

Sugar-sweetened Beverages and Obesity Among Children: A Review

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ABSTRACT: Over the last decades the prevalence of overweight and obesity throughout the world has increased in children. The rising incidence of childhood obesity poses an important public health challenge worldwide due to the increasing burden of chronic non-communicable diseases. However, there were growing evidences that increased consumption of sugar-sweetened beverages over time was associated with increased obesity among children and adolescents. Therefore, increasing public awareness of the health hazards associated with high intake of sugar-sweetened beverage in the diets of children should be of great concern to public health workers. This is especially important in children, because dietary habits in childhood track into adulthood.

INTRODUCTION

Over the last decades the prevalence of overweight and obesity throughout the world has increased in children (Luger *et al.*, 2017). It was estimated that the prevalence of obesity in children will be around 9.1% in 2020 (de Onis *et al.*, 2010). Childhood obesity has an important significance in health and well-being during childhood and also in later adult life (WHO, 2003; Freedman *et al.*, 2007; Reilly and Kelly, 2011). As because, obesity not only affect the metabolic and psychosocial status in the short term but also contribute to a higher risk for consequent cardiovascular diseases in adulthood (He *et al.*, 2018). Due to the rapid economic growth as well as radical shifts in dietary pattern and lifestyle, the prevalence of obesity and obesity-related cardiovascular risk factors in children including abnormal lipid, hypertension and elevated blood glucose levels have increased worldwide in the recent decades (Fagot-Campagna *et al.*, 2001; Lee *et al.*, 2016; He *et al.*, 2018). Moreover, a considerable proportion of children who are obese remain so in adulthood also (WHO, 2016).

Therefore, the rising incidence of childhood obesity poses an important public health challenge throughout the world due to the increasing burden of chronic non-communicable diseases (Lakshman *et al.*, 2012). One potential factor, which is temporally related with the rise in overweight and obesity, is an increased drinking of refined carbohydrate (Slyper *et al.*, 2004). It is well established that the trends toward growing obesity rates worldwide have paralleled an increase in sugar in food sources (Duffey and Popkin, 2007). However, the most common source of excess sugar consumption is sugar-sweetened beverages (De Boer *et al.*, 2013), which is an established risk factor for overweight and obesity (Morenga *et al.*, 2013; He *et al.*, 2018). Though, the consumption of sugar-sweetened beverages has increased intensely over the past decades in all ages including children (Scharf and De Boer, 2016), concerns regarding sugar-sweetened beverages consumption in children have gained significant attention recently. It was observed that added sugars, specifically in the form of sugar-sweetened beverages contribute to excess calories, which is an important factor for the development of obesity as sugars in liquid form induce less satiety

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than in dense form (Di Meglio and Mattes, 2000) and thus promote the over consumption of calories (Zhang *et al.*, 2020).

WHAT IS SUGAR SWEETENED BEVERAGES?

A significant consequence of the rise in sugar availability has been the rise in drinking of beverages sweetened with added sugars, frequently referred to as sugar-sweetened beverages (Scharf and De Boer, 2016). Sugar sweetened beverages are a category of beverages that contain added sugars, including regular soft drinks, fruit drinks, sports drinks, energy drinks, and sweetened coffees and teas (Godin *et al.*, 2018). Sugar-sweetened beverages are high calorie beverages with little nutritional content (Lasater *et al.*, 2011). Sugar-sweetened beverages also includes soda and fruit-flavored drinks, which is a major contributor to added sugars in children's diets and have been shown to be associated with obesity (Tasevska *et al.*, 2017).

WHAT IS OBESITY?

Obesity is a common and preventable disease of clinical and public health importance (Ofei, 2005). Obesity is characterized by an abnormal or excessive fat accumulation that may impair health and is commonly assessed by Body mass index (BMI) (WHO, 2020). BMI is calculated by dividing a person's weight in kilograms by the square of height in meters. Obesity in children is defined as a BMI at or above the 95th percentile for children and teens of the same age and sex (CDC, 2020).

