Review Article

Consumption patterns of sweetened condensed milk in the diet of young Indonesian children and its potential nutritional health consequences

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This critical review is intended to analyse the existing studies on the consumption patterns of sweetened condensed milk in the diet of young Indonesian children and its potential nutritional health consequences. Considering its limited nutritional value and high sugar content, sweetened condensed milk (SCM) should not be administered to young children (1-3 years old) with the goal of promoting their growth and development. However, such false practice has been reported in mostly urban studies among the underprivileged population. Conclusive scientific evidence is also still lacking regarding the health risks of long-term SCM consumption by young Indonesian children at early ages, as no study has focused on this specific topic. Nevertheless, inadequate understanding of SCM, its consumption patterns, and its long-term effects on health among young Indonesian children have been implicated in public confusion on the topic. Ongoing disparities that exist between regulation, industrial practices, and product advertisement have led to poor understanding in communities, which, to a considerable extent, has contributed to difficulties in segregating data on the consumption of SCM and its related products. Analogous to sugar-sweetened beverages, limited SCM consumption can be recommended when appropriately implemented with active monitoring and evaluation of product advertisements and product labeling, enforcement of regulations, and provision of effective customer education.

Key Words: sweetened condensed milk, sugar-sweetened beverages, young children, metabolic disorders, health outcomes

INTRODUCTION

As a common dairy product, sweetened condensed milk (SCM) is consumed by a variety of people at different ages and can be found easily in many parts of the world, including Indonesia. This product is flexibly used as a topping for various desserts and a spread, or it is mixed with water, coffee, or tea as beverages. However, because of its high content of sugar used as the preservative (estimated close to 50% of the total calories, although the exact amount is usually unspecified[1]), ideally, SCM should not be given to young children as either breast milk or formula milk substitutes.[2] Yet, indications of such improper utilization of SCM have been repeatedly documented in several independent studies mostly conducted in urban and semiurban areas in Indonesia.[3-5] These findings then raise the question of whether such alarming practices are actually prevalent in the country or not. Nationwide, however, the pattern of SCM consumption by young children, positioning of this product in the diet of children, and its contribution to daily sugar intake (in g) or specifically to the total daily energy intake (in %) remain unknown.

Toward the end of 2017 and until mid-2018 in Indonesia, national polemics increased for SCM as a nondairy and unhealthy product for consumption by young children. The major concerns were the replacement of breast milk with SCM and excessive sugar/calorie intake among children consuming SCM. The lack of knowledge among the majority of the Indonesian population on the product and its analogs[6] (i.e, sweetened skimmed milk, vegetable-fat SCM, creamed SCM, and creamer SCM) and differ-

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ences in their nutrient contents further confounded the public debate on product safety for child consumption. To objectively resolve the pros and cons of product safety, strong evidence must be made available to associate SCM consumption patterns with some selected health risk indicators among children. In other words, it is implausible to understand the health risks in the absence of data on the habitual intake of SCM among children.

This critical review was thus purposively conducted by a special team with various fields of expertise, including nutrition, child health, and food policies, to identify SCM consumption patterns among young Indonesian children and to examine the plausible health risks of a given consumption pattern. Both the intrinsic and extrinsic factors determining SCM consumption by young children were also mapped and linked with government responsiveness to regulate product characteristics, labeling, marketing, and advertisements in Indonesia.

Methodological issues

For constructing this review paper, logical steps similar to those described in the WHO Handbook for Guideline Development[7] were followed. The scheme in Figure 1 illustrates the interlinkages of four themes under review: [1] SCM consumption patterns, [2] determinants of SCM consumption (e.g., product characteristics and socioeconomic factors), [3] plausible health consequences, and [4] policy/regulations related to SCM. Due to very limited studies on any of those themes, evidence (data) was (were) compiled from peer-reviewed articles, local journals, policy documents (i.e., circular letter or decrees), government and nongovernment reports, and unpublished theses/dissertations. Expert judgment was applied for the inclusion and exclusion of references for this review. To evaluate the quality of evidence (e.g., high, moderate, and low) from those various sources, thorough assessments were conducted through team discussions in four phases of meetings. Any limitations of the data reviewed were identified and elaborated for objective justifications on the conclusiveness of evidence per theme, strength of recommendations, and identified research gaps. Each team member also signed a declaration of interest form before preparing the review.

Nationally and internationally, studies on SCM-related issues are scant, except those related to the subjects of food technology, production lines, and marketing. Among much scientific studies on sugar-sweetened beverages (SSBs) or milk, SCM is rarely the main focus; thus, very few SCM-related studies can be found in systematic search engines (i.e., PubMed). Using a snowball technique, the team started the review using the few documents that discussed—but were not specifically related to—SCM. During the process, the team also perused the list of reference in each of these reviewed documents to identify additional literature. The team then tried to access these references using Google scholar or by directly contacting the authors and investigators.

