



Published in final edited form as:

Fam Community Health. 2008 ; 31(3): 228–239. doi:10.1097/01.FCH.0000324480.40459.20.

Contextualizing the Effects of Yoga Therapy on Diabetes Management:

A Review of the Social Determinants of Physical Activity

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Abstract

This article provides a review of literature both to identify the effects of yoga-based therapy on the management of type 2 diabetes mellitus and to examine the social context of physical activity. Findings from the review indicate that yoga has a positive short-term effect on multiple diabetes-related outcomes; however, long-term effects of yoga therapy on diabetes management remain unclear. The context of the social environment, including interpersonal relationships, community characteristics, and discrimination, influences the adoption and maintenance of health behaviors such as physical activity, including yoga practice. Further research is necessary to determine the extent of this influence.

Keywords

discrimination; physical activity; social environment; type 2 diabetes mellitus; yoga

The prevalence of type 2 diabetes mellitus (also referred to as *diabetes*) is increasing nationwide. From 1980 to 2005, prevalence of diabetes among the US population rose from 5.8 million to 14.7 million.¹ Approximately 9.6% of Americans aged 20 years or older (a total of 20.6 million people) have diabetes.²

There are clear ethnic and racial disparities in the prevalence of diabetes and diabetes-related complications. Rates of prevalence of diabetes among ethnic minorities older than 20 years are as follows: 12.8% to 15.1% among American Indians/Alaskan natives, 13.3% among African Americans, and 9.5% among Hispanic/Latino Americans; these rates contrast with the prevalence of 8.7% among non-Hispanic Whites.³ Long-term complications such as blindness, end-stage renal disease, and lower extremity amputation are much higher among ethnic minorities than among non-Hispanic Whites with diabetes.⁴

Healthcare professionals and policy makers agree that reducing racial and ethnic disparities in diabetes and other health-related outcomes is a national priority; however, debate persists about root causes and taking appropriate action. Some argue that cultural practices are to blame, although culture itself is often defined poorly, if at all.⁵ Others purport that a viable solution

is the promotion of cultural competence among healthcare providers.^{6,7} Still others point to the lack of practical interventions tested among individuals with diabetes, particularly for the promotion of lifestyle changes in the form of physical activity (PA) and nutrition recommendations.^{8,9} Given the increasing prevalence of diabetes, enduring health disparities, dissatisfaction with conventional approaches, and growing public interest in complementary and alternative medicine (CAM), researchers have begun to study the effects of various CAM modalities on diabetes management.

The purpose of this review is 2-fold: (1) to probe the published research literature to identify current understanding of yoga-based therapy as a CAM modality for diabetes management and (2) to situate these findings in a broader context through a review of the social determinants of health behavior and lifestyle change, particularly PA. The primary aim of this integrative review is to examine key factors of the social environment that affect the practice of PA, including yoga, among adults with or at risk for type 2 diabetes mellitus.

BACKGROUND AND SIGNIFICANCE

To investigate the best means of improving health status among those with diabetes, researchers have targeted specific health behaviors for lifestyle change, namely, nutrition and PA, in the design of randomized clinical trials, measuring outcomes such as food intake, PA patterns, changes in body habitus (decreased body mass index, weight, or waist circumference), and improved glycemic control.^{10–15} Unfortunately, most of these studies do not address the mechanisms for maintenance of lifestyle change, nor do the studies have data points beyond 1 year postintervention.

Further complicating the challenge to improve health status among those with diabetes, a growing body of evidence suggests additional racial/ethnic disparities in the practice of dietary behavior and PA.¹⁶ In particular, only 25% of African Americans aged 18 years or older engage in consistent PA of moderate intensity in comparison with 35% of non-Hispanic Whites of the same age.¹⁷

Yoga therapy, as applied in western culture, is an innovative form of PA and stress management; this mind–body practice is a CAM modality that has become increasingly popular in recent years.^{18,19} Among adults with diabetes, yoga therapy has been associated with multiple benefits and few adverse effects.²⁰ Yet, studies that investigate yoga therapy and its outcomes rarely report data beyond 1 year postintervention, and few, if any, examine aspects of the social environment that may contribute to yoga practice as a lifestyle to prevent or minimize complications from diseases such as diabetes.