Sugar sweetened beverages and obesity

The increase in availability of sugar has paralleled the increase in BMI in the developing world (Scharf and De Boer, 2016). Historically, when safe drinking water was not readily accessible, beverage companies have promoted their products as safe alternatives, and in many places today, sugar-sweetened beverages remain a safer alternative (Scharf and De Boer, 2016). The consumption of sugar-sweetened beverages has significantly increased globally including Asian populations over the past decades (Shin *et al.*, 2018). Over the last two decades there has been a similar increasing trend of consumption of sugar sweetened beverages in Indian children also

(Gupta *et al.*, 2018). A survey conducted among children aged between 9 to 14 years demonstrated that 68% children consumed packaged sugar sweetened beverages more than once a week (Bhushan *et al.*, 2017). It was observed that in some places sugar-sweetened beverages contribute to over 20% of children's added sugar consumption (Azais-Braesco *et al.*, 2017). However, energy-dense sugar-sweetened beverage, as a consequence of improved economic conditions was considered to be one of the primary factors of the rapid escalation of obesity (Johns *et al.*, 2015).

There were growing evidences that increased consumption of sugar-sweetened beverages over time was associated with increased obesity among children and adolescent (De Boer *et al.*, 2013; Pereira, 2014). Consumption of sugar-sweetened beverages among children is particularly concerning because dietary habits in childhood track into adulthood (Kaikkonen *et al.*, 2013). In a study Masse *et al.* (2014) demonstrated that sugar-sweetened beverages were significantly associated with higher odds of being obese compared to normal weight among Canadian adolescents. De Boer *et al.* (2013) also demonstrated higher odds for being obese among children aged 5 years, who drank sugar-sweetened beverages regularly compared with infrequent or nondrinkers. Studies also demonstrated that regular consumers of sugar sweetened beverages between meals had a higher risk of being overweight or obese compared to non-consumers in children (Ludwig *et al.*, 2001; Dubois *et al.*, 2007). A meta-analysis (Malik *et al.*, 2009) also demonstrated significant positive association between sugar-sweetened beverages intake and weight gain. Ludwig *et al.* (2001) showed that an extra cup of sugar-sweetened beverages per day increases the risk of obesity by 1.6 times in American children. A study among Chinese children aged 7–18 years revealed that excessive sugar-sweetened beverages consumption greatly contributed to increased BMI, waist circumference and triglyceride levels as well as increased risk of both general and abdominal obesity, and hypertriglyceridemia (He *et al.*, 2018). Berkeley *et al.* (2004) demonstrated a linear relationship between the amounts of sugar-sweetened beverage consumed and BMI in girls. Te *et al.* (2013) also demonstrated an

association between sugar-sweetened beverage consumption and BMI. Grimes *et al.* (2013) in a large cohort of Australian children demonstrated that those drinking sugar-sweetened beverage were more likely to be overweight. Ariza *et al.* (2004) demonstrated that children who drank sugar-sweetened beverages had an odds ratio of 3.7 for obesity. Moreover, the study also demonstrated that overweight children were more likely to be sugar-sweetened beverage drinkers. In a study among US pre-school children it was observed that number of servings of sugar-sweetened beverages were significantly associated with BMI z-score as well as with overweight and obesity, even after adjustment for confounding variables, including sex, socio-economic status, and ethnicity (De Boer *et al.*, 2013). A study in children at 10 years from the Bogalusa Heart study demonstrated an odds ratio of 1.33 for overweight among sugar-sweetened beverage drinkers compared to non-drinkers (Nicklas *et al.*, 2003). National longitudinal study in UK children demonstrated that regular consumption of sugar-sweetened beverage was associated with greater increases in BMI as well as in percentage body fat (Lavery *et al.*, 2015). Costa *et al.* (2018) also demonstrated an association of higher consumption of sugar-sweetened beverages with higher levels of body fat. Other studies also demonstrated similar positive associations between sugar-sweetened beverages consumption and weight gain among children (Ludwig *et al.*, 2001; Malik *et al.*, 2006).

Similar results were also observed in longitudinal studies. A recent longitudinal study demonstrated that sugar-sweetened beverage consumption at 4 and 5 years were associated with a risk of obesity at 7–8 years (Macintyre *et al.*, 2018). High cumulative consumption of sugar-sweetened beverage at the pre-school stage also increases the risk of obesity in later childhood and early adolescence (Cantoral *et al.*, 2016). Pan *et al.* (2014) determined that sugar-sweetened beverage consumption during infancy had an odds ratio of 1.71 for obesity at the age of 6 years, compared with no consumption children. Dubois *et al.* (2007) found that children who drank sugar-sweetened beverages between the ages of 2.5–4.5 years had a higher odds ratio of 2.4 for being overweight at the age of 4.5 years, compared with