Currently, the Individual Food Consumption Survey 2014 (IFCS 2014), as a part of the National Total Diet Study 2014 (NTDS 2014), is the only data source available that can be used to assess SCM consumption patterns among children nationwide. However, this survey has some limitations related to data access, completeness, and accuracy that impede investigations into typical SCM consumption. Any results of the IFCS 2014 data analysis presented in this review were actually taken from an unpublished thesis.[8] Referring to the survey objectives, the data on SCM consumption in IFCS 2014 were collected as a small fraction of the overall data on food consumption, which might include SSB or milk consumption data. Additionally, information on product analogs may or may not be available in the data set. Some might not be speci-

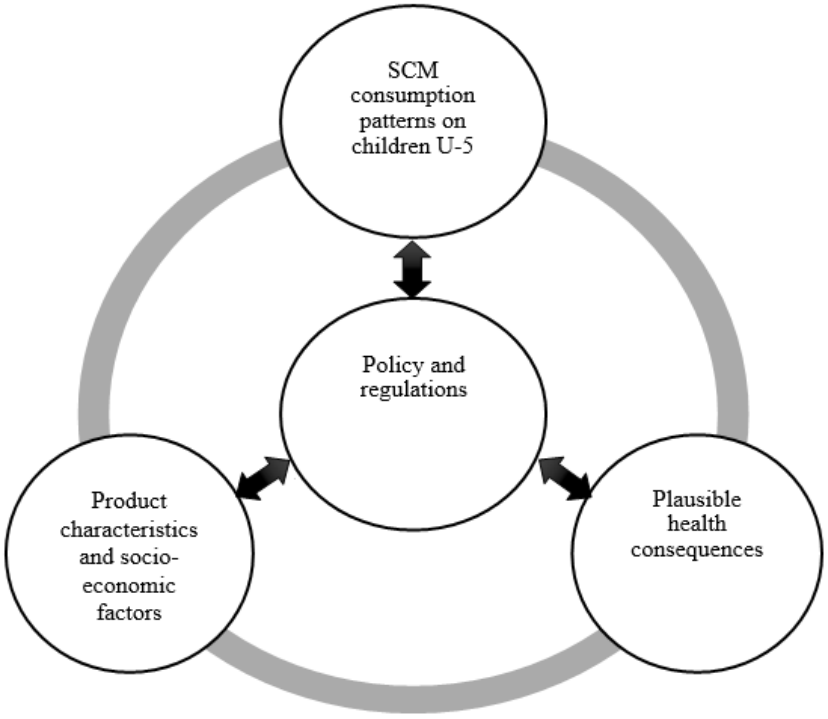

Figure 1. Framework of this SCM review. SCM: Sweetened Condensed Milk.

fied, whereas others could still be recognized if the brand name was recorded. Another limitation is that the food consumption data in this survey were derived from only 1-day food recall, which can hardly represent the usual intake of an individual,[9] as it could be subjected to the respondent's memory lapse, inability to closely estimate the amount of food/drink consumed, or bias in the form of the so-called flat-slope syndrome.[10] However, with the large sample size of the survey, the 1-day food recall data could still provide reliable estimates on the population's calorie and protein intakes.[9]

To add more information on the pattern of SCM consumption among children, the reports/publications of smaller cross-sectional surveys were also used as references. Although with much smaller scope, some of these surveys could actually generate accurate estimates of typical individual intake because the consumption data were collected using 2- or 3-day food recalls.

For clarity, any terms related to "sugar" used in this study follow the definitions in Table 1.

The market and patterns of SCM consumption among Indonesian children

Historically, SCM was invented in the 1850s as a "nutritional solution" that was believed to lower the risks of ill-health problems due to the contamination of milk stored for long periods in the absence of cold storage.[11,12] Since then, the supply and demand patterns of this product have changed over time in the global market, which are mainly attributable to the availability of the main product ingredients (e.g., fresh milk, whole milk powder, and sugar), the capacity of production plants, targeted consumers, evolving food trends, and consumption patterns, which are highly segmented by region. For example, in the Asia Pacific region, the SCM market is boosted by the increased consumption of SCM in beverages in some countries.[13,14] Supplies from China and India dominate the market within this region, with the United States and Europe as the major SCM exporters. To meet local demands, countries such as Indonesia, the Philippines, and Vietnam have become the major SCM importers of SCM from the United States.

