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A Systematic Review of Yoga Interventions in the Incarcerated Setting

ALEXANDRA S. WIMBERLY

JIA XUE

School of Social Policy & Practice
University of Pennsylvania

While yoga interventions in the incarcerated setting are on the rise, little is known regarding their efficacy. The objective of this article is to assess the effects of yoga on the well-being of incarcerated populations. Two reviewers systematically searched PubMed, PsycInfo, EBSCO MegaFILE, Web of Science, Science Direct, AMED, and Google Scholar for yoga intervention studies in jails and prisons. The search yielded 54 results; ten papers met inclusion criteria. Evaluated outcomes included stress, cognitive performance, mental and physical well-being and re-incarceration rates. While the majority of yoga practiced was hatha, yoga interventions also included a focus on yogic philosophy and spirituality. The reviewed studies found statistically significant outcomes pointing to the benefits of yoga. Many of the studies were limited by study design challenges (such as lack of control groups) and minimal discussion regarding the intervention's purported mechanism. Yoga interventions in the incarcerated setting are associated with positive well-being outcomes. Future interventions can choose outcomes based both on the type of yoga practiced and on the needs of the criminal justice population.

Key words: Yoga, jail, prison, incarcerate, correctional

Nearly seven million people are under correctional supervision in the United States, including almost five million people on probation or parole and over two million people in jail or prison (Kaeble, Glaze, Tsoutis, & Minton, 2015). People who are incarcerated often experience multiple deleterious health conditions at higher rates than the general population, including mental health problems (Prins, 2014), infectious diseases and stress-related illnesses (Massoglia, 2008) and chronic

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health problems (Binswanger, Krueger, & Steiner, 2009). In addition, substance use problems have widely been noted among the criminal justice population; in 2006, it was estimated that 85% of all incarcerated persons experienced problematic substance use (The National Center on Addiction and Substance Abuse, 2010). These poor health outcomes often continue into community reentry, which can contribute to a more difficult reentry experience. For example, eight in ten men and nine in ten women reentering the community report chronic health conditions (Mallik-Kane & Visser, 2008).

Despite the association of physical and mental health complications with incarceration and reentry, substance use services (Taxman, Perdoni, & Harrison, 2007) and mental health services (James & Glaze, 2005) in the corrections system are insufficient to meet the overall need. For example, in 2006, of incarcerated persons with a substance use disorder, only 11 percent received professional treatment (The National Center on Addiction and Substance Abuse, 2010). Service provision is also poor during reentry, as only three in ten of persons with need report participation in substance use treatment immediately following release; this further declines to two in ten in the year following release (Mallik-Kane & Visser, 2008). In regards to mental health services provision, just six in ten persons with mental health need report receiving treatment while incarcerated, which further declines to five in ten following release (Mallik-Kane & Visser, 2008). Further, one quarter of women and one third of men with physical health conditions do not receive treatment while incarcerated. Treatment provision decreases when released; eight to ten months after release, one half of men and two fifths of women with need report receiving no treatment for physical health conditions (Mallik-Kane & Visser, 2008).

With the sizeable criminal justice population in the United States, and the corresponding physical and behavioral health need of this population, innovative programming is needed to alleviate the poor health outcomes associated with correctional involvement. Yoga, a physical, mental and spiritual practice originating in South Asia, has recently been highlighted in the popular press for numerous correctional-based programs that address prisoner well-being (Grissom, 2013; Pilon, 2013;

Ullman, 2014).

The degree or reason for yoga's popularity in the criminal justice setting has yet to be researched; however, interviews with correctional administrators and experts reveal belief in the rehabilitative benefits of yoga and the draw of fiscally cheap programming (Pilon, 2013; Rammohan, 2012). It is also possible that the popularity of yoga practice in the correctional setting simply mirrors the rise in yoga practice in the general population in the United States. Six percent (approximately 13 million) of adults practiced yoga for health purposes during 2006 to 2007, which was an increase of approximately three million people since 2002 (Barnes, Bloom, & Nahin, 2008; U.S. Department of Health and Human Services, 2013). Another plausible reason for the popularity of yoga instruction within the criminal justice population is related to a desire among yoga teachers to reach an underserved population. Yoga practice in the United States has been critiqued for its marketing to privileged white women of a slender body type. Yoga teachers who are conscious of this disparity may be interested in expanding access to yoga instruction, such as to those within the criminal justice system. For example, a *New York Times* article reported that some yoga teachers are more fulfilled teaching to people in prison than teaching to the general population in yoga studios (Pilon, 2013).

Despite anecdotal endorsement of the benefits of yoga practice in the correctional setting, relatively limited empirical research exists. The following paper seeks to fill this gap by systematically reviewing the literature regarding yoga interventions in jails and prisons to determine the efficacy of yoga in addressing health and well-being in the correctional setting.

