**Supplemental Table 3** Sex consideration in biomarker prediction index that included dietary factors as explanatory variables

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| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Author (year)** | **Study name** | **Country** | **Sex** | **Sex consideration** | **Sample** | **Biomarker type** | **Biomarkers** | **Dietary assessment** | **Methods** | **Variables selected** |
| Cavicchia *et al.* (2009)(1) |  |  | F, M | Not considered | 929 articles (human, animal, cell culture) | Inflammatory markers  | IL-1b, IL-4, IL-6, IL-10, TNF-α, and CRP |  | Literature review (1950-2007; 929 articles were used) | DII41 foods and constituents (energy, garlic, ginger, saffron, tumeric, tea, caffeine, wine, beer, liquor, alcohol, carbohydrate, fiber, fat, n-3 fatty acids, n-6 fatty acids, MUFA, saturated fat, protein, cholesterol, vitamin A, thiamin, riboflavin, niacin, vitamin B6, folic acid, vitamin B12, vitamin C, vitamin D, vitamin E, beta-carotene, magnesium, zinc, iron, selenium, quercetin, luteolin, genistein, daidzein, cyanidin, epicatechin) |
| Shivappa *et al.*(2014)(2) |  |  | F, M | Not considered | 1943 articles (human, animal, cell culture) | Inflammatory markers  | IL-1b, IL-4, IL-6, IL-10, TNF-α, CRP |  | Literature review (1950-2010; 1943 articles were used) | DII45 foods and constituents (alcohol, vitamin B12, vitamin B6, beta-carotene, caffeine, carbohydrate, cholesterol, energy, eugenol, total fat, fibre, folic acid, garlic, ginger, fe, mg, MUFA, niacin, n-3 fatty acids, n-6 fatty acids, onion, protein, PUFA, riboflavin, saffron, saturated fat, se, thiamin, trans fat, tumeric, vitamin A, vitamin C, vitamin D, vitamin E, zn, green/black tea, flavon-3-ol, flavones, flavonols, flavonones, anthocyanidins, isoflavones, pepper, thyme/oregano, rosemary) |
| Tabung et al. (2016) (a)\*(3) | NHS | USA | F | Included only one sex in the study | 5230 F (30-55 years) | Inflammatory markers  | IL-6, CRP, TNF-αR2 | FFQ | RRR, stepwise linear regression | EDII- positive associations (processed meat, red meat, organ meat, other fish, other vegetables, refined grains, high-energy beverages, low-energy beverages, and tomatoes)- negative associations (beer, wine, tea, coffee, dark yellow vegetables, leafy green vegetables, snacks, fruit juice, and pizza)  |
| Tabung et al. (2016) (b)\*(4) | NHS | USA | F | Included only one sex in the study | 5818 F (30-55 years) with C-peptide3929 F (30-55 years) with TG and HDL-C | Insulinemic markers | C-peptide, TG:HDL-C | FFQ | Stepwise multivariable-adjusted linear regression | 1. Hyperinsulinemia (C-peptide) related dietary index1) EDIH: positive (red meat, low-energy beverages, cream soups, processed meat, margarine, poultry, butter, french fries, other fish, high-energy beverages, tomatoes, low-fat dairy products, eggs)-negative (wine, coffee, whole fruits, high-fat dairy products, green leafy vegetables)2) ELIH: positive (BMI, margarine, liquor, cream soups, butter, red meat, fruit juice), negative (coffee, whole fruit, wine, physical activity, high-fat dairy products, snacks, salad dressing)2. Insulin resistance (TG:HDL-C) related dietary index1) EDIR: positive (low-energy beverages, margarine, red meat, refined grains, processed meats, tomatoes, other vegetables, other fish, fruit juice, creamy soups), negative (coffee, wine, liquor, beer, green leafy vegetables, high-fat dairy products, dark yellow vegetables, nuts)2) ELIR: positive (BMI, refined grains, red meat, margarine, tomatoes, low-energy beverages, fruit juice, potatoes, processed meat, other vegetables, tea), negative (coffee, wine, liquor, high-fat dairy products, physical activity, green leafy vegetables) |

**Supplemental Table 3** *Continued*

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| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Author (year)** | **Study name** | **Country** | **Sex** | **Sex consideration** | **Sample** | **Biomarker type** | **Biomarker** | **Dietary assessment** | **Methods** | **Variables selected** |
| Giovannucci *et al.* (2006)(5) | HPFS | USA | M | Included only one sex in the study | 1637 M (40-75 years); training set 1095, testing set 542 | Vitamin D | 25(OH)D | FFQ, supplement use questionnaire | Multiple linear regression | Race, geographic region, dietary vitamin D, supplementary vitamin D, BMI, physical activity |
| Millen *et al.* (2010)(6) | WHI CaD clinical trial | USA | F | Included only one sex in the study | 4583 F (50-79 years); training set 3055, testing set 1528  | Vitamin D | 25(OH)D | FFQ, supplement use questionnaire | Stepwise linear regression | Total vitamin D intake from foods and supplements, waist circumference, recreational physical activity, race-ethnicity, regional solar irradiance, age |
| Gilbert *et al.* (2012)(7) | ProtecT study | UK | M | Included only one sex in the study | 1091 M (50-71 years) | Vitamin D | 25(OH)D | FFQ, supplement use questionnaire | Backwards stepwise regression, bootstrap resampling | Week exercise, BMI, family history, smoke, mean arterial pressure, dietary intake (FFQ; vitamin D, milk and cream, dairy products, retinol, pulses (legumes), total alcohol, multivitamin supplements, fish oil supplements), sun exposure, intense sun exposure, time spent outside, skin reaction, adult sunscreen use, childhood sunscreen use, sunscreen use (2 years) |
| Jensen *et al*. (2013)(8) | DNBC study | Denmark | F | Included only one sex in the study | 1048 F (mean, 29.4years); training set 573, testing set 475 | Vitamin D | 25(OH)D | FFQ, supplement use questionnaire | Univariate regression, stepwise multivariate regression | Smoking, month of blood draw, linear and non-linear terms for dietary vitamin D intake, linear and non-linear terms for tanning bed use, the interaction term between tanning bed use and season, vitamin D intake from supplements, linear and non-linear outdoor physical activity |
| Palmer *et al.* (2016)(9) | BWHS | USA | F | Included only one sex in the study | 2856 F (21-69 years); training set 4/5, testing set 1/5 | Vitamin D | 25(OH)D | FFQ, supplement use questionnaire, alcohol consumption questionnaire | Repeated k-fold cross-validation, stepwise selection in a generalized linear model | Supplementary vitamin D use, multivitamin use, dietary vitamin D, BMI, postmenopausal hormone use, vigorous physical activity, alcohol consumption, cigarette smoking, recent use of oral contraceptive, use of oral contraceptives 10 years or more |
| Bertrand *et al.* (2012)(10) | NHS | USA | F | Derived separately | 2858 F (42-69 years for training set); training set 2079, testing set 779 | Vitamin D | 25(OH)D | FFQ, supplement use questionnaire | Multivariable linear regression  | Race, UV-B radiation flux at residence, dietary and supplementary vitamin D intakes, BMI, physical activity, alcohol intake, post-menopausal hormone use, season of blood draw |
| NHS-II | USA | F | 1942 F (32-52 years for training set); training set 1497, testing set 445 | Multivariable linear regression  | Race, dietary and supplementary vitamin D intakes, BMI, physical activity, alcohol intake, season of blood draw |
| HPFS | USA | M | 1747 M (46-81 years for training set); training set 911, testing set 836 | Multivariable linear regression  | Race, UV-B radiation flux at residence, dietary and supplementary vitamin D intakes, BMI, physical activity, season of blood draw |
| Freedman *et al.* (2013)(11) | USRT Study | USA | F, M | Derived separately | 1500 F and M (48-93 years); training set n=1000, testing set n=500 | Vitamin D | 25(OH)D | Dietary questionnaire on 7 food items, supplement use questionnaire | Backwards stepwise linear regression | - Females: race, vitamin D supplement- Males: age, race, season, ambient UVR level, BMI, hours outside physically active, level of supplement use |

