Sartika, *et al. Kesmas: Jurnal Kesehatan Masyarakat Nasional (National Public Health Journal)*. 2022; 17 (1): 1-9
DOI: 10.21109/kesmas.v17i1.5532

Kesmas: Jurnal Kesehatan Masyarakat Nasional (National Public Health Journal)

Consumption of Sugar-Sweetened Beverages and Its Potential Health Implications in Indonesia

Ratu Ayu D Sartika[1*], Atmarita[2], M. I Zulkarnain Duki[3], Saptawati Bardosono[4], Lindawati Wibowo[5], Widjaja Lukito[6]

[1]Department of Public Health Nutrition, Faculty of Public Health, Universitas Indonesia, Depok, Indonesia, [2]Indonesian Health Researcher Association (APKESI), Jakarta, Indonesia, [3]Economic Resilience Strategy Institute for the Indonesian Chamber of Commerce and Industry, Jakarta, Indonesia, [4]Department of Nutrition, Faculty of Medicine, Universitas Indonesia-Cipto Mangunkusumo Central Public Hospital, Jakarta, Indonesia, [5]Team for Accelerated Stunting Prevention (TP2AK), Office of the Vice President of the Republic of Indonesia, Jakarta, Indonesia, [6]Postgraduate Program for Physician Specialist-I in Clinical Nutrition/Department of Nutrition, Faculty of Medicine, Universitas Indonesia, Jakarta, Indonesia

Abstract

The broad availability of sugar-sweetened beverages (SSBs) in the Indonesian market is increasing consumption. It, combined with escalating incidence and prevalence of diabetes and related non-communicable diseases (NCDs), and the ongoing debate on policies, has called for a comprehensive review as described in this study. Data was compiled from various sources but mainly gathered from the reported or published documents because of no direct access to the necessary data set. The lack of studies that assessed the direct relationship between SSB consumption and health outcomes in the Indonesian context also became a strong reason for the preparation of this review to highlight important points for further research, academic reviews, and debates on empiric policies to control sugar consumption at the population level. Sociocultural factors were an apparent and crucial determinant of the sweetness preferences of mainstream Indonesians. They were not capitalized in the available documents and should be embraced in future health promotional measures. Given the high contribution of carbohydrates and sugar to total energy intake in the Indonesian diet, it is pertinent to control the increasing trend of SSBs consumption through interventions on both the supply and demand sides.

Keywords: access to beverages, health outcomes, Indonesian consumption, sugar-sweetened beverages, sweetness preferences

Introduction

Of the several methods used to control the prevalence of noncommunicable diseases (NCDs) in Indonesia, limiting incredibly high sugar intake among the population—as indicated by the ubiquity of sugary foods and beverages on the market—is considered to be particularly essential. Beyond being easily accessible, these diverse products are offered at various price points, making them affordable for people of all socioeconomic classes. These items are sugar-sweetened beverages (SSBs), consumed both at and outside of mealtimes, with or without food.

Yet, up to now, the Indonesian Government has not implemented a significant policy to control sugar consumption, including SSB, as part of its efforts to control NCD. One argument is the lack of scientific studies or reviews as empirical evidence of the impact of sugar consumption on population health in the Indonesian context, as done in many other countries.[1] Understanding the issue of sugar consumption and its impact in this local context is critical considering the significance of various environmental factors on determining the diet of a given population, especially in Indonesia, which has very diverse tribes, races, and geographical conditions. In other words, multiple reports of the success of several countries' policies in controlling sugar consumption,[2-6] including SSB, can be a reference, could not be directly adopted, but still need to be studied and adapted to the Indonesian context for its implementation.

This paper aimed to review the following sequentially: (1) how habitual SSB intake among Indonesians could be shaped by its market accessibility and sociocultural preferences overall, (2) the substantial contribution of SSB consumption to daily sugar intake, and (3) concerns on limiting sugar intake as NCDs become a more serious national public health concern.