The State of Yoga Research

While research regarding yoga in the correctional setting is limited, research within the general population suggests that yoga improves physical health (Ross & Thomas, 2010), in particular by addressing low back pain (Posadzki & Ernst, 2011; Sherman et al., 2011; Sherman, Cherkin, Erro, Miglioretti, & Deyo, 2005), chronic disease (Yang, 2007) and cardiovascular disease and metabolic syndrome risk factors (Chu, Gotink, Yeh, Goldie, & Hunink, 2014). Research also demonstrates that

yoga may be an effective method of reducing psychological and emotional problems. Reviews regarding yoga and anxiety (Kirkwood, Rampes, Tuffrey, Richardson, & Pilkington, 2005), yoga and stress and anxiety (Wi & Goldsmith, 2012); and yoga and stress among healthy adults (Chong, Tsunaka, Tsang, Chan, & Cheung, 2011) find that the evidence is promising in support of yoga's effect in reducing anxiety and stress; however, limitations in study methodology prevent any definitive conclusion.

While yoga research in the general population is growing, research on yoga interventions in jails and prisons is in its infancy. We identified just one systematic review and meta-analysis that looked at both yoga and the associated practice of mindfulness meditation in prison (Auty, Cope, & Liebling, 2015). Of the 24 studies included in the systematic review, only 5 of those studies focused primarily on yoga. The review found that practitioners of yoga and meditation in prison experienced statistically significant small increases in psychological well-being and behavioral functioning. Further, interventions of a longer duration and less intensity had a slightly more positive, statistically significant effect on behavioral functioning than interventions of a shorter duration and more intensity.

Challenges with yoga research have also been identified (Elwy et al., 2014; Wi & Goldsmith, 2012). Elwy et al. (2014) detailed that yoga studies often lack rigorous reporting of the components and duration of the yoga practice and description of teacher qualifications, all components that can impact the intervention efficacy. Further, while the implementation of yoga randomized controlled trials has risen, the rigor of such trials has generally been low. Reviews have consistently pointed out that methodological rigor is lacking in yoga studies for any conclusive statement regarding yoga's efficacy to be reached.

With the breadth of health issues that incarcerated persons face and the breadth of health issues for which yoga has proven promising, yoga appears to be a feasible and low-cost intervention for that population. However, yoga research within the criminal justice system is limited, and issues with yoga research in the general population have been identified. The purpose of this review, therefore, is to look at the various outcomes assessed in yoga studies in jails and prisons, identify

methodological strengths and weaknesses of these studies and assess the impact of yoga on these populations. Coalescing the results of yoga practice in the incarcerated setting to date will inform future directions of research and practice.

Methods

The objective of this study is to summarize and assess research that documents the effects of yoga interventions among incarcerated persons in order to inform yoga programming in the incarcerated setting.

Literature Research Methods

PubMed, PsycInfo, EBSCO MegaFILE, Web of Science, Science Direct, AMED, and Google Scholar were systematically searched for yoga intervention studies in the incarcerated setting published up to January 15, 2016. Two reviewers extracted data and assessed study quality using data evaluation forms. The following terms were used for search criteria: "yoga" OR "yogic" AND "prison" OR "inmate" OR "jail" OR "correctional" OR "incarcerate" OR "criminal justice" OR "offender."

The inclusion criteria included quantitative or qualitative peer-reviewed journal articles or dissertations documenting yoga-based intervention studies that were conducted with a sample of incarcerated persons, and were written in English. A yoga intervention was defined as any intervention that was titled 'yoga' and included practice of one or more of the eight limbs associated with yoga practice, including ethical standards (yamas and niyamas), physical postures (asana), breathing exercises (pranayama), focusing attention on internal processes (pratyahara), concentration (dharana), meditation (dhyana), and integration (samadhi). The following were excluded from analysis: (1) books; (2) conference studies without full texts; and (3) news and reports without data. The two reviewers identified titles and abstracts, corroborated findings and extracted data using a data evaluation form crafted for this paper and informed by the Cochrane Collaboration (Higgins & Green, 2011).

Results

Search Results

The literature search yielded 54 relevant results. After reviewing the title, topic and abstract of these studies, 14 papers were eligible based on the inclusion criteria. Of these, four were further excluded after an in-depth review because they involved populations that were not incarcerated, including clients with mental illness and criminal justice involvement housed at an inpatient hospital (Sistig, Friedman, McKenna, & Consedine, 2015), juveniles charged with sex-offenses at a non-secure private treatment facility (Messina, Grella, Cartier, & Torres, 2010), juveniles in rehabilitation homes (Prince, 2012), and adolescents charged with sex offenses being treated at a human service agency (Derezotes, 2000). In total, ten papers that referenced nine studies were included in the in-depth review that follows (two of the papers refer to the same study, but completed different analyses) (Bilderbeck, Brazil, & Farias, 2015; Bilderbeck, Farias, Brazil, Jakobowitz, & Wikholm, 2013).