non-drinkers of sugar-sweetened beverages. De Boer *et al.* (2013) in a follow up study among children between ages 2 and 5 years demonstrated that children who consumed more than equal to one sugar-sweetened beverages serving daily had a higher change in BMI z-score and were more likely over the next 2 years to become overweight and obese, compared with those who drank less. Studies also demonstrated a potential link to increased long-term consumption of sugar-sweetened beverage and its contribution to greater weight gain (Nissinen *et al.*, 2009; Bae *et al.*, 2011). Berkey *et al.* (2004) also demonstrated similar association of increased sugar-sweetened beverage consumption and higher gains in BMI in children. A longitudinal study also indicated that children consuming one sugar-sweetened beverage each day are 55% more likely to be overweight compared to those with limited consumption (Morenga *et al.*, 2013).

Contrary to that, some studies also demonstrated lack of association between sugar-sweetened beverages and weight gain. For example, Keller *et al.* (2009) in a small cohort of children aged between 3 and 7 years did not observed higher BMI among children who drunk sugar-sweetened beverages. Forshee and Storey *et al.* (2003) also did not found any differences in BMI among different categories of sugar-sweetened beverage intake in a large cohort of children aged 6–19 years.

However, the exact biological mechanisms linking sugar-sweetened beverage consumption and weight gain remain unknown, a number of possible hypotheses have been proposed which indicated that energy from sugar-sweetened beverage bypass the homeostatic regulatory systems, that control appetite and energy intake and as a consequence hunger increased and satiety decreased, which leads to excessive energy consumption (Hafekost *et al.*, 2011) and results in weight gain (Pereira, 2014; Popkin and Hawkes, 2016) and obesity (He *et al.*, 2018).

Studies demonstrated that family environments including socio-demographic characteristics are associated with sugar-sweetened beverage consumption in children (Rompay *et al.*, 2015). It was observed that children whose parents regularly consumed sugar-sweetened beverages were almost three times more likely to consume sugar-sweetened

beverages regularly, compared to the children whose parents were not regular consumers of sugar-sweetened beverages (Grimm *et al.*, 2004). Average consumption of sugar-sweetened beverage was also higher among children whose parents had lower levels of education (Hafekost *et al.*, 2011). Similarly, national longitudinal study in UK children also demonstrated that sugar-sweetened beverage consumption was lower among children of mothers with higher educational qualifications (Laverty *et al.*, 2015). A study among multi-ethnic children showed that higher sugar-sweetened beverage intake was associated with lower socioeconomic status, higher total energy intake, lower fruit, vegetable intake and more sedentary time (Rompay *et al.*, 2015). De Boer *et al.* (2013) also demonstrated significant association of sugar-sweetened beverage consumption with socioeconomic status. Sugar-sweetened beverage consumption also varied by ethnic group (De Boer *et al.*, 2013). Consumption of sugar-sweetened beverage was also associated with unhealthy eating behaviors, such as eating at fast food restaurants, low vegetable consumption, high consumption of unhealthy meats, French fries and desserts (Ranjit *et al.*, 2010; Park *et al.*, 2012).

Although most of the studies on sugar-sweetened beverage consumption had focused on its relationship to unhealthy weight, some studies also demonstrated the association of sugar-sweetened beverages with other adverse outcomes in children. It was observed that higher intake of sugar-sweetened beverage was associated with dental caries (Marshall *et al.*, 2003), poor growth (Smith and Lifshitz, 1994), digestive problem (Committee on Nutrition, 2001), higher plasma triglyceride (Rompay *et al.*, 2015), higher blood pressure (Nguyen *et al.*, 2009), type-2 diabetes (Hu and Malik, 2010; Malik *et al.*, 2010), cardiovascular disease (Ambrosini *et al.*, 2013), neurological, psychiatric symptoms and cardiac dysrhythmias (Bedi *et al.*, 2014) as well as it was also increased the risk of cancer due to carcinogenic and allergenic properties of some food additives (Keshari and Mishra, 2016). Frequent consumption of sugar-sweetened beverage was also related to lower intake of vitamins and nutrients (Frery *et al.*, 2004), poor academic grades (Park *et al.*, 2012) and earlier timing of puberty (Vandeloo *et al.*, 2007). Furthermore, sugar-sweetened

beverage consumption is negatively associated with physical activity and positively associated with sedentary behaviors, such as watching television (Ranjit *et al.*, 2010; De Boer *et al.*, 2013; Laverty *et al.*, 2015; Cervi *et al.*, 2017).

