# Additional File 4

| Summary of Targeted Studies Presenting Candidate FIBs for Fermented Foods | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Fermented Food** | **All interventions** | **Dose** | **Study Design** | ***n*** | **Analytical Method** | **Biosample** | **Candidate FIBs[a]** | **Reference** |
| Beer | Beer vs. Non-alcoholic control drink | 330 mL | Acute, randomized, controlled, crossover | 19 healthy volunteers (n=4 urine, n=3 plasma, n=1 serum) | U(H)PLC-MS/MS (Targeted) | Serum, plasma, urine | • L-Tartaric acid<br>• Ethyl sulfate<br>• Ethyl-beta-D-gulcuronide<br>• Indoxyl sulfate<br>• Cresol sulfate<br>• Resveratrol<br>• Estrone sulfate<br>• Dihydroepiandrosterone sulfate<br>• (Isoxanthohumol)*<br>• (Isocohumulone)*<br>• (3-nitrotyrosine)*<br>• (Indole-3-lactic acid)*<br>• (Cortisol)*<br>• (Cortisol sulfate)*<br>(* Detected but not validated) | (1) |
| Beer | Amstel beer (RIAA) vs. Hahn Premium Light beer (TIAA) vs. Coopers Clear beer (HIAA) | 470-770 mL (Amstel), 850-1500 mL (Hahn), 500-850 mL (Coopers Clear) | Acute intervention | 5 healthy volunteers | U(H)PLC-MS/MS (Targeted) | Urine | • Iso-alpha-acids (isohumulones)<br>• Rho-iso-alpha-acids (RIAA)<br>• Tetrahydro-iso-alpha-acids (TIAA)<br>• Hexahydro-iso-alpha-acids (HIAA) | (2) |
| Beer | Beer | 330 mL | Acute intervention | 10 healthy volunteers | LC-ESI-MS/MS (Targeted) | Urine | • Isoxanthohumol<br>• Xanthohumol<br>• 8-prenylnaringenin | (3) |
| Beer | Beer + 300 g allopurinol (anti-hyperuricemic agent) vs. Beer alone vs. Allopurinol alone | 10 mL/kg body weight | Acute crossover | 5 healthy volunteers | Not reported (Targeted) | Plasma, urine | • Hypoxanthine<br>• Xanthine<br>• Uric acid | (4) |
| Beer | Volt-Damm beer | 330 mL (women); 660 mL (men) | Acute intervention | 7 healthy volunteers | Melatonin ELISA and HPLC (Targeted) | Serum | • Melatonin | (5) |
| Beer | Beer vs. Vodka and carbonated water | 1 L (standardized to 48 g alcohol content) | Acute crossover | 7 healthy volunteers | GC-MS/MS (Targeted) | Urine, serum | • Mevalonic acid | (6) |

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| Beer | Little Creatures Pale Ale (high-hopped) vs. Erdinger Weissbier (low-hopped) | 613 to 802 mL | Acute crossover | 5 healthy men | U(H)PLC-MS/MS (Targeted) | Whole blood, urine | • Iso-alpha-acids (isohumulones) | (7) |
| Beer | 1 Beer, 2 Beers, 3 Beers (male); 1 Beer, 1.5 Beers, 2 Beers (female) | 330 mL, 660 mL, 990 mL (males); 330 mL, 495 mL, 660 mL (females) | Acute dose-response, randomized, crossover | 41 healthy volunteers | LC-MS/MS (Targeted) | Urine | • Isoxanthohumol | (8) |
| | Beer vs. Gin vs. non-alcoholic beer | 660 mL (beer); 92 mL (gin) (standardized to 30 g ethanol/day); 990 mL non-alcoholic beer (equivalent amount of polyphenols) | 4-week randomized, open, controlled, crossover | 33 males with high CV risk | | | | |
| | Beer | No beer drinkers vs. intermittent/daily beer drinkers (22 to 825 mL/day) (from FFQ) | Parallel-group, multicenter, controlled, randomized 5-year clinical trial | 46 volunteers from PREDIMED cohort | | | | |
| Beer | Non-alcoholic beer | 2.5 L | Acute intervention | 4 healthy volunteers | LC-MS/MS (Targeted) | Urine | • Ethyl glucuronide<br>• Ethyl sulfate | (9) |
| Beer | Low-alcohol beer | 4 L over 4 hours | Acute intervention | 5 healthy men | HPLC-PDA (Targeted) | Urine | • Ferulic acid (total, free and glucuronidated)<br>• 4-Dydroxy-3-methoxy-cinnamic acid | (10) |
| Beer | Beer | 0.5 g/kg body weight (594 to 986 mL) | Acute intervention | 6 healthy volunteers | LC-MS (Targeted) | Urine | • Ethanol<br>• Ethyl glucuronide | (11) |
| Beer | Light beer | 330 mL | Acute intervention | 8 healthy volunteers | Enzymatic method (Targeted) | Capillary blood | • Ethanol | (12) |
| | Beer on empty stomach | 660 mL | Acute intervention | 9 healthy men | | | | |

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| | Beer with meal | 660 mL | Acute intervention | 9 healthy men | | | | |
| Beer | Low-alcohol beer (0.5%) vs. low-alcohol beer (0.9%) | 3 L | Acute, randomized, crossover | 20 healthy men | Alcohol dehydrogenase method (Targeted) | Blood | • Ethanol | (13) |
| Beer | Beer vs. whisky vs. white wine vs. dry sherry | ~614 mL (beer); 240 mL (beer); 157 mL (sherry); 66.6 mL (whisky); standardised to 0.3 g/kg body weight ethanol | Acute, randomized, crossover | 11 healthy men | Breathalyser (Targeted) | Blood | • Ethanol | (14) |
| Beer | Non-drinkers vs. drinkers after a drinking party | 0 (non-drinkers); not reported (drinking party) | Cross-sectional | 40 healthy men (non-drinkers); 13 healthy men (drinking party) | GC-MS (Targeted) | Urine | • 1-Methyl-1,2,3,4-tetrahydro-beta-carboline<br>• 1,2,3,4-Tetrahydro-beta-carboline<br>• Tryptamine (after administration of dideuterated L-tryptophan) | (15) |
| | Beer vs. whisky | 500 mL (beer); 68 mL (whisky) | Acute intervention | 4 healthy men | | | | |
| Beer | Beer | 16 mL/kg body weight | Acute intervention | 4 healthy men (3 flushers and 1 non-flusher) | HS-GC (Targeted) | Blood, urine | • Ethanol<br>• Acetaldehyde<br>• Acetate | (16) |
| Beer | Beer | 16 mL/kg body weight (non-flushers); 8 mL/kg (flushers) | Acute intervention | 4 healthy men | HS-GC-FID (Targeted) | Urine | • Free and bound ethanol<br>• Free and bound acetaldehyde<br>• Free and bound acetate<br>• Free and bound acetone<br>• Free and bound methanol | (17) |
| Beer | Beer vs. rum vs. carbonate mixed rum | 275 mL (beer); 40 mL (rum); standardised to 12 g ethanol | Acute parallel | 30 healthy volunteers | TDx Abbott analyzer (Targeted) | Plasma | • Ethanol | (18) |
| Beer | Tusker or Pilsner beer | 8-15 beers (500 mL each) for me; 8-12 beers for women | Acute intervention | 17 volunteers | GC (detector not specified) (Targeted) | Urine, blood | • Alcohol | (19) |

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| Beer | Beer | 762 to 1000 mL | Acute intervention | 4 healthy volunteers | HS-GC-EI-MS (ethanol), U(H)PLC-ESI-MS/MS (hordenine) (Targeted) | Plasma | • Ethanol<br>• Hordenine (N,N-dimethyltyramine) and glucuronidated and sulfated conjugates | (20) |
| Wine, beer | Consumption of 10 alcoholic beverages (light/medium/full strength beer; red/ white/sparkling wine; wine cooler, spirits/liqueurs, spirit-based mixed drinks, sherry/port, and other) | Frequency of intake (never or <1/month, 1–3 times/month, once/week, 2–4 times/week, 5–6 times/week, once/day, 2–3 times/day, 4–5 times/day, >6 times/day) for 10 alcoholic beverages (from FFQ) | Cross-sectional | 1785 healthy volunteers from the Childhood Determinants of Adult Health study | NMR (Targeted) | Serum | • Weak positive associations for fatty acids: total fatty acids, saturated fatty acids, MUFA, PUFA, omega-6 PUFA, linoleic acid, omega-3 PUFA, DHA (total alcohol, wine beer)<br>• Weak positive associations for low-molecular weight metabolites: Alanine (total, wine, beer), glutamine (wine), tyrosine (total, wine, beer), glucose (total, wine, beer), pyruvate (beer), glycerol (beer), acetoacetate (beer), beta-hydroxybutyrate (beer), albumin (beer), acetate (beer) | (21) |
| Wine, beer | Red wine vs. beer vs. Dutch gin vs. water | 4 glasses; standardised to 40 g/day alcohol | 3-week, randomized, controlled, crossover | 12 healthy men | HPLC-FLD/UV (Targeted) | Plasma | • Alpha-tocopherol<br>• Gamma-tocopherol<br>• Lutein<br>• Beta-cryptoxanthin<br>• Lycopene<br>• Alpha-carotene | (22) |
| Wine, beer | Red wine vs. Lager beer vs. Stout (alcoholic) vs. Stout (non-alcoholic) vs. Water with alcohol | 1 drink: 341 mL 3 drinks: 3 X 155 mL (wine); 3 X 341 mL (lager beer); 3 X 341 mL (stout), 3 X 341 mL (water) | Acute intervention | 12 healthy volunteers (1 drink); 8 healthy volunteers (3 drinks) | Sigma Alcohol kit, ELISA reader (Targeted) | Plasma | • Ethanol | (23) |
| Wine, beer | Alcohol intake (wine, beer and spirits) | Quartiles of alcohol intake as % total energy intake: Q1:0, Q2: 0.6, Q3: 2.3, Q4: 5.8 (from FFQ) | Association study | 1457 healthy volunteers from the IMMIDIET cohort | GC-FID (Targeted) | Plasma | • EPA (women and men)<br>• DHA (women) | (24) |

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| Wine, beer | Beer, white wine, vodka/tonic | All beverages give 0.5 g ethanol/kg body weight (5.1% v/v beer, 12.5% v/v chardonnay, 20% v/v vodka and tonic) | Acute crossover | 15 healthy men | HS-GC (Targeted) | Whole blood | • Ethanol | (25) |
| Wine, beer | Pilsen-type beer, Cabernet Sauvignon red wine, Scotch whisky, cachaca | All beverages give 0.5 g ethanol/kg body weight | Acute crossover | 20 healthy volunteers | COBAS INTEGRA Ethanol Kit (Targeted) | Plasma | • Ethanol | (26) |
| Wine, beer | Swedish vodka and tonic (Absolut), French wine (La Garonne), Swedish export beer (Pripps Export) | All beverages give 1.0 mL ethanol/kg body weight | Acute intervention | 6 healthy men | Not reported | Blood | • Ethanol | (27) |
| Wine, beer | White wine or beer | 0.1 or 0.2 L (white wine); 0.33 L or 0.66 L (beer) | Acute intervention | 12 healthy volunteers | LC-MS/MS (Targeted) | Urine | • Ethyl glucuronide<br>• Ethyl sulfate | (28) |
| Wine, beer | Choice of white wine or export beer | 50 g or 80 g ethanol | Acute intervention | 20 healthy volunteers ('social drinkers') | HS-GC, GC-MS, HPLC (Targeted) | Urine | • Ethanol<br>• Methanol<br>• 5-Hydroxytryptophol<br>• 5-Hydroxyindol-3-ylacetic acid | (29) |
| Wine | Dealcoholized red wine | 272 mL/day | 4-week, randomized, controlled intervention | 36 elderly men | U(H)PLC-MS/MS (Targeted 67 metabolites) | Urine | • (Epi)catechin glucuronides<br>• (Epi)catechin sulfates<br>• DHPV glucuronides<br>• DHPV sulfates<br>• Ethylgallate glucuronides<br>• Ethylgallate sulfate<br>• Methyl(epi)catechin glucuronides<br>• Methyl(epi)catechin sulfates<br>• Methylgallic sulfate<br>• MHPV glucuronide<br>• MHPV sulfates<br>• Hydroxybenzoic acids (especially gallic acid)<br>• Hydroxyphenylacetic acids<br>• Hydroxycinnamic acids | (30) |

