The Effect of Regular Exercise and its Duration on Metabolic Parameters

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ABSTRACT

Regular exercise is crucial for regulating metabolic parameters. This retrospective study aimed to evaluate the effects of regular exercise duration on glycaemic and metabolic parameters, insulin resistance, and atherogenic indices in individuals attending a single-family health centre. A total of 403 individuals were divided into three groups based on their exercise status as Group A with no regular exercise, Group B with <150 minutes, and Group C with ≥150 minutes of regular excercise per week. The demographic and clinical data were collected from the subjects' records. The median age in Group A was significantly higher than in Group B and C, the median weight of Group A and B was significantly lower than in Group C, and high-density lipoprotein cholesterol level was significantly higher in Group B than in C. Type 2 diabetes percentage was significantly higher in Group C compared to B. Other glycaemic and metabolic parameters, insulin-resistance, and atherogenic indices were similar among the three groups. The results of this study indicated that subjects with higher weight, lower HDL levels, and Type 2 diabetes mellitus were those doing regular exercise in the advised duration per week.

Key Words: *Exercise, Duration, Lifestyle, Insulin-resistance, Atherogenic index.*

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A healthy lifestyle mainly includes two counterparts; dietary and exercise habits. Consuming homemade healthy food with lower calories and high amounts of fiber along with regular exercise can help maintain healthy body weight. Most trainers offer at least 150 minutes of moderate-intensity aerobic physical activity through-out the week for adults.[1]

Despite the well-established benefits of healthy lifestyle interventions, a significant portion of the global population remains insufficiently active, especially if they are without known comorbidities. Worldwide, around 1 in 3 women and 4 men do not engage in enough physical activity to stay healthy.[1]

Although there are many studies about the importance of lifestyle interventions in patient groups with diabetes, obesity, and metabolic syndrome,[2] not much data is present to compare the effect of the duration of regular exercise on insulin-resistance and related glycaemic and metabolic parameters. This study aimed to investigate the impact of regular exercise duration on insulin-resistance, glycaemic and metabolic parameters, and atherogenic index in subjects admitted to a single family health centre.

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This retrospective study was conducted after the approval from the Clinical Research Ethics Committee of Bursa Uludag University, Faculty of Medicine (Ref. dated 2022-07-27/ decision no: 2022-15/7), following the Declaration of Helsinki. The data of a total of 403 consecutive individuals (220 females, 183 males) between 15 to 75 years of age admitted to Bursa Uludag University Family Health Center between 1st March and 30th April, 2021 were included in the study. The data of the subjects younger than 15, older than 75 years, with a disability to exercise, and with pregnancy were excluded from the study. Gender, age, height, weight, body mass index, systolic and diastolic blood pressures, glucose and lipid parameters, cigarette smoking, alcohol consumption, dietary habits, and comorbidities were obtained from the records of the subjects. The insulin-resistance index was calculated by dividing triglyceride (mg/dl) by glucose (mg/dl), and the atherogenic index by dividing triglyceride (mg/dl) by high-density lipoprotein cholesterol (HDL) (mg/dl). The regular exercise status of the subjects recorded in the files was upon the subject's declaration. Three groups were obtained as no regular exercise (Group A), less than 150 minutes per week (Group B), and more than or equal to 150 minutes per week (Group C). The parameters were compared among the three groups.

One-Way ANOVA (Robust Test: Brown-Forsythe) test from parametric tests and Dunnet's T3 test for post hoc analysis were used to compare more than two groups according to quantitative variables. While the Kruskal-Wallis H Test, one of the non parametric tests, was taken using Monte Carlo simulation results, Dunn's test was used for post hoc analysis.

Table I: Demographic and metabolic parameters of the subjects showed significant differences among the three exercise groups.

	Total	No regular exercise (Group A)	<150 minutes of regular exercise per week (Group B)	≥150 minutes of regular exercise per week (Group C)	p	Pair-wise comparison		
	(n=403)	(n=114)	(n=204)	(n=85)		p (A-B)	p (A-C)	p (B-C)
Age (year), Median (min-max)	25 (15-75)	29 (21-75) [B]	24 (15-66)	26 (20-65)	0.011 [k]	0.008		0.637
Weight (kg), Median (min-max)	70 (40-125)	67.5 (40- 125)	66.5 (41-122)	76 (45-125) [A-B]	0.007 [k]	0.999	0.017	0.014
Height (cm), Mean (SD)	170 (9)	167 (7) [B-C]	170 (9)	173 (11)	<0.001 [a]	0.034	<0.001	0.070
HDL cholesterol (mg/dl), Median (min-max)	52 (29-130)	50 (29-89)	56 (29-130)	48 (29-89) [B]	0.030 [k]	0.163	0.999	0.021

[a] One-Way ANOVA test (Brown-Forsythe); Post hoc test: Dunnet's T3 test. [k] Kruskal Wallis H test (Monte Carlo); Post hoc test: Dunn's test. [A] Expresses significance compared to the with no regular exercise. [B] Expresses significance compared to the <150 min/week group. [C] Expresses significance compared to the >150 min/week group. SD: Standard deviation, Min: minimum, Max: maximum.

