

CHAPTER 8

8.1 APPRAISAL

Thus, the present study infers that yogic life style could accrue several physical and mental health benefits improving the quality of living of T2DM patients through holistic cleansing. Further, it is also evident that the yoga life style intervention shows highly significant improvement in all clinical as well as psychological indices while comparing with the improvement indicated in the non-yoga control group who are under conventional treatment on anti- hyperglycaemic agents.

8.2 SUMMARY

Based on the findings of the present randomized controlled studies, 16 week yoga based lifestyle modification program brought significant improvements in several metabolic indices of major importance in the management of T2DM including glycaemic control, lipid level, and improvement of anthropometric characteristics, Health Satisfaction and Quality of Life among the mongoloid patients with T2DM.

8.3 CONCLUSION

In conclusion, the findings of the present study suggest that yoga lifestyle along with conventional treatment could bring about significant improvements in glycemic control, lipid profile, body composition, and psychological indices resulting in physical and emotional self satisfaction in subjects with T2DM.

8.4 IMPLICATION OF THE STUDY

Several evidence based studies among the diabetic population showed the effectiveness of yoga in reducing the risks of progression of T2DM state. The present study will be the first randomized controlled trial studies among the Indian mongoloid patients with T2DM that will show the evidence that yoga significantly affect the T2DM patients not only in reducing the hyperglycaemia state but also improving the health satisfaction and quality of life.

8.5 APPLICATION OF THE STUDY

Apart from significant improvements in anthropometric characteristics and metabolic parameters in yoga intervention group, there were significant difference in Quality of Life

and Health Satisfaction domain score between the control and the yoga group. The Yoga group also demonstrated greater improvement in the psychological measurements domain score than the control.

8.6 STRENGTH OF STUDY

The study was the first of its kind to investigate the role of integrated yoga intervention programme exclusively for the T2DM patients of mongoloid race of Manipur State.

It was a community based randomized controlled study for management of T2DM on metabolic parameters through cost effective life style modification programme of yoga practice.

A comprehensive yoga module was ideally designed after extensive literature review to make a perfect integration of eight limbs of Seer *Patanjali's astanga yoga* (eight-limbs of yoga philosophy) to suit for targeted disease under study. The study embodied the yoga intervention with an emphasis on *asanas, pranayamas, surya namaskar* and cyclic meditation with yoga education program in addition to dietary modification and conservative treatment with anti-hyperglycaemic agents.

The present study emphasised on the long term impact of yogic life style on the current Health Satisfaction and Quality of Life of the patients with T2DM as psychological outcome measures of yoga intervention.

No adverse events among the patients were observed during and after yoga intervention.

Both the experimental yoga group as well as non-yoga control group fully complied with the guidelines framed for the respective group during the period of investigation. Both the experimental and the control groups were under constant supervision of a senior endocrinology doctor of JNIMS, Hospital.

A new approach of combination treatment of yoga and modern medicine has been proposed to check further progression of T2DM which seems to give a new insight into the reversibility of the disease process.

8.7 LIMITATION OF THE STUDY

The exact requirement of duration for yoga sessions for the patients could not be assessed due to limitation of time for five batches of yoga intervention groups.

Data on dietary modification of the patients could not be collected and recorded apart from diabetic dietary lecture.

Medicine score could not be assessed on the basis of Doctor's prescription except the assessment done on the basis of the health satisfaction and quality of life improvement scores.

8.8 SUGGESTIONS FOR FUTURE RESEARCH

Suggest for advanced yoga research for T2DM involving larger sample size for long term study (with follow-up practice at home) integrating a well-stepped yoga module to provide more confirmatory evidence for prevention and control of T2DM.

Dietary modification and medicine score study be substantiated with proper monitoring and reported with scientific evidence.

Need to conduct research at molecular level to explore the mechanism of yoga practice in hormonal homeostasis for reversal of T2DM disease.

In case, the risk of T2DM is based on identified genetic loci, research on Genome sequencing may provide additional insights and possible therapies.

Suggest in depth research in yoga practice to un-fold the mechanism involved in improving the scores of various psychological assessments including health satisfaction and quality of life.

9 REFERENCES

- Abraham, A. M., Sudhir, P. M., Philip, M., & Bantwal, G. (2015). Illness perceptions and perceived barriers to self-care in patients with type 2 diabetes mellitus: an exploratory study from India. *International Journal of Diabetes in Developing Countries*, *35*(2), 137–144. <https://doi.org/10.1007/s13410-014-0266-z>
- ADA. (2013). Economic costs of diabetes in the U.S. in 2012. *Diabetes Care*, *36*(4), 1033–1046. <https://doi.org/10.2337/dc12-2625>
- ADA. (2014). Standards of medical care in diabetes--2014. *Diabetes Care*, *37 Suppl 1*, S14-80. <https://doi.org/10.2337/dc14-S014>
- ADA. (2018). Economic Costs of Diabetes in the U.S. in 2017. *Diabetes Care*, *41*(5), 917–928. <https://doi.org/10.2337/dci18-0007>
- Alberts, H. J. E. M., Thewissen, R., & Raes, L. (2012). Dealing with problematic eating behaviour. The effects of a mindfulness-based intervention on eating behaviour, food cravings, dichotomous thinking and body image concern. *Appetite*, *58*(3), 847–851. <https://doi.org/10.1016/j.appet.2012.01.009>
- Alexander, G. K., Innes, K. E., Selfe, T. K., & Brown, C. J. (2013). “More than I expected”: perceived benefits of yoga practice among older adults at risk for cardiovascular disease. *Complementary Therapies in Medicine*, *21*(1), 14–28. <https://doi.org/10.1016/j.ctim.2012.11.001>
- Amita, S., Prabhakar, S., Manoj, I., Harminder, S., & Pavan, T. (2009). Effect of yoga-nidra on blood glucose level in diabetic patients. *Indian Journal of Physiology and Pharmacology*, *53*(1), 97–101.
- Arumugam, G., Nagarathna, R., Majumdar, V., Singh, M., Srinivasalu, R., Sanjival, R., ... Nagendra, H. R. (2020). Yoga-based lifestyle treatment and composite treatment goals in Type 2 Diabetes in a rural South Indian setup- a retrospective study. *Scientific Reports*, *10*(1), 6402. <https://doi.org/10.1038/s41598-020-63133-1>
- Aswathy, S., Kalra, S., & Unnikrishnan, A. (2013). Effective management of type 2 DM in India: Looking at low-cost adjunctive therapy. *Indian Journal of Endocrinology and Metabolism*, *17*(1), 149. <https://doi.org/10.4103/2230-8210.107865>
- Balasubramaniam, M., Telles, S., & Doraiswamy, P. M. (2013). Yoga on our minds: A systematic review of yoga for neuropsychiatric disorders. *Frontiers in Psychiatry*. <https://doi.org/10.3389/fpsy.2012.00117>
- Bali, H. K. (n.d.). Yoga - an ancient solution to a modern epidemic. Ready for prime time? *Indian Heart Journal*, *65*(2), 132–136. <https://doi.org/10.1016/j.ihj.2013.03.002>
- Bardsley, M. J., Astell, S., McCallum, A., & Home, P. D. (1993). The performance of three measures of health status in an outpatient diabetes population. *Diabetic Medicine: A Journal of the*

- British Diabetic Association*, 10(7), 619–626. <https://doi.org/10.1111/j.1464-5491.1993.tb00134.x>
- Barker, D. J., Hales, C. N., Fall, C. H., Osmond, C., Phipps, K., & Clark, P. M. (1993). Type 2 (non-insulin-dependent) diabetes mellitus, hypertension and hyperlipidaemia (syndrome X): relation to reduced fetal growth. *Diabetologia*, 36(1), 62–67. <https://doi.org/10.1007/BF00399095>
- Barnes, P. M., Bloom, B., & Nahin, R. L. (2008). Complementary and alternative medicine use among adults and children: United States, 2007. *National Health Statistics Reports*, (12), 1–23.
- Beliya, K., Devi, L., Singh, S., & Singh, J. (2018). Prevalence of type 2 diabetes in north. <https://doi.org/10.24941/ijcr.32337.09.2018>
- Benichou, T., Pereira, B., Mermillod, M., Tauveron, I., Pfabigan, D., Maqdasy, S., & Dutheil, F. (2018). Heart rate variability in type 2 diabetes mellitus: A systematic review and meta-analysis. *PloS One*, 13(4), e0195166. <https://doi.org/10.1371/journal.pone.0195166>
- Beverly, E. A. (2014). Stressing the importance of diabetes distress: a comment on Baek et al. *Annals of Behavioral Medicine: A Publication of the Society of Behavioral Medicine*, 48(2), 137–139. <https://doi.org/10.1007/s12160-014-9602-2>
- Bhanu, R., Shankar, V. M. S., & Kutty, K. (2016). Influence of short term integrated approach of yoga therapy on quality of living in patients with Type II Diabetes Mellitus. *Indian Journal of Clinical Anatomy and Physiology*, 3(2), 113. <https://doi.org/10.5958/2394-2126.2016.00027.x>
- Bijlani, R. L., Vempati, R. P., Yadav, R. K., Ray, R. B., Gupta, V., Sharma, R., ... Mahapatra, S. C. (2005). A brief but comprehensive lifestyle education program based on yoga reduces risk factors for cardiovascular disease and diabetes mellitus. *Journal of Alternative and Complementary Medicine*, 11(2), 267–274. <https://doi.org/10.1089/acm.2005.11.267>
- Björntorp, P., & Rosmond, R. (2000). Neuroendocrine abnormalities in visceral obesity. *International Journal of Obesity and Related Metabolic Disorders: Journal of the International Association for the Study of Obesity*, 24 Suppl 2, S80-5. <https://doi.org/10.1038/sj.ijo.0801285>
- Black, S. A., Markides, K. S., & Ray, L. A. (2003). Depression predicts increased incidence of adverse health outcomes in older Mexican Americans with type 2 diabetes. *Diabetes Care*, 26(10), 2822–2828. <https://doi.org/10.2337/diacare.26.10.2822>
- Block, J. P., He, Y., Zaslavsky, A. M., Ding, L., & Ayanian, J. Z. (2009). Psychosocial stress and change in weight among US adults. *American Journal of Epidemiology*, 170(2), 181–192. <https://doi.org/10.1093/aje/kwp104>
- Bommer, C., Sagalova, V., Heesemann, E., Manne-Goehler, J., Atun, R., Bärnighausen, T., ... Vollmer, S. (2018). Global Economic Burden of Diabetes in Adults: Projections From 2015 to 2030. *Diabetes Care*, 41, dc171962. <https://doi.org/10.2337/dc17-1962>
- Bower, J. E., Greendale, G., Crosswell, A. D., Garet, D., Sternlieb, B., Ganz, P. A., ... Cole, S. W. (2014). Yoga reduces inflammatory signaling in fatigued breast cancer survivors: A randomized