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| | | | | | | | • Hydroxyphenylpropanoic acids<br>• Glycinates (vanilloylglycine)<br>• Hydroxyphenylvalerolactones<br>• Enterolactone<br>• Pyrogallol | |
| Wine | Sparkling wine | 0.1 to 0.2 L (9 or 18 g ethanol); 1 volunteer drank 0.54 L (49 g ethanol) | Acute intervention | 9 healthy volunteers | LC-ESI-MS/MS (Targeted) | Urine | • Ethyl sulfate<br>• Ethyl glucuronide | (31) |
| Wine | Merlot red wine | 250 mL | Acute intervention | 11 healthy men | HPLC-MS/MS (Targeted) | Urine | • Resveratrol (trans-resveratrol) and metabolites (trans-piceid, taxifolin, hexestrol, trans- and cis-resveratrol glucuronides and sulfates) | (32) |
| Wine | Red wine vs. dealcoholized red wine | 272 mL/day | 28-day, randomized, controlled, crossover | 73 volunteers with high cardiovascular risk | U(H)PLC-MS/MS (Targeted) | Urine | • Resveratrol (trans- and cis-resveratrol) and metabolites (trans-piceid, piceid glucurondies and sulfates, trans- and cis-resveratrol glucuronides and sulfates, dihydroresveratrol and its glucuronides and sulfates) | (33) |
| Wine | Red wine vs. dealcoholized red wine | 272 mL/day | 4-week, randomized, controlled, crossover | 36 men with high cardiovascular risk | U(H)PLC-MS/MS (Targeted 70 phenolic metabolites) | Plasma, urine | Plasma:<br>• 3-Hydroxyphenylacetic acid<br>• DHPV and glucuronides<br>• Gallic acid<br>• Methyl(epi)catechin glucuronides<br>• Methylgallic acid<br>• Methylgallic sulfate<br>• p-Coumaric acid<br>• (Epi)catechin glucuronides<br>• 3-Hydroxyphenylacetic acid<br>Urine:<br>• (Epi)catechin glucuronides<br>• (Epi)catechin sulfates<br>• 2,4-Dihydroxybenzoic acid<br>• 2,5-Dihydroxybenzoic acid<br>• 2,6-Dihydroxybenzoic acid<br>• 3-Hydroxyphenylacetic acid<br>• DHPV and glucuronides and sulfates<br>• Ethylgallate and glucuronides and sulfates<br>• Gallic acid<br>• Methyl(epi)catechin glucuronides<br>• Methyl(epi)catechin sulfates<br>• Methylgallic acid | (34) |

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| | | | | | | | • Methylgallic sulfate<br>• p-Coumaric acid<br>• Pyrogallol<br>• Resveratrol<br>• Syringic acid<br>• Vanilloylglycine<br>• 3-(3-hydroxyphenyl) propionate<br>• DHBA<br>• 3-Hydroxybenzoic acid<br>• 3-Hydroxyphenylacetic acid<br>• 4-Hydroxybenzoic acid<br>• Caffeic acid<br>• Enterolactone<br>• Ferulic acid<br>• MHPV glucuronides | |
| Wine | White wine vs. red wine | 300 mL/day | 15-day, randomized, controlled, parallel | 20 healthy volunteers | HPLC electrochemical method (Targeted) | Plasma | • Resveratrol | (35) |
| Wine | Wine vs. grape juice vs. grape tablets enriched with trans-resveratrol (also compared to separate study with olive oil) | 250 mL/day (wine); 1L/day (grape juice); 1 mg resveratrol/day (tablets) | 4-day, randomized, controlled, crossover | 12 healthy volunteers | GC-MS (Targeted) | Plasma | • Hydroxytyrosol and its metabolite, homovanillic alcohol | (36) |
| Wine | Red wine vs. no wine | 250 mL/day | 4-week, randomized, controlled, parallel | 41 healthy volunteers | U(H)PLC-ESI-MS/MS (Targeted microbial-derived phenolics) | Feces | • 3,5-Dihydroxybenzoic acid<br>• 3-Hydroxyphenylacetic acid<br>• 3-Phenylpropionate<br>• 4-hydroxy-5-(3,4-dihydroxyphenyl) valeric acid<br>• 4-Hydroxy-5-(phenyl) valeric acid<br>• 4-O-methylgallic acid<br>• DHPV<br>• Protocatechuic acid<br>• Syringic acid<br>• Vanillic acid | (37) |
| Wine | Wine, grapes, peanuts, and red wine intake (along with total | Continuous intake of resveratrol, resveratrol 3-O-glucoside, | Association study | 475 volunteers from the EPIC cohort | U(H)PLC-MS/MS (Targeted) | Urine | • Resveratrol | (38) |

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| | resveratrol intakes) | resveratrol aglycone, wine, grapes, peanuts, and red wine (from 24-h recalls and dietary questionnaire) | | | | | | |
| Wine | White wine (and crackers) | 250 mL | Acute intervention | 10 healthy volunteers | HPLC-ECD (Targeted) | Plasma | • Caffeic acid<br>• Ferulic acid<br>• P-coumaric acid | (39) |
| Wine | White wine | Volume to achieve ~0.5 g/kg body weight ethanol | Acute intervention | 13 healthy volunteers | LC-MS/MS (Targeted) | Serum, urine | • Ethyl glucuronide<br>• Ethyl sulfate | (40) |
| Wine | Extra virgin olive oil, red wine, extra virgin olive oil + red wine | 25 mL (EVOO), 150 mL (wine) | Acute, randomized, crossover | 12 healthy volunteers | HPLC-MS/MS (Targeted) | Urine | • Resveratrol (cis, trans, dihydro)<br>• Tyrosol (free, sulfate, and glucoronide)<br>• Hydroxytyrosol (free, sulfate, and glucoronide)<br>• Ethyl glucuronide (wine) | (41) |
| Wine | Red wine vs. dealcoholized red wine | 200 mL | Acute crossover | 10 healthy volunteers | HPLC-Coulochem II detector (Targeted) | Plasma | • Caffeic acid | (42) |
| Wine | Test meal (Milanese beef cutlet and chips) with red wine | 300 mL | Acute intervention | 10 healthy men | HPLC-UV and HPLC-PDA-MS (Targeted) | Serum | • Trans-resveratrol (and 3- and 4’ glucuronides) | (43) |
| | Red wine | 600 mL | Acute intervention | 5 healthy volunteers | HPLC-UV-DAD and LC-MS/MS (Targeted) | | • Trans-resveratrol (and 3- and 4’ glucuronides) | |
| | ‘Fat meal’ with red wine vs. ‘lean meal’ with red wine | 600 mL | Acute parallel | 10 healthy volunteers | | | • Trans-resveratrol (and 3- and 4’ glucuronides) | |
| Wine | Red wine vs. dealcoholized red wine | 272 mL/day | 20-day, randomized, controlled, crossover | 8 healthy volunteers | U(H)PLC-ESI-MS/MS (Targeted for microbial phenolics) | Feces | • 3,5-Dihydroxybenzoic acid<br>• 3-O-Methylgallic acid<br>• 4-Hydroxy-5-(phenyl) valeric acid<br>• p-Coumaric acid<br>• Phenylpropionic acid<br>• Protocatechuic acid<br>• Syringic acid | (44) |

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| | | | | | | | • Vanillic acid | |
| Wine | Red wine vs. dealcoholized red wine | 120 mL | Acute crossover | 9 healthy volunteers | GC-MS (Targeted) | Urine | • Catechin (free) and metabolites (catechin sulfate, glucuronide, glucuronide-sulfate)<br>• 3'-methylcatechin and glucuronides and sulfates | (45) |
| Wine | Red wine vs. alcohol abstinent | 150 mL/day (females); 300 mL/day (males) | 3-month, randomized, parallel | 44 healthy volunteers | LC-MS/MS (Targeted) | Whole blood | • Phosphatidylethanol<br>• Carbohydrate-deficient transferrin | (46) |
| Wine | Red wine, ethanol, water | 155 mL (wine, first dose), ethanol equivalent to acheive BAC of 40 mg/mL<br><br>310 mL (wine, second dose) | Acute, 2-dose, randomized, single-blind, crossover | 13 healthy volunteers | GC (detector not specified) (Targeted) | Plasma | • Resveratrol<br>• Catechin | (47) |
| Wine | Red wine (at 3 different doses) | 100 mL, 200 mL, or 300 mL | Acute, randomized, crossover | 21 healthy men | LC-ESI-MS/MS (Targeted) | Urine | • Tartaric acid | (48) |
| Wine | Mediterranean diet vs. occidental diet, with or without red wine | 240 mL/day | 3-month, randomized, parallel (1-month wine intake during second month) | 42 healthy men | HPLC-electrochemical detection (beta-carotene), spectrophotometry (L-ascorbic acid), Folin-Ciocalteu method (polyphenols) (Targeted) | Plasma, urine (polyphenols) | • Vitamin C<br>• Beta-carotene<br>• Polyphenols (gallic acid equivalents) | (49) |
| Wine | Wine | Non-wine consumers, intermittent wine consumers, daily wine consumers (from FFQ) | Prospective cohort | 1000 volunteers with high CV risk from the PREDIMED cohort | LC-MS/MS (Targeted) | Urine | • Resveratrol metabolites (trans- and cis-resveratrol glucuronides and sulfates) | (50) |

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| Wine | Mencia red wine | 1 glass/serving per day (volume not specified) | 3-day intervention | 25 healthy volunteers who are occasional wine drinkers | HPLC-MS/MS (Targeted) | Plasma | • Resveratrol (trans) | (51) |
| Wine | Sparking wine vs. gin | 300 mL/day (wine); 100 mL (gin), standardized to 30 g ethanol/day | 28-day, randomized, controlled, crossover | 10 healthy men | LC-MS/MS (Targeted) | Urine | • Total resveratrol metabolites (cis- and trans- resveratrol glucuronides) | (52) |
| | White wine vs. red wine | 200 mL/day, standardized to 20 g ethanol/day | 28-day, randomized, controlled, crossover | 10 healthy women | | | | |
| | Wine consumed at 3 different levels | Daily consumption, intermittent consumption, no consumption (from FFQ) | Prospective cohort | 52 volunteers from the PREDIMED cohort | | | | |
| Wine | Red wine vs. dealcholized red wine | 120 mL | Acute, randomized, crossover | 9 healthy volunteers | GC-MS (Targeted) | Plasma | • Catechin and 3'-O-methylcatechin (and glucuronide and sulfate conjugates) | (53) |
| Wine | Delacoholized red wine reconstituted with water vs dealcoholized red wine reconstituted with water and ethanol | 120 mL | Acute, randomized, crossover | 9 healthy volunteers | GC-MS (Targeted) | Plasma | • Total (+)-Catechin | (54) |
| Wine | Alcohol consumption, wine consumption | 3 categories for total alcohol consumption, wine consumption (from FFQ) | Prospective cohort | 1045 volunteers with high CV risk from the PREDIMED cohort | GC-MS (hydroxytyrosol); enzyme immunochemical method (ethyl glucuronide) (Targeted) | Urine | • Hydroxytyrosol<br>• Ethyl glucuronide | (55) |

