





The power of women: Does increasing women's parliamentary representation reduce intake of sugar-sweetened beverages among children and adolescents?

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Abstract

Objective: Consumption of sugar-sweetened beverages (SSB) is associated with overweight and obesity in children and adolescents. Although existing research confirms the significance of economic and social factors as determinants of SSB intake, comparative studies on political factors and cross-national analyses are lacking. Research indicates that including women in the process of political decision-making promotes healthcare and child protection. This study examined how women's parliamentary representation influences children's and adolescents' SSB intake compared with adults.

Design: The study used cross-national food and beverage intake data from the Global Dietary Database. The outcome measurement was SSB consumption (g/day) for different population groups. We modelled SSB intake as a function of age groups, women's parliamentary representation at the national level (the independent variable), regime types (the contextual factor) and import tariffs on SSB (the mediator) using country and time-fixed effects regression models.

Setting: One-hundred eighty-five countries across three waves from 2005 to 2015.

Participants: Different population groups.

Results: The impact of female representation on reducing SSB consumption is more prevalent in children and adolescents than in adults. Furthermore, the effect of women's parliamentary representation on SSB consumption among children and adolescents is conditional on a country's democratic status. Finally, the marginal effect decreases when import tariffs on SSB are considered a link in a causal chain. No changes in adult SSB intake are statistically significant.

Conclusions: The findings suggest that the presence of women in the legislature can have a substantial impact on child and adolescent health.

Keywords
Adolescents
Children
Parliament
Regime types
Sugar-sweetened beverages
Tariff
Women

Introduction

Sugar-sweetened beverage (SSB) consumption is associated with unhealthy body weight, dental caries, hyperactivity and inattention symptoms and insulin resistance⁽¹⁾. Although there is considerable variability between countries, the intake of SSB by children and adolescents remains high⁽²⁾. These trends have stimulated public health efforts to curtail consumption as a means of improving the health outcomes of children and adolescents.

Recent research has identified factors associated with children and adolescent SSB intake, including demographics; intrapersonal, i.e., health literacy, consumption

behaviour and sleep pattern; interpersonal, i.e., parenting style; and environmental level variables, i.e., the availability of SSB in the home and school environments, food insecurity and cultural difference. Based on the socio-ecological model to understand the relationship of multiple levels of influence on children and adolescent and their SSB intake, home availability of SSB was the strongest predictor, followed by parenting practice, health literacy and consumption behaviour⁽³⁾. In general, SSB consumption was higher among those who perceived sugary drinks to be usually available in their homes, those with poor nutrition knowledge and fast food consumption and those whose parents had positive attitudes towards SSB.

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However, these studies had certain limitations. SSB consumption among children and adolescents is not only caused by the microsystems—individuals' behaviour and social environmental factors such as the home and school neighbourhood food environments. Other broader social, political and economic conditions influence the structure and availability of microsystems, and the manner in which they affect children and adolescents. Furthermore, some studies investigate the policy's impact on market changes triggered by the tax levied on SSB⁽⁴⁾ or the addition of a warning label on SSB packaging⁽⁵⁾. The decision-making process in which different political actors will have different objectives and will try to influence under various political institutions, however, determines policies influencing SSB demand and supply in the market. Therefore, it is necessary to have a view of the political system. Finally, there is a lack of cross-national analysis.

In this study, we examined the effect of women's parliamentary representation on children's and adolescent's SSB intake compared with adults, a topic that has not, to our knowledge, been considered. There is a theoretical explanation: the more women there were in the parliament, the more likely they were to occupy a "female" standing committee, such as culture, education, health and social affairs, which can, in turn, introduce bills related to children and adolescents' rights. In terms of legislators' attitudes towards issues in thematic areas, women place a higher priority on women's equality and children and family issues than men⁽⁶⁾. This is because, for one thing, an increased number of women legislators means a larger potential support network for women, who push issues of importance to them. Second, the burdens on women in maintaining their homes and careers have become publicly evident. Currently, most women work outside the home, and the problems of this dual role affect most families. It would be natural for female legislators to try to ease that burden by supportive legislation⁽⁷⁾. There is evidence that women participate disproportionately in "female" committees and that the gendered division of labour in assignments to political committees persists over time^(8,9). The findings reveal that the higher percentages of female representatives in parliament introduce and pass more priority bills dealing with issues of women, children and families than men and more than their female counterparts in low-representation legislatures^(6,10). Examination of the bill debate shows that women are more frequent participants in debates of bills involving women's rights and children's and family issues than bills concerning issues that have traditionally concerned men^(11,12).

Legislation of children and adolescent rights would lead to a reduction in SSB consumption. Taxing SSB is a powerful legal tool for this purpose. In most countries, there is a basic constitutional principle that any act of taxation must have a legal basis, and that the legislative branch has the power to make tax laws. For example, the Cook Islands parliament approved legislation raising import tariffs on

SSB, which appeared to be effective in reducing import volumes and increasing prices⁽¹³⁾. A cross-national study also showed that higher tariffs effectively decrease imports of SSB, which, in turn, decreases the sales of SSB⁽¹⁴⁾. However, children and adults respond differently to the quantity demanded for goods in response to a change in price⁽¹⁵⁾. The price elasticity of demand tends to be low when spending on goods is a small proportion of the available income. Therefore, a change in the price of a good exerts very little impact on consumers' propensity to consume the goods. When a good represents a large chunk of a consumer's income, the consumer is said to possess a more elastic demand. In general, children and adolescents have a greater proportion of income (or allowance) spent on a commodity than adults do, and thus tend to have a relatively elastic price elasticity of demand. In this way, a small increase in the price levels of goods causes children and adolescents, as compared with adults, to consume substitutes. Taxing SSB results in significant declines in SSB sales and increases in the sales of water, fruit, vegetables and tea drinks⁽¹⁶⁾, and the substitution effect is more prevalent in children and adolescents. In summary, our study implies a potential pathway that links women's parliamentary representation, import tariffs on SSB and SSB consumption among children and adolescents.