**Supplemental Table 3** *Continued*

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| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Author (year)** | **Study name** | **Country** | **Sex** | **Sex consideration** | **Sample** | **Biomarker type** | **Biomarker** | **Dietary assessment** | **Methods** | **Variables selected** |
| Chan *et al.* (2010)(12) | AHS-2 | USA, Canada | F, M | Included in final model | 445 F and M; 209 black and 236 white (31-96 years) | Vitamin D | 25(OH)D | FFQ, supplement use questionnaire | Multivariable linear regression  | Age, sex, BMI, skin type, UV season, erythemal zone, total dietary vitamin D intake, sun exposure |
| Liu *et al.* (2010)(13) | FOS | USA | F, M | Included in final model | 1574 F and M (mean, 59 years); 805 training set and 769 testing set  | Vitamin D | 25(OH)D | FFQ, supplement use questionnaire | Multiple linear regression | Age, sex, BMI, month of blood sampling, total vitamin D intake, smoking status, total energy intake |
| Kuhn *et al. (*2014)(14) | EPIC-Germany study | Germany | F, M | Included in final model | 2100 F and M (mean, 50.9 years); training set 2/3, testing set 1/3 | Vitamin D | 25(OH)D | FFQ | Generalized linear model, backward selection | Season, sex, rs2282679 (GC), rs10741657 (CYP2R1) and rs12785878 (DHCR7), alcohol, fish and egg consumption, use of vitamin D supplements, use of exogenous hormones in women, sports, gardening, vigorous physical activity, waist circumference, smoking |
| Wu *et al.* (2017)(15) | NHS | USA | F | Derived separately | erythrocyte EPA: 1557, plasma EPA: 1353, erythrocyte DHA: 1966, plasma DHA: 1766 (≥ 50 years) | Fatty acid | EPA, DHA | FFQ | Stepwise linear regression | 1. EPA 1) erythrocyte: canned tuna, dark fish, other fish, shrimp and shellfish, chicken w/skin2) plasma: canned tuna, dark fish, other fish, shrimp and shellfish2. DHA 1) erythrocyte: canned tuna, dark fish, other fish, shrimp and shellfish2) plasma: canned tuna, dark fish, other fish, shrimp and shellfish  |
| HPFS | USA | M | erythrocyte EPA: 1364, plasma EPA: 1321, erythrocyte DHA: 1365, plasma DHA: 1319 (≥ 50 years) | FFQ | Stepwise linear regression | 1. EPA1) erythrocyte: canned tuna, dark fish, other fish2) plasma: canned tuna, dark fish, other fish 2. DHA 1) erythrocyte: canned tuna, dark fish, other fish, chicken w/oskin2) plasma: canned tuna, dark fish, other fish |
| Hallmann *et al.* (2015)(16) | Food4Me Study | Germany, Greece, Ireland, Netherlands, Poland, Spain, UK | F, M | Included in final model | 1698 F and M; training set 705, testing set 993 | Fatty acid | DGLA, AA, EPA, DPA, DHA | FFQ | Bolasso, MHT | 1. DGLA: FADS1 T:C, FADS1 T:T, woman, physical activity level, age, BMI, smoking, supplements, smoked fish, nonsmoked oily fish, pizza, crisps, cornflakes, offal, nuts and seeds, soups, tofu, cereals, garlic, sausages2. AA: FADS1 T:C, FADS1 T:T, woman, physical activity level, age, BMI, smoking, supplements, wine, chicken, nonsmoked oily fish, nonsmoked oily fish canned, smoked fish, eggs, tea, grapefruit, coleslaw 3. EPA: FADS1 T:C. FADS1 T:T, woman, physical activity level, age, BMI, smoking, supplements, smoked fish, tea, nonsmoked oily fish, pizza, wine, olive oil, avocado, lamb, offal, other vegetable oils, white bread, nonsmoked oily fish canned, broccoli, butter, flapjacks, low calorie soft drinks, white fish, kiwi, sweet biscuits4. DPA: FADS1 T:C. FADS1 T:T, woman, physical activity level, age, BMI, smoking, supplements, olive oil, smoked fish, butter, cereals, nuts and seeds, porridge, berries, ice cream, flapjacks, chocolates, sweet biscuits, high fat cheeses, sweet alcoholic drinks, brown bread, brown rice, potatoes, coffee, pears, pork5. DHA: FADS1 T:C. FADS1 T:T, woman, physical activity level, age, BMI, smoking, supplements, nonsmoked oily fish, smoked fish, white fish, pizza, fried fish, sushi, zero fat skimmed milk, avocado, nonsmoked oily fish canned, melon, burgers, medium fat cheeses, chips, sugar added to coffee/tea |

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| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Author (year)** | **Study name** | **Country** | **Sex** | **Sex consideration** | **Sample** | **Biomarker type** | **Biomarker** | **Dietary assessment** | **Methods** | **Variables selected** |
| Hendrickson *et al.*(2013)(17) | NHS | USA | F | Included only one sex in the study | 4180 F (30-55 years); training set 2787, testing set 1393 | Carotenoids | α-carotene, β-carotene, β-cryptoxanthin, lutein, lycopene, total carotenoids) | FFQ | Stepwise linear regression | 1) α-carotene: carrots(raw), bananas, carrots(cooked)2) β-carotene: carrots(raw), supplemental β-carotene, broccoli, lettuce(romaine or leaf), cantaloupe, prunes, pizza3) β-cryptoxanthin: juice(orange), oranges, peaches(apricots) or plums, carrots(raw), apples or pears(fresh), corn, prunes, cucumbers4) Lutein/zeaxanthin: lettuce(romaine or leaf), juice(orange), broccoli, spinach(cooked), carrots(raw), eggs, spinach(raw), eggplant/zucchini/other summer squash, tomatoes, corn, oranges, popcorn5) Lycopene: tomato sauce, pizza, tomatoes, juice(tomatoes)6) Plasma total carotenoids: carrots(raw), lettuce(romaine or leaf), juice(orange), tomato sauce, broccoli, corn, cantaloupe, tomatoes |
| Jung *et al.* (2015)\*(18) | NHS | USA | F | Included in final model (sex-adjusted homocysteine) | 1585 F (mean, 59 years); training set 1268, testing set 317 | Homocysteine | Homocysteine | FFQ, supplement use questionnaire | Multivariable linear regression  | Smoking, multivitamin use, caffeine, alcohol, dietary folate intake, supplementary folate intake |
| HPFS | USA | M | 438 M (mean, 64 years); training set 351, testing set 87 |
| Kvalem *et al.* (2012)†(19) | NFG | Norway | F, M | Included in final model | 188 F and M (mean, 52 years for F and 56 years for M)  | Dioxin and PCBs | PCDDs, PCDFs, PCDD/Fs, no-PCBs, mo-PCBs, dl-PCBs, PCB4 | FFQ | Stepwise linear regression | 1) Sum PCDDs: dietary PCDDs, residence by coast or inland, BMI, educational attainment, age2, sex, sex\*PCDDs2) Sum PCDFs: dietary PCDFs, residence by coast or inland, energy intake, BMI, age2, sex, PCDFs\*sex, (residence by coast)\*sex, BMI\*sex3) Sum PCDD/Fs: dietary PCDD/Fs, residence by coast or inland, energy intake, BMI, age2, smoke, sex, PCDD/Fs \*sex, (residence by coast)\*sex, BMI\*sex4) Sum no-PCBs: dietary no-PCBs, energy intake, BMI, educational attainment, age2, smoke, age, sex, no-PCB\*sex, age2\*sex5) Sum mo-PCBs: dietary mo-PCBs, residence by coast or inland, BMI, smoke, educational attainment, age2, age6) Sum dl-PCBs: dietary dl-PCB, energy intake, BMI, educational attainment, age2, smoke, age, sex, dl-PCB\*sex, age2\*sex, age\*sex7) Sum TEQ: dietary sum TEQ, residence by coast or inland, educational attainment, smoke, BMI, age2, age, sex, sum TEQ\*sex, smoke\*sex, age2\*sex, \*age\*sex8) PCB4: diet PCB4, residence by coast or inland, educational attainment, age2, breastfeeding 0–1 months, sex |

**Supplemental Table 3** *Continued*

Abbreviations: F, female; M, male; IL, Interleukin; TNF-α, tumor necrosis factor-α; CRP, C-reactive protein; DII, Dietary Inflammatory Index; MUFA, monounsaturated fatty acid; PUFA, polyunsaturated fatty acid; NHS, Nurses' Health Study; TNF-αR2, tumor necrosis factor-α receptor2; FFQ, food frequency questionnaire; RRR, reduced rank regression; EDII, Empirical Dietary Inflammatory Index; TG, triglycerides; HDL-C, high-density lipoprotein cholesterol; EDIH, empirical dietary index for hyperinsulinemia; ELIH, empirical lifestyle index for hyperinsulinemia; BMI, body mass index; EDIR, empirical dietary index for insulin resistance; ELIR, empirical lifestyle index for insulin resistance; HPFS, Health Professionals Follow-up Study; 25(OH)D, 25-hydroxyvitamin D; WHI CaD, Women’s Health Initiative Calcium plus vitamin D; ProtecT, Prostate testing for cancer and Treatment; DNBC, Danish National Birth Cohort; BWHS, Black Women’s Health Study; UV, ultraviolet; USRT, US Radiologic Technologists; UVR, ultraviolet radiation; AHS-2, Adventist Health Study-2; FOS, Framingham Offspring Stud; EPIC, European Prospective Investigation into Cancer and Nutrition; EPA, eicosapentaenoic acid; DHA, docosahexaenoic acid; DGLA, dihomo-𝛾-linolenic acid; AA, arachidonic acid; DPA, docosapentaenoic acid; Bolasso, bootstrapped LASSO(least absolute shrinkage and selection operator); MHT, multiple hypothesis testing; FADS1, fatty acid desaturase 1; NFG, Norwegian Fish and Game study; PCBs, polychlorinated biphenyls; PCDDs, polychlorinated dibenzo-p-dioxins; PCDFs,polychlorinated dibenzofurans; PCDD/Fs, polychlorinated dibenzo-p-dioxins/furans; no-PCB, non ortho polychlorinated biphenyls; mo-PCB, mono ortho polychlorinated biphenyls; dl-PCBs, dioxin-like polychlorinated biphenyls; PCB4, sum of ndl-PCBs CB-101, 138, 153 and 180; TEQ, toxic equivalents.

