

EXERCISE TRAINING IN STUDENTS WITH DIABETES: THE ROLE OF PE TEACHER AT SCHOOL

Anthi Peppas¹, Katerina Asonitou¹, and Dimitra Koutsouki¹

¹Department of Physical Education and Sport Science, Laboratory of Adapted Physical Activity / Developmental and Physical Disorders, University of Athens, Greece

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SUMMARY

Diabetes mellitus is the metabolic disease of disturbed glycaemic control and can mainly be divided into two categories: diabetes type 1 (DMT1) which is more common in students and diabetes type 2 (DMT2). Physical exercise has been shown to have various beneficial effects on diabetic patients and therefore it is strongly recommended for diabetic students at school. The work of physical educator in Greek public schools is obstructed by lack of formal educational seminars, required facilities, and information among society as well as phenomena of school phobia and stigmatization. The role of physical educator is encouraging and supporting diabetic students in regularly taking part in school sport activities, monitoring blood glucose levels and recording exercise plan and response to certain activities. Furthermore, from a psychological point of view, physical educator can help diabetic students to develop their special skills, adopt an optimistic attitude, obtaining self-confidence and learn to benefit from physical exercise. Finally, physical educator could be viewed as the coordinator of interactions among doctors, parents, school teachers, non-diabetic students and diabetic students regarding participation of diabetic students in school sport activities and their exercise performance along with achieving a balance on glycaemic levels.

Key Words: health – diabetes mellitus; physical activity; physical education; special needs students; teacher responsibility.

INTRODUCTION

Diabetes mellitus is a metabolic disease which is characterized by high levels of blood glucose, emerging from either defect in insulin production, or alternatively from the incompetence of cells to absorb and use available insulin. As a result, high levels of blood glucose leads to the classical symptoms of polyuria, polydipsia and polyphagia (“Pathogenesis and management of human diabetes mellitus. Workshop at the 23rd Annual Meeting of the European Society for Clinical Investigation. 1989, Athens, Greece,” 1992). Two types of diabetes have been described: (i) Diabetes Mellitus Type 1 (DMT1) in which the individual is not able to produce insulin or produce insufficient amount of insulin. DMT1 is also known as insulin-dependent diabetes mellitus (IDDM) and although it can theoretically occur in any age, it has been observed to be very frequent in children and adolescents and therefore, is also men-

tioned as juvenile diabetes in literature (Burn, 2010; von Herrath, Sanda, & Herold, 2007; Ma & Chan, 2009); (ii) Diabetes Mellitus Type 2 (DMT2) which is characterized by insulin resistance along with insulin deficiency in few cases (Athanasakis et al., 2010; Gershell, 2005). DTM 2 is also referred in literature as non-insulin-dependent diabetes mellitus (NIDDM) or adult-onset diabetes. Diabetes without proper treatments can cause many complications including hypoglycemia, diabetic ketoacidosis, or non-ketosis hyperosmolar coma, cardiovascular disease, chronic renal failure, retinal damage. Therefore, adequate clinical management of diabetes by drug administration is essential, as well as blood pressure control and healthy lifestyle (i.e. smoking cessation, body weight control). Students with DMT1 have absolute insulin deficiency and therefore, they must receive insulin replacement. Oral hypoglycemic agents do not restore insulin secretion. Non-pharmacological interventions

can facilitate control, but they can never substitute for exogenous insulin. In the patients with DMT2, initial treatment begins with non-pharmacological interventions, specifically, diet, exercise and weight loss. It must be underlined that the treatment of children and adolescents with DMT2 differs from that of adults (Peterson, Silverstein, Kaufman, & Warren-Boulton, 2007) because treatment in students is focused on decreased insulin sensitivity with advancing sexual maturity, physical growth, ability to provide self-management, and neurologic vulnerability to hypoglycemia (in children younger than five years). Interestingly, diet and exercise alone are effective for metabolic control in less than 10% of students with DMT1, and pharmacological application of insulin is usually required (Kaufman, 2002). However, the synergistic effect of diet, exercise and pharmacological treatment is considering the key in diabetes management. In this literature review, we will focus on physical education at common Greek schools for diabetic students.

