

Approach of Physical Activity in Type 1 Diabetic Patients

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Abstract

Introduction: Type 1 Diabetes Mellitus (T1DM) is an autoimmune disease caused by absolute deficiency of insulin because of the destruction of β cells islet of the pancreas. Aerobic exercise and diet are the two main points of diabetes treatment.

Methods: The data for this study comes from an online survey of 50 people with health diseases, conducted between June 8 and July 12, 2021. More precisely, the data of our study are un mail-only data, with people selected randomly from a database maintained by B-Sport Plus Project. The database contains questions about physical activities in diabetic patients.

Results: Among the 50 interviewers with type 1 diabetes, the largest age group covers those younger than 18 years old. 31% of the patients answered that health conditions limit their daily activity. 47% of them spent 1-2 h on sport and recreational activity per day. 47% of the patients reported they do multiple sport activities, the others do leisurely walking (walking their dog), bicycling, skating, swimming and curling, gardening and light housework, dancing or other moderate exercise classes,

weight training and running, brisk walk. 62% of them reported that they are willing to exercise 1-2 hours per day. 33% of the patients reported they do not participate in sport and recreational activities from lack of time, the others from financial constraints, family and friends influence, lack of self-confidence, illness/injury, problems with transportation.

Conclusion Aerobic exercise can improve the sensitivity of Insulin, blood glucose and lipid metabolism, thereby reducing insulin dosage and improving glycemic control. WHO recommends at least 150 minutes of moderate physical activity per week. T1DM patients, physiotherapists or fitness trainer, kinesiologist and endocrinologist need to fully understand how the physical activity effect on metabolism and implement individualized aerobic exercise programs.

Keywords: *type 1 diabetes, physical activity, glycemia, aerobic exercises.*

Introduction

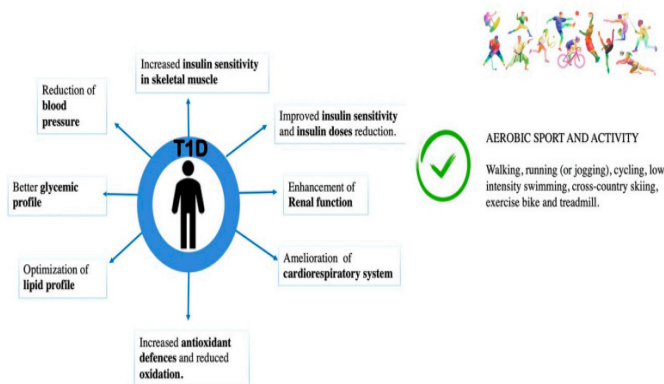
Diabetes Mellitus (DM) is a metabolic and endocrine disease caused by the reduction or absence of a hormone called Insulin. According to the American Diabetes Association (1), diabetes is classified in four types:

1. Type 1 Diabetes Mellitus (T1DM): T1DM is an autoimmune disease caused by absolute deficiency of insulin because of the destruction of β cells islet of the pancreas.
2. Type 2 Diabetes Mellitus (T2DM): T2DM is a disease caused by reduction in insulin secretion because of the insulin resistance (decrease in the sensitivity of peripheral tissues like adipose and muscle tissue and hepatocyte to insulin).
3. Gestational Diabetes Mellitus (GDM): Abnormal levels of glucose in the first stage of pregnancy who can return to normal after delivery or not.
4. Atypical forms of diabetes: maturity-onset diabetes mellitus of the young (MODY), latent-autoimmune diabetes in adults (LADA), mitochondrial diabetes mellitus (MDM), abnormalities of the exocrine pancreas, endocrinopathies, drug induced diabetes, etc.