\*Evaluated the validity of the developed index in independent study population (female cohort, Nurses' Health Study-II and male cohort, Health Professionals Follow-up Study).

†Evaluated the validity of the developed index in independent study population (male and female study, Lake Mjosa study).

**Supplemental Table 4** Sex consideration in dietary patterns to explain the variation of biomarkers

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| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Author (year)** | **Study name** | **Country** | **Sex** | **Sex consideration** | **Sample** | **Biomarker type** | **Biomarker** | **Dietary assessment** | **Methods** | **Variables selected** |
| Schulze et al. (2005)(20) | NHS | USA | F | Included only one sex in the study | 1350 F (43-69 years); 656 cases for diabetes, 694 controls | Inflammatory markers  | sTNFR2, IL-6, CRP, E-selectin, sICAM-1, sVCAM-1 | FFQ | RRR, stepwise regression | - positive associations (sugar-sweetened soft drinks, refined grains, processed meat, diet soft drinks, other vegetables)- negative associations (wine, coffee, cruciferous vegetables, yellow vegetables) |
| Meyer et al. (2011)(21) | MONICA project | Germany | M | Included only one sex in the study | 981 M (45-64 years) | Inflammatory markers  | CRP, IL-6, IL-18 | 7 days DR | RRR, PLS | Dietary pattern derived using RRR- positive associations (meat (except poultry), soft drinks, beer)- negative associations (fresh vegetables, cooked vegetables, fresh fruit, chocolates, cake and pastries, wholemeal bread, cereals and muesli, curd, condensed milk and cream, butter, nuts, sweet bread spread, tea)Dietary pattern derived using PLS- positive associations (meat (except poultry), cooked sausage, beer)- negative associations (fresh vegetables, cooked vegetables, fresh fruit, cake and pastries, wholemeal bread, cereals and muesli, curd, cheese, condensed milk and cream, butter, nuts, sweet bread spread, tea) |
| Lucas et al. (2014)(22) | NHS | USA | F | Included only one sex in the study | 4692 F (50-77 years) | Inflammatory markers  | CRP, IL-6, TNF-αR2 | FFQ | RRR, stepwise linear regression | - positive associations (sugar-sweetened soft drinks, refined grains, red meat, diet soft drinks, margarine, other vegetables, fish)- negative associations (wine, coffee, olive oil, green (leafy vegetables), yellow vegetables) |
| Gu et al. (2018)(23) | WHICAP | USA | F, M | Evaluated, but not presented (sensitivity analysis for sex-adjustment) | 330 F and M (mean, 79 years) | Inflammatory markers  | CRP, IL-6 | FFQ | RRR | - positive associations (cholesterol)- negative associations (pantothenic acid, thiamin, calcium, vitamin E, riboflavin, vitamin B6, vitamin D, vitamin A, total folate, Ω-3 polyunsaturated fatty acid, niacin) |
| Heidemann et al. (2005)(24) | EPIC-Potsdam Study | Germany | F, M | Not considered | 574 F and M (mean, 55.5 years); 192 cases for diabetes, 382 controls | Inflammatory markers  | HbA1c, HDL-C, CRP, adiponectin | FFQ | RRR | - positive associations (fresh fruit)- negative associations (high-caloric soft drinks, beer, red meat, poultry, processed meat, legumes, bread (except whole grain bread)) |
| Nettleton et al. (2007)(25) | MESA | USA | F, M | Not considered | 5089 F and M (45-84 years) | Inflammatory markers  | CRP, IL-6, Hcy, fibrinogen | FFQ | RRR | - positive associations (fats and oils, processed meat, nondiet soda)- negative associations (cruciferous vegetables, dark-yellow vegetables, soy foods and beverages) |
| Liese et al. (2009) (a)(26) | IRAS | USA | F, M | Not considered | 880 F and M (40-69 years) | Inflammatory markers  | PAI-1, fibrinogen | FFQ | RRR | - positive associations (red meat, low-fiber bread and cereal, dried beans, fried potatoes, tomato vegetables, eggs, cheese, cottage cheese)- negative associations (wine) |

**Supplemental Table 4** *Continued*

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| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Author (year)** | **Study name** | **Country** | **Sex** | **Sex consideration** | **Sample** | **Biomarker type** | **Biomarker** | **Dietary assessment** | **Methods** | **Variables selected** |
| Liese et al. (2010) (b)(27) | IRAS | USA | F, M | Not considered | 802 F and M (40-69 years) | Inflammatory markers  | PAI-1, fibrinogen | FFQ | RRR, stepwise linear regression | - positive associations (low-fibre bread and cereal, red and processed meat, cottage cheese, tomato foods, regular soft drinks and sweetened beverages) - negative associations (wine, rice and pasta, meal replacements, poultry) |
| Calle et al. (2013)(28) | DIALBEST | USA | F, M | Not considered | 103 F and M diagnosed with type2 diabetes (mean, 56.2 years) | Inflammatory markers  | IL-6, TNF-α, MCP-1 | 24-hour dietary recall | RRR | - positive associations (green stewed vegetables, refined grains, sugar-free beverages, vegetable oil, soup, high fat dairy)- negative associations (fruits, dark yellow vegetables, added sugars)  |
| McGeoghegan et al. (2015)(29) | NDNS | UK | F, M | Not considered | 1531 F and M (19-65 years); 52 cases for diabetes, 1479 controls | Inflammatory markers  | CRP, carotenoids | 4 days DR | RRR | - positive associations (vegetables, fruit, pasta rice and other cereals, cheeses, oily fish and other fish)- negative associations (chips fried roast potatoes, sugars and sweet spreads, white bread)  |
| Ozawa et al. (2016)(30) | Whitehall II study | UK | F, M | Not considered | 5083 F and M (mean, 56 years) | Inflammatory markers  | IL-6 | FFQ | RRR | - positive associations (red meat, processed meats, peas and legumes, fried food)- negative associations (whole grains) |
| Barroso et al. (2018)(31) | Generation R study | Netherlands | F, M | Not considered | 1997 boys and girls (mean, 12.9 years) | Inflammatory markers  | 1/TG2A | FFQ | RRR | - positive associations (whole cereals, fruit, butters and margarines, meat products)- negative associations (refined cereals, soups and bouillons, fish and fish products, legumes, non-sugar-containing beverages) |
| Vermeulen et al. (2018)(32) | InCHIANTI study | Italy | F, M | Not considered | 827 F and M (≥65 years) | Inflammatory markers  | CRP, IL-6, TNF-α, IL-1β, IL-1ra, IL-18 | FFQ | RRR | Inflammatory dietary pattern I (CRP, IL-6, TNF-α)- positive associations (sweet snacks, refined grains, pasta, rice, sauce)- negative associations (bread, game, shellfish, other alcoholic beverages, other vegetables)Inflammatory dietary pattern II (IL-1β, IL-1ra, CRP, IL-18)- positive associations (pasta, sugar sweetened beverages, processed meat, chocolate and sweets, sauce, other alcoholic beverages)- negative associations (dairy products, fruit, added sugar, olive oil, butter, fish, coffee and tea) |

**Supplemental Table 4** *Continued*

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Author (year)** | **Study name** | **Country** | **Sex** | **Sex consideration** | **Sample** | **Biomarker type** | **Biomarker** | **Dietary assessment** | **Methods** | **Variables selected** |
| Hoffmann et al. (2004)(33) | CORA | Germany | F | Included only one sex in the study | 455 F (30-80 years); 200 cases for coronary artery disease, 255 controls | Chronic disease-related markers (CVD) | LDL-C, HDL-C, lipoprotein(a), C-peptide, CRP | FFQ | RRR | - positive associations (meat except poultry, margarine, other vegetable fats and oils, poultry, sauce) - negative associations (vegetarian dishes, wine, cooked vegetables, raw vegetables, whole-grain cereals and muesli) |
| Fung et al. (2012) (a)(34) | NHS | USA | F | Included only one sex in the study | 833 F (quintile 3 mean, 58 years) | Chronic disease-related markers (Diabetes) | C-peptide | FFQ | Stepwise linear regression | - positive associations (meat, fish, sweetened beverage intake)- negative associations (coffee, high fat dairy, whole grains) |
| Jankovic, N., et al. (2014) (35) | Zutphen Elderly Study | Netherlands | M | Included only one sex in the study | 467 M (64-85 years) | Chronic disease-related markers (CVD) | BMI, SBP, DBP, HDL-C, total cholesterol, uric acid | Cross-check dietary history method | Backward regression analysis, RRR | 1) Dietary pattern 1 “(low in) cereal fibre pattern”. (1) 1985 - positive associations (fruit juices, ready to eat meals, sugar sweetened beverages, beer, wine) - negative associations (high-fibre bread, high-fibre cereals, cheese, high-fat milk products) (2) 1990 - positive associations (fruit juices, fatty fish, beer, wine) - negative associations (high-fibre bread, high-fibre cereals, unhealthy fats, sugar and sweets) 2) Pattern 2 “alcohol pattern” (1) 1985 - positive associations (ready to eat meals, beer, wine, strong alcoholic beverages) - negative associations (none of food items lower than -0.10) (2) 1990 - positive associations (unhealthy fats, beer, wine, strong alcoholic beverages) - negative associations (high-fat milk products) 3) Pattern 3 “inconsistent” (1) 1985 - positive associations (fatty fish, cheese) - negative associations (lower-fibre cereals, sugar and sweets) (2) 1990 - positive associations (high-fat milk products, ready to eat meals, strong alcoholic beverages) - negative associations (fruits, cheese, unhealthy fats) |