First imported from Holland in 1873, SCM has been locally produced in Indonesia since 1967.[15] Currently, with the SCM production capacity at approximately 812,000 tons annually, local industries in Indonesia obtain fresh milk supplies from more than one hundred thousand dairy farmers, which is economically equivalent to an investment value IDR 5.4 trillion, and these industries employ 6,652 workers.[15,16] In contrast to such impressive economic figures, the supplies used for processing SCM include low-grade local fresh milk, which contains high amounts of bacteria and low protein.[17-20] In the evaporation process, fresh milk is pasteurized, which can remove pathogens and inactivate vegetative spoilage bacteria and enzymes, but not bacterial spores. To increase the protein content up to the FDA's standard level,[6] powdered whole milk powder (WMP) is then added as an SCM ingredient.[19,20] Due to the limited amount of locally produced WMP, local manufacturers rely on imported WMP, mostly from New Zealand (53%–65%), followed by Australia (15%–16%), the United Kingdom (7%), and very limited quantities (data was not shown in the report) from the United States.[20,21]

From the global perspective, Indonesia is still categorized as a country with low milk consumption, with an estimated country-specific intake of less than 30 kg or 29.1 L per capita/year.[22]Although increasing from year to year (see Figure 2), the milk consumption per capita/year in Indonesia remains the lowest among other Association of Southeast Asian Nations countries, including the Philippines (22.1 L per capita/year), Malaysia (50.9 L per capita/year), and Thailand (33.7 L per capita/year).[17-21,23-24] With such little intake, SCM is one of the very few dairy products that has been commonly consumed by the Indonesian population over the past few decades.[15] As stated in the annual reports of the USDA Foreign Agricultural Service from 2009 to 2015,[17-21,23] SCM, with a market share of 35%, has sustainably dominated the national market together with liquid ready-to-drink milk (26%) and powdered milk (39%).

The market for liquid milk grew faster (17.4% annually), and the annual market for SCM also grew steadily by 4.74 %.[18-20] The increasing demand for liquid milk is assumed to be driven by the increasing proportion of the middle class population in Indonesia, who have preferences for and possess better health consciousness of the benefits of fresh/natural products such as liquid milk. However, the much cheaper price and the ease of bulk transportation without the need for cold chain management (its added sugar acts a preservative) make the market distribution of SCM so widespread within the country.

Table 1. Different definitions used for sugars in dietary recommendations[38]

Term	Definition
Nonmilk extrinsic sugars† - UK, 1991	Sugars not contained within the cellular structure of a food except lactose in milk and milk products.
Free sugars† - WHO, 2015	Free sugars include monosaccharides and disaccharides added to foods and beverages by the manufacturer, cook, or consumer, and sugars naturally present in honey, syrups, fruit juices, and fruit juice concentrates.
Added sugars – US, 2005	Sugars and syrups that are added to foods during processing and preparation.
Added sugars – EFSA, 2009	Sucrose, fructose, glucose, starch hydrolysates (glucose syrup, high fructose-syrup), and other isolated sugar preparations used as such or added during food preparation and manufacturing.

†The only difference between non-milk extrinsic sugars and free sugars is that nonmilk extrinsic sugars include 50% of the fruit sugars from stewed, dried, or canned fruit, but free sugars include none.

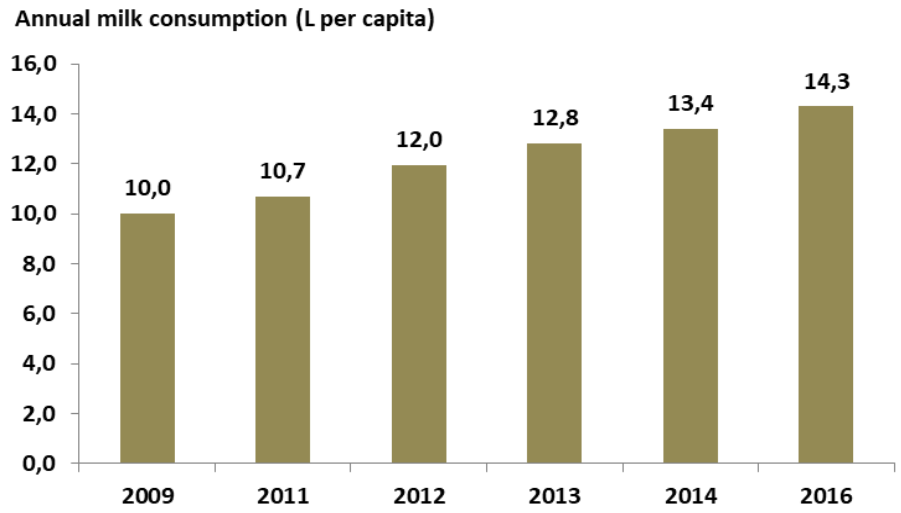

Figure 2. Milk consumption per capita per year in Indonesia between 2009 and 2016[17–21,23-24]

Pricing and convenience for storage have become the main reasons why approximately 90% of the Indonesian population still prefer consuming SCM, milk powder, or ultra-high-temperature (UHT) milk than fresh/ready-to-drink milk.[25] An increasing trend of the annual consumption of SCM and its product analogs per capita (in 397 g per capita) from 2010 to 2016 was also presented in the report by Ministry of Agriculture in 2017, as illustrated in Figure 3.[26] However, the detailed stratification of these annual consumption data by age groups has not been provided.