Social conditions such as poverty, discrimination, socioeconomic status, and ecologic resources influence the risk and trajectory of disease; yet, the focus of intervention is often upon behavioral risk factors at the level of the individual.²¹ Examining the social determinants of PA holds relevance for the advancement of science in the fields of public health, nursing, and CAM modalities. Until the effects of the social environment are more clearly understood, innovative programs to improve health will have limited effectiveness in real-world settings. Indeed, randomized controlled trials that emphasize intervention efficacy to the exclusion of intervention reach, adoption, and maintenance over time inevitably narrow the possibility of research translation into practice.²²

METHODS

This review focuses on published research articles indexed in the CINAHL, PubMed, MEDLINE, Web of Science, and PsycINFO databases and relevant articles obtained through the ancestry approach. Search criteria included research articles written in English, published

between 1985 and April 2007, and concerning studies conducted among adult humans. For the first aim of the review (yoga-based therapy in diabetes management), the key words were “yoga” and “diabetes mellitus.” For the second aim of the review (social determinants of PA), the key words included “diabetes mellitus,” “physical activity,” “social support,” “social environment,” “stigma,” “prejudice,” and “discrimination.”

Exclusion criteria included articles that were not written in English and those with a target population of children, young adults, or pregnant women. Among the articles describing study findings, those excluded were those with outcomes less than 6 months postintervention or those lacking a focus on diabetes-related outcomes. After application of inclusion and exclusion criteria, 73 articles were eligible for review. Additional articles were retrieved from the reference lists of the eligible articles. Most of the articles included in the review were based on research in the United States, although articles based on research in other countries were included if they were written in English and pertained to the aim of the review.

YOGA THERAPY IN DIABETES MANAGEMENT

Although considered an ancient tradition in Indian culture, yoga therapy falls within the domain of CAM in American society. Public interest in CAM continues to grow; consequently, it behooves healthcare professionals to be informed and to engage their patients in open discussion regarding CAM use.^{23,24}

According to a study drawn from analysis of the 2002 National Household Interview Survey,²⁴ persons with diabetes use CAM at rates of prevalence equal to those with-out diabetes. Although this study is subject to self-report and recall bias, its findings are clinically important: those with diabetes are more likely to practice prayer than those with-out diabetes, but they are less likely to use herbs, consume vitamins, or practice yoga therapy.²⁴

Current projections of undiagnosed diabetes are quite high, so true patterns of CAM use or yoga practice among those with diabetes are difficult to abstract. One readily discernible trend, however, is the increased experimentation with yoga practice in the United States in recent years. In 2004, findings from a nationwide survey indicated that 7.5% of a nationally representative sample had practiced yoga at some point in their lives, with almost 4% having practiced yoga in the past year; interestingly, 90% of the sample expressed the belief that yoga was very helpful in improving or maintaining health, or both.²⁵ Although the low response rate and low proportion of yoga users necessitate the judicious interpretation of these data, the evidence base for yoga therapy as an efficacious strategy for chronic illness management continues to expand.

The implementation of yoga therapy varies widely. While many researchers conceptualize yoga as a form of PA, others argue that comprehensive yoga, an approach incorporating body postures (*asanas*), breathing techniques (*pranayamas*), meditation, cleansing, nutrition, attitudinal and behavioral modification, and mental discipline, is more beneficial and loyal to its ancient tenets.^{19,26–28} Nonetheless, western forms of yoga primarily emphasize components of exercise and stress management.^{18,19}