**Supplemental Table 4** *Continued*

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Author (year)** | **Study name** | **Country** | **Sex** | **Sex consideration** | **Sample** | **Biomarker type** | **Biomarker** | **Dietary assessment** | **Methods** | **Variables selected** |
| Shin *et al.* (2015)(36) | NHANES | USA | F | Included only one sex in the study | 249 F (16–41 years) | Chronic disease-related markers (Diabetes) | Prepregnancy BMI, dietary fiber and ratio of PUFA and MUFA to SFA | 24-hour dietary recall | RRR | 1) “High refined grains, fats, oils and fruit juice”- positive associations (refined grains, whole grains, other fruits, tomatoes, other vegetables, beans and peas, nuts and seeds, citrus/melons/berries, oils, other red and orange vegetables (excludes, tomatoes))2) “High nuts, seeds, fat and soybean; low milk and cheese”,- positive associations (soybean products (excludes calcium fortified soy milk and mature soybeans), nuts and seeds, oils) - negative associations (milk (includes calcium fortified soy milk), other fruits, cheese, solid fats) 3) “High added sugar and organ meats; low fruits, vegetables and seafood”.- positive associations (beans and peas, added sugars)- negative associations (soybean products (excludes calcium fortified soy milk and mature soybeans), other vegetables, citrus/melons/berries, potatoes (white potatoes), meat (beef, veal, pork, lamb, game), eggs) |
| Ehsani *et al.* (2016)(37) | TLGS | Iran | F | Included only one sex in the study | 220 F (18-45 years) | Chronic disease-related markers (Obesity) | VAI | FFQ | RRR | - positive associations (fried vegetables, vegetable oils (except olive oil), salty snacks, legumes, eggs, fast foods, onion and garlic)- negative associations (traditional sweets, high fat dairy, low fat dairy, cruciferous vegetables, sugars, honey) |
| Sabrina *et al.* (2017)(38) |  | Taiwan | F | Included only one sex in the study | 117 F (mean, 43.0 years) | Chronic disease-related markers | Percent skeleton muscle mass, percent visceral fat mass, serum AST, hepcidin, LDL-C, CML | FFQ | RRR | - positive associations (beef and lamb, dairy products, fruits, whole grains, eggs) - negative associations (rice, noodles, bread and pastries, stir-fried food, deep-fried food, organs) |
| Starling *et al.* (2017)(39) | Healthy Start prospective cohort | USA | F | Included only one sex in the study | 764 mother-infant pairs (≥16 years) | Chronic disease-related markers | gestational weight gain and fasting glucose during pregnancy | 24-hour dietary recall | RRR | 1) Dietary pattern 1- positive associations (healthy protein sources (poultry, nuts, and seeds), whole grains, cheese, citrus fruits, melons and berries, and other fruits, added sugars and discretionary solid fat)2) Dietary pattern 2- positive associations (eggs, potatoes, other starchy vegetables, discretionary solid fat, citrus, melons and berries, and nonwhole grains)- negative associations (yogurt, added sugars, soy products (tofu and meat analogs), dark-green vegetables, and whole grains) |

**Supplemental Table 4** *Continued*

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| **Author (year)** | **Study name** | **Country** | **Sex** | **Sex consideration** | **Sample** | **Biomarker type** | **Biomarker** | **Dietary assessment** | **Methods** | **Variables selected** |
| Yeh *et al.* (2011)(40) | NAHSIT | Taiwan | F, M | Derived separately | 5647 F and M (mean 52.9 years inNAHSIT 1993-1996 and 54.3 years in NAHSIT 2005-2008) | Chronic disease-related markers (Metabolic syndrome) | HDL-C, WC, SBP, DBP, TG, fasting glucose | FFQ  | RRR | Males- positive associations (marble meat, viscera, legumes) - negative associations (fermented, seaweed, carrot, cucumber, mushroom, dark green vegetables) Females- negative associations (lean meat, egg, soybean, vegetables, dark green vegetables, fruit, seaweed, carrot, mushroom) |
| Günther  *et al.* (2015)(41) | DONALD Study | Germany | F, M | Derived separately | Early life 128 (1–2 years), Adiposity rebound 179 (4-6 years), Puberty (boys: 10–15 years, girls: 9–14 years) | Chronic disease-related markers | IGF-1, IGFBP-3, HOMA-IR, FMI | ≥ 2 day weighed DR | RRR | 1. Early life 1) “cake, canned fruit, cheese & eggs”: positive associations (cakes/pastries/sweet bread, fruit/canned or dried, cheese, eggs, miscellaneous), negative associations (fish, sausages/cold cut/high fat, sausages/cold cut/low fat) 2) “Favorable carbohydrate sources”: positive associations ((ready to eat-) cereals/>90% whole grain/muesli with fruit/nuts or chocolate, flour/dough, pasta, fruit), negative associations (dairy products/sweetened/low-fat, ice cream, sugar/candy, sweet parfait) 2. Adiposity rebound 1) sweets & dairy: positive associations (cakes/pastries/sweet bread, dairy products/sweetened/high-fat, eggs, dressings/dips/gravy, water, light soft drinks), negative associations (whole grain bread, flour/dough, cheese, meat/high-fat, sausages/cold cut/low-fat) 2) rice & pasta: positive associations (rice and other grains, pasta), negative associations (potato products, ice cream, water) 3) snack and convenience foods: positive associations (potato products, ice cream, savoury snacks, convenience foods (based on grain, vegetables, meat or fish), negative associations ((ready to eat-) cereals/>90% whole grain/muesli with fruit/nuts or chocolate, flour/dough, fruit, sweet parfait) 3. Puberty 1) Boys (1) “High-fat foods“: positive associations (fruit/canned or dried, nuts, animal fat, sausages/cold cut/high-fat, ice cream), negative associations (vegetables/canned/dried, potato products, dairy products/unsweetened, savoury snacks, light soft drinks) (2) “Sweet bread/cake & convenience foods“: positive associations (cakes/pastries/sweet bread, animal fat, convenience foods (based on grain, vegetables, meat or fish), and water), negative associations (brown bread, white bread, (ready to eat-) cereals/>90% whole grain/muesli with fruit/nuts or chocolate, fruit) (3) “Traditional & convenience carbohydrate”: positive associations ((ready to eat-) cereals/>90% whole grain/muesli with fruit/nuts or chocolate, potatoes, sugar/candy, convenience foods (based on grain, vegetables, meat or fish), miscellaneous), negative associations (pasta, dairy products/sweetened/low fat, alcohol) 2) Girls (1) “White bread & convenience foods”: positive associations (white bread, convenience foods (based on grain, vegetables, meat or fish)), negative associations (whole grain bread, biscuits, legumes, potatoes, nuts, sugar/candy) (2) “Brown bread, low-fat dairy & light soft drinks”: positive associations (brown bread, light soft drinks), negative associations (fruit) |