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| Wine | Red wine vs. grape juice vs. red wine extract tablets | 250 mL (wine); 1 L (juice); 10 tablets; standardized to 14 ug/kg resveratrol | Acute, randomized, controlled, crossover | 11 healthy men | GC-MS (Targeted) | Plasma, urine | • Resveratrol (trans, cis), dihydroresveratrol | (56) |
| Wine | Red wine | 200 mL | Acute intervention | 5 healthy men | LC-ESI-MS/MS (Targeted) | Urine | • Tartaric acid<br>• Malic acid<br>• Succinic acid | (57) |
| Wine | Alcohol consumption | Quartiles of alcohol consumption, continous intake of wine (from FFQ) | Association study | 1000 volunteers with high CV risk from the PREDIMED cohort | LC-MS/MS (Targeted) | Urine | • Total resveratrol metabolites (trans- and cis-resveratrol glucuronides and sulfates) | (58) |
| Wine | Merlot red wine | 250 mL | Acute intervention | 11 healthy men | LC-ESI-MS/MS (Targeted) | Plasma LDL | • Trans-resveratrol and metabolites (3-O-glucuronide, cis-3-O-glucuronide, cis-3-O-glucoside) | (59) |
| Wine | Diet without vegetable, fruit, and wine vs. diet with vegetable and fruit vs. diet with wine and no vegetable or fruit vs. diet with wine, vegetable, and fruit | Grouped intakes of fruit, vegetabe, and wine intake (from 24-h recall) | Cross-sectional | 180 healthy free-living volunteers | HPLC-FLD (Targeted) | Plasma | • (+)-Catechin | (60) |
| Wine | Red wine vs. no red wine | 375 mL/day | 2-week, randomized, controlled, parallel | 20 healthy free-living volunteers | HPLC-MS/MS (Targeted) | Plasma | • Total phenolics<br>• (+)-Catechin glucuronide<br>• (-)-Epicatechin glucuronide<br>• Methyl catechin glucuronide<br>• Methyl epicatethin glucuronide | (61) |
| Wine | Red wine | 100, 200, 300 mL | Acute, dose-response intervention | 5 healthy men | HPLC-Coulochem II detector (Targeted) | Plasma | • Caffeic acid | (62) |

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| Wine | Table red wine vs. Port red wine | 250 mL (table red wine); 150 mL (Port red wine) | Acute crossover | 4 healthy men | HPLC-DAD, HPLC-MS (Targeted) | Plasma, urine | • Total plasma anthocyanins and metabolites<br>• Delphinidin-3-O-glucoside<br>• Petunindin-3-O-glucoside<br>• Peonidin-3-O-glucoside<br>• Delphinidin-glucuronide<br>• Peonidin-glucuronide<br>• Malvidin-3-O-beta-glucuronide<br>• Malvidin-3-O-beta-glucoside | (63) |
| Wine | Oak-aged red wine vs. strawberries vs red raspberries vs. walnuts (all containing ellagitannins) | 300 mL (wine); 250 g (strawberries); 225 g (raspberries); 35 g (walnuts) | Acute crossover | 40 healthy volunteers | LC-MS/MS (Targeted) | Urine | • Urolithin B derivatives (glucuronide more than aglycone) | (64) |
| Wine | Wine vs. vodka (diluted in lemon-flavored water) vs. dealcoholised wine vs. placebo (lemon-flavored water) | 147 mL | Acute, randomized, controlled, crossover | 28 healthy men | Method not reported (Targeted) | Urine | • Hydroxytyrosol<br>• 3'-Dihydroxyphenylacetic acid<br>• Homovanillic acid<br>• 4-Hydroxyphenylacetic acid | (65) |
| Wine | Wine (alcohol consumption) vs. no wine (alcohol abstinent) | 1 glass/day for women (16 g ethanol); 2 glasses/day for men (32 g ethanol) | 3-month, randomized, controlled, parallel | 44 healthy volunteers | LC-MS/MS (Targeted) | Hair | • Ethyl glucuronide | (66) |
| Wine | Red wine vs. red grape juice | 400 mL | Acute crossover | 9 healthy volunteers | HPLC-UV-VIS (Targeted) | Plasma, urine | • Total anthocyanins<br>• Cyanidin-3-glucuronide<br>• Delphinidin-3-glucuronide<br>• Malvidin-3-glucuronide<br>• Peonidin-3-glucuronide<br>• Petunidin-3-glucuronide | (67) |
| Wine | Red wine vs. delacoholised red wine vs. red grape juice | 500 mL | Acute, randomized, crossover | 6 healthy men | HPLC-PDA (Targeted) | Plasma, urine | • Malvidin-3-glucoside | (68) |
| Wine | Wine vs. mature whisky vs. new whisky | 100 mL | Acute, randomized, crossover | 9 healthy volunteers | Folin Ciocalteu method (Targeted) | Plasma, urine | • Total phenols (gallic acid equivalents) | (69) |

| Summary of Targeted Studies Presenting Candidate FIBs for Fermented Foods | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Fermented Food** | **All interventions** | **Dose** | **Study Design** | ***n*** | **Analytical Method** | **Biosample** | **Candidate FIBs[a]** | **Reference** |
| Wine | Red wine vs. Red grape juice | 400 mL | Acute, randomized, crossover | 9 healthy volunteers | HPLC-UV-VIS (Targeted) | Plasma, urine | • Total anthocyanins<br>• Cyanidin-3-glucuronide<br>• Delphinidin-3-glucuronide<br>• Malvidin-3-glucuronide<br>• Peonidin-3-glucuronide<br>• Petunidin-3-glucuronide | (70) |
| Wine | Wine | 250 mL | Acute intervention | 7 healthy volunteers | LC-MS/MS (Targeted) | Urine | • Ethyl glucuronide | (71) |
| Wine | Listerine mouth rinse vs. non-alcoholic wine vs. vodka | 4.2 to 7.5 dL (wine); 3.75 mL (vodka) | Acute parallel | 12 healthy volunteers | HPLC-MS/MS, HPLC-UV (Targeted) | Oral fluid, whole blood, urine | • Ethyl glucuronide<br>• Ethyl sulfate | (72) |
| Wine | Pinot noir red wine vs. Cabernet sauvignon red wine vs. dry semillon white wine vs. sauvignon blanc white wine vs. absolute alcohol in water | 0.3 g/kg body weight ethanol | Acute, randomized, crossover | 108 volunteers with previous illness | GLC (Targeted) | Blood | • Ethanol | (73) |
| Rice wine | Japanese rice wine (sake) vs. water | 0.4 g/kg body weight ethanol | Acute intervention | 63 healthy men | GC-FID (Targeted) | Breath, blood | • Alcohol<br>• Acetaldehyde | (74) |
| Rice wine | Sake vs. rice wine | 100 mL (sake); 50 mL (rice wine) | Acute intervention | 2 healthy volunteers | 1H NMR (Targeted) | Urine | • Ethyl glucoside | (75) |
| Yoghurt | Yoghurt vs. milk | 800 g | Acute, randomized, double-blind, crossover | 14 healthy men | GC-MS (Targeted) | Serum | • Lactose<br>• Galactose | (76) |
| Yoghurt | Probiotic yoghurt with *Bifidobacterium animalis* subsp. *lactis* LKM512 or placebo yoghurt | 100 g/day | 4-week, double-blind, placebo-controlled, crossover | 10 adults with moderate atopic dermatitis | HPLC-Scanning FLD (fecal polyamines); HPLC-Differential Refractomet er (fecal | Feces | • Butyrate vs baseline (no increases for other SCFAs measured, acetate, propionate, isobutyrate, valerate, and isovaleate)<br>• Spermidine (also some with increased putrescine, but spermine levels not detected) | (77) |

| Summary of Targeted Studies Presenting Candidate FIBs for Fermented Foods | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Fermented Food** | **All interventions** | **Dose** | **Study Design** | ***n*** | **Analytical Method** | **Biosample** | **Candidate FIBs[a]** | **Reference** |
| | | | | | SCFAs) (Targeted) | | | |
| Yoghurt | Yoghurt consumers vs. non-consumers | >200 g/day (consumers), 0 g/day (non-consumers) (from 24-h food records) | Free-living cohort | 30 (consumers) ad 21 (non-consumers) from the SU.VI.MAX cohort | GC (detector not specified) (SCFAs); GLC (for bile acids) (Targeted) | Feces | • No significant differences in fecal SCFA (total, acetate, propionate, butyrate, iso-acids, valerate + caproate)<br>• No significant differences in neutral bile acids (cholesterol, coprostanol, cholestanol, coprostanone, beta-sitosterol, copro-beta-sistosterol)<br>• Increase in 7-keto-lithocholic (no significant differences in other acidic bile acids cholic, deoxycholic, ursocholic, 7-keto-deoxycholic, chenodeoxycholic, lithocholic, ursodeoxycholic, 7-keto-lithocholic, sum) | (78) |
| Yoghurt | Probiotic yoghurt with *Bifidobacterium animalis* subsp. *lactis* LKM512 vs. placebo yoghurt | 100 g/day | 2-week, placebo-controlled, crossover | 7 healthy adults | HPLC-Scanning FLD (fecal polyamines); HPLC-Differential Refractometer (fecal SCFAs) (Targeted) | Feces | • Spermidine (putrescine not increased, spermine levels not detected)<br>• No significant changes in lactate or acetate | (79) |
| Yoghurt | Fresh yoghurt (>$10^7$ CFU) vs. heated yoghurt (<$10^2$ CFU) | 500 g/day | 15-day, randomized | 12 healthy men with lactose malabsorption and 12 healthy men without lactose malabsoption | HS-GC-FID (SCFAs) (Targeted) | Plasma | • Butyrate (in volunteers without lactose malabsorption for fresh yoghurt vs. heated)<br>• Propionate (in volunteers with lactose malabsorption for fresh yoghurt vs. baseline)<br>• No change in acetate | (80) |
| Yoghurt | Whole milk, commercial unflavored yoghurt, heated yoghurt | 400 mL (milk); 450 g (yoghurts) | Acute, randomized, crossover | 8 healthy volunteers with lactose malabsorption | Enzymatic assay (Targeted) | Ileal fluid | • Lactose (higher after heated yoghurt than yoghurt)<br>• Galactose (not signficant)<br>• Glucose (not significant)<br>• Hexoses (higher after heated yoghurt than yoghurt) | (81) |
| Cheese, yoghurt (general dairy) | Total dairy intake | Quintiles of total dairy intake: Q1: 0-2.07, Q2: 2.1-4.1, Q3: 4.13-6.65, Q4: | Association study | 659 volunteers without diabetes from the | GC-FID (Targeted) | Serum | • Pentadecanoic acid (15:0)<br>• Trans-palmitoleic acid (trans 16:1n-7) was not considered to be a specific marker for total dairy intake | (82) |