- controlled trial. *Psychoneuroendocrinology*, 43, 20–29.
<https://doi.org/10.1016/j.psyneuen.2014.01.019>
- Brown, R. P., & Gerbarg, P. L. (2005). Sudarshan Kriya Yogic breathing in the treatment of stress, anxiety, and depression. Part II--clinical applications and guidelines. *Journal of Alternative and Complementary Medicine (New York, N.Y.)*, 11(4), 711–717.
<https://doi.org/10.1089/acm.2005.11.711>
- Bruce, D. G., Davis, W. A., Starkstein, S. E., & Davis, T. M. E. (2005). A prospective study of depression and mortality in patients with type 2 diabetes: the Fremantle Diabetes Study. *Diabetologia*, 48(12), 2532–2539. <https://doi.org/10.1007/s00125-005-0024-3>
- Burckhardt, C. S., & Anderson, K. L. (2003). The Quality of Life Scale (QOLS): reliability, validity, and utilization. *Health and Quality of Life Outcomes*, 1, 60. <https://doi.org/10.1186/1477-7525-1-60>
- Burroughs, T. E., Desikan, R., Waterman, B., Gilin, D., & McGill, J. B. (2004). Development and Validation of the Diabetes Quality of Life Brief Clinical Inventory. *Diabetes Spectrum*, 17, 41–49.
- Büssing, A., Michalsen, A., Khalsa, S. B. S., Telles, S., & Sherman, K. J. (2012). Effects of yoga on mental and physical health: a short summary of reviews. *Evidence-Based Complementary and Alternative Medicine : ECAM*, 2012, 165410. <https://doi.org/10.1155/2012/165410>
- Bystritsky, A., Danial, J., & Kronemyer, D. (2014). Interactions Between Diabetes and Anxiety and Depression Implications for Treatment. <https://doi.org/10.1016/j.ecl.2013.10.001>
- Cappuccio, F. P., D'Elia, L., Strazzullo, P., & Miller, M. A. (2010). Quantity and quality of sleep and incidence of type 2 diabetes: a systematic review and meta-analysis. *Diabetes Care*, 33(2), 414–420. <https://doi.org/10.2337/dc09-1124>
- Cavelti-Weder, C., Babians-Brunner, A., Keller, C., Stahel, M. A., Kurz-Levin, M., Zayed, H., ... Donath, M. Y. (2012). Effects of gevokizumab on glycemia and inflammatory markers in type 2 diabetes. *Diabetes Care*, 35(8), 1654–1662. <https://doi.org/10.2337/dc11-2219>
- Chandler, K. (2001). The emerging field of yoga therapy. *Hawaii Medical Journal*, 60(11), 286–287.
- Chandra, A., Neeland, I. J., Berry, J. D., Ayers, C. R., Rohatgi, A., Das, S. R., ... Turer, A. T. (2014). The relationship of body mass and fat distribution with incident hypertension: observations from the Dallas Heart Study. *Journal of the American College of Cardiology*, 64(10), 997–1002.
<https://doi.org/10.1016/j.jacc.2014.05.057>
- Chandratreya, S. (2011). Yoga: An evidence-based therapy. *Journal of Mid-Life Health*, 2(1), 3–4.
<https://doi.org/10.4103/0976-7800.83251>
- Chen, L., Magliano, D. J., & Zimmet, P. Z. (2011). The worldwide epidemiology of type 2 diabetes mellitus--present and future perspectives. *Nature Reviews. Endocrinology*, 8(4), 228–236.
<https://doi.org/10.1038/nrendo.2011.183>

- Cho, N. H., Shaw, J. E., Karuranga, S., Huang, Y., da Rocha Fernandes, J. D., Ohlrogge, A. W., & Malanda, B. (2018). IDF Diabetes Atlas: Global estimates of diabetes prevalence for 2017 and projections for 2045. *Diabetes Research and Clinical Practice*, *138*, 271–281. <https://doi.org/10.1016/j.diabres.2018.02.023>
- Chung, F., Chang, D.-M., Tsai, J. C.-R., Huang, H.-F., Shin, S.-J., & Lee, Y.-J. (2006). Elevated plasma level of visfatin/pre-B cell colony-enhancing factor in patients with type 2 diabetes mellitus. *The Journal of Clinical Endocrinology and Metabolism*, *91*(1), 295–299. <https://doi.org/10.1210/jc.2005-1475>
- Chung, S.-C., Brooks, M. M., Rai, M., Balk, J. L., & Rai, S. (2012). Effect of Sahaja yoga meditation on quality of life, anxiety, and blood pressure control. *Journal of Alternative and Complementary Medicine (New York, N.Y.)*, *18*(6), 589–596. <https://doi.org/10.1089/acm.2011.0038>
- Cnop, M., Landchild, M. J., Vidal, J., Havel, P. J., Knowles, N. G., Carr, D. R., ... Kahn, S. E. (2002). The concurrent accumulation of intra-abdominal and subcutaneous fat explains the association between insulin resistance and plasma leptin concentrations : distinct metabolic effects of two fat compartments. *Diabetes*, *51*(4), 1005–1015. <https://doi.org/10.2337/diabetes.51.4.1005>
- Colberg, S. R., Sigal, R. J., Fernhall, B., Regensteiner, J. G., Blissmer, B. J., Rubin, R. R., ... Braun, B. (2010). Exercise and type 2 diabetes: the American College of Sports Medicine and the American Diabetes Association: joint position statement. *Diabetes Care*, *33*(12), e147-67. <https://doi.org/10.2337/dc10-9990>
- Cramer, H., Lauche, R., Langhorst, J., & Dobos, G. (2013). YOGA FOR DEPRESSION: A SYSTEMATIC REVIEW AND META-ANALYSIS. *Depression and Anxiety*, *30*(11), 1068–1083. <https://doi.org/10.1002/da.22166>
- Cui, J., Yan, J.-H., Yan, L.-M., Pan, L., Le, J.-J., & Guo, Y.-Z. (2017). Effects of yoga in adults with type 2 diabetes mellitus: A meta-analysis. *Journal of Diabetes Investigation*, *8*(2), 201–209. <https://doi.org/10.1111/jdi.12548>
- Daubenmier, J., Kristeller, J., Hecht, F. M., Maninger, N., Kuwata, M., Jhaveri, K., ... Epel, E. (2011). Mindfulness Intervention for Stress Eating to Reduce Cortisol and Abdominal Fat among Overweight and Obese Women: An Exploratory Randomized Controlled Study. *Journal of Obesity*, *2011*, 651936. <https://doi.org/10.1155/2011/651936>
- de G R Hansen, E., & Innes, K. E. (2013). The benefits of yoga for adults with type 2 diabetes: a review of the evidence and call for a collaborative, integrated research initiative. *International Journal of Yoga Therapy*, *(23)*, 71–83.
- DeFronzo, R. A., & Tripathy, D. (2009). Skeletal muscle insulin resistance is the primary defect in type 2 diabetes. *Diabetes Care*, *32 Suppl 2*(Suppl 2), S157-63. <https://doi.org/10.2337/dc09-S302>

- Delamater, A. M., Jacobson, A. M., Anderson, B., Cox, D., Fisher, L., Lustman, P., ... Wysocki, T. (2001). Psychosocial therapies in diabetes: report of the Psychosocial Therapies Working Group. *Diabetes Care*, *24*(7), 1286–1292. <https://doi.org/10.2337/diacare.24.7.1286>
- Delmonte, M. M. (1985). Biochemical indices associated with meditation practice: a literature review. *Neuroscience and Biobehavioral Reviews*, *9*(4), 557–561. [https://doi.org/10.1016/0149-7634\(85\)90002-8](https://doi.org/10.1016/0149-7634(85)90002-8)
- Devi, K. B. L., Singh, H. S., & S, J. S. (2019). PREVALENCE OF TYPE 2 DIABETES IN NORTHEAST India : A review research article prevalence of type 2 diabetes in north-east north east India : A review, (February). <https://doi.org/10.24941/ijcr.32337.09.2018>
- Eaton, W. W., Armenian, H., Gallo, J., Pratt, L., & Ford, D. E. (1996). Depression and risk for onset of type II diabetes. A prospective population-based study. *Diabetes Care*, *19*(10), 1097–1102. <https://doi.org/10.2337/diacare.19.10.1097>
- edition International Diabetes Federation, IDF Diabetes Atlas, 8th. (2017). *Eighth edition 2017. IDF Diabetes Atlas, 8th edition*. [https://doi.org/http://dx.doi.org/10.1016/S0140-6736\(16\)31679-8](https://doi.org/http://dx.doi.org/10.1016/S0140-6736(16)31679-8).
- Elbein, S. C., Hasstedt, S. J., Wegner, K., & Kahn, S. E. (1999). Heritability of pancreatic beta-cell function among nondiabetic members of Caucasian familial type 2 diabetic kindreds. *The Journal of Clinical Endocrinology and Metabolism*, *84*(4), 1398–1403. <https://doi.org/10.1210/jcem.84.4.5604>
- Eriksson, K. F., & Lindgärde, F. (1991). Prevention of type 2 (non-insulin-dependent) diabetes mellitus by diet and physical exercise. The 6-year Malmö feasibility study. *Diabetologia*, *34*(12), 891–898. <https://doi.org/10.1007/BF00400196>
- Esser, N., Legrand-Poels, S., Piette, J., Scheen, A. J., & Paquot, N. (2014). Inflammation as a link between obesity, metabolic syndrome and type 2 diabetes. *Diabetes Research and Clinical Practice*, *105*(2), 141–150. <https://doi.org/10.1016/j.diabres.2014.04.006>
- Fappa, E., Yannakoulia, M., Pitsavos, C., Skoumas, I., Valourdou, S., & Stefanadis, C. (2008). Lifestyle intervention in the management of metabolic syndrome: could we improve adherence issues? *Nutrition (Burbank, Los Angeles County, Calif.)*, *24*(3), 286–291. <https://doi.org/10.1016/j.nut.2007.11.008>
- Faulenbach, M., Uthoff, H., Schwegler, K., Spinass, G. A., Schmid, C., & Wiesli, P. (2012). Effect of psychological stress on glucose control in patients with Type 2 diabetes. *Diabetic Medicine : A Journal of the British Diabetic Association*, *29*(1), 128–131. <https://doi.org/10.1111/j.1464-5491.2011.03431.x>
- Fishman, L., & Saltonstall, E. (2008). Yoga in Pain Management (pp. 259–284). https://doi.org/10.1007/978-1-59745-344-8_13
- Fowler, M. J. (2011). Microvascular and Macrovascular Complications of Diabetes, *29*(3), 116–122.
- Gardner, C., Wylie-rosett, J., Gidding, S. S., Steffen, L. M., Johnson, R. K., Reader, D., ... Jecfa, A.

