Relationship between consumption of sugar-containing beverages and weight gain in children

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Background on SSB

- Associated with obesity in adults and children, but unclear in younger children
- Mechanism unclear
  - Increased total calorie consumption (liquid calories less satisfying)
  - Independent effect of the sugars themselves
    - Non-controlled for total energy
    - Controlled for total energy
Background on SSB

- Associated with obesity in adults and children, but unclear in younger children
- Mechanism unclear
  - Increased total calorie consumption (liquid calories less satisfying)
  - Independent effect of the sugars themselves
- Despite reduction in recent years, SSB and added sugar consumption greatly exceeds recommendations
**Background on SSB**

- We examined fruit juice content
  - Nutrient content is very similar to SSB
  - High consumption among young children

- Sugar Containing Beverages (SCB)
  - SCB = SSB + Fruit Juice

- SCB may affect body fat distribution
  - Total Adiposity
  - Central Adiposity
Does increased consumption of sugar-containing beverages among children under 12 years result in excess weight gain?
Results

2887 Unique Citations

- 2762 Citations Excluded
- 124 Citations
  - 86 Citations Excluded
  - 38 Citations
    - 31 studies with SCB as exposure
    - 15 studies with fruit juice as exposure
      - 31 with total adiposity as outcome
      - 6 with central adiposity as outcome
      - 15 with total adiposity as outcome
      - 2 with central adiposity as outcome
* Substantial heterogeneity (Qualitative SR)

- populations
- study designs
- exposures
- covariates
<12: SCB ~ Total Adiposity

* 40%-71% of analyses tended positive whether or not:
  * Change over change analysis design
  * Sample size ≥ 250
  * Risk of bias low
  * Controlled for age, sex, PA
  * U.S. study
<12: SCB ~ Central Adiposity

* 67%-100% of analyses tended positive whether or not:
  * Change over change analysis design
  * Sample size ≥ 250
  * Risk of bias low
  * Controlled for age, sex, PA
  * U.S. study
**<12: Juice ~ Total Adiposity**

- 20%-40% of analyses tended positive whether or not:
  - Change over change analysis
  - Sample size ≥ 250
  - Risk of bias low vs. moderate or high
  - Controlled or not controlled for age, sex, PA
  - U.S. study or not

- No studies were positive if:
  - Sample size < 250
2 studies

- Differing study designs
- 2 of 2 were negative
  - Whether controlling or not controlling for total energy
70%-100% of analyses were positive if:

- Sample size ≥ 250
- Risk of bias low
- Not controlled for age, sex, PA
- Non-U.S. study
Methods used in published studies vary widely.

Results of review indicate:

- A positive association between SCB consumption among children < 12 and both total and central adiposity, regardless of study design.
- The association with total adiposity may be strongest among children <5 at baseline.
Summary of Results

* Methods used in published studies vary widely

* Results of review indicate:
  * Mixed results with fruit juice only and total adiposity
  * Most studies are positive in children <5 but not in children <12
  * No studies of SCBs or fruit juice among children < 5 and central adiposity

* Controlling for total energy decreases but does not eliminate likelihood of a positive association
Strengths

- Robust methodology
  - Adhered to PRISMA Guidelines for conducting and reporting a systematic review
  - Comprehensive literature search
  - Screening, data abstraction in duplicate
• Only SR focused on children <12 years

• Conducted several sub-group analyses
  • Controlled for total energy vs not
  • SCB vs fruit juice

• No studies identified as having been funded by the food, beverage or sugar industry
  • It is possible that funding could have been provided indirectly
Weaknesses

- Substantial variation in the definition of SCB
  - sweetened beverages
  - 100% fruit juice
  - sweetened tea/coffee
  - variation in recording sweet beverage exposure

- No two studies had similar methodology

- Meta-analysis could not be performed
  - Vote counting utilized

- Did not look at data stratified by baseline weight
  - SCB may have greater impact on those with different weight & obesity status at baseline
Weaknesses

* Out of 38 studies, only one was an RCT
  * High risk of bias

* Measurement of exposure
  * Some studies evaluated exposure during either one or multiple observations at baseline and assumed that the exposure level extended for the duration of the study
  * Some studies calculated an average exposure form longitudinal observations, but did not describe how this average was calculated
Most studies:
- Were retrospective
- Had significantly small numbers of subjects in the cohort used for the analysis compared to the original cohort
- Did not control for age, sex and physical activity
Weaknesses

- The clinical relevance of any association is unclear
  - Even for those studies that did demonstrate an association most had a small magnitude of effect
  - Difficultly in measurement
  - Effect within the range of usual consumption of children at this age is possibly minimal

Of note: To reduce the prevalence of obesity among U.S. children age 2-5 years to 5%, the level observed in the 1970s, it has been estimated that an average reduction of only 33 calories/day would be needed (Wang, 2012)
Conclusions

- Evidence exists for a positive association between SCBs and total and central adiposity among children
  - the evidence related to fruit juice is much weaker

- Evidence is most consistent with SCB consumption among children <5 years

- The observed association appears to be due in part due to an increase in total energy intake with increased SCBs
  - SCBs may have an energy independent effect
Additional high-quality RCTs and well-designed long-term cohort studies are needed to determine the extent to which the differences observed are due to:

- residual confounding
- differences in the
  - exposure (type or amount) of beverage consumed
  - metabolic condition of the children studied
  - other factors

Additional studies could significantly alter these conclusions.
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