| Summary of Targeted Studies Presenting Candidate FIBs for Fermented Foods | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Fermented Food** | **All interventions** | **Dose** | **Study Design** | ***n*** | **Analytical Method** | **Biosample** | **Candidate FIBs[a]** | **Reference** |
| | | 6.69-9.73, Q5: 9.8-31.08 (from FFQ) | | IRAS cohort | | | | |
| Cheese, yoghurt (general dairy) | Dairy fat intake | Continuous levels of dairy fat intake (from 1 week weighted diet records and FFQ) | Association study | 81 healthy women | GC with (Targeted) | Subcutaneous adipose tissue | • Pentadecanoic acid (15:0)<br>• Heptadecanoic acid (17:0) | (83) |
| Cheese, yoghurt (general dairy) | Natural yoghurt, cheddar cheese, semi-skimmed milk, water (dairy as snack) | 410 mL | Acute, randomized, crossover | 40 overweight men | GC-FID (Targeted) | Plasma | • Amino acids (alpha-amino butyric acid, Ala, Asn, cysteine, Gly, Glu, His, Ile, Leu, Lys, Met, Orn, phe, Pro, Ser, Thr, Trp, Try, Val) | (84) |
| Cheese, yoghurt (general dairy) | Dairy: Milk (1% fat), yoghurt (1.5% fat), cheese (34% fat)<br>Control: fruit and vegetable juice, cashews and a cookie | 3 servings/day (375 mL milk/day, 175 yoghurt/day, 30 g cheese/day) | 4 week, randomized, free-living, multi-center, crossover | 124 healthy volunteers | GC-FID (Targeted) | Plasma | • Pentadecanoic acid (15:0)<br>• Heptadecanoic acid (17:0)<br>• Trend towards higher cis-9, trans-11-18:2n-6, p=0.06)<br>• Total SFA<br>• 18:3n-6<br>• 22:1n-9<br>• SFA:MUFA and SFA:PUFA | (85) |
| Cheese, yoghurt (general dairy) | Total dairy, high-fat dairy, low-fat dairy, milk, cream, yoghurt, cheese, butter | Continuous levels of total dairy, high-fat dairy, low-fat dairy, milk, cream, yoghurt, cheese, butter (from FFQ) | Association study | 334 control and 1054 intervention volunteers from Food4Me | GC-FID (Targeted) | Dried blood spots | • Pentadecanoic acid (15:0)<br>• Heptadecanoic acid (17:0) | (86) |
| Cheese, yoghurt (general dairy) | Meat, dairy food, egg, and fish | Quartiles/levels of milk and dairy products, milk, cheese, total meat, red meat, processed meat, white meat, fis hand shellfish, and | Association study | 271 participants of the Second Bavarian Food Consumption Survey | LC-MS (Targeted) | Plasma | • Trimethylamine-N-oxide with milk and dairy products, milk (not for other food groups)<br>• No associations for betaine or choline | (87) |

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|---|---|---|---|---|---|---|---|---|
| **Fermented Food** | **All interventions** | **Dose** | **Study Design** | ***n*** | **Analytical Method** | **Biosample** | **Candidate FIBs[a]** | **Reference** |
| | | eggs and egg products (from 24-h recalls) | | | | | | |
| Cheese, yoghurt | Dairy (total dairy, milk, cheese, yoghurt, cream/butter) intake | Frequency of dairy consumption from never/ <1 time/month to ≥6 times/day (from FFQ) | Association study | 2205 volunteers from the Framingham Health Study Offspring cohort and 866 volunteers from the Gen3 cohort | HILIC- and lipid-LC-MS and MS/MS (Targeted and Untargeted) | Plasma | • Cheese: C46:0 triacylglycerol, C54:4 triacylglycerol, C54:5 triacylglycerol, C54:6 triacylglycerol<br>• Yoghurt: C20:5 cholesterol ester | (88) |
| Cheese, yoghurt, fermented milk (general dairy) | Total milk products, cream, cheese, fermented milk, total milk, ice cream | Quartiles of of total milk products, cream, cheese, fermented milk, total milk, ice cream, and 15:0 and 17:0 (from FFQ) | Prospective case-control nested within larger cohort NSHDS | 444 cases of myocardial infarction and 556 controls | GLC (Targeted) | Plasma | • Pentadecanoic acid (15:0)<br>• Heptadecanoic acid (17:0) | (89) |
| Cheese, soy sauce | Soy sauce with a meal (not further specified) or Appenzeller cheese | 9 mL soy sauce; 10 g cheese | Acute intervention | 4 volunteers (cheese); 3 volunteers (soy sauce) | HPLC-IS-MS (Targeted) | Urine | • 4-methylspinacemine (4-methyl-4,5,6,7-tetrahydro-1H-imidazo-[4,5-c]pyridine)<br>• 1,4-dimethylspinacemine | (90) |
| Cheese | Probiotic cheese with *L. plantarum* TENSIA vs. control cheese | 50 g/day | 3-week, randomized, double-blind, placebo-controlled, parallel | 25 hospitalized patients | GC-FID (Targeted) | Urine | • Putrescine and acetylated putrescine in control group decreased vs baseline (no significant differences in other polyamines, tyramine or acetylated spermidine)<br>• Extent of change is significantly higher for probiotic cheese vs control for putrescine and acetylated putrescine | (91) |
| Cheese | Cheese (from cows with linseed oil added tot heir diet) vs. control cheese | 3 X 50 g/week | 4-week, randomized, double-blind, crossover | 30 healthy, free-living volunteers | GC-FID (Targeted) | Serum | • C18:0 in test cheese group vs baseline<br>• No other significant differences in serum fatty acids compared to baseline for either group (12:0, 14:0, 16:0, 18:0, 16:1, 18:1, 18:2, 20:4) | (92) |

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|---|---|---|---|---|---|---|---|---|
| **Fermented Food** | **All interventions** | **Dose** | **Study Design** | ***n*** | **Analytical Method** | **Biosample** | **Candidate FIBs[a]** | **Reference** |
| Soy | Untreated soymilk vs. beta-glucosidase soymilk vs. fermented soymilk | 100 mL | 7-day crossover | 12 healthy volunteers | LC-MS (Targeted) | Serum, urine | • Isoflavones (daidzein, genistein, glycitein) | (93) |
| Soy | Breakfast casseroles containing tofu, tempeh, cooked soybeans, or texturized vegetable protein | 30 g (texturized vegetable protein); 100 g (tempeh); 100 g (cooked soybeans); 300 g tofu | Acute, randomized, crossover | 10 healthy women | HPLC with variable wavelength detector (Targeted) | Plasma, urine, feces | • Isoflavones (daidzein, genistein) | (94) |
| Soy | Breakfast with natto and spinach vs. detergent-solubilized K1 vs. low-vitamin K diet | 200 g (natto) and 400 g (spinach) | Acute crossover | 6 healthy men | HPLC-FLD (Targeted) | Serum | • Vitamin K2 (menaquinones); higher than vitamin K1 (phylloquinones in spinach) | (95) |
| Soy | Fermented soy vs. non-fermented soy | 112 g (tempeh); 125 g (soybeans) | 9-day, randomized, crossover | 22 healthy men | GC-MS (Targeted) | Urine | • Isoflavoids (equol, O-desmethylangolensin, daidzein, genistein), daidzein and genistein recover greater with tempeh diet<br>• Lignans (enterolactone, enterodiol) decreased with soy intake | (96) |
| Soy | Fermented soymilk containing *Bifodibacterium animalis* Bb-12 vs. non-fermented soymilk | 200 mL/day, containing 20, 40, or 80 mg isoflavone/200 mL | 14-day, randomized, double-blind, crossover | 16 healthy postmenopausal women | HPLC-UV-VIS (Targeted) | Urine | • Isoflavones (genistein, daidzein, glycitein) aglycones, and beta-glucoside isomers | (97) |
| | | | | | | | • Equol (tendency to increase in the fermented group over time but did not reach significance) | (98) |
| Soy | Isogen capsules vs. soymilk vs. fermented soybeans | 84.8 mg (isogen); 43.8 g (fermented soybeans); 600 mL (soymilk); standardised to 64.8 mg isoflavones | Acute, randomized, controlled, parallel | 26 healthy women | HPLC (detector not specified) (Targeted) | Plasma, urine | • Isoflavones (genistein, daidzein) higher urinary recovery in fermented group, longer plasma half-life in fermented and isogen groups | (99) |

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|---|---|---|---|---|---|---|---|---|
| **Fermented Food** | **All interventions** | **Dose** | **Study Design** | ***n*** | **Analytical Method** | **Biosample** | **Candidate FIBs[a]** | **Reference** |
| Soy | Tofu, natto (fermented soybean), soy milk, soy isoflavone supplement | 180 g (tofu), 100 g (natto), 300 g (soymilk), 1 supplement, all standardized to 75 mg isoflavones | 1-day intervention | 20 healthy women (9 equol producers and 11 non-producers) | HPLC-UV (Targeted) | Urine | • Isoflavones (genistein, daidzein) | (100) |
| Soy | Fermented soy powder (aglycone-rich) with *Aspergillus oryzae* vs. non-fermented soy powder (glycoside-rich) | 23 g (standardized to 95 umol isoflavones) | Acute, randomized, double-blind, crossover | 11 healthy postmenopausal women | LC-MS/MS (Targeted) | Serum, urine | • Isoflavones (total) increased bioavailability and urinary excretion; trend towards increased in daidzein, genistein, and glycitein as well, no significant difference in equol | (101) |
| Soy | Stinky tofu | 146 g | Acute intervention | 36 healthy volunteers (18 equol producers, 18 non-producers) | HPLC-UV (Targeted) | Urine | • S-equol, similar rates of excretion in producers and non-producers<br>• Daidzein and dihydrodaidzein<br>• Total daidzein (daidzein, dihydrodaidzein, S-equol, O-desmethylangolensin) | (102) |
| Soy | Fermented soymilk with *Lactobacillus casei* Shirota (containing aglycones) vs. placebo soymilk (no aglycones) | 100 mL | Acute, randomized, double-blind, placebo-controlled, crossover | 7 healthy postmenopausal women | LC-MS/MS (Targeted) | Serum | • Isoflavones (genistein, daidzein, glycitein, dihydrodaidzein, O-desmethylangolensin, equol) | (103) |
| Soy | Natto (fermented with *Bacillus natto*) | Natto consumption frequency (questionnaire); 80 g in acute intervention | Cross-sectional, and acute intervention | Group 1: 49 postmenopausal women from Tokyo (8 also participated in acute intervention)<br>Group 2: 25 postmenopausal | HPLC-FLD (Targeted) | Serum | • Vitamin K2 (menaquinone-7)<br>• Phylloquinone (slightly higher in Japanese than British women)<br>• Menaquinone-4 (below limit of detection in most women) | (104) |

