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Augmented-Sugar Intake: A Mobile Application to Teach Population about Sugar Sweetened Beverages

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Abstract

Mexico remains, as the second worldwide nation with 32% obese adults and 34% of Mexican school-aged children and more than 33% of Mexican teens are either overweight or obese. Sugar sweetened beverages in Mexico's are linked to the pandemics of obesity. Even though a national policy campaign that includes: substantial tax on sugar drinks, a front-of-package labeling system, banning sodas and regulation of unhealthy food in schools; population at large lacks of tools to understand ultra-processed beverages labeled data. This work introduces Augmented-Sugar Intake, an enhanced augmented reality mobile app as a teaching tool to inform about ultra-processed sugar sweetened beverages. Using the app an intervention was design with the objective to develop a critic thinking of sugar ingestion by children and adults. Results show that participants did not know how much sugar a single soda contains, how mobile augmented reality can aid in the struggle against obesity and how data interpretation provides informed consumption to users.

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Keywords: Sugar intake, mobile augmented reaality, ultra-processed beverages.

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1. Introduction

Sugar consumption in Mexico is excessive. One of the main sources of sugar intake comes from ultra-processed sweetened beverages (UPSB). The increase in the consumption of such drinks is one factor, of many others, that creates problems of overweight and obesity in the population and more distressing, in children. UPSB consumption has become a priority issue in the Mexican public health agenda[1].

The increased consumption of added sugars implicates: amplified cardiovascular diseases, obesity, dental caries, glucose intolerance, hypertension and diabetes[2]. Sugary drinks such as flavored beverages, fruit juices and carbonated drinks are the leading source of added sugars[3] and its consumption has increased in recent decades almost 100 percent in countries like Mexico and the United States[4]. These drinks have a high-energy content, high glycemic index and a low rate of fullness, which may cause increased food intake after ingestion.

Mexico is one of the largest per capita consumers of soft drinks in the world. The recommendation is to consume these drinks only on a casual basis. In the quantities currently consumed, these drinks contribute to obesity and diabetes epidemic in Mexico. Furthermore, sodas and sugary drinks are not the only high-calorie drinks. New drinks, with the same profile, are constantly offered[5].

Recently, by March 4, 2015, the World Health Organizations (WHO) published new guidelines for sugar consumption in children and adults. In them, urging international organizations to reduce to less than 10 percent of total calories daily intake of free sugars. A further reduction to less than 5 percent per day, provide additional health benefits[6].

By 2010, the Ministry of Health and all sectorial participants signed a national agreement for healthy food and promoted three key initiatives: regulation of sodas and unhealthy food in elementary to high schools, sodas taxation and a front-of-package labeling system[7].

The nutritional labeling of processed foods and beverages in Mexico is regulated by the Mexican Official Standard NOM-051-SCFI / SSA1-2010[8]. The NOM-051-SCFI specifies nutritional declaration of prepackaged products is mandatory. This should be placed in the back of the packaging and include: energy content, amount of protein, amount of carbohydrates indicating the corresponding amount of sugar, amount of fat specifying amounts of saturated fat, dietary fiber and sodium as well as the amount of any nutrient for which the claim is made or deemed important, Figure 1 shows an example of a front label of package in Mexico.

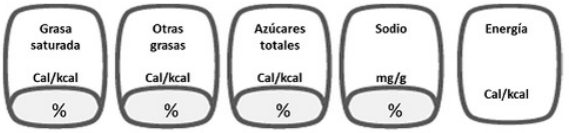

Fig. 1. Shows a front label, in Spanish, for processed food and sweetened beverages in Mexico.

Food labels are tools designed to help consumers to make healthy food choices. However, consumers experience difficulty in interpreting the information in the labels, which directly affects the purpose of this tool. Additionally, label data lacks of a personal interpretation for individual characteristics[9, 10,11]. Thus, the use of mobile technologies can aid on how consumers receive the information enabling them to interpret in a simple way the nutritional information, and more specifically the amount of sugar containing in UPSB. This work introduces a mobile Augmented Reality enhanced mobile app named Augmented-Sugar Intake as a tool to help students to interpret the amount of sugar in UPSB. The aim of the developed application is to help reducing daily intake of sugars in the population, report the amount of sugar recommended for daily consumption and create a tool for teaching students and population at large about UPSB.