Child age is documented as a substantial determinant of the shifting of the milk consumption pattern from breast milk or formula to SCM. Studies in urban Yogyakarta,[5] Bogor,[27] and West Jakarta[28] have consistently found gradual increases in the proportions of children consuming SCM in analyses stratified by age group (Table 2). Believing that milk is a substantial food for toddlers to grow,[3] some caregivers tend to maintain their children's milk consumption using whatever type of milk they could provide regularly. Sometimes, SCM is given in combination with breast milk, as found in a survey in Jakarta among 22.1% of children 12–38 months old.[4] It was also found that 30% of caregivers of preschoolers (aged 3–5 years) in urban Yogyakarta tried to maintain their children's milk consumption simply by substituting the growing-up formula/milk with SCM, especially when their children grew older.[5] The tendency of caregivers to delay the introduction of SCM to their children at an early age is consistent with the assertion by the FDA[29] that SCM is not suitable for infants. However, a few cases where infants that were ideally supposed to be exclusively breastfed were given SCM as the substitute were still found in some studies, either among normal (0.25%)[27] or underweight infants (2.2%).[30]

The preference for dairy products for consumption is also attributable to some interlinked factors related to product characteristics and socioeconomic variables. Intrinsic factors of the product could range from product characteristics (i.e., taste, aroma, and freshness), shelf-life, storage, brand name, nutrition label, packaging, pricing, and halal logo. With the prevalent lack of knowledge of product analogs, one could assume that many SCM buyers do not fully understand or are aware of the nutrition label or the attached nutritional value information (NVI) on the product package. Usually, SCM and its analogs are incorrectly perceived as the same products and to be nutritionally equivalent. Studies in urban and semiurban slums have reported that some caregivers, especially those from families with low socioeconomic status, perceived that SCM is nutritionally sufficient to support growth of a toddler.[3,4] This false understanding could not be interpreted as negligence on the product's nutritional value, when in fact it was commonly admitted as one important factor considered by mothers when selecting milk products for their children.[31,32] However, such a positive attitude does not necessarily translate to the behavior of reading nutrition labels.[33] This might explain why other product characteristics of SCM appear to matter more than its nutritional value, particularly within certain population segments (i.e., underprivileged, poor or less educated). Data have shown that SCM in sachets is favorable to be administered to toddlers because the product is easy to obtain, very affordable, has an enjoyable taste, needs no storage with only a one-serving portion per sachet, and can be prepared whenever the child wants it, even more than once a day.[3,5]

As reported in different cross-sectional studies, socioeconomic variables, such as family income and parents' education, are consistently associated with child milk consumption patterns. Considered as a luxury good, milk and other dairy products are mainly prioritized for infants and children.[19] Pricing is then assumed to be the main reason for choosing a dairy product, particularly by those who belong to economically restricted populations. With a much lower retail price than that of liquid or powdered milk, SCM is affordable even for those with low purchasing power.[20,21] According to Sugito,[4] 58.9% of children who consumed SCM were from families with a low socioeconomic status, which has been confirmed by the results of mostly urban-setting studies as summarized in Table 2. Similarly, parents' education, particularly the mother's, is also associated with the preference to administer SCM to children, including the daily consumption

Table 2. Associations between the consumption of SCM or SSB by children and some socioeconomic variables