- D. I. (2012). AHA / ADA Scientific Statement Nonnutritive Sweeteners : Current Use and Health Perspectives A Scientific Statement From the American Heart Association and the American Diabetes Association, 509–519. <https://doi.org/10.1161/CIR.0b013e31825c42ee>
- Glasgow, R. E., & Osteen, V. L. (1992). Evaluating diabetes education. Are we measuring the most important outcomes? *Diabetes Care*, *15*(10), 1423–1432. <https://doi.org/10.2337/diacare.15.10.1423>
- Gordon, L. A., Morrison, E. Y., McGrowder, D. A., Young, R., Fraser, Y. T. P., Zamora, E., ... Irving, R. R. (2008). Effect of exercise therapy on lipid profile and oxidative stress indicators in patients with type 2 diabetes. *BMC Complementary and Alternative Medicine*. <https://doi.org/10.1186/1472-6882-8-21>
- Gowtham, L., Vasanthi, B., Jayshree, N., Ambika, & Jacob, S. (2018). Effects of Yoga in type 2 diabetes mellitus with hypertension : Alteration in RBC morphology as a marker for oxidative stress. *Indian Journal of Physiology and Pharmacology*, *62*, 51–58.
- Gress, T. W., Nieto, F. J., Shahar, E., Wofford, M. R., & Brancati, F. L. (2000). Hypertension and antihypertensive therapy as risk factors for type 2 diabetes mellitus. Atherosclerosis Risk in Communities Study. *The New England Journal of Medicine*, *342*(13), 905–912. <https://doi.org/10.1056/NEJM200003303421301>
- Guariguata, L., Whiting, D., Weil, C., & Unwin, N. (2011). The International Diabetes Federation diabetes atlas methodology for estimating global and national prevalence of diabetes in adults. *Diabetes Research and Clinical Practice*, *94*(3), 322–332. <https://doi.org/10.1016/j.diabres.2011.10.040>
- Gupta, A., Gupta, R., Sarna, M., Rastogi, S., Gupta, V. P., & Kothari, K. (2003). Prevalence of diabetes, impaired fasting glucose and insulin resistance syndrome in an urban Indian population. *Diabetes Research and Clinical Practice*, *61*(1), 69–76. [https://doi.org/10.1016/S0168-8227\(03\)00085-8](https://doi.org/10.1016/S0168-8227(03)00085-8)
- Gupta, N., Khera, S., Vempati, R. P., Sharma, R., & Bijlani, R. L. (2006). Effect of yoga based lifestyle intervention on state and trait anxiety. *Indian Journal of Physiology and Pharmacology*, *50*(1), 41–47.
- Gwaltney, C. J., Metrik, J., Kahler, C. W., & Shiffman, S. (2009). Self-efficacy and smoking cessation: a meta-analysis. *Psychology of Addictive Behaviors: Journal of the Society of Psychologists in Addictive Behaviors*, *23*(1), 56–66. <https://doi.org/10.1037/a0013529>
- Habibi N, & Marandi SM. (2014). Effect of 12 weeks of yoga practice on glucose, insulin and triglycerides serum level in women with diabetes type II. *Journal of Gorgan University of Medical Sciences*, *15*(4), 1–7.
- Haffner, S., Temprosa, M., Crandall, J., Fowler, S., Goldberg, R., Horton, E., ... Barrett-Connor, E. (2005). Intensive lifestyle intervention or metformin on inflammation and coagulation in

- participants with impaired glucose tolerance. *Diabetes*, 54(5), 1566–1572. <https://doi.org/10.2337/diabetes.54.5.1566>
- Hagins, M., Rundle, A., Consedine, N. S., & Khalsa, S. B. S. (2014). A randomized controlled trial comparing the effects of yoga with an active control on ambulatory blood pressure in individuals with prehypertension and stage 1 hypertension. *Journal of Clinical Hypertension (Greenwich, Conn.)*, 16(1), 54–62. <https://doi.org/10.1111/jch.12244>
- Hamman, R. F. (1992). Genetic and environmental determinants of non-insulin-dependent diabetes mellitus (NIDDM). *Diabetes/Metabolism Reviews*, 8(4), 287–338. <https://doi.org/10.1002/dmr.5610080402>
- Hegde, S V, Adhikari, P., Kotian, S., Pinto, V. J., D'Souza, S., & D'Souza, V. (2011). Effect of 3-month yoga on oxidative stress in type 2 diabetes with or without complications: a controlled clinical trial. *Diabetes Care*, 34, 2208–2210. <https://doi.org/10.2337/dc10-2430>
- Hegde, Shreelaxmi V, Adhikari, P., Shetty, S., Manjrekar, P., & D'Souza, V. (2013). Effect of community-based yoga intervention on oxidative stress and glycemic parameters in prediabetes: a randomized controlled trial. *Complementary Therapies in Medicine*, 21(6), 571–576. <https://doi.org/10.1016/j.ctim.2013.08.013>
- Hessler, D., Fisher, L., Glasgow, R. E., Strycker, L. A., Dickinson, L. M., Arean, P. A., & Masharani, U. (2014). Reductions in regimen distress are associated with improved management and glycemic control over time. *Diabetes Care*, 37(3), 617–624. <https://doi.org/10.2337/dc13-0762>
- Hu, F. B. (2011, June). Globalization of diabetes: the role of diet, lifestyle, and genes. *Diabetes Care*. <https://doi.org/10.2337/dc11-0442>
- Innes, K. E., Bourguignon, C., & Taylor, A. G. (n.d.). Risk indices associated with the insulin resistance syndrome, cardiovascular disease, and possible protection with yoga: a systematic review. *The Journal of the American Board of Family Practice / American Board of Family Practice*, 18(6), 491–519. Retrieved from <http://www.ncbi.nlm.nih.gov/pubmed/16322413>
- Innes, K. E., & Selfe, T. K. (2016). Yoga for Adults with Type 2 Diabetes: A Systematic Review of Controlled Trials. *Journal of Diabetes Research*, 2016. <https://doi.org/10.1155/2016/6979370>
- Innes, K. E., & Vincent, H. K. (2007). The Influence of Yoga-Based Programs on Risk Profiles in Adults with Type 2 Diabetes Mellitus: A Systematic Review. *Evidencebased Complementary and Alternative Medicine ECAM*, 4, 469–486. <https://doi.org/10.1093/ecam/nel103>
- Innes, K. E., Vincent, H. K., & Taylor, A. G. (2007). Chronic stress and insulin resistance-related indices of cardiovascular disease risk, part I: neurophysiological responses and pathological sequelae. *Alternative Therapies in Health and Medicine*, 13(4), 46–52.
- Inzucchi, S. E. (2002). *Oral Antihyperglycemic Therapy for Type 2 Diabetes Scientific Review*. *Journal of the American Medical Association* (Vol. 287). American Medical Association. <https://doi.org/10.1001/jama.287.3.360>

- Inzucchi, S. E., Bergenstal, R. M., Buse, J. B., Diamant, M., Ferrannini, E., Nauck, M., ... Matthews, D. R. (2012). Management of hyperglycemia in type 2 diabetes: a patient-centered approach: position statement of the American Diabetes Association (ADA) and the European Association for the Study of Diabetes (EASD). *Diabetes Care*, *35*(6), 1364–1379. <https://doi.org/10.2337/dc12-0413>
- Jain, S. C., Uppal, A., Bhatnagar, S. O. D., & Talukdar, B. (1993). A study of response pattern of non-insulin dependent diabetics to yoga therapy. *Diabetes Research and Clinical Practice*, *19*(1), 69–74. [https://doi.org/10.1016/0168-8227\(93\)90146-V](https://doi.org/10.1016/0168-8227(93)90146-V)
- Jayasinghe, S. R. (2004). Yoga in cardiac health (a review). *European Journal of Cardiovascular Prevention and Rehabilitation: Official Journal of the European Society of Cardiology, Working Groups on Epidemiology & Prevention and Cardiac Rehabilitation and Exercise Physiology*, *11*(5), 369–375. Retrieved from <http://www.ncbi.nlm.nih.gov/pubmed/15616408>
- Jensen, C. C., Cnop, M., Hull, R. L., Fujimoto, W. Y., & Kahn, S. E. (2002). Beta-cell function is a major contributor to oral glucose tolerance in high-risk relatives of four ethnic groups in the U.S. *Diabetes*, *51*(7), 2170–2178. <https://doi.org/10.2337/diabetes.51.7.2170>
- Johnsson, I. W., Haglund, B., Ahlsson, F., & Gustafsson, J. (2015). A high birth weight is associated with increased risk of type 2 diabetes and obesity. *Pediatric Obesity*, *10*(2), 77–83. <https://doi.org/10.1111/ijpo.230>
- Joseph, J. J., & Golden, S. H. (2014). Type 2 diabetes and cardiovascular disease: what next? *Current Opinion in Endocrinology, Diabetes, and Obesity*, *21*(2), 109–120. <https://doi.org/10.1097/MED.0000000000000044>
- Joshi, S. R. (2015). Diabetes Care in India. *Annals of Global Health*, *81*(6), 830–838. <https://doi.org/10.1016/j.aogh.2016.01.002>
- Jyotsna, V. P., Joshi, A., Ambekar, S., Kumar, N., Dhawan, A., & Sreenivas, V. (2012). Comprehensive yogic breathing program improves quality of life in patients with diabetes. *Indian Journal of Endocrinology and Metabolism*, *16*(3), 423–428. <https://doi.org/10.4103/2230-8210.95692>
- Kahn, S. E., Cooper, M. E., & Del Prato, S. (2014). Pathophysiology and treatment of type 2 diabetes: perspectives on the past, present, and future. *Lancet (London, England)*, *383*(9922), 1068–1083. [https://doi.org/10.1016/S0140-6736\(13\)62154-6](https://doi.org/10.1016/S0140-6736(13)62154-6)
- Katterman, S. N., Kleinman, B. M., Hood, M. M., Nackers, L. M., & Corsica, J. A. (2014). Mindfulness meditation as an intervention for binge eating, emotional eating, and weight loss: a systematic review. *Eating Behaviors*, *15*(2), 197–204. <https://doi.org/10.1016/j.eatbeh.2014.01.005>
- Kelley, G. A., & Kelley, K. S. (2007). Effects of aerobic exercise on lipids and lipoproteins in adults with type 2 diabetes: a meta-analysis of randomized-controlled trials. *Public Health*, *121*(9),