Type 1 Diabetes Mellitus is a chronic disease in which the pancreas produces little or no insulin, so the current treatment for T1DM patients is exogenous insulin replacement therapy. Aerobic exercise and diet are the two main points of diabetes treatment. WHO defines physical activity as any bodily movement produced by skeletal muscles that requires energy expenditure (2). Physical activity refers to all

movement including during leisure time, for transport to get to and from places, or as part of a person's work. Aerobic exercise can improve the sensitivity of Insulin, blood glucose and lipid metabolism, thereby reducing insulin dosage and improving glycemic control [3-5]. Boniol et al. and X. Lu and C. Zhao [6] found that physical activity reduced fasting blood glucose and HbA1c levels in T1DM patients, and its benefits were associated to the duration of exercise performed weekly rather than the type of exercise performed [7]. This was explained by different mechanisms like the increase in the number of cellular glucose transporters, improvement of insulin receptors function on skeletal muscle and adipose tissues, increase of the sensitivity of peripheral tissues to insulin, [8–11]; increasement of the uptake and oxidation of fatty acids in muscle tissues [12]; increasement of the expression of nitric oxide synthase (NOS) in vascular endothelial cells [13, 14]; promotion of lipoprotein activity, etc. However, for these patients, exercise still has the risk of hypoglycemia or hyperglycemia. T1DM patients, physiotherapists or fitness trainer, kinesiologist and endocrinologist need to fully understand how the physical activity effect on metabolism and implement individualized aerobic exercise programs.

FIGURE 1. Positive effects of physical activity, in type 1 diabetic patients



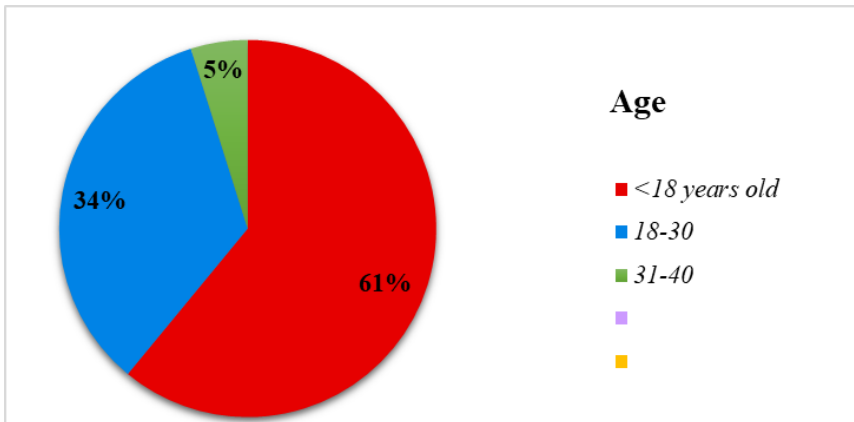
Methods

This is a descriptive study. The data for this study comes from an online survey of 50 people with health diseases, conducted between June 8 and July 12, 2021. More precisely, the data of our study are un mail-only data, with people selected randomly from a database maintained by B-Sport Plus Project. The database contains questions about physical activities in persons with health diseases, from which we have studied diabetic patients. We studied the data of 50 patients in Albania, diagnosed with type 1 Diabetes Mellitus. These patients underwent a

questionnaire for their physical activity (sports and recreational activity), to study the effect of physical activity in diabetes. We excluded patients with type 2 Diabetes Mellitus.

