

CHAPTER 7: DISCUSSION

7 DISCUSSIONS

Self-regulation is a conscious effort to maintain a stable physiological system while managing adverse psychological or physiological states (Kumar, 2006). The self-regulation is behavioral component of yoga, which has significantly contributed in achieving improved glycemic control.

Biochemical changes at a glycemic level from prediabetes to normoglycemia are associated with a lower prevalence of diabetes-associated complications (Perrault.,2019). Lifestyle and pharmacological interventions have regression to normoglycemia, with conversion ranging from 23% in the DPP trial to 55–80% in an England-based study with 10-years of follow-up (Hamman et al., 2006; Lindström et al., 2003). In the present study, YBL was found to significantly accelerate the regression to normoglycemia OR of 1.26 (95% CI, 1.05-1.50). At the end of the study of 3 months, half of the intervention group (52.8%) reverted to normoglycemia compared to 37.8% of the control group. The study supports. yoga develops resilience by providing the ability to “bounce back,” adapt in times of adverse physiological states, as impaired glycemic control (Sullivan, 2018). The efficacy of YBL against diabetes prevention is because of the higher suitability of Asian Indians to the culturally tailored yoga-based protocol (Mcdermott, 2014 ;Weyrich, 2007) and the high baseline risk of the participants (high-risk IDRS score).

When stratified by baseline age, the efficacy of YBL against diabetes prevention was high for young participants aged ≤ 40 years compared to their older counterparts, aged >40 years P for interaction=0.045. But if compare their belief, a higher percentage of individuals above 45 years agreed that yoga accords spiritual and a few other benefits to the practitioner.

Similarly, the beneficial effect of YBL towards reversion to normoglycemia was also observed to be higher in the younger cohort (P for interaction <0.0001). On the contrary, Diabetes Prevention Program Finnish DPS (Lindström et al., 2003) and the DPP (Hamman et al., 2006) have shown more pronounced effects of the lifestyle intervention in the older subgroup of participants. Nanditha et al. mentioned no significant influence of baseline age on the effectiveness of diet and lifestyle interventions on diabetes prevention in Asian Indians (Nanditha et al., 2016). Young adults also exhibit pathophysiology of diabetes, which is complex, aggressive, and response poor to medication which is a higher overall risk of a lifetime (Tabák et al., 2009). Hence, this age-specific modality of YBL has significant relevance to the increased diabetes susceptibility of the Indian population at a younger age (Anjana et al., 2015).

Weight loss appears to take center stage for lifestyle modification delaying the onset of diabetes (Kahn, 2014). Findings suggest equivalence of conversion from prediabetes to diabetes in overweight and average weight participants. The peculiar Indian phenotype could explain these findings, wherein even lean individuals with low BMI are also at high risk of metabolic disorders (Weber et al., 2016). However, YBL for diabetes worked well in prevention irrespective of baseline BMI. This finding could be an essential aspect for the generalizability of the intervention protocol across the different community and population settings.

7.1 MECHANISM FOR STRESS, PSYCHOSOCIAL RISK FACTORS FOR PREDIABETES, T2DM

yoga is a 5000-year traditional practice from the ancient Indian culture and is considered the science of holistic living. The tradition of yoga involves various practices, viz. disciplined lifestyle (*Yama and Niyama*), cleansing procedures (*Kriyā*), physical postures (*Āsana*),

breath regulation (*Prāṇayam*), concentration (*Dharana*), and meditation (*Dhyana*) (Mukhtibodhananda, 1993; Taimni, 1999).

Pancreatic cell's rejuvenation/regeneration may be due to yoga postures causing abdominal stretching, aid in the metabolism of glucose in adipose tissue, liver, and peripheral tissue by the enzymatic process (Husein et al., 2017). Improvement in Insulin sensitivity and sensitivity of the β -Cells of the pancreas to the glucose signal may be due to the adding in effect of performing the physical postures (Manjunatha et al., 2005).