CONCLUSION

These findings suggested that increased consumption of sugar-sweetened beverage was closely linked with weight gain and higher prevalence of obesity in children. Therefore, increasing public awareness of health hazards associated with high intake of sugar-sweetened beverage in the diets of children should be of great concern to public health advocates. This is especially important in children because dietary habits in childhood track into adulthood (Kaikkonen *et al.*, 2013). However, more systematic studies are needed to understand the factors associated with unhealthy dietary habits and to promote healthy lifestyle in children for the prevention and management of childhood obesity.

REFERENCES CITED

- Ambrosini, G. L., W. H. Oddy, R. C. Huang, T.A. Mori, L. J. Beilin and S. A. Jebb. 2013. Prospective Associations Between Sugar-sweetened Beverage Intakes and Cardiometabolic Risk Factors in Adolescents. *Am. J. Clin Nutr.*, 98:327-334.
- Ariza, A. J., E. H. Chen, H. J. Binns and K. K. Christoffel. 2004. Risk Factors for Overweight in Five- to Six- year old Hispanic-American Children: A Pilot Study. *J. Urban Health.*, 81:150-161.
- Azais-Braesco, V., D. Sluik, M. Maillot, F. Kok and L. A. Moreno. 2017. A Review of Total & Added Sugar Intakes and Dietary Sources in Europe. *Nutr. J.*, 16: 6.
- Bae, M. H., J. H. Lee, S. H. Lee, S. H. Park, D. H. Yang, H. S. Park, Y. Cho, J. E. Jun and S. C. Chae. 2011. Serum Uric Acid as an Independent and Incremental Prognostic Marker in Addition to N-terminal Pro-B-type Natriuretic Peptide in Patients with Acute Myocardial Infarction. *Circ. J.*, 75: 1440-1447.
- Bedi, N., P. Dewan and P. Gupta. 2014. Energy Drinks: Potions of Illusion. *Indian Pediatr.*, 51: 529-533.
- Berkey, C. S., H. R. Rockett, A. E. Field, M. W. Gillman and G. A. Colditz. 2004. Sugar-added Beverages and Adolescent Weight Change. *Obes. Res.*, 12:778-788.
- Bhushan, C., S. Taneja and A. Khurana. 2017. *Burden of Packaged Food on School Children: Based on the CSE Survey 'Know Your Diet'*. Centre for Science and Environment, New Delhi.