| **Summary of Targeted Studies Presenting Candidate FIBs for Fermented Foods** | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Fermented Food** | **All interventions** | **Dose** | **Study Design** | ***n*** | **Analytical Method** | **Biosample** | **Candidate FIBs[a]** | **Reference** |
| | | | | women from Hiroshima<br>Group 3: 31 postmenopausal British women | | | | |
| Soy | Soya milk vs. miso soup | 250 mL (soymilk); 31 g Hacco miso; standardized to 48 mg isoflavones | 1-day or 2 non-consecutive days, randomized, crossover | 21 healthy women | LC-MS (Targeted) | Urine | • Isoflavones (daidzein, genistein, equol) | (105) |
| Soy | Fermented soy (tempeh) vs. non-fermented soy (soybean) | 112 g (tempeh); 125 g (soybean) | 9-day, randomized, controlled, crossover | 17 healthy men | GC-MS (Targeted) | Urine | • Isoflavones (daidzein, genistein) higher excretion for fermented group (although fermentation decreased isoflavone content of the soy product) | (106) |
| Soy | Soy flour vs. fermented soybean paste | 12.2 g (soy flour); 52 g (soybean paste); standardized to 20 mg isoflavones | Acute, randomized, controlled, crossover | 10 healthy volunters | LC-ESI-MS/MS (Targeted) | Urine | • 20 isoflavone metabolites detected, consisting of daidzein and genistein glucuronides and sulfoglucuronides, daidzein sulfate, equol glucuronide, and ODMA glucuronides)<br>• Isoflavones (especially glucuronides of daidzein, genistein) higher in fermented group | (107) |
| Soy | Natto fermented with *Bacillus subtilis,* double-boiled natto with short interval, vitamin K syrup | 50 g/day | 3-day intervention with untreated natto; acute, crossover with natto, boiled natto, and vitamin K syrup | 32 healthy volunteers | HPLC (detector not specified) (Targeted) | Plasma | • Menaquinone-7 (increased following natto consumption; negligible levels of phylloquinone and menaquinone-4)<br>• Lower levels of menaquinone-7 following boiled natto consumption compared to regular natto and syrup | (108) |
| Soy | Fermented soybean soup with *Aspergillus oryzae* vs. placebo soup | 20 g powder with water; standardized to 24 mg isoflavones/day | 4-week, randomized, double-blind, placebo-controlled, parallel | 65 healthy postmenopausal women | HPLC-UV (Targeted) | Urine | • Isoflavones (daidzein, genistein, glycitein), total isoflavoens, especially daidzein and glycitein, were higher in fermented group | (109) |

| Summary of Targeted Studies Presenting Candidate FIBs for Fermented Foods | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Fermented Food** | **All interventions** | **Dose** | **Study Design** | ***n*** | **Analytical Method** | **Biosample** | **Candidate FIBs[a]** | **Reference** |
| Soy | Soybean milk, fried bean curd puff, fresh bean curd, soybeans, fermented bean curd, and other bean foods | Quartiles of soy product consumption, including soybean milk, fried bean curd puff, fresh bean curd, soybeans, fermented bean curd, and other bean foods (from FFQ) | Case-control nested within a large randomized trial of breast self-examination among textile workers in Shanghai | 1823 women (1590 women without breast cancer, and 233 women with breast cancer) | LC-coularray and LC-MS (Targeted) | Serum | • Isoflavones (daidzein, genistein) | (110) |
| Soy | Regular natto vs. reinforced natto 1 vs. reinforced natto 2 | 50 g (775 ug/100g MK7; 1298 ug/100g MK7; 1765 ug/100g MK7) | 7-day crossover | 8 healthy men | HPLC (detector not specified) (Targeted) | Serum | • Vitamin K2 (menaquinone-7) | (111) |
| | Rare intake of natto vs. occasional intake vs. frequent intake | ~0 (rare); a few times a month (occasional), a few times a week (frequent) (from food record) | Cross-sectional | 134 healthy volunteers | | | | |
| Soy | Biscuits with fermented soybean meal vs. biscuits with soybean meal | 75 g; dose equivalent to 0.44 mg/kg body weight of isoflavones | Acute, randomized, double-blind, crossover | 18 healthy volunteers | HPLC-DAD-FLD (Targeted) | Urine | • Glycitein<br>• Daidzein<br>• Genistein<br>• Dihydrodaidzein<br>• O-demethylangolensin<br>• Dihydrogenistein<br>• 6-hydroxy-O-demethylangolensin<br>• Equol<br>• Total aglycones<br>• Total colonic metabolites | (112) |
| Soy | Testmeals with fermented soybean vs. non-fermented soybean | 33 g of soybean | Acute (2-dose), randomized, controlled, crossover | 12 healthy volunteers | UPLC-DAD-QTOF-MS (Targeted) | Plasma, urine | • Soy isoflavones: genistein 5-O-glucoside, daidzein 7-O-glucoside (daidzin), glycitein 7-O-glucoside (glycitin), genistein 7-O-glucoside (genistin), daidzein 4′-O-(6″-O-malonyl)glucoside, genistein 5-O-(6″-O-malonyl)glucoside, daidzein 7-O-(4″-O-malonyl)glucoside, glycitein 7-O-(4″-O-malonyl)glucoside, daidzein 7-O-(6″-O-malonyl)glucoside, glycitein 7-O-(6″-O-malonyl)glucoside, daidzein 7-O-(6″-O-succinoyl)glucoside, daidzein 7-O-(6″-O-acetyl)glucoside, genistein 4′-O-(6″-O-malonyl)glucoside, genistein 7-O-(4″-O-malonyl)glucoside, glycitein 7-O-(6″-O-acetyl)glucoside, genistein 7-O-(6″-O-malonyl)glucoside, genistein 4′-O-(6″-O- | (113) |

| Summary of Targeted Studies Presenting Candidate FIBs for Fermented Foods | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Fermented Food** | **All interventions** | **Dose** | **Study Design** | ***n*** | **Analytical Method** | **Biosample** | **Candidate FIBs[a]** | **Reference** |
| | | | | | | | acetyl)glucoside, daidzein, genistein 7-O-(6″-O-succinoyl)glucoside glycitein, genistein 7-O-(6″-O-acetyl)glucoside genistein, Sum of glucoside forms, simple glucoside, acetyl glucoside, succinyl glucoside, malonyl glucoside) | |
| Soy | Fermented soybean paste (Cheonggukjang) | 50 g/kg body weight | Acute intervention | 48 healthy men | UPLC-QTOF-MS (Targeted) | Plasma | • Isoflavone metabolites: Daidzein, Genistein, Glycitein, 3-hydroxydaidzein, 2-hydroxygenistein, Daidzein 4'-glucuronide, Daidzein 7-glucuronide, Daidzein diglucuronide, Daidzein 4'-sulfate, Daidzein 7-sulfate 4'-glucuronide, Genistein 7-glucuronide, Genistein diglucuronide, Genistein-7-glucuronide-4'-sulfate, Genistein 4'-sulfate, Genistein-7-sulfate, Dihydrogenistein, Dihydrodaidzein sulfate, Equol-7-glucuronide, Equol-4-sulfate, 5-hydroxy equol, O-Desmethylangolensin) | (114) |
| Bread | Whole-grain and fibre-rich rye bread vs. refined wheat bread | 174 g/day (wholegrain products); 188 g/day (refined white breads) | 12-week, randomized, parallel | 51 volunteers with metabolic syndrome | GC-MS (Targeted) | Plasma | • Alkylrecorsinols (AR homologs C17:0-25:0) | (115) |
| Bread | Wholegrain wheat and rye | Continuous intake of various wholegrains (from FFQ) | Association study | 360 postmenopausal women from the Danish Diet, Cancer and Health Study | GC-MS (Targeted) | Plasma | • Alkylrecorsinols (AR homologs C17:0-25:0) | (116) |
| Bread | High-fiber rye bread | 198 g (containing 45 mg ARs) and 21 g butter | Acute intervention | 15 healthy volunteers | HPLC-CEAD (Targeted) | Plasma | • Alkylrecorsinol metabolites DHBA and DHPPA | (117) |
| Bread | Whole grain breads | Total daily whole grain intake (whole grain soft bread + dark crisp bread) (from FFQ) | Association | 20 free-living women from the Swedish Mammography Cohort | GC-MS (Targeted) | Plasma, subcutaneous adipose tissue | • Alkylrecorsinols (AR homologs C17:0-25:0) | (118) |
| Bread | Wholegrain rye porridge vs. refined wheat bread | 2 wholegrain rye porridges (40/55 g), 3 rye porridges with different inulin | Acute, randomized, crossover | 21 healthy volunteers | NMR (36 plasma metaboites); GC-MS (short chain | Plasma | • Valine, leucine, isoleucine, lysine, phenylalanine, 2-oxoisocaproate<br>• Acetate, butyrate, propionate, acetoacetate, 3-hydroxybutyrate | (119) |

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|---|---|---|---|---|---|---|---|---|
| **Fermented Food** | **All interventions** | **Dose** | **Study Design** | ***n*** | **Analytical Method** | **Biosample** | **Candidate FIBs[a]** | **Reference** |
| | | (55 g); refined wheat bread (55 g) | | | fatty acids) (Targeted) | | | |
| Bread | Rye bran bread products vs. control wheat bread products | 250 g | 6-week, randomized, crossover | 18 healthy postmenopausal women | HPLC-DAD (Targeted) | Urine | • Ferulic acid | (120) |
| Bread | Wheat bread vs. fresh pasta (both enriched with wheat bran) | 132 g (bread); 119 g (pasta) | Acute, randomized, crossover | 9 healthy men | GC-MS (Targeted) | Plasma | • L-Isoleucine, L-leucine, lactic acid, fructose, xyloe, arabinose, 2,4-dihydroxybutanoic acid, L-phenylalanine, L-proline (treatment X time effect)<br>• 1,2-diglyceride, 1-methylhistidine, urea, sitosterol, glyceric acid, phosphate, fumaric acid (treatment effect)<br>• C14:0, C17:0, glycerol, beta-alanine, L-valine, L-tryptophan, L-tyrosine, inositol, succinic acid, citric acid, L-ornithine, mannose, 2-hydroxypiperidine, iminodiacetic acid, ribulose/xylulose (treatment and time effect) | (121) |
| Bread | Wholegrain bread vs. bread enriched with aleurone fraction | 94 g (wholegrain bread had 87 mg of ferulic acid, while aleurone bread had 43 mg) | Acute, single-blind, randomized, crossover | 15 healthy volunteers | U(H)PLC-MS and MS/MS (Targeted) | Urine, plasma | • Ferulic acid metabolites (especially ferulic acid-4'-O-sulfate, dihydroferulic acid-4'-O-sulfate, dihydroferulic acid-O-glucuronide) | (122) |
| Bread | Wholegrain wheat crisp bread vs. wholegrain rye crisp bread | 100 g/day | 1-week, randomized, crossover | 15 healthy volunteers | GC-MS (ARs), automatic fluoroimmunoassay (enterolactone) (Targeted) | Plasma, erythrocytes, lipoproteins (ARs), serum (enterolactone) | • Alkylrecorsinols (AR homologs C17:0-21:0)<br>• Enterolactone | (123) |
| Bread | Wholegrain rye and wheat bread vs. no wholegrain rye and wheat products (in habitual diet) | 1. Habitual diet of wholegrain rye bread (3-5 pieces/day) and wholegrain wheat bread (2 pieces/day)<br><br>2. Habitual diet and wholegrain rye bread (2 pieces/day) and wholegrain | 1. 1 week avoidance, 1 week habitual diet<br><br>2. 2 weeks of habitual diet<br><br>3. 2 weeks of gluten-free diet | 1. 4 healthy volunteers<br><br>2. 4 healthy voluntters<br><br>3. 1 volunteer | GC-MS (Targeted) | Plasma, erythrocytes | • Alkylrecorsinols (AR homologs C17:0-25:0) | (124) |