Study site (authors)	Methods	Subjects	Associated variables		
			Child age groups	Family income	Parent's education
Urban Yogyakarta (Prawirohartono et al[5])	3-day food recall	249 children aged 3–5 years; compared between those who consumed growing-up formula (GF), sweetened condensed milk (SCM), and less milk (LM)	The proportions of children who consumed SCM increase by age*: More children at the age of ≤48 months consumed GF (53.7%) than SCM (34.2%) or LM (40.0%) More children aged >48 months consumed SCM (65.8%) or LM (60.0%) than GF (55.0%)	More families in the GF group owned tertiary goods, such as refrigerator (61.2%) and computer (34.7%), than those in SCM (35.6% & 15.1%) or LM (34.5% & 18.2%) groups*	Fewer (5.5%) mothers with high education (some post-secondary) in the SCM group than those in GF (18.5%) or even LM (12.7%) groups*
Bogor City (Palupi E[27])	History of breastfeeding and milk consumption, milk consumption frequency, 2-day food recall	221 children at ages 5 to 6	The proportions of children who consumed SCM increase by age*: 0–<6 months: 0.25% 6–<12 months: 1.27% 12–<24 months: 5.04% 24–<72 months: 22%	Children from families with lower incomes had higher usual daily SCM intake (mL/d; presented in mean±SE): <25 USD/mo: 85.1±18.9[a] 25–49 USD/mo: 75.6±11.5[ab] 50–99 USD/mo: 52.6±11.8[b] 100–249 USD/mo: 24.0±10.2[c] ≥250 USD/mo: 38.2±25.5[b]	Children from parents with less education (≤9th grade) had higher usual daily SCM intake (mL/d; presented in mean±SE): Mother's education: ≤6th grade: 69.3±11.1[a] 6th–9th grade: 76.7±14.3[a] Completed high school: 49.1±11.7[ab] Some postsecondary: 39.5±26.4[b] Completed bachelor's degree: 7.2±7.2[b] Father's education: ≤6th grade: 66.3±11.8[a] 6th–9th grade: 78.7±15.9[a] Completed high school: 69.2±10.2[ab] Some post-secondary: 69.4±13.3[b] Completed bachelor's degree: 6.8±4.7[b]
Indonesia, (Ruswandi RBI[8])	1-day food recall	(Total sample) children 0 –<60 months			More children of less-educated mothers consumed SSB: ≤6th grade: 37.5% 6th–9th grade: 25.8% Completed high school: 36.7%
West Jakarta, (Sartika RAD & Ruswandi RBI, unpublished data)	2-day food recall	200 children aged 12–<60 months	The proportions of children who consumed SCM by age groups 12–<24 months: 32.6% 24–<36 months: 38.6% 36–<60 months: 43%	The proportions of children who consumed SCM by family income Low income (< RMW): 40.9% Medium to high income (≥ RMW): 31.0%	More children of less-educated mothers consumed SCM: ≤6th grade: 76.2% 6th–9th grade: 55.0% Completed high school: 25%

USD: US Dollar (1 USD ≈ IDR 10,000); IDR: Indonesian Rupiah; SE: standard error.
*Sig. at $p<0.05$.
Superscript letters (a–c) indicate significantly different mean values (sig. at $p<0.05$); RMW: Regional Minimum Wage - at Jakarta, the cut off point for RMW in 2017 was equal to 3,355,750 IDR ≈ 258 USD.

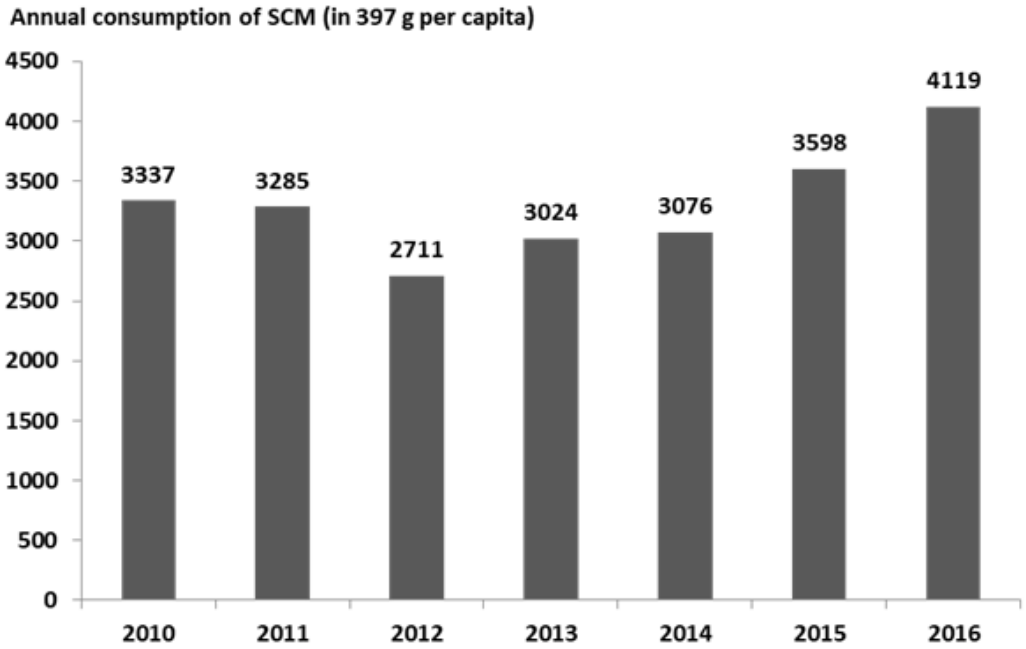

Figure 3. Annual consumption of SCM and its product analogs per capita (in 397 g per unit) from 2010 to 2016[26]

amount. This practice may become more frequent when parents adopt passive feeding by letting the child decide on what, when, and how much they want to eat.[3,30] However, with a minimal support system, sufficient time allotment, and better perception of what food should be given to children, mothers could actually practice proper child feeding regardless of where they reside, the economic status of the family, and their educational level.[3,5]

To determine the contribution of any given commodity, such as SCM, to the sugar intake of children and to later associate it with health outcomes, one must first understand the daily sugar intake of this population segment. Based on IFCS data, the average of daily sugar intake of children aged less than 5 years was 17.8±17.3 g/child/day.[34] Given this intake relative to the government recommended limit of daily sugar consumption of <50 g/person/day,[35] one might assume that most, if not all, children still have a tolerable consumption of sugar. However, this government limit is in fact too high for children, as it is calculated based on 10% of adult energy intake with 2,000 kcal/person/day. Using the estimated energy intakes per age group,[36] the age-specific limits of sugar intake can be calculated using the WHO recommended free sugar intake set at less than 5%–10% of the total dietary energy.[37] Based on the calculations, all age-specific limits are actually lower than 50 g (Table 3). Based on these limits, especially the 5% cut-off, a number of children might actually have moderate to high sugar consumption.

