Lifestyle of patients with diabetes mellitus type 1: a systematic review

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Abstract *The aim of this review was to verify data concerning the relationship between the existent lifestyle and glycemic control in patients with Diabetes Mellitus Type 1 (DM1). The methods applied included the literature search strategy, selection of studies by means of inclusion and exclusion strategies, according to the characteristics of the studies. The search was conducted in the Lilacs, Medline, PubMed, Cochrame, SciELO and IBECS databases between in the period between 2005 and 2014. The articles selected were studies in humans, investing lifestyle, physical activities and glycemic levels. Of the 1798 studies initially identified, 11 met the eligibility criteria. Among the studies analyzed, 1 cohort; 1 longitudinal prospective, 1 case control and 8 transversal studies that approached the proposed theme were related. Regular physical activity was the variable that presented greatest relationship with the improvement in glycemic levels. Healthy active life, balanced diet, physical activities and education in diabetes improved the glycemic control of the DM1 patient. The results allowed the authors to conclude that a lifestyle based on physical activities interfered directly in the health of patients with DM1, in addition to contributing the glycemic control.*

Key words *Diabetes Mellitus Type 1, Lifestyle, Physical activity, Psychological aspects, Socioeconomic conditions*

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Introduction

Diabetes Mellitus Type 1 (DM1), present in 5 to 10% of the cases of diabetes, results from the destruction of pancreatic beta cells, consequently leading to insulin deficiency. The main immunological markers of pancreatic compromise are the anti-islet, anti-insulin and anti-glutamic acid decarboxylase (GAD) antibody levels present in 90% of patients at the time of diagnosis[1]. Diabetes type 1 habitually occurs in children and adolescents, however, it may also manifest in adults, generally in a more insidious manner. Patients with this type of diabetes necessarily depend on insulin administration[2]. The main goal of treatment is to prevent the appearance or progression of chronic complications, such as microvascular (diabetic retinopathy, nephropathy and neuropathy) and macrovascular (cerebral vascular accident and peripheral arterial disease) complications, simultaneously minimizing the risks of acute complications such as severe hypoglycemia[3].

Lifestyle is an important determinant of glycemic control in diabetic type 1 and 2 patients. The treatment of DM1 interferes in the lifestyle, is complicated, painful, depends on self-discipline and is essential to the patient's survival[4]. The therapeutic approach involves various levels of action, such as insulin therapy, dietary guidance, acquisition of knowledge bout the disease, the ability to self-apply insulin, and self-monitoring of glycemia, maintenance of regular physical activity and psychosocial support[5].

Due to the many beneficial effects, regular physical activity is indicated for patients with DM1, because it improves metabolic control and diminishes cardiovascular risk, in addition to adding an important effect on preventing the chronic complications of this pathology[6]. Nevertheless, individuals with DM1 do not follow the recommendation of practicing physical activity for a minimum period of 30 minutes, five times per week, or aerobic physical activity of vigorous intensity for a minimum period of 20 minutes on three days each week[7]. This fact would favor the continuity of an active lifestyle throughout life.

In DM1, the important of following a balanced diet, adopting knowledge about the correct consumption of carbohydrates, proteins and fats. Observation of the quantities and qualities required of each food group enables glycemic control and prevention of complications; and adhesion to treatment is the key to attaining the objectives desired[8].

Since diabetes demands intense control to prevent complication, the emotional aspect will have significant influence on this control, bearing in mind that this pathology is capable of causing various negative feelings. Thus, group or individual psychological follow-up is frequently necessary to improve the quality of life[9].

The aim of this systematic review was to relate the outcomes lifestyle, physical activity, psychological aspects and socioeconomic conditions in individuals with DM1. The second objective was to relate the lifestyle to glycemic control.

Methodology

The question posed for conducting this systematic review was to determine whether the DM1 patient was subject to influences of the outcomes lifestyle, physical activity, and socioeconomic conditions.