DIABETIC STUDENTS AND PROBLEMS AT SCHOOL LIFE IN GREEK PUBLIC SCHOOLS

Despite recent advances in diabetes management, diabetes remains a disease that hampers life quality in terms of various somatically, economical and psychological impediments in children and parents' everyday life. The diabetes management program for a diabetic child comprises one or two insulin injections on a daily basis along with measurements of glucose levels in blood and urine, special diet and exercise needs. Each diabetic student is able to have a normal school life provided that the following aspects will be taken into consideration as amenably as possible (Faro, 1995; Goodrich & McDermott, 1989; Henderson, 2005; Lionis & Papathanasiou, 2008; Nichols & Norris, 2002; Owens-Gary, Shea, & Lewis, 2010; Papadaki, Linardakis, Codrington, & Kafatos, 2008; Wagner, Heapy, James, & Abbott, 2006; Wagner & James, 2006):

- The lack of formal education seminars for teachers and school staff in Greece concerning chronic diseases in children and specifically diabetes (Kalyva, Malakonaki, Eiser, & Mamoulakis, 2011). Although teachers are not doctors (Tahirovic & Toromanovic, 2007), it is essential to be well informed for basic diabetes management for emergency conditions (Abdel Gawwad, 2008; Alnasir & Skerman, 2004; Gagliardi, Neighbors,

Spears, Byrd, & Snarr, 1994; Hellemis & Clarke, 2007; Olympia, Wan, & Avner, 2005; Parent, Wodrich, & Hasan, 2009; Tahirovic & Toromanovic, 2006), be able to support student in daily medical practice (i.e. blood test, insulin injection) and control child habits at school (i.e. food, exercise). Furthermore, teachers must be well informed for psychological aspects of diabetes and provide means for a "socially healthy" school environment. The diabetic child or adolescent must feel comfortable at school, without fears for exclusion or stigmatization due to the disease. Other students should be also encouraged by educators to be well-behaved and support their classmates with chronic disease such as diabetes.

- The lack of suitable private rooms for health issues (Kalyva et al., 2011). In most Greek public school, restrooms are used as private space for medical purposes whereas a pharmacy as small as a cupboard exist in director's office. Both for hygiene and for psychological reasons, it is essential that diabetic students will be able to use a special room for necessary treatments where they will feel both safe and comfortable (Hellemis & Clarke, 2007).
- A fruitful collaboration among people around diabetic student including teachers, family, classmates is an absolute requirement for normal school life of students with diabetes (Abdel Gawwad, 2008). The role of educators in these cases is multicenter, since they have to coordinate interactions among student, inform and consult parents, estimate feedback from parents for student's behavior at home, adopt new rules and means for support of diabetic students.
- Absences from school for diabetic students is a factor that cannot be predict. It is common that students with diabetes are absent from school because of frequent sickness or because of hospitalization for days or weeks. The interpretation of school absences is not easy, but diabetic students have to face this abnormal situation as a fact and not feel guilty or insecure. Rehabilitation of diabetic student in normal school life after each absence, especially when this is long, must be as mild as possible for student's psychological condition (Kadohiro, 2009; Nimsgern & Camponeschi, 2005; "Students with chronic illnesses: guidance for families, schools, and students", 2003).
- The effect of diabetes on learning procedure, memory and overall brain function. Numerous

studies have reported that in cognitive dysfunction in diabetic patients which is characterized by a slowing of mental speed and a diminished mental flexibility, whereas learning and memory are spared (Brands, Biessels, de Haan, Kappelle, & Kessels, 2005; Deary et al., 1993; Gold, Deary, & Frier, 1997; Hasanein & Shahidi, 2011; Kadohiro, 2009; McCarthy, Lindgren, Mengeling, Tsalikian, & Engvall, 2002; Ryan & Williams, 1993; Sachon et al., 1992). The magnitude of the cognitive deficits is mild to moderate, but even mild forms of cognitive dysfunction might hamper everyday activities, especially in students, since they can be expected to present problems in more demanding situations.

- School phobia also known as school refusal (Le Heuzey, 2008) is the phenomenon characterized by a complex and extreme form of anxiety about going to school. Diabetic students often suffer from school phobia or develop school phobia as consequence of lack of socialization at school or emotions of rejection by school mates (Ohki, Kishi, Orimo, & Ohkawa, 2004). It is important to point out that school phobia is not related to indolence but it is a stressed-related psychological disorder that needs to be treated.
- Educators, parents and classmates attitudes are decisive for diabetic student's development and health (Abdel Gawwad, 2008; "Students with chronic illnesses: guidance for families, schools, and students", 2003). Teacher is responsible for informing and controlling harmonic co-existence of non-diabetic and diabetic students and promoting relationships among students (Nakamura et al., 1997). Parents in the context of school life should interact with educators on a regular basis and support their child in achieving a productive, pleasant and safe school life.