Description of the Studies

The search yielded eight yoga intervention articles from peer-reviewed journals, one doctoral dissertation and one master's thesis. The methodological approaches varied, including one randomized controlled trial (Bilderbeck et al., 2015; Bilderbeck et al., 2013), two pre-post test designs with control groups (Ambhore & Joshi, 2009; Bunk, 1978), three pre-post test designs without control groups (Duncombe, Komorosky, Wong-Kim, & Turner, 2005; Harner, Hanlon, & Garfinkel, 2010; Ramadoss & Bose, 2010), two cross-sectional studies with comparison groups (Landau & Gross, 2008; Pham, 2013) and a qualitative study (Rucker, 2005).

The demographics varied considerably across the studies, and several studies had limited reporting on demographics. One study was based in India, one study was based in Great Britain, and the remaining seven were based in the United States. One study included only juveniles (Ramadoss & Bose, 2010), three studies had a mix of younger and older participants (Bilderbeck et al., 2015, 2013; Pham, 2013; Rucker, 2005), and the rest of the studies included adults only (Ambhore &

Joshi, 2009; Bunk, 1978; Duncombe et al., 2005; Harner et al., 2010; Landau & Gross, 2008). In three studies, the majority of participants were Caucasian (Bilderbeck et al., 2013; Bunk, 1978; Harner et al., 2010). In three studies, the majority of the participants were African American (Landau & Gross, 2008; Pham, 2013; Ramadoss & Bose, 2010). It should be noted that in Ramadoss & Bose's (2010) study, only 12 % of participants reported their race. In addition, Landau & Gross (2008) only included demographics regarding people who attended more than four yoga classes, but did not report the demographics of the control group, which included people who attended less than four yoga classes. Duncombe et al. (2005) enrolled participants of diverse ethnicities, including Native Hawaiian, Japanese, Chinese, Filipino, Samoan, Tongan, Marshallese, African American, Caucasian and Native American. One study included only females (Harner et al., 2010), and four studies included only males (Ambhore & Joshi, 2009; Bunk, 1978; Pham, 2013; Rucker, 2005). Studies largely included participants of a broad range of convicted offenses and sentence lengths.

Study Findings

Eight of the studies assessed a variety of psychological well-being outcomes, one study also looked at cognitive-behavioral outcomes, and one study addressed re-incarceration. Well-being outcomes included stress, depression and anxiety, positive and negative affect, impulse control, aggression, spirituality, locus of control, general well-being, self-esteem, hope, and compassion. The multiple outcomes studied point to the many purported ways yoga affects practitioners. In addition to multiple outcomes, the studies also delivered various types of yoga interventions. The most common yoga practiced was hatha. Significant study findings are described below. Table 1 includes the measures used for each outcome, as well as significant findings.

Hatha yoga and associated yoga interventions. Hatha yoga focuses on physical postures in order to relax the body and mind, so as to better access meditation ("Hatha Yoga," 2016). Four of the studies in this review implemented hatha yoga interventions. In addition, one study's yoga intervention focused