Yoga therapy has been associated with a multitude of benefits and few adverse effects according to a recent systematic review of the effects of yoga on physiologic and clinical risk factors in adults with diabetes.²⁰ Benefits include significant reductions in fasting and postprandial blood glucose levels, hemoglobin A_{1c}, total cholesterol and low-density lipoprotein, triglycerides, coronary stenosis, oxidative stress, blood pressure, body weight, waist-to-hip ratio, heart rate, catecholamine levels, need for medication relative to baseline, and psychosocial risk factors.^{18–20,26–28} Yoga is also associated with decreased weight gain in healthy adults, a matter of significance in the prevention and management of many chronic

illnesses, including diabetes.²⁹ Although intervention studies reveal similar positive findings, many have a poor study design, lack an adequate control group, and offer an insufficient description of sampling and statistical analysis techniques.²⁰

Yoga-based therapy is clearly a promising intervention for primary and secondary prevention of diabetes, given the multiple health benefits attributed to the practice of yoga. However, the literature is unclear regarding the most beneficial forms of yoga, the possibility of a dose–response relationship in managing diabetes, and the most labor-effective, cost-effective, and time-effective manner in which to train patients. Moreover, no studies were identified that measured factors contributing to the maintenance of yoga practice over time. An exploration of the social determinants of PA in general will provide a logical basis for understanding factors that may contribute to yoga practice as well.

SOCIAL DETERMINANTS OF PHYSICAL ACTIVITY

Little has been published regarding the factors that contribute to the adoption and maintenance of yoga therapy as a form of PA. The focus of the extant literature on the initiation and maintenance of PA in general is largely upon factors at the level of the individual person, with limited consideration of environmental factors.³⁰ Researchers agree that self-efficacy, for example, is a fundamental element of PA adoption and maintenance.^{31–38} In addition, there is ample evidence linking demographic factors with PA. For example, long-term maintenance is less likely for older, ethnic minority women who reside in the southern or northeastern regions of the United States.^{35–37,39–41} It appears that the intensity of PA is also predictive of its longevity in practice; activities that emphasize moderate intensity conducive to lifestyle integration are more likely to be maintained over time.^{33,35}

The initiation and maintenance of PA do not depend solely upon individual factors, however; environmental factors are critical determinants as well.^{33,35,37,39,42} Environmental factors include physical features and social characteristics. Social environmental factors constitute the focus of this integrative review.

A uniform definition of the social environment is difficult to pinpoint, although scientists would generally agree that key features of the social environment, such as social norms, social stressors, and social constraints on individuals' opportunities and choices, shape health behaviors such as PA.⁴³ The authors of *Healthy People 2010* emphasize the role of social environmental factors in healthy living and highlight the influence of 2 aspects of socioeconomic status—income and education—on leading health indicators, one of which is PA.⁴⁰

Social support is the most widely investigated social environmental factor in the health literature; encouragement or assistance from family and friends constitutes a form of proximal support that affects lifestyle changes in diabetes management, including PA.^{34,44–46} Social resources in the neighborhood and community, on the other hand, provide distal support for PA maintenance, which is equally important for sustained lifestyle change.^{31,39,41,44,47–49} These resources may be either stress-buffering or stress-inducing qualities of the environment. Moreover, certain social environmental factors (“leverage points”) exert a disproportionate influence on behavior and well-being.^{50–52}

Social influence of interpersonal support

Findings from the literature suggest that social support is a critical determinant of health status and serves as a protective factor for those suffering with or at risk for chronic illness.^{53–56} Some view their family members as a reliable source of emotional support, especially in times of illness.⁵⁷ Individuals with diabetes often report that family members provide instrumental

support, encouraging them to engage in self-management behaviors, including exercise, judicious grocery shopping, meal preparation, and foot care— activities that can help them to achieve better glycemic control over time.^{58–60} Mechanisms by which social support influences PA include the establishment of social norms that promote the adoption and maintenance of health behaviors, such as exercise, and the provision of helpful ideas and material resources to overcome barriers to PA.³⁴

Family members, however, are not always a positive source of support. In direct contrast to reports that characterize family members as seemingly idyllic encouragers, some individuals testify that their family members have a tendency to make matters worse by engaging in regulatory or nagging behavior.^{56,61} Participants in one study emphasize that some family members are in denial or simply do not understand; they provide poor healthcare advice, particularly with regard to food choices.⁶² Regarding PA, it appears that working women who remain physically active report lower family support but higher levels of social support from friends than women who are inactive.³⁵

