

Effects of supervised structured exercise program on insulin sensitivity in type 2 Diabetes mellitus-a scoping review

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INTRODUCTION

Diabetes mellitus , a systemic disease with disorders in carbohydrates, fat, protein ,insulin metabolism affects the structure & function of blood vessels shows its early symptoms related to metabolic defects, findings late resulting from vascular defects .Prediction of increase to 439 million adults in 2030 in India.

American Diabetic Association (ADA)'s suggestion that blood glucose level more than which is considered to be normal (100- 125 mg/dl) & Indian council of Medical Research (ICMR) 's suggestion that Random glucose level above 200mg/dl ²⁴ is diabetes mellitus . In type 2 DM Increased level of fasting blood glucose arises due to body not using insulin properly , higher plasma insulin levels, impairment in glycemic control (increased HbA1c) and failure in response of cells in the body to insulin is referred to as IR(Insulin resistance) .²⁶It is not detectable, but causes impairment in glucose tolerance .

Physical inactivity is more associated with developing insulin resistance , increased blood pressure, dyslipidemia impaired microvascular functions in healthy individuals . The long and short term physical inactivity causing changes in vascularity, metabolism finally leading to IR and hence T2DM.^{25,22} Physical activity programs both vigorous and non-vigorous cause positive impacts on insulin sensitivity and thus IR reduction in mild to moderate type of T2DM patients hence recommending moderate physical activity with glucose tolerance impaired patients and with T2DM.^{28, 25}

Management of few modifiable factors like exercising, Keeping up diet ,giving up smoking and stress relief contributes to IR control . Lifestyle intervention to address these becomes valuable in any therapeutic approach.^{28, 24}

Many exercise programs exists,various systematic reviews & metaanalysis recommending future research to find optimal exercise prescription for treating insulin sensitivity .Structuring the exercise programs are needed & it also shows the need for effective dosage & type of exercise to manage type 2 diabetes

Present review was done with the objective of finding a clear prescription of supervised structured exercise program on insulin sensitivity in type 2 Diabetes

METHODS:

As defined by Armstrong et al. ²⁹ a scoping review was done as it allows less focused research questions. scoping reviews's inclusion criteria does not involve study's quality. Framework suggested by Arksey and O'Malley ³⁰, a method allowing flexibility ,transparency in collecting and reporting evidences through a scoping review involves (i) Relevant study identification (ii) study selection (iii) data chart(iv) report of Data Research was limited from 2016 to 2020

RELEVANT STUDY IDENTIFICATION

we selected important scientific databases in field of medicine to locate all possibly relevant studies a.Scopus

b.Web of Science

c.Pubmed

d.Cochrane Central Register of Controlled Trials

Composing seven different queries:

1.Diabetes

2.Exercise in Type 2 diabetes

3.Best exercises for Diabetic neuropathy

4. Aerobic exercises
5. Structured exercise
6. Aerobic exercise in Indian population
7. Sample of physiotherapy protocol In Diabetes

STUDY SELECTION

Screening was done excluding Studies on (a) nondiabetic patients (b) nonadult patients (c) Language other than English (d) Publication other than first validation papers

Selection of text with the same criteria was done to find relevant papers alone. Thereby resolving the Conflicts by consensus.

DATA CHART AND REPORT OF DATA

Extraction of data from original papers and reviews., if not already done priorly .Retrieving the first validation studies, once again screening Validation studies to select relevant ones onlywith (a) developed Specifically for diabetic patients (b)adults sample Validation (iii) studies in English (iv) Structured exercise program

Developing database and data extraction plan

1. Sampath Kumar et al (2019), In the study Exercise & Insulin Resistance in Type 2 DM: A systematic Review & Meta analysis, recommended further study to find prescription of optimal exercise to treat insulin sensitivity & proved the benefits of exercising for more than 150min per week in Type 2 DM.^{31 2. Demographics³²}

