**Supplementary Appendix**

1. **Characteristics of food groups**

**Supplementary Table 1** Characteristics of food groups

|  |  |
| --- | --- |
| Food groups | Food items, g/day |
|
|
| 1. Refined grains  | Bread, whiteCrispbread, whiteSweet bun/roll/pretzelWafflePancakesNoodles, instant (e.g. Mr Lee)Cereal rice/oats, puffedCereal muesli, sweetenedCornflakesCereal, sweetened (e.g. Honnikorn/Choco/Frosties)Porridge with rice/other with milkPorridge sour cream Hotdog bun/potato wrap |
| 2. Whole grains 50-100% | Bread, wholegrain 50%Bread, wholegrain 50-100%Crispbread, wholegrainPorridge oatmealOatmeal/4-grainCereal muesli, unsweetenedCereal, unsweetened (e.g. All Bran/Weetabix/Havrefras) |
| 3. Butter, margarine, or mix of butter, margarine, and oil as spread | Butter on bread Margarine Bremykt on breadMargarine Brelett on breadMargarine soft other on bread (e.g. Soft Flora/Soft Ekstra) Margarin Vita Hjertego on breadMargarine Soft Flora Lett/Vita Hjertego Lett on breadMargarine Melange on breadMargarine other on bread |
| 4. Whey cheese | Spread cheese, whey/primSpread cheese, whey/prim light |
| 5. White cheese | Spread cheese, white/goudaSpread cheese, white/gouda lightSpread cheese, soft spread Spread cheese, soft spread lightSpread cheese, cottageSpread cheese, blue |
| 6. Processed meat or paté for sandwiches | Spread, bologna sausageSpread, boiled ham/turkey ham/light saveloySpread, salami/smoked/cured sausageSpread, liver pasteSpread, liver paste light |
| 7. Canned/smoked fish, cod roe from a toothpaste-like tube, or shrimp/crab for sandwiches | Spread, caviarSpread, caviar and cod liver mixSpread, mackerel in tomato sauceSpread, smoked/gravlax salmon/troutSpread, sardines/pickled herring/anchovySpread, tuna fishSpread, shrimp/crab |
| 8. Sweet spreads or sweeteners | Spread, jam/marmaladeSpread, jam lightSpread, chocolate/nutSpread sweet (e.g. honey/syrup/Sunda)Jam on cereal/porridgeSugar on cereal/porridgeSugar in coffeeSugar in tea |
| 9. Mayonnaise salads or mayonnaise as spread/dressing | Mayonnaise on breadSpread, mayonnaise salad (e.g. Italian salad)Spread, mayonnaise salad light (e.g. Italian salad light)Potato salad with mayonnaiseMayonnaise/remouladeMayonnaise/remoulade light |
| 10. Regular milk/soured milk or low-fat milk | Milk, whole milk/cultured/kefir 3.5% fatMilk, semi-skimmed 1% fatMilk, extra semi-skimmed 0.5% fat fortified with vitamin D Milk, skimmed/cultured skimmed 0.1% fat |
| 11. Natural/flavoured yoghurt or milk with probiotics | Yoghurt, naturalYoghurt, drinkableYoghurt, fruitYoghurt, GoMorgen musliYoghurt, light musliYoghurt, light fruitMilk with probiotics Biola/Cultura flavouredMilk with probiotics Biola/Cultura natural |
| 12. Flavoured chocolate/strawberry milk, milk/cream in coffee/tea or hot chocolate/cocoa | Milk, flavoured chocolate/strawberryMilk/cream in coffee/teaHot chocolate/cocoa |
| 13. Water | Water, tapWater, bottle still/sparkling |
| 14. Juice | Juice, orangeJuice, apple/otherNectar, apple/other |
| 15. Sugary drinks (ice tea, soft drinks or fruit/berry drinks) | Ice tea, sugarSoft drinks, sugarFruit/berry drinks, sugar |
| 16. Artificially sweetened drinks (ice tea, soft drinks or fruit/berry drinks) and beer non-alcoholic  | Ice tea, artificially sweetenedSoft drinks, artificially sweetenedFruit/berry drinks, artificially sweetenedBeer, non-alcoholic ≤0.7% alcohol |
| 17. Wine | Wine, redWine, white |
| 18. Alcoholic beverages except wine  | Beer, strong >4.7% alcohol/pils 4.5% alcohol Beer, light ≤2.7% alcoholCider/alcopops with alcoholWine, fortified (e.g. sherry/port)Liquor/spirits Drinks, mixed/cocktail  |
| 19. Tea | Tea, black Tea, green Tea, herbal  |