**Supplemental Table 4** *Continued*

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| **Author (year)** | **Study name** | **Country** | **Sex** | **Sex consideration** | **Sample** | **Biomarker type** | **Biomarker** | **Dietary assessment** | **Methods** | **Variables selected** |
| Floegel *et al.* (2013)(42) | EPIC-Potsdam study | Germany | F, M | Included in final model (food intake was adjusted for age and sex)Evaluated, but not presented (sensitivity analysis for sex-separate analysis) | 2380 F and M (means, 49.8years) | Chronic disease-related markers | 127 serum metabolites | FFQ | RRR | - A pattern with high intake of butter and low intake of margarine was related to acylcarnitines, acyl-alkyl-phosphatidylcholines, lyso-phosphatidylcholines and hydroxy-sphingomyelins, particularly with saturated and monounsaturated fatty acid side chains. - A pattern with high intake of red meat and fish and low intake of whole-grain bread and tea was related to hexose and phosphatidylcholines. - A pattern consisting of high intake of potatoes, dairy products and cornflakes particularly explained methionine and branched chain amino acids. - Dietary patterns related to type 2 diabetes-relevant metabolites included high intake of red meat and low intake of whole-grain bread, tea, coffee, cake and cookies, canned fruits and fish. |
| Weber *et al.* (2016)(43) | GDS | Germany | F, M | Included in final model (food consumption frequenciesfrom the FPQ were transformed to sex-specificstandard normal scores) | 348 F and M (52.6 years) | Chronic disease-related markers (CVD) | TG, HDL-C, LDL-C | FPQ | RRR | 1) RRR pattern1- positive associations (fruit gum, fruit juice unsweetened, potato dumpling)- negative associations (fruits fresh, vegetables raw)2) RRR pattern2- positive associations (coffee, potatoes boiled)- negative associations (margarine semi-fat, noodles egg, fruit/herbal tea)3) RRR pattern3- negative associations (butter, cream cake, french fries, high-percentage alcohol beverages (schnapps, cognac, whiskey)) |
| DiBello *et al.* (2008)(44) |  | Costa Rica  | F, M | Evaluated, but not presented (sensitivity analysis for sex-separate analysis) | 3574 F and M (mean, 58 years); 1787 cases for myocardial infarction, 1787 controls | Chronic disease-related markers (CVD) | Adipose tissue levels of ALA and trans-fatty acids, dietary intakes of saturated fat, fiber, and folate | FFQ | RRR, PLS | Dietary pattern derived using RRR1) RRR factor 1- positive associations (fruit, yellow vegetables, green leafy vegetables, other vegetables, legumes, condiments (fresh), soybean oil)- negative associations (processed meat, high-fat dairy foods, palm oil)Dietary pattern derived using PLS1) PLS factor1- positive associations (lean chicken, fruit, yellow vegetables, cruciferous vegetables, green leafy vegetables, other vegetables, condiments (fresh), soybean oil)- negative associations (sugar, palm oil)2) PLS factor 4- positive associations (high-energy drinks, liquor, wine and beer, other oil)- negative associations (high-fat dairy foods, condiments (fresh), soybean oil) |
| McNaughton *et al.* (2008)(45) | Whitehall II study | UK | F, M | Evaluated, but not presented (sensitivity analysis for sex-adjusted analysis) | 7339 F and M (39-63 years) | Chronic disease-related markers (Diabetes) | HOMA-IR | FFQ | RRR | - positive associations (low-calorie/diet soft drinks, onions/leeks/garlic, sugar-sweetened beverages, burgers and sausages, crisps or other snacks, white bread and rolls) - negative associations (medium- and high-fiber breakfast cereals, jam/marmalade/honey, french dressing and vinaigrette, wholemeal bread and rolls) |

**Supplemental Table 4** *Continued*

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| **Author (year)** | **Study name** | **Country** | **Sex** | **Sex consideration** | **Sample** | **Biomarker type** | **Biomarker** | **Dietary assessment** | **Methods** | **Variables selected** |
| McNaughton *et al.* (2009)(46) | Whitehall II study | UK | F, M | Evaluated, but not presented (sensitivity analysis for sex-adjusted analysis) | 7314 F and M (35-55 years) | Chronic disease-related markers (CVD) | Total cholesterol, HDL-C, TG | FFQ | RRR (repeated the RRR analysis in half of the cohort) | Dietary pattern 1- positive associations (white bread, fried potatoes, sugar in tea and coffee, burgers and sausages, soft drinks)- negative associations (french dressing (vinaigrette), other vegetables)Dietary pattern 2- positive associations (red meat, cabbage/brussels sprouts and cauliflower)- negative associations (wholemeal bread, jam/marmalade and honey, tofu and soya, buns/cakes/pastries/fruit pies, polyunsaturated margarine) |
| Dekker *et al.* (2015)(47) | HELIUS study  | Netherlands | F, M | Evaluated, but not presented (sensitivity analysis for sex-adjusted analysis) | 3776 F and M (18-70 years)  | Chronic disease-related markers (Diabetes) | HbA1c, fasting glucose  | FFQ | RRR | 1) Dutch origin- positive associations (red meat, processed meat, potato and root vegetables, tea, brassica vegetables, fat/oil (not olive oil) and full fat margarine)- negative associations (high fiber cereals, pasta)2) South Asian Surinamese- positive associations (rice and noodle dishes, tomato and tomato products, other vegetables, roti (indian flat bread))- negative associations (high fiber cereals, snacks, french fries and other fried potato dishes)3) African origin Surinamese- positive associations (processed meat, soups, beer, coffee)- negative associations (french fries and other fried potato dishes, tea)4) Turkish- positive associations (high fiber bread/bread products, coffee, low fat dairy products)- negative associations (snacks, sugar sweetened beverages, brassica vegetables)5) Moroccan- positive associations (processed meat, high fiber bread/bread products, coffee, eggs, cheese)- negative associations (high fiber cereals, savoury sauces) |
| Sauvageot *et al.* (2016)(48) | NESCAV study | Greater region's population (Grand duchy of Luxembourg, Wallonia (Belgium), Lorraine (France)) | F, M | Evaluated, but not presented (sensitivity analysis for sex-separate analysis) | 2298 F and M (median, 46.3 years) | Chronic disease-related markers (CVD) | BMI, WHR, SBP, DBP, fasting glucose, HbA1c, TG, LDL-C, HDL-C | FFQ | RRR | 1) “Prudent” dietary pattern - positive associations (brown bread, fruits, dried fruits, vegetables, butter and lower fat butter, olive oil, fat rich omega-6, coffee, tea)- negative associations (rice/pasta, fried foods, lean meat, fatty meat, processed meat, ready-meals, soft drinks, beer)2) “Animal protein and alcohol” dietary pattern- positive associations (white bread, potatoes, lean meat, offals, coffee, beer, wine, aperitifs and spirits)- negative associations (cereals, sugar and sweets, soft drinks) |

**Supplemental Table 4** *Continued*

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| **Author (year)** | **Study name** | **Country** | **Sex** | **Sex consideration** | **Sample** | **Biomarker type** | **Biomarker** | **Dietary assessment** | **Methods** | **Variables selected** |
| Jacobs S et al. (2017)(49) | MEC | USA | F, M | Evaluated, but not presented (sensitivity analysis for sex-separate analysis) | 10,008 F and M (45-75 years) | Chronic disease-related markers (Diabetes) | Adiponectin, leptin, CRP, TG | FFQ | RRR | 1) Combining ethnic dietary pattern - positive associations (whole grains, fruit, yellow-orange vegetables, green vegetables, low-fat dairy) - negative associations (processed meat, red meat, sugar-sweetened beverages, diet soft drink, white rice) 2) Ethnicity-specific dietary patterns (1) African American - positive associations (whole grains, yellow-orange vegetables, green vegetables, cruciferous vegetables, tomatoes, low-fat dairy) - negative associations (processed meat, red meat, poultry, shellfish, other tubers and potatoes) (2) Japanese American - positive associations (whole grains, fruit, yellow-orange vegetables, green vegetables, low-fat dairy, legumes) - negative associations (processed meat, red meat, eggs, white rice) (3) Latino - positive associations (fish, nuts, whole grains, fruit, yellow-orange vegetables, green vegetables, low-fat dairy) - negative associations (processed meat, red meat, sugar-sweetened beverages) (4) Native Hawaiian - positive associations (nuts, cottage cheese, coffee, alcohol) - negative associations (red meat, poultry, other tubers and potatoes, french fries, diet soft drinks, white rice) (5)White - positive associations (fruit, green vegetables, cruciferous vegetables, other vegetables, legumes) - negative associations (red meat, sugar-sweetened beverages, white rice) |
| Imamura *et al.* (2009)(50) | FOS | USA | F, M | Not considered | 2879 F and M (mean, 54.2 years) | Chronic disease-related markers | BMI, glucose, HDL-C, TG, SBP, DBP | FFQ | RRR | 1) Exploratory dietary pattern scores using food grouping of the NHS- positive associations (red meats, processed meats, margarine, refined grains, low-calorie soft drinks, caloric soft drinks, french fries, fried foods, pizza)- negative associations (dark-yellow vegetables, green leafy vegetables, whole grains, wine, beer, other alcoholic beverages)2) Exploratory dietary pattern scores using food grouping of the EPIC- positive associations (red meats, processed meats, margarine, refined grains, low-calorie soft drinks, french fries, fried foods, pizza)- negative associations (wine, beer, other alcoholic beverages)3) Exploratory dietary pattern scores using food grouping of the Whitehall II- positive associations (beef burgers and sausages, refined grains, low-calorie soft drinks, fried foods, pizza)- negative associations (dried fruit(raisins)) |