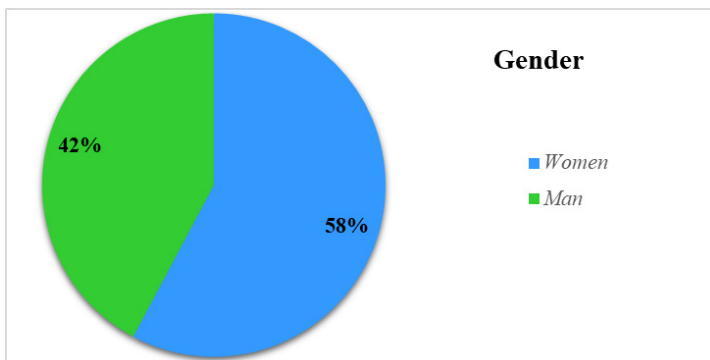
Results and Discussion

FIGURE 2. Age distribution of the sample



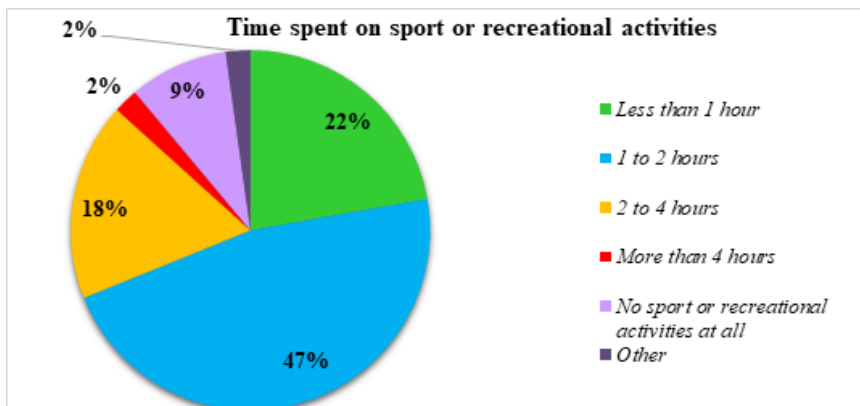
Among the 50 interviewees with type 1 diabetes, the largest age group covers those younger than 18 years old. The purpose of the questionnaire is to study physical activity in young people with type 1 diabetes and the important thing is to understand if young people with type 1 diabetes are physically active. The number of people with diabetes rose from 108 million in 1980 to 422 million in 2014. Prevalence has been rising more rapidly in low- and middle-income countries than in high-income countries (18)

FIGURE 3. Gender distribution of the sample



In this questionnaire, more females responded than males, with a minor difference. Type 1 diabetes, unlike other autoimmune diseases, affects both males and females equally (19)

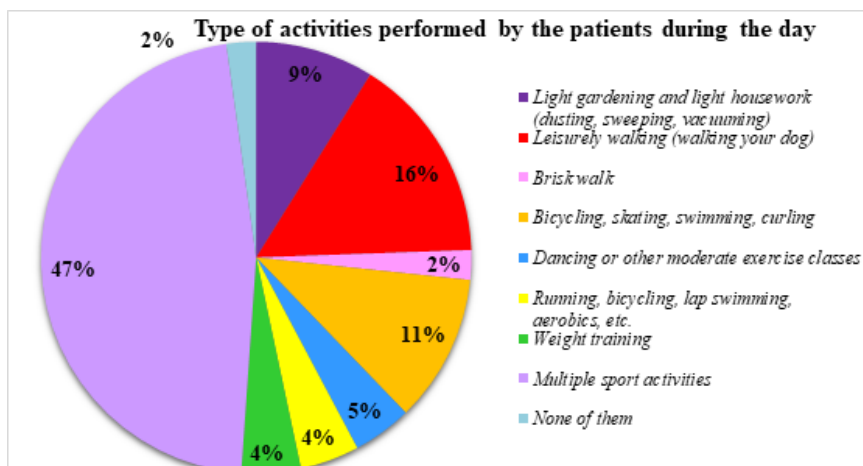
FIGURE 4. Time spent in sport and recreational activities



47% of the patients spent 1-2 hours doing sport and recreational activity per day, 22% of them less than 1 hour, 18% of them 2- 4 hours, 9% of them don't make any activity or sport, 2% of them more than 4 hours. In comparison to our study, the majority of the studies in America or Britain show that adults in this countries take on average 5117 and 2000 steps/day during the week, approximately 40 and 20 minutes/day respectively (15). According to this study, 38% of US citizens report no leisure-time physical activities and 43% report 1 to 2 activities in 30 days.

WHO recommends at least 150 minutes of moderate physical activity per week (approximately 20 to 25 minutes sports per day).