Family conflict can mitigate the positive aspects of social support and increase the stress faced by those living with diabetes. Because of differential forms of conflict measurement and analysis of outcomes, research findings regarding the influence of unresolved family conflict are contradictory. While some assert that addressing conflict leads directly to improved clinical outcomes and reduced healthcare costs, others indicate that conflict management does not appear to affect clinical measures directly.^{57,63} Still others determined that family conflict is related to depression, which, in turn, influences quality of life and attitude toward diabetes self-management.⁶⁴

A recent review of controlled trials testing the effects of social support interventions determined that the role of social support in diabetes management remains unclear.⁵⁶ Varying definitions, divergent measurement, and contradictory findings limit the understanding of social support mechanisms in promoting lifestyle changes. Among those with diabetes, the effect of social support appears to vary by gender; men tend to prefer spousal and family support, whereas women favor the support of friends or extended family networks.⁵⁶ Emotional and instrumental support are commonly reported, but further research is necessary to explore the types of social support that are most beneficial for sustaining lifestyle changes necessary for diabetes management and prevention.

Social influence of the neighborhood and community

Environmental variables that capture characteristics of neighborhoods and communities are beginning to gain the attention of researchers, yet the expanding evidence base of PA determinants focuses more heavily on psychosocial and behavioral factors at the individual level.³⁰ The influence of the social environment is widely recognized in health behavior research, yet the primary focus of the published literature pertains to the influence of the physical environment.³⁴ Although physical and social aspects of the environment have independent effects, social processes inevitably mediate the influence of the physical environment.⁵²

Social cohesion enhances the collective social capital of communities, which is, in turn, related to increased PA.³⁴ Yet, the few studies that investigate social and environmental aspects of neighborhoods and communities predominantly focus upon neighborhood deprivation as opposed to neighborhood assets.³⁴ The extent to which a given environment provides opportunities for the development of supportive interpersonal relationships will determine the growth of social cohesion, commitment, and innovation for changes within that neighborhood or community.⁵²

A large, cross-sectional phone-based survey of middle-aged and older women revealed that neighborhood characteristics are significantly related to physical inactivity. Among the 4 ethnic groups responding, in particular African American women, the infrequent observations of others exercising in the neighborhood greatly increased one's odds of having an inactive lifestyle.³⁰ Not only do social norms influence PA but psychosocial hazards within a neighborhood may also affect the practice of PA. A recent review of the literature on PA maintenance among women high-lighted the importance of environmental variables such as neighborhood safety, climate, and accessibility of trails or facilities for PA.³⁵

Studies that examine the influence of perceived neighborhood safety on PA reveal contradictory findings. Results from a survey of almost 3,000 multiethnic women across the United States reveal that perceived safety of one's neighborhood is not a significant predictor of PA.³⁰ In contrast, a cross-sectional analysis of baseline data from a multilevel cohort study of community-dwelling older adults ($N = 1,140$) revealed that visible, stable features of neighborhood environments evoking fear or alarm among residents are significantly related to less PA and less healthy diets.⁶⁵ Likewise, a report from the Centers for Disease Control and Prevention on the analysis of 1996 Behavioral Risk Factor Surveillance System data from Maryland, Montana, Ohio, Pennsylvania, and Virginia indicates that neighborhood safety contributes to the physical inactivity of Americans across many regions of the United States.⁶⁶

The relationship between the social environment and PA is complex and needs further clarification through research among various population groups. Moreover, it is vital to both assess individuals' perceptions of environmental influence on PA and provide objective assessment of the environment.³⁰ Additional suggestions for the assessment of the social influence of neighborhoods and communities on PA include enumeration of the resources in the community that promote exercise, such as community walking clubs or local media reports addressing the benefits of PA.³⁴