Method

The preparation of this review paper followed the logical steps applied by the World Health Organization (WHO) in developing a guideline.[7] After the authors

Correspondence: Ratu Ayu D Sartika, Public Health Nutrition Department, Faculty of Public Health, Universitas Indonesia, F Building 2nd Floor, Kampus FKM UI Depok 16424, Indonesia, E-mail: ratuayu.fkm.ui@gmail.com, Phone: +62 896-0297-4813*

Received : December 15, 2021
Accepted : January 17, 2022
Published : February 25, 2022

agreed on the objectives and purposes of writing this review paper, a search of the literature and relevant data sources was carried out to be used as references. Out of many scientific studies on sugar-sweetened beverages (SSBs), the authors have focused on publications within the Indonesian contexts, except for the health-related outcomes of high SSB consumption. Due to the lack of publications related to SSB in the Indonesian context, the literature compilation process was carried out in two ways: using systematic search engines (ScienceDirect) and manual document selection based on expert judgment from the authors. The literature ranged from peer-reviewed journals, national survey reports, policy documents, and even some online articles, especially those related to the historical perspective on the sweetness preference of the Indonesian population.

Although the National Basic Health Research/*Riset Kesehatan Dasar* (Riskesdas) surveys include some indicators on SSB consumption and cardiometabolic syndrome (CMS), the authors did not have access to the raw data. Therefore, necessary analytical tests could not be performed using the data. Thus, based on the literature review, the present elaborations on the SSB market, its consumption pattern, and health consequences of high SSB consumption among mainstream Indonesians.

Results and Discussion

Sociocultural and Behavioral Factors and Sweetness Preferences among Mainstream Indonesians

The predisposition to sweetness is an innate preference that can be altered through repeated sensory exposure and familiarization to certain tastes and flavors as early as during the prenatal period.[8-10] Short- and long-term exposure to sweetness in food or drink, termed learned responses, can increase the inclination and stimulus threshold for sweetness.[11,12] Such responses typically originate from and form through repetitive exposure to foods prepared regularly at home, which are decided by family choices or parental preferences.[13-17] These selections can constitute a fusion of local food culture and what is accessible or available on the market.

The combination of innate and learned hedonic responses to sweetness, triggered by a complex neurobiological mechanism, is probably why most Indonesians favor sweet foods or beverages. These preferences can be traced back to the *cultuurstelsel* or cultivation system government policy in Indonesia under Dutch colonization.[18,19] The policy was defined by the enforcement of the planting of export crops such as sugarcane (processed into cane sugar for export). Hundreds of sugar factories operated out of East and Central Java (Figure 1). Until the onset of the Great Depression in 1930, East Java was the center of the second-largest sugar industry in the world.[20]

During this era, the extreme conversion of 70% of Indonesia's rice fields into sugarcane plantations led to a sharp decline in rice production. With rice being a staple food, this caused mass hunger among approximately 80.6% of Indonesians, who were Java residents according to census data from 1905.[21-23] Sugarcane juice was