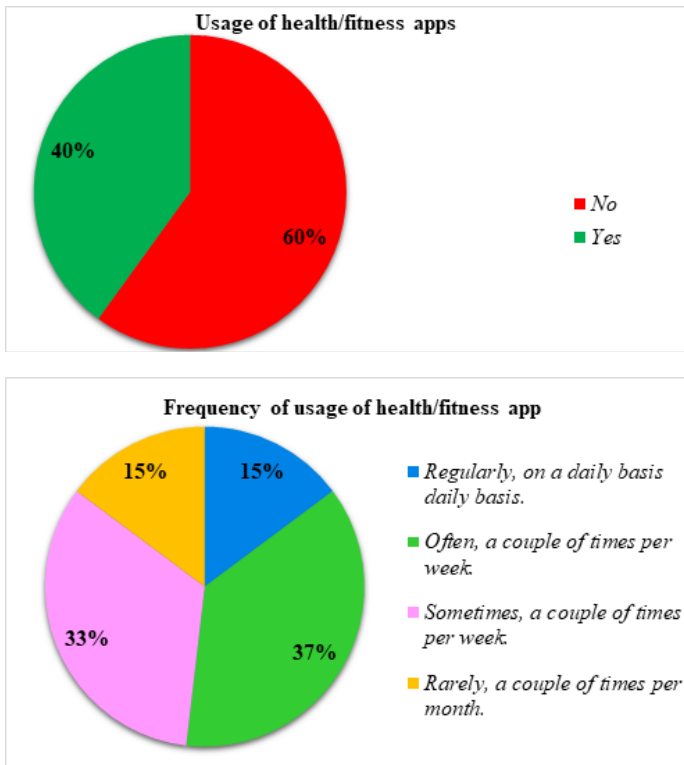
FIGURE 5. Type of activities performed by the patients during the day



47% of the patients reported that they do multiple sport activities, 16% of them do leisurely walking (walking their dog), 11% of them do bicycling, skating, swimming, and curling, 9% of them do light gardening and light housework, 5% of them do dancing or other moderate exercise classes, 4% of them do weight training and running, 2% of them do brisk walk.

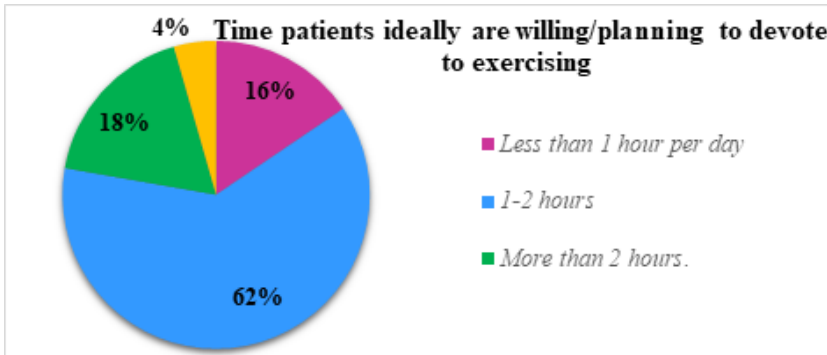
According to a study in the US, the most common physical activity was walking (the average time of walking was 198 minutes/week for men and 152 minutes/week for women). After the walk, the most frequent physical activities for men were bicycling and yard work, while for women were aerobic exercise and dance. (16)