Social influence of discrimination

Another aspect of the social environment is social discrimination. For purposes of this article, *social discrimination* is defined as any form of prejudice or stigma based on physical traits such as race, weight, and age. In recent years, researchers have examined the effects of social discrimination on health-related outcomes. Specifically, scientists have documented the negative effects of racial discrimination on stress, depression, blood pressure level, substance abuse, and satisfaction with medical care.⁶⁷⁻⁷²

Racial discrimination is a present and historical reality for many Americans, and a recent review of community-based studies confirmed its positive association with outcomes in mental and physical health status.⁷¹ Racial discrimination has a dual description: *individual perceptions*, resulting in emotional distress and greater risk of chronic illness over time; and *institutional racism*, resulting in reduced access to optimal healthcare, increased exposure to hazardous conditions in the physical environment (related to housing and occupational opportunities), and aggressive advertising of both legal and illicit drugs and substances in segregated neighborhoods.³⁴

Measurement difficulties continue to impede progress in this line of research, particularly the broad range of instruments designed to measure discrimination and the extent to which specific health-related out-comes of interest have been based largely on self-report, including self-rated physical health, stress, and depressive symptoms. Although subject to bias, such measures remain important, for they capture qualities of the social environment that have been overlooked by researchers for decades. Future research is necessary to determine the influence of racial discrimination on PA and other health-related behaviors, as few, if any, such studies

have been published in the research literature.³⁴ To date, the primary behaviors that have a documented association with racial discrimination are alcohol and tobacco use.⁷¹

In addition to racial bias, an “antifat” bias is apparent in American society. This bias poses a significant problem for those with diabetes because the association between obesity and diabetes is clearly established in the literature.^{73–75} Documented correlates of weight-based discrimination include healthcare avoidance, depression, and low self-esteem.^{76–82} The literature regarding the influence of weight-based discrimination on health-related outcomes is accumulating, but measures used to assess the phenomenon have been categorical and, in some cases, dichotomous, which limits data analysis. Even so, it is important to note the findings from a large study of a convenience sample, indicating that more than 20% of women and 17% of men report weight-related mistreatment, not only from their spouse or loved one but also from strangers.⁷⁸ Furthermore, significant amounts of antifat bias are pervasive among healthcare professionals who work with obese patients or conduct obesity research.⁸¹ Some healthcare providers attribute negative characteristics to obese patients, and society as a whole often perceives obese individuals as deviant and having flaws in character that lead to their condition.⁷⁶

A recent study of 216 women revealed that obesity is associated with increased healthcare avoidance and delay in seeking medical attention.⁷⁶ This particular study is limited because of its reliance on self-reported data. One of the key findings, however, is that women avoid visiting healthcare providers because they simply do not want to be weighed in the clinic, nor want to be told to lose weight.⁷⁶ The authors indicate that healthcare avoidance may be especially pronounced if women perceive that their obese condition disproportionately affects their treatment through the lack of diagnostic evaluation and further testing or if healthcare providers focus solely on weight to the exclusion of apparent symptoms.⁷⁶ Although the evidence base is insufficient to draw conclusions, it is logical that weight-based discrimination could influence health behaviors such as PA or limit access to unbiased education and healthcare.

Ageism affects health behavior and health-related outcomes as well. Studies indicate that physicians are less likely to recommend PA to older adults, that sedentary behavior stems from sociocultural attitudes and prejudice toward aging, and that negative stereotypes of aging influence physiologic function important for lifelong PA.^{83–85}

In particular, it is proposed that biologic changes inherent in the aging process, coupled with societal values and cultural attitudes regarding the activity of older adults, significantly affect the PA patterns of older adults.⁸³ As they age, women in particular often report a delicate balance among factors such as avoiding the risk of injury, desiring to meet sociocultural ideals for beauty and longevity, and seeking to maintain an independent lifestyle as they pursue PA. Others simply hold subtle societal beliefs that suggest that their aging bodies are incapable of handling the exertion of PA.⁸³

