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The Effect of Duration of Physical Exercises on Biochemical Parameters: A South Asian Perspective

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Abstract

Regular physical exercises (RPE) have been found to reduce the blood glucose and lipid levels. However, the exact duration of RPE to elicit a positive effect on blood glucose and lipid levels is still inconclusive. The aim of this mini-review is to understand the current knowledge on the duration of physical exercises on blood glucose and lipid levels of the South Asians. The published research papers on physical exercises in South Asian populations were retrieved from PubMed data base. The studies show that South Asian populations show favourable effects of RPE on blood glucose and lipid levels after 8 weeks of RPE which is comparable to the Caucasians. However, more research from the South Asian cohorts with well-structured RPE is necessary to draw conclusions on exact duration of the exercises to elicit a positive effect on glucose and lipid levels.

Keywords: *Exercises; glucose; lipid; duration; South Asian*

Abbreviations: RPE, NCD, T2DM, WHO, FBG, PRT

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Introduction

Sedentary life style with lack of adequate physical activity has become a cause of mortality in modern societies. Currently, the physical inactivity has been identified as the fourth leading risk factor for global mortality which is the cause for about 6% of the deaths globally [1]. Furthermore, physical inactivity has been identified as one of the main risk factors for the development of the breast and colon cancers, diabetes and cardio vascular diseases [2-4]. The degree of physical inactivity is rising in many countries resulting major implications in the prevalence of non-communicable diseases (NCDs) and health [1].

South Asian region in the Indian subcontinent is the home to one-fifth of the world's population and is one of the most densely populated regions in the world [5]. In light of the urbanization and life style changes that occur during the contemporary period, NCDs such as cardiovascular diseases, cancers, metabolic and mental health disorders have been increased contributing to the increased mortality rates in South Asia [6-8]. The prevalence of NCDs in South Asian population was reported as 78 million cases in 2015 [9]. NCDs were responsible for 52% of mortalities in the South Asia in 2015, and have been expected to increase up to 72% by 2030 [9].

Ethnic differences in the development of NCDs among different populations have been reported [10-16]. It has been found that the South Asians are more prone to cardio vascular diseases and type2 diabetes mellitus (T2DM) compared to other ethnicities [17]. Nearly 25 million people with South Asian origin (India, Pakistan, Bangladesh, Nepal and Sri Lanka) [4] live in Western countries (USA, Canada, and Europe) as immigrants and reported to show similar prevalence rates of NCD compared to the resident South Asians [18]. Case-control studies have demonstrated that compared to the Caucasians, the prevalence, clinical presentation and the mean age of development of cardio vascular diseases differ in South Asians. Higher prevalence and incidence rates with significantly younger age at first hospitalization for myocardial infarction have been reported in South Asians [13, 15-17]. Additionally prevalence of obesity, hypertension and dyslipidemia has been shown to be high in South Asians compared to Western [11].

Morris and co-workers in 1953 reported the benefits of the physically active life style by comparing the mortality rates of the workers who involved in occupations that required hard physical work compared to the sedentary life style of clerical workers [19]. It has been shown that the hard physical work increases the healthy life with low mortality rates [20]. Since then many research has provided data for the direct relationships between the physical activity and health benefits [21-23].

It has been found that RPE which has been identified as "planned, structured, repetitive, and purposeful physical activity" by World health organization (WHO) [1] can reduce the risk of NCDs [1]. The effect of RPE on health parameters has been studied extensively [24]. RPE have shown to reduce the risk of DM and atherosclerosis [25-32]. Furthermore, the beneficial effects induced upon introduction of RPE has lead to incorporate physical exercises in the treatment and management of variety of NCDs such as coronary heart diseases [33-35], hypertension [36-38], T2DM [39], obesity [40], hypercholesterolemia [41,42], osteoporosis [43,44], osteoarthritis [45,46], obstructive pulmonary disease [47], depression and anxiety disorders [48], dementia [49], congestive heart failure [50] and stroke [51]. However, the extensiveness and the length of the exercises that requires bringing beneficial effects are inconclusive.