Table 1. Study Results

Study	Outcome Measures	Significant Results
Ambhore & Joshi (2009)	Sinha Comprehensive Anxiety Test	Decreased anxiety favoring yoga over the treatment as usual ($F = 17.56$, $p < 0.01$)
	Impulse Control Scale developed by Dr. Anjali Shrivastva & Prof. R. K. Naidu (1987)	Increased impulse control favoring yoga over treatment as usual ($F = 12$, $p < .01$).
	Aggression Scale developed by Dr. Guru Pyari Mathur & Dr. Raj Kumari Bhatngar (2004)	Decreased aggression favoring yoga over treatment as usual ($F = 8.80$, $p < .01$)
Bilderbeck et al. (2013)	Positive and Negative Affect Scale (Watson, Clark, & Tellegen, 1988)	Decreased stress in favor of yoga ($F(1, 86) = 4.31$, $p = 0.041$)
	Perceived Stress Scale (Cohen, Kamarck, & Mermelstein, 1983)	Increased positive affect in favor of yoga ($F(1, 86) = 5.26$, $p = 0.024$)
	Brief Symptom Inventory (Derogatis & Spencer, 1993)	Decreased psychological distress in favor of yoga ($F(1, 86) = 4.48$, $p = 0.037$)
	Go/No Go Trials	Better performance on the cognitive behavioral task in favor of yoga ($F(1, 76) = 5.43$, $p = 0.022$)
	The Barratt Impulsiveness Scale (Stanford & Barratt, 1995)	
Bilderbeck, et al. (2015) (parent study above)	Positive and Negative Affect Scale (Watson, Clark, & Tellegen, 1988)	Greater yoga class attendance is associated with greater age ($\beta = 0.074 \pm 0.031$, CI [0.011, 0.134], $p = 0.023$)
	Perceived Stress Scale (Cohen et al., 1983)	Greater yoga class attendance ($\beta = -1.053 \pm 0.383$, CI [-1.850, -0.341], $p = 0.010$) and self-practice 5 or more times per week ($\beta = 0.5329 \pm 2.408$, CI [-10.147, -0.636], $p = 0.032$) is associated with greater decreases in stress
	Brief Symptom Inventory (Derogatis & Spencer, 1993)	Self practice 5 or more times per week associated with greater decreases in negative affect ($\beta = -4.863 \pm 2.187$, CI [-9.128, -0.441], $p = 0.033$)
	Go/No Go Trials	
	The Barratt Impulsiveness Scale (Stanford & Barratt, 1995)	
Bunk (1978)		Decreased state anxiety favoring yoga only, meditation and yoga and meditation only over delayed control ($F = 6.75$, $p = .0006$)
		Decreased trait anxiety favoring yoga and meditation over yoga only, meditation only and delayed control ($F = 3.39$, $p = .02$)
	Spielberger's State-Trait Anxiety Inventory (Spielberger, Gorsuch, & Lushene, 1970)	Increased locus of control favoring yoga only, yoga and meditation and meditation only over delayed control ($F = 7.10$, $p = .0004$)
	Rotter's Locus of Control Measure (Rotter, 1966)	
	Tennessee Self-Concept Scale (Fitts & Roid, 1964)	Decreased psychoticism favoring yoga and meditation over delayed control ($F = 2.98$, $p = .0384$)

Table 1. Study Results, continued

Study	Outcome Measures	Significant Results
Duncombe et al. (2005)	Center for Epidemiologic Studies Depression Scale (Radloff, 1977)	Decreased depression ($t = 3.53$, $p = .002$).
	The Rosenberg Self-esteem Scale (Rosenberg, 1979)	Increased hope ($t = 3.09$, $p = .001$).
	The Hope Scale (Snyder et al., 1991)	Increased physical-mental wellness ($t = -2.59$, $p = .018$)
	The Life Outlook-Compassion Scale (Duncombe et al., 2005)	Increased human connection ($t = -2.25$, $p = .036$)
	The Physical-Mental Wellness Scale (Duncombe et al., 2005)	
Harner et al. (2010)	Beck Depression Inventory II (Beck, Steer, & Brown, 1996)	Decreased depression ($p < .001$)
	Perceived Stress Scale (Cohen et al., 1983)	
	Beck Anxiety Inventory (Beck, Epstein, Brown, & Steer, 1988)	
Landau & Gross (2008)	Re-incarceration rate from North Carolina Department of Corrections public information website	Lower re-incarceration favoring yoga (Chi-square test statistic of 5.68 (1, $N = 190$), $p < 0.025$)
Pham (2013)	Spiritual Well-Being Scale (Ellison & Paloutzian, 2009)	Increased spiritual well-being favoring yoga ($t = 4.03$, $p < .001$)
Ramadoss & Bose (2010)	Perceived Stress Scale (Cohen et al., 1983)	Decreased stress ($t = 2.061$, $p = .04$) Increased self-control ($t = -2.3$, $p = .02$)
	Tangney Self-Control Scale (Tangney, Baumeister, & Boone, 2004)	
Rucker (2005)	Qualitative study explored self-regulation, self-exploration and self-liberation	

on physical postures (as with hatha yoga).

A randomized controlled trial conducted in seven British prisons (of various security levels and including one female prison and one prison with younger people of 21-25 years) compared outcomes for 45 persons who completed a 10-week 2-hour hatha yoga intervention, versus 55 people in a treatment as usual control group who did not receive yoga instruction (Bilderbeck et al., 2013). The intervention included 100-110 minutes of hatha yoga postures followed by 10 - 20 minutes of relaxation (including breathing exercises). Significant results included decreases in stress and psychological distress, increases in positive affect and better performance on a cognitive-behavioral task for the yoga participants in comparison to the control group. Authors performed a follow-up analysis

on the data and found that more yoga practice (either greater attendance to the yoga intervention or greater self-study) was associated with a greater decrease in stress. Further, those who were older had greater attendance to classes (Bilderbeck et al., 2015).

