**Sources of dietary gluten in the first two years of life and associations with celiac disease autoimmunity and celiac disease in Swedish genetically predisposed children: TEDDY study**

Elin M Hård af Segerstad, Xiang Liu, Ulla Uusitalo, Daniel Agardh, Carin Andrén Aronsson for the TEDDY study group.

**Supplementary Table 1.** Original food grouping of gluten-containing foods in the Swedish TEDDY food database and new food groups for the purpose of the present study. Rationale for combining new food groups or excluding food groups from analyses of the associations between dietary sources and risk of celiac disease autoimmunity and celiac disease in Swedish children at genetic risk. Gluten contents in food groups are estimates based on standard Swedish foods and recipes.

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| **Original main food group** | **Original subgroup** | **Description** | **Rationale for combination** | **New food group** | **Gram (g) gluten/ portion** |
| **Bread** | Soft white bread | Based mainly on wheat, may contain other grains | Similar proportions of flour  Similar cooking techniques used | **Bread** | 2 g/slice  35 grams |
| Rye bread | Based mainly on rye, may contain wheat |
| Soft wholemeal bread | Based mainly on wheat and rye |
| Crisp bread | Based on various grains, at least one gluten-containing | Similar proportions of flour  Similar types of flours  Similar cooking techniques used | **Cookies and crackers** | 0.9 g/piece  10 grams |
| Crispy flatbread | Based on various grains, at least one gluten-containing |
| Dishes based on bread | Filled sandwiches, burrito, wrap, breakfast muffin etc. | Large variation flour/dough  In <10 food records | *Excluded* |  |
| **Porridge,**  **milk cereal drink** | Porridge | Infant cereals and homemade porridge with at least one gluten-containing grain |  | **Porridge** | 0.2-0.9 g/portion  120 grams1 |
| Milk cereal drink | Follow-on formula with at least one gluten-containing grain |  | **Milk cereal drink** | 0.4-1.5 g/bottle  200 ml1 |
| Pudding | Commercial wheat or rice pudding with jam | Large variation in gluten content  In <50 food records | *Excluded* |  |
| **Cereals, muesli** | Cereals, muesli, low/unsweetened | Based on a mix of grains (with/without gluten) | Different sugar content | **Breakfast cereals** | 0-2 g/portion  1 deciliter1 |
| Cereals, muesli, sweetened | Based on a mix of grains (with/without gluten) |
| Commercial baby fruit cereal | Main ingredient fruit purée, ≤ 5 % grains (with/without gluten) | Very low/no content of gluten | *Excluded* |  |

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| **Pancakes, waffles, crêpes** | Pancakes, waffles, crêpes |  |  | **Pancakes** | 1.8 g/pancake  60 grams |
| Dishes with meat, sausage, poultry | Oven baked pancake with/without meat | Similar proportions of flour as in standard pancakes |
| Dishes with fish, seafood | Filled pancakes/crêpes | Conversion factor 0.7 to account for the pancake/crêpes part of the dish |
| Dishes with vegetables | Filled pancakes/crêpes |
| **Pizza, pie, pirogue** | Pizza dough, butter dough | Dough |  | **Bread** | 1.9 g/slice  35 grams |
| Filled pizza, pie, pirogue | Filling with meat, sausage, poultry | Similar proportions of flour  Similar grains used  Similar cooking techniques used  Conversion factor 0.3 to account for the dough part in the dish |
| Filled pizza, pie, pirogue | Filling with fish and seafood |
| Filled pizza, pie, pirogue | Filling with vegetables |
| Filled pizza, pie, pirogue | Filling with cheese and egg |
| **Pasta** | Pasta cooked | Fresh and dry pasta, pasta in dishes |  | **Pasta** | 0.7g/port  60 grams |
| **Bakery sweet** | Biscuits, cookies, crackers | Based mainly on wheat.  Unsweetened and sweetened products. | Similes grain content  Similar proportion of flour  Similar cooking techniques used | **Cookies and crackers** | 0.9 g/piece  10 grams |
| Buns, crusts | Based on wheat | Based on wheat  Similar proportion of flour  Similar cooking techniques used | **Sweet baked goods** | 0.8g/piece  20 grams |
| Cake, pastry, Swiss roll | Based on wheat |
| Sponge cake | Based on wheat, without filling |

1 Range reflects the variation of gluten content depending on included grains in foods within the food group.

**Supplementary Table 2** Number of children enrolled in the Swedish cohort of The Environmental Determinants of Diabetes in The Young study, as well as the number of collected food records per clinic visit. Percent of the cohort who dropped out as well as the number of missing food records per clinic visit is also reported. Reasons for leaving the study includes lost to follow up, withdrawn from study and developing type 1 diabetes.