- 643–655. <https://doi.org/10.1016/j.puhe.2007.02.014>
- Khalsa, S. A. T. B. I. R. S. (2004). SPECIAL INVITED ARTICLE YOGA AS A THERAPEUTIC INTERVENTION : A BIBLIOMETRIC ANALYSIS OF PUBLISHED RESEARCH STUDIES. *Indian Journal of Physiology Pharmacology*, *48*, 269–285.
- Khatrri, D., Mathur, K. C., Gahlot, S., Jain, S., & Agrawal, R. P. (2007). Effects of yoga and meditation on clinical and biochemical parameters of metabolic syndrome. *Diabetes Research and Clinical Practice*, *78*(3), e9-10. <https://doi.org/10.1016/j.diabres.2007.05.002>
- Kjaer, T. W., Bertelsen, C., Piccini, P., Brooks, D., Alving, J., & Lou, H. C. (2002). Increased dopamine tone during meditation-induced change of consciousness. *Brain Research. Cognitive Brain Research*, *13*(2), 255–259. [https://doi.org/10.1016/s0926-6410\(01\)00106-9](https://doi.org/10.1016/s0926-6410(01)00106-9)
- Klonoff, D. C., Buse, J. B., Nielsen, L. L., Guan, X., Bowlus, C. L., Holcombe, J. H., ... Maggs, D. G. (2008). Exenatide effects on diabetes, obesity, cardiovascular risk factors and hepatic biomarkers in patients with type 2 diabetes treated for at least 3 years. *Current Medical Research and Opinion*, *24*(1), 275–286. <https://doi.org/10.1185/030079908x253870>
- Kosuri, M., & Sridhar, G. R. (2009). Yoga practice in Diabetes improves Physical and Psychological outcomes. *Metabolic Syndrom Related Disorders*, *7*, 515–518.
- Kosuri, Madhu, & Sridhar, G. R. (2009). Yoga Practice in Diabetes Improves Physical and Psychological Outcomes. <https://doi.org/10.1089/met.2009.0011>
- Kumar, V., Jagannathan, A., Philip, M., Thulasi, A., Angadi, P., & Raghuram, N. (2016). Role of yoga for patients with type II diabetes mellitus: A systematic review and meta-analysis. *Complementary Therapies in Medicine*, *25*, 104–112. <https://doi.org/10.1016/j.ctim.2016.02.001>
- Kurian, J., Mohanthy, S., & Nanjumdaiah, R. M. (2022). Mechanism of action of yoga on prevention and management of type 2 diabetes mellitus: Narrative review. *Journal of Bodywork and Movement Therapies*, *29*, 134–139. <https://doi.org/https://doi.org/10.1016/j.jbmt.2021.10.003>
- Kutty, B. M., & Raju, T. R. (2010). New vistas in treating diabetes--insight into a holistic approach. *The Indian Journal of Medical Research*, *131*, 606–607.
- Kyizom, T., Singh, S., Singh, K. P., Tandon, O. P., & Kumar, R. (2010). Effect of pranayama & yoga-asana on cognitive brain functions in type 2 diabetes-P3 event related evoked potential (ERP). *Indian Journal of Medical Research*, *131*(5), 636–640.
- Lam, D. W., & LeRoith, D. (2012). The worldwide diabetes epidemic. *Current Opinion in Endocrinology, Diabetes, and Obesity*, *19*(2), 93–96. <https://doi.org/10.1097/MED.0b013e328350583a>
- Larsen, C. M., Faulenbach, M., Vaag, A., Ehses, J. A., Donath, M. Y., & Mandrup-Poulsen, T. (2009). Sustained effects of interleukin-1 receptor antagonist treatment in type 2 diabetes. *Diabetes Care*, *32*(9), 1663–1668. <https://doi.org/10.2337/dc09-0533>
- Lee, J.-A., Kim, J.-W., & Kim, D.-Y. (2012). Effects of yoga exercise on serum adiponectin and

- metabolic syndrome factors in obese postmenopausal women. *Menopause (New York, N.Y.)*, *19*(3), 296–301. <https://doi.org/10.1097/gme.0b013e31822d59a2>
- Levitt, N. S., Steyn, K., Lambert, E. V, Reagon, G., Lombard, C. J., Fourie, J. M., ... Hoffman, M. (1999). Modifiable risk factors for Type 2 diabetes mellitus in a peri-urban community in South Africa. *Diabetic Medicine: A Journal of the British Diabetic Association*, *16*(11), 946–950. <https://doi.org/10.1046/j.1464-5491.1999.00185.x>
- Li, G., Zhang, P., Wang, J., Gregg, E. W., Yang, W., Gong, Q., ... Bennett, P. H. (2008). The long-term effect of lifestyle interventions to prevent diabetes in the China Da Qing Diabetes Prevention Study: a 20-year follow-up study. *Lancet (London, England)*, *371*(9626), 1783–1789. [https://doi.org/10.1016/S0140-6736\(08\)60766-7](https://doi.org/10.1016/S0140-6736(08)60766-7)
- Littman, A. J., Bertram, L. C., Ceballos, R., Ulrich, C. M., Ramaprasad, J., McGregor, B., & McTiernan, A. (2012). Randomized controlled pilot trial of yoga in overweight and obese breast cancer survivors: effects on quality of life and anthropometric measures. *Supportive Care in Cancer: Official Journal of the Multinational Association of Supportive Care in Cancer*, *20*(2), 267–277. <https://doi.org/10.1007/s00520-010-1066-8>
- Liu, X. C., Pan, L., Hu, Q., Dong, W. P., Yan, J. H., & Dong, L. (2014). Effects of yoga training in patients with chronic obstructive pulmonary disease: A systematic review and meta-analysis. *Journal of Thoracic Disease*, *6*(6), 795–802. <https://doi.org/10.3978/j.issn.2072-1439.2014.06.05>
- Mahapure, H. H., Shete, S. U., & Bera, T. K. (2008). Effect of yogic exercise on super oxide dismutase levels in diabetics. *International Journal of Yoga*, *1*(1), 21–26. <https://doi.org/10.4103/0973-6131.36792>
- Malhotra, V. (2018). Status of NIDDM patients after yoga asanas: Assessment of Important parameters. *Journal of Clinical and Diagnostic Research*, (October).
- Malhotra, V., Singh, S., Tandon, O. P., & Sharma, S. B. (2005). The beneficial effect of yoga in diabetes. *Nepal Medical College Journal: NMCJ*, *7*(2), 145–147. Retrieved from <http://europepmc.org/abstract/MED/16519085>
- McCaffrey, R., Ruknui, P., Hatthakit, U., & Kasetomboon, P. (2005). The effects of yoga on hypertensive persons in Thailand. *Holistic Nursing Practice*, *19*(4), 173–180. <https://doi.org/10.1097/00004650-200507000-00009>
- McDermott, K. A., Rao, M. R., Nagarathna, R., Murphy, E. J., Burke, A., Nagendra, R. H., & Hecht, F. M. (2014). A yoga intervention for type 2 diabetes risk reduction: A pilot randomized controlled trial. *BMC Complementary and Alternative Medicine*, *14*, 212. <https://doi.org/10.1186/1472-6882-14-212>
- McMillan, C. V, Honeyford, R. J., Datta, J., Madge, N. J. H., & Bradley, C. (2004). The development of a new measure of quality of life for young people with diabetes mellitus: the ADDQoL-Teen.

- Health and Quality of Life Outcomes*, 2, 61. <https://doi.org/10.1186/1477-7525-2-61>
- Miller, C. K., Kristeller, J. L., Headings, A., Nagaraja, H., & Miser, W. F. (2012). Comparative Effectiveness of a Mindful Eating Intervention to a Diabetes Self-Management Intervention among Adults with Type 2 Diabetes: A Pilot Study. *Journal of the Academy of Nutrition and Dietetics*, 112(11), 1835–1842. <https://doi.org/10.1016/j.jand.2012.07.036>
- Miller, R. E. (1981). Pancreatic neuroendocrinology: peripheral neural mechanisms in the regulation of the Islets of Langerhans. *Endocrine Reviews*, 2(4), 471–494. <https://doi.org/10.1210/edrv-2-4-471>
- Mishra, P., Greenfield, S. M., Harris, T., Hamer, M., Lewis, S. A., Singh, K., ... Chattopadhyay, K. (2021). Yoga Program for Type 2 Diabetes Prevention (YOGA-DP) Among High-Risk People: Qualitative Study to Explore Reasons for Non-participation in a Feasibility Randomized Controlled Trial in India. *Frontiers in Public Health*, 9(September), 1–10. <https://doi.org/10.3389/fpubh.2021.682203>
- Mitra, A., Dewanjee, D., & Dey, B. (2012). Mechanistic studies of lifestyle interventions in type 2 diabetes. *World Journal of Diabetes*, 3(12), 201–207. <https://doi.org/10.4239/wjd.v3.i12.201>
- Mohammed, R., Banu, A., & Kumar Jaiswal, R. (2016). Importance of yoga in diabetes and dyslipidemia. *International Journal of Research in Medical Sciences Mohammed R et Al. Int J Res Med Sci*, 4(8), 3504–3508. <https://doi.org/10.18203/2320-6012.ijrms20162320>
- Mondal, S., Kundu, B., & Saha, S. (2018). Yoga as a therapeutic intervention for the management of type 2 diabetes mellitus. *International Journal of Yoga*, 11(2), 129. https://doi.org/10.4103/ijoy.ijoy_74_16
- Monnier, L., Colette, C., & Owens, D. R. (2008). Glycemic variability: the third component of the dysglycemia in diabetes. Is it important? How to measure it? *Journal of Diabetes Science and Technology*, 2(6), 1094–1100. <https://doi.org/10.1177/193229680800200618>
- Monroe, R. C., Power, J. R., Kumar, A. E., Nagarathna, R., & Dandona, P. (1992). Yoga therapy for NIDDM: a controlled trial.
- Mooradian, A. D. (2009, March). Dyslipidemia in type 2 diabetes mellitus. *Nature Clinical Practice Endocrinology and Metabolism*. <https://doi.org/10.1038/ncpendmet1066>
- Naga Venkatesha Murthy, P. J., Janakiramaiah, N., Gangadhar, B. N., & Subbakrishna, D. K. (1998). P300 amplitude and antidepressant response to Sudarshan Kriya Yoga (SKY). *Journal of Affective Disorders*, 50(1), 45–48. [https://doi.org/10.1016/S0165-0327\(98\)00029-9](https://doi.org/10.1016/S0165-0327(98)00029-9)
- Nagarathna, R., Usharani, M. R., Rao, A. R., Chaku, R., Kulkarni, R., & Nagendra, H. R. (2012). Efficacy of yoga based life style modification program on medication score and lipid profile in type 2 diabetes—a randomized control study. *International Journal of Diabetes in Developing Countries*, 32(3), 122–130. <https://doi.org/10.1007/s13410-012-0078-y>
- Nagarathna, Raghuram, Tyagi, R., Kaur, G., Vendan, V., Acharya, I. N., Anand, A., ... Nagendra, H.