| 20. Coffee | Coffee, boiled/French pressCoffee, filteredCoffee, instantCoffee espressoCoffee, cafe latteCoffee, cappuccino |
| 21. Sausage or bacon | Sausage, pork/beef Sausage, pork/beef lightSausage, chicken/turkeyBacon |
| 22. Processed meat dishes or fast food | Sausage hot dog, pork/beefSausage hot dog, chicken/turkeyHamburger with bunTaco, shell with meat and saladTortilla wrap with meat and saladKebabLasagne/moussakaCalzonePie/quicheSpring rollsPizzaMeat burger karbonadeMeat burger/medisterburger/meatloafStew with minced meat/meat sauce |
| 23. Red meat | Roast moose/deer/reindeer/venisonChops pork/beef/lambRoast pork/beef/lambRoast moose/deer/reindeer/venison |
| 24. Stew meat and chicken  | Stew with meat/frikasse/faarikaalStew with meat and vegetables/betasuppe Chicken stew |
| 25. Chicken  | Chicken, grilledChicken, filletChicken, stew |
| 26. Processed fish | Fish burger/puddingFish ballsFish sticksFish baked gratin |
| 27. Lean fish | Cod/pollock/haddock/catfish/redfish, boiledCod/pollock/haddock/catfish/redfish, fried |
| 28. Fatty fish | Herring, fresh/smoked/curedMackerel, fresh/smokedSalmon/trout, boiled/fried |
| 29. Shrimp/crab or seafood wok | Shrimp/crabWok with seafood and vegetables |
| 30. Vegetarian dish or vegetable soup  | Vegetarian dish/pizza/gratinSoup, vegetable (e.g. tomato/cauliflower/pea) |
| 31. Eggs and eggs dishes | OmeletteEgg, boiled/fried/scrambled |
| 32. Boiled/baked or mashed potatoes | Potatoes, boiled/bakedPotatoes, mashed |
| 33. Fried potatoes | Potatoes, gratinated with creamPotatoes, friedFrench fries, deep-friedFrench fries, oven-baked |
| 34. Rice or pasta | RicePasta, spaghetti/macaroni/other  |
| 35. Vegetables  | CabbageCauliflowerBroccoliBrussel sproutsLettuce (e.g. iceberg/arugula)Bell/sweet pepperAvocadoTomatoCornSpread, vegetablesSalad, mixed (e.g. with lettuce, tomato, cucumber, corn)Vegetables, mixed frozen |
| 36. Root vegetables (onion, carrot, rutabaga) | Onion, raw/friedCarrotRutabaga |
| 37. Fruit | ApplePearBananaOrangeClementineGrapefruitPeach/nectarineKiwiGrapeMelonFruit on breadFruit salad, fresh |
| 38. Berries | Strawberry, fresh/frozenRaspberry, fresh/frozenBlueberryCloudberry |
| 39. Dried fruit or fruit and nut mix | RaisinFruit, dried (e.g. apricot/fig)Fruit and nut mix |
| 40. Dessert or cakes | Pudding (e.g. chocolate/caramel)Sauce, vanillaCream, whippedIce creamIce lolly/sorbetFruit, hermeticSweet bun/roll with custardDanish pastryMuffin/cake without icingLefse with spreadCake, chocolate/brownieCake, sponge with whipped cream/marzipanCake, chocolate/brownieBiscuit, sweet (e.g. Cookies, Bixit, Hop Nobs)Snowball (chocolate-coated marshmallow treat with dried coconut) |
| 41. Chocolate or candy | Chocolate (e.g. milk chocolate/Snickers)Chocolate, dark ≥70% cocoaConfections, chocolateCandy/pastilles/liquorice/SeigmennCandy/sweets mix smagodtPastilles, sugar-free |
| 42. Salty snacks | Potato chips Salty snacks, other |
| 43. Nuts or peanut butter | Peanut butterAlmond/hazelnut/walnutPeanut/cashew |
| 44. Sauces, sauce butter/margarine melted, or creamy dressing | Sauce, brown/bechamelSauce, bearnaise/hollandaiseButter with herbs/spicesSour cream 35% fatSour cream light 20% fatSour cream extra light 10% fatSauce butter/margarine melted |
| 45. Salad dressing like thousand Island, salad dressing oil, mustard or soy sauce | Salad dressing (e.g. Thousand Island)Salad dressing, light (e.g. Thousand Island light)Salad dressing, oil/vinaigrettePestoOil olive/other on breadMustardSoy sauce |
| 46. Tomato sauce | Salsa/tomato sauceKetchup |
| 47. Wok with meat/chicken | Wok with meat/chicken and vegetables |
| 48. Beans/lentils | Beans/lentils |
| 49. Stew/soup with fish | Stew/soup with fish |

