

CHAPTER 3 : REVIEW OF SCIENTIFIC LITERATURE

3 REVIEW OF SCIENTIFIC LITERATURE

3.1 NCD/DIABETES

WHO -World Health Organization's global action plan on physical activity stresses being “active” for health and wellness (NCD, 2019). Roots of physical, mental, social, and spiritual wellness are the broad concept of health (Dhar, 2011). Public health delivery, in this context, is critical for provisioning an evidence-based integration of alternative approaches for the betterment of society. In 2016, NCD RisC collected data from 751 studies from 146 countries to make global estimates for Diabetes. Between 1980 and 2014, there was a fourfold increase in the number of people with Diabetes. Age-standardized prevalence among men and women increased by more than 50% (NCD RisC, 2016). People with Diabetes have an increased risk of heart disease and stroke and are ten times more prone to a lower limb amputation than non-diabetic. It is one of the leading causes of renal failure, visual impairment, and blindness (Ramachandran, 2006).

3.2 LIFESTYLE MODIFICATION AND STRESS

The non-modifiable risk factors associated with Diabetes include family history and age. Risk is more in the age group of 60-79 years in developing countries like India with a substantial T2DM population, thus increasing the risk (Anjana et al., 2015). The modifiable risk factors include obesity, sedentary lifestyle, lack of physical exercise, and an unbalanced diet that can be reversed or controlled to prevent the progression of the disease.

Diabetes Prevention study in Finland was the first intervention study to prevent or postpone Diabetes in high-risk individuals. The follow-up studies reported that the intervention group

underwent dietary and physical activity-related lifestyle modifications and showed significantly more significant weight reductions and glycemic index (Lindstrom, 2003). Finnish Diabetes prevention study recommends continuing diet and exercise reduce 58% the incidences of new-onset Diabetes against the group receiving only general instructions (Tuomilehto, 2001). (see Figure 6,7, Table 5) Another study in which medical conditions (Diabetes and lifestyle factors) were self-reported by individuals in the form of a questionnaire at the baseline, 5 and 10 years (Kato, 2009). This study explored and proved the association of perceived mental stress with the onset of Diabetes. Similarly, a 3-year follow-up showed that impaired glucose metabolism (risk factor of Diabetes) was related to stress (Toshihiro, 2008).