| Summary of Targeted Studies Presenting Candidate FIBs for Fermented Foods | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Fermented Food** | **All interventions** | **Dose** | **Study Design** | ***n*** | **Analytical Method** | **Biosample** | **Candidate FIBs[a]** | **Reference** |
| | | wheat bread (2 pieces/day)<br><br>3. Gluten-free diet with no wheat, rye, or barley products | | | | | | |
| Bread | High-fiber rye bread | 198 g (containing 100 mg ARs) and 21 g butter | Acute intervention | 15 healthy volunteers | HPLC-CEAD (Targeted) | Urine | • Alkylrecorsinol metabolites DHBA and DHPPA | (125) |
| Bread | Bread, rye bread, refined wheat bread, bran-seed bread | Continuous intake of bread, rye bread, refined wheat bread, bran-seed bread (from 3-day food records) | Association study | 31 free-living men with prostate cancer and 91 non-cancer control men | HPLC-CEAD (Targeted) | Plasma (DHPPA), urine (DHBA and DHPPA) | • Alkylrecorsinol metabolites DHBA and DHPPA | (126) |
| Bread | Wholegrain products | Continuous intake of wholegrain products, including rye bread, wholegrain bread, rolled oats and muesli, and crispbread (from FFQ) | Association study | 43 893 volunteers from the Danish Diet, Cancer, and Health cohort (ARs were measured in subset of 516 volunteers) | GC-MS (Targeted) | Plasma | • Alkylrecorsinols (AR homologs C17:0-25:0) | (127) |
| Bread | Wholegrain wheat vs. refined wheat | 70 g/day biscuits (wholegrain); 33 g/day crackers and 27 g/day toasted bread (refined grain) | 8-week, randomized, placebo-crontrolled, parallel | 80 healthy obese/over weight volunteers | HPLC-MS/MS (Targeted) | Serum, urine, feces | • Phenolic acids (dihydroferulic acid in serum, ferulic acid in feces following wholegrain wheat) | (128) |
| Bread | Refined-grain wheat bread vs. wholegrain wheat bread | 196 g (refined grain); 208 g (wholegrain), both with 21 g butter | Acute, crossover | 12 healthy volunteers | LC-MS (Targeted) | Urine | • Alkylrecorsinol metabolites (3,5-DHBA glycine, 3,5-DHPPTA, 3,5-DHBA, 3,5-DHPPA) | (129) |

| Summary of Targeted Studies Presenting Candidate FIBs for Fermented Foods | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Fermented Food** | **All interventions** | **Dose** | **Study Design** | ***n*** | **Analytical Method** | **Biosample** | **Candidate FIBs[a]** | **Reference** |
| Bread | Wholegrain rye bread vs. low-fiber wheat bread | 214 g (rye); 178 (wheat) | 8-week, randomized, crossover | 39 healthy postmenopausal women | GC-MS (ARs); fluoroimmunoassay (enterolactone) (Targeted) | Plasma | • Alkylrecorsinols<br>• Enterolactone | (130) |
| Bread | White wheat flour soft bread and white wheat flour crispbread vs. rye bran-enriched soft bread and whole grain rye crisp bread | 142.8 g/day and 92.4 g/day; 180.6 g/day and 91.0 g/day | 2-week, randomized, crossover | 10 volunteers with previous proctocolectomy for ulcerative colitis | GC-MS (Targeted) | Ileal effluent | • Alkylrecorsinols (AR homologs C17:0-25:0) | (131) |
| Bread | Sourdough fermented bread vs. traditional sourdough bread vs. baker's yeast bread | 215 mL (mimicking chewing and homogenisation of the bread portion + 160 mL water) | Acute, randomized, double-blind, crossover | 36 healthy volunteers | Biochrom 30 series Amino Acid Analyzer (Targeted) | Plasma | • Total free amino acids | (132) |
| Bread | Rye-based bread vs. white wheat bread | 75 g | 3-day, randomized, controlled, crossover | 38 healthy volunteers | GC (detector not specified) (Targeted) | Plasma | • Acetate<br>• Butyrate<br>• Total SCFAs | (133) |
| Cocoa | Sugar-free, flavanol-rich cocoa alone vs. low-dose sugar + cocoa vs. high-dose sugar + cocoa | 0.125 g/kg body weight (cocoa); 8.75 kJ/kg (low-dose sugar); 17.5 kJ/kg (high-dose sugar) | Acute crossover | 6 healthy volunteers | HPLC-coulometric multiple-array detection (Targeted) | Plasma | • Total flavonols (epicatechin + catechin) | (134) |
| | Sugar-free, flavanol-rich cocoa alone vs. bread+ cocoa vs. steak + cocoa vs. butter + cocoa (macronutrient-rich foods) | 0.125 g/kg body weight (cocoa); 17.5 kJ/kg (foods) | | | | | • Total flavonols (epicatechin + catechin) | |

| Summary of Targeted Studies Presenting Candidate FIBs for Fermented Foods | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Fermented Food** | **All interventions** | **Dose** | **Study Design** | ***n*** | **Analytical Method** | **Biosample** | **Candidate FIBs[a]** | **Reference** |
| | Sugar-free, flavanol-rich cocoa alone vs. bread + cocoa vs. milk + cocoa vs. grapefruit juice + cocoa | 0.125 g/kg body weight (cocoa); 17.5 kJ/kg (foods) | | | | | • Total flavonols (epicatechin + catechin) | |
| | Water + cocoa vs. water + cocoa + Famotidine | 0.125 g/kg body weight (cocoa); 20 mg (Famotidine) | | | | | • No difference in flavonols | |
| Cocoa | Semi-sweet chocolate (M&Ms chocolate mink baking bits) vs. vanilla milk chips | 80 g | Acute, parallel | 13 healthy volunteers | HPLC-Coulochem II detector (Targeted) | Plasma | • Catechin<br>• Epicatechin | (135) |
| Cocoa | Nestle Noir 70% dark chocolate | 100 g | Acute intervention | 5 healthy volunteers | LC-MS/MS (Targeted) | Plasma, urine | • (-)-Epicatechin-3'-beta-D-glucuronide<br>• (-)-Epicatechin-3'-sulfate<br>• 3'-O-methyl epicatechin sulfates | (136) |
| Cocoa | Cocoa powder + skimmed milk vs. skimmed milk | 20 g/day with 250 mL skimmed milk; 500 mL/day skim milk | 4-week, randomized, controlled, crossover | 42 healthy volunteers | LC-MS/MS (Targeted) | Plasma, urine | • (-)-Epicatechin<br>• (-)-Epicatechin glucuronides and sulfates<br>• O-methyl-epicatechin glucuronides and sulfates<br>• DHPV glucuronides and sulfates<br>• MHPV glucuronides and sulfates<br>• Vanillic acid<br>• 3,4-Dihydroxyphenylacetic acid<br>• 3-Hydroxyphenylacetic acid | (137) |
| Cocoa | Cocoa powder + water vs. cocoa powder + whole milk vs. whole milk | 40 g (cocoa powder) in 250 mL (milk or water) | Acute, randomized, crossover | 21 healthy volunteers | HPLC-MS/MS (Targeted) | Urine | • (-)-Epicatechin glucuronide<br>• (-)-Epicatechin sulfates | (138) |
| Cocoa | Dark chocolate vs. high sucrose chocolate vs. high milk protein chocolate vs. sucrose milk protein | 40 g or 250 mL (for drinks) | Acute, randomized, crossover | 6 healthy volunteers | HPLC-EAD (Targeted) | Serum | • Epicatechin, catechin, and glucuronide and sulfate conjugates | (139) |

| Summary of Targeted Studies Presenting Candidate FIBs for Fermented Foods | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Fermented Food** | **All interventions** | **Dose** | **Study Design** | ***n*** | **Analytical Method** | **Biosample** | **Candidate FIBs[a]** | **Reference** |
| | chocolate drink vs. non-nutritive sweetner milk protein chocolate drink | | | | | | | |
| Cocoa | Flavonoid-rich dark chocolate (72%) vs. flavonoid-free placebo (dyed) white chocolate | 50 g | Acute, randomized, controlled, parallel | 65 healthy men | HPLC-EAD (Targeted) | Plasma | • Epicatechin | (140) |
| Cocoa | High-flavanol chocolate with mannitol vs. high-flavanol chocolate with sucrose vs. low-flavanol chocolate with sucrose | 25 g; standardized to macro and micronutrients, theobromine, and caffeine | Acute, randomized, double-blind, crossover | 15 healthy volunteers | HPLC-FLD/UV (Targeted) | Plasma | • Total cocoa flavanols (epicatechin, catechin, procyanidin oligomers)<br>• 3' and 4'-O-methylated epicatechins | (141) |
| Cocoa | Cocoa beverage vs. milk | 40 g cocoa powder in 250 mL milk; 250 mL milk | Acute, randomized, controlled, crossover | 36 healthy volunteers | Folin-Ciocalteu Assay (modified) (Targeted) | Urine | • Total polyphenols (+-catecgub equivalents) | (142) |
| Cocoa | Cocoa with water | 40 g cocoa powder in 250 mL water | Acute intervention | 21 healthy volunteers | LC-MS/MS (Targeted) | Urine | • Caffeic acid<br>• Ferulic acid<br>• 3-hydroxyphenylacetic acid<br>• Vanillic acid<br>• 3-hydroxybenzoic acid<br>• 4-hydroxyhippuric acid<br>• Hippuric acid<br>• (-)-Epicatechin<br>• Procyanidin B2 | (143) |
| Cocoa | Dark chocolate (70%) vs. white chocolate | 45 g | 2-week, controlled, parallel | 20 healthy volunteers | HPLC-DAD (Targeted) | Plasma | • (-)-Epicatechin | (144) |
| Cocoa | Cocoa beverage with milk vs. cocoa beverage with water | 10 g cocoa power in 250 mL milk or water | Acute crossover | 9 healthy volunteers | HPLC-PDA, HPLC-MS (Targeted) | Plasma, urine | • (Epi)catechin-O-sulfate<br>• (-)-Epicatechin-O-glucuronide<br>• (Epi)catechin-O-sulfate<br>• O-Methyl-(epi)catechin-O-sulfate | (145) |