In a federal minimum security Texas prison, 80 people were consecutively enrolled to hatha yoga only, mantra meditation only, hatha yoga and mantra meditation combined, or a delayed control group (Bunk, 1978). The intervention groups met three times per week for five weeks for 90-105 minute sessions. The hatha yoga intervention included 35 different physical postures and different breathing techniques, such as diaphragm breathing, alternate nostril breathing, and rapid breathing (bhastrika). The hatha yoga and mantra meditation combined group consisted of the same yoga sequence as the hatha yoga only group, in addition to 10-20 minutes of mantra meditation. This quasi-experiment found that people in the yoga only, meditation only, and yoga and meditation combined groups scored significantly lower on state anxiety and significantly higher on locus of control than the delayed control group. Further, the yoga and meditation combined group scored significantly lower on trait anxiety and psychoticism in comparison to the delayed control group.

Harner, Hanlon, & Garfinkel (2010) employed a repeated measures design, finding that six women who completed a 12-week twice a week 120-minute Iyengar yoga course in a medium security prison in the eastern half of the United States experienced significant decreases in depression from baseline to study completion. Iyengar yoga is a form of hatha yoga that focuses on correct alignment of physical postures and precise practice of breathing exercises. The intervention, sequenced to increase confidence and decrease stress, included strengthening and balancing poses, and relaxation practices.

Rucker's (2005) qualitative study of seven men in a maximum-security mid-western prison who participated in two-hour twice-weekly three-month yoga classes documented gains in self-regulation, self-exploration and self-liberation, conceptualized as a continuum with people moving from self-regulation, to self-exploration, to self-liberation. Self-regulation included stress management and anger control techniques.

Self-exploration consisted of a greater understanding of one's self. Self-liberation/compassionate service consisted of a deeper understanding of how one is situated in one's environment, as by committing to community service. The benefits that participants experienced were consistent with what the men had reported that they desired to get out of the yoga and meditation practice. Classes included: breathing techniques and relaxation to facilitate breath and body awareness; hatha yoga postures and breathing to understand the connection of body, breath, and mind; meditation; discussion of the relationship between body, breath, mind, and habits (including the habits of fear, self-hatred and loneliness); and discussion of ethical standards.

Although not described explicitly as hatha yoga, Ramadoss & Bose's (2010) study looked at the Transformative Life Skills program which, similar to hatha yoga, focused on physical postures. The program incorporated physical postures, breathing techniques and meditation with the aim to decrease stress and increase self-control and self-awareness among youth in juvenile halls. The classes began with a moment of silence, followed by a "check-in," followed by yoga poses and breathing exercises, and closing with a "check-out." In an Alameda County, California Juvenile Justice Center, 75 juveniles who participated in the Transformative Life Skills 60-minute yoga classes experienced significant decreases in stress and increases in self-control from baseline to completion of yoga classes. Transformative Life Skills classes were delivered for 18 months; within this time period the number of classes that each of the 75 juveniles attended was not reported.

Yoga interventions focusing on philosophy or spirituality. Three of the yoga interventions focused on yogic philosophy or spirituality. Pham (2013) compared the one-time spirituality score of participants in a California state prison yoga program (Sanatana Yoga Prison Project) who had attended at least three sessions ($n = 31$) versus a control group of people who had not attended any yoga sessions ($n = 31$), and found that people who attended yoga scored significantly higher on a spirituality measure than those who did not attend yoga. Qualitative interviews with ten of the yoga participants also revealed that yoga participants experienced physical benefits, relaxation,

and psycho-spiritual development. The two-hour yoga classes included physical postures, breathing exercises, and meditation. Meditation instruction included mindfulness-based strategies and discussion of the yogic chakra system. However, participants were supported to use, if applicable, any of their existing meditation or prayer practices. Classes also incorporated discussion regarding morality and spirituality.

At the minimum security Wake Correctional Center in Raleigh, North Carolina, five-year re-incarceration rates were compared among people who attended more than four Ananda Marga yoga classes, versus those who attended less than four (Landau & Gross, 2008). The 120-minute yoga classes included: a 60-minute discussion regarding yoga philosophy; 30-45 minutes of physical postures chosen to induce calmness and basic breathing exercises; and 15-30 minutes of self-massage, guided relaxation, call and response chanting (kirtan) and mantra meditation. In addition, yoga classes sometimes hosted a guest teacher from Ananda Marga and hosted a monthly vegetarian meal. Class attendance increased by two to three times when the monthly vegetarian meals were held. The study found that the 47 people who attended more than four yoga classes and were released between 2002 and 2007 had an 8.5% re-incarceration rate. In comparison, the 111 people who attended less than four yoga classes during the same period had a 22.5% re-incarceration rate.