We further examine whether this relationship is conditioned by political context. We argue that a high level of female representation has large negative associations with children and adolescents' SSB intake when female legislators have sufficient motivation and ability to act. Women legislators pay greater attention to issues concerning children and adolescents' rights⁽¹⁷⁾ and, thus, have sufficient motivation to push relevant bills. However, political systems facilitate and inhibit these attitudes. When democracy is not functioning well, some ideas are difficult to express or silenced, and the range of perspectives and possibilities is curtailed. As a result, malnourished children, poor hygiene or limited maternal care might not be "picked up" by the press or included in the policy agenda of politicians who compete for office. In these contexts, female legislators may act as unique and innovative voices for such issues⁽¹⁸⁾. Thus, we would expect that female representatives will tend to tackle issues raised by excess SSB consumption among children and adolescents in weak democratic contexts.

Female empowerment is likely consequential in curtailing SSB consumption among both children and adolescents. Female legislators with bargaining power in the decision-making process are likely to introduce and pass bills on children and adolescent issues. Political systems continue to play a crucial role. The more democratic a country is, the more developed its civil society and the more likely it is that women's groups will have greater influence. However, democracy unleashes complex and difficult-to-predict empowering processes; it empowers some women's groups and may strengthen religious institutions opposed to change⁽¹⁹⁾. In contrast, a non-democratic

regime ties leaders of various social groups to regime elites as a way of sharing power. As more women enter the political arena and gain power, they might be expected to help increase the polity's de facto legitimacy⁽²⁰⁾. To secure women's loyalty, dictatorships might grant women legislators the power to address feminine issues⁽²¹⁾. As a result, in authoritarian regimes, elite women and progressive reformers in parliament who may have privileged access to power can push up surprising advances in women's rights⁽¹⁹⁾. Female legislators pass priority bills dealing with issues of women, children and families without threatening the regime⁽²²⁾. Therefore, we expect that the negative effects of female representation on SSB consumption among children and adolescents will be particularly strong in weak democratic contexts.

The present study used cross-national panel data covering 185 countries across three waves from 2005 to 2015 to (1) investigate the relationship between the political representation of women in legislatures and children and adolescents' SSB intake compared with adults, (2) specify the contexts under which women's parliamentary representation affects the intake of SSB in children and adolescents and (3) demonstrate the internal causal mechanism.

Methods

This study used food intake data from the Global Dietary Database, the first database of consumption estimates for SSB (g/day) by country ($n = 185$), age group, sex, education level and residential area, across a total of three waves from 2005 to 2015 ($n = 177,600$). There are multiple steps involved in developing the dietary intake estimates: searching for and obtaining individual-level intake data worldwide; combining these data with food balance sheets available in all nations and years; estimating mean food intake and associated uncertainty for each stratum, accounting for differences in intakes versus availability, survey methods and representativeness and sampling and modelling uncertainty⁽²³⁾.

This study defines SSB as SSB containing over 50 kcal/8 oz serving, including sodas, fruit drinks, sports/energy drinks, pre-sweetened iced tea and homemade SSB⁽²⁴⁾. The outcome measurement was SSB consumption (g/day) for different population groups. Women's parliamentary representation was defined as the percentage of parliamentary seats held by women in a single or lower chamber. We sourced this data from the Inter-Parliamentary Union.

A list of covariates, including political regimes, media freedom, economic development, economic growth and armed conflict, is also considered. First, political regimes affect the allocation of resources in a society, and thereby, the possibilities for different households to spend on the health and nutrition of their children⁽²⁵⁾. The study used the Polity IV Project to define a "democracy" as the presence of institutions and procedures by which executive

power is checked and through which citizens can express effective preferences on alternative policies and leaders. The Polity IV data series scales regimes from -10 to $+10$, for which 6 is considered the threshold value for a democracy. Second, people with the ability to access, interpret and use nutrition information can change their dietary behaviours⁽²⁶⁾, and media freedom helps ensure that the right kind of resources (e.g., reliable nutrition information) actually reach people⁽²⁷⁾. However, increasing media freedom may help spread health-related misinformation. These arguments indicate that the level of media freedom is related to SSB consumption. Media freedom is defined as the degree to which a country allows the free flow of news and information. This research measured media freedom using the Freedom of the Press index from Freedom House. For the present research, the index was rescaled into a range of $0-100$: A score of "0" indicated least free, whereas "100", most free.

Third, a literature review indicated an association between greater GDP per capita and higher consumption of SSB⁽²⁸⁾. However, in low-and middle-income countries, an increase in affordability, partly due to high rates of economic growth, is linked to increased consumption of SSB⁽²⁹⁾. Thus, we used a natural logarithm form of GDP per capita to capture economic development and the World Bank's data on annual per capita GDP growth as a measure of economic growth. The data were adjusted for inflation. Fourth, existing research has confirmed that armed conflict negatively impacts the health and nutritional status of children and adolescents⁽³⁰⁾. Lack of security during conflict affects food supply and household food purchasing decisions, which are key determinants of malnourishment. The study thus controlled armed conflict as a dummy variable, where $1 =$ major episodes of international, civil and ethnic warfare involving the state, and $0 =$ no episodes, using data from Major Episodes of Political Violence, 1946–2017.

