



Learning healthy lifestyles through active videogames, motor games and the gamification of educational activities



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ABSTRACT

The World Health Organization (WHO) has declared obesity as a 21st-century epidemic after reaching global proportions. In Spain, this disease is suffered by 62% of the population, leading to the emergence of new health problems. Increasing childhood obesity in the world is a direct result of changes in the lifestyles of the population. Therefore, in this paper we present a gamification training program to prevent childhood obesity based on motor games, and active videogames developed for overweight children ages 8–12. The design of the program consisted of: group sessions in a school setting, individual sessions at home for the children, and developing healthy habits to help families. The motivation and the effectiveness of the gamification training program were studied. The results involving biometric variables, learning healthy habits and experience in the intervention were highly satisfactory.

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1. Introduction

In 2004, the WHO declared obesity as a 21st-century epidemic as it reached global proportions, although as early as 1998, the WHO had already spoken about obesity as an emergent health problem in its global report (World Gastroenterology Organization (WGO), 2011; World Health Organization (WHO), 2004). This epidemic mainly affects developed and developing countries, although it is no longer exclusive to high-income countries as it begins to be present in poor countries, in all age ranges from childhood to adulthood. In Spain, 62% of the population suffers from this disease, according to the Study of Nutrition and Cardiovascular Risk in Spain, ENRICA (2009–2011) (Spanish Society for the Study of Obesity (SEEDO), 2013).

The importance of this disease lies in the serious health problems associated with overweight and obesity. It is the fifth leading risk factor for death in the world, causing nearly three million deaths a year. It is responsible for nearly 58% of diabetes and 21% of ischemic heart disease cases, and between 8% and 42% of some cancers, and these risks grow in proportion to the increase in body weight (Spanish Agency for Food Safety, 2005; WGO, 2011; WHO, 2014).

Obesity has been increasing steadily over recent decades, and obesity in the pediatric population has become one of the most serious public health problems. It is estimated that about 42 million children under five were overweight or obese in 2010, 35 million of whom live in developing countries (Ezzati & Riboli, 2013; Spanish Agency for Food Safety, 2005; WHO, 2014.)

Obesity is defined as “abnormal or excessive fat accumulation in the body that harms health”.

Childhood obesity has a complex and multifactorial etiology that stems from multiple genetic factors and the environment (WHO, 2003). And although there is some genetic predisposition, obese is mainly the result of an imbalance between energy

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consumption and expenditure over a sustained period of time. This is confirmed by the low proportion of patients diagnosed with obesity because of genetic or hormonal disorders. Risk factors that have been shown to influence the development and maintenance of obesity, such as parental obesity, low education and socioeconomic status of parents, insufficient sleep, high birth weight, or exclusive artificial breastfeeding also play an important role (González Jiménez et al., 2012; Klünder-Klünder, Cruz, Medina-Bravo, & Flores-Huerta, 2011).

This increase in the amount of childhood obesity around the world is a direct consequence of lifestyle changes and of the social and labor development that most populations have endured. Traditional foods like fruits, vegetables, legumes and fish have been replaced with foods richer in calories, fats, and sugars, as part of a diet that is now based on pastries (food industry), snacks and salt. Little or no physical activity is carried out due to a higher level of urbanization and mechanization, the development of transport systems, changes in social and health policies, urban planning schemes that leave little room for green zones and the long time spent by schoolchildren engaging in sedentary leisure activities at the computer or TV (Cussó Segura & Garrabou Segura, 2007; Spanish Agency for Food Safety and Nutrition, 2008).

In Spain, changes in lifestyle and the development of the National Health System, among other factors, led to the emergence of new health problems; thus, non-communicable diseases such as obesity replaced infectious diseases. In the Canary Islands this phenomenon is due to the economic development that occurred with tourism and migration from the countryside to the big cities, which ultimately led to a change in eating habits, and to the replacement of traditional foods with those rich in fat (SEEDO, 2013).

The easiest way to calculate excess body fat is through the body mass index (BMI), a simple indicator of the relationship between weight and height that is used to identify overweight and obesity in adults using the following formula: weight (in kilograms) divided by the square of the height of the individual (in meters). It is easy to use, inexpensive, and noninvasive. Thus, the WHO and the International Obesity Task Force (IOTF), which is based on Western lifestyles, establish a cutoff point in adults of 25 kg/m² to define overweight and 30 kg/m² for obesity. This measure is intended for international use (Martínez Costa & Pedrón Giner, 2002; WHO, 2014).