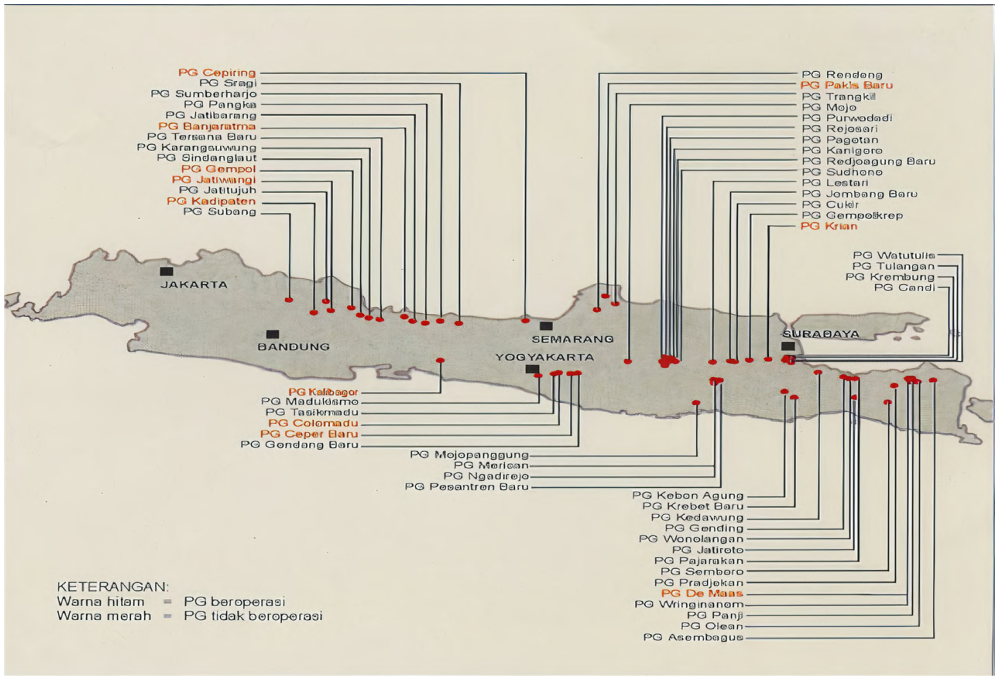


Figure 1. Sugar Factories in Java Island,[24]

increasingly used for cooking to compensate for the carbohydrate intake that would have ordinarily come from rice consumption. In the long term, preference for sweetness in food and drink was absorbed into local food culture and dietary habits. Following domestic migration, which explained the 11.9% reduction (80.6% to 68.7%) in Indonesians residing in Java between 1905 and 1930, these changes spread to other islands in the country.[22,23]

The Sugar-Sweetened Beverages Market and Patterns of Sugar-Sweetened Beverages Consumption among Mainstream Indonesians

According to 2019 study conducted by the Monell Chemical Senses Center in the United States, which involved a synthesis of 400,000 customer reviews, food products commercially available today are more on the sweet side or even considered overly sweet, and this is regarded as a global phenomenon.[24] Specifically, SSBs have become increasingly variegated after 2000 and accessible over the years. Before 2000, SSBs comprised a limited selection of soft drinks, sweetened teas, juices or juice-based drinks, and sweetened milk and fermented milk beverages. Today, consumers can also choose from sweetened coffee, flavored water, energy drinks, honey drinks, bubble tea, and powdered drinks. Each type varies in brand, volume, sugar content, price, packaging, and targeted customer groups.

Within the country, SSBs are produced by medium and large corporations and small microenterprises that have absorbed many workers.[25] The inclusion of more than 60% of street vendors into retail businesses has made SSBs highly accessible to various classes of customers, accounting for taste preference, purchasing power, and even lifestyle. Thus, it is unsurprising that the recent data from the Liquid Intake over 7-Days (Liq.In7) surveys, which were conducted across Europe, South America, and Asia,[26] showed that SSBs constitute the third-largest source of Indonesians' liquid consumption (227 mL/day, approximately 8%) after water and hot beverages (2,164 and 263 mL/day, or approximately 80% and 10%, respectively). Herein, SSBs refer to both factory-made products and homemade beverages such as coffee or tea, to which sugar is typically added. From 22 samples of SSBs randomly selected in the market, it was determined that a 317-mL serving of an average factory-made SSB is close to Indonesians' per capita daily SSB consumption. The data suggest that it is likely that SSBs are consumed in their entirety in one sitting.[26]

Following the WHO recommendation to limit free sugar intake to 5% to 10% of daily total energy intake (TEI),[27] once-daily consumption of SSB may already put an individual at risk of exceeding that limit. Using the upper limit of 10% of TEI, the daily free sugar intake allowance for adults and children aged under five years would be 50 g and 27 g–40 g, respectively.[7] The Ministry of Health of the Republic of Indonesia noted that free sugar intake of more than 50 g per day is excessive and recommends that it not exceed 25 g.[28] From the same 22 samples of SSBs, a 317 mL serving portion of an SSB contains 23 g of sugar or approximately 7.26 g per 100 mL. The fact that unhealthy choices in SSBs continue to dominate the local market, considering that the National Agency of Drug and Food Control/*Badan Pengawas Obat dan Makanan* (BPOM) classifies "healthy choices" in SSBs as containing no more than 6 g of sugar per 100 mL.[29] Consumption of SSB by itself, even once a day, can mean ingesting amounts of free sugar approaching the daily intake limits set by the WHO and the Ministry of Health.