This study applied country-and time-fixed effects regression models. The country-fixed effects model helps consider unobserved characteristics unique to entities that may bias the predictor and outcomes. For example, scholars associate beverage intake differences with culturally specific reasons⁽³¹⁾, a time-invariant characteristic specific to each country. The time-fixed effect eliminates bias from the unobservables that change over time but are constant over entities. To investigate the effects of women's parliamentary representation on SSB consumption among children and adolescents compared with adults, we included an interaction term "age group \times women's parliamentary representation." There is no universal definition of children. We defined a child as any person who ranged from 6 to 10 years of age, compared with infants from birth to 12 months of age and toddlers ranging from 1 to 5 years of age. Adolescents are defined as individuals between the ages of 11 and 19 years. To confirm the political context under which women's parliamentary representation certainly exerts divergent effects on SSB consumption among



children and adolescents, a three-way interaction term was computed: “age group \times women’s parliamentary representation \times democracy.” Table S1 summarises the variables, operationalisation of the indicators and data sources.

However, reverse causality is a problem. Women tend to be more directly concerned with child health and nutrition⁽³²⁾. Therefore, higher rates of SSB consumption among children and adolescents could drive voters to choose female candidates in elections because citizens might believe that female candidates are in a better position to address such issues. To eliminate endogeneity, we developed an instrumental variable (IV). A good IV should have a theoretical interpretation that it is expected to influence the endogenous variable, but is unrelated to the outcome. However, finding valid instruments for female representatives in parliament is by no means easy, as economic and social variables that are correlated with the participation of women in parliamentary representation are very likely to influence SSB intake in children and adolescents. In the literature, we identified two potentially valid instruments. First, gender quotas have proven to be an effective means to increase the number of women in the legislature^(33,34). We created a dummy variable so that 1 = “a country has implemented a gender quota, including reserved seats, candidate quota or hybrid quotas that use a mix of both types, in an election” and 0 = “otherwise,” using a new dataset—QAROT (Quota Adoption and Reform Over Time)—the first global dataset on gender quota adoption, implementation and reform over time⁽³⁵⁾. Second, the literature finds that proportional representation (PR) systems and single transferable vote (STV) generally produce a higher representation of women than plurality or majority systems^(36,37). A dummy variable was created where 1 = “party-list proportional representation and single transferable vote” and 0 = “otherwise.” We sourced this data from the International Institute for Democracy and Electoral Assistance and the Inter-Parliamentary Union. However, it is theoretically implausible that these two institutional rules relate to SSB consumption among children and adolescents. This study used two-stage least-squares regression analysis.

A mediation model sought to explain the mechanism linking women’s parliamentary representation to the SSB intake of children and adolescents. A mediation effect was found to exist when (1) women’s legislative representation in the context of the political system and import tariffs on SSB both affected SSB consumption among children and adolescents; (2) women’s legislative representation in different political systems was associated with tariff levels on SSB and (3) their effects on SSB intake in children and adolescents disappeared (or at least weakened) when import tariffs on SSB were included in the regression. Data on applied tariffs to the most favoured nations, which are non-discriminatory tariffs charged on imports of World Trade Organization (WTO) member countries, were from the WTO tariff database. We computed the average of both

tariff lines: 2202 (mineral water and aerated water, containing added sugar or other sweetening matter or flavoured) and 2009 (fruit drinks). A higher tariff value indicates higher duties or taxes applied to imports. Further, we tested whether higher tariffs on SSB lead children and adolescents to consume more fruit, vegetables, coffee and tea as alternatives to SSB, as compared with their adult counterparts, using data on fruit, vegetable (g/day), coffee and tea consumption (cups/day) from the Global Dietary Database.

For sensitivity analyses, this study broke down the study samples into subsets of the population based on shared characteristics, including gender (female and male) and residential area (urban and rural). This study aimed to assess whether the observed effect was consistent across the underlying population subgroups. Additionally, this study used the Bjørnskov-Rode update and expansion of Cheibub, Gandhi and Vreeland’s DD dataset⁽³⁸⁾ as an alternative to Polity IV data. The DD dataset adds the alternation in power rule to classify a regime, whereas Polity IV distinguishes the regime based on the existence of institutionalised constraints on the exercise of power by the executive. Both factors may influence women’s decision-making positions within parliament. Furthermore, female politicians may not have an immediate impact on SSB consumption. In other words, it can take time for policies to be implemented. Thus, this study lagged the independent variable by different periods to allow time for its effect on SSB consumption to materialise. Finally, not all democracies are identical. Left-wing democratic governments are generally “women friendly”⁽³⁹⁾, which may reduce the incentive of female legislators to work on children issues. Minority governments must negotiate with parliament to find new ways of working, which may empower female legislators. This implies that the effect of female representation in reducing SSB consumption for children and adolescents under non-left-wing or minority democratic governments may not be less prevalent than in non-democratic governments, given that female legislators have sufficient motivation or ability to act in these political contexts. Thus, it is necessary to test a more complex political context in which different types of factors interact to influence the motivation and ability of female legislators to act; for example, non-democratic versus non-left-wing democratic governments, to obtain more robust results. We sourced data on the ideology of the party of the chief executive and a government’s majority status from the Database of Political Institutions.

Results

Figure 1 shows a negative correlation between women’s parliamentary representation and SSB consumption among children and adolescents. One percentage point increase in the proportion of seats held by women in national parliaments resulted in a 2.38, 3.50 and 3.12 g/day decrease in the intake of SSB among children and adolescents (6–10 years: -2.38 ,