- Cantoral, A., M. M. Tellez-Rojo, A. S. Ettinger, H. Hu, M. Hernandez-Avila and K. Peterson 2016. Early Introduction and Cumulative Consumption of Sugar-sweetened Beverages During the Pre-school Period and Risk of Obesity at 8–14 Years of Age. *Pediatr. Obes.*, 11: 68–74.
- Center for Disease Control and Prevention (CDC). 2020. <https://www.cdc.gov/obesity/childhood/defining.html>: accessed on 12.05.2020.
- Cervi, M. M., T. Agurs-Collins, L. A. Dwyer, C. L. Thai, R. P. Moser and L. C. Nebeling. 2017. Susceptibility to Food Advertisements and Sugar-sweetened Beverage Intake in Non-Hispanic Black and Non-Hispanic White Adolescents. *J. Community Health.*, 42: 748-756.
- Committee on Nutrition 2001. The Use and Misuse of Fruit Juice in Pediatrics. *Pediatrics.*, 107: 1210-1213.
- Costa, C. S., B. Del-Ponte, M. C. F. Assunção and I. S. Santos. 2018. Consumption of Ultra-processed Foods and Body Fat During Childhood and Adolescence: A Systematic Review. *Public Health Nutr.*, 21: 148-159.
- De Boer, M. D., R. J. Scharf and R. T. Demmer. 2013. Sugar-sweetened Beverages and Weight Gain in 2- to 5- year-old Children. *Pediatrics.*, 132: 413-420.
- de Onis, M., M. Blossner and E. Borghi. 2010. Global Prevalence and Trends of Overweight and Obesity Among Preschool Children. *Am. J. Clin. Nutr.*, 92: 1257-1264.
- DiMeglio, D. P and R. D. Mattes. 2000. Liquid Versus Solid Carbohydrate: Effects on Food Intake and Body Weight. *Int. J. Obes. Relat. Metab. Disord.*, 24: 794-800.
- Dubois, L., A. Farmer, M. Girard and K. Peterson. 2007. Regular Sugar Sweetened Beverage Consumption Between Meals Increases Risk of Overweight Among Pre-school Aged Children. *J. Am. Diet. Assoc.*, 107: 924-934.
- Duffey, K. J and B. M. Popkin. 2007. Shifts in Patterns and Consumption of Beverages Between 1965 and 2002. *Obesity (Silver Spring)*, 15: 2739-2747.
- Fagot-Campagna, A., K. M. Narayan and G. Imperatore. 2001. Type 2 Diabetes in Children. *B.M. J.*, 322: 377-378.
- Forshee, R. A and M. L. Storey. 2003. Total Beverage Consumption and Beverage Choices Among Children and Adolescents. *Int. J. Food Sci. Nutr.*, 54: 297-307.
- Frary, C. D., R. K. Johnson and M. Q. Wang 2004. Children and Adolescents' Choices of Foods and Beverages High in Added Sugars are Associated with Intakes of Key Nutrients and Food Groups. *J. Adolesc. Health.*, 34:56–63.
- Freedman, D. S., Z. Mei, S. R. Srinivasan, G. S. Berenson and W. H. Dietz. 2007. Cardiovascular Risk Factors and Excess Adiposity Among Overweight Children and Adolescents: The Bogalusa Heart Study. *J. Pediatr.*, 150: 12-17.
- Godin, K. M., D. Hammond, A. Chaurasia and S. T. Leatherdale. 2018. Examining Changes in School Vending Machine Beverage Availability and Sugar-sweetened Beverage Intake among Canadian Adolescents Participating in the COMPASS study: A Longitudinal Assessment of Provincial School Nutrition Policy Compliance and Effectiveness. *Int. J. Behav. Nutr. Phys. Act.*, 15:121.
- Grimes, C. A., L. J. Riddell, K. J. Campbell and C. A. Nowson. 2013. Dietary Salt Intake, Sugar-sweetened Beverage Consumption and Obesity Risk. *Pediatrics.*, 131: 14-21.
- Grimm, G. C., L. Harnack and M. Story. 2004. Factors Associated with Soft Drink Consumption in School-aged Children. *J. Am. Diet. Assoc.*, 104: 1244-1249.
- Gupta, A., U. Kapil and G. Singh. 2018. Consumption of Junk Foods by School-aged Children in Rural Himachal Pradesh, India. *Indian J. Public Health.*, 62: 65-67.
- Hafekost, K., F. Mitrou, D. Lawrence and S.R. Zubrick 2011. Sugar sweetened beverage consumption by Australian children: Implications for public health strategy. *B.M.C. Public Health.*, 11:950.
- He, B., W. Long, X. Li, W. Yang, Y. Chen and Y. Zhu. 2018. Sugar-sweetened Beverages Consumption Positively Associated with the Risks of Obesity and Hypertriglyceridemia among Children Aged 7–18 Years in South China. *J. Atheroscler. Thromb.*, 25: 81-89.
- Hu, F. B and V. S. Malik. 2010. Sugar-sweetened Beverages and Risk of Obesity and Type 2 diabetes: Epidemiologic Evidence. *Physiol. Behav.*, 100: 47-54.
- Johns, D. J, A. K. Lindroos, S. A. Jebb, L. Sjostrom, L. M. Carlsson and G. L. Ambrosini. 2015. Dietary Patterns, Cardiometabolic Risk Factors and the Incidence of Cardiovascular Disease in Severe Obesity. *Obesity.*, 23: 1063-1070.
- Kaikkonen, J. E., V. Mikkilä, C. G. Magnussen, M. Juonala, J. S. Viikari and O. T. Raitakari. 2013. Does Childhood Nutrition Influence Adult Cardiovascular Disease Risk? – Insights From the Young Finns Study. *Ann. Med.*, 45: 120-128.
- Keller, K. L., J. Kirzner, A. Pietrobelli, M. P. St-Onge and M. S. Faith. 2009. Increased Sweetened Beverage Intake is Associated with Reduced Milk and Calcium Intake in 3- to 7-year-old Children at Multi-item Laboratory Lunches. *J. Am. Diet. Assoc.*, 109: 497-501.
- Keshari, P and C. P. Mishra 2016. Growing Menace of Fast Food Consumption in India: Time to Act. *Int. J. Community Med. Public Health.*, 3: 1355-1362.
- Lakshman, R., C. E. Elks and K. K. Ong 2012. Childhood Obesity. *Circulation*, 126: 1770-1779.
- Lasater, G., C. Piernas and B. M. Popkin. 2011. Beverage Patterns and Trends Among School-aged Children in the US, 1989-2008. *Nutr. J.*, 10:103.
- Laverty, A. A., L. Magee, C. A. Monteiro, S. Saxena and C. Millett. 2015. Sugar and Artificially Sweetened Beverage Consumption and Adiposity Changes: National Longitudinal Study. *Int. J. Behav. Nutr. Phys. Act.*, 12:137.
- Lee, A. M., M. J. Gurka and M. D. DeBoer. 2016. Trends in Metabolic Syndrome Severity and Lifestyle Factors