Indonesians are introduced to SSBs at an early age. The Total Diet Study in 2014 indicated that 42.6% of children aged under five years consume SSBs, with the highest consumption (59.8%) among those aged 36–59 months.[30] High SSB consumption can also be reflected in the substantial proportion (67.19%) of household spending devoted to SSBs, as reported in the 2017 National Socioeconomic Survey/*Survei Sosial Ekonomi Nasional* conducted by Daeli and Nurwahyuni.[31] In line with these estimates, the 2018 of Basic Health Research survey,[32] indicated that 61.3% of Indonesians aged ≥3 years consumed at least one SSB per day (Figure 2), with

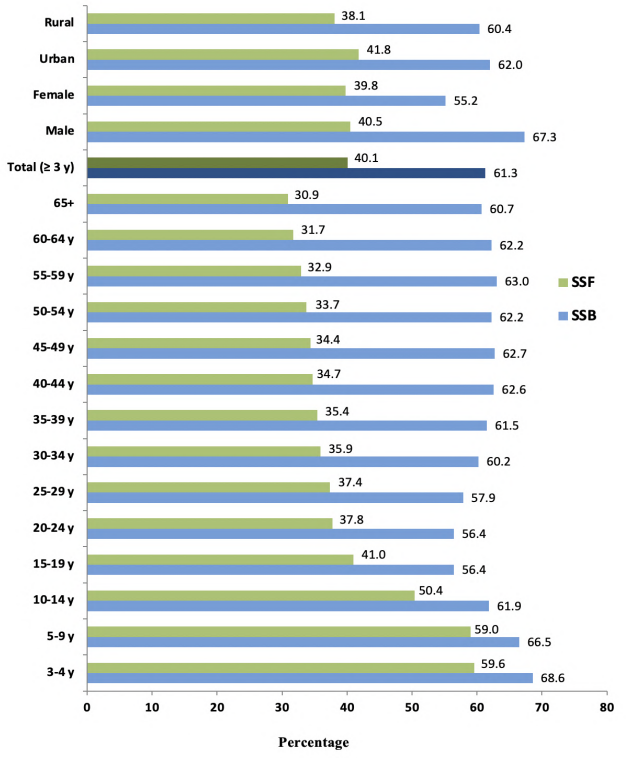


Figure 2. Individual Daily Consumption of Sugar-Sweetened Beverages and Sugar-Sweetened Foods by Age, Sex, and Location,[32]

consumption exceeding that of sugar-sweetened food (40.1%). Sugar-sweetened food consumption was higher in male than female Indonesians (67.3% vs. 55.2%), but no notable age- or location-based (rural vs. urban) differences in consumption patterns were observed.

These findings explain why the consumption of SSBs, regardless of origin, can be regarded as the most considerable source of per capita sugar intake in Indonesia and constitutes a potent risk factor of various relevant health conditions. Studies have consistently reported that SSBs account for almost 20% of the TEI of teenagers in East Jakarta,[33] and Bandung.[34] In addition, a systematic review on snack food or SSB consumption in young children in low- and middle-income countries (including Indonesia) reported a TEI of 13%–38% (median 19.3%), exceeding the maximum allowance of 10%.[35]

According to data from the 2017 National Socioeconomic Survey,[36] among all variants of SSBs (alcoholic or otherwise), soft drinks were the least popular. In contrast, ready-to-drink beverages such as coffee, milk coffee, tea, and chocolate milk were the most highly purchased and consumed. Using the same data set, Daeli and Nurwahyuni,[31] analyzed the determinants of SSB consumption in Indonesia. The consumption of fast food and processed snacks, the price of SSBs, and per capita income were found to be positively associated with SSB intake. This study revealed that SSB intake was reduced by 19.86% with every 10% price increase. Being aged 65 years or over was negatively associated with SSB consumption.