Search Strategy

A systematic review of the literature was conducted in the second semester of 2014, covering a wide range of findings of a search conducted in the following databases: Lilacs, Medline, PubMed, Cochrame, SciELO and IBECS . Selection of the descriptors used in the review process was carried out through consulting the DeCS (Health Sciences Descriptors of the structured and trilingual thesaurus created by Bireme). The authors resorted to the logical operators "AND", "OR" and "AND NOT" for combination of the descriptors and terms used for tracing the publications.

Published articles were sought based on the descriptors Diabetes Mellitus Type 1, Lifestyle, Physical Activity, Psychological Aspects and Socioeconomic Conditions, written in the English, Portuguese and Spanish languages, comprising articles published in the last five years, from January 2010 to October 2014, because the recent literature embraces the topic in a more solid manner. The aim of this review was to include the recent body of evidence from psychosocial and economic researches in individuals with DM1. Recent researches have approached the modern lifestyle in general health[10].

The databases were searched with the following search key words: "DM1" [MESH], and "lifestyle" [MESH] and "physical activity" [MESH] in the PubMed database; and "DM1" [DESC], "estilo de vida"[DESC], "atividade física" [DESC],"aspectos psicológicos" [DESC] and

"condições sócio econômicas" [DESC] in the Lilacs and e SciELO databases. In the Pubmed database, the following search strategy was performed: in the research field the terms were inserted according to MESH] "DM1" AND "lifestyle" AND "physical activity", with a search filter considering articles published in the last 5 years, in addition to the filter for languages, considering articles in English, Spanish and Portuguese.

Inclusion and exclusion criteria

By means of this procedure, 1798 potentially eligible articles were initially identified for inclusion in this review. After this, the authors identified the articles that met the following inclusion criteria: a) articles published between 2010 and 2014, b) research articles with human beings, c) English, Spanish and Portuguese languages; d) all the published studies involving any of the outcomes, lifestyle, physical activity, psychological aspects and socioeconomic conditions, specifically for patients with DM1. Duplicated and review articles were excluded.

Data Extraction

After the first analysis, with evaluation of the titles, 66 articles (PubMed = 29 Medline = 31 Cochrane = 6) were considered eligible for the second stage of this review that consisted of reading the abstracts. After evaluating the abstracts, the studies that appeared to meet the inclusion criteria were read in full. One reviewer extracted the data and the other verified the results. Two reviewers evaluated the quality and strength of evidence. On concluding the evaluation, 11 articles met all the inclusion criteria (Figura 1).

In the category characteristic of the sample, the participants of the study and demography were inserted, as well as the instruments of evaluation used to measure the outcomes analyzed. In the category detail of methods, the methods used in each study and statistical analysis chosen were inserted. In the last category, detail of the results, the main results and conclusions of each study were described (Chart 1).

Results

The Chart 1, after the references, present general information about the 11 studies included. One article used the Case Control design[11], one used a cohort study[12], one, the Prospective design[13] and the remainder were cross-sectional studies[14-20].

The composition of samples varied as regards age-range, with four articles including children[11,16-18]; two articles included the children's guardians[18,20] and others also included adolescents and adults.

Four studies were conducted in the United States[12,18,19]; two in Sweden[11,15]; and the others in India[13]; Canada[14]; Italy[16]; Germany[17], and Brazil[20].

