Games for Diabetes Control

Subjects: Nursing

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Finding methods to improve people's diabetes control and management is important to prevent its complications and maintain the quality of life. The aim of this review was to assess the effect of games on the blood glucose level (glycated hemoglobin (HbA1c)). A systematic review and meta-analysis were made. Pubmed, Scopus, and CINAHL databases were consulted in July of 2020. Ten studies were selected as a final sample, most of them being clinical trials using games to improve diabetes control. Half of the studies had samples between 8 and 14.9 years old and the other half between 57 and 65 years old. The studies informed about using applications/games for mobile phones, game consoles, and board games for diabetes education and management. The meta-analysis was performed with 4 studies showing a mean difference of 0.12 (CI 95% 0.57, 0.33) of HbA1c in favor of the intervention group with $p > 0.05$. Games are positive for diabetes health education and promoting healthier lifestyle, but their impact on HbA1c is low.

diabetes mellitus | disease management | games | gamification | glycated hemoglobin A | meta-analysis | smartphone | systematic review

1. Introduction

Diabetes Mellitus (DM) is an endocrine disease, with a certain hereditary component, characterized by an increase in blood glucose. It can be classified into type 1 (DM1) or insulin-dependent diabetes, type 2 (DM2) or non-insulin-dependent diabetes mellitus, and others less frequent such as gestational diabetes and sub-categories of DM1 like Latent Autoimmune Diabetes in Adults (LADA) and Maturity Onset Diabetes of Youth (MODY) [1][2].

DM1 is characterized by autoimmune B-cell destruction, which generally leads to absolute insulin deficiency, and it usually occurs in children or young adults. The characteristic symptoms are: polyuria, polydipsia, and, approximately a third, present diabetic ketoacidosis. In DM1, there are no factors that can be prevented, but fluctuations in blood glucose must also be controlled to avoid hyperglycemia and hypoglycemia. A good control of blood glucose will improve the quality of life and will avoid secondary pathologies [3].

On the other hand, DM2 is a chronic disease characterized by an increase in blood glucose. This is due to a relative insulin deficiency caused by pancreatic β-cell dysfunction and insulin resistance in target organs [3][4]. In DM2, there are risk factors that influence its development and evolution such as overweight, sugar consumption, or

sedentary life [5]. For example, being overweight or obese can cause some degree of insulin resistance, which is present in many people with diabetes in their adulthood [6].

Glucose level control is essential to decrease the risk of diabetes microvascular and macrovascular complications . According to recent data, 75% of DM2 cases develop in low and middle-income countries, and total global health spending due to diabetes is estimated at 673 billion dollars [7]. Furthermore, according to the “World Diabetes Report”, this situation is increasing, with approximately 415 millions of people with diabetes in 2015 and an estimated 642 million people by 2040 [7].

DM2 and its complications can be prevented by performing physical activity regularly, following a healthy diet, and avoiding tobacco and alcohol, and controlling parameters such as blood pressure and cholesterol [8]. Thus, a non-pharmacological approach with healthy habits is essential to improve blood glucose levels, which are reflected in the glycated hemoglobin (HbA1c) values [9]. HbA1c is a very reliable measure that averages blood glucose over the past three months [10][11]. Finally, in those cases for which it is necessary, the inclusion of pharmacological treatment with oral antidiabetics and subcutaneous insulin will be chosen [12].

Glucose level control is managed by each person who needs health education and tools like glucometers, smartphone applications, or an insulin pump. Taking this into account, and all the variables that play an important role in diabetes control, it is important to treat people with diabetes from a multidisciplinary view (to improve all the necessary aspects for the control of the disease such as nutrition, treatments, health education, motivation, etc.) and using technology to help. People with diabetes, with the help of new technologies, can significantly improve their HbA1c levels [13][14]. Games and gamification (application of game elements and its dynamics in non-game environments) can be a good instrument for health education and management of chronic diseases, since it is motivating and fun and consequently, more efficient for the learning process and the management of the disease [15][16][17]. The use of games, although their engagement seems to be short-term, is a strong promise for diabetes education and management, but it is necessary to perform more research to clarify its real impact [17][18].