1. **Energy-adjusted dietary pattern analyses**

We used the residual method for energy adjustment (1, 2), where we generated standardised residuals by regressing the consumption of food groups (g/day) on total energy intake. Standardised residuals were input variables in principal component analysis (PCA) with varimax rotation. All food groups were log-transformed in order to reduce skewness. To account for zeroes in dietary variables, a log (x + 0.1) transformation was applied.

**2.1 Five retained energy-adjusted dietary patterns**

First, five energy-adjusted dietary patterns were extracted based on eigenvalues >1.0 and inspection of the scree plot (Supplementary Figure 1).

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**Supplementary Figure 1** Scree plot for identification of five energy-adjusted dietary patterns (components) by principal component analysis (Bartlett test of sphericity, p<0.001; Kaiser-Meyer-Olkin Measure of Sampling Adequacy=0.775).

Supplementary Table 2 shows the loading matrix (≥|0.20|) and explained variances for the first five energy-adjusted dietary patterns.

**Supplementary Table 2** Loading matrix (≥|0.20|) and explained variances for the first five energy-adjusted dietary patterns

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|  | Westernised | Fruit and vegetables | Meat/fishand potatoes | Seafood, eggs, and wine | Refined grain and dessert |
|  | PC1 | PC2 | PC3 | PC4 | PC5 |
| Refined grains |   |   |   |   | 0.39 |
| Whole grains 50-100% |   |   |   | -0.22 |   |
| Butter, margarine, or mix of butter, margarine, and oil as spread |   |   |   |   |   |
| Whey cheese |   |   |   |   |   |
| White cheese |   |   |   |   |   |
| Processed meat or paté for sandwiches |   |   |   |   |   |
| Canned/smoked fish, cod roe from a toothpaste-like tube or shrimp/crab for sandwiches |   |   |   | 0.28 |   |
| Sweet spreads or sweeteners |   |   |   |   | 0.34 |
| Mayonnaise salads or mayonnaise as spread/dressing |   |   |   | 0.20 |   |
| Regular milk/soured milk or low-fat milk |   |   |   |   |   |
| Natural/flavoured yoghurt or milk with probiotics |   |   |   |   |   |
| Flavoured chocolate/strawberry milk, milk/cream in coffee/tea or hot chocolate/cocoa |   |   |   |   | 0.22 |
| Water |   |   |   |   |   |
| Juice |   |   |   |   | 0.23 |
| Sugary drinks (ice tea, soft drinks or fruit/berry drinks) |   | -0.26 |   |   |   |
| Artificially sweetened drinks (ice tea, soft drinks or fruit/berry drinks) and non-alcoholic beer | 0.25 |   |   |   |   |
| Wine |   |   |   | 0.30 |   |
| Alcoholic beverages except wine |   | -0.20 |   |   |   |
| Tea |   |   |   |   |   |
| Coffee |   | 0.20 |   |   |   |
| Sausage or bacon |   |   | 0.33 |   |   |