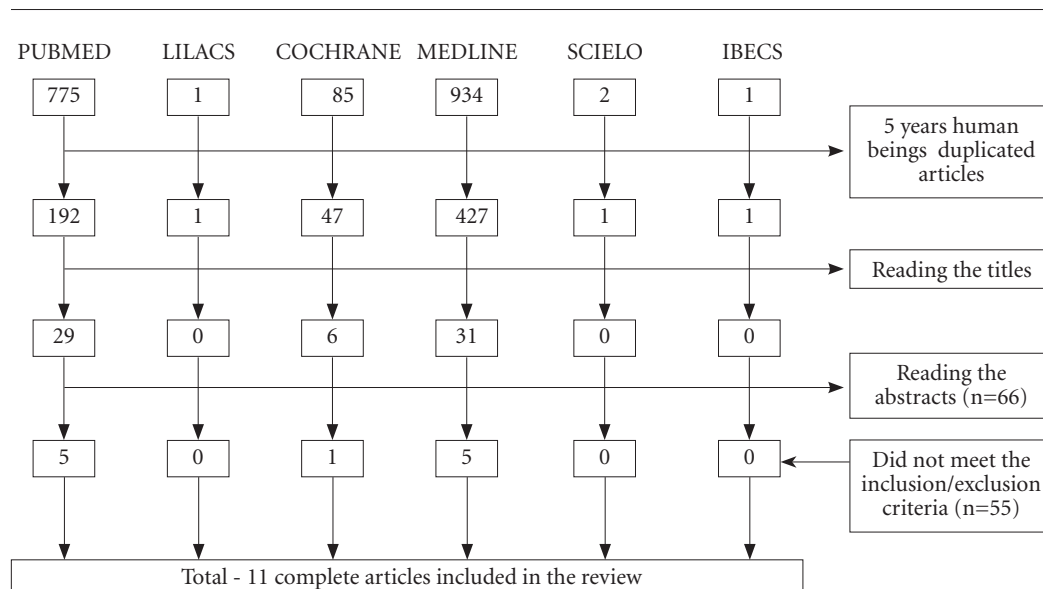| PUBMED	LILACS	COCHRANE	MEDLINE	SCIELO	IBECS	
775	1	85	934	2	1	5 years human beings duplicated articles
192	1	47	427	1	1	Reading the titles
29	0	6	31	0	0	Reading the abstracts (n=66)
5	0	1	5	0	0	Did not meet the inclusion/exclusion criteria (n=55)
Total - 11 complete articles included in the review						

Figure 1. Flow diagram of selection of articles and databases.

Chart 1. Criteria for selection of articles.

Impact Factor	Study Design	Country Sample size	Age Group	Inclusion and Exclusion Factors	Methods	Results	Conclusions
Reference: Brazeau et al.[14], 2012							
A2	A Cross Sectional Study	Canada GDM1 = 75 GC = 75	> 18 years	*Inclusion:* DM1 + 6 months after diagnosis > 18 years And capable of using the ergometric bicycle *Exclusion:* chronic complications of diabetes	* Use of movement sensor * Cardiorespiratory aptness test * Evaluation (BMI and RCO?/ lean and fat mass measurements) * Evaluation of presence of diabetes, HbAc1, lipid profile and AP.	- Body composition did not differ between the studied groups. - Active lifestyle, leads to better body composition in patients with or without diabetes.	- Body Composition obtained a better level with an active lifestyle profile in the two groups.
Reference: Bishop et al.[12], 2014							
B4	Cohort Study	U.S.A. Men GDM1=211 GC= 67	from 12 to 19 years	*Inclusion:* DM1 with 5 years of diagnosis; patients treated at the Barbara Davis Center for Childhood Diabetes *Exclusion:* Brother with DM1 for control; patients with diabetes that was not DM1.	* Questionnaire of daily diet and time spent in front of the television; * Physical activity and anthropometric data * Guidance on diet and physical exercise * Follow-up of 4 years	Increase in consumption of vegetables, fruits and physical activities; increase in consumption of fried foods and breakfast.	Some improvements in diet and physical activity in both groups. Adolescence is a period of changes in behavior.
Reference: Melin et al.[15], 2013							
A2	A Cross Sectional Study	Sweden DM1=292 (male and female)	18 to 59 years	*Inclusion:* age 18 to 59 years and diagnosis of diabetes of more than 1 year *Exclusion:* severe somatic comorbidities, severe mental disturbance, little knowledge of the Swedish language.	* Depression and Anxiety Scale and Toronto Alexithymia Scale. * Anthropometric and clinical data.	- Depression, mainly in women, and of importance for control of the glycemic level, as well as obesity and smoking - Alexithymia was associated with depression.	Psychological factors were related to glycemic control. Greater care taken in patients with depression and Alexithymia, so that they could obtain better glycemic control.