In Ambhore & Joshi's (2009) quasi-experiment, 45 persons incarcerated at Amravati district central jail in Maharashtra, India who participated in a nine-month yoga intervention, were compared with 45 persons at the same jail who did not participate in yoga. Those who participated in the yoga intervention experienced significant decreases in anxiety, significant increases in impulse control, and significant decreases in aggression. The 60-minute yoga intervention was comprised of 10 minutes of prayer and chanting, 5 minutes of cleansing practices, 5 minutes of subtle body movements (sukshama exercise), 15 minutes of physical postures, 15 minutes of breathing exercises and meditation, and 10 minutes of relaxation (yog nidra).

Yoga intervention that incorporated other associated practices. Twenty inmates at Maui Community Correctional Center who participated in the 12-week Free Inside Program experienced significant decreases in depression, significant increases in hope, physical-mental wellness and human connection from baseline to study completion (Duncombe et al., 2005). The Free Inside Program incorporated yoga, meditation, and chi gung; classes were comprised of stretching, breathing, self-massage and guided or silent reflection. Classes aimed to instill acceptance of practices hailing from various ethnic traditions that strengthen both the physical and mental capacities and increase one's sense of connectedness to others.

Effect Size

Three studies were appropriately designed to generate effect sizes, including one randomized controlled trial (Bilderbeck et al., 2013) and two quasi-experiments (Ambhore & Joshi, 2009; Bunk, 1978). Three studies were excluded from effect size analysis because they did not include a comparison group (Duncombe et al., 2005; Harner et al., 2010; Ramadoss & Bose, 2010). One study was excluded because it was a qualitative study (Rucker, 2005). Two studies were excluded from the effect size analysis because they were cross-sectional studies (Landau & Gross, 2008; Pham, 2013). The comparison groups used in these two studies render the data inadequate to complete an effect size analysis, because there was only one time-point measured for these studies. Therefore, it is impossible to know if the participants in the yoga groups would have had higher spirituality scores in Pham's (2013) study and lower reincarceration rates in Landau & Gross's (2008) study, regardless of practicing yoga.

To generate the effect sizes for each outcome of the three studies appropriately designed for effect size analysis (Ambhore & Joshi, 2009; Bilderbeck et al., 2013; Bunk, 1978) we calculated the mean difference between the yoga and control groups. Because two of the studies had yoga and control groups of unequal sample size, we used Klauer, Willmes, & Phye's (2002) effect size calculator, which controls for different sample sizes. It should be noted that the pre- and post-tests are considered independent, not repeated, measures.

Table 2. Effect Size of Each Outcome by Study

Study	Outcome	N	Yoga Group		N	Control Group		Corrected effect size d_{corr}	
			Pre	Post		Pre	Post		
			M	SD	M	SD	M	SD	
Bilderbeck et al., 2013	Positive Affect	45	35.51	1.14	37.16	1.16	33.15	1.10	3.33
	Negative Affect		17.04	0.96	15.02	0.80	18.53	0.96	2.68
	Perceived Stress		16.87	1.24	11.40	1.10	17.91	0.97	3.41
	Psychological Distress		38.07	4.42	24.49	3.38	39.51	4.03	3.05
Bunk, 1978	Locus of Control	15	8.53	2.92	5.53	2.23	8.55	4.03	0.78
	State Anxiety		44.73	9.84	35.40	7.04	41.95	9.38	1.20
	Trait Anxiety		38.07	5.32	33.60	6.95	37.75	9.43	0.56
	Self-criticism*		34.00	5.01	34.53	4.78	34.30	6.89	0.20
	Total positive*		340.20	30.08	356.60	25.68	340.25	29.14	0.47
	Personality defect*		70.93	11.29	75.27	7.04	71.45	9.84	0.38
	Neuroticism*		80.67	9.60	86.80	6.68	82.30	13.76	0.47
Ambhore & Joshi, 2009	Personality integration*		8.80	2.62	11.27	3.31	8.30	4.40	0.59
	Deviant signs*		17.13	12.32	9.47	6.85	17.80	11.30	0.67
	Psychoticism *		48.80	6.25	46.60	6.88	48.80	6.16	0.76
	Aggression	45	192.44	25.33	166.37	17.46	183.71	29.31	0.93
	Anxiety		52.71	12.15	36.46	10.42	52.40	13.40	1.18
	Impulse control		201.20	20.19	225.73	23.61	209.11	18.21	1.33

Note: * from self-concept scale

The three studies included in the effect size analysis did not share any one outcome. Therefore, we were unable to complete a meta-analysis. Two of the studies did look at anxiety and found very large effects in anxiety (Ambhore & Joshi, 2009) and state anxiety, and a moderate effect for trait anxiety (Bunk, 1978). Effect sizes, sample sizes and the mean and standard deviation of pre-and post-tests of the yoga and control groups are presented in Table 2.