Physical postures cause a shift toward parasympathetic nervous system dominance, possibly via direct vagal stimulation (Innes et al., 2005; Shapiro et al., 2007) noted significant reductions in low-frequency heart rate variability – a sign of sympathetic nervous system activation – in depressed patients following an eight-week yoga intervention. A significant decrease in inflammatory markers was seen following three months of hatha yoga practice in breast cancer survivors of all ages (27–76). (Kiecolt-Glaser et al., 2014). yoga practices were given to novice and experts for two years. The outcome showed novice serum interleukin (IL)-6 levels were 41% higher than experts across sessions. The results of young/novice yoga practitioners having detectable C-reactive protein (CRP) were 4.75 times as high as an expert. Age, cardiorespiratory fitness, abdominal fat, and depressive symptoms have a level of inflammation that yoga can reduce, suggest data. (Kiecolt-Glaser et al., 2010)

7.2 YOGIC BREATHING

Yogic breathing is an effective means to combat oxidative stress. Yogic breathing lowers the free radical load and increases the superoxide dismutase (SOD) among healthy volunteers compared to a control population (Bhattacharya et al., 2002).

A breathing Practice Nāḍīcuddhi *Prāṇāyāma* and breath-holding for four weeks elucidated reductions in baseline HR (Heart Rate), SBP (Systolic Blood pressure), and DBP (Diastolic blood pressure), attributed to increased vagal tone and reduced sympathetic tone. (Bhargava et al., 1988). T2DM has a sympathovagal imbalance. *Prāṇāyāma* for six months and standard Therapy improved sympathetic functions in people with diabetes than standard therapy alone (Jyotsna et al., 2013).

7.3 CHANGES IN OXYGEN CONSUMPTION WITH YOGIC BREATHING

The body's metabolic activity needs oxygen consumption, which is used to understand the Metabolic process. Right nostril breathing increased oxygen consumption and overall metabolic status compared to the left nostril and alternate nostril breathing for the same duration (Telles et al., 1996, 2013). These studies have indicated right nostril breathing in conditions with lower metabolic rates, like obesity (caution as the practice of right nostril breathing increased BP) (Raghuraj, 2008).

Prāṇāyāma breathing (manipulation of breath movement) has a physiologic autonomic effect with oxygen consumption. *Prāṇāyāma* contributes by decreased oxygen consumption, decreased heart rate, and reduced blood pressure, increased theta wave amplitude in EEG recordings, increased parasympathetic activity accompanied by the experience of alertness and reinvigoration (Jerath et al., 2006). *Shavāsana*, *Prāṇāyāma*, meditation gives deep rest to the entire system, decreases stress, calms cravings, reduces hunger, and reduces the stress hormones in the blood. The reduction of stress hormones in the blood (cortisol, adrenalin, etc.) automatically puts the glucose levels back to normal. Extra demand on Insulin to counteract the glycemic surge of stress is taken away (Nagaratna, 2002). Deep stimulation, deep awareness followed by deep rest, brings relaxation to the pancreas.

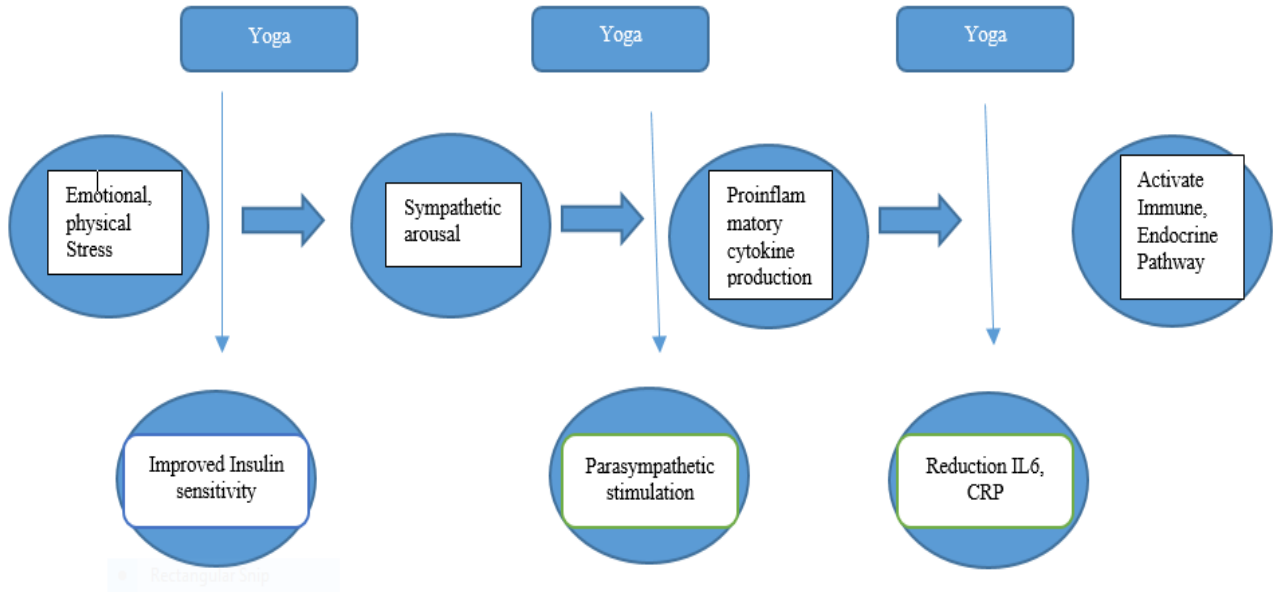
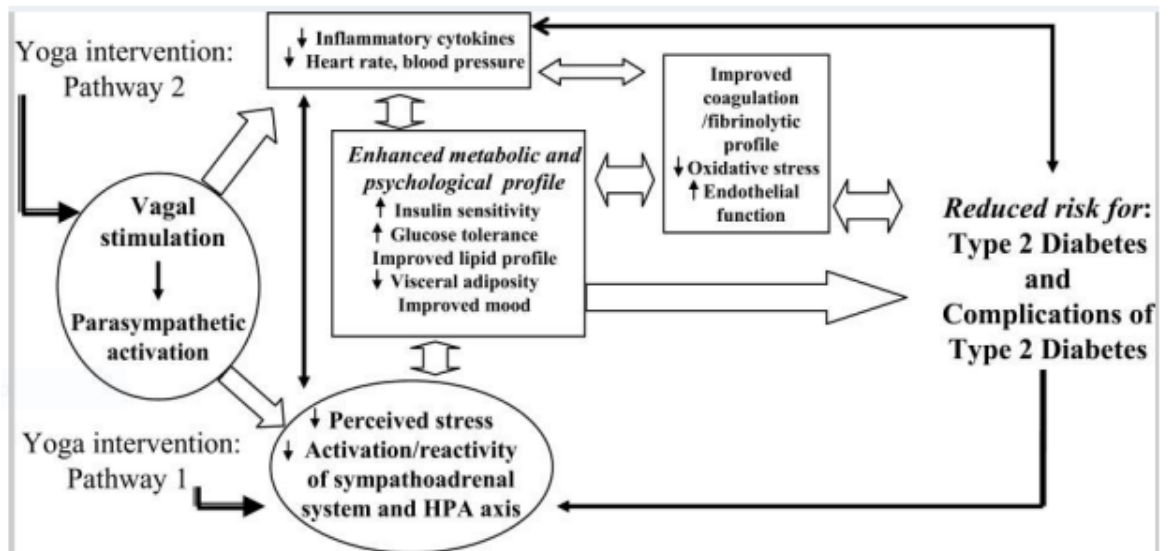


FIGURE 26: PSYCHO-NEURO-IMMUNOLOGY PATHWAY FOR THE MECHANISM OF YOGA

FIGURE 27: POSTULATED MECHANISMS BY WHICH YOGA CAN HELP REDUCE THE RISK FOR TYPE 2 DIABETES MELLITUS AND ITS COMPLICATIONS



(Ref: <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC2176136/figure/F1/>)

Mechanism of yoga can be hypothesized as following pathways:

- a. By way of vagal stimulation with parasympathetic activation and HPA axis modification. (Innes et al., 2005).
- b. Improved insulin sensitivity (Nagarathna et al., 2012).
- c. Improved Immunity (Kiecolt-Glaser et al., 2010; Wellen, 2005).

A nationwide survey constituted 162,330 participants, revealing 11.8% of the population practicing yoga. The yoga practice prevalence among various categories—the males and females, urban, new diabetics, pre-diabetics, and age group (60–79 years) besides the upper-middle-class socioeconomic was almost equal. Evidence from the knowledge and attitude sampling results affirms yoga efficacy among masses. For lifestyle modifications, 92.6% believe yoga works, the proportion of those adopting yoga practice needs a lot of improvement (11.8%). Reasons for knowledge–practice gap need to be worked. However, other surveys were not sampled as the door-to-door in a cluster design and were not for a large sample. The different surveys methods included emails and phone calls that lack the reliability, interface, and rigor that the door-to-door survey provides.

The study reports first from India the perceived stress among persons with prediabetes and DM. Our findings revealed that persons with prediabetes had higher perceived stress and depression on some, but not all, scales than those with existing DM. Despite higher reported stress in the prediabetes group, longitudinal studies are imperative before any cause/effect relationships between stress and conversion of prediabetes to DM can be established.