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| --- | --- | --- |
| **Clinic visit age, months** | **Enrolled, n**  **(drop-out %)** | **Food records, n,**  **(missing %)** |
| 6 | 2,088 | 2,024 (3) |
| 9 | 2,064 (1.1) | 1,989 (3.6) |
| 12 | 2,055 (1.6) | 1,928 (6.2) |
| 18 | 1,992 (4.6) | 1,777 (10.8) |
| 24 | 1,952 (6.5) | 1,714 (12.2) |
|  |  | Total 9,432 |

**Supplementary Table 3** Spearman’s correlation coefficient calculated for the correlation between consumers of a given gluten-containing food, and their total daily gluten intake assessed from three-day food records in Swedish children at genetic risk of celiac disease enrolled in The Environmental Determinants of Diabetes in the Young study. Children with celiac disease autoimmunity or celiac disease at the time of the dietary assessment were excluded.

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|  | Correlation with total gluten intake, ρ (*p*-value) | | | | |
| Age in months | **6** | **9** | **12** | **18** | **24** |
| Food group |  |  |  |  |  |
| Porridge | 0.514 (<0.001) | 0.269 (<0.001) | 0.053 (0.037) | -0.008 (0.813) | -0.043 (0.325) |
| Milk cereal drink | 0.170 (<0.001) | -0.133 (<0.001) | 0.086 (0.001) | 0.071 (0.011) | 0.098 (0.002) |
| Bread | 0.444 (<0.001) | 0.451 (<0.001) | 0.439 (<0.001) | 0.316 (<0.001) | 0.339 (<0.001) |
| Cookies and crackers | 0.179 (0.003) | 0.119 (<0.001) | 0.142 (<0.001) | 0.090 (0.004) | 0.112 (<0.001) |
| Pasta | 0.723 (<0.001) | 0.670 (<0.001) | 0.549 (<0.001) | 0.643 (<0.001) | 0.630 (<0.001) |
| Pancakes | 0.224 (0.527) | 0.393 (<0.001) | 0.198 (0.004) | 0.196 (<0.001) | 0.155 (0.004) |
| Sweet baked goods | 0.419 (0.058) | 0.174 (0.025) | 0.157 (<0.001) | 0.222 (<0.001) | 0.134 (<0.001) |
| Breakfast cereals | n.a. | 0.261 (0.130) | 0.206 (0.003) | 0.124 (0.002) | 0.058 (0.109) |

**Supplementary Table 4A-E** The estimated hazard rations (HR) and their related 95% confidence intervals (CI 95%) of the association between intake of gluten-containing foods and grains assessed by three-day food records (one table per clinic visit at six to 24 months of age) and either time to celiac disease autoimmunity (CDA) or to celiac disease in Swedish children at genetic risk. Depending on the percent of consumers (having an intake >0 g/day) at each age, intake variables were modelled as binary (if <50% consumers; 0 g/day, >0 g/day), categorical (if >50% consumers; 0 g/day, <median intake, >median intake) and continuous variables (if >75% consumers). Included covariates in the analyses were HLA risk group, sex, having a parent or sibling with celiac disease, and energy as well as gluten intake assessed by the respective food record. Statistically significant *p*-values are highlighted.