FIGURE 6. Usage and frequency of health/fitness apps



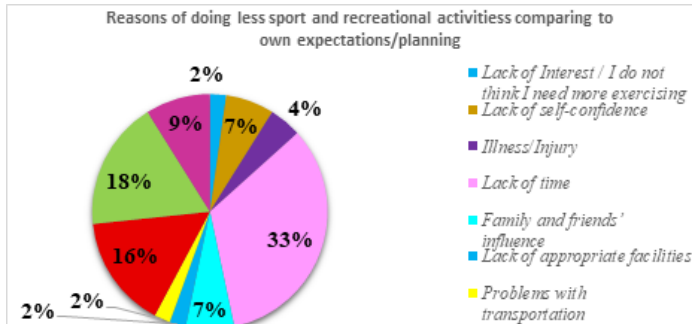
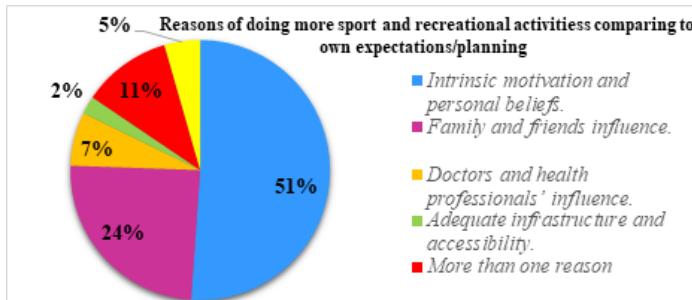
More than half of the patients reported that they do not use any health or fitness app tool to track their health, while 40% of them do use them. According to a study, 42.26% of diabetic patients were smartphone owners, from whom 41.1% used fitness and diet apps. 37% of those who use health and fitness apps report that they use it a couple of times per week, 33% of them sometimes, 15 % of them regularly on a daily basis and 15% a couple of times per month.

FIGURE 7. Time patients are ideally willing/planning to devote to exercising



62% of them reported that they are willing to exercise 1-2 hours per day, 18% of them more than 2 hours, 16% of them less than 1 hour per day, 4% of them were not sure they had time for physical activity. engagement

FIGURE 8. Reasons of doing more or less sport compared to own expectations/planning



51% of the patients reported they are willing to do sport and recreational activities because of intrinsic motivations and personal beliefs, 24% of them because of family and friend influence, 7% of them because of doctors and health

professionals influence, 2% of them because of adequate infrastructure and accessibility.

On the other hand, 33% of the patients reported they do not participate in sport and recreational activities from lack of time, 18% of them from multiple reasons, 16% of them from financial constraints, 7% of them from family and friends influence, 7% of them from lack of self-confidence, 4% of them from illness/injury, 2% of them from problems with transportation. According to a survey, 58% of diabetic patients want to play more sport, with only 6% of people saying they want to play less.

The main reason for not doing physical activities was not having enough time, followed by lack of money, the weather, not having sports facilities or people to play (17).

Conclusions

Aerobic exercise can improve the sensitivity of Insulin, blood glucose and lipid metabolism, thereby reducing insulin dosage and improving glycemic control. Most of the cases spent 1-2 h sport and recreational activity per day, followed by less than 1 hour, 2- 4 hours, and no activity or sport. A major part of the patients reported that they do multiple sport activities, followed by leisurely walking (walking their dog), bicycling, skating, swimming, curling, light gardening and light housework, dancing or other moderate exercise classes, weight training and running and brisk walk. Diabetic patients commonly reported that they do not use any health or fitness app tool to track their health. According to our study, the majority of the cases reported that they are willing to exercise 1-2 hours per day, some of them more than 2 hours and a minority of the cases less than 1 hour per day or were not sure they had time for physical activity. Most of the patients reported they do not participate in sport and recreational activities from lack of time, some of them from multiple reasons or from financial constraints and a minority of the cases from family and friends influence, from lack of self-confidence, from illness/injury, or from problems with transportation. However, for these patients, exercise still has the risk of hypoglycemia or hyperglycemia. T1DM patients, physiotherapists or fitness trainers, kinesiologist and endocrinologist need to fully understand how physical activity affects metabolism and implement individualized aerobic exercise programs. WHO recommends at least 150 minutes of moderate physical activity per week (approximately 20 to 25 minutes sports per day).