| Summary of Targeted Studies Presenting Candidate FIBs for Fermented Foods | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Fermented Food** | **All interventions** | **Dose** | **Study Design** | ***n*** | **Analytical Method** | **Biosample** | **Candidate FIBs[a]** | **Reference** |
| Cocoa | Hershey's milk chocolate | 113 g | Acute intervention | 6 nursing mothers | HPLC (detector not specified) (Targeted) | Plasma, saliva, breast milk | • Theobromine | (146) |
| Cocoa | Dark chocolate vs. white chocolate | 6.3 g/day | 18-week, randomized, controlled, parallel | 44 healthy volunteers | LC-MS/MS (Targeted) | Plasma | • Epicatechin<br>• Catechin<br>• Procyanidin B2<br>• Procyanidin B2 galate | (147) |
| Cocoa | Cocoa powder with no added methylxanthine vs. cocoa powder enriched with methylxanthine | 15 g dissolved in 200 mL (milk) | Acute, randomized, controlled, crossover | 13 healthy volunteers | HPLC-DAD, LC-QTOF, LC-DAD (Targeted) | Plasma, urine | • Theobromine<br>• Caffeine<br>• Paraxanthine<br>• Theophylline<br>• Methylxanthines (1-, 3-, 7, 1,7-, 3,7-, 1,3-, 1,3,7-)<br>• Methyluric acid (1-, 1,3-, 1,7-, 3,7-, 1,3,7-) | (148) |
| Cocoa | Cocoa in skimmed milk vs. skimmed milk | 40 g/day (cocoa powder) in 500 mL (milk) | 4-week, randomized, crossover | 42 volunteers with high CV risk | LC-MS/MS (Targeted) | Urine | • (-)-Epicatechin glucuronides and sulfates<br>• O-Methyl-epicatechin glucuronides and sulfates<br>• 5-(3-Methyoxy-4-hydroxyphenyl)-gamma-valerolactone glucuronides and sulfates<br>• 5-(3,4-Methyoxy-4-hydroxyphenyl)-gamma-valerolactone<br>• 3-Hydroxyphenylacetic acid<br>• 3,4-Dihydroxyphenylacetic acid<br>• Vanillic acid | (149) |
| Cocoa | Dark chocolate (85%) vs. milk chocolate (<35%) | 40 g | Acute, single-blind, crossover | 20 healthy volunteers and 20 smokers | HPLC-UV (Targeted) | Serum | • Epicatechin | (150) |
| Cocoa | Cocoa beverage | 0.375 g cocoa/kg body weight in 300 mL water | Acute intervention | 5 healthy volunteers | HPLC-CEAD, LC-MS/MS (Targeted) | Plasma | • Procyanidin dimer B2 [epicatechin-4beta-8)-epicatechin]<br>• Catechin<br>• Epicatechin | (151) |
| Cocoa | Flavanoid-enriched chocolate bars vs. placebo | 27 g/day with 90 mg catechin/day | 1-year, randomized, controlled, parallel | 93 postmenopausal women with type 2 diabetes | LC-MS/MS (Targeted) | Urine | • Epicatechin monoglucuronide<br>• Methylepicatechin monoglucuronide<br>• Epicatechin monosulfate<br>• Methylepicatechin sulfate<br>• Epicatechin monosulfate monoglucuronide | (152) |
| Cocoa | Cocoa in whole milk vs. cocoa in water vs. milk | 40 g (cocoa powder) in 250 mL (milk or water) | Acute, randomized, crossover | 21 healthy volunteers | LC-MS/MS (Targeted) | Plasma | • (-)-Epicatechin glucuronide | (153) |

| Summary of Targeted Studies Presenting Candidate FIBs for Fermented Foods | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Fermented Food** | **All interventions** | **Dose** | **Study Design** | ***n*** | **Analytical Method** | **Biosample** | **Candidate FIBs[a]** | **Reference** |
| Cocoa | Cocoa beverage | Powder in 500 mL water; 10.7 mg cocoa flavanols/kg body weight | Acute intervention (X2) | 7 healthy young volunteers | HPLC-FLD/UV/ECD (Targeted) | Plasma, urine | • (-)-Epicatechin-3'-beta-D-glucuronide<br>• (-)-Epicatechin-3'-sulfate<br>• 3'-O-Methyl-(-)-epicatechin-5-sulfate<br>• 3'-O-Methyl-(-)-epicatechin-7-sulfate | (154) |
| | Cocoa beverage vs. acetaminophen in beverage | Powder in 500 mL water; 5.3 and 10.7 mg cocoa flavanols/kg body weight; 2X 500 mg acetaminophen in water | Acute, randomized, crossover | 20 young healthy men and 20 elderly healthy men | | | • (-)-Epicatechin-3'-beta-D-glucuronide<br>• (-)-Epicatechin-3'-sulfate<br>• 3'-O-Methyl-(-)-epicatechin-5-sulfate<br>• 3'-O-Methyl-(-)-epicatechin-7-sulfate | |
| Cocoa | High-flavanol cocoa drink vs. low-flavanol cocoa drink | Powder in 300 mL water; 917 mg or 37 mg cocoa flavanols | Acute, randomized, double-blind, crossover | 10 healthy men | HPLC-MS (Targeted) | Plasma | • (-)-Epicatechin<br>• Catechin<br>• 4'-Methyl-epicatechin<br>• Epicatechin-O-beta-D-glucuronide<br>• 4'-O-Methyl-epicatechin-O-beta-D-glucuronide (highest) | (155) |
| Cocoa | Dark chocolate | 100 g | Acute intervention | Healthy volunteers (number not reported) | LC-MS/MS (Targeted) | Urine | • 3'-O-methyl-(-)-epicatechin-5/7-O-sulfate<br>• 4'-O-methyl-(-)-epicatechin-5/7-O-sulfate | (156) |
| Cocoa | High-flavanol chcolate vs. low-flavanol chocolate | 40 g (first visit single dose); 20 g/day thereafter | Acute and 12-week, randomized, parallel | 44 healthy pregnant women | HPLC-FLD (Targeted) | Plasma | • Epicatechin<br>• Catechin<br>• Caffeine<br>• Theobromine<br>• Theophylline | (157) |
| Cocoa | Cocoa in milk vs. whole milk | 40 g (cocoa powder) in 250 mL (milk) | Acute, randomized, crossover | 5 healthy volunteers | LC-MS/MS (Targeted) | Plasma, urine | • (-)-Epicatechin<br>• (-)-Epicatechin glucuronide<br>• (-)-Epicatechin sulfate | (158) |
| Cocoa | Alkalized cocoa powder in water | 20.3 g (cocoa powder) in 400 mL water | Acute intervention | 8 healthy volunteers | LC-MS/MS (Targeted) | Urine | • N-[4'-hydroxy-(E)-cinnamoyl]-L-aspartic acid<br>• N-[4'-hydroxy-(E)-cinnamoyl]-L-glutamic acid<br>• N-[4'-hydroxy-3'-methoxy-(E)-cinnamoyl]-L-tyrosine | (159) |
| Cocoa | Chocolate | 80 g | Acute intervention | 11 healthy volunteers | GC-MS, HPLC-ESI-MS/MS (Targeted) | Urine | • M-Hydroxyphenylpropionic acid<br>• Ferulic acid<br>• 3,4-dihydroxyphenylacetic acid<br>• M-hydroxyphenylacetic acid<br>• Vanillic acid<br>• M-Hydroxybenzoic acid | (160) |

| **Summary of Targeted Studies Presenting Candidate FIBs for Fermented Foods** | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Fermented Food** | **All interventions** | **Dose** | **Study Design** | ***n*** | **Analytical Method** | **Biosample** | **Candidate FIBs[a]** | **Reference** |
| Cocoa | Cocoa in whole milk vs. cocoa in water | 40 g (cocoa powder) in 250 mL (milk or water) | Acute, randomized, crossover | 21 healthy volunteers | LC-MS/MS (Targeted) | Urine | • 3,4-dihydroxyphenylacetic acid<br>• Phenylacetic acid<br>• Protocatechuic acid<br>• 4-hydroxybenzoic acid<br>• 4-hydroxyhippuric acid<br>• Hippuric acid<br>• Vanillic acid<br>• Caffeic acid<br>• Ferulic acid | (161) |
| Cocoa | Cocoa beverage vs. whole milk | 40 g (cocoa powder) in 250 mL water; 250 mL (milk) | Acute, randomized, crossover | 21 healthy volunteers | LC-MS/MS (Targeted) | Urine | • (-)-Epicatechin glucuronide<br>• (-)-Epicatechin sulfates | (162) |
| Cocoa | Chocolate (M&Ms semi-sweet chocolate mink baking bits) at 4 doses | 0, 27, 53, 80 g | Acute, randomized, crossover | 20 healthy volunteers | LC-Coulochem II coulometric detector (Targeted) | Plasma | • (-)-Epicatechin | (163) |
| Cocoa | Chocolate vs. cocoa | 35 g cocoa powder in each | Acute crossover | 5 healthy men | HPLC-MS (Targeted) | Plasma, urine | • (-)-Epicatechin and metabolites (glucuronides, sulfates, sulfoglucuronides, non-methylated, methylated) | (164) |
| Cocoa | Cocoa drink with low flavanols, medium flavanols, vs. high flavanols | 18 g cocoa beverage mix in 250 mL water | Acute, randomized, double-blind, controlled, crossover | 10 diabetic patients | HPLC-FLD (Targeted) | Plasma | • Total flavanols (epicatechin, catechin, and methylated, glucuronidated) | (165) |
| | Cocoa drink with high flavanols vs. low flavanols | | 30-day, randomized, double-blind, controlled, parallel | 40 diabetic patients | | | | |
| Cocoa | High-flavanol dark chocolate vs. low-flavanol dark chocolate | 46 g | 2-week, randomized, double-blind, placebo-controlled, parallel | 21 healthy volunteers | HPLC-ECD (Targeted) | Plasma | • Epicatechin | (166) |
| Cocoa | Dark chocolate (85%) vs. milk chocolate (≤35%) | 40 g | Acute, randomized, single-blind, crossover | 20 patients with peripheral | HPLC-UV (Targeted) | Serum | • Epicatechin<br>• Epicatechin-3-O-methylether<br>• Epigallocatechin-3-gallate | (167) |

| Summary of Targeted Studies Presenting Candidate FIBs for Fermented Foods | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Fermented Food** | **All interventions** | **Dose** | **Study Design** | ***n*** | **Analytical Method** | **Biosample** | **Candidate FIBs[a]** | **Reference** |
| | | | | artery disease | | | | |
| Cocoa | Chocolate vs. cola vs. caffeine capsules vs. theobromine capsules | 82 g (chocolate); 800 mL (cola); 72 mg (caffeine capsules); 370 mg (theobromine capsule) | Acute crossover | 7 healthy volunteers | HPLC-DAD (Targeted) | Plasma | • Methylxanthine<br>• Caffeine<br>• Paraxanthine<br>• Theophylline<br>• Theobromine | (168) |
| Cocoa | Cocoa drink vs. sugar | 36 g cocoa powder | 2-week, randomized, controlled, parallel | 15 healthy men | HPLC-amperometric ECD (Targeted) | Plasma, urine | • Epicatechin | (169) |
| Cocoa | Nestle Noir dark chocolate low-dose vs. high-dose | 40 g; 80 g | Acute crossover | 8 healthy men | HPLC-DAD/FLD (Targeted) | Plasma | • Theobromine<br>• Epicatechin | (170) |
| Cocoa | Dark chocolate vs. milk chocolate | 200 g | 3-day, randomized, controlled, parallel | 58 healthy volunteers | Enzymatic method (oxalate) | Urine | • Oxalate | (171) |
| Cocoa | Dark chocolate (70%) vs. white chocolate (4% cocoa) | 1 g/kg body weight | Acute crossover | 10 healthy volunteers | Not reported | Plasma | • Catechin<br>• Epicatechin and metabolites | (172) |
| Cocoa | Dark chocolate vs. theobromine sodium acetate oral solution | 6 mg/kg body weight of theobromine (chocolate); 10 mg/kg body weight theobromine (oral solution) | 7-day intervention (chocolate); acute intervention (oral solution) | 12 healthy volunteers | HPLC-solit scintillator flow cell detector (Targeted) | Urine, serum | • Theobromine | (173) |
| Cocoa | Milk chocolate vs. chocolate powder vs. dark chocolate | 40 g/day | 7-day crossover | 20 healthy volunteers | HPLC-PDA (Targeted) | Urine | • Theobromine | (174) |
| Cocoa | Non-alkalized cocoa beverage vs. alkalized cocoa beverage | 0.6 g/kg body weight (alkalized powder); 0.8 g/kg body | Acute, randomized, double-blind, crossover | 12 healthy volunteers | HPLC-CEAD (Targeted) | Plasma | • Epicatechin | (175) |