| Processed meat dishes or fast food | 0.32 |   | 0.26 |   |   |
| Red meat |   |   | 0.31 |   |   |
| Stew meat and chicken |   |   | 0.25 |   |   |
| Chicken | 0.31 |   |   |   |   |
| Processed fish |   |   | 0.28 |   |   |
| Lean fish |   |   | 0.26 |   |   |
| Fatty fish  |   |   |   | 0.21 |   |
| Shrimp/crab or seafood wok |   |   |   | 0.38 |   |
| Vegetarian dish or soup vegetable |   |   |   |   |   |
| Eggs and eggs dishes |   |   |   | 0.27 |   |
| Boiled/baked or mashed potatoes |   |   | 0.33 |   |   |
| Fried potatoes | 0.22 |   |   |   |   |
| Rice or pasta | 0.36 |   |   |   |   |
| Vegetables |   | 0.36 |   |   |   |
| Root vegetables (onion, carrot, rutabaga) |   | 0.37 |   |   |   |
| Fruit |   | 0.35 |   |   |   |
| Berries |   |   |   |   |   |
| Dried fruit or fruit and nut mix |   |   |   |   |   |
| Dessert or cakes |   |   |   |   | 0.39 |
| Chocolate or candy | 0.25 |   |   |   | 0.21 |
| Salty snacks | 0.32 |   |   |   |   |
| Nuts or peanut butter |   |   |   |   |   |
| Sauces, sauce butter/margarine melted, or creamy dressing |   |   | 0.28 |   |   |
| Salad dressing like thousand Island, salad dressing oil, mustard, or soy sauce |   |   |   | 0.23 |   |
| Tomato sauce | 0.30 |   |   |   |   |
| Wok with meat/chicken | 0.30 |   |   |   |   |
| Beans/lentils |   |   |   |   |   |
| Stew/soup with fish |   |   |   | 0.28 |   |
| Proportion of variance explained by each dietary pattern, % | 6.2 | 6.0 | 5.8 | 5.1 | 4.5 |
| Cumulative | 27.6 |  |  |  |  |

Abbreviation: PC: Principal Components.

We analysed the associations between five energy-adjusted dietary patterns and periodontitis and number of teeth. We found that the Fruit and vegetables energy-adjusted dietary pattern was associated with increased odds of advanced periodontitis (Supplementary Table 3).

**Supplementary Table 3** Regression models between tertiles of the Fruit and vegetables energy-adjusted dietary pattern scores and periodontitis groups

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Dietary pattern | *Moderate bone loss* *versus**No periodontitis/slow bone loss* | *Rapid bone loss* *versus**No periodontitis/slow bone loss* | *Rapid bone loss versus**Moderate bone loss* |  |
| OR(95% CI) | p-value | ptrend | OR (95%CI) | p-value | p trend | OR(95% CI) | p-value | p trend |
| *Fruit and vegetables* |  |  |  |  |  |  |  |  |  |
| Tertile 1(ref.) | 1 |  |  | 1 |  |  | 1 |  |  |
| Tertile 2 | 1.09 (0.81,1.47) | 0.552 | 0.738 | 0.55 (0.31,0.9) | 0.041 | 0.005 | 0.50(0.28,0.88) | 0.017 | 0.002 |
| Tertile 3 | 1.05 (0.76,1.45) | 0.757 |  | 0.40 (0.20,0.8) | 0.010 |  | 0.38 (0.19,0.76) | 0.006 |  |

Model adjusted for sex, age, education, smoking status, toothbrushing frequency, body mass index, and physical activity.