Chart 1. continuation

Impact Factor	Study Design	Country Sample size	Age Group	Inclusion and Exclusion Factors	Methods	Results	Conclusions
Reference: Singhal et al.[13], 2011							
	Prospective Study	India DM1=56 (31 men and 25 women) CG=50 (30 men and 20 women)	15 to 17 years	NT	Interventions: Lectures about health; Questionnaires; Individual guidance for parents and teachers; Promotion of physical activity; Change in canteen menu; sustainability program at school.	- After six months, there was improvement in beta cell function; - Reduction in ultra sensitive C-reactive protein levels; - Significant reduction in abdominal circumference.	Used the same type of intervention to prevent DM1, improving insulin resistance and prevention of DM2.
Reference: Fainardi et al.[16], 2011							
	A Cross Sectional Study	Italy DM1=129 GC = 214	School-going age	NT	Questionnaires (via telephone) about physical activity, clinical data and sedentary lifestyle.	Diabetic children Had the same intensity of physical activity; more involved in group sports; consumed less food when watching TV or immediately after physical activity.	The largest portion of children with DM1 practiced physical activity such as GC and considered it entertainment and not medical obligation.
Reference: Galler et al.[10], 2011							
A1	A Cross Sectional Study	Germany DM1= 296 (children, adolescents and young adults)	< 22 years	NT	*Anthropometric data (BMI) * Clinical data HbA1c * Self-report Questionnaires (German Health Interview and Examination Survey). * Winkler index for evaluating socioeconomic level.	- Multiple regression identified that the time of diabetes, socioeconomic level and hours spend on the media per day has a linear relationship with the levels of HBa1c. Are risk factors for metabolic control	The socioeconomic level and daily times spent on media activity are important for increasing HbA1c. No relationship with physical activity was found.

Chart 1. continuation

Impact Factor	Study Design	Country Sample size	Age Group	Inclusion and Exclusion Factors	Methods	Results	Conclusions
Reference: Haskell et al.[7], 2007							
	A Cross Sectional Study	U.S.A. DM1=349	9 to 17 years	*Inclusion:* diagnosis of DM1 of at least 6 months *Exclusion:* Having another chronic disease	Two stages: 1- 200 individuals were evaluated with regard to memory, learning ability and management of the disease. 2- 149 individuals were provided with guidance to prevent worsening of care taken of diabetes.	Ethnical differences in the levels of HbA1 and in taking care of the disease. Among the sociodemographic factors, multivariate analysis identified the socioeconomic condition best explained the differences.	Education for diabetes must also include the parents of diabetics within its scope, providing guidance about: healthy lifestyle, control of glycemic level and socioeconomic class.
Reference: Tsai et al.[18], 2010							
B1	A Cross Sectional Study	U.S.A. 430,912 from 50 States and all the territories of the United States.	>18 years	NT	Questionnaire fore self-report of health (SRH) in the area of physical activity, health and medical history.	- Was excellent in DM1 (53.3%), DM2 (52.2%) and 86.2% without DM. - The more active the individuals were, the higher was the SRH index.	Guidance on incorporating physical activity into the lifestyle; Promote means to achieve improvement in health and well-being of the population.
Reference: Schwarz et al.[19], 2010							
B1	A Cross Sectional Study	U.S.A. DM1=89	13 to 19 years	*Exclusion:* individuals could not be pregnant, and unable to speak English. Present mental retardation or DM1 for less than 1 year.	Questionnaires for evaluation about sexuality, prejudice, preconception, preconcepção, contraceptives and pregnancy; evaluate the relationship with their doctors and freedom to request birth control.	- 50% had sexual relations without contraception. - Half the patients had not discussed birth control. - Two thirds of them felt comfortable in talking to health professionals about this topic.	Adolescents with diabetes felt ashamed about seeking guidance from professionals about birth control. Educators in diabetes must also provide them with guidance on this aspect.