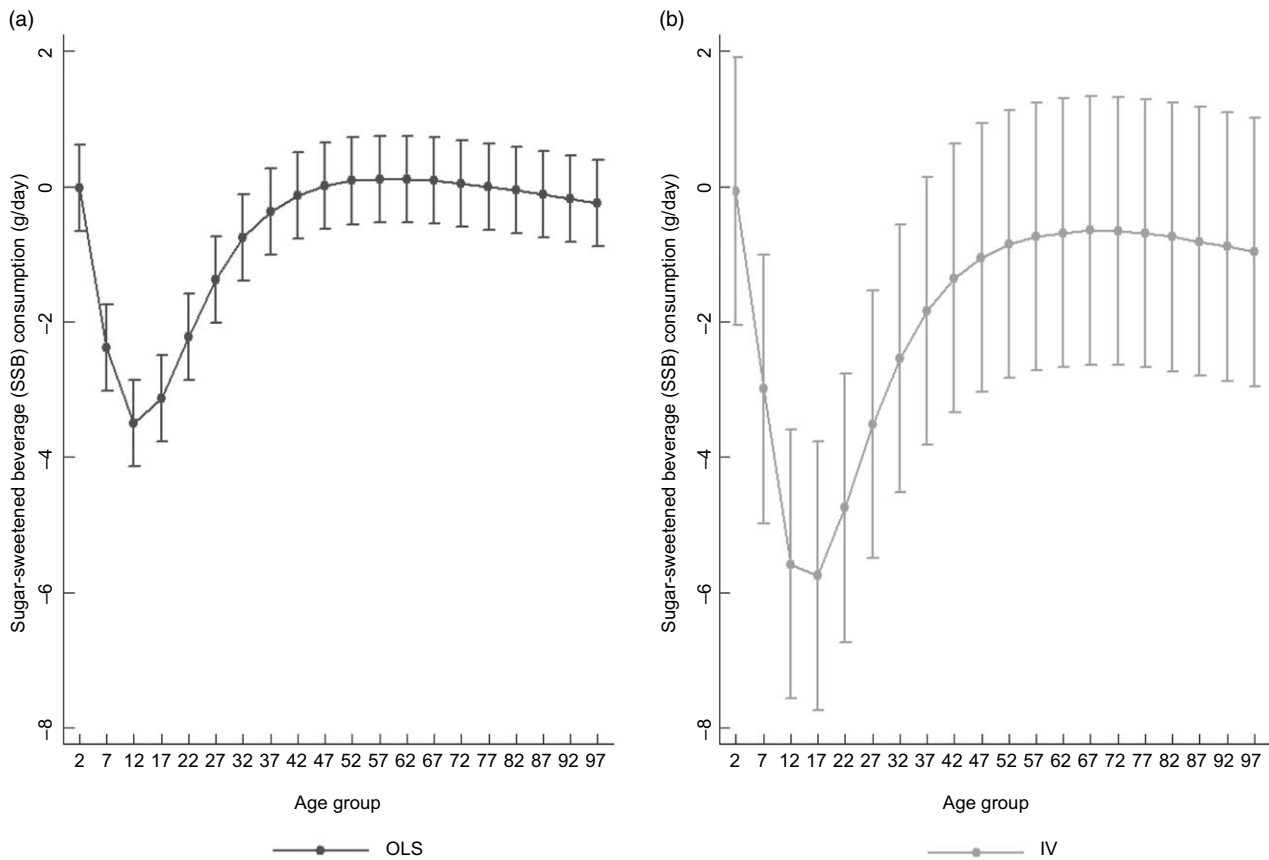


Fig. 1 Association of an additional percentage point increase in women in national parliament on SSB consumption by age groups, 2005–2015

Note: marginal effects (OLS): 6–10 years: -2.38^{***} , CI = -3.02 to -1.74 ; 11–14 years: -3.50^{***} , CI = -4.14 to -2.86 ; 15–19 years: -3.12^{***} , CI = -3.76 to -2.49 ; marginal effects (IV): 6–10 years: -2.99^{***} , CI = -4.98 to -1.01 ; 11–14 years: -5.59^{***} , CI = -7.57 to -3.60 ; 15–19 years: -5.76^{***} , CI = -7.74 to -3.77^{**} ; * $p < 0.05$, ** $p < 0.01$ and *** $p < 0.001$.

Source: the author.

CI = -3.02 to -1.74 ; 11–14 years: -3.50 , CI = -4.14 to -2.86 ; 15–19 years: -3.12 , CI = -3.76 to -2.49 , Fig. 1a). The impact of female representation in reducing SSB consumption was more prevalent for children and adolescents than young adults (6–10 years: -1.62 , CI = -2.38 to -0.85 ; 11–14 years: -2.74 , CI = -3.50 to -1.97 ; 15–19 years: -2.36 , CI = -3.13 to -1.60 , Table S4), middle-aged adults (6–10 years: -2.46 , CI = -3.22 to -1.70 ; 11–14 years: -3.58 , CI = -4.35 to -2.82 ; 15–19 years: -3.21 , CI = -3.97 to -2.44 , Table S4) and older adults (6–10 years: -2.32 , CI = -3.09 to -1.56 ; 11–14 years: -3.44 , CI = -4.21 to -2.68 ; 15–19 years: -3.07 , CI = -3.83 to -2.31 , Table S4). The results were obtained after dividing the study samples into subsets of the population (Figure S1), and the independent variables were lagged by different periods (Figure S2).

Figure 1b shows that the results from IV are similar to the ordinary least squares (OLS) estimation, with estimated coefficients much larger than those in OLS. For example, 1 percentage point increase in the proportion of seats held by women in national parliaments resulted in a 2.99, 5.59 and 5.76 g/day decrease in the intake of SSB among children and adolescents (6–10 years: -2.99 , CI = -4.98 to -1.01 ;

11–14 years: -5.59 , CI = -7.57 to -3.60 ; 15–19 years: -5.76 , CI = -7.74 to -3.77). This effect was less prevalent in adults.

