Original Article

Effects Of Supervised Structured Exercise Program On Insulin Sensitivity In Type2 Diabetes Mellitus-A Scoping Review

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Abstract

Back ground: Diabetes mellitus which is a systemic disease is with prediction upto 79.4 million by 2030 **Methods**: Inspite of existence of various exercise programs ,supervised Structuring with clear prescription is most needed in the present scoping review. Collection :Scopus, Pubmed, WOS, Cochrane register comprising components of diabetes ,Best exercise, Aerobic exercise, sample protocol qualified according to broad domains of exercise programs were identified and assessed**. Results**: Recent Scoping review reports clear picture of most appropriate Structuring of exercise program with clear dosage .

Key words: Type 2 Diabetes mellitus, Insulin Sensitivity, Supervised Structured exercise Program.

INTRODUCTION

Diabetes mellitus which is a chronic systemic disease characterized by disorders in (1) metabolism of insulin & of carbohydrates, fat, protein and (2) the structure & function of blood vessels has its early symptoms related to metabolic defects, findings late resulting from vascular defects .Diabetes affects approximately 382 million adult's worldwide & is predicted to increase to 439 million adults by 2030. It is predicted that by 2030 diabetes mellitus may afflict up to 79.4 million individuals in India.[23]

According to American Diabetic Association (ADA) blood glucose level higher than normal (100- 125 mg/dl) & according to Indian council of Medical Research (ICMR)Random glucose level more than 200mg/dl [24] is considered as diabetes mellitus (DM). In type 2 DM the body does not use insulin properly leading to higher level of fasting blood glucose, increased plasma insulin level, impaired glycemic control (higher HbA1c) and insulin resistance (IR). IR is a pathological state where the human body cells in muscles fail to respond appropriately to the hormone insulin (sensitivity).[26]IR often remains undetectable, but it produces impaired glucose tolerance (IGT) or T2DM, leading to systemic complications.

Physical inactivity is highly associated with the development of insulin resistance, dyslipidemia, high blood pressure, and impaired micro-vascular function in healthy population. The long and short term physical inactivity causes metabolic and vascular changes, which lead towards IR and ultimately to T2DM.[25,22] A vigorous and non-vigorous physical activity programs produced positive impacts on insulin sensitivity and reduction in IR in mild to moderate type of T2DM patients and supports the recommendation of moderate physical activity in patients with impaired glucose tolerance and T2DM.[28, 25]

Managing certain modifiable factors such as diet, exercise, smoking and stress are thought to contribute to the control of IR. Lifestyle intervention to address these factors appears to be a valuable part of any therapeutic approach.[28, 24]

Many exercise programs exists, various systematic reviews & meta analysis 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

On the basis of this premise the present literature review was carried out with the main objective of identifying supervised structured exercise program on insulin sensitivity in type 2 Diabetes

METHODS

we performed a scoping review as defined by Armstrong et al. [29]The method of the scoping review was preferred over a more systematic approach since it allows for broader, less focused research questions. Moreover, unlike systematic reviews, often in scoping reviews inclusion criteria do not entail the quality of studies—which can be assessed post hoc. To carry out our study, we referred to the framework proposed by Arksey and O'Malley [30], a methodology which allows a transparent and rigorous, though flexible, way to collect and report evidences through a scoping review. This is a multistep process, namely (i) identification of the relevant studies (ii) study selection (iii) data charting (iv) data report research was limited from 2016 to 2020

Identification of the Relevant Studies.

To identify all possibly relevant studies, we interrogated a selection of the most important scientific databases in the medical field

(i) Scopus
(ii) Web of Science Core Collection (
(iii) Pubmed
(iv) Cochrane Central Register of Controlled Trials

The research string was composed of different queries:

- Diabetes
- Exercise in Type 2 diabetes
- Best exercises for Diabetic neuropathy
- Aerobic exercises
- Structured exercise
- Aerobic exercise in Indian population
- Sample of physiotherapy protocol In Diabetes

Study Selection. a title and abstract screening of the references removing papers according to the following exclusion criteria: (i) Studies on nondiabetic patients (ii) Studies on nonadult patients (iii) Language of the publication different from English or unavailable online (iv) Publication different from first validation papers or scoping reviews

After that, full-text selection—following the same criteria—of the studies was carried out to identify only the relevant papers. Conflicts were resolved by consensus.

Data Charting and Report

Finally, criteria for data extraction were defined. data were extracted from both original and reviews., the first validation study was retrieved (if not already obtained during the previous steps). Validation studies were once again screened to only select those who were relevant to our research questions according to the following criteria: (i) Specifically developed for diabetic patients (ii) Validated on an adult sample (iii) Validation study available in English (iv) Structured exercise program

We then developed the data extraction plan and database

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

Demographic data for studies in the systematic review. [32]