**Supplementary table 4A** Intake at six months of age

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| --- | --- | --- | --- | --- | --- |
| **Gluten source** | **Intake modelled** | **CDA**  **HR (95% CI)** | ***p-value*** | **Celiac disease**  **HR (95% CI)** | ***p-value*** |
| ***Grain*** |  |  |  |  |  |
| Wheat | *No intake* | 1 *(reference)* |  | 1 *(reference)* |  |
|  | *≤5.7 g/day* | 1.09 (0.86, 1.39) | 0.490 | 0.95 (0.67, 1.33) | 0.752 |
|  | *>5.7 g/day* | 0.72 (0.46, 1.14) | 0.160 | 0.90 (0.48, 1.68) | 0.741 |
| Rye | *Yes (no reference)* | 0.95 (0.64, 1.40) | 0.788 | 1.14 (0.68, 1.91) | 0.617 |
| ***Food group*** |  |  |  |  |  |
| Porridge | *No intake*  *≤118 g/day*  *>118 g/day*  *Per 120 g (portion)* | 1 *(reference)*  1.28 (0.96, 1.69)  1.28 (0.95, 1.72)  1.04 (0.91, 1.20) | 0.089  0.102  0.561 | 1 *(reference)*  1.07 (0.72, 1.58)  1.31 (0.87, 1.97)  1.16 (0.96, 1.40) | 0.737  0.198  0.118 |
| Milk cereal drink | *Yes (no reference)* | 1.11 (0.91, 1.35) | 0.320 | 1.25 (0.95, 1.64) | 0.117 |
| Bread | *Yes (no reference)* | 1.01 (0.75, 1.38) | 0.927 | 1.23 (0.82 1.85) | 0.316 |
| Cookies and crackers | *Yes (no reference)* | 0.91 (0.69, 1.21) | 0.527 | 1.20 (0.84, 1.74) | 0.320 |

**Supplementary Table 4B** Intake at nine months of age

|  |  |  |  |  |  |
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| **Gluten source** | **Intake modelled** | **CDA**  **HR (95% CI)** | ***p-value*** | **Celiac disease**  **HR (95% CI)** | ***p-value*** |
| ***Grain*** |  |  |  |  |  |
| Wheat | *Per g* | 0.99 (0.98, 1.01) | 0.477 | 1.00 (0.97, 1.02) | 0.846 |
| Rye | *Yes (no reference)* | 1.03 (0.85, 1.25) | 0.748 | 1.02 (0.77, 1.34) | 0.902 |
| ***Food group*** |  |  |  |  |  |
| Porridge | *No intake*  *≤158 g/day*  *>158 g/day*  *Per 120 g (portion)* | 1 *(reference)*  **1.53 (1.05, 2.23)**  1.41 (0.95, 2.09)  0.96 (0.85, 1.08) | **0.026**  0.088  0.521 | 1 *(reference)*  1.51 (0.87, 2.62)  1.38 (0.78, 2.46)  0.94 (0.79, 1.11) | 0.144  0.270  0.467 |
| Milk cereal drink | *No intake*  *<400 g/day*  *>400 g/day* | 1 *(reference)*  0.93 (0.74, 1.18)  0.98 (0.78, 1.25) | 0.574  0.889 | 1 *(reference)*  1.00 (0.71, 1.41)  1.10 (0.77, 1.56) | 0.989  0.604 |
| Bread | *No intake*  *≤10.7 g/day*  *>10.7 g/day* | 1 *(reference)*  1.16 (0.93, 1.45)  1.10 (0.86, 1.41) | 0.196  0.445 | 1 *(reference)*  1.22 (0.89, 1.66)  0.91 (0.63, 1.30) | 0.217  0.585 |
| Pasta | *Yes (no reference)* | 1.01 (0.80, 1.27) | 0.382 | 0.89 (0.63, 1.26) | 0.502 |
| Cookies and crackers | *Yes (no reference)* | 1.09 (0.90, 1.31) | 0.958 | 1.25 (0.96, 1.63) | 0.093 |