Thus, taking into account the positive influence of games and gamification on behavioral changes related to health and healthy lifestyles [17][19], and the positive influence of these on diseases control and management, the aim of this study was to analyze the effect of games and gamification on the levels of glycated hemoglobin (HbA1c) in people with diabetes.

2. Discussion

The use of game and gamification processes reduces HbA1c level, but it does not show significant differences with the control group. Mobile applications linked to games and gamification processes with educational health content are an advance for people with diabetes, but their use does not make an effective difference with other usual interventions. In the case of DM1, when debuting at an early age, an effective method of communication and transmission of knowledge is by playing [20]. This can help to learn the administration of subcutaneous insulin to

children [21] and other things like proper nutrition [22]. Although it seems that the games are more oriented to children and adolescents, there are also games for adults that are effective [23].

Even though various studies demonstrate the effectiveness of using games through mobile applications for health education in people with diabetes [24][25], some authors said that technology can be a barrier for some populations [26]. Research in this field should continue to advance in order to make the use of mobile applications easier and more practical [27], since, in some cases, patients may not learn the basic concepts needed for good self-control of the disease [28]. Moreover, health professional training is required to recommend and apply these technologies, knowing that they are safe and reliable [29]. The use of innovative therapies such as the use of games in people with diabetes is a very useful tool in clinical practice [30] for problems' solutions, since it improves adherence and minimizes complications [31].

In addition, the use of games in mobile applications has recently been implemented. These facilitate access to people with diabetes and are an educational tool that can improve HbA1c levels [32]. Health education provides many benefits to patients [33]. Nonetheless, it is true that it requires a responsibility on the part of the patients [34] and that a standardization and simplification of the different applications is necessary, since there is a decrease in communication with health professionals [35].

Making a person adhere to the recommendations and treatments that professionals give is not easy. It has been observed that patients follow medical prescriptions better if they understand the treatment. Several authors affirm that the integration of technology-based exercise programs can have a positive effect on the adherence of the diabetic patient, since they produce an increase in enjoyment and make it easier to perform these programs [36][37]. Patients think that everything is important and these applications help them make decisions [38]. The use of these methods encourages the user to carry out physical activity, producing favorable results in the medium–long term and leading to an improvement in balance or flexibility [39] as well as an improvement at a psychological level, reducing the levels of depression [40][41]. However, there are authors who state that practicing physical exercise through the use of electronic applications or games only produces psychological benefits and does not improve adherence [42]. Likewise, other authors say that they do not observe this type of benefits, and affirm that adherence is greater when performed outdoors [43]. In turn, some authors claim that these methods are beneficial for exercising continuously from home. Decreasing barriers such as displacement, the weather, or going to activities where there are many people, can generate some insecurity in some people and this option solves this problem [44].

The study has some limitations. Although the number of games and gamification processes for diabetes is growing, the number of studies analyzing its effect on HbA1c is low. Most of the studies come from the USA and all of them are from the Western countries, so the results should be taken into account with caution in countries with different culture and life style. Future research should analyze which factors promote the attractiveness of a game to create more enjoyable and desirable games. Additionally, in clinical practice, the implementation of the games with better results would be of interest for long term follow-up studies. Finally, the use of behavioral sciences [45] to identify the

key information for the design and development of games for diabetes would be of interest for developing better games.

3. Conclusions

Games and gamification processes are beneficial for education in people with diabetes and to promote adherence to healthy lifestyle habits. However, their impact on glycated hemoglobin (HbA1c) does not appear to be clinically relevant. It is necessary to investigate into this area to find the mechanism to create more effective games for diabetes management and glycemic control.

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