Recent research into exercises has explored the impact of the duration of RPE on the effectiveness [52-56]. It has been stated that 15–24 weeks of duration of RPE is required to attain significant favourable effects on aerobic capacity or muscle strength and endurance [57] with additional health benefits after 24 weeks of prolong RPE [58]. As reviewed by Clark JE in 2016, the duration of endurance training required to achieve the plasma glucose and lipid levels to normal ranges are 9-15 weeks and 8 weeks respectively [59]. The data and the findings on duration of RPE needed to provide a positive effect on the cardio metabolic risk factors have been derived mostly from the Caucasian populations, a few studies from East Asian countries like Japan and Korea [59] have been included but none of the data from South Asian have been analyzed. The reported differences in the disease profile, prevalence and incidence between Caucasians and South Asians as mentioned above lead us to explore the studies that have been done on duration and the effects of RPE on South Asians to examine if there is any deviations from the recommended periods of RPE to achieve favourable effects on health parameters of Asians than Caucasians. We restricted our search to the effects of RPE on plasma glucose levels and lipid profiles and this review provides an understanding on the duration of exercise and their effect on plasma glucose and lipid levels of South Asian (India, Pakistan, Sri Lanka, Nepal, Bangladesh, Bhutan, and Maldives) populations.

Criteria of literature review

The published research papers on physical exercises in South Asian populations were retrieved from PubMed data base. The key words used for literature search were: exercise, glucose, lipid, South Asian, India, Pakistan, Sri Lanaka, Bangladesh, Nepal, Bhutan and Maldives. Total of 213 articles for India, 21 for Pakistan, 8 for Sri Lanka, 14 for Bangladesh, 5 for Nepal, 0 for Bhutan and 0 for Maldives were taken into consideration when analysing the effect of exercises on blood glucose levels. For lipid profiles the number of articles appeared in PubMed was: 252 for India, 22 for Pakistan, 5 for Sri Lanka,10 for Bangladesh, 9 for Nepal, 0 for Bhutan and 0 for Maldives. Relevant articles which described effects of any type of regulated exercise (supervised low, moderate or high intensity exercises, walking, spot running, yoga etc.) were selected. The research carried out without describing the type, intensity and duration of exercises adequately and research done with other parameters controlled such as diet was eliminated.

The duration of exercises on blood glucose levels

A positive effect on blood glucose levels [measured as a significant reduction in the blood glucose level at pre and post experiment or compared to the control group] have been observed after 9-15 weeks of resistance/endurance training in Western populations [54]. In the South Asian populations, the fasting blood glucose (FBG) or HbA1c levels have been shown to improve from 6-24 weeks of exercises (Table 1) [60-77]. However, the majority (11/18) of the studies reported that 8-12 weeks of physical exercises could provide a positive effect with significant reduction of the FBG and HbA1c levels at post experiment or compared to non-exercised control groups [60-77]. Sixteen (88%) studies discussed the possible effects of moderate exercises on the FBG and/or HbA1c levels while only 3 reports were based on progressive resistance training (PRT) (Table 1). According to these reports both moderate exercise training and resistance training have shown positive effects on blood glucose levels after 8-12 weeks. The study subjects of majority of the studies (16/18) were patients with various metabolic syndromes and 10/18 studies have used patients with T2DM as the subjects.

Type of exercise program	Number of subjects	Age (Years)	Type of sample	Duration for a significant reduction (weeks)	Reference no
Light post meal walking of 2 hours after intake of a high glycemic food.	11	-	Healthy	Every 15 min/2 hours	60
Free moderate-intensity exercises at home	136	20 - 40	NDO	-	61
Treadmill exercise	10	45-60	T2DM	06	62
75 min yoga practice/day	50	-	Healthy	06	63
Moderate-intensity brisk walking covering 1500–1600 steps for 15 min	32	49.0 - 50.7	T2DM	08	64
Moderate-intensity aerobic exercise	40	54.40±1.24	T2DM	08	65
PRT & aerobic exercise (AE)	20	53.8 +/- 8.8	T2DM	08	66
PRT	48	44.7 ± 4.2	T2DM	08	67
Aerobic walking	40	-	T2DM	08	68
Culturally appropriate diet and exercise program	40	20-50	MS	12	69
Exercise through pedometers	74	> 18	CVD	12	70
Yoga for 1 hour, two days / week.	124	-	T2DM	12	71
Home exercise program with information technology (IT) support	94	50	MS	12	72
Diaphragmatic breathing	123	60.0 _ 10.4	T2DM	12	73
PRT	30	-	T2DM	12	74
2 km of walking in 30 min	45	55 - 64	Obese	20	75
Moderate exercise - rapid walking and spot running	231	-	CHD	24	76
Yoga training	30	36 - 55	T2DM	24	77