Health Outcomes Related to High Sugar-Sweetened Beverages Consumption

Thousands of published studies have addressed the negative health effects of SSB consumption, with evidence of the link between the two ranging from low, moderate, and strong (Figure 3).[1] Experimental tests indicated that SSB consumption may not necessarily induce satiety or self-regulation in the next food or drink consumed. A person's sensitivity to proper compensation for excessive caloric intake, especially following the consumption of liquids,[37] that are not solid sources of carbohydrates, appears to diminish by age or body adiposity.[38-40] These could lend a plausible explanation to why SSB consumption has been associated with conditions such as for overweight,[39,40] obesity,[41,42] fatty liver,[43] CMS,[44-47] and type 2 diabetes.[48,49]

Other studies have associated SSB consumption with risks of tooth decay,[50] kidney disease,[51-53] micronutrient deficiencies,[54-57] cancer,[58] strokes,[59] psychological dis-

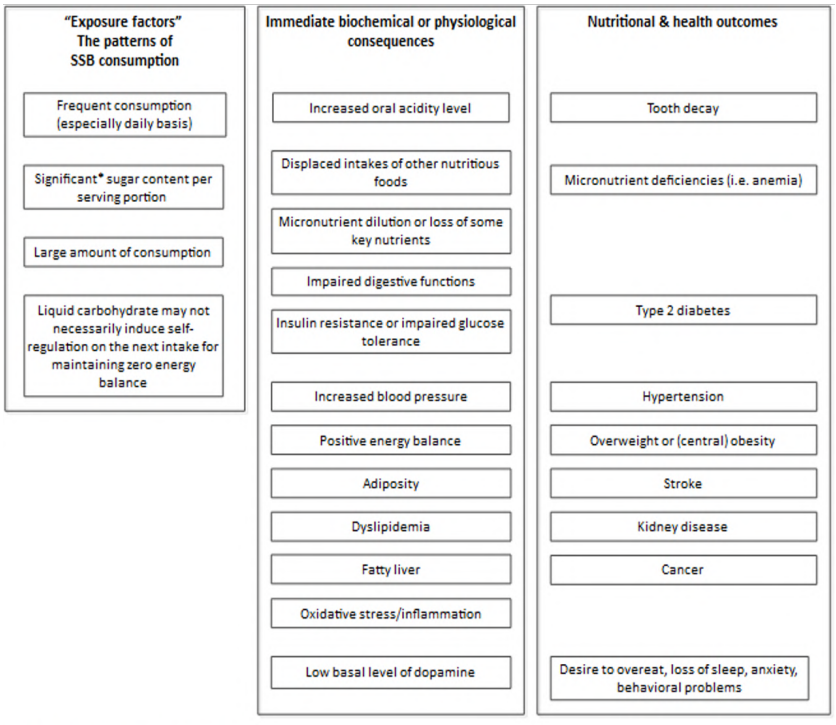


Figure 3. Immediate Biophysiological Consequences and Nutritional Health Outcomes Related to Sugar-Sweetened Beverages Consumption

orders such as anxiety, sleep loss,[60] and behavioral problems among preschoolers,[61] among others.[62] Such disturbances have been linked to the high sugar content and other substances (e.g., carbon dioxide, caffeine, and artificial sweeteners) in SSBs. Their consumption initially leads to some intermediate conditions such as positive energy balance, increased oral acidity level, impaired digestive function, and the insufficient intake or loss of certain key nutrients.