To understand the sources contributing to the moderate to high sugar intake of some children aged less than 5 years, Atmarita et al[34] presented the average consumptions of nine sugar source commodities across five age groups: [1] 0–59 months; [2] 5–12 years; 13–18 years; [4] 19–55 years old; and [5] >55 years. These food commodities included granulated sugar, palm sugar, jam, candy, syrup, chocolate, jelly/gelatin, honey, and sweeteners. However, the selection process and the reasons why the same food commodities applied across different age groups were not detailed in the paper. One might argue that the preferences of 'products with added sugar' such as SSBs are likely to be different between children and adults. SSB in any form might also be one of the major sources of free sugar for children aged less than 5 years because 42.6% of them have been exposed to it.[8] Some variants of SSB, such as SCM in beverages, might be consumed more than any others by a specific age group. One could assume that the selections of the nine sugar-source commodities were actually based on the rank of frequencies generated from the pooled data rather than the age-specific data set. Further detail analysis on the IFCS 2014 data is required to gain an adequate understanding on the patterns of SSB or SCM consumptions by children aged less than 5 years.

Evidence on the association between (regular) consumption of SCM and health measures

Based on its naturally nutrient rich (NNR) score, SCM has the lowest nutritional value as compared with the other types of milk, which makes it less ideal for young children to consume (Table 4).[27] The tendency of mothers to delay the introduction of SCM for their children at early age (Table 2) is appropriate given its lowest nutritional value. As shown in Table 5, the BMIfz of children at ages 5–6 years had positive associations with daily formula and reconstituted milk consumption but have negative associations with SCM and breast milk intake. Based on the intake, SCM could hardly be a full substitute for any other milk across different nutritional status groups, but it is consumed more by undernourished groups. By analyzing IFCS 2014 data, Ruswandi[8] found that children aged less than 5 years who consumed SSB (not specifically SCM) had a 3.8-fold higher risk of being underweight than those who did not consume SSB after controlling for mothers' education, total child energy intake, and the interaction between SSB consumption and mothers'

Table 3. Age-specific limits of sugar intake for children aged less than 5 years based on 5% of total dietary energy

Age (years)	Boys			Girls		
	Mean energy intake[36] (kcal/day)	Limit of sugar intake[35] (g)		Mean energy intake[36] (kcal/day)	Limit of sugar intake[35] (g)	
		5% of TDE†	10% of TDE‡		5% of TDE†	10% of TDE‡
1-2	1,140	14.3	28.5	1,090	13.6	27.3
2-3	1,340	16.8	33.5	1,250	15.6	31.3
3-4	1,490	18.6	37.3	1,370	17.1	34.3
4-5	1,610	20.1	40.3	1,465	18.3	36.6

TDE: total dietary energy.
†The limit of daily sugar intake predicted from equation: (mean energy intake/4) × 0.05.
‡The limit of daily sugar intake predicted from equation: (mean energy intake/4) × 0.1.

education. As a product with low nutritional value but with high added sugar, SCM may be associated with the risk of under- rather than overnutrition among young children with poor dietary patterns if the energy from sugar causes "voluntary reduction in the intake of other foods/drinks."[37] Further study must be conducted better understand the direction of the association: whether SCM intake increases the risk of undernutrition or whether undernourished children consume SCM more due to other reasons (i.e., poverty, poor feeding, energy compensation, or maternal education).

As one of the SSB variants, the health risks of high SCM consumption might also be linked to its high sugar content. The public health recommendation to limit free sugar consumption from any sources is fundamental for the prevention of health disorders, such as type 2 diabetes mellitus and dental caries. Based on the WHO experts' reviews and discussions, only the associations of these two conditions and SSB consumption are supported with sufficient (moderate) evidence.[37] Conclusions could not be drawn for risk factors; health outcomes; measures such as HDL-cholesterol, body weight, weight gain, body fat percentage, fat distribution, and energy intake (children); and conditions including coronary events, stroke, incident hypertension, glycemia, insulinemia, insulin resistance/sensitivity, and oral cancer due to insufficient evidence for the relationship with SSB. In Indonesia, the prevalence of overweight and obese residents showed increasing trends after the age of 15 years, but not among those aged less than 5 years, and diabetes mellitus prevalence was elevated after the age of 18 years.[39] Among 57.6% of people surveyed who had oral health and dental problems, only 10.2% had access to dental health services. Only approximately 2.8% of children aged 3 years and older demonstrated proper tooth-brushing behavior. With these profiles, much more evidence is still needed to properly understand the health risks of consuming SSB or SCM by young Indonesian children aged less than 5 years.