**Supplemental Table 4** *Continued*

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| **Author (year)** | **Study name** | **Country** | **Sex** | **Sex consideration** | **Sample** | **Biomarker type** | **Biomarker** | **Dietary assessment** | **Methods** | **Variables selected** |
| Centritto *et al.* (2009)(51) | Moli-sani project | Italy | F,M | Not considered | 7646 F and M (mean, 50 years) | Chronic disease-related markers (CVD) | HDL-C, TG, SBP, glucose, CRP | FFQ | RRR | - positive associations (pasta and other grains, tomatoes cooked, red meat, animal fats, other sauces, wine, bread, beer, offals, processed meat)- negative associations (milk, breakfast cereals, yogurt, sugar and sweets, fresh cheese) |
| Liu *et al.* (2009)(52) | MESA | USA | F, M | Not considered | 4601 F and M (45-84 years) | Chronic disease-related markers (Metabolic syndrome) | WC, TG, SBP, DBP, glucose, HDL-C | FFQ | RRR | - positive associations (food with a high glycemic index (refined-grain bread/pasta, white potatoes, and sweet breads), high-fat meats, cheeses, processed foods (fried potatoes, salty snacks, pizza, and ice cream))- negative associations (vegetables, soy, fruit, green and black tea, low-fat dairy desserts, seeds and nuts, fish) |
| Heroux *et al.* (2010)(53) | ACLS | USA | F, M | Not considered | 13621 F and M (20-84 years) | Chronic disease related biomarkers | HDL-C, total cholesterol, TG, fasting glucose, mean arterial blood pressure, uric acid, white blood cell, BMI | 3 days DR | RRR (random sample cross-validation procedure) | - positive associations (processed meat, red meat, white potato products, non-whole grains, added fat)- negative associations (non-citrus fruits) |
| Barbaresko *et al.* (2014)(54) | PopGen control cohort | Germany | F, M | Not considered | 905 F and M (25-82 years); 391 cases for metabolic syndrome, 514 controls | Chronic disease-related markers (Metabolic syndrome) | WC, TG, HDL-C, SBP, DBP, HbA1c | FFQ | RRR (random sample cross-validation and van der Voet's test) | - positive associations (potatoes, other vegetables, legumes, bread, beef, pork, processed meat, other fats, sauce, bouillon)- negative associations (tea, pasta/rice) |
| Lamichhane *et al.* (2014)(55) | SEARCH | USA | F, M | Not considered | 1153 F and M diagnosed with type1 diabetes (≥10 years) | Chronic disease-related markers (CVD) | TG, LDL-C, SBP, HbA1c, CRP, WC | FFQ | RRR | - positive associations (diet soda, sweetened soda and fruit-flavored drink, sweetened coffee and tea, eggs, potatoes, high-fat meats (other than processed))- negative associations (sweets and desserts, low-fat dairy) |
| Yu *et al.* (2014)(56) | PATH cohort study; a part of CPTP | Canada | F, M | Not considered | 960 F and M (35-69 years) | Chronic disease-related markers (Obesity) | BMI, WC | FFQ, dietary behaviour questionnaire | RRR | - positive associations ((1)oil product use with bread, (1)full fat margarine with bread, (2)margarine (including low fat) for cooking, refined or milled grains, eggs, meat and/or poultry, snack foods (pretzels, potato chips, buttered popcorn, and crackers), other tea, artificial sweetener use, non-diet drink, diet drink, milk drink,(6)fast food)- negative associations (fruits, nuts or seeds) |

**Supplemental Table 4** *Continued*

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| **Author (year)** | **Study name** | **Country** | **Sex** | **Sex consideration** | **Sample** | **Biomarker type** | **Biomarker** | **Dietary assessment** | **Methods** | **Variables selected** |
| Koch *et al.* (2014)(57) | PopGen control cohort | Germany | F, M | Not considered | 354 F and M (tertile2 mean of LSI, 68.2 years) | Chronic disease-related markers | LSI | FFQ | PLS | - positive associations (soups, beer, wine, poultry, juices, eggs)- negative associations (fruit and herbal tea, green and black tea, sugar and confectionary, other fats, bread, breakfast cereals, cheese) |
| Biesbroek *et al.* (2015)(58) | EPIC-NL | Netherlands | F, M | Not considered | 34644 F and M (20-70 years) | Chronic disease-related markers (CVD) | BMI, total:HDL-C, SBP | FFQ | RRR | First factor: traditional- positive associations (potatoes, coffee, eggs, boiled vegetables/legumes, red meat, processed meat)- negative associations (french fries, low-fiber cereals, high-fiber cereals, soy products, fast food, sugar/sweets, savory sauces)Second factor: western- positive associations (french fries, soft drinks with sugar, soft drinks without sugar, fast food, savory sauces, red meat)- negative associations (wine, fruit)Third factor: prudent- positive associations (wine, fruit, raw vegetables)- negative associations (potatoes, sugars/sweets) |
| Frank *et al.* (2015)(59) | KDH study | Ghana | F, M | Not considered | 1206 F and M; 538 cases for diabetes (mean, 54.7 years), 668 controls (46.8 years )  | Chronic disease-related markers (Diabetes) | Adiponectin, HDL-C, TG | FFQ | RRR | - positive associations (plantain, cassava, garden egg)- negative associations (rice, juice, vegetable oil, eggs, chocolate drink, sweets, red meat) |
| Jaacks *et al.* (2015)(60) | 3CNAS | China | F, M | Not considered | 99 F and M (median, 43.6 years) | Chronic disease-related markers (CVD, Diabetes) | HbA1c, LDL-C | 24-hour dietary recall | RRR | Dietary pattern1- positive associations (pickled vegetables, beans & products)- negative associations (high-fat cakes, wheat products)Dietary pattern2- positive associations (eggs, rice)- negative associations (tea & coffee, fish & shellfish, high-fat cakes, nuts & seeds) |
| Batis *et al.* (2016)(61) | CHNS | China | F, M | Not considered | 4316 F and M; 245 for case for diabetes (mean, 51.7 years), 4071 for controls (46.5 years) | Chronic disease-related markers (Diabetes) | HbA1c, HOMA-IR, fasting glucose | 3 days 24-hour dietary recall | RRR | - positive association (wheat noodles, wheat buns and breads, deep-fried wheat, soya milk)- negative associations (rice, fresh legumes, poultry and game, eggs and egg products, fish and seafood) |

**Supplemental Table 4** *Continued*

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| **Author (year)** | **Study name** | **Country** | **Sex** | **Sex consideration** | **Sample** | **Biomarker type** | **Biomarker** | **Dietary assessment** | **Methods** | **Variables selected** |
| Chang *et al.* (2017)(62) | NAHSIT | Taiwan | F, M | Not considered | 195 F and M (mean, 36 years); 39 cases for morbid obesity, 156 controls | Chronic disease-related markers (Obesity) | BMI | FFQ | RRR | - positive associations (ice pop/candy/sweetened beverage, red meat, processed seafood & meat products)- negative associations (tea & coffee(no sugar), breakfast cereals, milk/yogurt/cheese, nuts, fresh fruit & 100% juice) |
| Di Giuseppe et al. (2018)(63) | PopGen control cohort | Germany | F, M | Not considered | 853 F and M (mean, 61 years); 493 cases for metabolic syndrome, 360 controls | Chronic disease-related markers (Metabolic syndrome) | SELENOP | FFQ | RRR | - positive associations (fruiting and root vegetables, fruits, nuts, other fruits, tea, wine, condiments and yeasts)- negative associations (red meat and game, poultry, processed meat, coffee, spirits) |
| Pounis *et al.* (2014)(64) | IMMIDIET Project | Italy, Belgium and UK | F, M | Not considered | 1604 F and M (26-65 years) | Chronic disease-related markers (CVD) | Total plasma n-3 FAs (ALA, EPA, DPA, DHA), Total RBC n-3 FAs (ALA, EPA, DPA, DHA) | FFQ | RRR | Model1 (total plasma n-3 FAs)- positive associations (cabbages and root vegetables, dairies, vegetable oils, chocolate/coffee and tea, mayonnaise) - negative associations (cheese, pasta/rice, red meat and products, olive oil)Model2 (total RBC n-3 FAs)- positive associations (cabbages and root vegetables, fishes, mollusks, vegetable oils, chocolate/coffee and tea, mayonnaise)- negative associations (pasta/rice, red meat and products, olive oil) |
| Noh *et al.* (2011)(65) |  | Korea | F | Included only one sex in the study | 198 F (means, 9.8 years) | Physical growth related markers | BMI, BMD, BMC | 1 day 24 hour-dietary recall2 days DR | RRR | Dietary pattern 1 (Egg & Rice dietary pattern)- positive associations (eggs, rice)- negative associations (nuts and seeds, processed meats, potatoes, eastern grains, vegetables and mushrooms, fish and seashells)Dietary pattern 2 (FNMBEG dietary pattern, "Fruit, Nut, Milk, Beverage, Egg, Grain” dietary pattern)- positive associations (fruits, nuts and seeds, milk and dairy products, other beverages, eggs, fruits juice, eastern grains)- negative associations (vegetables and mushrooms, kimchi, sugar and sweets, fish and seashells) |
| Diethelm *et al.* (2014).(66) | DONALD Study | Germany | F, M | Included in final model (dietary intakes were standardized by age and sex) | 371 children (6-7 years to 10 -11 years) | Physical growth related markers | Changes in BMI, FMI between ages 6 and 7 years and ages 10 and 11 years | 3 days weighed DR at four time points | RRR | 1. RRR baseline pattern1) BMI changes: positive association (canned or dried fruit)2) FMI changes: positive associations (white bread), negative associations (biscuits, pulses, cereals (>90% whole grain), whole-grain bread, cheese)2. RRR change pattern1) BMI changes: positive association (savoury snacks)2) FMI changes: positive associations (dressings/dips/gravy, water, cheese, sausages/cold cuts/ high fat), negative associations (chocolate/chocolate bars, dairy products/sweetened/high fat, meat/high fat, canned or dried fruit)  |