**Supplementary Table 4C** Intake at 12 months of age

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| **Gluten source** | **Intake modelled** | **CDA**  **HR (95% CI)** | ***p-value*** | **Celiac disease**  **HR (95% CI)** | ***p-value*** |
| ***Grain*** |  |  |  |  |  |
| Wheat | *Per g* | 1.03 (0.87, 1.21) | 0.749 | 0.97 (0.95, 1.00) | 0.051 |
| Rye | *Per g* | 1.03 (0.90, 1.19) | 0.645 | 1.00 (0.98, 1.03) | 0.763 |
| ***Food group*** |  |  |  |  |  |
| Porridge | *No intake*  *≤133 g/day*  *>133 g/day*  *Per 120 g (portion)* | 1 *(reference)*  1.19 (0.93, 1.53)  0.97 (0.75, 1.27)  0.94 (0.83, 1.06) | 0.174  0.843  0.320 | 1 *(reference)*  1.26 (0.89, 1.80)  1.07 (0.73, 1.56)  0.94 (0.79, 1.13) | 0.198  0.739  0.500 |
| Milk cereal drink | *No intake*  *≤410 g/day*  *>410 g/day*  *Per 200 ml (bottle)* | 1 *(reference)*  0.96 (0.74, 1.23)  1.04 (0.80, 1.35)  1.02 (0.93, 1.11) | 0.726  0.770  0.736 | 1 *(reference)*  1.01 (0.70, 1.47)  1.19 (0.81, 1.73)  1.04 (0.91, 1.18) | 0.940  0.372  0.558 |
| Bread | *No intake*  *≤18.3 g/day*  *>18.3 g/day*  *Per 10 g* | 1 *(reference)*  1.24 (0.91, 1.70)  **1.47 (1.05, 2.05)**  1.04 (0.98, 1.10) | 0.176  **0.023**  0.205 | 1 *(reference)*  1.21 (0.76, 1.94)  **1.79 (1.10, 2.91)**  1.07 (0.98, 1.16) | 0.427  **0.019**  0.131 |
| Pasta | *Yes (no reference)* | 0.91 (0.74, 1.12) | 0.379 | 1.24 (0.93, 1.66) | 0.137 |
| Cookies and crackers | *No intake*  *≤3.0 g/day*  *>3.0 g/day* | 1 *(reference)*  1.18 (0.95, 1.47)  1.10 (0.88, 1.39) | 0.144  0.404 | 1 *(reference)*  1.04 (0.76, 1.42)  1.00 (0.72, 1.39) | 0.798  0.993 |
| Sweet baked goods | *Yes (no reference)* | 1.16 (0.94, 1.43) | 0.172 | 0.97 (0.72, 1.32) | 0.863 |
| Pancakes | *Yes (no reference)* | 0.90 (0.67, 1.22) | 0.500 | 0.96 (0.64, 1.46) | 0.858 |
| Breakfast cereals | *Yes (no reference)* | 0.86 (0.63, 1.18) | 0.354 | 0.89 (0.57, 1.38) | 0.595 |

**Supplementary Table 4D** Intake at 18 months of age

|  |  |  |  |  |  |
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| **Gluten source** | **Intake modelled** | **CDA**  **HR (95% CI)** | ***p-value*** | **Celiac disease**  **HR (95% CI)** | ***p-value*** |
| ***Grain*** |  |  |  |  |  |
| Wheat | *Per g* | 0.95 (0.88, 1.02) | 0.144 | 0.94 (0.88, 1.01) | 0.075 |
| Rye | *Per g* | 0.95 (0.89, 1.02) | 0.131 | 0.95 (0.90, 1.01) | 0.132 |
| ***Food group*** |  |  |  |  |  |
| Porridge | *Yes (no reference)* | 0.92 (0.75, 1.12) | 0.394 | 0.91 (0.68, 1.20) | 0.485 |
| Milk cereal drink | *No intake*  *≤383 g/day*  *>383 g/day*  *Per 200 ml (bottle)* | 1 *(reference)*  0.97 (0.75, 1.25)  0.99 (0.75, 1.29)  1.03 (0.93, 1.14) | 0.819  0.922  0.606 | 1 *(reference)*  1.14 (0.78, 1.67)  1.40 (0.95, 2.06)  **1.16 (1.00, 1.33)** | 0.511  0.092  **0.047** |
| Bread | *No intake*  *≤26.0 g/day*  *>26.0 g/day*  *Per 10g* | 1 *(reference)*  1.20 (0.74, 1.95)  1.18 (0.72, 1.94)  1.01 (0.96, 1.07) | 0.468  0.520  0.648 | 1 *(reference)*  1.27 (0.64, 2.53)  1.19 (0.59, 2.40)  1.03 (0.95, 1.11) | 0.492  0.633  0.458 |
| Pasta | *No intake*  *≤23.0 g/day*  *>23.0 g/day* | 1 *(reference)*  1.18 (0.93, 1.51)  0.98 (0.73, 1.33) | 0.182  0.914 | 1 *(reference)*  0.94 (0.67, 1.31)  0.76 (0.51, 1.15) | 0.717  0.199 |
| Cookies and crackers | *No intake*  *≤5.0 g/day*  *>5.0 g/day* | 1 *(reference)*  0.95 (0.75, 1.20)  0.96 (0.75, 1.23) | 0.662  0.747 | 1 *(reference)*  1.01 (0.73, 1.41)  1.11 (0.80, 1.56) | 0.954  0.527 |
| Sweet baked goods | *Yes (no reference)* | 1.04 (0.85, 1.28) | 0.717 | 0.98 (0.74, 1.30) | 0.881 |
| Pancakes | *Yes (no reference)* | 0.93 (0.73, 1.19) | 0.548 | 1.06 (0.77, 1.47) | 0.722 |
| Breakfast cereals | *Yes (no reference)* | 0.88 (0.71, 1.08) | 0.205 | 0.89 (0.67, 1.18) | 0.414 |

**Supplementary Table 4E** Intake at 24 months of age

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Gluten source** | **Intake modelled** | **CDA**  **HR (95% CI)** | ***p-value*** | **Celiac disease**  **HR (95% CI)** | ***p-value*** |
| ***Grain*** |  |  |  |  |  |
| Wheat | *Per g* | 1.25 (0.78, 2.04) | 0.364 | 1.31 (0.70, 2.47) | 0.405 |
| Rye | *Per g* | 1.22 (0.81, 1.84) | 0.331 | 1.26 (0.74, 2.15) | 0.389 |
| ***Food group*** |  |  |  |  |  |
| Porridge | *Yes (no reference)* | 1.13 (0.90, 1.43) | 0.301 | 1.13 (0.84, 1.51) | 0.412 |
| Milk cereal drink | *No intake*  *≤360 g/day*  *>360 g/day* | 1 *(reference)*  0.82 (0.63, 1.08)  0.81 (0.60, 1.09) | 0.159  0.168 | 1 *(reference)*  1.15 (0.81, 1.63)  1.35 (0.93, 1.96) | 0.437  0.119 |
| Bread | *No intake*  *≤30.3 g/day*  *>30.3 g/day*  *Per 10g* | 1 *(reference)*  1.14 (0.58, 2.24)  1.28 (0.64, 2.54)  1.04 (0.98, 1.10) | 0.712  0.487  0.204 | 1 *(reference)*  1.67 (0.67, 4.14)  1.91 (0.76, 4.80)  1.05 (0.97, 1.13) | 0.268  0.170  0.210 |
| Pasta | *No intake*  *≤25.0 g/day*  *>25.0 g/day* | 1 *(reference)*  0.85 (0.64, 1.13)  0.81 (0.55, 1.17) | 0.269  0.260 | 1 *(reference)*  0.93 (0.64, 1.34)  1.38 (0.86, 2.21) | 0.691  0.184 |
| Cookies and crackers | *No intake*  *≤6.0 g/day*  *>6.0 g/day* | 1 *(reference)*  1.27 (0.96, 1.68)  1.23 (0.93, 1.64) | 0.101  0.153 | 1 *(reference)*  1.12 (0.79, 1.59)  1.13 (0.79, 1.61) | 0.517  0.501 |
| Sweet baked goods | *Yes (no reference)* | 1.09 (0.87, 1.36) | 0.473 | 1.10 (0.83, 1.46) | 0.516 |
| Pancakes | *Yes (no reference)* | 1.13 (0.87, 1.48) | 0.356 | 1.09 (0.77, 1.53) | 0.644 |
| Breakfast cereals | *Yes (no reference)* | 0.85 (0.68, 1.06) | 0.154 | 1.01 (0.76, 1.34) | 0.967 |