition, we are unable to determine the specificity of yoga's effects; future interventions should compare yoga to other forms of exercise or equal-contact conditions (e.g., wellness education)
- Future studies should: adopt appropriate analyses taking into account directionality of treatment effects; vary the length, form, and dose of yoga practice; extend findings to clinical samples
- To enhance yoga's conceptual foundation, tests of the mechanisms by which yoga impacts DT should be examined. Specifically mindfulness and behavioral exposure should be examined as possible "active ingredients" of yoga for increasing DT

REFERENCES

- Anestis, M. D., Selby, E. A., Fink, E., & Joiner, T. E. (2007). The multifaceted role of distress tolerance in dysregulated eating behaviors. *International Journal of Eating Disorders*, 40, 718–726.
- Baer, R. A. (2003). Mindfulness training as a clinical intervention: A conceptual and empirical review. *Clinical Psychology: Science and Practice*, 10, 125-143.
- Baer, R. A., Smith, G. T., Hopkins, J., Krietemeyer, J., & Toney, L. (2006). Using self-report assessment methods to explore facets of mindfulness. *Assessment*, 13, 27-45
- Bernstein, A., Zvolensky, M. J., Vujanovic, A. A., & Moos, R. (2008). Integrating anxiety sensitivity, distress tolerance, and discomfort intolerance: A hierarchical model of affect sensitivity and tolerance. *Behavior Therapy*, 40, 291-301.
- First, M. B., Spitzer, R. L., Gibbon, M., & Williams, J. B. W. (1996). *Structured Clinical Interview for DSM-IV-TR Axis I Disorders, Research Version, Non-patient Edition (SCID-I/NP)*. New York: Biometrics Research, New York State Psychiatric Institute, November 2002.
- Leyro, T. M., Zvolensky, M. J., & Bernstein, A. (2011). Distress tolerance and psychopathological symptoms and disorders: A review of the empirical literature among adults. *Psychological Bulletin*, 136, 576-600.
- MacKinnon, D. P., Fritz, M. S., Williams, J., & Lockwood, C. M. (2007). Distribution of the product confidence limits for the indirect effect: Program PRODCLIN. *Behavior Research Methods*, 39(3), 384-389.
- MacKinnon, D. P., Lockwood, C. M., & Williams, J. (2004). Confidence limits for the indirect effect: Distribution of the product and resampling methods. *Multivariate Behavioral Research*, 39(1), 99-128.
- Otto, M. W., Smits, J. A., Reese, H. E. (2004). *Cognitive-behavioral therapy for the treatment of anxiety disorders*. The Journal of Clinical Psychology, 65, 34-41.
- Peterson, R. A., & Reiss, S. (1992). *Anxiety Sensitivity Index Manual Revised*. Worthington, OH: International Diagnostic Systems.
- Raudenbush, S. W., & Xiao-Feng, L. (2001). Effects of study duration, frequency of observation, and sample size on power in studies of group differences in polynomial change. *Psychological methods*, 6(4), 387.
- Raudenbush, S., Bryk, A., Cheong, Y.F., & Congdon, R. (2004). *HLM 6: Hierarchical linear and nonlinear modeling*. Lincolnwood, IL: Scientific Software International.
- Reiss, S., Peterson, R., Gursky, D., & McNally, R. (1986). Anxiety sensitivity, anxiety frequency, and the prediction of fearfulness. *Behaviour Research and Therapy*, 24, 1–8.
- Simons, J. S., & Gaher, R. M. (2005). The distress tolerance scale: Development and validation of a self-report measure. *Motivation and Emotion*, 29, 83-102.
- Singer, J. D., & Willett, J. B. (2003). *Applied longitudinal data analysis: Modeling change and event occurrence*. Oxford University Press.
- Smits, J. A. J., Berry, A. C., Rosenfield, D., Powers, M. B., Behar, E., & Otto, M. W. (2008). Reducing anxiety sensitivity with exercise. *Depression & Anxiety*, 25, 689-699.
- Strong, D. R., Lejuez, C. W., Daughters, S., Marinello, M., Kahler, C. W., & Brown, R. A. (2003). *The computerized mirror tracing task, version 1*. Unpublished manual.
- Telch, C. F., Agras, W. S., & Linehan, M. M. (2001). Dialectic behavior therapy for binge eating disorder. *Journal of Consulting and Clinical Psychology*, 69, 1061-1065.
- Van Strien, T., Frijers, J. E. R., Bergers, G. P. A., & Defares, P. B. (1986). The Dutch Eating Behavior Questionnaire (DEBQ) for assessment of restrained, emotional, and external eating behavior. *International Journal of Eating Disorders*, 5, 295-315
- Zvolensky, M. J., Vujanovic, A. A., Bernstein, A., & Leyro, T. (2010). Distress tolerance theory, measurement, and relations to psychopathology. *Current Directions in Psychological Science*, 19(6), 406-410.