**Supplemental Table 4** *Continued*

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| **Author (year)** | **Study name** | **Country** | **Sex** | **Sex consideration** | **Sample** | **Biomarker type** | **Biomarker** | **Dietary assessment** | **Methods** | **Variables selected** |
| Voortman *et al.* (2016) (67) | Generation R study | Netherlands | F, M | Included in final model (age- and sex-adjusted FMI and FFMI) | 2026 F and M; dietary intake (median, 12.9 months), body composition (median, 5.9 years) | Physical growth related markers | FMI, FFMI | FFQ | RRR | 1) Dietary pattern1 - positive associations (refined grains, vegetables, potatoes, soups and sauces, fish, meat, sugar-containing beverages) 2) Dietary pattern2 - positive associations (whole grains, pasta and rice, dairy, fruit, vegetables, vegetable oils, other fats, non-sugar-containing beverages) |
| de Jonge *et al.* (2017)(68) | Rotterdam Study | Netherlands | F, M | Included in final model (standardized all response variables for age, sex, body weight, and height) | 4028 F and M (≥55 years) | Bone | BMD, bone width, section modulus, cortical buckling ratio | FFQ | RRR | 1) BMD for fruits, vegetables, and dairy - positive associations (fruit, vegetables, milk, yogurt) - negative associations (sweets, animal fats) 2) BMD and hip geometry (bone width, section modulus, buckling ratio) (1) fruits, vegetables, and dairy: positive associations (fruit, vegetables, milk, yogurt), negative associations (sweets, animal fat) (2) sweets, animal fat, and low meat: positive associations (whole grains, sweets, animal fats, porridges), negative associations (soy, refined grains, whole grains, unprocessed meat, processed meat, poultry) |
| Wosje *et al.* (2010)(69) |  | USA | F, M | Not considered | 325 F and M; children contributed data from 13 visits over 4 separate study years (age ranges: 3.8–4.8, >4.8–5.8, >5.8–6.8, and >6.8–7.8 years) | Physical growth related markers | Fat mass, bone mass | 3 days DR | RRR | Pattern1 Year 1: positive associations (non-whole grains, cheese, processed meats, eggs, fried potatoes, fried chicken and fish, nondairy desserts, discretionary fats, artificially sweetened beverages) Year 2: positive associations (non-whole grains, cheese, poultry (nonfried), processed meats, eggs, fried potatoes, nondairy desserts, discretionary fats, artificially sweetened beverages) Year 3: positive associations (non-whole grains, white potatoes, meat, poultry (nonfried), processed meats, eggs, fried potatoes, discretionary fats) Year 4: positive associations (non-whole grains, cheese, meat, processed meats, eggs, fried potatoes, fried chicken and fish, discretionary fats, artificially sweetened beverages) Pattern2 Year1: positive associations (whole grains, non-whole grains, dark-green vegetables, other vegetables, processed meats, beans and peas, meat and dairy alternates, savory snacks, sweetened beverages) negative associations (fried potatoes) Year2: positive associations (whole grains, dark-green vegetables, deep-yellow vegetables, tomatoes, fruit juices, poultry (nonfried), processed meats, nuts/seeds/peanut butter, meat and dairy alternates) negative associations (fried chicken and fish, fried potatoes) Year3: positive associations (non-whole grains, dark-green vegetables, deep-yellow vegetables, fruit juices, processed meats, fish (nonfried)) negative associations (fried chicken and fish, artificially sweetened beverages) Year4: positive associations (fried chicken and fish, fried potatoes, artificially sweetened beverages), negative associations (deep-yellow vegetables, noncitrus fruit, processed meats, eggs) |

**Supplemental Table 4** *Continued*

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| **Author (year)** | **Study name** | **Country** | **Sex** | **Sex consideration** | **Sample** | **Biomarker type** | **Biomarker** | **Dietary assessment** | **Methods** | **Variables selected** |
| Weikert *et al.* (2005)(70) | CORA Study | Germany | F | Included only one sex in the study | 455 F (30-80 years); 200 cases for coronary heart disease, 255 controls | One-carbon metabolism related markers | Plasma folate, vitamin B12, hcy | FFQ | RRR | 1) Dietary pattern1 - positive associations (whole-grain bread, fresh fruit, olive oil, mushrooms, cruciferous vegetables, wine, nuts) - negative associations (fried potatoes) 2) Dietary pattern2 - positive associations (vegetarian dishes, sweet bread spreads, fresh fruit, raw vegetables, low-fat cheese, alcoholic beverages other than wine, beer, sprites) - negative associations (wine) 3) Dietary pattern3 - positive associations (nuts, sweet bread spreads) - negative associations (pizza, cake and cookies, legumes, coffee, sauce, meat other than poultry) |
| Vujkovic *et al.* (2009)(71) |  | Netherlands | F | Included only one sex in the study | 131 F; 50 mothers of children with spina bifida (mean, age at delivery 30.3 years), 81 control mothers (31.7 years) | One-carbon metabolism related markers | Serum and RBC folate, serum vitamin B12 and total plasma hcy | FFQ | RRR | - positive associations (alcohol, vegetables, vegetable oil, legumes, fruits, fish, dairy products, cereal products)- negative associations (sugars, sauces and condiments, potatoes, drinks) |
| Obermann-Borst *et al.* (2011)(72) | HAVEN study | Netherlands | F | Included only one sex in the study | 231 F (dietary patterns were derived from only controls); 179 mothers of children with congenital heart defects (mean, 33.1 years), 231 controls (32.4 years) | One-carbon metabolism related markers | SAM, SAH | FFQ | RRR, linear regression | 1) One-carbon-poor dietary pattern- positive associations (snacks, sugar and confectionery, nonalcoholic beverage)2) One-carbon-rich dietary pattern- positive associations (fish and other seafood) |
| Chuang *et al.* (2011)(73) | NAHSIT | Taiwan | F, M | Derived separately | 4640 F and M (≥19 years) | Uric acids | Serum uric acid | FFQ | RRR | Males- positive associations (organ meats, bamboo shoots, fermented foods, soft drinks)- negative associations (coffee, carrots, other seafood, vegetables, soy products, lean meat)Females- positive associations (bamboo shoots)- negative associations (seaweed, eggs, mushrooms, coffee, soy products, dark vegetables, carrots, other seafood) |
| Sluijs *et al.* (2013)(74) | EPIC-NL | Netherlands | F, M | Not considered | 2318 F and M (20-70 years) | Uric acids | plasma uric acid | FFQ | RRR  | - positive associations (alcoholic beverages, meat, french fries, sugar-sweetened soft drinks, eggs)- negative associations (cakes and cookies, soy products, tea) |

**Supplemental Table 4** *Continued*

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Author (year)** | **Study name** | **Country** | **Sex** | **Sex consideration** | **Sample** | **Biomarker type** | **Biomarker** | **Dietary assessment** | **Methods** | **Variables selected** |
| Iglesia *et al.* (2017)(75) | HELENA study | Greece, Germany, Belgium, France, Hungary, Italy, Sweden, Austria, and Spain | F, M | Derived separately | 586 F and M (12.5-17.5 years) | B vitamins | PLP, plasma folate, RBC folate, plasma vitamin B12, HoloTC | 2 days 24-hour dietary recall | RRR | 1) PLP(1) boys: positive (bread and rolls, margarine and lipids of mixed origins, breakfast cereals, coffee/tea, meat substitutes), negative (chocolate, vegetables excluding potatoes, water, confectionary products)(2) girls: positive (dairy dessert and cream, pulses, soups/bouillon, cheese), negative (bread and rolls, vegetables excluding potatoes, starch roots/potatoes, fruit and vegetable juices, whole milk and buttermilk)2) Plasma folate(1) boys: positive (bread and rolls, chocolate, nuts/seeds/olives/avocado, margarine and lipids of mixed origins, starch roots/potatoes), negative (meat substitutes)(2) girls: positive (meat, cakes/pies/biscuits), negative (nuts/seeds/olives/avocado, fish products, eggs, meat substitutes, savory snacks)3) RBC-folate(1) boys: positive (vegetables excluding potatoes, water, meat, cheese, meat substitutes), negative (sugars, soups/bouillon, soft drinks)(2) girls: positive (nuts/seeds/olives/avocado, breakfast cereals, soups/bouillon, eggs, whole milk and buttermilk, cheese, cakes/pies/biscuits), negative (chocolate, dairy dessert and cream, salty sauces, pulses)4) Plasma vitamin B12(1) boys: positive (pasta/rice/flour, alcoholic drinks, vegetable oils, starch roots/potatoes), negative (yogurt/milk, margarine and lipids of mixed origins, fruits, cheese, confectionary products)(2) girls: positive (soups/bouillon, soft drinks, meat), negative (alcoholic drinks, butter and animal fats, breakfast cereals, cheese)5) HoloTC(1) boys: positive (yogurt/milk, butter and animal fats, vegetables excluding potatoes, coffee/tea), negative (starch roots/potatoes, fish products, confectionary products)(2) girls: positive (sugars, yogurt/milk, breakfast cereals, coffee/tea, eggs), negative (dairy dessert and cream, fruits, water, fish products) |
| Kesse-Guyot *et al.* (2014)(76) | SU.VI.MAX study | France | F, M | Not considered | 381 F and M (45–60 years) | Carotenoids | Plasma Lutein, zeaxanthin, β-cryptoxanthin, lycopene, α-carotene, trans-β-carotene and cis-β-carotene | 24-hour dietary recall | RRR | "carotenoid-rich dietary pattern"- positive associations (green-coloured fruits and vegetables, vegetable oils, orange-coloured fruits and vegetables, soup)- negative associations (wine, beer and cider) |

