Improvement of biochemical markers after reduction of artificially sweetened beverages consumption. A clinical randomised trial

February, 2018

Introduction

Overweight and obesity are public health problems across the world. In 2016 the World Health Organization (WHO) estimated that over 1900 million adults were diagnosed as overweight or obese (1). Currently, these pathologies are associated with the risk of developing pathologies such as insulin resistance, Type 2 Diabetes Mellitus(T2DM) and Metabolic Syndrome (2).

These pathologies result from the interaction between many factors, mainly poor alimentary habits and a sedentary lifestyle (2-4). The high consumption of simple carbohydrates and sugar sweetened beverages (SSBs), like soft drinks, juices and flavored water, is considered one of the main factors that contribute to the increase in incidence and prevalence of overweight and obesity. A high consumption of simple carbohydrates promotes an increase glucose concentrations in blood, which facilitates the formation of triglycerides that are subsequently stored in adipose tissue (2, 4, 5).

Mexico is the Latin American country with the highest consumption of SSBs. It was estimated that the intake per person was 384 SSBs per year (6). The exact figures of the population that consumes ASBs are not known. However, an increase in the consumption of products containing artificial sweeteners (ASs) was reported (7, 8). In Mexico, more than 70% of the adult population has been diagnosed as overweight or obese (1).

To decrease the caloric intake attributable to SSBs, the food industry promotes the commercialization of ASBs (9). These products have the same organoleptic features than SSBs, with the perks of having a minimum or no caloric contribution at all, not

affecting the energy metabolism (10). For this reason, in Mexico the official treatment guidelines for overweight and obesity recommend it use as part of the nutritional treatment (11).

Nonetheless, recent studies relate the consumption of ASBs with a deregulation of the metabolic homeostasis, promoting physiological modifications (12). In a study conducted by Duran, *et. al*. aiming to evaluate the effect of the reduction of SSBs and ASBs, concluded that the reduction in the consumption of these beverages decreased weight and body fat (13). On the other hand, Madjad, *et. al*. reported a decrease in body weight of women with type 2 diabetes mellitus after substituting the consumption of ASBs, for water (14). Some cohort studies reported an association between the consumption of ASBs and the increase in body weight and waist circumference (4, 15). Likewise, it was reported that ASs increased glucose and insulin concentrations in blood, which is detrimental to health, especially in population with a pre-existing risk of developing non-infectious diseases, such as overweight and obesity (12, 16-18).

While population increases the consumption of ASBs, the prevalence of overweight and obesity increased too. To contribute to the knowledge on the effect of these substances in the human body, we evaluated the effect of reducing the consumption of ASBs in overweight and obese young adults.

Objective

Evaluate the effect of restriction ASBs consumption on the metabolism in overweight and obese young adults

Hypothesis

The restriction of ASBs in young people who consume them and who present overweight and obesity, decrease an anthropometric data, and biochemical markers.

Design and methods

- **Study Design**

This study is a single-blind randomized clinical trial it will perform at the University of Veracruz, Veracruz, Mexico, between February 2017 to October 2018. Young adults students of the University of Veracruz will randomly allocate to a 12-week no consumption of ASBs intervention or control group.

- **Randomization and intervention procedure**

All the volunteers that will meet the inclusion criteria will sign the informed consent before the study started. The volunteers will randomly allocate in control or intervention group (1:1 allocation ratio to each group) in blocks of 2 by using Microsoft Office Excell. Nobody involved with data acquisition will have access to de assignment of the subjects. Once randomly assigned, a blood sample and anthropometric variables will take to establish basal data. Participants will interview to know, caloric intake (24-h food recall), consumed portions and beverage consumption (Food frequency questionnaire). The intervention group is not allowed to consume ASBs, however they are allow consuming products that did not contain ASs in their formulae. For the control group ASBs consumption are not modified. Both groups continue the normal food habits.

Anthropometric measures, 24-h food recall and food frequency questionnaire data will collect at week 6 and 12. Blood sample will take once more at study week 12. In order to categorize the physical activity a previously validated questionnaire will apply, the physical level are divide in low, moderate and high.

- **Study population**

Young overweight or obese students between 19 and 27 years old with normally consumption of ASBs

- **Sample**

It is a probabilistic, stratified sampling that is made from the overweight and obese population who consume ASbs.

The data for obtaining the sample will be collected from the questionnaires that will be applied to the students in which we will know who consume ASBs.

- **Statistic**

They will be analyzed with the statistical program SPSS 21. With a two-way analysis of variance ANOVA or T-student test with repeated measures. And the variables will be correlated.

- **Ethical and biosecurity considerations**

According to the Regulation of the General Health Law on Health Research, which was enacted in 1984 by Miguel de la Madrid in his third article, research for health includes the development of actions that contribute; to the knowledge of the biological and psychological processes of humans, to the knowledge of the links to the causes of illness, the medical practice and the social structure, to the prevention and control of health problems, to the knowledge and evaluation of the harmful effects of health environment, to the study of the techniques and methods that are recommended or used for the provision of health services, and to the production of supplies for health.

According to article 13 of this law, in any investigation in which the human being is subject to the study, the criterion of respect for their dignity and the protection of their rights and welfare must prevail.

According to article 16 in the investigations of human beings the privacy of the individual subject to the investigation will be protected, identifying it only when the result requires it and this authorizes.

According to article 17 in its second section, this research is considered as minimal risk since the risk of data is used through common procedures, physical or psychological diagnostic tests or routine treatments.

