Sugar intake from sweet food and beverages, common mental disorder and depression: prospective findings from the Whitehall II study<br>Anika Knüppel ${ }^{1^{*}}$<br>Martin J. Shipley ${ }^{1}$<br>Clare H. Llewellyn ${ }^{1}$<br>Eric J. Brunner ${ }^{1}$<br>${ }^{1}$ Affiliations: Department of Epidemiology and Public Health, University College London, London, WC1E 6BT, UK<br>*corresponding author: anika.knuppel.14@ucl.ac.uk

Participants at phases $3 / 5 / 6 / 7 / 8 / 9 / 11$,
$\mathrm{n}=8815 / 7870 / 7355 / 6967 / 7173 / 6761 / 6308$


Participants at Phases $3 / 5 / 7 / 9, n=8711 / 7804 / 6902 / 6698$

Excluded:

- Missing values energy intake, $\mathrm{n}=456$ / 2410 / 1253 / 1324
- Missing information to assess energy misreporting, $\mathrm{n}=86 / 107 / 59 / 47$
- Energy ( $\log$ EI/EE >3SD, <3SD), $\mathrm{n}=66$ / 28 / 36 / 30
- Less than half of sweet food/beverage items answered, $\mathrm{n}=5 / 21 / 18 / 11$

Participants with sufficient data on sugar intake from sweet foods/beverages: Phases $3 / 5 / 7 / 9$, $n=8098 / 5227 / 5534 / 5282$

## Excluded:

- Missing GHQ caseness, $\mathrm{n}=11$ / 81 / $50 / 27$
- Missing CES-D caseness at phases 7 / 9, n = 341 / 178

Observations eligible for cross-sectional analysis:
For common mental disorder: Phases $3 / 5 / 7 / 9, n=8087 / 5131 / 5483 / 5253$ For depression: Phases $7 / 9$, $n=5175 / 5094$

| Observations eligible for incidence and recurrence analyses (based on common mental disorder at baseline): |  |  |  |  |
| :---: | :---: | :---: | :---: | :---: |
| Follow-up period |  | Outcome phases | Incidence | Recurrence |
| $\begin{aligned} & \text { ờ } \\ & \text { ( } \end{aligned}$ | 2 year | 6/8 | $\mathrm{n}=3640 / 4178$ | $\mathrm{n}=917 / 999$ |
|  | 5 year | 5 / 7 / 9 / 11 | $\mathrm{n}=5116 / 3664 / 4069 / 4161$ | $\mathrm{n}=1447 / 956 / 965 / 662$ |
|  | 10 year | 7/9/11 | $\mathrm{n}=4850 / 3526 / 3806$ | $\mathrm{n}=1397 / 925 / 917$ |
| 岂 | 5 year | 7/9/11 | $\mathrm{n}=3366$ / $3951 / 3996$ | $\mathrm{n}=868 / 937 / 630$ |
|  | 10 year | 7/9/11 | $n=4368 / 3416 / 3661$ | $\mathrm{n}=1252 / 901 / 877$ |
|  | 5 year | 11 | $\mathrm{n}=3929$ | $\mathrm{n}=631$ |
|  | 10 year | 11 | $\mathrm{n}=3514$ | $\mathrm{n}=859$ |

Figure S1 Inclusion of person observations by phase
Abbreviations: GHQ = General Health Questionnaire, CES-D = Centre of Epidemiologic Studies Depression Scale, CIS-R = revised Clinical Interview Schedule.

| Sweet food | Beverages |
| :--- | :--- |
| sweet biscuits | fizzy soft drinks |
| buns or pastries | fruit squash or cordial |
| Cakes | fruit juice |
| chocolates or chocolate bars | malted milk drinks, such as Horlicks |
| fruit pies, tarts or crumbles | cocoa or hot chocolate |
| ice cream |  |
| jam, marmalade or honey |  |
| milk puddings, sponge puddings |  |
| added sugar |  |
| sweets, toffees or mints |  |
|  |  |