Figure 2 shows the effect of women's parliamentary representation on SSB consumption among children and adolescents conditional on a country's democratic status. First, children and adolescents had a higher SSB consumption in non-democracies (6–10 years: 402.97, CI = 383.73–422.22; 11–14 years: 489.49, CI = 470.24–508.74; 15–19 years: 461.08, CI = 441.84–480.33) than democracies (6–10 years: 304.88, CI = 285.25–324.50; 11–14 years: 385.51, CI = 365.89–405.14; 15–19 years: 379.93, CI = 360.30–399.55), given that no women were elected to the parliament. However, the higher the women's parliamentary representation, the more prevalent the effect in non-democracies, compared with its counterpart. In other words, the estimated slope coefficients were distinct; one indicated a relatively flat slope (democracies, 6–10 years: -0.80 , CI = -1.67 to 0.06 ; 11–14 years: -1.41 , CI = -2.28 to -0.55 ; 15–19 years: -1.25 , CI = -2.11 to -0.38), whereas the other exhibited a much steeper slope (non-democracies, 6–10 years: -5.22 , CI = -6.16 to -4.28 ; 11–14 years: -5.92 , CI = -6.86 to -4.97 ; 15–19 years: -4.95 , CI = -5.89 to -4.00). In contrast,

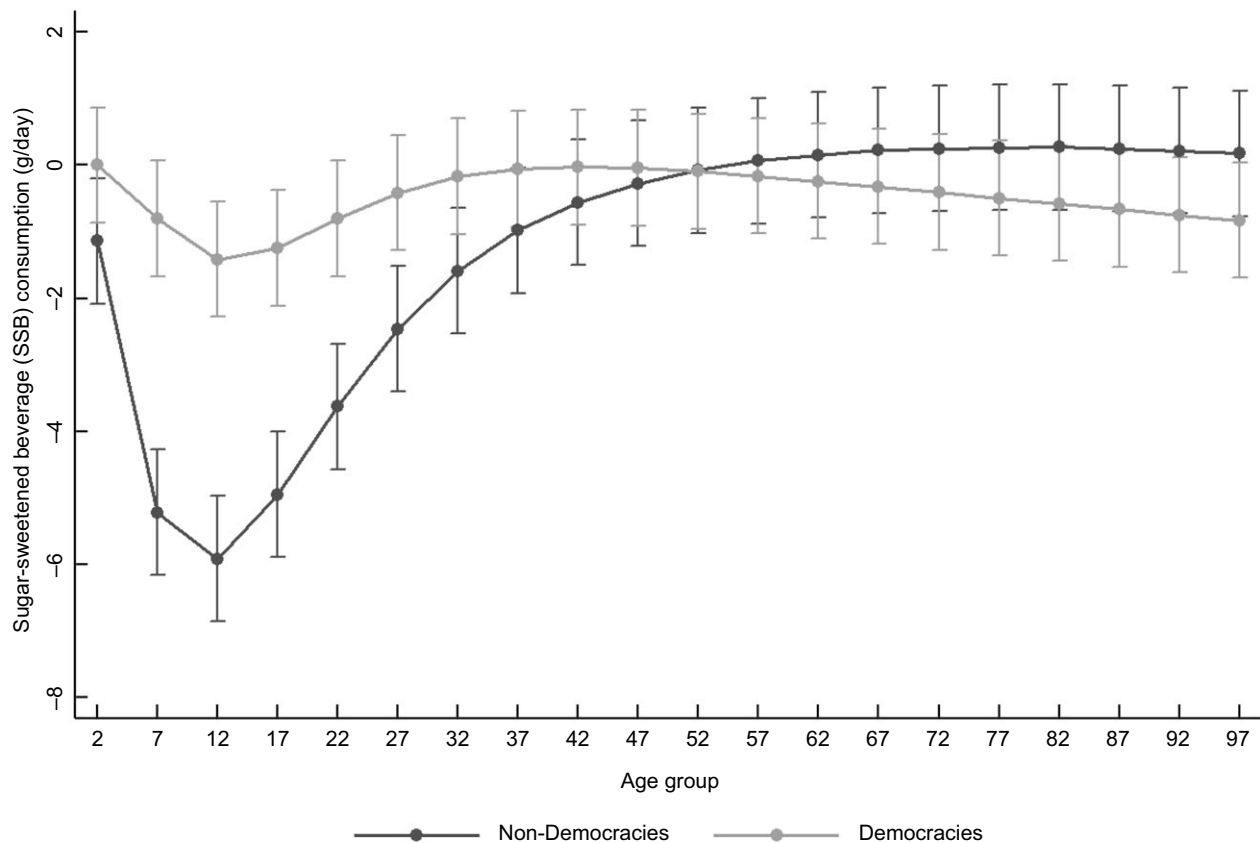


Fig. 2 Association of an additional percentage point increase in women in national parliament on SSB consumption by age groups and regime types, 2005–2015

Note: marginal effects (democracies): 6–10 years: -0.80 , CI = -1.67 to 0.06 ; 11–14 years: -1.41^{**} , CI = -2.28 to -0.55 ; 15–19 years: -1.25^{**} , CI = -2.11 to -0.38 ; marginal effects (non-democracies): 6–10 years: -5.22^{***} , CI = -6.16 to -4.28 ; 11–14 years: -5.92^{***} , CI = -6.86 to -4.97 ; 15–19 years: -4.95^{***} , CI = -5.89 to -4.00 ; * $p < 0.05$, ** $p < 0.01$ and *** $p < 0.001$.
Source: the author.

the slope coefficient did not reach statistical significance in the adult group. The impact of female representation in reducing SSB consumption for children and adolescents, compared with adults, was more prevalent in non-democracies than in democracies (Table S5). A robustness test confirmed our theoretical expectations (Figs S3 and S4).

Figure S5 shows the effect of women’s parliamentary representation on SSB consumption among children and adolescents conditional on the ideology of the party of the chief executive or the government’s majority status. These results imply a complex political environment. Figure S6 shows that the effects of female representation on SSB consumption for different age groups differed across a wide variety of regimes and government types. Nevertheless, these analyses have shown that non-democratic governments are more likely than democratic governments to influence how women’s parliamentary representation relates to the SSB intake of children and adolescents.

Mediation analysis revealed that import tariffs on SSB are linked in a causal chain. First, a rise of one percentage point in the proportion of seats held by women in national parliaments led to an increase of 0.1 percentage point in

import tariffs on SSB for non-democracies (0.10, CI = 0.03–0.16, Fig. 3). However, the result for democratic countries was not statistically significant (-0.03 , CI = -0.09 to 0.02 , Fig. 3).