Health Outcomes that are Potentially Linked to High Sugar-Sweetened Beverages Consumption in Indonesia

Growing concerns about SSB-related health risks must be sufficiently addressed concerning the efforts to reduce SSB consumption in Indonesia, especially in consideration of trends in national health statistics within the past two decades, which have highlighted the emergence and population risk of NCDs as the persistent problem of undernutrition. The Global Health Estimates of the WHO,[63] NCDs attributed to 61.3% of deaths in 2000, 68.9% in 2010, 72.5% in 2015, and 73.3% in 2016—a clear upward progression. The National Basic Health Research survey in 2018,[32] reported that the onset of overweight in early infancy was 13.6%, declined approximately 5% to 6% between the ages of 6 and 59 months, and rose again after 5 years. As shown in Figure 4, the proportional distribution of individuals with obesity shifted from being lower to being consistently higher than that of individuals with overweight, with considerably significant proportional differences of more than 6% between the ages of 25 and 64 years. The percentage of girls and women with overweight aged ≤18 years was higher than boys and men with the same condition. In contrast, the percentage of boys and men with obesity was higher than that of girls and women with the same condition. Beyond that age, however, the proportion of women with obesity spiked almost sevenfold, far exceeding that of men with obesity.

Across all age groups, the prevalence of overweight and obesity was consistently higher in urban than rural areas (Figure 4). The proportional distribution patterns of overweight and obesity by age group were similar by location (e.g., urban or rural), with a higher prevalence of overweight than obesity in individuals aged less than 18 years. At and over the age of 18 years, obesity was more prevalent than overweight. Across years, the prevalence of overweight and obesity rose steadily across all age groups, with the most striking increase in the preva-

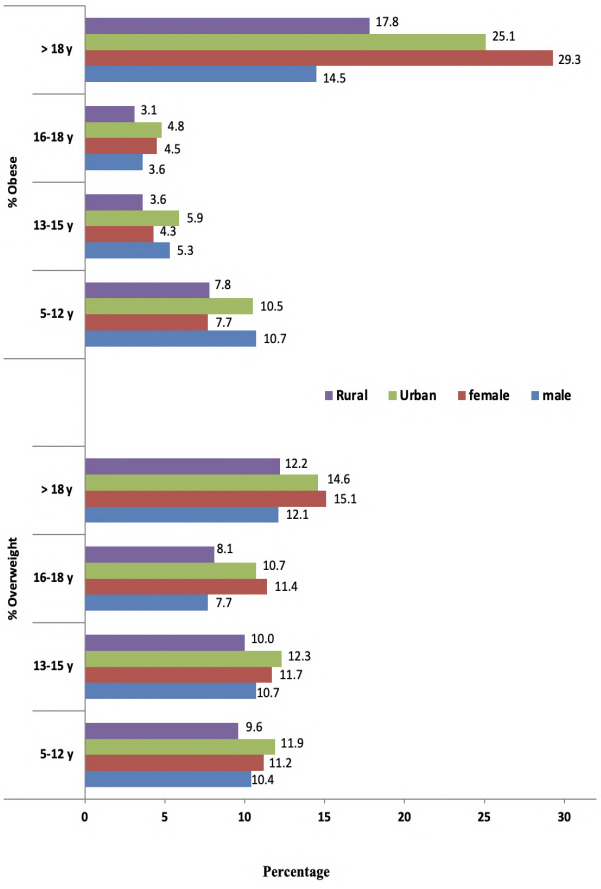


Figure 4. Prevalence of Overweight and Obesity by Age Group,[32]