Table S1 Sources of sugar intake from sweet food/ beverages

|  | Incident common mental disorder ${ }^{\text {b }}$ after 2 years, OR (95\% CI) |  |  |  |
| :---: | :---: | :---: | :---: | :---: |
|  | events / person observations | Model $0^{\text {c }}$ | Model $1^{\text {d }}$ | Model $2^{\text {e }}$ |
| Sugar intake from sweet food/beverages |  |  |  |  |
| Lowest Tertile | 214 / 2059 | 1.0 (reference) | 1.0 (reference) | 1.0 (reference) |
| MiddleTertile | 194 / 1799 | 1.05 (0.82, , 1.34 ) | 1.05 (0.82 ,1.34) | 1.00 (0.78,1.29) |
| Highest Tertile | 196 / 1581 | 1.33 (1.03,1.71) | $1.31(1.01,1.70)$ | $1.19(0.90,1.56)$ |
| Total | 604 / 5439 |  |  |  |
| $P$ for trend |  | 0.032 | 0.045 | 0.234 |
|  |  |  |  |  |
|  | Incident common mental disorder ${ }^{\text {b }}$ after 5 years, OR (95\% CI) |  |  |  |
|  | events / person observations | Model $0^{\text {f }}$ | Model $1^{\text {d }}$ | Model $2^{\text {e }}$ |
| Sugar intake from sweet food/beverages |  |  |  |  |
| Lowest Tertile | 463 / 4391 | 1.0 (reference) | 1.0 (reference) | 1.0 (reference) |
| MiddleTertile | 434 / 3886 | 1.06 (0.90,1.24) | 1.08 (0.92,1.27) | 1.05 (0.89, 1.24) |
| Highest Tertile | 456 / 3467 | 1.30 (1.10,1.54) | $1.32(1.11,1.56)$ | 1.24 (1.04,1.48) |
| Total | 1353 / 11744 |  |  |  |
| $P$ for trend |  | 0.002 | 0.002 | 0.019 |
|  |  |  |  |  |

Table S2 Prospective association of sugar intake from sweet food/beverages and incident common mental disorder after 2 and 5 years in men excluding participants with self-reported doctor diagnosed depression at each baseline ${ }^{\text {a }}$
Abbreviations: $\mathrm{OR}=$ Odds ratio, $\mathrm{CI}=$ Confidence interval, $\mathrm{DASH}=$ Dietary Approaches to Stop Hypertension.
${ }^{\text {a }}$ Prospective association across phases 3, 5 for 2-year and 3, 5, 7, 9 for 5-year incident common mental disorder.
${ }^{\mathrm{b}}$ Common mental disorder measured using the 30 -item General Health Questionnaire.
${ }^{c} 2$-year model 0 (631events / 5661 person observations): adjusted for age, ethnicity.
${ }^{\mathrm{d}}$ Model 1: additionally adjusted for marital status, last grade level in civil service, smoking, alcohol intake, physical activity, sleep duration.
${ }^{\mathrm{e}}$ Model 2: additionally adjusted for energy intake from other foods, modified DASH diet score, fish, coffee and tea intake.
${ }^{\mathrm{f}} 5$-year model 0 ( 1413 events / 12238 person observations): adjusted for age, ethnicity.

|  | Recurrent clinical depression after 5 years $^{\text {b }}$, OR ( $95 \%$ CI) |  |  |  |
| :---: | :---: | :---: | :---: | :---: |
|  |  | Model $0^{\text {c }}$ | Model 1 ${ }^{\text {d }}$ | Model $2^{\text {e }}$ |
| Sugar intake from sweet food/beverages |  |  |  |  |
| Lowest Tertile | 27/236 | 1.0 (reference) | 1.0 (reference) | 1.0 (reference) |
| MiddleTertile | 26/182 | 1.37 (0.79, 2.40) | 1.23 (0.68, 2.24) | 1.11 (0.60, 2.05) |
| Highest Tertile | $29 / 172$ | 1.65 (0.96, 2.87) | 1.58 (0.87, 2.86) | 1.24 (0.67, 2.31) |
| Total | $82 / 590$ |  |  |  |
| $P$ for trend |  | 0.07 | 0.13 | 0.50 |
|  |  |  |  |  |

Table S3 Prospective association of sugar intake from sweet food/beverages and recurrent clinical depression after 5 years ${ }^{\text {a }}$
Abbreviations: $\mathrm{OR}=$ Odds ratio, $\mathrm{CI}=$ Confidence interval, DASH = Dietary Approaches to Stop Hypertension.
${ }^{\text {ap }}$ Prospective association across phase 9 to 11 .
${ }^{\mathrm{b}}$ Clinical depression measured using the revised Clinical Interview Schedule.
${ }^{\text {c C Clinical depression model }} 0$ ( 92 events / 631 participants): adjusted for age*sex, ethnicity.
${ }^{\mathrm{d}}$ Model 1: additionally adjusted for marital status, last grade level in civil service, smoking, alcohol intake, physical activity, sleep duration.
${ }^{\mathrm{e}}$ Model 2: additionally adjusted for energy intake from other foods, modified DASH diet score, fish, coffee and tea intake.