1.1. Mobile Applications and Nutrition

Smartphones and mobile applications (apps) can aid people to change nutrition patterns or physical activity[12,], record meal consumption[13], diabetes prevention or other nutrition related diseases[14] and even weight loss using

mobile text messaging [15]. Within the market for applications related to nutrition, there are those aimed at weight loss, diets, calorie counters, nutritional advice and guidelines. And several applications provide partial solutions to tackle overweight and obesity pandemics.

With regard to food labeling, highlights the FoodSwitch[16] application, developed among others by researchers at The George Institute for Global Health, initially available in Australia and now in New Zealand and England. The purpose of this application is to provide nutritional information to consumers to easily understand and to help them make healthier food choices when they buy food. This application allows consumers to scan the barcode of products and internally performs a comparison between the scanned product against other products that are taken into the database and thus able to suggest healthier alternatives. FoodSwitch database application had initially 17,000 products; It includes nutritional information of the products relating to energy, protein, total fat, saturated fat, carbohydrates, sugar, fiber, sodium and calcium and barcode. The format chosen to display information is a traffic light and the red, amber and green colors are used to indicate high, medium and low values respectively of total fat, saturated fat, sugar and salt scanned product. Additionally it has a fifth indicator (colorless), which reports on the energy density. *FoodSwitch* includes a feature called crowdsourcing through which users can contribute by providing information about products that are not found in the database. If the bar code of a product is scanned and the application does not return information, it prompted the user to take a photograph of the front of the product, the nutrition facts and ingredient list. FoodSwtich was developed for both Android devices and iOS devices. It was launched in January 2012. The role of crowdsourcing has allowed an expansion of the database as mentioned above began with 17,000 products and 2014 more than 50,000 products were reported.

The *Show me the Sugar*[17] application aims to show the amount of sugar a product contains both grams and teaspoons. To do this, the application requires the user to scan camera with mobile barcode of a product. Product search can be done by manually entering the barcode or product name. Another important feature of the application is that it allows the user to define the amount of sugar you consume per day. To help the user to achieve their daily sugar consumption target, the application takes a count of the progress of consumption and displayed to the user, as a list, the products have been consumed. The *Show me the Sugar* application has a database of 1.2 million of products ranging from salads to spaghetti and is available for free from February 2015 to iOS and Android devices. One of the disadvantages of the application is that only recognizes the bar code or the name of products produced in the United States.

The EZ Sugar Tracker application[18] allows the user to select the grams of sugar consumed daily basis. If these are unknown, the user has the option to search the product database application that features more than 17,000 products. The EZ Sugar Tracker application is available from September 2013 for iOS and Android devices and free of charge. Mentioned works lack of specific databases for the Mexican market of sweetened beverages; nevertheless new approaches can be achieved with new tools as mobile Augmented reality (AR).

Augmented reality (AR) has been successfully applied in different research areas one being the treatment of obesity[19]. Access a virtual environment provides users with a "safe zone" in which they can experience and practice how to overcome challenges relating to food that are unsurpassed in the real world. Using applications with AR can help strengthen and improve treatments for obesity. New behaviors as estimating portions and selection of balanced meals that are learned during treatments and are essential for regulating weight can be "tested" in a virtual environment until they become habits that can be put into practice in the real[19] world. A particular challenge of AR applications that address the issues of diet and nutrition is the lack of databases with information about foods and nutrients.

2. Proposed solution

Augmented-Sugar Intake Android is a mobile application developed with the aim to aid users in the understanding of front labels of ultra-processed sweetened beverage (UPSB). To achieve this we propose to integrate a Mexican database of ultra-processed food and sweetened beverages and a mobile app that uses augmented reality to display how many teaspoons contains an UPSB. To assist in the interpretation of sugar consumption the user must provide his personal height and we calculate his “Ideal Weight” to calculate his maximum sugar ingestion suggested by the World Health Organization (WHO) [20]. We worked within an interdisciplinary team with nutritionists and computer and information technology academics.

2.1. Ultra-processed sweetened beverages (UPSB)

This work aims to achieve a national database of UPSB and their individual data provided by producers in the front labels, added in their different products across diverse presentations. For UPSB, we propose a classification of products and the number of leading producers in Mexico, as shown in Table 1.

Table 1. Products classification

Products	Main Companies
Sodas	2
Milks and yogurts	4
Juices	2

From classification we selected a representative number of products to capture nutritional and ingredients data to create a central database.