**Supplemental Table 4** *Continued*

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Author (year)** | **Study name** | **Country** | **Sex** | **Sex consideration** | **Sample** | **Biomarker type** | **Biomarker** | **Dietary assessment** | **Methods** | **Variables selected** |
| Vanaelst *et al.* (2012)(77) | ChiBS project | Belgium | F | Included only one sex in the study | 218 F (5-10 years) | Mineral concentrations  | Hair concentrations of Ca, Cu, Fe, Na, Mg, P and Zn | CEHQ-FFQ | RRR | 1) Ca: positive associations (fresh fruits without added sugar, fresh fruits with added sugar, water, pasta/noodles/rice, fried fish, fresh meat not fried, fried or scrambled eggs, boiled or poached eggs, tofu/tempe/quorn/soy milk, snacks like crisps/corn crisps/popcorn etc, snacks like biscuits/packaged cakes or pastries/puddings, ice cream/milk or fruit based bars) 2) Cu: positive associations (fried potatoes/potato croquettes, fresh fruits with added sugar, diet soft drinks, sweetened or sugared breakfast cereal, white bread/white roll/white crispbread, fried or scrambled eggs, snacks like crisps/corn crisps/popcorn etc, snacks like biscuits/packaged cakes or pastries/puddings) 3) Fe: positive associations (water, whole meal bread/dark roll/dark crispbread, sweetened milk, sweetened yoghurt and fermented milk beverage, chocolate or nut-based spread, snacks like crisps/corn crisps/popcorn etc, snacks like candies/loose candies/marshmallow, snacks like biscuits/packaged cakes or pastries/puddings) 4) Mg: positive associations (fresh fruits without added sugar, fresh fruits with added sugar, pasta/noodles/rice, fish not fried, fried fish, fresh meat not fried, fried or scrambled eggs, boiled or poached eggs, snacks like crisps/corn crisps/popcorn etc, snacks like biscuits/packaged cakes or pastries/puddings, ice cream/milk or fruit based bars) 5) P: positive associations (white bread/white roll/white crispbread, sweetened yoghurt and fermented milk beverages, fish not fried, fried fish, snacks like biscuits/packaged cakes or pastries/puddings) 6) Zn: positive associations (fresh fruits with added sugar, sweetened or sugared breakfast cereal, sweetened yoghurt and fermented milk beverages, fried fish, mayonnaise and mayonnaise based products, snacks like candies/loose candies/marshmallow,, snacks like biscuits/packaged cakes or pastries/puddings) |
| Fung *et al.* (2012) (b)(78) | NHS | USA | F | Included only one sex in the study | 550 F (30-55 years) | Sex hormone | Estradiol, estrone sulfate | FFQ | RRR, stepwise linear regression | - positive associations (red meat, legumes, pizza)- negative associations (coffee, whole grains) |
| Papadopoulou *et al.* (2014)(79) | NewGeneris project | Greece, Spain, United Kingdom, Denmark and Norway  | F | Included only one sex in the study | 604 F (mean, 31.3 years) | Dioxins and dioxin-like compounds | Dioxin-like activity in maternal blood (pg CALUX-TEQ/g lipid) | FFQ during pregnancy | RRR | - positive associations (red meat, white meat, lean fish, fatty-fish, mix fish dishes, low-fat dairy)- negative associations (salty snacks, high-fat cheese) |

Abbreviations: NHS, Nurses' Health Study; F, female; sTNFR2, soluble tumor necrosis factor receptor2, IL, Interleukin; CRP, C-reactive protein; E-selectin, sICAM-1, soluble intracellular cell adhesion molecule-1; sVCAM-1, soluble vascular cell adhesion molecule-1; FFQ, food frequency questionnaire; RRR, reduced rank regression; MONICA, Monitoring of Trends and Determinants in Cardiovascular Diseases; M, male; DR, dietary record; PLS, partial least squares regression; TNF-αR2, tumor necrosis factor-α receptor2; WHICAP, Washington Heights, Hamilton Heights, and Inwood Columbia Aging Project; EPIC, European Prospective Investigation into Cancer and Nutrition; HbA1c, hemoglobin A1c; HDL-C, high-density lipoprotein cholesterol; MESA, Multi-Ethnic Study of Atherosclerosis; Hcy, Homocysteine; IRAS, Insulin Resistance Atherosclerosis Study; PAI-1, plasminogen activator inhibitor-1; DIALBEST, Diabetes among Latinos Best Practices Trial; TNF-α, tumor necrosis factor-α; MCP-1, monocyte chemotactic protein-1; NDNS, National diet and nutrition survey; TG2A, transglutaminase type 2 autoantibodies; InCHIANTI, Invecchiare in Chianti; IL-1ra, IL-1 receptor antagonist; CORA, Coronary Risk Factors for Atherosclerosis in Women; CVD, cardiovascular disease; LDL-C, low-density lipoprotein cholesterol; BMI, body mass index; SBP, systolic blood pressure; DBP, diastolic blood pressure; NHANES, National Health and Nutrition Examination Survey; PUFA, polyunsaturated fatty acid; MUFA, monounsaturated fatty acid; SFA,saturated fatty acids; TLGS, Tehran Lipid and Glucose study;VAI, Visceral Adiposity Index; AST, aspartate aminotransferases; CML, Nε-(carboxymethyl)lysine; NAHSIT, Nutrition and Health Survey in Taiwan; WC, waist circumference; TG, triglycerides; DONALD, Dortmund Nutritional and Anthropometric Longitudinally Designed; IGF-1, insulin-like growth-factor-1; IGFBP-3, insulin-like-growth-factor binding protein-3; HOMA-IR, homoeostasis model assessment for insulin resistance; FMI, fat-mass index; GDS, German Diabetes Study; FPQ, food propensity questionnaire; ALA, α-Linolenic acid; HELIUS, HEalthy LIfe in an Urban Setting; NESCAV, Nutrition, Environment and Cardiovascular Health; WHR, waist to hip ratio; MEC, Multiethnic Cohort; FOS, Framing Offspring Study; ACLS, Aerobics Center Longitudinal Study; PopGen control cohort, A population-based biobank with prospective follow-up of a control group; SEARCH, SEARCH for Diabetes in Youth Study; PATH; The Atlantic Partnership for Tomorrow'sHealth; CPTP, Canadian Partnership for Tomorrow Project; LSI, liver signal inensity; KDH, Kumasi Diabetes and Hypertension; 3CNAS, The 3C Nutrition Ancillary Study; CHNS, China Health and Nutrition Survey; SELENOP, Selenoprotein P; IMMIDIET, The impact of migration as a model of gene-environment interaction; FAs, fatty acids; EPA, eicosapentaenoic acid; DPA, docosapentaenoic acid; DHA, docosahexaenoic acid; RBC, red blood cell; BMD, bone mineral density; BMC, bone mineral content; FFMI, fat-free mass index; HAVEN, Hartafwijkingen, vasculaire status en nutriënten; SAM, S-adenosylmethionine; SAH, S-adenosylhomocysteine; HELENA, Healthy Lifestyle in Europe by Nutrition in Adolescence; PLP, pyridoxal 5′phosphate; HoloTC, Holotranscobalamin; SU.VI.MAX, Supplémentation en Vitamines et Minéraux Antioxydants; ChiBS, Children's Body composition and Stress project; CEHQ-FFQ, Children's Eating Habits Questionnaire- food frequency questionnaire; NewGeneris, Newborns and Genotoxic exposure risks; CALUX-TEQ, chemical-activated luciferase gene expression-toxic equivalents.

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