- R. (2019). Efficacy of a Validated Yoga Protocol on Dyslipidemia in Diabetes Patients: NMB-2017 India Trial. *Medicines (Basel, Switzerland)*, 6(4).
<https://doi.org/10.3390/medicines6040100>
- Nagendra, N. and. (1985). *Yoga for Positive health*. Swami Vivekananda Yoga Prakashana, Bangalore.
- Nagendra, N. and. (2014). *Yoga and Diabetes* (2002nd ed.). Bangalore: Yoga Prakashana.
- Nagpal, J., Kumar, A., Kakar, S., & Bhartia, A. (2010). The development of 'Quality of Life Instrument for Indian Diabetes patients (QOLID): a validation and reliability study in middle and higher income groups. *The Journal of the Association of Physicians of India*, 58, 295–304.
- Nayak, N. N., & Shankar, K. (2004). Yoga: a therapeutic approach. *Physical Medicine and Rehabilitation Clinics of North America*, 15(4), 783–798, vi.
<https://doi.org/10.1016/j.pmr.2004.04.004>
- NCD. (2016). Worldwide trends in diabetes since 1980: a pooled analysis of 751 population-based studies with 4.4 million participants. *Lancet (London, England)*, 387(10027), 1513–1530.
[https://doi.org/10.1016/S0140-6736\(16\)00618-8](https://doi.org/10.1016/S0140-6736(16)00618-8)
- Neel, J. V. (1962). Diabetes mellitus: a “thrifty” genotype rendered detrimental by “progress”? *American Journal of Human Genetics*, 14(4), 353–362.
- Newberg, A. B., Wintering, N., Waldman, M. R., Amen, D., Khalsa, D. S., & Alavi, A. (2010). Cerebral blood flow differences between long-term meditators and non-meditators. *Consciousness and Cognition*, 19(4), 899–905. <https://doi.org/10.1016/j.concog.2010.05.003>
- Nivethitha, L., Mooventhan, A., & Manjunath, N. K. (2016). Effects of Various Prāṇāyāma on Cardiovascular and Autonomic Variables. *Ancient Science of Life*, 36(2), 72–77.
https://doi.org/10.4103/asl.ASL_178_16
- Oliver, G., Wardle, J., & Gibson, E. L. (2000). Stress and food choice: a laboratory study. *Psychosomatic Medicine*, 62(6), 853–865. <https://doi.org/10.1097/00006842-200011000-00016>
- Opie, E. L. (1901). THE RELATION OF DIABETES MELLITUS TO LESIONS OF THE PANCREAS. HYALINE DEGENERATION OF THE ISLANDS OF LANGERHANS. *The Journal of Experimental Medicine*, 5(5), 527–540. <https://doi.org/10.1084/jem.5.5.527>
- Pasquali, R., Vicennati, V., Cacciari, M., & Pagotto, U. (2006). The hypothalamic-pituitary-adrenal axis activity in obesity and the metabolic syndrome. *Annals of the New York Academy of Sciences*, 1083, 111–128. <https://doi.org/10.1196/annals.1367.009>
- Patel, N. K., Newstead, A. H., & Ferrer, R. L. (2012). The effects of yoga on physical functioning and health related quality of life in older adults: a systematic review and meta-analysis. *Journal of Alternative and Complementary Medicine (New York, N.Y.)*, 18(10), 902–917.
<https://doi.org/10.1089/acm.2011.0473>
- Pitsavos, C., Panagiotakos, D., Weinem, M., & Stefanadis, C. (2006). Diet, exercise and the metabolic

- syndrome. *The Review of Diabetic Studies : RDS*, 3(3), 118–126.
<https://doi.org/10.1900/RDS.2006.3.118>
- R. Agrawal, R. Aradhana, S. Hussain R. Beniwal, M. S. and D. K. (2003). ABSTRACTS. *International Journal of Diabetes in Developing Countries*, 23, 130–134.
- Raina, M. K., & Ph, D. (2016). THE LEVELS OF HUMAN CONSCIOUSNESS AND CREATIVE FUNCTIONING: INSIGHTS FROM THE THEORY OF PANCHA KOSHA (FIVE SHEATHS OF CONSCIOUSNESS), 48(2), 168–189.
- Raj Thangasami, S., & Lal Chandani, A. (2015). Emphasis of Yoga in the Management of Diabetes. *J Diabetes Metab*, 6, 613. <https://doi.org/10.4172/2155-6156.1000613>
- Rajbhoj, P. H., Shete, S. U., Verma, A., & Bhogal, R. S. (2015). Effect of Yoga Module on Pro-Inflammatory and Anti-Inflammatory Cytokines in Industrial Workers of Lonavla: A Randomized Controlled Trial. *JOURNAL OF CLINICAL AND DIAGNOSTIC RESEARCH*, 9(2), CC01.
- Ramamoorthi, R., Gahreman, D., Moss, S., & Skinner, T. (2019). The effectiveness of yoga to prevent diabetes mellitus type 2: A protocol for systematic review and meta-analysis. *Medicine*, 98(3), e14019. <https://doi.org/10.1097/MD.00000000000014019>
- Ranga, S. A., Agrawal, S., Rukadikar, C. A., & Rukadikar, A. R. (2021). Study of effect of yoga on blood pressure , blood glucose , and glycosylated hemoglobin levels of patients with Type 2 diabetes mellitus, 11(04), 449–453. <https://doi.org/10.5455/njppp.2021.11.02056202110032021>
- Rao, P. R., Shobhana, R., Lavanya, A., Padma, C., Vijay, V., & Ramachandran, A. (2005). Development of a reliable and valid psychosocial measure of self-perception of health in type 2 diabetes. *The Journal of the Association of Physicians of India*, 53, 689–692.
- Raveendran, A. V., Deshpandae, A., & Joshi, S. R. (2018, September). Therapeutic Role of Yoga in Type 2 Diabetes. *Endocrinology and Metabolism*. Korean Endocrine Society. <https://doi.org/10.3803/EnM.2018.33.3.307>
- Reaven, G. M. (1993). Role of insulin resistance in human disease (syndrome X): an expanded definition. *Annual Review of Medicine*, 44, 121–131. <https://doi.org/10.1146/annurev.me.44.020193.001005>
- Ross, A., & Thomas, S. (2010, January). The health benefits of yoga and exercise: A review of comparison studies. *Journal of Alternative and Complementary Medicine*. J Altern Complement Med. <https://doi.org/10.1089/acm.2009.0044>
- Rubia, K. (2009). The neurobiology of Meditation and its clinical effectiveness in psychiatric disorders. *Biological Psychology*, 82(1), 1–11. <https://doi.org/10.1016/j.biopsycho.2009.04.003>
- Sahay, B. K. (2007). Role of yoga in diabetes. *The Journal of the Association of Physicians of India*, 55, 121–126.
- Sami, W., Ansari, T., Butt, N. S., & Hamid, M. R. A. (2017). Effect of diet on type 2 diabetes

- mellitus: A review. *International Journal of Health Sciences*, 11(2), 65–71.
- Shantakumari, N., Sequeira, S., & El Deeb, R. (2013). Effects of a yoga intervention on lipid profiles of diabetes patients with dyslipidemia. *Indian Heart Journal*, 65(2), 127–131. <https://doi.org/10.1016/j.ihj.2013.02.010>
- Shaw, J. E., Sicree, R. A., & Zimmet, P. Z. (2010, January). Global estimates of the prevalence of diabetes for 2010 and 2030. *Diabetes Research and Clinical Practice*. Elsevier. <https://doi.org/10.1016/j.diabres.2009.10.007>
- Sigal, R. J., Kenny, G. P., Wasserman, D. H., Castaneda-Sceppa, C., & White, R. D. (2006). Physical Activity/Exercise and Type 2 Diabetes A consensus statement from the American Diabetes Association. <https://doi.org/10.2337/dc06-9910>
- Singh, R. B., Kartik, C., Otsuka, K., Pella, D., & Pella, J. (2002). Brain-heart connection and the risk of heart attack. *Biomedicine & Pharmacotherapy = Biomedecine & Pharmacotherapie*, 56 Suppl 2, 257s–265s. [https://doi.org/10.1016/s0753-3322\(02\)00300-1](https://doi.org/10.1016/s0753-3322(02)00300-1)
- Singh, S., Kyizom, T., Singh, K. P., Tandon, O. P., & Madhu, S. V. (2008). *INFLUENCE OF PRANAYAMAS AND YOGA-ASANAS ON SERUM INSULIN, BLOOD GLUCOSE AND LIPID PROFILE IN TYPE 2 DIABETES*. *Indian Journal of Clinical Biochemistry* (Vol. 23).
- Singh, S., Malhotra, V., Singh, K. P., Madhu, S. V., & Tandon, O. P. (2004). Role of yoga in modifying certain cardiovascular functions in type 2 diabetic patients. *The Journal of the Association of Physicians of India*, 52, 203–206.
- Sinha, B., Ray, U. S., Pathak, A., & Selvamurthy, W. (2004). Energy cost and cardiorespiratory changes during the practice of Surya Namaskar. *Indian Journal of Physiology and Pharmacology*, 48(2), 184–190.
- Siu, P. M., Yu, A. P., Benzie, I. F., & Woo, J. (2015). Effects of 1-year yoga on cardiovascular risk factors in middle-aged and older adults with metabolic syndrome: a randomized trial. *Diabetology & Metabolic Syndrome*, 7(1), 40. <https://doi.org/10.1186/s13098-015-0034-3>
- Skevington, S. M., Lotfy, M., & O'Connell, K. A. (2004). The World Health Organization's WHOQOL-BREF quality of life assessment: psychometric properties and results of the international field trial. A report from the WHOQOL group. *Quality of Life Research: An International Journal of Quality of Life Aspects of Treatment, Care and Rehabilitation*, 13(2), 299–310. <https://doi.org/10.1023/B:QURE.0000018486.91360.00>
- Smith, C., Hancock, H., Blake-Mortimer, J., & Eckert, K. (2007). A randomised comparative trial of yoga and relaxation to reduce stress and anxiety. *Complementary Therapies in Medicine*, 15(2), 77–83. <https://doi.org/10.1016/j.ctim.2006.05.001>
- Supriya, R., Yu, A., Lee, P., Lai, C., Cheng, K., Yau, S. S.-Y., ... Siu, P. (2017). Yoga training modulates adipokines in adults with high-normal blood pressure and metabolic syndrome. *Scandinavian Journal of Medicine & Science in Sports*, 28. <https://doi.org/10.1111/sms.13029>