Table : 1

Author name	Year	Journal	Type of study	Sample size	Intervention group	Control group	Duration of intervention
Katsui et al.	2001	Diabetes care	Non-RCT	55	Aerobic training and diet	No group	6 weeks
Short et al.	2003	Diabetes	RCT	90	Aerobic control and exercise program	Flexibility exercises	16 weeks
O'Donovan et al.	2005	Eur J Appl Physiol	RCT	67	High and moderate intensity exercise	No exercise	24 weeks
Lazarevic et al.	2006	Diabetes Metab	RCT	30	Structured and supervised aerobic exercise program	No exercise	6 months
Michishita et al.	2008	Diabetes Res Clin Pract	Non-RCT	30	Submaximal exercise testing – NGT, IGT, DM	No group	12 weeks
Misra et al.	2008	Diabetes Care	Non-RCT	30	Supervised Progressive resistance exercise training protocol	No group	12 weeks
Jorge et al.	2011	Metabolism	RCT	48	Aerobic, resistance, and combined exercise training	No exercise	12 weeks
El-Kader et al.	2011	Journal Adv Res	Non-RCT	40	Aerobic and resistance exercise training	No group	3 months
Geirsdottir et al.	2012	Journal Gerontol	RCT	237	Resistance exercise program	Healthy older group	12 weeks
Mavros et al.	2013	Diabetes Care	RCT	103	High-intensity progressive resistance training	Sham	12 months
Motahari-Tabari et al.	2015	Global J Health Science	RCT	53	Aerobic exercise	No group	8 weeks

Table 1 summarises the 11 selected publications from International Diabetes Federation,[2] European Association for the Study of Diabetes,[3 17] American Diabetes Association,[12 16 17] Francophone Diabetes Society,[20] European Society of Cardiology,[3] American Heart Association,[14] American College of Sports Medicine,[12] Exercise and Sports Science Australia,[15] Belgian Physical Therapy Association,[13] Canadian Diabetes Association[19] and Swedish National Institute of Health.[18]

Table : 2

Organization	Type	Mode	Duration	Intensity, Frequency
ACSM and ADA[12]	**Aerobic** Any form that uses large muscle (eg, brisk walking)	Minimum of 150 min/week	Moderate to vigorous	At least 3 days/week with no more than 2 consecutive days without exercising
	Resistance machines and free weights involving major muscle groups	1–4 sets 8–15 repetitions 5–10 exercises on each session	Moderate to vigorous	At least twice weekly on non-consecutive days
	Flexibility	Part of physical activity, it should not substitute other types of exercise		
FDS[20]	Aerobic	Minimum of 150 min/week	moderate	At least 3 days/week with no more than two consecutive days without exercising
	Resistance Exercise involves major muscle groups	3 sets 8-10 repetitions 5-10 exercises on each session	Moderate to vigorous	At least twice weekly on non-consecutive days
BPTA[13]	Aerobic	Minimum of 150 min/week	Low to moderate	3–5 days/week
	Resistance	3 sets 10-15 repetitions 5-10 exercises on each session	Moderate	Combined with aerobic exercise
ESSA[15]	Aerobic eg.walking,Running,cycling,swimming)	Minimum of 150 min/week	Moderate	Not more than 2 consecutive days without Exercise
	Resistance Multi joint exercises involving large muscle groups	2–4 sets 8–10 repetition (60 min/week) 8-10 exercises on each session (35 mins per week)	Moderate or vigorous	Two or more sessions per week

CDA[19]	Aerobic Large muscle activities (eg, biking, brisk walking and continuous swimming)	Minimum of 150 min/week	Moderate to vigorous	At least 3 days/week with no more than two consecutive days without exercising
	Resistance Resistance machines or free weights	3 sets ,8 repetitions	Moderate to vigorous	At least twice weekly
AHA[14]	Aerobic Large-muscle activities	Minimum of 150 min/week OR Minimum of 90 min/week	Moderate Vigorous	3–7 days/week 5-7 days /week
	Resistance Multi joint exercises; large-muscle groups	2–4 sets 8–10 repetitions Exercises for all muscle groups on each session	Moderate to vigorous	3 days/week
ADA[16]	Aerobic For example, walking	Minimum of 150 min/week	Moderate	At least 3 days/week with no more than consecutive 2 days without exercising.
	Resistance Free weights or weight machines involving large muscle groups	At least 1 set 5 or more different exercises on each session		At least twice per week
SNIPH[18]	Aerobic For example, brisk walking, cycling For example, tennis, swimming	Minimum of 30 mins 20–60 min	Moderate Vigorous	Daily 3-5 days/week
	Resistance Bodyweight, elastic bands, free weights or weight machines	8–10 exercises on each session		2–3 days/week
	Flexibility	5–10 min at the end of aerobic and resistance exercise sessions		
IDF[2]	Aerobic	Minimum of 150 min/week	Moderate	3–5 days/week
	Resistance			3 days/week
ADA and EASD[17]	Aerobic	Minimum of 150 min/week	Moderate	
	Resistance			
	Flexibility			

ESC and EASD[3]	Aerobic	Minimum of 150 min/week	Moderate to Vigorous	
	Resistance			

ACSM, American College of Sports Medicine; ADA, American Diabetes Association; AHA, American Heart Association; BPTA, Belgian Physical Therapy Association; CDA, Canadian Diabetes Association; EASD, European Association for the Study of Diabetes; ESC, European Society of Cardiology; ESSA, Exercise and Sports Science Australia; FDS, Francophone Diabetes Society; IDF, International Diabetes Federation; SNIPH, Swedish National Institute of Public Health.

RESULTS

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

LIMITATIONS

This scoping review has some limitations: we searched only those databases which we believed to be the most relevant to our research question

CONCLUSION

Finally, for the purpose of guiding the reader in the choice of the most suitable SSEP to reduce insulin sensitivity.

Data Availability

Data are available upon request to the corresponding author.

Conflicts of Interest

The authors declare that there is no conflict of interest.

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