Existing policies that regulate the marketing and promotion, including risk communication, of SCM for children

Along with the development of product analogs, food policy has evolved accordingly. Based on Indonesian FDA regulations, SCM with milk fat content <8% and protein content not less than 6.5% is further classified into four product analogs: [1] sweetened skimmed milk (fat content not less than 8%), [2] vegetable-fat SCM (milk fat content not more than 1%), [3] creamed SCM (milk fat content not less than 45% and total solid not less than 65%), and [4] creamer SCM. Overall, these products, with the exception of creamer SCM, were regulated at least for milk fat[40] and protein contents[41] but not for total fat content. With product labeling, the existing regulation[42] follows the Codex Alimentarius; however, information on the content of sugar used as the product preservative is not mandatory in labeling. The Indonesian FDA usually monitors the permit number, safety, and quality of SCM and its product analogs at pre- and post-marketing stages. Soon after the national polemics of 2017 and 2018, a circular letter[43] followed by a new Indonesian FDA regulation[42] were issued to reinforce the correct labeling and advertisement of SCM (including its analogs) as "not a suitable product for infant." However, a better strategy is needed to improve the monitoring of products post marketing, which now still relies on the provision of an external official complaint by consumers to enable a special team within the FDA to react to the problem of product overclaims.

Limitations of the review

Studies related to SCM are very limited and indirect, and most available data were collected as part of studies on SSBs. Several limitations are identified with respect to the scopes, number of samples, objectives, and overall designs of those studies, which compromise the quality and conclusiveness of the obtained evidence for generalization nationwide. Only one report was based on national data (IFCS 2014 data), which also did not provide a detailed stratified analysis of SCM consumption based on product analogs. As clearly seen in Table 2, three studies were conducted only in urban settings with small samples that did not cover all age groups below the age of 5 years. Additionally, these three studies were not specifically designed to describe the SCM consumption pattern of children in detail, but they described the overall milk consumption in relation to some bodily functions. Similarly, all quantitative studies did not conduct in-depth investigations into the underlying factors of milk consumption pattern shifts. Due to the very limited evidence on any subject related to SCM, some trade-offs were required inthe process of selecting information sources for this review.

Implication for research and nutritional health promotion

Considering ethical issues, a case–control study could be conducted in different settings to better understand the

Table 4. Naturally nutrient rich (NNR) score of some milk products consumed by children using Dietary Reference Intake (DRI) for 1–3 and 4-6 years of age respectively.[27]

Nutrient	AKG 1–3 y		Heated milk		Powdered milk		Reconstituted milk	Condensed milk
			3.5% fat	1.5% fat	>1–3 y	>3 y	>1 y	>1 y
1–3 years								
Energy	1125	kcal						
Protein	26	g	2.10	2.79	1.49	1.61	1.59	0.63
Vitamin								
A	400	mcg	1.19	0.34	2.90	2.68	2.56	2.70
D	15	mcg	0.03	0.09	6.54	3.93	1.75	0.70
E	6	mg	0.17	0.00	2.11	1.67	1.24	2.79
C	40	mg	0.43	0.75	3.28	2.14	0.81	1.10
B1	0.6	mg	1.14	0.47	1.98	1.69	2.69	4.15
B2	0.7	mg	4.38	5.34	2.64	1.81	2.30	2.30
B3	6	mg	0.28	na	2.31	2.05	2.77	2.17
B6	0.5	mg	2.05	na	2.37	1.78	4.52	3.22
B5	2	mg	2.98	1.50	2.57	2.09	2.26	0
B12	0.9	mcg	8.33	7.50	4.84	9.87	3.41	3.58
Mineral								
Ca	650	mg	2.88	3.83	2.22	2.15	3.89	0.98
Zn	4	mg	1.70	2.60	3.30	2.95	3.59	0
Fe	8	mg	0.11	0.00	0.33	1.46	0.50	0
K	3000	mg	0.80	1.44	0.61	0.74	0.86	0.41
Mg	60	mg	2.84	na	2.15	1.40	2.16	2.37
NNR			1.96	2.05	2.60	2.50	2.31	2.50
4–6 years								
Energy	1600	kcal						
Protein	35	g	2.22	2.95	1.58	1.70	1.68	0.66
Vitamin								
A	450	mcg	1.51	0.43	3.66	3.39	3.23	3.42
D	15	mcg	0.05	0.13	9.31	5.58	2.49	1.00
E	7	mg	0.21	0.00	2.57	2.04	1.51	3.40
C	45	mg	0.54	0.95	4.15	2.71	1.02	1.39
B1	0.8	mg	1.21	0.50	2.11	1.80	2.87	4.43
B2	1	mg	4.36	5.32	2.63	1.80	2.29	2.29
B3	9	mg	0.27	na	2.19	1.95	2.63	2.06
B6	0.6	mg	2.42	na	2.81	2.11	5.35	3.82
B5	2	mg	4.24	2.13	3.66	2.98	3.21	0.00
B12	1.2	mcg	8.89	8.00	5.16	10.53	3.63	3.82
Mineral								
Ca	1000	mg	2.67	3.54	2.05	1.99	3.60	0.91
Zn	5	mg	1.94	2.95	3.75	3.36	4.08	0.00
Fe	9	mg	0.13	0.14	0.42	1.84	0.64	0.00
K	3800	mg	0.89	1.62	0.69	0.83	0.97	0.46
Mg	95	mg	2.55	na	1.94	1.26	1.94	2.13
NNR			2.13	2.20	3.04	2.87	2.57	1.86