- Telles, S., Naveen, V. K., Balkrishna, A., & Kumar, S. (2010). Short term health impact of a yoga and diet change program on obesity. *Medical Science Monitor : International Medical Journal of Experimental and Clinical Research*, *16*(1), CR35-40.
- Temelkova-Kurktschiev, T., & Stefanov, T. (2012). Lifestyle and genetics in obesity and type 2 diabetes. *Experimental and Clinical Endocrinology & Diabetes : Official Journal, German Society of Endocrinology [and] German Diabetes Association*, *120*(1), 1–6. <https://doi.org/10.1055/s-0031-1285832>
- The diabetes epidemic in full flight: Forecasting the future | Request PDF. (n.d.). Retrieved from https://www.researchgate.net/publication/289384023_The_diabetes_epidemic_in_full_flight_Forecasting_the_future
- Thind, H., Lantini, R., Balletto, B. L., Donahue, M. L., Salmoirago-Blotcher, E., Bock, B. C., & Scott-Sheldon, L. A. J. (2017, December). The effects of yoga among adults with type 2 diabetes: A systematic review and meta-analysis. *Preventive Medicine*. Academic Press Inc. <https://doi.org/10.1016/j.ypmed.2017.08.017>
- Tindle, H. A., Davis, R. B., Phillips, R. S., & Eisenberg, D. M. (2005). Trends in use of complementary and alternative medicine by US adults: 1997-2002. *Alternative Therapies in Health and Medicine*, *11*(1), 42–49.
- Traina, S. B., Colwell, H. H., Crosby, R. D., & Mathias, S. D. (2015). Pragmatic measurement of health satisfaction in people with type 2 diabetes mellitus using the Current Health Satisfaction Questionnaire. *Patient Related Outcome Measures*, *103*. <https://doi.org/10.2147/prom.s79368>
- Tryon, M. S., DeCant, R., & Laugero, K. D. (2013). Having your cake and eating it too: a habit of comfort food may link chronic social stress exposure and acute stress-induced cortisol hyporesponsiveness. *Physiology & Behavior*, *114–115*, 32–37. <https://doi.org/10.1016/j.physbeh.2013.02.018>
- Tuomilehto, J., Lindström, J., Eriksson, J. G., Valle, T. T., Hämäläinen, H., Ilanne-Parikka, P., ... Uusitupa, M. (2001). Prevention of type 2 diabetes mellitus by changes in lifestyle among subjects with impaired glucose tolerance. *The New England Journal of Medicine*, *344*(18), 1343–1350. <https://doi.org/10.1056/NEJM200105033441801>
- Turner, R. C., Millns, H., Neil, H. A. W., Stratton, I. M., Manley, S. E., Matthews, D. R., & Holman, R. R. (1998). Risk factors for coronary artery disease in non-insulin dependent diabetes mellitus: United Kingdom prospective diabetes study (UKPDS: 23). *British Medical Journal*, *316*(7134), 823–828. <https://doi.org/10.1136/bmj.316.7134.823>
- Uebelacker, L. A., Epstein-Lubow, G., Gaudiano, B. A., Tremont, G., Battle, C. L., & Miller, I. W. (2010). Hatha yoga for depression: critical review of the evidence for efficacy, plausible mechanisms of action, and directions for future research. *Journal of Psychiatric Practice*, *16*(1), 22–33. <https://doi.org/10.1097/01.pra.0000367775.88388.96>

- Vaishali, K., Kumar, K. V., Adhikari, P., & UnniKrishnan, B. (2012). Effects of Yoga-Based Program on Glycosylated Hemoglobin Level Serum Lipid Profile in Community Dwelling Elderly Subjects with Chronic Type 2 Diabetes Mellitus—A Randomized Controlled Trial. *Physical & Occupational Therapy In Geriatrics*, 30(1), 22–30. <https://doi.org/10.3109/02703181.2012.656835>
- Violi, F., Targher, G., Vestri, A., Carnevale, R., Averna, M., Farcomeni, A., ... Pastori, D. (2017). Effect of aspirin on renal disease progression in patients with type 2 diabetes: A multicenter, double-blind, placebo-controlled, randomized trial. The renal disease progression by aspirin in diabetic patients (LEDA) trial. Rationale and study design. *American Heart Journal*, 189, 120–127. <https://doi.org/10.1016/j.ahj.2017.04.005>
- Vizcaino, M., & Stover, E. (2016). The effect of yoga practice on glycemic control and other health parameters in Type 2 diabetes mellitus patients: A systematic review and meta-analysis. *Complementary Therapies in Medicine*, 28, 57–66. <https://doi.org/10.1016/j.ctim.2016.06.007>
- Wang, D. J. J., Rao, H., Korczykowski, M., Wintering, N., Pluta, J., Khalsa, D. S., & Newberg, A. B. (2011). Cerebral blood flow changes associated with different meditation practices and perceived depth of meditation. *Psychiatry Research*, 191(1), 60–67. <https://doi.org/10.1016/j.psychresns.2010.09.011>
- Warziski, M. T., Sereika, S. M., Styn, M. A., Music, E., & Burke, L. E. (2008). Changes in self-efficacy and dietary adherence: the impact on weight loss in the PREFER study. *Journal of Behavioral Medicine*, 31(1), 81–92. <https://doi.org/10.1007/s10865-007-9135-2>
- Weinberger, M., Kirkman, M. S., Samsa, G. P., Cowper, P. A., Shortliffe, E. A., Simel, D. L., & Feussner, J. R. (1994). The relationship between glycemic control and health-related quality of life in patients with non-insulin-dependent diabetes mellitus. *Medical Care*, 32(12), 1173–1181. <https://doi.org/10.1097/00005650-199412000-00002>
- Weyer, C., Bogardus, C., Mott, D. M., & Pratley, R. E. (1999). The natural history of insulin secretory dysfunction and insulin resistance in the pathogenesis of type 2 diabetes mellitus. *The Journal of Clinical Investigation*, 104(6), 787–794. <https://doi.org/10.1172/JCI7231>
- Wild, S., Roglic, G., Green, A., Sicree, R., & King, H. (2004). Global Prevalence of Diabetes: Estimates for the year 2000 and projections for 2030. *Diabetes Care*, 27(5), 1047–1053. <https://doi.org/10.2337/diacare.27.5.1047>
- Wolff, M., Sundquist, K., Larsson Lönn, S., & Midlöv, P. (2013). Impact of yoga on blood pressure and quality of life in patients with hypertension - a controlled trial in primary care, matched for systolic blood pressure. *BMC Cardiovascular Disorders*, 13, 111. <https://doi.org/10.1186/1471-2261-13-111>
- Wu, Y., Ding, Y., Tanaka, Y., & Zhang, W. (2014). Risk factors contributing to type 2 diabetes and recent advances in the treatment and prevention. *International Journal of Medical Sciences*,

11(11), 1185–1200. <https://doi.org/10.7150/ijms.10001>

- Yadav, R. K., Ray, R. B., Vempati, R., & Bijlani, R. L. (2005). Effect of a comprehensive yoga-based lifestyle modification program on lipid peroxidation. *Indian Journal of Physiology and Pharmacology*, 49(3), 358–362. Retrieved from <http://www.ncbi.nlm.nih.gov/pubmed/16440857>
- Yang, K., Bernardo, L. M., Sereika, S. M., Conroy, M. B., Balk, J., & Burke, L. E. (2011). Utilization of 3-month yoga program for adults at high risk for type 2 diabetes: a pilot study. *Evidence-Based Complementary and Alternative Medicine: ECAM*, 2011, 257891. <https://doi.org/10.1093/ecam/nep117>
- Yang, L., Shao, J., Bian, Y., Wu, H., Shi, L., Zeng, L., ... Dong, J. (2016). Prevalence of type 2 diabetes mellitus among inland residents in China (2000-2014): A meta-analysis. *Journal of Diabetes Investigation*, 7(6), 845–852. <https://doi.org/10.1111/jdi.12514>
- Yang, W., Lu, J., Weng, J., Jia, W., Ji, L., Xiao, J., ... He, J. (2010). Prevalence of Diabetes among Men and Women in China. *New England Journal of Medicine*, 362(12), 1090–1101. <https://doi.org/10.1056/NEJMoa0908292>
- Yoon, K. H., Lee, J. H., Kim, J. W., Cho, J. H., Choi, Y. H., Ko, S. H., ... Son, H. Y. (2006, November). Epidemic obesity and type 2 diabetes in Asia. *Lancet*. Elsevier Limited. [https://doi.org/10.1016/S0140-6736\(06\)69703-1](https://doi.org/10.1016/S0140-6736(06)69703-1)
- Youngwanichsetha, S., Phumdoung, S., & Ingkathawornwong, T. (2014). The effects of mindfulness eating and yoga exercise on blood sugar levels of pregnant women with gestational diabetes mellitus. *Applied Nursing Research*, 27(4), 227–230. <https://doi.org/10.1016/j.apnr.2014.02.002>
- Zia, T., Hasnain, S. N., & Hasan, S. K. (2001). Evaluation of the oral hypoglycaemic effect of *Trigonella foenum-graecum* L. (methi) in normal mice. *Journal of Ethnopharmacology*, 75(2–3), 191–195. [https://doi.org/10.1016/S0378-8741\(01\)00186-6](https://doi.org/10.1016/S0378-8741(01)00186-6)

APPENDIX






APPENDIX-1	PLAGIARISM
APPENDIX-2	INSTITUTIONAL ETHICAL COMMITTEE APPROVAL
APPENDIX-3	PERMISSION LETTER FOR YOGA INTERVENTION TO T2DM PATIENTS AT JNIMS HOSPITAL,MANIPUR
APPENDIX-4	PHOTOS SHOWING YOGA SESSIONS
APPENDIX-5	<ul style="list-style-type: none">• QUALITY OF LIFE INSTRUMENT FOR INDIAN DIABETES PATIENTS(QOLID-Q)• CURRENT HEALTH SATISFACTION-QUESTIONNAIRE(CHES-Q)
APPENDIX-6	INFORMED CONSENT FORM
APPENDIX-7	PUBLICATIONS- 3 RESEARCH PAPERS



Document Information

Analyzed document	Ibohal Singh_Thesis.doc (D137667419)
Submitted	2022-05-23T15:40:00.0000000
Submitted by	plagiarismcheck
Submitter email	plagiarismcheck@svyasa.edu.in
Similarity	9%
Analysis address	plagiarismcheck.svyasa@analysis.orkund.com

Sources included in the report

SA	49) Ibohal Nongthombam-Impact of Yoga based Treatment on Blood Glucose levels and Lipid Profile write up (1).doc Document 49) Ibohal Nongthombam-Impact of Yoga based Treatment on Blood Glucose levels and Lipid Profile write up (1).doc (D130523455)		58
SA	Chapter IV & V_P.Anuja_12071.doc Document Chapter IV & V_P.Anuja_12071.doc (D64019152)		2
SA	poonam thesis.pdf Document poonam thesis.pdf (D127220928)		1
SA	Results and discussion -part -II.docx Document Results and discussion -part -II.docx (D17249292)		1
SA	Final Thesis by sonal bhardwaj 30-10-2020.pdf Document Final Thesis by sonal bhardwaj 30-10-2020.pdf (D83402391)		1



INSTITUTIONAL ETHICS COMMITTEE

JAWAHARLAL NEHRU INSTITUTE OF MEDICAL SCIENCES, IMPHAL- 795008

No. Ac/02/IEC/JNIMS/2016/R

Dated: Imphal, the 22nd Oct 2016

To,

Nongthombam Ibohal Singh (PI)
Research Scholar
SVYASA University, Bangalore

Dr Ksh Achouba Singh (Co- PI)
Associate Professor (Endocrinology)
Department of Medicine
Jawaharlal Nehru Institute of Medical Sciences, Imphal

Dear Mr Nongthombam Ibohal Singh & Dr Ksh Achouba Singh,

The office of the Institutional Ethics committee, Jawaharlal Nehru Institute of Medical Sciences, Imphal reviewed and discussed on your research Proposal No. 24/16/2016(R) version 02, submitted on 21/10/2016 entitled 'A study on the effect of an integrated Yoga program on self-satisfaction among Type 2 DM patients of Mongoloid origin attending JNIMS hospital, Imphal'.