Chart 1. continuation

Impact Factor	Study Design	Country Sample size	Age Group	Inclusion and Exclusion Factors	Methods	Results	Conclusions
Reference: Malerbi et al.[20], 2012							
B1	A Cross Sectional Study	Brazil DM1= 1,079 (parents of patients)	< 18 years	*Inclusion:* Have had diabetes for longer than 1 year and have been followed-up for at least 1 year.	* Multicentric Study; * 28 public clinics in 20 cities. * Questionnaires with psychosocial questions were directed toward parents, clinical record chart data from the last medical consultation. * The demographic, educational and sociodemographic profile. * The levels off HbA1c recorded.	- Complaints: discomfort and anxiety; depression, more frequently in mothers; the majority reported changes in the family after the diagnosis; complications and care-giving overloaded the parents; the more rebellious children presented higher HbA1c value; parents whose children had been hospitalized for DM1 presented more anxiety and depression.	The lifestyle of all families changed after the diagnosis of diabetes, interfering in their quality of life. The mothers were the main care-givers of children and adolescents with DM1. Difficulty in defining limits that made glycemic control difficult. Importance of the family in the DM1 patient's engagement with his/her treatment.
Reference: Sundberg et al.[11], 2012							
B1	Case Control Study	Sweden GDM1=24 GC= 26	< 7 years	*Inclusion*: < 7 years and duration of DM1 for over three months up to entry into the study. *Exclusion:* Another disease that affected the capacity to be physically active, diagnosis of diabetes known not to be type 1, insufficient knowledge of the Swedish language, and social privation.	* Evaluation of height and weight (BMI) and HbA1c. Physical activity was measured by using a movement sensor, and a heart rate sensor combined, in two time intervals during 1 year. * Self-applied questionnaire to parents about education, employment and marital status.	- The children with diabetes were considered less active. - Sedentary time was not significant in the two groups. -AP and time spent on moderate and vigorous physical activity was more prevalent in boys. Significant effect of age was observed.	Physical activity was reduced in children with DM1.

Six studies mentioned that the work was approved by an Ethics Committee, three mentioned at least one ethical aspect (that the participants gave their consent). The authors point out that they only evaluated whether the article mentioned the aspects, and these could have been met irrespective of being mentioned in the body of the article.

In 07 manuscripts the inclusion and exclusion factors were detailed[11,12,14,15,17,19,20]. With regard to the instruments used for data collection, the authors verified that only two[11,14] used the movement sensor instrument, eight used questionnaires[11-13,16-20], two related guidance about diet and exercises[12,13] and three used anthropometric data[12,15,17].

All the studies showed risk of bias. However, scientific evidence was scarce for many of the outcomes examined.

Discussion

The studies included in this review will be discussed according the the age-ranges and variables investigated. The case control study included in this review demonstrated that children under 7 years of age with DM1 were less physically active than healthy children. Girls with DM1 ran greater risk of not being physically active. Physical inactivity increased the risk of cardiovascular diseases, complications and low physical aptness, therefore activities should be proposed to increase energy spent by children with DM1[11]. Different results were presented in a research conducted in Italy, in which diabetic children of school-going age were more involved in sports and performed physical activity as a good pastime and not as a medical obligation[16]. The authors verified that the socioeconomic level and time spent on media activity made glycemic control difficult, increasing the metabolic risk[17]. The importance of the degree of physical activity in DM1 treatment may increase sensitization to this problem. Therefore, strategies that aim to stimulate parents, care-givers and day-care centers to encourage these children to increase their need for physical activities must be elaborated in health care programs.

Adolescents with DM1, aged between 12 and 19 years, were followed-up in a cohort study for a period of 4 years, to verify the physical activities performed, time spent in front of the TV, and daily diet. The adolescents were given instructions with reference to diet and practicing phys-

ical exercises. The adolescents showed some improvements,such as increase in the consumption of vegetables and fruits, and physical activities. However, they reported increased consumption of fried foods, showing that adolescence is the stage of life when changes occur in behavior and eating habits[12].

In a prospective study involving youngsters aged between 15 and 17 years, strategies were applied involving individual guidance, promotion of physical activities, change in the canteen menu, guidance provided to parents and teachers, and formation of voluntary student groups to foster sustainability of the program at the school. After six months of study, improvements were identified in beta cell function, improving insulin resistance and prevention of DM2, in addition to reduction in the C-reactive protein levels and significant reduction in abdominal circumference[13].