Discussion

The nine yoga studies reviewed here document promising outcomes within the correctional setting, a setting that poses numerous institutional hurdles. However, the studies also present methodological and sampling issues that limit the generalizations that can be drawn from the results, such as small sample sizes, inadequate comparison groups, and lack of reporting regarding demographics. In addition, because the studies looked at a variety of outcome measures, there are limited results for each outcome, thus restricting assertions of yoga's effect. Despite these limitations, the positive findings reflect the potential of yoga interventions in the incarcerated setting and inform research in this area.

Hatha Yoga Studies: Findings on Stress

The five hatha yoga interventions demonstrated statistically significant decreases in stress, depression, anxiety, psychological distress, and psychoticism, and demonstrated statistically significant increases in self-control, positive affect and cognitive abilities. Stress was the most widely explored outcome measure, which is unsurprising, given the extraordinary stress of incarceration. Stress reduction is also a logical outcome for hatha yoga interventions, with hatha yoga's aim to relax the body and mind in preparation for meditation. In particular, Bilderbeck et al. (2013) and Ramadoss & Boss (2010) found decreases in self-reported stress among incarcerated populations of varying security levels and ages and among incarcerated juveniles, respectively. Conversely, Harner, Hanlon & Garfinkel (2010) did not find a significant decrease in stress

among women in a medium-security prison. Authors posit that the Perceived Stress Scale (Cohen, Kamarck, & Mermelstein, 1983) may not have accurately captured the state of stress for a person who is incarcerated (Harner et al., 2010). In addition, with only six participants included in the analysis, it is conceivable that there was a particularly challenging event occurring at the prison during the yoga intervention that affected stress levels. However, without a comparison group, this is only conjecture.

The qualitative feedback that Rucker (2005) obtained from people in a maximum-security prison after participation in a hatha yoga intervention also pointed to stress-reduction benefits. Participants experienced self-regulation, which included stress relief gained through breath awareness and yoga postures. Rucker (2005) posits that yoga can contribute to self-mastery, aiding prisoners to feel some semblance of control in a system that otherwise restricts a person's freedom. Rucker (2005) also notes that the four men who practiced yoga the longest in the study were all facing longer sentences than the others. This finding can be researched further to determine if sentence length is associated with yoga intervention effects and attrition.

While Bunk (1978) does not look at the outcome of stress, he suggests that yoga and meditation relax the body and mind, thus reducing stress and associated negative outcomes (such as anxiety and impulse control), which are important to address among the population of prisoners who experience chronic stress. His finding that yoga plus mantra meditation had greater positive effects than yoga only or meditation only may support the idea that physical postures and breathing exercises help a person relax so as to attain a deeper level of meditation (Bunk, 1978). This idea deserves further research, through studies like Bunk's (1978) that compare yoga and meditation combined groups to meditation only and yoga only groups.

In sum, hatha yoga interventions largely were effective in reducing stress among correctional populations. Future studies can also look at how sentence length affects outcomes and look at whether meditation included with hatha yoga instruction is most effective.

Yoga Interventions Focused on Philosophy: Findings on Multiple Outcomes

The three yoga interventions that focused on yoga philosophy and spirituality were associated with statistically significant decreases in aggression, anxiety, and re-incarceration, and statistically significant increases in impulse control and spirituality. Each study looked at different outcomes. In addition, while the yoga interventions all focused on elements of yoga philosophy or spirituality, the interventions were markedly different.

Ambhore & Joshi (2009) described an intervention that included various components of yoga, including prayer and chanting. Physical postures, breathing exercises, and meditation comprised only half of each intervention session. The intervention was the most intensive of those reviewed here, with classes offered daily for nine months. In addition, the yoga intervention included more of the practices traditionally associated with yoga than any other study reviewed here. Ambhore & Joshi (2009) posit that yoga leads to greater self-awareness and self-discipline, thus alleviating a range of psychological issues, such as aggression, impulsivity, and anxiety. These outcomes were chosen based on the authors' contention that these are issues faced by many prisoners.

In Pham's (2013) study, yoga classes included discussion of spirituality (the main study outcome), in addition to breathing awareness, physical postures, and meditation. Pham (2013) notes that spiritual well-being is associated with overall well-being and therefore may be an important outcome for the prison population whose health is compromised. Pham (2013) chose a comparison group of people who never attended the yoga intervention. Clearly there is the potential for self-selection bias. It may be that people who chose to attend the yoga intervention had higher spirituality scores to begin with than people who chose not to attend the yoga intervention.