And although in the case of adults this is a good way to diagnose overweight, the normal amount of fat in the pediatric population varies by sex and stage of growth. To address this problem, certain graphs are used to show how a child should grow in optimal conditions. In Spain the most widespread graphs are the 1998 and 2004 growth curves and tables from the Faustino Orbegozo Foundation's Research Institute for Growth and Development, which establish overweight in P90 and childhood obesity in P97. Also used are the tables from a more recent study by Carrascosa et al., as these have been designed specifically for our child population (Martínez Costa & Pedrón Giner, 2002; Working Group of the CPG for Prevention and Treatment of Childhood and Adolescent Obesity, 2009).

The Spanish Society for the Study of Obesity (SEEDO) confirms that 44.5% of Spanish children are overweight. This means that almost one in two children is overweight relative to the growth patterns established by the WHO. In Europe, only Italy and Cyprus exceed these numbers according to the IDEFICS study (Identification and Prevention of Dietary and Lifestyle-Induced Health Effects In Children and infants), which aimed to assess the risks of overweight and obesity in children and its long-term consequences throughout the European Union.

A comparison of the results of recent epidemiological studies in Spain (the Paidós study (1984), the EnKid study (1998–2000), the 2006 and 2011–2012 National Health Surveys and the Aladino study (2011)) highlight the increasing BMI of children, and therefore the increasing prevalence of childhood obesity in Spain since the 80s, especially in the autonomous community of the Canary Islands, the region with the highest percentage of childhood obesity in the country. However, there is some good news, as the results of the 2013 Aladino study show a slight decrease in the rates of childhood overweight and obesity. While two years ago this percentage stood at 45.3% for children between 7 and 8 years, it currently affects just 43%, a decrease of 2.3 points. This is likely due to the efforts of health agencies to craft policies promoting healthy living habits, especially for school children (Canary Islands Government, 2014; Serra Majem et al., 2003; Spanish Ministry of Health, 2014).

Another concern is the large influence of the media on the consumption and behavior habits of young people, as the messages they convey can be either beneficial or harmful to health (Menéndez García & Francisco Diez, 2009). Advertising aims to stimulate the desire and the need to consume, with children and adolescents being a significant percentage of its market share. It creates stereotypes whereby consuming a product becomes a need. However, this type of advertising often tends to focus on the consumption of high-calorie foods (Jiménez, 2006; Muñoz, 2000).

A study in Cuba found that adolescents acquire knowledge on vegetable consumption through television (95%), followed by school (79%), radio (62%) and family (52%). Similar findings were obtained by two studies in Mexico and Cuba showing that the media, especially television, has an important effect on people's behaviors and beliefs, and provides a means that can be used to promote learning that is even more effective than school or family. A study in Spain found that 35.2% of students do not recognize the influence of television on their eating habits; however, 71.8% consume products announced on television. Finally, a study in Peru found that the most influential medium among groups of adolescents was television, with no significant differences between students studying in schools promoting sustainable development and those that do not. However, for both groups the family environment had an important role as an educator on the consumption of healthy foods (Roman & Quintana, 2010).

Therefore, and due to the significant influence of the media on the acquisition of lifestyle habits, many educational initiatives by governments and institutions have focused on controlling advertising and on exploiting the positive aspect of the media as a mass communication channel to transmit messages that promote healthy lifestyles. A good example in Spain is the PAOS code, an agreement signed between the Ministry of Health and the Spanish Federation of Food and Beverage Industries to self-regulate food advertising aimed at children (WHO, 2011).

The educational program we describe in this paper's main objective aims to improve the quality of life of overweight and obese children by educating them in healthy lifestyles. The main objective of the training in healthy habits program is to promote behavioral changes in the short, medium and long term. We thus used gamification (Hsin-Yuan Huang & Soman, 2013) as a tool to increase their motivation. Also, as this training was not regulated by the school, an informal education program was designed, although it was validated in a school outside school hours, as well as at children's homes.

Computers have been criticized for enticing children into more sedentary lifestyles that hinder healthy behaviors. This work thus focuses on the design and use of technologies that promote active lifestyles. Indoor and outdoor physical activities can be enhanced

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