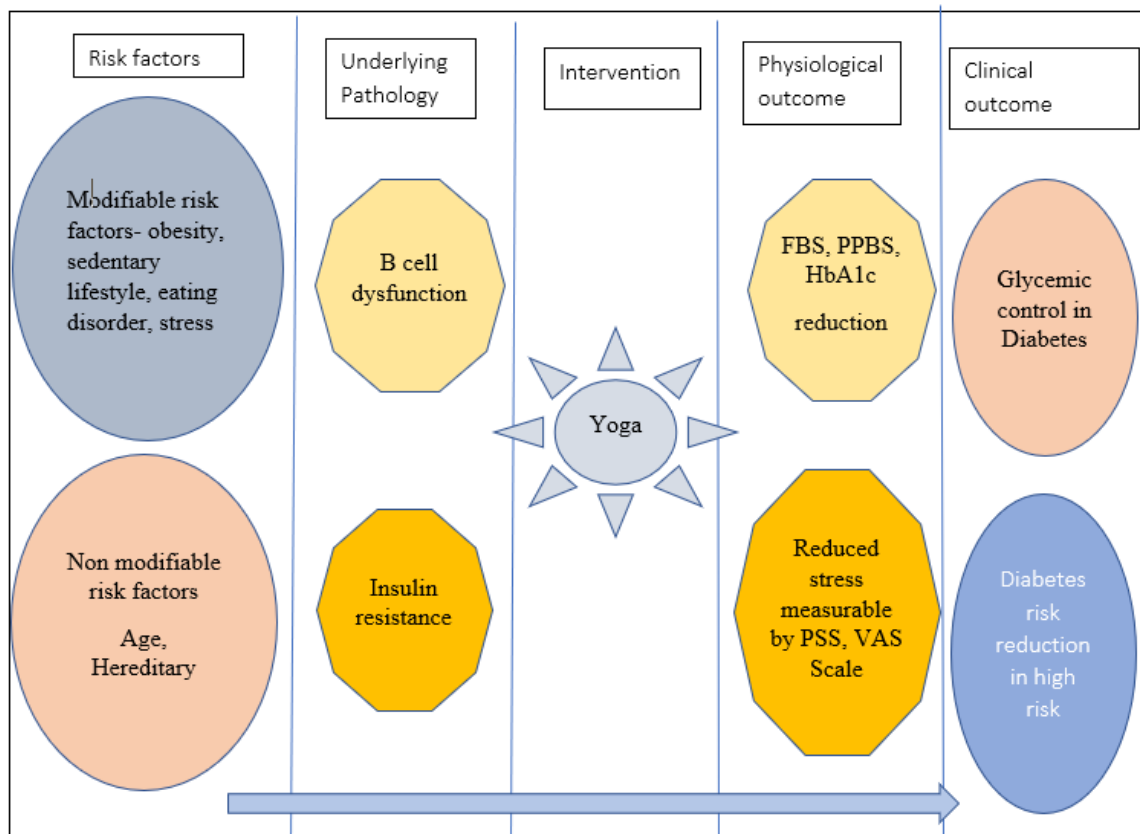


FIGURE 6A: SCHEMATIC PRESENTATION OF RISK FACTOR, YOGA INTERVENTION AND EXPECTED OUTCOME FOR DIABETES, PREDIABETES

3.3 T2DM, YOGA, AND STRESS

Epidemiological studies have shown Lifestyle interventions are cost effective in prevention and management of T2DM.53 systematic review studies brought focus to lifestyle interventions which include dietary modification and exercise to reduce incidence of T2DM. (Figure 7) China's Da Qing T2DM Prevention study showed that regular physical activity and dietary changes reduce diabetes incidence by 51% in 6 year period and in 20 years follow up, by 43%.For prediabetes D-CLIP (Diabetes Community lifestyle improvement Programme) brought reduction by 32%.

In lifestyle intervention comprehensive -physical, mental, social, and emotional wellbeing is expected. Yoga encompass approach with cleansing technique, physical yoga postures (Asana), breathing (Sullivan et al., 2018)practices(prāṇāyama), relaxing technique (śavāsana), meditation, emotion culture with fiber rich vegetarian(sātvik) diet. Yoga comprises exercise and stress reduction as major component.(Kumar et al., 2016; Robinson Monroe, 1992) Multiple evidence based yoga studies offer improved glycemic control, nerve conduction velocity, lipid profile improvement, insulin sensitivity, weight reduction, improved cognition and cardiovascular autonomic functions.(Chaya et al., 2008). In addition, subjective measure as less fatigue, sound sleep, reduced medication score and better quality of life. But few studies on integrating yoga for prediabetes to reduce T2DM risk.(NCD Risk Factor Collaboration (NCD-RisC), 2016; WHO, 2020a)

Yoga lifestyle is a form of mind-body Practice (Tyagi, 2016) that involves moderation in diet, behavior, and sleep pattern. Include physical postures, a set of breathing techniques, relaxation techniques, and meditation (Nagarathna et al., 2012). In T2DM, yoga practices reduce perceived stress, depression and help improve blood glucose control (Agte, 2004).

Yet, in other studies, yoga is an effective intervention in reducing stress and its effects (West, 2004). yoga helped reduce depression, improve mood, and helping adopt good stress coping strategies (Kozasa, 2008).

3.4 T2DM AND YOGA

Control Blood Glucose is the primary objective of T2DM management. Diabetic complication risk is reduced with Optimal blood glucose control and delivers a quality of life in T2DM (Nathan, 1986). Yoga reduces fasting blood glucose, postprandial blood glucose, and HbA1C (Nagarathna, 2012). Yoga helps lower insulin resistance in T2DM (Nidhi, 2012).

In India prevalence of overweight in adults increased from 9.0% in 1990 to 20.4% in 2016 in every state of the country. In India, for every 100 overweight adults aged 20 years or older, 38 adults (34–42) had Diabetes, against the global average of 19 adults (17–21) in 2016.

The burden of T2DM and Non-Communicable Diseases is one India struggles with. Integrating cost-effective traditional systems, complementary and alternative medicine with the conventional medical methods under the AYUSH (*Āyurveda*, yoga, Unani, Siddha, and Homeopathy) system becomes inevitable to promote holistic health (Fan, 2017).

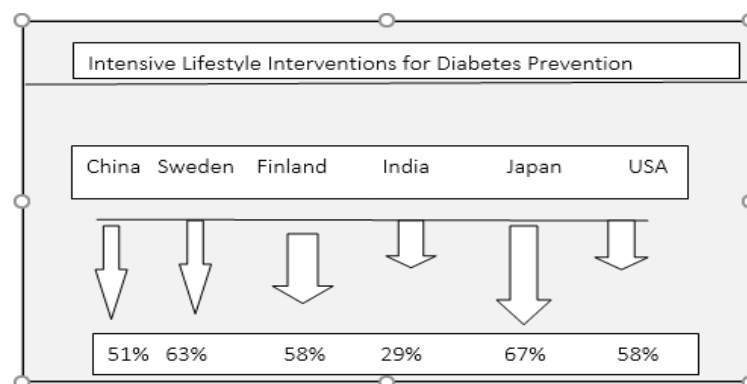


FIGURE 6 B: INTENSIVE LIFESTYLE INTERVENTIONS FOR DIABETES PREVENTION (Ref: IDF WORLD ATLAS 2019)