Second, 1 percentage point increase in import tariffs on SSB resulted in a 1.99, 2.13 and 1.76 g/day decrease in the intake of SSB among children and adolescents (6–10 years: -1.99 , CI = -2.73 to -1.25 ; 11–14 years: -2.13 , CI = -2.87 to -1.39 ; 15–19 years: -1.76 , CI = -2.50 to -1.03 , Fig. 4a). The impact of import tariffs on SSB in reducing SSB consumption was more prevalent for children and adolescents than young adults (6–10 years: -1.24 , CI = -2.16 to -0.32 ; 11–14 years: -1.38 , CI = -2.30 to -0.46 ; 15–19 years: -1.02 , CI = -1.94 to -0.09 , Table S6), middle-aged adults (6–10 years: -1.68 , CI = -2.60 to -0.76 ; 11–14 years: -1.82 , CI = -2.74 to -0.90 ; 15–19 years: -1.46 , CI = -2.38 to -0.54 , Table S6) and older adults (6–10 years: -1.97 , CI = -2.90 to -1.05 ; 11–14 years: -2.11 , CI = -3.04 to -1.19 ; 15–19 years: -1.75 , CI = -2.67 to -0.83 , Table S6).

Third, when the explanatory variable and mediator were included, the strength of the coefficient of the previously significant explanatory variable was reduced. The

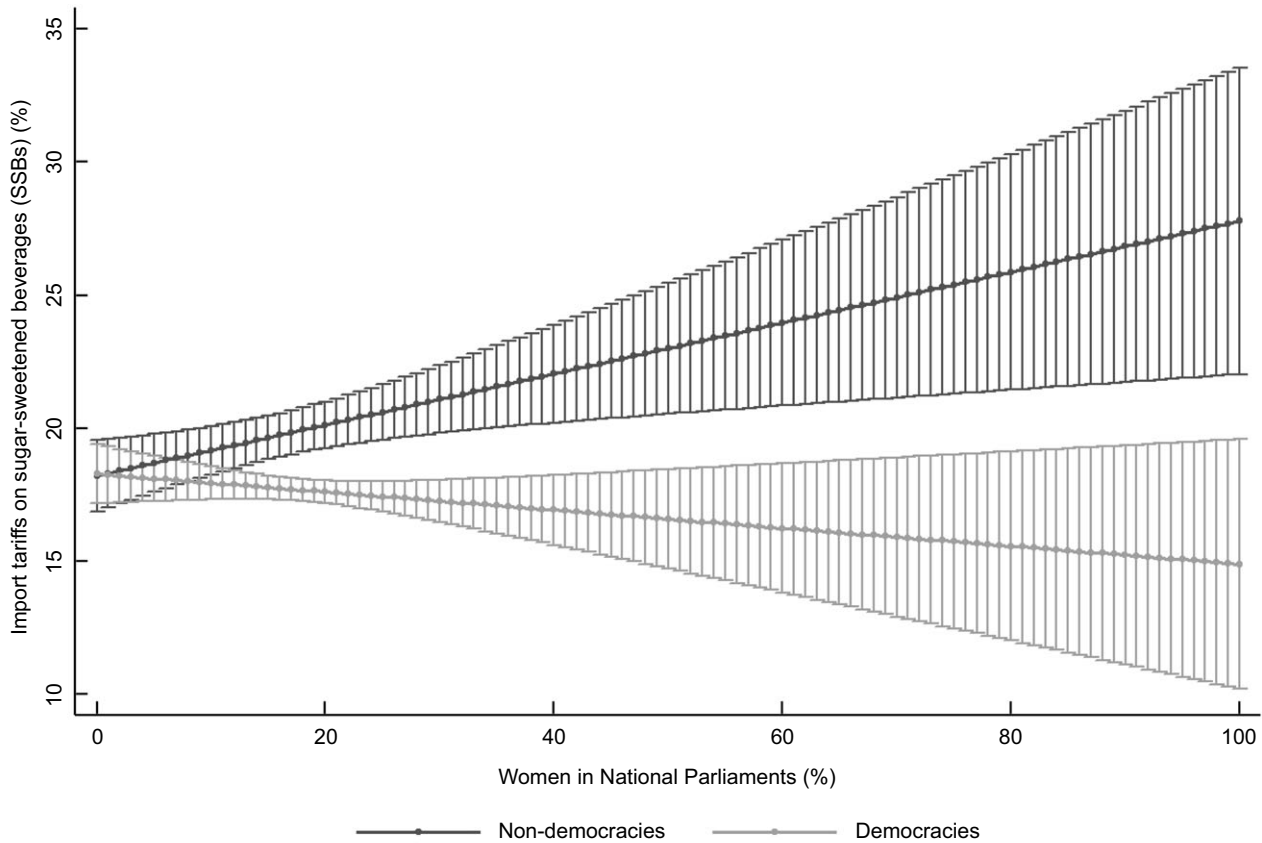


Fig. 3 The effects of women in national parliament and regime types on import tariffs on SSB, 2000–2020
Note: marginal effects: democracies: -0.03 , CI = -0.09 to 0.02 ; non-democracies: 0.10^{***} , CI = 0.03 – 0.16 ; * $p < 0.05$, ** $p < 0.01$ and *** $p < 0.001$.
Source: the author.

impact in non-democracies was reduced (Fig. 4b). Further, the gap has narrowed between non-democracies and democracies in terms of the impact of female representation on SSB consumption for children and adolescents, compared with adults (Tables S7–S9). However, the mediator, import tariffs on SSB, is still a significant predictor of the dependent variable. Finally, we found that higher tariffs on SSB lead children and adolescents to consume more fruit, vegetables and coffee as alternatives to SSB compared with their adult counterparts (Figs S7 and S8).