Abbreviation: OR: odds ratio, CI: confidence interval.

The Refined grain and dessert energy-adjusted dietary pattern was not associated with number of teeth (data not shown).

* 1. **Four retained energy-adjusted dietary patterns**

Since one of the five energy-adjusted dietary patterns, i.e., PC4 that included seafood, eggs, fat fish, mayonnaise, and wine, was difficult to interpret (Supplementary Table 2), we extracted dietary pattern scores when only the first four dietary patterns were retained, which is similar to the method used for the extraction of four unadjusted dietary patterns (Supplementary Figure 2).



**Supplementary Figure 2**

Scree plot for identification of four energy-adjusted dietary patterns (components) by principal component analysis (Bartlett test of sphericity, p<0.001; Kaiser-Meyer-Olkin Measure of Sampling Adequacy=0.775).

Supplementary Table 4 shows four energy-adjusted dietary patterns.

**Supplementary Table 4** Loading matrix (≥|0.20|) and explained variances for the first four energy-adjusted dietary patterns

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | Fruit and vegetables | Westernised | Meat/fishand potatoes | Refined grain and dessert |
|  | PC1 | PC2 | PC3 | PC4 |
| Refined grains |   |   |   | 0.38 |
| Whole grains 50-100% |   |   |   |   |
| Butter, margarine, or mix of butter, margarine and oil as spread |   |   |   |   |
| Whey cheese |   |   |   | 0.22 |
| White cheese |   |   |   |   |
| Processed meat or paté for sandwiches |   |   |   |   |
| Canned/smoked fish, cod roe from a toothpaste-like tube or shrimp/crab for sandwiches |   |   | 0.23 |   |
| Sweet spreads or sweeteners |   |   |   | 0.37 |
| Mayonnaise salads or mayonnaise as spread/dressing |   |   |   |   |
| Regular milk/soured milk or low-fat milk |   |   |   |   |
| Natural/flavoured yoghurt or milk with probiotics | 0.22 |   |   |   |
| Flavoured chocolate/strawberry milk, milk/cream in coffee/tea or hot chocolate/cocoa |   |   |   |   |
| Water |   |   |   |   |
| Juice |   |   |   |   |
| Sugary drinks (ice tea, soft drinks or fruit/berry drinks) |   |   |   |   |
| Artificially sweetened drinks (ice tea, soft drinks or fruit/berry drinks) and non-alcoholic beer |   | 0.25 |   |   |
| Wine |   |   |   | -0.23 |
| Alcoholic beverages except wine |   |   |   |   |
| Tea |   |   |   |   |
| Coffee | 0.26 |   |   |   |
| Sausage or bacon |   |   | 0.29 |   |
| Processed meat dishes or fast food |   | 0.29 |   |   |
| Red meat |   |   | 0.33 |   |
| Stew meat and chicken |   |   | 0.25 |   |
| Chicken |   | 0.28 |   |   |
| Processed fish |   |   | 0.26 |   |
| Lean fish |   |   | 0.32 |   |
| Fatty fish  |   |   |   |   |
| Shrimp/crab or seafood wok |   |   |   | -0.21 |
| Vegetarian dish or soup vegetable |   |   |   |   |
| Eggs and eggs dishes |   |   |   |   |
| Boiled/baked or mashed potatoes |   |   | 0.29 |   |
| Fried potatoes |   | 0.26 |   |   |
| Rice or pasta |   | 0.33 |   |   |
| Vegetables | 0.31 |   |   |   |
| Root vegetables (onion, carrot, rutabaga) | 0.26 |   |   |   |
| Fruit | 0.31 |   |   |   |
| Berries | 0.28 |   |   |   |
| Dried fruit or fruit and nut mix | 0.27 |   |   |   |
| Dessert or cakes |   |   |   | 0.35 |
| Chocolate or candy |   | 0.27 |   |   |
| Salty snacks |   | 0.32 |   |   |
| Nuts or peanut butter | 0.24 |   |   |   |
| Sauces, sauce butter/margarine melted, or creamy dressing |   |   | 0.28 |   |
| Salad dressing like thousand Island, salad dressing oil, mustard or soy sauce |   | 0.21 |   |   |
| Tomato sauce |   | 0.32 |   |   |
| Wok with meat/chicken |   | 0.26 |   |   |
| Beans/lentils |   |   |   |   |
| Stew/soup with fish |   |   |   |   |
| Proportion of variance explained by each dietary pattern, % | 7.4 | 6.4 | 5.8 | 4.9 |
| Cumulative | 24.5 |  |  |  |