TABLE 6: MAJOR RANDOMIZED PRIMARY PREVENTION TRIALS IN TYPE 2 DIABETES USING LIFESTYLE MODIFICATION (IDF, 2019)

Study (year); Country; no. of participants	Intervention	Duration; main outcome (relative risk reduction)
Da Qing Diabetes Prevention study (CDQOPS) 1997, (extended study 2008,2014)	Lifestyle modification	6 years Diet (31.0), Exercise (46.0), Diet + Exercise, (42), 20 years (43.0),23 years (45.0)
Diabetes Prevention Study, (2001), Finland; n=522, Diabetes Prevention Extended Study (2013)	Lifestyle modification	3.2 years; intervention (58.0), 13 years; intervention (38.0)
Diabetes Prevention Program (2002); United States; n=3234, Diabetes Prevention Program Outcome study;(2009)	Lifestyle modification, metformin	2.8 years; intervention (58.0), 10 years; intervention (34.0)
Indian Diabetes Prevention Programme-1,(2006);India;n=531	Lifestyle modification, metformin	2.6 years; intervention (28.5)
Indian Diabetes Prevention Programme-2,(2009);India; n=407	Lifestyle modification, pioglitazone	3.0 years; No benefit by adding pioglitazone
Indian SMS Study, (2013);India n=537	Lifestyle modification; SMS	2.0 years; intervention (36.0)
Indian SMS Study Extended Follow-up,(2018);n=346	Lifestyle modification	3.0 years; intervention (30.0)
Diabetes Community Lifestyle improvement	Lifestyle modification, metformin	3.0 years; intervention (32.0)

Programme (D-CLIP) (2016)		
Pakistan Diabetes Prevention Study;(2012); Pakistan; n=317	Lifestyle modification, metformin	1.5 years; intervention (71.0)
Prevention of type2 diabetes by lifestyle intervention, (2005); Japan; n=458	Lifestyle modification	4.0 years; intervention (67.4)
Zensharen Study for prevention of Lifestyle Diseases;(2011); Japan; n=641	Lifestyle modification	3.0 years;(44.0)

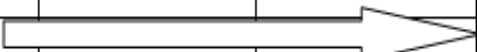
World bank income classification	Prevalence of diabetes (%)	Number of people with diabetes(millions)	Prevalence of diabetes(%)	Number of people with diabetes(millions)
High income countries	10.4(8.6-13.3)	95.2(78.7-120.9)	11.4(9.4-14.3)	107.0(88.3-134.4)
Middle income countries	9.5(7.6-12.3)	353.3(280.1-455.3)	10.7(8.4-13.7)	449.6(353.0-576.7)
Low-income countries	4.0(2.8-6.7)	14.5(10.0-24.3)	4.3(3.0-7.1)	21.9(15.2-36.4)
2019			2030	

FIGURE 7: NUMBER OF ADULTS (20 - 79 YEARS) WITH DIABETES PER WORLD BANK INCOME CLASSIFICATION IN 2019, 2030 (IDF, 2019)

3.5 UNAFFORDABILITY OF MEDICINES

World Bank income classification is in Middle-income countries, which is around 77%, this would grow. Hence, there is a need to have Lifestyle modification in place to reduce the burden. Many low- and middle-income countries (Figure 8) have a shortage of medicines in

the public sector, forcing them to the private sector, prices are up to 16 times higher. The generic drug availability in the public sector in these countries is only 57% (too little as 3%). About 80% of people with Diabetes live in developing countries. Yet 90% of the expenditure on medical care for Diabetes is made by the world's wealthiest countries (Zhang et al., 2010). As seen in Figure 9, 87 % death occurs in the low and middle-income group but 35% Related health expenditure.