Table 1: *Details of the exercise programs that brought a positive effect on blood glucose levels*
NDO: Non diabetic obese MS: Metabolic syndrome CHD: Coronary Heart Disease CVD: Cardiovascular disease T2DM: Type 2 Diabetes mellitus

The duration of exercises on blood lipid levels

Positive effects on blood lipid profiles have been observed after 8 weeks of resistance/endurance training in Western populations [54]. The lipid levels in the blood have also been shown to vary between 1-25 weeks with the duration of the exercise program in studies

done in the South Asian cohort (Table 2) [61-84]. However, 43% (06/14) of the studies show that 8-12 weeks of RPE are able to provide a positive effect on the plasma lipid levels. Out of the selected literature, 85% of studies had discussed the effects of moderate exercises on the lipid levels and only 2 reports were based on PRT. The data of these two reports suggest that the resistance training show positive effects on lipid levels after 8 weeks (Table 2).

Type of exercise	Sample no	Age (years)	Type of sample	Duration for a significant reduction (Weeks)	Reference no
Free moderate-intensity exercises at home	136	20-40	NDO	20	61
Treadmill for 60 min	10	20-28	CHD	01	78
90 minutes/day yoga or supervised walking	68	36.4	Obese	02	79
Moderate exercise - rapid walking	231	-	CHD	04	76
Comprehensive yoga /three times a week	15	36 - 63	T2DM	06	80
PRT and AE	30	53.8 +/- 8.8	T2DM	08	66
PRT	48	44.7 ± 4.2	T2DM	08	67
Culturally appropriate diet and exercise program	40	20-50	MS	12	69
Exercise through Pedometers	74	> 18	CVD	12	70
Supervised progressive resistance-exercise training	30	-	T2DM	12	74
Yoga 1 hour/day	100	-	T2DM	12	81
Moderate intensity (MI) and high intermittent intensity (HII) for 40min/day for 5 days/week and 20 min/day for 3 days/week	MI (n = 22) , HII (n = 29)	19-35	Obese	15	82
Supervised structured aerobic exercise training program / 3 days a week	51	40-70	T2DM	25	83
Regular exercise	53	-	Healthy	25	84

Table 2: *Details of the exercise programs that brought a positive effect on plasma lipid levels*
NDO: Non diabetic obese MS: Metabolic syndrome CHD: Coronary Heart Disease CVD: Cardiovascular disease T2DM: Type 2 Diabetes mellitus

Conclusion

South Asian populations show favourable effects of RPE on blood glucose and lipid levels after 8-12 weeks and after > 8 weeks of RPE respectively. Majority of the Western studies also report similar findings of exercise on the blood glucose and lipid levels. However, the results of the exercise programs conducted under different settings may vary due to the type of exercise program. Underline life style patterns of South Asians may have also contributed to the overall effect of these exercise programs. It has been found that the consumption of saturated, n-6 polyunsaturated and Tran's fatty acids is higher and n-3 polyunsaturated fatty acids lower in South Asians as compared to Caucasians [54]. Use of ghee (clarified butter), vegetable ghee (partially hydrogenated vegetable oil) and coconut oil, which have a high content of saturated fatty acids and trans-fatty acids in cooking is higher in South Asians than other populations [55].

In addition, normal physical activity levels in South Asians are lower when compared that of the other ethnic groups [11, 62-66]. The structured recreational exercise has not been a part of the culture of South Asian countries [11]. Furthermore, it has been shown that the South Asians demonstrate a lower cardio-respiratory fitness and capability of fat oxidation during exercise as compared to Caucasians [69]. Moreover, South Asians show increased abdominal adipose deposition with expressed genes that could facilitate increased fat storage after a calorie rich meal [5,10].

Only a few studies describing the effect of exercises on blood glucose and lipid levels have used well planned, structured and repetitive RPE. The exercising programs were varied largely from free exercises at home to PRT. It has been shown that both resistant training and a combination of resistance and endurance training are more effective than endurance training alone in Western populations [59]. Adequate data were not available from South Asian populations to draw such conclusions. Therefore, more and more research from the South Asian cohorts with well-structured RPE is necessary to draw conclusions on exact duration of the exercises to elicit a positive effect on glucose and lipid levels.

Conflict of interest

Authors declare no conflict of interest.

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