References

1. Lu, X., Zhao, C. (2020). Exercise and Type 1 Diabetes. In: Xiao, J. (eds) *Physical Exercise for Human Health. Advances in Experimental Medicine and Biology*, vol 1228. Springer, Singapore. https://doi.org/10.1007/978-981-15-1792-1_7
2. WHO. (2016). *Global Report on Diabetes*. https://apps.who.int/iris/bitstream/handle/10665/204871/9789241565257_eng.pdf
3. Litchfield I, Andrews RC, Narendran P, Greenfield S (2019) Patient and healthcare professionals perspectives on the delivery of exercise education for patients with type 1 diabetes. *Front Endocrinol (Lausanne)* 10:76
4. Valerio G, Spagnuolo MI, Lombardi F, Spadaro R, Siano M, Franzese A (2007) Physical activity and sports participation in children and adolescents with type 1 diabetes mellitus. *Nutr Metab Cardiovasc Dis* 17(5):376–382
5. Cai Y, Xie KL, Zheng F, Liu SX (2018) Aerobic exercise prevents insulin resistance through the regulation of miR-492/resistin axis in aortic endothelium. *J Cardiovasc Transl Res* 11(6):450–458
6. Boniol M, Dragomir M, Autier P, Boyle P (2017) Physical activity and change in fasting glucose and HbA1c: a quantitative meta-analysis of randomized trials. *Acta Diabetol* 54(11):983–991
7. Pedersen MT, Vorup J, Bangsbo J (2018) Effect of a 26-month floorball training on male elderly's cardiovascular fitness, glucose control, body composition, and functional capacity. *J Sport Health Sci* 7(2):149–158
8. Richter EA, Hargreaves M (2013) Exercise, GLUT4, and skeletal muscle glucose uptake. *Physiol Rev* 93(3):993–1017
9. Munoz VR, Gaspar RC, Kuga GK, da Rocha AL, Crisol BM, Botezelli JD, Baptista IL, Mekary RA, da Silva ASR, Cintra DE, de Moura LP, Ropelle ER, Pauli JR (2018) Exercise increases Rho-kinase activity and insulin signaling in skeletal muscle. *J Cell Physiol* 233(6):4791–4800
10. Liu M, Wright J, Guo H, Xiong Y, Arvan P (2014) Proinsulin entry and transit through the endoplasmic reticulum in pancreatic beta cells. *Vitam Horm* 95:35–62
11. Le S, Mao L, Lu D, Yang Y, Tan X, Wiklund P, Cheng S (2016) Effect of aerobic exercise on insulin resistance and central adiposity disappeared after the discontinuation of intervention in overweight women. *J Sport Health Sci* 5(2):166–170
12. Xie W, Su JH, Wang J (2019) Changes of blood pressure, serum inflammatory factors and endothelin levels in patients with hypertension under rehabilitative aerobic exercise. *J Biol Regul Homeost Agents* 33(2):531–536
13. Sixt S, Beer S, Bluher M, Korff N, Peschel T, Sonnabend M, Teupser D, Thiery J, Adams V, Schuler G, Niebauer J (2010) Long- but not short-term multifactorial intervention with focus on exercise training improves coronary endothelial dysfunction in diabetes mellitus type 2 and coronary artery disease. *Eur Heart J* 31(1):112–119
14. Wang S, Li J, Zhang C, Xu G, Tang Z, Zhang Z, Liu Y, Wang Z (2019) Effects of aerobic exercise on the expressions and activities of nitric oxide synthases in the blood vessel endothelium in prediabetes mellitus. *Exp Ther Med* 17(5):4205–4212

15. Got A Sedentary Life Sitting At The Office? Here's How Much You Should Exercise To Stay Healthy. (2020, January 24). Youmatter. <https://youmatter.world/en/sports-exercise-health-sedentary-work/>
16. time spent participating: Topics by Science.gov. (n.d.). Wwww.science.gov. Retrieved October 17, 2022, from <https://www.science.gov/topicpages/t/time+spent+participating>
17. Whiting, K. (2021, August 25). Where do people exercise most around the world - and what stops them? World Economic Forum. <https://www.weforum.org/agenda/2021/08/exercise-sport-fitness-world/>
18. World Health Organization. (2022, September 16). Diabetes. World Health Organization. <https://www.who.int/news-room/fact-sheets/detail/diabetes>
19. Gender Disparities in Mortality in Patients With Type 1 Diabetes. (n.d.). American College of Cardiology. <https://www.acc.org/latest-in-cardiology/articles/2015/05/18/12/17/gender-disparities-in-mortality-in-patients-with-type-1-diabetes>