EXERCISE FOR DIABETIC STUDENTS

Attitudes in physical education for diabetic students

Although DMT1 historically has been more common in patients with an age ranging from 8 to 19 years, DMT2 diabetes is also emerging as an important disease in this group. DMT2 diabetes accounts for 8-45% of childhood diabetes in different countries (Peterson et al., 2007). The goal of physical education at school context is to develop physically educated individuals who have the knowledge, skills and con-

fidence to enjoy a lifetime of healthful physical activity (Fairclough & Stratton, 2005; Haywood, 1991). Healthy lifestyle habits, including healthy eating and physical activity, can lower the risk of becoming obese and developing related diseases (Daniels et al., 2005). This general goal of physical education is even more critical for the quality of life and health of students with chronic diseases such as diabetes. School-based physical education has many benefits, including increasing physical activity and improving physical fitness and muscular endurance. Increasing physical activity through physical education is a public health strategy for reducing childhood obesity. Physical education improves students' health, which improves their ability to learn. Recent studies provide intriguing evidence that students who are fit and healthy are more ready to learn. Physical education seems to be a critical contributor to physical fitness, health and academic performance. More specifically, improved fitness condition has been associated with better school attendance records at elementary school level, fewer disciplinary referrals (Carlson et al., 2008; Telford et al., 2011), and higher academic achievement at high school and university level (Aktop, 2010; Coe, Pivarnik, Womack, Reeves, & Malina, 2006; Rheault & Shafernich-Coulson, 1988; Sallis et al., 1999; Silverman, Devillier, & Ramirez, 1991; Telford et al., 2011).

Based on aforementioned evidences for the role of physical education, the advantages of physical education for diabetic students concerning both somatically, mental and psychological positive effects. Diabetic student does not faced inclusion, have an improved self-esteem, is socialized with other students during team sports and learns to controls their body energy needs. In this context, provided that medical doctor provide permission for the diabetic student for attending common physical education classes, student should be encouraged both by parents and educators to participate in physical education activities at school. In Greek public schools (Bekiari, Kokaridas, & Sakellariou, 2006; Christodoulos, Douda, Polykratis, & Tokmakidis, 2006; Digelidis & Papaioannou, 1999; Kanioglou, 2008; Koutedakis & Bouziotas, 2003), there is a tendency by students with chronic disease to avoid completely exercise. Parents and teachers are in most cases overprotective and students can easily "escape" from physical exercise courses. This attitude is completely out of the scope of physical education and supports the development of incompetent patients with low confidence and motivation for life and sports activities, whereas strengths diabetic students isolation and stigmatization.

As far as type of exercise suitable for diabetic students, diabetes management's studies support a combination of routine exercise plus team sport (Adolfsson, Nilsson, & Lindblad, 2011; Aouadi et al., 2011; Boule, Haddad, Kenny, Wells, & Sigal, 2001; Chipkin, Klugh, & Chasan-Taber, 2001; Franz, 1987; Maiorana et al., 2001; Wallberg-Henriksson, Rincon, & Zierath, 1998):

- *Routine Exercise*: Exercise improves insulin sensitivity; the duration and intensity of exercise will influence blood glucose levels. This may result in a decreased requirement for insulin and/or an increased potential of hypoglycemic episodes. To avoid this, the student may need to eat an additional snack before exercising. If a student has symptoms of low blood glucose or will be participating in more than 40-45 minutes of physical activity, blood glucose levels should be checked before exercising. Glucose monitoring equipment should be available at the activity site (Aouadi et al., 2011; Giannini, de Giorgis, Mohn, & Chiarelli, 2007).
- *Team Sports*: Team sports should be encouraged especially when students express themselves an interest. Student, parents and doctor will provide the guidance necessary to accommodate full participation. The absolute requirement for participating in team sports is monitoring supplies and snacks available at the site of the activity and staff trained regarding their use. Most students old enough to participate in school sports are able to monitor their own blood and to adjust their snacks accordingly (Aouadi et al., 2011; Giannini et al., 2007).