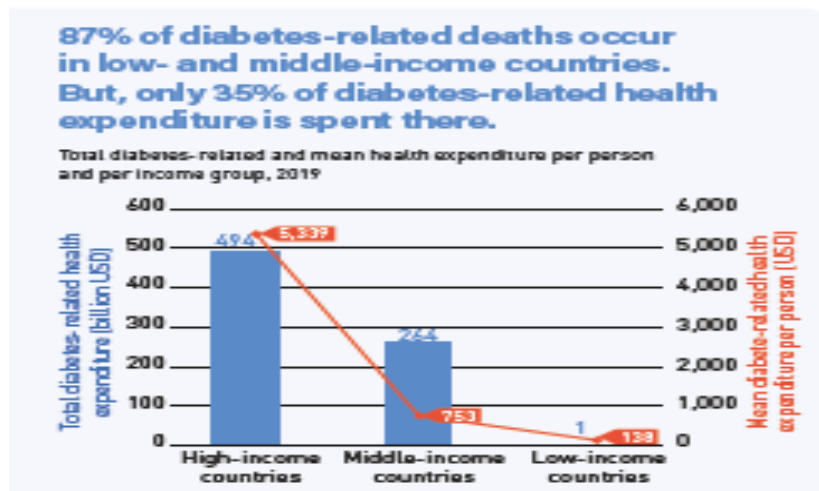


FIGURE 8: TOTAL DIABETES-RELATED & MEAN HEALTH EXPENDITURE PER PERSON AND PER INCOME GROUP (IDF, 2019)

Nagarathna et al. RCT study of 277 T2DM from Bengaluru for yoga-based lifestyle (YBL) yoga was better than an exercise in decreasing oral hypoglycemic medication requirement and Ldl, increasing HDL(Nagarathna et al., 2012). Diabetes yoga Protocol for three months reduced the HbA1c, and stress levels could be a cost-effective tool for preventing Prediabetes to Diabetes progression (Singh et al., 2019). A lot of publications are available on Diabetes and yoga. But comparatively fewer studies are available about yoga and Prediabetes. Hence, such a study will provide insight and provide a paradigm shift on preventing and delaying the onset of Diabetes.

TABLE 7: PUBLICATION ON LIFESTYLE & YOGA IN DIABETES (NAGARATHNA ET AL., 2019)

Serial no.	Author ref	Title	Result
1.	Lifestyle Intervention		
A.	Howells L et al	Clinical impact of lifestyle interventions for the prevention of diabetes. An overview of systematic reviews.	Concluded that relatively long duration lifestyle interventions can limit or delay progression to diabetes when compared to time-limited interventions.
B.	Li G Zhang P et al (2008)	The long-term effect of lifestyle intervention to prevent diabetes in the China Daqing Diabetes prevention study. A 20 year follow up study.	Compared with control participants in combined lifestyle intervention group had 51% lower incidence of diabetes during the active intervention period and 43% lower incidence over 20-year period.
2.	Integrated yoga Therapy		
A.	Monro R et al (1992)	Yoga therapy for NIDDM: a controlled trial	FBG and HbA1c improve significantly better ($p < 0.005$) than control group.

B.	Kumar et al (2010)	Role of yoga for type2 diabetes mellitus. A systematic review and meta-analysis.	yoga as add-on intervention in comparison to standard treatment FBS mean difference 1.40, p<0.001, PPBG 0.91, P<0.001, HbA1c 0.64,p<0.002.
C.	Nagraj C et al (2013)	Effect of integrated yoga therapy on nerve conduction in type 2 diabetic. A cross sectional study.	Significantly higher means of nerve conduction velocity in the right p=0.004 and left wrist p=0.017 in yoga group. Significantly difference between group, in the right-hand p=0.004
D.	Chaya MS et al (2008)	Insulin sensitivity and cardiac autonomic function in young practitioner of yoga.	Glucose clamp study in normal yoga healthy practitioner, fasting plasma insulin was significantly lower in the yoga than matched control volunteers. Insulin sensitivity was better p<0.001 than control group.
E.	Mc Dermott KA et al (2014)	A yoga intervention for type2 diabetes risk reduction. A pilot randomized control trial.	yoga participants had significantly greater reduction in weight, waist circumference and BMI versus control. weight 0.8±2.1 v/s 1.4±3.6 p=0.02, wc 4.2±4.8 v/s 0.7±4.2, p<0.01, BMI 0.2±0.8 v/s 0.6±1.6, p=0.05
3.	Yoga and Exercise		
A.	Ross a et al (2010)	The health benefits of yoga and exercise. A review of comparative studies.	Studies comparing the effect of yoga and physical exercise seen in healthy and diseased population show that yoga be as effective or

			better than exercise in improving variety of health-related measures.
B.	Govindraj R et al (2016)	yoga and physical exercise review and comparison.	Compared the studies of effect of yoga and physical exercise in most outcome measures during practice and importance given to maintenance of postures, differentiate yoga from physical exercises
<p>BMI-Body Mass Index, HbA1c= Glycolated Hemoglobin= Fasting blood glucose, PPBG= Post prandial blood glucose.</p>			