AKG: Angka Kecukupan Gizi or the same as DRI; Note: NNR is the nutritional evaluation using a nutrient density approach that is calculated from the average of ratio contribution of 16 selected compounds from milk which contain 1125 kcal energy (DRI of energy for children aged 1–3 years) to cover the DRI children at the age 1–3; na: the information is not available.

health implications of prolonged consumption of SCM by young children. The consumption patterns of SCM and any other SSB by types, quantity, frequencies, and total contribution to the total daily energy intake must be known together with any other confounding variables, such as physical activity and food balance, for determining its attributable effects on specific nutritional and metabolic health outcomes, a fact that has been frequently raised in various debates.

Based on the available evidence, at least three main conclusions can be drawn in relation to SCM or any other SSB consumption, and these should be promoted: [1] behavior of reading food labels by caregivers to correctly understand which products are actually safe to be consumed by young children; [2] considering limiting free sugar consumption from any sources, including SSB and SCM; and [3] understanding and applying a balanced diet as the core of young child feeding. For better promotion to limit free sugar intake from SCM or any other SSB, well-design formative research is required to investigate the underlying lay concepts and perceptions that impinge on the caregivers' decisions to administer such products to their young children.

Conclusions

Studies of SCM are very limited, but the reported findings related to attributable factors of SCM consumption by young children are likely to be consistent. The intrinsic factors of the products are interlinked with the socioeconomic variables that determined caregivers' prefer-

Table 5. Duration of breastfeeding (months) and usual daily milk intake at the age of 5–6 years (mL/day) by nutritional status (BMI-for-age z-score)[27]

Nutritional status	Breast milk*		Milk powder		Reconstituted milk		Condensed milk		Heated milk		Total milk	
	Mean	SE	Mean	SE	Mean	SE	Mean	SE	Mean	SE	Mean	SE
SAM	18.2	1.49[b]	107	22.0[a]	65.4	9.12[ab]	59.1	13.3[b]	4.41	2.22	241	25.3[a]
MAM	18.0	1.02[b]	129	26.9[a]	64.5	9.56[a]	65.1	13.0[b]	0.98	0.51	266	29.9[a]
Normal	16.4	0.82[b]	202	20.1[b]	85.1	8.80[ab]	51.0	8.1[b]	9.17	4.23	346	22.0[b]
Overweight	12.7	1.59[a]	368	56.1[c]	142	32.0[b]	24.5	15.0[a]	13.4	5.55	549	57.5[c]
Obesity	12.3	1.37[a]	381	40.4[c]	101	14.8[b]	33.8	15.9[a]	5.91	2.6	513	38.0[c]
Mean	15.9	0.53	222	14.2	87.6	6.06	48.9	5.4	7.1	1.96	365	15.0

BMI: body mass index in kg/m^2; N: number of respondents; BMIfz: BMI-for-age z-score; SAML: severe acute malnutrition (BMIfz <−3, N=60); MAM: moderate acute malnutrition (−2<BMIfz≤−3, N=61); Normal: −2≤MBIfz≤1, N=163; Overweight: 1<BMIfz≤−2, N=43; Obesity: BMIfz> 2, N=60; Mean: usual daily intake of milk calculated by the multiple source method (MSM); SE: standard error.
Mean values with superscript letters (a–c) are significantly different (*p* value <0.05) according to Mann–Whitney U test.

ence for giving SCM to their young children. Corrective measures to such a nonideal practice should be delivered through active monitoring of product ads, enforcement of regulations, and provision of effective customer education.

Although evidence is lacking on the health risks of SCM consumption by young children, limiting the consumption of free sugar from any source, including SCM as a part of SSBs, is still highly recommended.

AUTHOR DISCLOSURES

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