Name of the Author	PublishedYear	Journal	Type of study	Sample size	Intervention	Control	Duration of intervention
Katsul et al.	2001	Diabetes care	Non-RCT	55	Diet with Aerobics	No group	1 month,2 weeks
Short et al.	2003	Diabetes	RCT	90	General exercise program with Aerobic control	Flexibility exercises	4 months
O'Donovan et al.	2005	Eur J Appl Physiol	RCT	67	Exercises of High and moderate intensity	No exercise	6 months
Lazarevic	2006	Diabetes	RCT	30	Aerobics that are		24 weeks
Name of the Author	PublishedYear	Journal	Type of study	Sample size	Intervention	Control	Duration of intervention
et al.		Metab			structured and supervised		
Michishita et al.	2008	Diabetes Res Clin Pract	Non-RCT	30	Exercise testing that is Submaximal	No group	3 months
Misra et al.	2008	Diabetes Care	Non-RCT	30	Progressive resisted exercise that is Supervised	No group	3 months
Jorge et al.	2011	Metabolism	RCT	48	Exercises including resistance & Aerobics	No exercise	3 months
El-Kader et al.	2011	Journal Adv Res	Non-RCT	40	Exercises including resistance & Aerobics	No group	12 weeks
Geirsdottir et al.	2012	Journal Gerontol	RCT	237	Resisted exercises	Healthy elders	3 months
Mavros et al.	2013	Diabetes Care	RCT	103	progressive resisted High-intensityExercises	Sham	1 year
Motahari-Tabari et al.	2015	Global J Health Science	RCT	53	Aerobics	No group	1 month,2 weeks

Exercise prescription Guidelines by several scientific organisations for type 2 DM

Scientific Organisation	Specified Type	Specified Mode	Specified Duration	Specified Intensity & Frequency
ACSM and ADA ²²	Aerobics	large muscle groups usage like brisk walk	150 mins per week	Moderate to vigorous 3 days/week not exceeding 2 consecutive days without exercising
	Resistance Exercises	free weights, Resistance machines that involves major muscles	1 to 4 sets 8 to 15 reps 5 to 10 exercises per session	Moderate to vigorous weekly twice not in sequence
	Aerobics & Flexibility	Inclusion in physical activity non substituting other types of exercises FDS ²³	150 min per week	Moderate 3 days per week not exceeding 2 consecutive days without exercises
	Resisted Exercises that involves major muscles		3 sets 5 to 10 exercises per session	Moderate to vigorous twice weekly not sequential
BPTA ²⁵	Aerobic		150 min per week	Low to moderate 3 to 5 days per week
	Resistance		3 sets 10-15 reps 5 to 10 exercises per session	Moderate Combination of aerobic exercises
ESSA ²⁶	Aerobics	large muscle activity (walking, running, cycling, swimming, running, cycling and swimming)	2-4 sets 8-10 repetitions	60 min/week OR Moderate Two or more sessions per week
	Resistance	Multi joint exercises involving large muscle groups	8-10 exercises on each session	35 min/week Vigorous
COA ¹⁹ biking, brisk	Aerobics	activities involving large muscle groups like continuous swimming, walking	150 min/week	Moderate 3 days per week without exceeding two consecutive days without exercising
	Resistance Exercises	free weights & resistance machines	3 sets 8 reps	To vigorous Moderate to vigorous Weekly twice
AHA ²⁴	Aerobics	activities involving larger muscle	150 min per week OR 90 min per week	Moderate Vigorous 3 to 7 days per week 3 days per week
	Resistance	Multi joint exercises involving large muscles	2 to 4 sets 8 to 10 reps All muscle groups exercised Per session	Moderate to vigorous 3 days per week
ADA ²⁴	Aerobics	walking	150 min per week	Moderate 3 days/week without exceeding two consecutive days without exercises
	Resistance exercises	weight machines or free weights involving large muscles	1 set 5 or more different exercises per session	Weekly twice
SNIPP ¹⁸	Aerobics	cycling, brisk walk, swimming, tennis	30 min 20 to 60 min	Moderate Vigorous Daily 3 to 5 day per week
	Resistance Exercises	Bodyweight, elastic bands, free weight or weight machines	8- to 10 reps	2 to 3 days per week
	Flexibility	5-10 min by the end of aerobic and resistance exercises		
IDF ²	Aerobics		150 min per week	Moderate 3 to 5 days per week
	Resistance Exercises			3 days per week
ADA and EASD ²⁷	Aerobic			
	Resistance Flexibility		150 min per week	Moderate
ESC and EASD ³	Aerobics, Resisted Exercises		150 mins per week	Moderate to vigorous Not exceeding two consecutive days without Exercising

RESULTS

Most analysed validation studies are well reported & has given an idea to frame structured exercise protocol to reduce insulin sensitivity.

Limitations limitations is we searched databases that we believed to be more relevant .

Conclusion the purpose of guiding readers the choice of the most suitable SSEP to reduce insulin sensitivity.

Availability of Data

Data is given access on request to corresponding author.

Conflicts of Interest:

Nil