The following sub-committee members were present at the time of taking the decision.

- 1 Prof L Fimate, Prof & Head, Dept of Forensic Medicine, JNIMS, Member
- 2 Dr.Kh. Lokeshwar Singh, Assoc Prof. Dept. of Medicine, JNIMS, Member
- 3 Dr. A. Kaini Pfoze, Assoc.Prof. Dept. of Anatomy, JNIMS, Member
- 4 Dr N. Somorjit Singh, Assoc. Prof, Dept. of Surgery, JNIMS, Member
- 5 Dr Bishwalata RK, assoc Prof, Dept.of Community Medicine, Member Secretary

In persuasion of the resolution No.3/23/16(R), I am to convey that the opinion of the committee about the protocol as under:

Opinion of the Sub- Committee:-

The sub-committee resolved that the study titled "A study on the effect of an integrated Yoga program on self-satisfaction among Type 2 DM patients of the Mongoloid origin attending JNIMS hospital, Imphal" is Recommended/Approved by the IEC, JNIMS for a period of 6(six) months commencing from 1st October 2016.

Yours' sincerely,

Bishwalata

(Dr Bishwalata Rajkumari)

Member Secretary, IEC, JNIMS

APPENDIX 1
Member Secretary
Institutional Ethics Committee
JNIMS,



J.N. Institute of Medical Sciences
Porompat, Imphal East

No. JIMS/Academic. 3(40)/Ph.D/15

Imphal the 28th December, 2016

To

Dr. Ksh. Achouba Singh
Assoc. Prof.
Department of Medicine, JNIMS,
Imphal.

Subject: - Permission for use of Examination Hall (Old Faculty Block) for Yoga Practice of Diabetic patients.

Sir,

I am to inform you that Shri N. Ibohal Singh, Research Scholar (Yoga) working under your guidance as Research Scholar for Ph.D degree under the Swami Vivekananda Yoga University, Bengaluru can utilise the old Examination Hall for practice of yoga by the Diabetic patients.

However, the Hall will be available only after January, 2017.

The Research Scholar will have the responsibility for proper maintenance of all the furniture and electrical items in the hall.

Yours faithfully,



(Prof. W. Gyaneshwar Singh)
Dean (Academic)
JNIMS, Porompat









Imphal the 27th December, 2016











No. JIMS/Academic. 3(40)/Ph.D/15

Copy to:-








1. The Director, JNIMS for information.
2. Shri N. Ibohal Singh, Research Scholar (Yoga).
3. Office file.





APPENDIX-4

Yoga protocol practiced during the treatment of T2DM patients through Yoga intervention			
A. Breathing practices:			
			
1.a	1.b	2.a	2.b
			
2.c	3	4.a	4.b
1.a,b – Hand in and out, 2.a,b,c – Hand Stretch, 3 – Ankles raise, 4.a,b – Tiger breathing			

B. Loosening exercises:				
				
1.a	1.b	1.c	1.d	2.a
				
2.b	3	4	5	6
1.a,b,c,d – Neck movements, 2.a,b – Shoulder rotation, 3 – Side Stretch, 4 – Skating, 5- Toes Rotation, 6- Trunk Twist				

C. Yogasana postures:			
			
1	2	3	4
			
5	6	7	8
			
9	10	11	
			
12	13	14	

D. Pranayama:			
			
1	2	3	4
			
5.a	5.b	6.	
1- Abdominal breathing, 2- Thoracic breathing, 3- Clavicular breathing, 4- Full Yogic breathing, 5.a,b- Nadisuddhi Pranayama, 6 – Bhramari Pranayama			

E. Kriyas			
			
1	2	3	4
1- Agnisara 2- Catheter Neti 3- Jala Neti 4- Nauli			

APPENDIX 5

QOLID Questionnaire

Instruction

The following assessment asks how you feel about the impact of diabetes on your quality of life. Your response will help us find ways for improving diabetes care. If you are unsure about which response to give to a question, please choose the one that appears to be the most appropriate. We would request you to attempt to answer all questions. However the choice or decision to not to answer a particular question is entirely yours. You can always seek the help of the interviewer in case there is any confusion regarding the meaning of some questions or choice.

Role Limitation Due to Physical Health

1. How often do you miss your work because of your diabetes?

Always	Frequently	Often	Sometimes	Never
1	2	3	4	5

2. A person with diabetes has the requirement of adhering to a schedule for eating and taking regular medication. How often does this affect your work?

Always	Frequently	Often	Sometimes	Never
1	2	3	4	5

3. How often does diabetes affect your efficiency at work?

Always	Frequently	Often	Sometimes	Never
1	2	3	4	5

4. How often do you find diabetes limiting your social life?

Always	Frequently	Often	Sometimes	Never
1	2	3	4	5

5. To what extent do you avoid traveling (business tour, holiday, general outings) because of your diabetes?

A lot	Highly	Little	Very little	Not at all
1	2	3	4	5

6. Compared to others of your age are your social activities (visiting friends/partying) limited because of your diabetes?

Always	Frequently	Often	Sometimes	Never
1	2	3	4	5

Physical Endurance

An important part of understanding your general health and well being has to do with your ability to perform various activities.

Thus for the following questions please indicate if your health has limited your activities in following areas in the past three months. Please tick any one option.

1. How often in last three months has your overall health problems limited the kind of vigorous activities you can do like lifting heavy bags/objects, running, skipping, jumping.

Always	Frequently	Often	Sometimes	Never
1	2	3	4	5

2. How often in last three months has your overall health problems limited the kind of moderate activities you can do like moving a table, carrying groceries or utensils.

Always	Frequently	Often	Sometimes	Never
1	2	3	4	5

3. How often in last three months has your overall health problems limited you from walking uphill or climbing 1-2 floors.

Always	Frequently	Often	Sometimes	Never
1	2	3	4	5

4. How often in last three months has your overall health problems limited you from walking 1-2 km at a stretch.

Always	Frequently	Often	Sometimes	Never
1	2	3	4	5

5. How often in last three months has your overall health problems limited you from bending, squatting, or turning.

Always	Frequently	Often	Sometimes	Never
1	2	3	4	5

6. How often in last three months has your overall health problems limited you from eating, dressing, bathing, or using the toilet.

Always	Frequently	Often	Sometimes	Never
1	2	3	4	5

General Health

1. In general would you say your health

Poor	Fair	Good	Very good	Excellent
1	2	3	4	5

2. How well are you able to concentrate in everything like working, driving, reading etc?

Not at all	A little	Moderate	Very much	An extreme amount
1	2	3	4	5

3. How many times in the past three months have you had fatigue/felt very tired?

Always	Frequently	Often	Sometimes	Never
1	2	3	4	5

Treatment Satisfaction

The following set of questions would enable us to know how satisfied are you with your treatment for diabetes. Please tick any one option.

1. How satisfied are you with your current diabetes treatment?

Very dissatisfied	Moderately dissatisfied	Neither satisfied nor dissatisfied	Moderately satisfied	Very satisfied
1	2	3	4	5

2. How satisfied are you with amount of time it takes to manage your diabetes?

Very dissatisfied	Moderately dissatisfied	Neither satisfied nor dissatisfied	Moderately satisfied	Very satisfied
1	2	3	4	5

3. How satisfied are you with the amount of time you spend getting regular checkups (once in 3 months)?

Very dissatisfied	Moderately dissatisfied	Neither satisfied nor dissatisfied	Moderately satisfied	Very satisfied
1	2	3	4	5

4. A person with diabetes needs to exercise for 35-45 min, 4 times a week. Keeping this in mind how satisfied are you with the time you spend exercising?

Very dissatisfied	Moderately dissatisfied	Neither satisfied nor dissatisfied	Moderately satisfied	Very satisfied
1	2	3	4	5

Symptom Botherness

1. How many times in the past three months have you had thirst/dry mouth?

Always	Frequently	Often	Sometimes	Never
1	2	3	4	5

2. How many times in the past three months have you felt excessive hunger?

Always	Frequently	Often	Sometimes	Never
1	2	3	4	5

3. How many times in the past three months have you had frequent urination related to diabetes management?

Always	Frequently	Often	Sometimes	Never
1	2	3	4	5

Financial Worries

The following set of questions will help us know how your diabetes has affected your or your family's finances. Please tick any one option!

1. What do you think about the cost involved in your management of diabetes?

Very expensive	little expensive	reasonable	not at all expensive
1	2	3	4

2. To what extent has your priority of expenditure shifted towards diabetes management?

A lot	Highly	Little	Very little	Not at all
1	2	3	4	5

3. To what extent has your family budget got affected by the expenses related to the management of diabetes?

A lot	Highly	Little	Very little	Not at all
1	2	3	4	5

4. To what extent has your diabetes limited your expenditure on other aspects of life (Movies, outings, parties etc)?

A lot	Highly	Little	Very little	Not at all
1	2	3	4	5

Emotional/Mental Health

1. How satisfied are you with yourself?

Very dissatisfied	Moderately dissatisfied	Neither satisfied nor dissatisfied	Moderately satisfied	Very satisfied
1	2	3	4	5

2. How satisfied are you with your personal relationships (family, friends, relatives and known tos)

Very dissatisfied	Moderately dissatisfied	Neither satisfied nor dissatisfied	Moderately satisfied	Very satisfied
1	2	3	4	5

3. How satisfied are you with the emotional support you get from your friends and family?

Very dissatisfied	Moderately dissatisfied	Neither satisfied nor dissatisfied	Moderately satisfied	Very satisfied
1	2	3	4	5

4. How often are you discouraged by your health problems?

Always	Frequently	Often	Sometimes	Never
1	2	3	4	5

5. All people want to fulfill certain roles and lead their lives in a purposeful manner. To what extent do you feel that you have been able to lead your life in the same way?

Not at all	A little	Moderate	Very much	An extreme amount
1	2	3	4	5

Diet Satisfaction

Diabetes demands a little modification in diet, thus the following set of questions would help us know how much satisfied you are with modifications in your diet.

(For participants who have been advised some dietary modification/counseling).