Discussion

This study investigated the relationship between female representation in national legislatures and SSB consumption for different population groups, adjusted for country-level covariates. We hypothesised that (1) the impact of female representation in reducing SSB consumption was more prevalent in children and adolescents than in adults; (2) a strong negative linear relationship would exist for countries with weak democratic contexts and (3) import tariffs on SSB would be a link in a causal chain. These hypotheses are supported by our findings.

Research indicates that involving women in political decision-making processes is beneficial for healthcare and child protection^(40,41). Similarly, our study, by arguing that more women in legislative positions are more likely to increase import tariffs on SSB, which in turn reduces SSB intake in children and adolescents, contributes to evidence on the influence of female parliamentary representation on child and adolescent health advantages. The effect on SSB intake was less prevalent in adults; however, it appeared to be more common in early adulthood than in middle or late adulthood. One possible explanation is the similar consumption behaviour in adolescence and early adulthood. Literature shows that dietary patterns established in adolescence are likely to be tracked into early adulthood⁽⁴²⁾. The other, as argued previously, is price elasticity by age group. Because younger adults tend to have less income than their older counterparts, it is more difficult for the young to absorb price increases⁽¹⁵⁾.

Children and adolescents are more sensitive to price changes than adults. Evidence has shown that youth who smoke are more sensitive to cigarette price increases than adults, given that the youth population is more price-elastic in cigarette demand⁽¹⁵⁾. The current study adds to the existing literature by finding that an increase in import

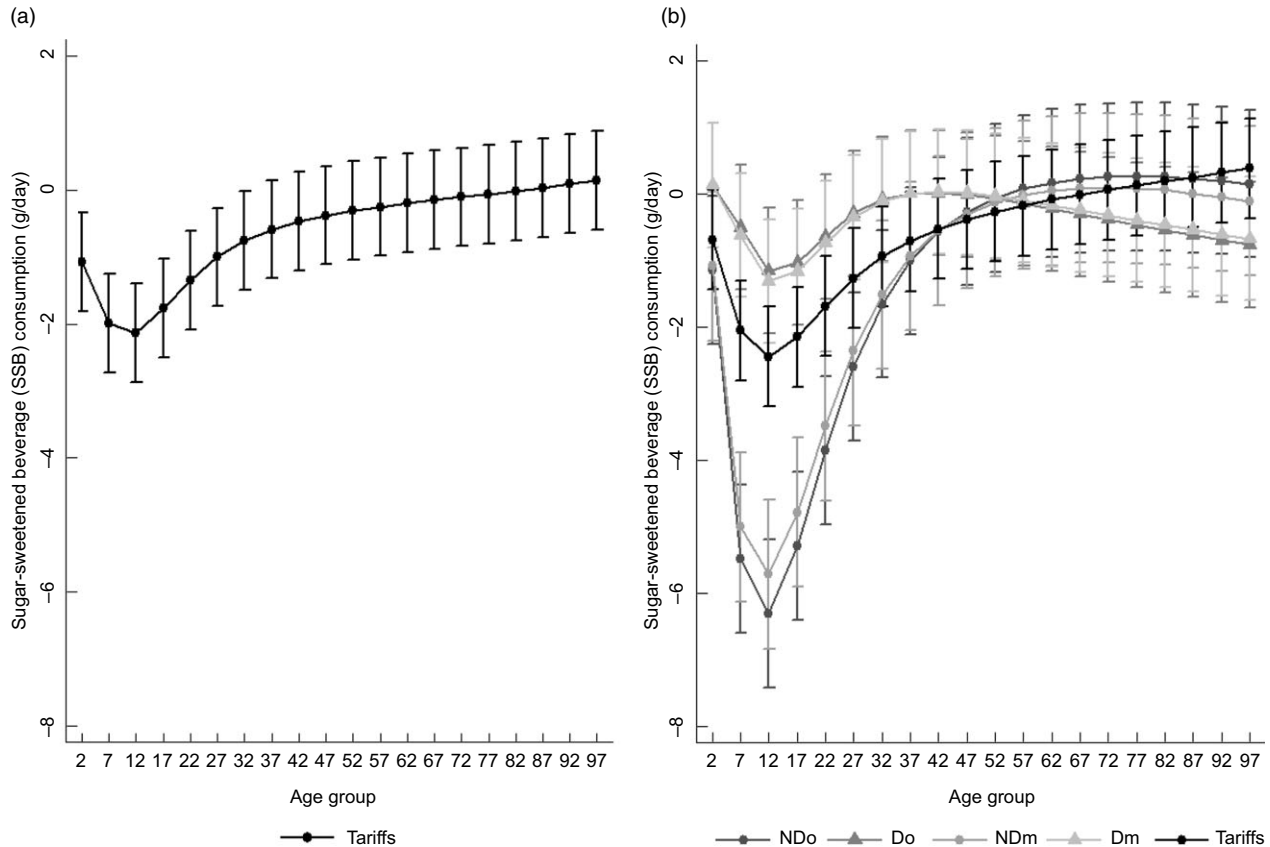


Fig. 4 Association of an additional percentage point increase in import tariffs on SSB and women in national parliament on SSB consumption by age groups and regime types, 2005–2015