- Among Adolescents. *Pediatrics.*, 137: e20153177
- Ludwig, D. S., K. E. Peterson and S. L. Gortmaker. 2001. Relation Between Consumption of Sugar-sweetened Drinks and Childhood Obesity: A Prospective, Observational Analysis. *Lancet.*, 357: 505-508.
- Luger, M., M. Lafontan, M. Bes-Rastrollo, E. Winzer, V. Yumuk and N. Farpour-Lambert. 2017. Sugar-sweetened Beverages and Weight Gain in Children and Adults: A Systematic Review From 2013 to 2015 and a Comparison with Previous Studies. *Obes. Facts.*, 10: 674-693.
- Macintyre, A. K., L. Marrayat and S. Chambers. 2018. Exposure to liquid sweetness in early childhood: artificially-sweetened and sugar-sweetened beverage consumption at 4–5 years and risk of overweight and obesity at 7–8 years. *Pediatr. Obes.*, 13: 755-765.
- Malik, V. S., B. M. Popkin, G. A. Bray, J. P. Despres, W. C. Willett and F. B. Hu. 2010. Sugar sweetened beverages and risk of metabolic syndrome and type 2 diabetes: a meta-analysis. *Diabetes Care.*, 33: 2477-2483.
- Malik, V. S., M. B. Schulze and F. B. Hu. 2006. Intake of sugar-sweetened beverages and weight gain: a systematic review. *Am. J. Clin. Nutr.*, 84: 274-288.
- Malik, V. S., W. C. Willett and F. B. Hu. 2009. Sugar-sweetened beverages and BMI in children and adolescents: reanalyses of a meta-analysis. *Am. J. Clin. Nutr.*, 89: 438-439.
- Marshall, T. A., S. M. Levy, B. Broffitt, J. J. Warren, J. M. Eichenberger-Gilmore, T. L. Burns and P. J. Stumbo. 2003. Dental caries and beverage consumption in young children. *Pediatrics*, 112: e184-191.
- Masse, L. C., J. E. de Niet-Fitzgerald, A. W. Watts, P. J. Naylor and E. M. Saewyc. 2014. Associations between the school food environment, student consumption and body mass index of Canadian adolescents. *Int. J. Behav. Nutr. Phys. Act.*, 11: 29.
- Morenga, T. L., S. Mallard and J. Mann. 2013. Dietary sugars and body weight: systematic review and meta-analyses of randomized controlled trials and cohort studies. *B. M. J.*, 346: e7492.
- Nguyen, S., H. K. Choi, R. H. Lustig and C. Y. Hsu. 2009. Sugar-sweetened beverages, serum uric acid, and blood pressure in adolescents. *J. Pediatr.*, 154: 807-813.
- Nicklas, T. A., S. J. Yang, T. Baranowski, I. Zakeri and G. Berenson. 2003. Eating patterns and obesity in children. The Bogalusa Heart Study. *Am. J. Prev. Med.*, 25: 9-16.
- Nissinen, K., V. Mikkila, S. Mannisto, M. Lahti-Koski, L. Rasanen and J. Viikari. 2009. Sweets and sugar-sweetened soft drink intake in childhood in relation to adult BMI and overweight The Cardiovascular Risk in Young Finns Study. *Public Health Nutr.*, 12: 2018-2026.
- Ofei, F. 2005. Obesity - a preventable disease. *Ghana Med. J.*, 39: 98-101.
- Pan, L., R. Li, S. Park, D. A. Galuska, B. Sherry and D. S. Freedman. 2014. A longitudinal analysis of sugar sweetened beverage intake in infancy and obesity at 6 years. *Pediatrics*, 134: S29-35.
- Park, S., H. M. Blanck, B. Sherry, N. Brener and T. O'Toole. 2012. Factors associated with sugar-sweetened beverage intake among United States high school students. *J. Nutr.*, 142:306-312.
- Park, S., B. Sherry, K. Foti and H. M. Blanck. 2012. Self-reported academic grades and other correlates of sugar-sweetened soda intake among US adolescents. *J. Acad. Nutr. Diet.*, 112: 125-131.