1. How often do you feel because of your diabetes a restriction in choosing your food when eating out?

Always	Frequently	Often	Sometimes	Never
1	2	3	4	5

2. As you have diabetes, how much choice do you feel you have in eating your meals or snacks away from home e.g. if you go in a party and there is a buffet where there are also a lot of fried snacks and desserts would you be able to make enough choice?

No choice	Very little	little	enough	A lot
1	2	3	4	5

3. How often do you eat the food items that you shouldn't, in order to hide the fact that you are having diabetes.

Always	Frequently	Often	Sometimes	Never
1	2	3	4	5

Current Health Satisfaction Questionnaire (CHES-Q)

	Strongly disagree	Disagree	Somewhat disagree	Neither agree nor disagree	Somewhat agree	Agree	Strongly agree
1. I am satisfied with my current body weight.	1	2	3	4	5	6	7
2. I am satisfied with my current level of energy.	1	2	3	4	5	6	7
3. I am satisfied with my current appetite (my overall desire to eat).	1	2	3	4	5	6	7
4. I am satisfied with my current ability to sleep through the night.	1	2	3	4	5	6	7
5. I am satisfied with my current ability to do physical activities such as walk or climb stairs.	1	2	3	4	5	6	7
6. I am satisfied with my current ability to have social interactions with family and friends.	1	2	3	4	5	6	7
7. I am satisfied with my current attitude toward diabetes.	1	2	3	4	5	6	7
8. I am satisfied with my current mood.	1	2	3	4	5	6	7
9. I know my current blood sugar levels.	1	2	3	4	5	6	7
10. I am satisfied with my current blood sugar levels.	1	2	3	4	5	6	7
11. I know my current blood pressure.	1	2	3	4	5	6	7
12. I am satisfied with my current blood pressure.	1	2	3	4	5	6	7
13. Overall, I am satisfied with my current health.	1	2	3	4	5	6	7
14. My current level of knowledge about diabetes is ...	1 Not at all knowledgeable	2 Somewhat knowledgeable	3 Knowledgeable	4 Very knowledgeable	5 Extremely knowledgeable		

INFORMED CONSENT**Part- I (Participants Information Sheet)****Participant ID:**

Title: A study on the effect of Integrated Yoga Program on Self-satisfaction among the Type2 DM patients of Mongoloid origin attending JNIMS, Imphal.

Principal Investigator: Nongthombam Ibohal Singh

Purpose of the Study:

Holistic approach of Integrated yoga intervention for a period of 4 months along with conventional treatment as usual may improve the glycaemic parameters and self satisfaction among the T2DM patients of mongoloid origin.

Aims:

There is no valid published report of scientific study for management of T2DM illness through intervention of integrated yoga program on self satisfaction among the T2DM patients of Manipuri community. It is essential to research social cognitive factors that impact self- satisfaction in patients with T2DM.

Objectives:

- (i) To study the effect of intervention through integrated yoga programme for management of T2DM patients of Mongoloid community.
- (ii) Considering the importance of health satisfaction as individual strategy for managing T2DM, the Current Health Satisfaction Questionnaire (CHES-Q) and Quality of Life Instrument for Diabetes Questionnaire (QOLID-Q) are considered for pragmatic assessment of many aspects of diabetes related health satisfaction.

Introduction:

Type 2 Diabetes Mellitus(T2DM) is the single most important metabolic disorder and non- communicable disease that affect nearly every organ system in the body. This dreaded disease is projected to increase to 300 million people worldwide by 2025 (Snnemmari, 2005). India is considered as the 'Diabetes Capital of the World' as the number of diabetes subjects steadily increases. In 2006, diabetic population in India was 40.9 million and it is estimated to increase to 69.9 million in 2025 and 80 million in 2030. Even more alarming is shifting age of onset in diabetes patients. Now, younger age people are found to be suffering from diabetes. The prevalence of T2DM in Manipur is to the tune of 20 percent of the total population of the State from the age group

total population of the State from the age group 20 to 60 years (NE State Diabetes Society,2010). A comprehensive report on the result of a National survey conducted on the use of Complementary and Alternative medicine(CAM) among the persons suffering from diabetes mellitus was documented by Yeh et al.(2002) giving about 20% of the respondents benefitted from CAM in treating diabetes. The present study is a holistic health care approach in lieu of the present conventional approach alone for the treatment of T2DM. The intervention of an integrated yoga programme like yoga asanas, pranayamas, kriyas including Transcendental meditation(TM) and Self Management of Excessive Tension(SMET) which include the mind and body interaction will be scientifically carried out considering the relevant parameters like metabolic, anthropometric data, glucose tolerance test(GTT), serum insulin estimation, plasma total cholesterol, serum urea, serum creatinine, serum lipid profile, ECG, exercise tolerance test, etc. among the Type 2 Diabetes Mellitus patients of Manipuri community attending JNIMS Hospital, Manipur so as to assess the response of the integrated yoga programme.

Study design / Procedure:

The diabetic patients will be diagnosed by a Senior endocrinologist on the basis of their clinical test reports, anthropometric data, etc. The sample size will be of 60 patients(age from 30-60 years) or more. A set of age and sex matched control with T2DM will be maintained with traditional treatment. Pre - and Post – treatment/ yoga intervention/health satisfaction questionnaire data on all the parameters studied will be maintained for analysis using Statistical Package for Social Sciences(SPSS).

Eligibility: The patients who have been clinically and medically diagnosed as T2DM by a senior endocrinologist Doctor will be eligible for the study.

Exclusion Criteria: The patient with myocardial infarction or cerebro-vascular illness, major psychiatric disorder, serious retinopathy, renal problems will be excluded.

No bias on class, caste, ethnicity, race for the study. However, so far no scientific study has been done on yoga intervention or complementary and alternative medicine for treatment of T2DM. Hence, the present study will be emphasised on the Manipuri Community.

Risks and benefits: No risk.

Pre and post Glucose level control either fasting plasma glucose(FPG and Post-prandial) and/or glycolated haemoglobin (HbA1c) will be the primary outcome measure in the study. Yoga may offer a promising lifestyle intervention for decreasing weight related type 2 diabetes risk factors and potentially increasing psychological well being.

Compensation for participation: No

Ancillary care:

If any condition or disorder discovered during this study period is not related to it, you will be referred to the proper hospital or concerned doctor for further management .

Confidentiality:

If you wish to hide your identity, all efforts will be made to protect your privacy and confidentiality. The project staff will keep your personal information confidential. Besides this consent form, all other forms and samples will mention only the assigned code number. The forms linking your name and code number will be withheld from others. The information will not be revealed except with your permission. However, collective data without identifiers will be presented and may be published.

Privacy:

Interview will be conducted in a separate room and data will be kept confidential.

Right of withdrawal:

You may decide not to take part or withdraw from the study at any time. However you will continue to receive ongoing routine medical care.

Part – II (Consent form)

Statement to be made by a person willing to participate in the study

I have read this consent form completely/this consent form has been read out to me in my own language. I understand that I can withdraw my participation anytime, if I feel so. I have received and understood the information about my rights and have been promised that my personal information shall be kept confidential if I should desire so. All my doubts have been cleared.

I want to participate in this study myself by my own free will and am willing to (Circle number/s that is accepted):

1. Count the study person.
2. Answer the questionnaire.
3. Recommend any other person who is suffering from T2DM and known to me.
4. Permit the publication / presentation of report.
5. All (1+2+3+4)

I have been offered a copy of my consent form and I want a copy of my consent form/I do not want a copy of my consent form. I understand that anytime I can contact the investigators in case of doubt. I have been promised to be supplied any new development/ information which has a bearing to this study.

Part – II (Consent form)

Statement to be made by a person willing to participate in the study

I have read this consent form completely/this consent form has been read out to me in my own language. I understand that I can withdraw my participation anytime, if I feel so. I have received and understood the information about my rights and have been promised that my personal information shall be kept confidential if I should desire so. All my doubts have been cleared.

I want to participate in this study myself by my own free will and am willing to (Circle number/s that is accepted):

1. Count the study person.
2. Answer the questionnaire.
3. Recommend any other person who is suffering from T2DM and known to me.
4. Permit the publication / presentation of report.
5. All (1+2+3+4)

I have been offered a copy of my consent form and I want a copy of my consent form/I do not want a copy of my consent form. I understand that anytime I can contact the investigators in case of doubt. I have been promised to be supplied any new development/ information which has a bearing to this study.

Compensation for participation: No

Ancillary care:

If any condition or disorder discovered during this study period is not related to it, you will be referred to the proper hospital or concerned doctor for further management .

Confidentiality:

If you wish to hide your identity, all efforts will be made to protect your privacy and confidentiality. The project staff will keep your personal information confidential. Besides this consent form, all other forms and samples will mention only the assigned code number. The forms linking your name and code number will be withheld from others. The information will not be revealed except with your permission. However, collective data without identifiers will be presented and may be published.

Privacy:

Interview will be conducted in a separate room and data will be kept confidential.

Right of withdrawal:

You may decide not to take part or withdraw from the study at any time. However you will continue to receive ongoing routine medical care.

Part – II (Consent form)

Statement to be made by a person willing to participate in the study

I have read this consent form completely/this consent form has been read out to me in my own language. I understand that I can withdraw my participation anytime, if I feel so. I have received and understood the information about my rights and have been promised that my personal information shall be kept confidential if I should desire so. All my doubts have been cleared.

I want to participate in this study myself by my own free will and am willing to (Circle number/s that is accepted):

1. Count the study person.
2. Answer the questionnaire.
3. Recommend any other person who is suffering from T2DM and known to me.
4. Permit the publication / presentation of report.
5. All (1+2+3+4)

I have been offered a copy of my consent form and I want a copy of my consent form/I do not want a copy of my consent form. I understand that anytime I can contact the investigators in case of doubt. I have been promised to be supplied any new development/ information which has a bearing to this study.

APPENDIX-7

Publication

Sl. No	Publication
1	Singh N I, Pradhan B, Pandey M, Parajuli N, Singh AK. Influence of Yoga-based program on health satisfaction in the Mongoloid patients diagnosed with type 2 diabetes mellitus. Yoga Mimamsa [serial online] 2021 [cited 2022 May 24];53:109-15. Available from: https://www.ym-kdham.in/text.asp?2021/53/2/109/333351
2	Singh, N. I., Pradhan, B., Pandey, M., Parajuli, N., & Singh, A. K. (2022). Effect of 16-weeks of Yoga Intervention on the Quality of Life of Type-2 Diabetes Mellitus patients of mongoloid community. <i>Turkish Online Journal of Qualitative Inquiry</i> . 13(1), 893-902
3	Singh, N. I., Pradhan, B., Pandey, M. & Singh, A. K. (2022). Relationship between FBS, PPBS, HbA1c and Urine Glucose in the Type 2 Diabetes Mellitus patients having different levels of Serum Urea. <i>Turkish Online Journal of Qualitative Inquiry</i> . 13(1).1301-1305