In a study of community-dwelling men and women aged between 63 and 82 years, investigators reported significant increases in walking speed and other improvements in gait among those who were exposed to positive stereotypes of aging and no changes in those exposed to negative stereotypes of aging. The authors conclude that stereotypes of aging have a profound impact on gait and other aspects of physiologic function.⁸⁴ A recent review of the literature regarding ageist stereotypes indicates that healthcare providers likely propagate aging myths by being less aggressive in both their treatment of conditions and their recommendations for health-promoting behaviors.⁸⁵ In particular, physicians may be less likely to recommend PA, in spite of known benefits, simply because they perceive older adults as having earned rest and repose.⁸⁵

Discrimination is pervasive in modern society. Evidence suggests that anywhere between 70% and 100% of adults report racial discrimination, more than 20% of adults report mistreatment related to weight, and more than 80% of Americans aged 50 or older report experiencing some form of ageism.^{78,85,86} Recent research suggests that the internalization of negative stereotypes and discrimination poses a significant threat to health and is related to glucose intolerance, abdominal obesity, elevated blood pressure level, and physical inactivity.^{68,85,87,88} Although the social stigma caused by perceived discrimination may affect the adoption and maintenance of health behaviors such as PA, this relationship is rarely measured.⁸⁹ In fact, no such studies were retrieved in a recently published review of the literature regarding the social environment and PA.³⁴

A clear gap exists in the literature regarding the social influence of discrimination on PA. Further research is necessary to inform practice and build the knowledge base for appropriate levels of intervention to promote health and PA among all people, regardless of their background or physical appearance.

DISCUSSION

The 2-fold purpose of this review was to identify from the published research literature the effects of yoga therapy as a CAM modality for diabetes management and provide context for these findings through an examination of the social determinants of PA. The implications for yoga-based research are evident. Although wide variations in the design and implementation of yoga therapy preclude the possibility of meta-analysis at this point, findings indicate that yoga has a positive short-term effect on multiple health-related out-comes. It would be prudent for healthcare providers to encourage exploration of yoga therapy as an option for PA and stress management for all patients, including those with diabetes; however, yoga is not considered a substitution for medical care but rather an adjuvant approach for health promotion. The long-term effects of yoga therapy on diabetes management remain unclear, a reflection of the lack of longitudinal research with data points beyond 1 year postintervention.

The social determinants of PA and associated implications are myriad. Simply put, further research is necessary to clarify the effects of the social environment on PA. Unfortunately, diverse measurements of social support and discrimination inhibit firm conclusions about the respective influence of these variables on the adoption and maintenance of PA. The social influence of neighborhoods and communities remains unclear, although a growing body of evidence points to the importance of social connectedness and cohesion, which can then influence social norms in favor of PA. For too long, research on neighborhoods and communities has focused on deprivation, crime, and fear, without assessing social assets or the capacity for social cohesion. It is essential to acknowledge the influence of deficits in the social environment, but identifying social ecologic leverage points for change is equally important.⁵²

Disparities in diabetes and other health-related outcomes warrant the investigation of researchers and the attention of practitioners. The findings of this review support the assumption that complementary and alternative approaches, particularly yoga therapy, are efficacious in health promotion and diabetes management, yielding many benefits with few adverse effects. However, an intervention in isolation, no matter how innovative it may be, is not adequate to ensure long-term behavior change. Environmental factors are critical determinants of health behavior, and social influences are clearly important for the practice of all forms of PA, including yoga, and other lifestyle changes necessary for optimal diabetes management. Behavioral interventions are more likely to make an appreciable impact on the public's health when the interventions apply a conscientious appraisal of the social context of

behavior to the meaningful development of strategies that enhance social assets while minimizing social hazards and inequalities, thereby achieving greater ecologic depth.

Acknowledgments

This research was supported in part by the University of Virginia Institute on Aging, grant no. R21-AT-0002982 from the National Center for Complementary and Alternative Medicine (NCCAM) and the Office of Women's Health, and grant no. T32-AT-000052 from the NCCAM. Its contents are solely the responsibility of the authors and do not necessarily represent the official views of the University of Virginia, NCCAM, Office of Women's Health, or the National Institutes of Health.

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