- Pereira, M. A. 2014. Sugar-sweetened and artificially-sweetened beverages in relation to obesity risk. *Adv. Nutr.*, 5: 797-808.
- Popkin, B. M and C. Hawkes. 2016. Sweetening of the global diet, particularly beverages: patterns, trends, and policy responses. *Lancet Diabetes Endocrinol.*, 4: 174-186.
- Ranjit, N., M. H. Evans, C. Byrd-Williams, A. E. Evans and D. M. Hoelscher. 2010. Dietary and activity correlates of sugar-sweetened beverage consumption among adolescents. *Pediatrics*, 126: e754-e761.
- Reilly, J. J and J. Kelly. 2011. Long-term impact of overweight and obesity in childhood and adolescence on morbidity and premature mortality in adulthood: systematic review. *Int. J. Obes.*, 35: 891-898.
- Rompay, M. I. V., N. M. McKeown, E. Goodman, M. Eliasziw, V. R. Chomitz, C. M. Gordon, C. D. Economos and J. M. Scheck. 2015. Sugar-sweetened beverage intake is positively associated with baseline triglyceride concentrations, and changes in intake are inversely associated with changes in HDL cholesterol over 12 months in a multi-ethnic sample of children. *J. Nutr.*, 145: 2389-2395.
- Scharf, R. J and M. D. DeBoer. 2016. Sugar-sweetened beverages and children's health. *Annu. Rev. Public Health.*, 37: 273-293
- Shin, S., S. Kim, J. Ha and K. Lim. 2018. Sugar-Sweetened beverage consumption in relation to obesity and metabolic syndrome among Korean adults: A Cross-Sectional Study from the 2012–2016 Korean National Health and Nutrition Examination Survey (KNHANES). *Nutrients*, 10: 1467.
- Slyper, A. H. 2004. The pediatric obesity epidemic: causes and controversies. *J. Clin. Endocrinol. Metab.*, 89: 2540-2547.
- Smith, M. M and F. Lifshitz. 1994. Excess fruit juice consumption as a contributing factor in nonorganic failure to thrive. *Pediatrics*, 93: 438-443.
- Tasevska, N., D. DeLia, C. Lorts, M. Yedidia and P. Ohri-Vachaspati. 2017. Determinants of sugar-sweetened beverage consumption among low-income children: are there differences by race/ethnicity, age, and gender? *J. Acad. Nutr. Diet.*, 117: 1900-1920.
- Te, M. L., S. Mallard and J. Mann. 2013. Dietary sugars and body weight: systematic review and meta-analyses of randomized controlled trials and cohort studies. *B. M. J.*, 346: e7492.

- Vandelloo, M. J., L. M. Bruckers and J. P. Janssens. 2007. Effects of lifestyle on the onset of puberty as determinant for breast cancer. *Eur. J. Cancer Prev.*, 16: 17-25.
- World Health Organization (WHO) 2003. *Diet, Nutrition and the Prevention of Chronic Diseases; Report of a Joint WHO/FAO Expert Consultation*. World Health Organization: Geneva.
- World Health Organization (WHO) 2016. *Report on the Commission on Ending Childhood Obesity*. World Health Organisation: Geneva.
- World Health Organization (WHO) 2020. <https://www.who.int/news-room/fact-sheets/detail/obesity-and-overweight>, accessed on 12.05.2020
- Zhang, T., S. L. A. Yeung, M. K. Kwok, L. L. Hui, G. M. Leung and C.M. Schooling. 2020. Association of sugar-sweetened beverage frequency with adiposity: evidence from the “Children of 1997” birth cohort. *Nutrients*, 12: 1015.



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