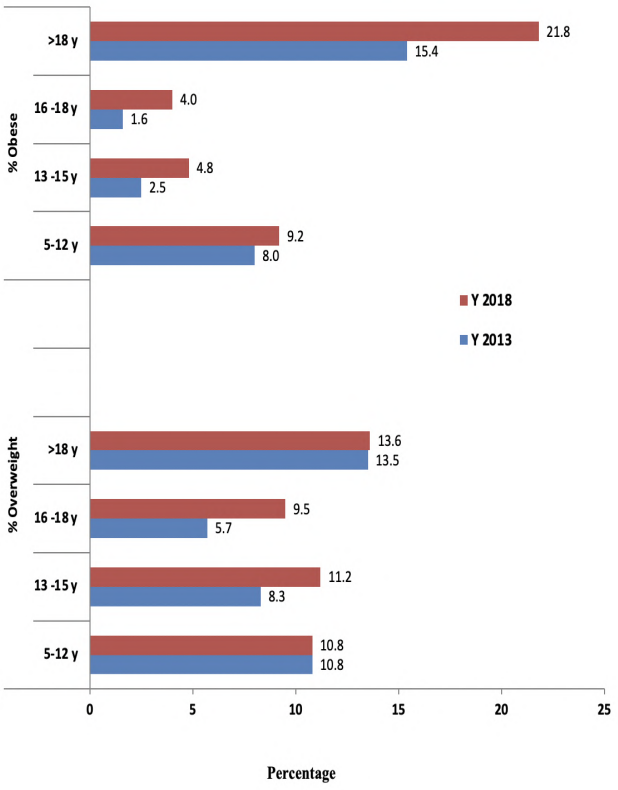
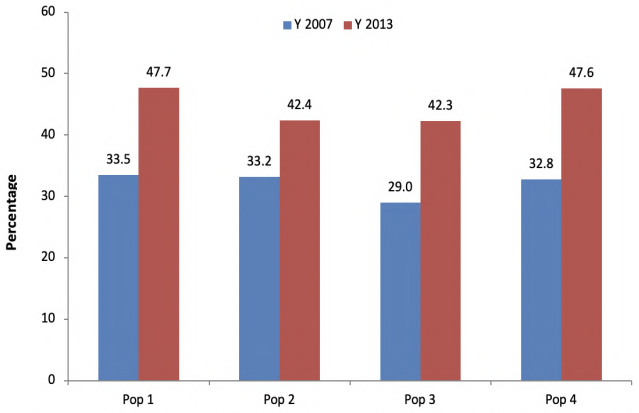


Figure 5. Prevalence of Overweight and Obesity by Age Group Across Years,[32,64]



Notes: Population 1: Hypertension, diabetes, cancer, obesity, central obesity; Population 2: Hypertension, diabetes, cancer, obesity; Population 3: Hypertension, diabetes, obesity; Population 4: Hypertension, diabetes, obesity, central obesity.

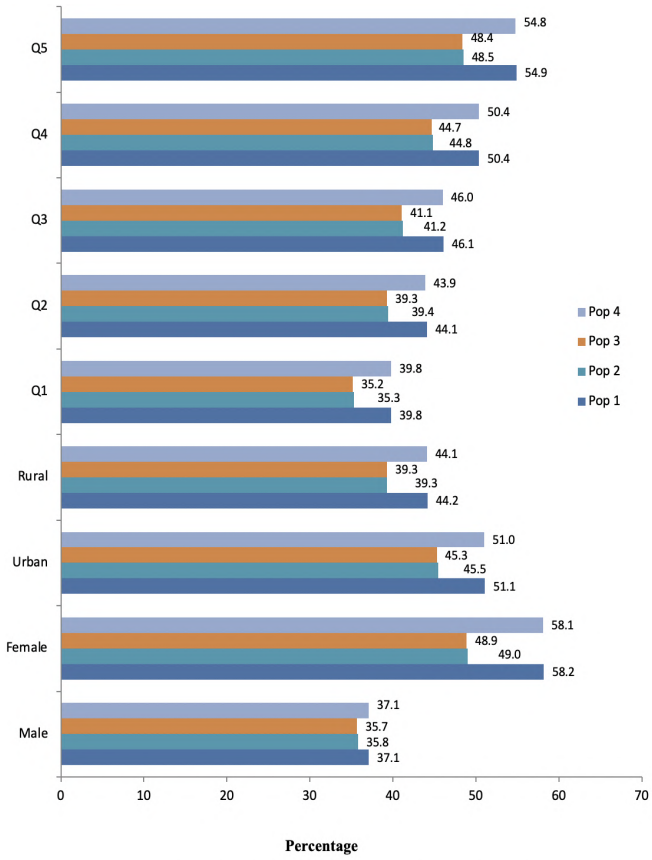
Figure 6. Prevalence of NCDs Across Years,[64,65]

lence of obesity in those aged 18 years or over from 15.4% to 21.8% between 2013 and 2018 (Figure 5).