Similar to Pham (2013), in Landau & Gross' (2008) study the comparison group consisted of people who demonstrated less interest in yoga. Landau & Gross (2008) chose a comparison group of people who attended less than four yoga classes. Because the groups were not randomized and were chosen at a cross-sectional point, we cannot know if the findings

regarding lower re-incarceration rates for those who practiced yoga were related to characteristics in the groups other than yoga practice. Landau & Gross (2008) posit that practice of Ananda Marga yoga facilitated improved physical and mental well-being that in turn engendered a positive attitude and greater self-efficacy to make positive choices, which then affected the chosen outcome of re-incarceration (assumedly by making choices that avoid criminal justice contact). Authors suggest that lower re-incarceration rates among Ananda Marga yoga practitioners may have been related to learning about yoga philosophy, greater relaxation and self-control from physical postures and meditation practice, and social support through attention paid by instructors and fellowship of the other group members. This study highlights the idea of the transformative power of yoga to bring about major life changes such as a reduction in re-incarceration. However, this view disregards the many stressors that people face with a criminal justice history and the difficulty in transitioning from the incarcerated setting to the community. The potential for re-incarceration is not based only on individual decisions, but rather is based on the extraordinary barriers that people face upon reentry, such as inaccessibility of public services, barriers to employment opportunities, and tough parole and probation sanctions. Because of the many structural and environmental factors that make reentry so difficult, re-incarceration may not be an ideal outcome for individual-level interventions.

Yoga Intervention with Other Components: Findings on Multiple Outcomes

Duncombe et al. (2005) looked at the Free Inside program that includes chi gung with yoga and meditation practice, thus limiting the ability to ascribe the outcomes solely to yoga. The authors suggested that yoga, meditation, and chi gung may improve happiness, thereby improving overall physical and mental health. As such, they looked at a range of well-being outcomes. While the study noted some positive outcomes, these outcomes are not related solely to yoga but also to chi gung.

Limitations

The different yoga techniques employed in the reviewed studies make it difficult to evaluate the effects of yoga, because each intervention is unique. For example, even within the hatha yoga interventions, there is a great deal of variation. The contribution of different aspects of yoga practice, including physical postures, breathing techniques, meditation, and spiritual practices are not easily identified (Telles, Kozasa, Bernardi, & Cohen, 2013). Yoga studies should therefore clearly define what comprises the yoga intervention.

It is generally believed that physical postures (asanas) stretch and strengthen the body, thereby alleviating physical tension, increasing energy, and improving overall physical well-being. Additionally, pranayama breathing exercises condition one's breathing to affect one's mood, as by increasing energy or relaxation. Yoga philosophy (as derived from such seminal texts as Patanjali's *Yoga Sutras*) encourages reflection to improve mental and physical well-being. Physical postures, breathing exercises, yoga philosophy, and the other limbs of yoga work in concert to unite one's mind, body, and spirituality, improve one's overall well-being, and increase one's connection to one's community. However, there is no one formula regarding how much of each yoga component should be included in a given yoga practice, and varying degrees of each component may cause different outcomes. Because of this fluidity of yoga, it is important for studies to outline intervention components and their hypothesized relation to outcomes. For example, a yoga intervention that incorporates more physical postures may have a sizeable impact on physical health, while a yoga intervention that focuses on yoga philosophy may have a greater impact on mental well-being.

Finally, because the needs of people in the criminal justice setting are varied, it may be important for future correctional yoga studies to choose outcome measures based on the needs of the particular criminal justice population. For example, the concerns of a person who has a life sentence in prison may be very different from a person who will shortly be reentering the community. As such, studies may want to cater yoga interventions to meet those specific needs. Further, despite the potential for yoga to create positive change, it is important to note

that a person with criminal justice involvement faces a number of stressors, so much so that it is difficult to envisage that a yoga intervention can completely transform a person's life. As such, studies should choose realistic outcomes that take into account the challenges to which the population is exposed.

Implications

Few studies have been conducted on the effects of yoga in the incarcerated setting. To our knowledge, this is the first review study that classified and discussed the type of yoga practiced within research studies, and the related health outcomes for incarcerated people. Therefore, this study offers valuable information for both researchers and practitioners.

Future studies can report demographics of all participants, particularly looking at the demographics of those who do not complete the study. Attrition rates varied across studies, including 9.5% (Bilderbeck et al., 2013), 52% (Rucker, 2005), 24% (Bunk, 1978) and 65% (Harner et al., 2010). Attrition raises the question, "For whom is yoga most effective and most attractive?"—a question that can begin to be answered by looking at demographics of non-completers versus completers.

While methodological limitations prevent a definitive claim regarding yoga's efficacy with this population, yoga in the incarcerated setting demonstrates many promising outcomes. Future studies can clearly define the yoga intervention, suggest a purported mechanism, employ randomized designs with an active control group, employ qualitative designs to get participant feedback, and explore reasons for attrition. In addition, it may be important for yoga intervention studies to choose study outcomes based both on the type of yoga intervention and the criminal justice status of the participants.

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