Note: marginal effects (tariffs, original model): 6–10 years: -1.99^{***} , CI = -2.73 to -1.25 ; 11–14 years: -2.13^{***} , CI = -2.87 to -1.39 ; 15–19 years: -1.76^{***} , CI = -2.50 to -1.03 ; marginal effects (Do: democracies, original model): 6–10 years: -0.50 , CI = -1.43 to 0.44 ; 11–14 years: -1.15^* , CI = -2.09 to -0.21 ; 15–19 years: -1.03^* , CI = -1.97 to -0.09 ; marginal effects (NDo: non-democracies, original model): 6–10 years: -5.48^{***} , CI = -6.59 to -4.37 ; 11–14 years: -6.31^{***} , CI = -7.42 to -5.20 ; 15–19 years: -5.29^{***} , CI = -6.40 to -4.18 ; marginal effects (Dm: democracies, mediation model): 6–10 years: -0.62 , CI = -1.55 to 0.31 ; 11–14 years: -1.31^{**} , CI = -2.24 to -0.38 ; 15–19 years: -1.16^* , CI = -2.09 to -0.23 ; marginal effects (NDm: non-democracies, mediation model): 6–10 years: -5.00^{***} , CI = -6.12 to -3.88 ; 11–14 years: -5.71^{***} , CI = -6.83 to -4.60 ; 15–19 years: -4.78^{***} , CI = -5.90 to -3.66 ; marginal effects (tariff, mediation model): 6–10 years: -2.05^{***} , CI = -2.80 to -1.30 ; 11–14 years: -2.44^{***} , CI = -3.19 to -1.69 ; 15–19 years: -2.15^{***} , CI = -2.90 to -1.40 ; * $p < 0.05$, ** $p < 0.01$ and *** $p < 0.001$.

Source: the author.

tariffs on SSB reduces SSB intake more among children and adolescents than adults. We hypothesised that children and adolescents tend to be price elastic in their demand for SSB, largely because of their low-income levels. In fact, people with low incomes have higher SSB consumption rates⁽⁴³⁾. Recent empirical evidence suggests that beverage taxes reduce SSB purchases more among people with lower incomes than among those with higher incomes^(44,45).

Higher tariffs on SSB lead children and adolescents to consume more fruit, vegetables and coffee as alternatives to SSB compared with their adult counterparts. Our results overlap with those of previous studies that reported an association between SSB taxes and increased consumption of fruits and vegetables⁽¹⁶⁾ and coffee⁽⁴⁶⁾. However, we found no evidence of the substitution of tea drinks for SSB by children and adolescents. It appears arbitrary to argue that “motivations” can have consequences for

alternative beverage choice. A recent finding suggests that tea is less popular than coffee, partly because coffee consumption is considered a habitual behaviour, whereas tea consumption is motivated by socialisation⁽⁴⁷⁾. Future studies should re-examine whether motivation plays a vital role in the selection of alternative beverages.

The current study confirms that a higher proportion of female legislators leads to higher tariffs on SSB. Female legislators are more likely to value trade policy as an effective means of improving women’s living conditions. One study found that a greater female presence in legislative bodies leads to lower tariffs on trade, given the positive impact of trade liberalisation on women’s empowerment and development⁽⁴⁸⁾. Another study confirmed that women’s presence in the legislature is associated with decreased import tax penalties on women’s goods⁽⁴⁹⁾. Our results highlight that female parliamentarians may opt to adjust import tariffs



for a particular good in pursuit of child and adolescent health. Thus, female legislators do not always favour liberal or protectionist trade policies; instead, they assess the economic and social effects of their policy choices.

The impact of female representation on reducing SSB consumption among children and adolescents exists in non-democratic countries. The results were fully consistent with previous research indicating that high female political representation effectively offsets health liabilities associated with weak democratic contexts⁽¹⁸⁾. However, a study of gendered import tax discrimination found that in settings where greater democratic institutionalisation allows more women in decision-making roles, gains in women's representation have a substantively large effect⁽⁴⁹⁾. Thus, these findings suggest that women representatives may act as a "substitute for" or a "complement of" democracy, which may depend on issues that women legislators attempt to address. In non-democracies, where the ability to rule is questionable and de facto legitimacy is low, the dictator might grant women legislators the power to improve population health or the general interests of women (e.g., reproductive and educational rights) that can create public support for the regime. Issues such as import tax differentials on gender-classified imports may not be a priority for dictators. In conclusion, future research should explore the dual role of female representatives in ameliorating the democratic function and its implications for population dynamics.

This study has several limitations. First, countries were observed over a relatively short period and not all countries were included, whereas more cases were required for causal inference. The use of the Global Dietary Database, Inter-Parliamentary Union and other sources of data allowed us to analyse 185 countries for the given period. Second, import tariffs were not the only policy option for taxing SSB. There was no assessment of the sugary drink tax, thus causing a bias. Approximately fifty countries have implemented taxes on SSB to date; however, two-thirds of the countries have applied it after 2015. Therefore, we would expect them to have a small or statistically non-significant effect on SSB intake in children and adolescents, given the analysis of data for the periods prior to 2015. Future research should test the validity of the proposed arguments using additional measurements. Third, no data exist for unpacking the mechanisms underlying how women's presence in legislature would engage more in committees dealing with food and nutrition policies, which in turn might help reduce SSB consumption among children and adolescents, particularly in non-democracies. More detailed data may enable the examination of the causal hypotheses. Fourth, there is enormous variation across dictatorships. If leadership derives support from a narrower group, rulers are less inclined to improve population health but benefit only that group, and thus less likely to grant women legislators decision-making power. Future research that considers such issues would enrich our understanding of the link between women's participation in formal politics and improvements in child and

adolescent health. Fifth, individual- and environmental-level mechanisms may be a source of bias in our results. Future research should explore cross-level interactions. Sixth, changes in tariffs, and by extension availability and prices, could differentially affect socioeconomic groups. Our results could both overestimate and underestimate the observed effects in households within a certain income range. In future research, we will test the robustness when data become available.

At least three policy implications warrant consideration. First, taxation is an effective means of socially enacted preventive nutrition for deterring SSB consumption in children and adolescents. Second, efforts to guide governments to increase tariff levels on SSB could start with an increase in women's share of Member of Parliament. Third, scholars of political science and social epidemiology in non-democratic regimes could pay particular attention to the presence of women in national parliaments, which would promote healthy development for children and adolescents.

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Supplementary material

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