Between 2007 and 2013, the prevalence and risk of NCDs among individuals aged 18 years or over increased by approximately more than 1% (Figure 6). Statistics from the National Basic Health Research survey in 2013,[64] indicated that NCD prevalence and risk were higher among women living in urban areas and those of a higher socioeconomic class (including women with both of these attributes; Figure 7). More detailed analysis is warranted for interpreting whether this higher prevalence means a higher risk of developing NCDs and/or is ascribable to higher compliance to medical care. Aside from the prevalence differences, statistics from the 2007,[65] and 2013,[64] National Basic Health Research survey indicate that NCDs constitute a serious public health concern (Figure 6 and 7).

Conclusion and Recommendation

Understanding the potential contributions of Indonesia's high SSB consumption is exigent as CMS, and any other health conditions show increasing trends over time. Some relevant indicators from the National Basic Health Research survey in 2018 can be a preliminarily study to examine any correlations in SSB consumption with the population's dietary quality and nutritional outcomes by age group, sex, socioeconomic class, and location (urban/rural and geographical). Future studies are required to estimate better Indonesia's annual financial and non-financial losses (e.g., in terms of government health spending and disability-adjusted life years, respectively) attributable to NCDs. These estimates can form a strong foundation for developing policies on limiting the population's sugar intake, including SSBs.



Notes: Population 1: Hypertension, diabetes, cancer, obesity, central obesity; Population 2: Hypertension, diabetes, cancer, obesity; Population 3: Hypertension, diabetes, obesity; Population 4: Hypertension, diabetes, obesity, central obesity.

Figure 7. Prevalence of NCDs by Sex, Location, and Socioeconomic Class,[64]

On the supply side, four approaches to lower SSB consumption are proposed as follows: (1) enforcing regulations to limit the sugar content of any form of SSB and provide complete nutritional information, particularly total sugar content; (2) promoting both the production and consumption of products containing less sugar; and (3) reinforcing interventions on retail and food services to set beverages with less sugar as default options, offer more of such products on counters, or even apply strict conditions on selling products with substantially high sugar content; (4) and pursuing further study, academic reviews, and debates on empiric policies to control sugar consumptions at the population level.

Equally importantly, on the demand side, practical educational approaches must be explored and implemented to modify Indonesians' sweetness preferences, with adjustments made for age groups and sociocultural contexts. Such education must strongly emphasize the following: (1) the health benefits of reducing free sugar intake (including that from SSBs) and (2) promoting

healthier eating habits among the population, including the limitation of sugary food and drink, starting from an early age.

Abbreviations

SSB: Sugar-Sweetened Beverages; NCDs: Noncommunicable Disease; WHO: World Health Organization; CMS: Cardiometabolic Syndrome; PG: *Pabrik Gula* (Sugar Factory); TEI: Total Energy Intake; BPOM: *Badan Pengawas Obat dan Makanan*; g: gram; mL: milliliter; Riskesdas: *Riset Kesehatan Dasar*.

Ethics Approval and Consent to Participate

Not Applicable

Competing Interest

The author declares that there are no significant competing financial, professional, or personal interests that might have affected the performance or presentation of the work described in this manuscript.

Availability of Data and Materials

The dataset used and analyzed are available in published documents and the internet.

Authors' Contribution

All authors contribute to the conception and construction of the review outline and the compilation of references. Furthermore, RADS, A, MIZB, SB, and WL provide input on substantial elements of the review, research implications and near future policy development, considerations on the political implication of the review. LW coordinated communication between experts, synthesis the review, aligned the progress of the draft review with recommended time frame provided by the donor. WL also coordinated funding support from the donor and the final editing of the draft manuscript.

Acknowledgment

The Indonesian Danone Institute Foundation funded this work. Also, this manuscript was edited by Wallace Academic Editing.

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