In comparing categorical variables, Fisher-Freeman-Halton tests were done with the Monte Carlo simulation technique. Quantitative variables were expressed as mean (standard deviation) and median (minimum/maximum) in the tables, while categorical variables were shown as n (%). The variables were analysed at a 95% confidence level, and a p-value less than 0.05 was considered significant.

A total of 403 individuals (220 females, 183 males) were included in the study. There were 114 subjects (68 females, 59.6%) in Group A, 204 subjects (115 females, 56.4%) in Group B, and 85 subjects (37 females, 43.5%) in Group C. There was no significant difference in female subject percentages among the three groups. The median age in Group A was significantly higher than in Group B and C, the median weight of Group A and B were significantly lower than in Group C, and the mean height of Group A was significantly lower than of Group C (Table I). Regarding metabolic parameters, only HDL cholesterol level was significantly higher in Group B than in Group C. There was no significant difference among groups in other glycaemic and metabolic parameters, insulin-resistance (Triglyceride/glucose), and atherogenic indices (Triglyceride/HDL). When the subjects' smoking status, alcohol consumption, dietary habits, and comorbidities were evaluated, only Type 2 diabetes percentage was statistically significantly higher in Group C as compared to B (7.1% *vs*. 1.5%, p = 0.043). There was no significant difference among groups concerning other parameters.

The results of the present study indicated that subjects with higher weight, lower HDL levels, and Type 2 diabetes mellitus were those doing regular exercise in the advised duration per week, although they had similar dietary habits of consuming homemade food.

Exercise is crucial in regulating insulin-resistance. Exercise can increase insulin-sensitivity through several molecular mechanisms. It causes upregulation of insulin-transporters in the cellular membrane of insulin-dependent cells. It ameliorates the pathophysiologic pathways involved in insulin-resistance like reduction of adipokines, inflammation, oxidative stress, and improvement in insulin signal transduction.[3] Several studies indicated significant improvement in glucose tolerance and insulin-sensitivity in response to exercise within 12 to 48 hours of the last exercise session. Exercise also promotes weight loss, which reverses insulin resistance. The positive effect of regular daily exercise on insulin-resistance can be augmented if body fat, especially visceral adiposity, is also decreased. Besides improving the overall quality of life and well-being, exercise reduces the morbidity and mortality associated with cardiovascular disease, dyslipidemia, obesity, and diabetes.[4,5]

The triglyceride to glucose ratio is used in the evaluation of insulin-resistance and the atherogenic index triglyceride to HDL ratio in the evaluation of cardiovascular disease risk. The association of triglyceride to HDL ratio with insulin-resistance is shown in the recent studies.[6] Exercise by improving the insulin-resistance index may also improve this atherogenic index. In this study, the authors could not find any difference among groups concerning these two indices. This may be due to the features of the population of this study. The main limitations of this study were the relatively low number of subjects and the self-reported regular exercise duration intensity by the subjects. On the other hand, the results highlighted the increased awareness about the importance of regular exercise in subjects with comorbidities like Type 2 diabetes mellitus, lower HDL, and abnormal weight.

In conclusion, promoting regular exercise as a habit can help prevent health issues related to insulin-resistance. Exercising regularly in the recommended amount as a precaution before metabolic diseases settle will be beneficial for a healthy life.

ETHICAL APPROVAL:

The study was conducted after approval from the Clinical Research Ethics Committee of Bursa Uludag University, Faculty of Medicine (Ref. dated 2022-07-27/ decision no. 2022-15/7), following the Declaration of Helsinki.

COMPETING INTEREST:
The authors declared no competing interest.

AUTHORS' CONTRIBUTION:
OG: Drafted the work, interpreted data, and finally approved it to be published.
CE: Contributed to the conception/design of the work, drafted the work, and revised it critically.
All authors approved the final version of the manuscript to be published.

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