When considering the importance of lifestyle throughout the life of individuals, one of the important strategies to be applied is health education about DM1, which should comprise not only the patients involved, but also the parents of diabetics, providing them with guidance about a healthy lifestyle and how to improve control of the glycemic level[18]. Since mothers are the main care-givers of children and adolescents with DM1, they should be made aware of the risks of poor glycemic control, so that there will be no difficulty with defining limits for children and adolescents with DM1. In addition to acting on the lifestyle of all families, especially after the diagnosis of diabetes in a family member, this interfered favorably in their quality of life[20].

Another important aspect found in this review were studies that identified psychological factors related to poor glycemic control, such as depression and Alexithymia, particularly in diabetic women[15], who felt ashamed about asking professionals for guidance about birth control, since they mistakenly believed that these methods were less effective in diabetic women[19].

The multidisciplinary team, by means of educating diabetic patients may provide them with a better quality of life, by guiding them with regard to the composition of a healthy diet and incorporation of physical activity into a adequate lifestyle[18-20]. In the same way, cities must provide means for this education, thereby improving the health and well-being of the population[19].

The purpose of the investigation conducted by Haskell et al.[7] was to identify the management and prevention of DM1, and was divided into

two stages. In the first stage, the cited authors identified memory, learning skill and management of DM1. Whereas in the second stage, they related methods for preventing the worsening of care taken with DM1. In the mutivariate analysis, the confirmed the ethnical differences in the levels of HbA1 and in taking care of the disease. However, the sociodemographic factors showed that these factors would be better explained by the socioeconomic status. The care taken of diabetes must include the parents of diabetics, pointing out the importance of a healthy lifestyle and how to improve control of the glycemic level, particularly taking into consideration their socioeconomic status. Reinforcing and complementing these findings, another study identified that the time of diabetes, socioeconomic level and hours spend on the media per day had a linear relationship with the levels of HBa1c[7]. That is to say, they are risk factors for inadequate metabolic control. On the other hand, the studies of Haskell et al.[7], found no association with physical activity. When diabetic children were compared with the controls, they showed the same intensity of physical activity, however, they were more involved in group sports, like to practice these activities as a good pastime and opportunity of making new friends during these activities. The children with diabetes appeared to ingest more food when they watched television, or immediately after physical activity. The largest portion of children with DM1 practiced physical activity in the same way those who were non-diabetic, and considered it entertainment and not a medical obligation[16].

The research of Schwarz et al.[19], with American adolescents with DM1, over the age of 18 years, demonstrated that half the sexually active adolescents engaged in sexual relationships without taking any care to use a birth control method. Among the reports found, there was emphasis on the few birth control options existent for diabetics, and others mistakenly believed that the birth control methods were less effective in women with DM1. Around half of the patients had not discussed birth control with their doctors, and a third of them had not received any instruction about the topic. The finding causing most concern was that only two thirds of these patients felt comfortable in talking to health professionals about birth control. Many adolescent women with DM1 presented risk for undesired pregnan-cy, and did not feel comfortable about asking the health professional about birth control[19]. Educators who work with groups of patients with diabetes must initiate preconception counseling in puberty and discuss the options of contraception with adolescent women with diabetes, which may improve the results of pregnancy. The inclusion of young women with DM1 in health care networks for chronic nontransmittable diseases as early as possible may improve their present and future performance, and frequently reduce the need for using health care services at higher levels of complexity.

The present systematic review points out the importance of elaborating health programs with focus on physical activities for individuals with DM1 that may offer benefit for glycemic control. Programs for Web-based or Telehealth-based lifestyle intervention must be elaborated for use by DM1 patients. Long-duration future studies must be conducted to better elucidate the relationship between lifestyle and Diabetes Type 1.

Conclusion

The present systematic review allowed the authors to conclude that lifestyle based on physical activities directly interferes in the health of patients with DM1, in addition to contributing to glycemic control. Health promotion in DM1 must be based on regular physical activities, specific guidance with regard to human sexuality, and practices for reducing daily stress, As well as providing guidance about the risks of anxiety and depression disturbances, to improve the lifestyle and control the glycemic level.

Collaborations

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