Abbreviation: PC: Principal Components.

We analysed the associations between four energy-adjusted dietary patterns and periodontitis. We found a significant negative association between the Fruit and vegetables energy-adjusted dietary pattern and advanced periodontitis (Supplementary Table 5).

**Supplementary Table 5** Regression models between tertiles of the Fruit and vegetables energy-adjusted dietary pattern scores and periodontitis groups

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Dietary pattern | *Moderate bone loss* *versus**No periodontitis/slow bone loss* | *Rapid bone loss**versus**No periodontitis/slow bone loss* | *Rapid bone loss versus**Moderate bone loss* |  |
| OR (95% CI) | p-value | p trend | OR (95% CI) | p-value | p trend | OR (95% CI) | p-value | p trend |
| *Fruit and vegetables* |  |  |  |  |  |  |  |  |  |
| Tertile 1 (ref.) | 1 |  |  | 1 |  |  | 1 |  |  |
| Tertile 2 | 1.00 (0.74,1.35) | 0.983 | 0.567 | 0.58 (0.33,1.02) | 0.056 | 0.006 | 0.57 (0.33,1.00) | 0.051 | 0.011 |
| Tertile 3 | 0.91 (0.65,1.26) | 0.552 |  | 0.39 (0.19,0.80) | 0.010 |  | 0.43(0.21,0.88) | 0.020 |  |

Model adjusted for sex, age, education, smoking status, toothbrushing frequency, body mass index, and physical activity.

Abbreviation: OR: odds ratio, CI: confidence interval.

We analysed associations between four energy-adjusted dietary patterns and number of teeth. We found that the Refined grain and dessert energy-adjusted dietary pattern was associated with increased odds of having ≤19 teeth (Supplementary Table 6).

**Supplementary Table 6** Regression models between tertiles of the Refined grain and dessert energy-adjusted dietary pattern scores and number of teeth categories

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Dietary pattern | OR (95% CI) | p-value | p trend | OR (95% CI) | p-value | p trend | OR (95% CI) | p-value | ptrend |
|  |  |  |  |  |  |  |  |  |  |
| *Refined grain and dessert* | *≤19 teeth versus* *25-28 teeth* | *≤19 teeth versus* *20-24 teeth* | *20-24 teeth versus* *25-28 teeth* |
| Tertile 1 (ref.) | 1 |  |  | 1 |  |  | 1 |  |  |
| Tertile 2 | 1.23 (0.64,2.37) | 0.530 | 0.007 | 0.83(0.42,1.63) | 0.585 | 0.116 | 1.49(1.06,2.08) | 0.020 | 0.040 |
| Tertile 3 | 2.28(1.22,4.26) | 0.010 |  | 1.62(0.85,3.09) | 0.144  |  | 1.41(0.99,2.00) | 0.055 |  |

Model adjusted for sex, age, education, smoking status, toothbrushing frequency, body mass index, and physical activity.

Abbreviation: OR: odds ratio, CI: confidence interval.

References:

1. Willett W (2013) Nutritional Epidemiology: OUP USA.

2. Willett WC, Howe GR Kushi LH (1997) Adjustment for total energy intake in epidemiologic studies. Am J Clin Nutr 65, 1220S-1228S; discussion 1229S-1231S.