For what subject to the law, the informed consent letter will be provided to the research prospectus, which will be delivered prior to the application of the questionnaire. For the application of the questionnaire will pass through each classroom of the Faculty of Nutrition and Biochemistry of the Veracruz University Veracruz campus, which will be carried out after authorization by the authorities of each faculty. Likewise, the subject will be given a clear and concise explanation of the objectives of the research, the benefits, the inconveniences or risks expected the procedures that will be used, its purpose and the previous investigations that have been carried out on the subject, as well as those that arise during the time of the study. This process will be in charge of the main researcher of the project.

The prospect should be aware that he is at liberty to withdraw his consent at any time, and that the information collected during the investigation will be used only by the research group who will replace his name with a code to guarantee the confidentiality of the data.

Only the principal investigator of this project acquires the commitment with the participating subjects to continue with a nutritional follow-up during the 3 months after the end of the study, which includes a personalized nutritional plan, which will be obtained from anthropometric measurements. In the same way, the researcher commits to provide the results of the analysis of the biochemical values that are carried out at the beginning and at the end of the project.

To present the results obtained in the research to the participating subjects and the Health Services Studies Center, a summary of the most relevant data of the study signed by the main researcher will be made, which will be sent to them by email or will deliver them in a personal way according to the preference of the subject and the institution.

REFERENCES

1. WHO. Obesity and overweight. In: center Hr, editor. 2017.
2. Allison RL. Back to Basics: The Effect of Healthy Diet and Exercise on Chronic Disease Management. South Dakota medicine : the journal of the South Dakota State Medical Association. 2017;Spec No:10-8. Epub 2017/08/18.
3. Wilson C. Obesity: sugar-sweetened beverages--fueling the epidemic of childhood obesity? Nature reviews Endocrinology. 2012;8(12):696. Epub 2012/10/10.
4. Fowler SP, Williams K, Resendez RG, Hunt KJ, Hazuda HP, Stern MP. Fueling the obesity epidemic? Artificially sweetened beverage use and long-term weight gain. Obesity (Silver Spring). 2008;16(8):1894-900. Epub 2008/06/07.
5. Ebbeling CB, Feldman HA, Chomitz VR, Antonelli TA, Gortmaker SL, Osganian SK, et al. A randomized trial of sugar-sweetened beverages and adolescent body weight. The New England journal of medicine. 2012;367(15):1407-16. Epub 2012/09/25.
6. Simon Barquera LH-B, Maria Lizbeth Tolentino, Juan Espinosa, Shu Wen Ng, Juan A. Rivera, and Barry M. Popkin Energy Intake from Beverages Is Increasing among Mexican Adolescents and Adults. The Journal of Nutrition. December, 2008;vol. 138 no. 12 2454-2461: 2454-61.
7. Romo-Romo A, Aguilar-Salinas CA, Gomez-Diaz RA, Brito-Cordova GX, Gomez-Velasco DV, Lopez-Rocha MJ, et al. Non-Nutritive Sweeteners: Evidence on their Association with Metabolic Diseases and Potential Effects on Glucose Metabolism and Appetite. Revista de investigacion clinica; organo del Hospital de Enfermedades de la Nutricion. 2017;69(3):129-38. Epub 2017/06/15.
8. Sylvetsky AC, Jin Y, Clark EJ, Welsh JA, Rother KI, Talegawkar SA. Consumption of Low-Calorie Sweeteners among Children and Adults in the United States. Journal of the Academy of Nutrition and Dietetics. 2017;117(3):441-8 e2. Epub 2017/01/15.
9. Mozaffarian D, Hao T, Rimm EB, Willett WC, Hu FB. Changes in diet and lifestyle and long-term weight gain in women and men. The New England journal of medicine. 2011;364(25):2392-404. Epub 2011/06/24.
10. FDA. High-Intensity Sweeteners. 2014.
11. Norma Oficial Mexicana NOM-008-SSA3-2010, Para el tratamiento integral del sobrepeso y la obesidad. , (2010).
12. Pepino MY, Tiemann CD, Patterson BW, Wice BM, Klein S. Sucralose affects glycemic and hormonal responses to an oral glucose load. Diabetes care. 2013;36(9):2530-5. Epub 2013/05/02.
13. Vazquez-Duran M, Orea-Tejeda A, Castillo-Martinez L, Cano-Garcia A, Tellez-Olvera L, Keirns-Davis C. A randomized control trial for reduction of caloric and non-caloric sweetened beverages in young adults: effects in weight, body composition and blood pressure. Nutricion hospitalaria. 2016;33(6):1372-8. Epub 2016/12/22.
14. Madjd A, Taylor MA, Delavari A, Malekzadeh R, Macdonald IA, Farshchi HR. Beneficial effects of replacing diet beverages with water on type 2 diabetic obese women following a hypo-energetic diet: A randomized, 24-week clinical trial. Diabetes, obesity & metabolism. 2017;19(1):125-32. Epub 2016/10/18.
15. Fowler SP, Williams K, Hazuda HP. Diet soda intake is associated with long-term increases in waist circumference in a biethnic cohort of older adults: the San Antonio Longitudinal Study of Aging. Journal of the American Geriatrics Society. 2015;63(4):708-15. Epub 2015/03/18.
16. Suez J, Korem T, Zeevi D, Zilberman-Schapira G, Thaiss CA, Maza O, et al. Artificial sweeteners induce glucose intolerance by altering the gut microbiota. Nature. 2014;514(7521):181-6. Epub 2014/09/19.

17. Kuk JL, Brown RE. Aspartame intake is associated with greater glucose intolerance in individuals with obesity. Applied physiology, nutrition, and metabolism = Physiologie appliquee, nutrition et metabolisme. 2016;41(7):795-8. Epub 2016/05/25.
18. Swithers SE. Artificial sweeteners produce the counterintuitive effect of inducing metabolic derangements. Trends in endocrinology and metabolism: TEM. 2013;24(9):431-41. Epub 2013/07/16.