For aerobic exercise, walking, cycling, and swimming are well tolerated by most diabetic patients. These activities should ideally be included in diabetic students exercise program. However, most schools at Greece do not support extended sport facilities, but still aerobic exercise can take place. Aerobic training should gradually be increased in duration to last for 30–45 minutes to reach energy expenditure recommendations and heart rate has been suggested to reach of 55–79% of maximum.

As far as discrimination of DMT1 versus DMT2 diabetic students is concerned during physical education training (De Feo et al., 2006; Robertson, Adolfsson, Scheiner, Hanas, & Riddell, 2009), physical educator should take into consideration the fact that students with DMT2 should participate fully in physical education classes and team sports since they have to handle with obesity and cardiovascular problems. Students with DMT1 will make adjustments in

their insulin and food intake, in order to maintain blood glucose levels within their target ranges during exercise, and prevent hypoglycemia. These students have to check their blood glucose levels more frequently while engaging in physical activity. Physical educators must be able to recognize and assist with the treatment of hypoglycemia. A quick-acting source of glucose and the student's glucose meter should always be available, along with water (De Feo et al., 2006).

The role of PE teacher

Physical exercise is important for individual's health and well-being, but it's especially beneficial for diabetic students. In order to improve overall fitness, diabetic students should participate regularly in physical exercise courses which help in the direction of glycemic control. Diabetic students can play and succeed at sports just like their non-diabetic peers. However, diabetic students and their educators must be careful about when, how long, and how intensely they exercise, and they must take steps to avoid hypoglycemia during or after the activity, including monitoring glucose both before and after exercise, always having glucose tablets or a high-energy snack on hand for unexpected lows, and drinking extra water to prevent dehydration. Students with DMT1 must coordinate exercise with diet and insulin therapy, making adjustments in insulin dosing or snacking. It is essential also to keep a record of exercise and physical reactions is important, because each person has his or her own unique response to exercise that can be observed through weekly treatment adjustments, and because different types of exercise have different effects on blood glucose. In this issue the support of physical educator is critical, since can provide student with record forms, design special exercise program for diabetic student when necessary, encourage and help student with keeping exercise reports.

Overall, a successful physical educator must taking into consideration the following issues (De Feo et al., 2006; Gallivan & Greenberg, 2003; Kollipara & Warren-Boulton, 2004; Marschilok, 2008):

- Encourage exercise and participation in physical activities and sports for diabetic students as they would for other students.
- Treat the student with diabetes the same as other students, except in meeting his or her medical needs.
- Respect the diabetic student's right to privacy and confidentiality.

- Make sure blood glucose monitoring equipment is available at all activity sites, and encourage the student to keep personal supplies readily accessible.
- Allow and encourage the student to check blood glucose levels.
- Understand and be aware that hypoglycemia can occur during and after physical activity and that a change in the student's behavior could be a symptom of blood glucose changes.
- Recognize and respond to the signs of hypoglycemia and hyperglycemia and take initial actions.
- Treat hypoglycemia, provide the student with immediate access to a fast-acting form of glucose.
- Communicate with the medical doctors and parents for any observations or concerns about the student

CONCLUSIONS

Physical education is an essential component of both school practice and healthy lifestyle. Furthermore, physical exercise is essential for the medical management of diabetes and for preventing the development of diabetes. Benefits of exercise for diabetic students include glycemic control, blood pressure reduction and improved cardiovascular system condition. Despite the preponderance of evidence of the benefits for exercise in diabetic students, there is still a lack of participation among diabetic students in school sport activities as well as limited information among teachers, non-diabetic students, parents and society in Greek public schools. No special educational programs are available and efficient handling of diabetic students is a personal successful story for each physical educator. The role of physical educator in dealing with diabetic students is multifactorial and concerns coordination and interactions with diabetic students, non-diabetic students, parents, doctors, and other school teachers and employees. The ultimate goal of physical educator in the context of diabetic students management is to encourage them in order to regularly participate in school sport activities and facilitate their rehabilitation among non-diabetic classmates and on long term basis educate diabetic students as to responsibly take care of their health, organize their own fitness activities and enjoying benefits from exercise on their life and health quality.

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Correspondence to:

Anthi Peppas, MSc

41 Ethnikis Antistasis

17237 Athens

Greece

e-mail: anthi.peppas@googlemail.com

Phone: