##### **Supplementary Material**

##### Supplementary Table 1: Groups and subgroups of NOVA food classification system applied to the AUSNUT 2011-13 and NNPAS 2011-12

|  |  |
| --- | --- |
| NOVA Group |   |
| 1 | **Unprocessed or minimally processed foods** |
| Milk and plain yoghurt |
| Fruits |
| Potatoes and other tubers and roots |
| Red meat |
| Poultry |
| Cereals |
| Pasta |
| Vegetables |
| Eggs |
| Nuts and seeds |
| Fish |
| Legumes |
| Other unprocessed or minimally processed foods a |
| Freshly squeezed juices  |
| 2 | **Processed culinary ingredients** |
| Salt |
| Table sugar |
| Animal fats |
| Plant oil |
| Other processed culinary ingredients b |
| 3 | **Processed foods** |
| Beer and wine |
| Cheese |
| Vegetables and other plant foods preserved in brine |
| Processed breads |
| Bacon and other salted, smoked or canned meat or fish |
| Other processed foods c |
| 4 | **Ultra-processed foods** |
| Mass-produced packaged breads |
| Packaged ready meals |
| Breakfast cereals |
| Sausage and other reconstituted meat products |
| Confectionary |
| Ice cream, ice pops and frozen yogurts |
| Biscuits |
| Pastries, buns, and cakes |
| Industrial French fries |
| Margarine and other spreads |
| Milk-based drinks |
| Sauces, dressing and gravies |
| Packaged salty snacks |
| Frozen pizza |
| Industrial desserts |
| Instant and canned soups |
| Soft drinks, carbonated |
| Fruit drinks and iced teas |
| Alcoholic distilled drinks |
| Ultra-processed cheese |
| Other ultra-processed foods d |
| Fast food dishes  |

a Including non-presweetened, non-flavoured coffee and tea; coconut water; b Including vinegar; baking powder and baking soda; c Including salted or sugared nuts and seeds; peanut, sesame, cashew; d Including soya products such as meatless patties and fish sticks; baby food and baby formula. Reproduced with permission (1)

##### Supplementary Table 2: Components and scoring methods of the revised Dietary Guideline Index (DGI-2013)

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Dietary Guideline | Component and Description | Criteria for Maximum Score 1 | Criteria for Minimum Score | Maximum Score |
| Guidelines for adequate intake |
| 1. Enjoy a wide variety of nutritious foods | Food variety 2: proportion of food from each of the 5 core food groups eaten at least one serve per week | 100% | 0% | 10 |
| 2. Plenty of vegetables | Total vegetable intake: servings of vegetables per day | 19–50 y: M ≥ 6, F ≥ 5 | 0 | 10 |
| 51–70 y: M ≥ 5.5, F ≥ 5 |
| > 70 y: M ≥ 5, F ≥ 5 |
| 3. Fruit | Total fruit intake: servings of fruit per day | ≥2 | 0 | 10 |
| 4. Grain (cereal) foods | Total cereal intake: servings of grains per day | 19–50 y: M ≥ 6, F ≥ 6 | 0 | 5 |
| 51–70 y: M ≥ 6, F ≥ 4 |
| >70 y: M ≥ 4.5, F ≥ 3 |
|  | Mostly wholegrain or high fibre cereals: Type of bread usually consumed | Wholemeal bread | White bread | 5 |
| 5. Lean meat and poultry, fish, eggs, nuts and seeds, and legumes/beans | Total meat and alternative: servings per day | 19–50 y: M ≥ 3, F ≥ 2.5 | 0 | 5 |
| 51–70 y: M ≥ 2.5, F ≥ 2 |
| >70 y: M ≥ 2.5, F ≥ 2 |
|  | Lean meat: proportion of lean meats and alternatives to total meat and alternatives per day | 100% | 0% | 5 |
| 6. Milk, yoghurt, cheese and/or their alternatives 3 | Total dairy and alternative: servings per day | 19–50 y: M ≥ 2.5, F ≥ 2.5 | 0 | 10 |
| 51–70 y: M ≥ 2.5, F ≥ 4 |
| >70 y: M ≥ 3.5, F ≥ 4 |
| 7. Drink plenty of water | Total beverage intake 4: servings per day | M ≥ 10; F ≥ 8 | 0 | 5 |
|  | Water 5: proportion of water to total beverage intake per day | ≥50% | 0% | 5 |
| Guidelines to limit or moderate intake |
| 8. Limit intake of foods containing saturated fat, added salt, added sugars and alcohol | Limit discretionary foods | M ≤ 3; F ≤ 2.5 | M > 3; F > 2.5 | 10 |
| 9. Limit intake of foods high in saturated fat | Trim meat: trimming fat from meat | Usually | Never or rarely | 5 |
|  | Choose reduced-fat milk: type of milk usually consumed | Skim, low or reduced fat milk | Whole milk | 5 |
| 10. Small allowance of unsaturated oils, fats or spreads | Unsaturated spreads and oils: servings per day | 19–50 y: M ≤ 4, F ≤ 2 | M > 4; F > 2 | 10 |
| 51–70 y: M ≤ 4, F ≤ 2 |
| >70 y: M ≤ 2, F ≤ 2 |
| 11. Limit intake of foods and drinks containing added salt | Salt use: salt added during cooking | Never or rarely | Usually | 5 |
|  | Salt use: salt added during the meal | Never or rarely | Usually | 5 |
| 12. Limit intake of foods and drinks containing added sugars | Limit extra sugar 6: servings per day | M ≤ 1.5; F ≤ 1.25 | M > 1.5; F > 1.25 | 10 |
| 13. If you choose to drink alcohol, limit intake | Limit alcohol: servings per day | ≤2 | >2 | 10 |

1: Criteria for maximum scores were derived from the Australian Dietary Guidelines (2) unless otherwise noted; y: years; M: Male; F: Female; 2: Food variety was measured and scored using a similar method to the Recommended Food Score (3); 3: Choosing reduced fat dairy is captured in the “Limit intake of foods high in saturated fat” component; 4: The Eat for Health Australian Dietary Guidelines do not have specific recommendations for beverage consumption and recommended the guidelines found in the Nutrient Reference Values for Australia and New Zealand (4); 5: The proportion of water to total beverage intake was derived from US beverage guidelines (5); 6: Since added sugar intake is not recommended there are no cut-off values for the number of recommended servings, instead half of the maximum discretionary food cut-off were used consistent with the original DGI. (6) Reproduced with permission. (7)

##### Supplementary Table 3: Adjusted ¥ mean dietary share of ultra-processed foods (% energy intake) according to socio-demographic characteristics and diet quality in Australian adults from the 2011-12 National Nutrition and Physical Activity Survey (n = 8,209).

|  |  |
| --- | --- |
| **Characteristics** | **% energy intake from ultra-processed foods (SE)** |
|
| **Sex** |   |
|  | Male | 39.3 (0.5) |
|  | Female | 38.5 (0.4) |
| **Age (years)** |   |
|  | 19-30 | 43.9 (0.9) |
|  | 31-50 | 39.2 (0.4) |
|  | 51-70 | 35.5 (0.5) |
|  | 71+ | 38.4 (0.8) |
| **Country of Birth** |   |
|  | Australia | 40.6 (0.4) |
|  | Main English-Speaking Country | 39.4 (0.7) |
|  | Other | 32.5 (0.7) |
| **Area Level Disadvantage a** |   |
|  | First quintile (greater disadvantage) | 39.8 (0.8) |
|  | Second quintile | 38.8 (0.6) |
|  | Third quintile | 39.7 (0.7) |
|  | Fourth quintile | 39.1 (0.8) |
|  | Fifth quintile (most advantage) | 37.4 (0.7) |
| **Education b** |   |
|  | Low | 39.9 (0.7) |
|  | Medium | 39.1 (0.4) |
|  | High | 37.6 (0.6) |
| **Household income c** |   |
|  | First quintile (20% lowest income) | 37.7 (0.6) |
|  | Second quintile | 41.1 (0.8) |
|  | Third quintile | 39.6 (0.6) |
|  | Fourth quintile | 40.0 (0.7) |
|  | Fifth quintile (20% highest income) | 36.5 (0.7) |
| **Rurality** |   |
|  | Major city of Australia | 38.8 (0.3) |
|  | Inner Regional Australia | 39.4 (0.6) |
|  | Other | 39.0 (1.0) |
| **Diet quality (DGI) score d** |   |
|  | Low (lowest diet quality) | 46.4 (0.6) |
|  | Medium | 39.2 (0.5) |
|  | High (highest diet quality) | 31.2 (0.5) |

Note: SE, standard error; DGI, Australian Dietary Guideline Index; ¥ Adjusted means derived from linear regression analyses controlled for all the other variables in the table (socio-demographics and diet quality), and BMI, physical activity, and smoking status; a calculated using Index of Relative Socio-economic Disadvantage - 2011 - Quintiles – National; b low (incomplete high school or less), medium (completed high school or incomplete high school and/or certificate/diploma), and high (tertiary qualification); c combined income of all household members aged ≥15 years, divided into quintiles of the population; d DGI scores could range between 0 and 130, with a higher score indicating better diet quality – low DGI 13.4-70.5 (mean 60.0), medium DGI 70.5-83.9 (mean 77.2), high DGI 84.0-121.0 (mean 93.2).

##### Supplementary Table 4: Analysis of the associations between dietary share of ultra-processed foods (% of total energy) and diet quality (DGI) components in Australian adults from the 2011-12 National Nutrition and Physical Activity Survey (n = 8,209).

|  |  |
| --- | --- |
|  | Dietary contribution of ultra-processed foods (% of total energy intake) |
| DGI component | **Crude β** | **95% CI** | **p-value** | **Adjusted β** | **95% CI** | **p-value** |
| Food variety | -3.9 | -4.3 to -3.4 | <0.001 | -3.5 | -3.9 to -3.0 | <0.001 |
| Fruit | -0.9 | -1.0 to -0.7 | <0.001 | -0.7 | -0.8 to -0.5  | <0.001 |
| Vegetables | -1.8 | -2.0 to -1.6 | <0.001 | -1.7 | -1.8 to -1.5 | <0.001 |
| Cereal (total) | -0.6 | -0.8 to -0.3 | <0.001 | -0.4 | -0.6 to -0.1 | 0.003 |
| Meat and alternatives (total) | -2.0 | -2.3 to -1.8 | <0.001 | -1.9 | -2.1 to -1.7 | <0.001 |
| Total dairy and alternatives | 0.1 | -0.1 to 0.3 | 0.296 | -0.1 | -0.3 to 0.1 | 0.525 |
| Fluid intake (total) | -0.7 | -1.0 to -0.4 | <0.001 | -0.7 | -1.0 to -0.4 | <0.001 |
| Limit discretionary foods | -1.5 | -1.6 to -1.4 | <0.001 | -1.4 | -1.5 to -1.3 | <0.001 |
| Limit saturated fat (total) | -0.5 | -0.8 to -0.3 | <0.001 | -0.4 | -0.6 to -0.2 | 0.002 |
| Moderate unsaturated-fat | 0.7 | 0.5 to 0.9 | <0.001 | 0.6 | 0.4 to 0.7 | <0.001 |
| Limit added salt (total) | 0.1 | -0.2 to 0.3 | 0.544 | 0.1 | -0.1 to 0.3 | 0.502 |
| Limit extra sugar | -1.4 | -1.5 to -1.3 | <0.001 | -1.3 | -1.4 to -1.2 | <0.001 |
| Limit alcohol | 0.7 | 0.5 to 0.8 | <0.001 | 0.8 | 0.6 to 1.0 | <0.001 |

Note: CI, Confidence Interval; DGI, Australian Dietary Guideline Index; ; ¥ Adjusted linear regression analyses were controlled for sex, age, country of birth, area level disadvantage, education, household income, rurality, physical activity, BMI and smoking status; area level disadvantage calculated using Index of Relative Socio-economic Disadvantage - 2011 - Quintiles – National; education defined as low (incomplete high school or less), medium (completed high school or incomplete high school and/or certificate/diploma), and high (tertiary qualification); household income calculated as combined income of all household members aged ≥15 years, divided into quintiles of the population

##### Supplementary Table 5: Sensitivity analysis of the associations between dietary share of ultra-processed foods (% of total energy) and socio-demographic and diet quality characteristics with additional adjustment for energy intake misreporting in Australian adults from the 2011-12 National Nutrition and Physical Activity Survey (n = 8,209).

|  |  |
| --- | --- |
| Characteristic | Dietary contribution of ultra-processed foods (% of total energy intake) |
| **Adjusted β** | **95% CI** | **p-value** |
| Sex |   |   |  |
|   | Male | Reference | - | 0.862  |
|   | Female | -0.4 | -1.9 to 1.1 |   |
| Age |   |   |  |
|   | 19-30 | Reference | - | <0.001  |
|   | 31-50 | -4.2 | -6.1 to -2.4 |   |
|   | 51-70 | -8.1 | -10.2 to -6.1 |   |
|   | 71+ | -5.2 | -7.8 to -2.6 |   |
| Country of Birth |   |   |  |
|   | Australia | Reference | - | <0.001  |
|   | Main English-Speaking Country | -1.2 | -2.8 to 0.4 |   |
|   | Other | -7.9 | -9.8 to -6.0 |   |
| Area Level Disadvantage a |   |   |  |
|   | First quintile (greater disadvantage) | Reference | - | 0.017  |
|   | Second quintile | -0.6 | -2.4 to 1.3 |   |
|   | Third quintile | -0.3 | -2.2 to 1.7 |   |
|   | Fourth quintile | -1.3 | -3.5 to 1.0 |   |
|   | Fifth quintile (most advantage) | -2.6 | -5.0 to -0.3 |   |
| Education b |   |   |  |
|   | Low | Reference | - | 0.027  |
|   | Medium | -0.5 | -2.3 to 1.2 |   |
|   | High | -1.8 | -4.0 to 0.4 |   |
| Household income c |   |   |  |
|   | First quintile (20% lowest income) | Reference | - | 0.017  |
|   | Second quintile | 4.1 | 2.0 to 6.1 |   |
|   | Third quintile | 2.5 | 0.8 to 4.3 |   |
|   | Fourth quintile | 2.6 | 0.5 to 4.7 |   |
|   | Fifth quintile (20% highest income) | -0.7 | -2.8 to 1.4 |   |
| Rurality |   |   |  |
|   | Major city of Australia | Reference | - | 0.843  |
|   | Inner Regional Australia | 1.1 | -0.5 to 2.6 |   |
|   | Other | -0.4 | -2.4 to 1.6 |   |
| Diet quality (DGI) score d | -0.5 | -0.5 to -0.4 | <0.001 |

CI, confidence interval; a calculated using Index of Relative Socio-economic Disadvantage - 2011 - Quintiles – National; b low (incomplete high school or less), medium (completed high school or incomplete high school and/or certificate/diploma), and high (tertiary qualification); c combined income of all household members aged ≥15 years, divided into quintiles of the population; d DGI scores could range between 0 and 130, with a higher score indicating better diet quality; ¥Adjusted linear regression analyses were controlled for all the other variables in the table (socio-demographics and diet quality), and BMI, physical activity, smoking status, and energy intake misreporting.

**References:**

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