2.2. Augmented-Sugar Intake components

The main interactions of the Augmented-Sugar Intake application are carried out with Vuforia's cloud recognition service[21] and a central database of ultra-processed foods and sweetened beverages, described in Figure 2. The Sugar Intake database contains different national products data. Front label and ingredients facts are available through exposed web services.

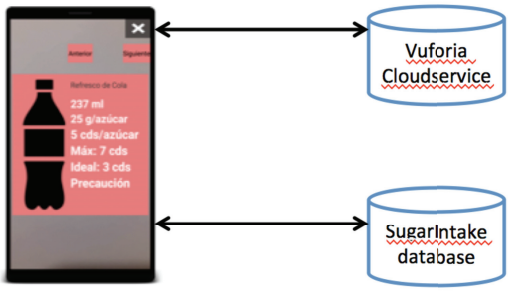

Fig. 2. Augmented-Sugar Intake components are the Vuforia's Cloud Service and Sugar-Intake database of nutritional facts from different products.

The Vuforia's cloud database contains 50 logos of different producers and metadata to access the Sugar Intake products database. Our database contains more than 200 UPSB and processed food, which was manually, captured by nutrition and computer science students.

2.3. Data Integration and visualization

To simplify target recognition, we considered that users trigger the augmented reality experience with their mobile camera by pointing to products logos to get information of UPSB, data interpretation of products labeled system and an advice of consume, as shown in Figure 3. Augmented-Sugar Intake implements a simply design to display data providing how many sugar spoons can be ingested, the highest and ideal sugar spoons recommend for the user personal height. Through a simple navigation control, with buttons of back and forward, the user can visualize different products of one manufacturer. For each product a recommendation is displayed based on the maximum and ideal sugar an individual can take in one day.

Fig. 3. (a) User height input; (b) 237ml cola beverage; (c) 355ml cola beverage; (d) 600ml cola beverage.

Augmented-Sugar Intake combines mobile technology and augmented reality to include users from different ages and socio-economics conditions.

3. Discussion

The high level of sugars intake –particularly in the form of sugar-sweetened beverages- is a national concern because it's associated with poor diet quality, obesity and risk of nutrition related diseases (most of them are silent diseases) [20,22, 23]. Nutritional labeling aims to help consumers make informed decisions about fat / lipids, sugar, sodium / salt and energy consumption. However, it is questionable if the front-of-package labeling system is clearly understood and inferred adequately by population at large. The nutritional label information is provided in the form of calories or grams. This information is difficult to understand and does not postulate a clear specification about a high, moderate or low nutrient content.

A study in Mexico evaluated the understanding of nutritional labeling between undergraduate nutrition students considering it is a sector of the population that better recognizes the basis for labeling. This study showed that also nutrition students had difficulty to comprehend label data of ultra-processed products, especially when data is provided per serving and containers have more than one serving [9]. The front-of-package data requires mathematical skills, time to analyze and personal data in order to appropriately use.

An accurate and easy-to-understand labeling is a big challenge that should be considered as an important strategy among many to address obesity. It is necessary to reduce label complexity and convey numeric nutrition information in simpler and meaningful way to aid consumers to understand nutritional information. Mobile phone technology may be a cost-effective and easy access way to deliver meaningful label information and thereby prevent or treat overweight and nutrition related chronic diseases.

Augmented-Sugar Intake can help consumers in making better-informed choices. This app provides information about the sugar content of UPSB in an easy-to-understand form because the amount of sugar is presented in the form of teaspoons instead of grams. Teaspoons are a home portion well known by population in Mexico. Furthermore, the app shows the maximal and optimal amount of sugar consumption recommended according to the user's ideal weight also in the form of teaspoons. Therefore, consumer can compare the amount of sugar that provides a UPSB with his/her individual sugar intake recommendation. This approach to understand label information does not require mathematical skills and could be analyze in just few seconds.

4. Conclusions

In this paper, we have introduced Augmented-Sugar Intake an augmented reality app that provides a meaningful and easy-to-understand labeling on sugar content. This tool could help consumers make better-informed decisions

about sugar consumption. Further studies will evaluate the impact on the use of this tool, consumer decisions, a national database of ultra-processed products and augmented reality adoption against ultra-processed sweetened beverages intake.

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