| Summary of Targeted Studies Presenting Candidate FIBs for Fermented Foods | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Fermented Food** | **All interventions** | **Dose** | **Study Design** | ***n*** | **Analytical Method** | **Biosample** | **Candidate FIBs[a]** | **Reference** |
| | | weight (non-alkalized powder) in 6 mL/kg body weight skimmed milk | | | | | | |
| Cocoa | Conventional cocoa beverage vs. flavanol-rich cocoa beverage | 15 g (conventional); 25 g (flavanol rich) in 200 mL semi-skimmed milk | Acute, radomised, blind, crossover | 13 healthy volunteers | HPLC-ESI-QTOF-MS (Targeted) | Plasma, urine | • Epicatechin metabolites (Epicatechin-3-glucuronide, 3-methoxy-glucuronide, 3-sulfate, methoxy-sulfate)<br>• Phenyl-gamma-valerolactone derivatives (DHPV lactones, 5-(3-Hydroxyphenyl)-γ-valerolactone-4-glucuronide, 5-(4-Hydroxyphenyl)-γ-valerolactone-3-glucuronide, 5-(Hydroxyphenyl)-γ-valerolactone-sulfate, 5-Phenyl-γ-valerolactone-methoxy-glucuronide, 5-Phenyl-γ-valerolactone-methoxy-sulfate, 5-(3-Hydroxyphenyl)-γ-valerolactone, 5-Phenyl-γ-valerolactone-3-glucuronide, 5-Phenyl-γ-valerolactone-3-sulfate)<br>• Phenylvaleric acid derivatives (4-Hydroxy-5-(3,4-dihydroxyphenyl)valeric acid, 4-Hydroxy-5-(hydroxyphenyl)valeric acid-glucuronide, 4-Hydroxy-5-(hydroxyphenyl)valeric acid-sulfate)<br>• Other microbial metabolites (3,4-Dihydroxyphenylpropionic acid, 3-Methoxy-4-hydroxyphenylpropionic acid 3-Hydroxyphenylpropionic acid 3,4-Dihydroxyphenylacetic acid, 3-Methoxy-4-hydroxyphenylacetic acid 3-Hydroxyphenylacetic acid, Ferulic acid Isoferulic acid, 3,4-Dihydroxybenzoic acid, 4-Hydroxyhippuric acid, 3-Hydroxyhippuric acid, Hydroxybenzoic acid ) | (176) |
| Cocoa | Milk chocolate vs. hazelnut and cocoa spread | 60 g | Acute, randomized, single-blind, crossover | 20 healthy smokers | Folin-Ciocalteau method (polyphenols); GC-MS (vitamin E) (Targeted) | Plasma (polyphenols); serum (vitamin E) | • Total polyphenols<br>• Vitamin E | (177) |
| Cocoa | Dark chocolate (90%) | 50 g | Acute intervention | 18 healthy men | U(H)PLC-ESI-MS/MS (Targeted) | Plasma | • Epicatechin and metabolites (glucuronides, glucuronide-sulfate, sulfates, methyl-epicatechin sulfates)<br>• Phenyl-gamma-valerolactones (5-(3-Hydroxyphenyl)-g-valerolactone-4-glucuronide, 5-Phenyl-g-valerolactone-glucuronide-sulfate, 5-(4-Hydroxyphenyl)-g-valerolactone-3-glucuronide, 5-Phenyl-g-valerolactone-3-glucuronide, 5-(Hydroxyphenyl)-g-valerolactone-sulfate isomers, 5-Phenyl-g-valerolactone-sulfate-methoxy, 5-Phenyl-g-valerolactone-3-sulfate) | (178) |

| Summary of Targeted Studies Presenting Candidate FIBs for Fermented Foods | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Fermented Food** | **All interventions** | **Dose** | **Study Design** | ***n*** | **Analytical Method** | **Biosample** | **Candidate FIBs[a]** | **Reference** |
| Cocoa | Cocoa-enriched dark chocolate (70%) vs. cocoa-depleted control chocolate | 561 kcal | Acute, single-blind, randomized, crossover | 16 healthy male cyclists | RP-HPLC-UV (Targeted) | Plasma | • Epicatechin<br>• Theobromine | (179) |
| Coffee | Coffee consumption | 0, 1, 2-4, 5-8, >8 cups of coffee/day (from questionnaire) | Association study | 3503 patients undergoing elective coronary angiography from the WECAC cohort | LC-MS/MS (Targeted) | Plasma | • Trigonelline<br>• Nicotinamide<br>• N-methylnicotinamide | (180) |
| Coffee | Instant coffee (Nescafe Gold Blend) | 3.4 g powder in 200 mL water | Acute intervention | 5 volunteers with an ileostomy | HPLC-PDA-MS/MS (Targeted) | Ileal effluent, urine | • Total chlorogenic acid and metabolites<br>• 3-, 4-, and 5-O-caffeoylquinic acids<br>• 3-, 4-, and 5-O-caffeoylquinic acid sulfates<br>• 3- and 4--O-caffeoylquinic acid glucuronides<br>• 3-, 4-, and 5-O-feruloylquinic acids<br>• 3-, 4-, and 5-O-feruloylquinic acid sulfate<br>• 3- and 4-O-feruloylquinic acid glucuronides<br>• 3- and 4-O-caffeoylquinic acid lactones<br>• 3- and 4-O-caffeoylquinic glucuronides and sulfates<br>• 4- and 5-O-p-coumaroylquinic acid<br>• 3,4-, 3,5-, and 4,5-O-di-caffeoylquinic acid<br>• Caffeic acid<br>• Caffeic acid 4- and 3-O-sulfates<br>• Ferulic acid<br>• Ferulic acid-4-O-sulfate<br>• Feruloylglycine<br>• Dihydroferulic acid-4-O-sulfate<br>• Isoferulic acid 3-O-sulfate and glucuronide<br>• Dihydrocaffeic acid-3-O-sulfate | (181) |
| Coffee | Instant coffee | 200 mL | Acute intervention | 11 healthy volunteers | HPLC-PDA-MS/MS (Targeted) | Plasma, urine | • Dihydrocaffeic acid 3’-sulfate<br>• Dihydrocaffeic acid-3’-O-glucuronide<br>• Caffeic acid 4’-sulfate<br>• Dihydroferulic acid 4’-sulfate<br>• Caffeic acid 3’-sulfate<br>• Dihydroferulic acid 4’-O-glucuronide<br>• Ferulic acid 4’-sulfate<br>• Isoferulic acid 3’-sulfate<br>• Dihydroisoferulic acid 3’-O-glucuronide | (182) |

| Summary of Targeted Studies Presenting Candidate FIBs for Fermented Foods | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Fermented Food** | **All interventions** | **Dose** | **Study Design** | ***n*** | **Analytical Method** | **Biosample** | **Candidate FIBs[a]** | **Reference** |
| | | | | | | | • Isoferulic acid 3'-O-glucuronide | |
| Coffee | Coffee vs. tea vs. Cola soft drink | At least 1 cup of coffee or tea, 500 mL soft drink | Acute intervention | 146 healthy volunteers | HPLC-UV (Targeted) | Urine | • 5-acetylamino-6-formylamino-3-methyluracil<br>• 1-methylxanthine | (183) |
| Coffee | Low-polyphenol coffee vs. high-polyphenol coffee vs. caffeine in hot water | 3.6 g ground coffee to 50 mL water; 110 mg caffeine | Acute, randomized, controlled, crossover | 15 healthy men | U(H)PLC-ESI-MS/MS (Targeted) | Plasma | • Total chlorogenic acid metabolites<br>• 3-caffeoylquinic acid<br>• 4-caffeoylquinic acid<br>• Caffeic-4-O-sulfate<br>• 3-feroylquinic acid<br>• 4-feroylquinic acid<br>• 5-feroylquinic acid<br>• Ferulic acid<br>• Isoferulic acid<br>• Methylferulic acid<br>• Ferulic-4-O-glucuronide<br>• Isoferulic-3-O-glucuronide<br>• Ferulic-4-O-sulfate<br>• Isoferulic-3-O-sulfate | (184) |
| Coffee | Caffeinated coffee vs. decaffeinated coffee vs. combination | 2 cups (caffeinated); 2 cups (decaffeinated); 1 cup (caffeinated) + 1 cup (decaffeinated) | Acute, randomized, crossover | 17 men with coronary artery disease performing a treadmill test | HPLC (detector not specified) (Targeted) | Serum | • Caffeine | (185) |
| Coffee | Coffee (mostly instant coffee) and tea | Number of cups of coffee and tea consumption (FFQ for usual consumers; 24h recall for current consumers) | Association study | 111 free-living volunteers (usual consumers); 344 healthy volunteers (current consumers) | GC-MS (Targeted) | Urine | • Isoferulic acid | (186) |

| Summary of Targeted Studies Presenting Candidate FIBs for Fermented Foods | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Fermented Food** | **All interventions** | **Dose** | **Study Design** | ***n*** | **Analytical Method** | **Biosample** | **Candidate FIBs[a]** | **Reference** |
| Coffee | Filtered coffee | 0 (refrain from consumption), 4 cups/day, 8 cups/day (150 mL/cup) | 1-month, crossover | 47 habitual coffee drinkers | HPLC-MS, GC-MS (Targeted) | Serum, plasma | • Caffeine<br>• Paraxanthine<br>• Theobromine<br>• Theophylline<br>• Caffeic acid<br>• Dihydrocaffeic acid<br>• Ferulic acid<br>• Isoferulic acid<br>• Dihydroferulic acid<br>• Dihydroisoferulic acid<br>• 3-(3-Hydroxyphenyl)propanoic acid<br>• 3-(3,4-Dimethoxyphenyl)propanoic acid<br>• 3,4-Dimethylcaffeic acid<br>• 3-Coumaric acid | (187) |
| Coffee | Coffee | Cups of coffee consumption (1-2, 3-7, >8) (from survey) | Association study | 284 healthy men | LC-ESI-MS/MS (Targeted 363 metabolites) | Serum | • Sphingomyelin SM(OH,COOH)<br>• Sphingomyelin SM(OH)<br>• Long- and medium-chain acylcarnitines | (188) |
| Coffee | Coffee | Non-coffee consumers (0 mL/day), low-coffee consumers (≤100 mL/day), high-coffee consumers (>100 mL/day) (from 24h recalls and FFQ) | Association study | 169 healthy volunteers | FIA-MS/MS, HPLC-MS/MS (Targeted) | Plasma | • 3-, 4-, 5-Caffeoylquinic acid<br>• 5-Feruloylquinic acid<br>• 4-Ethylguaiacol<br>• 4-Vinylguaiacol<br>• Catechol<br>• Pyrogallol<br>• LysoPC C16:0/16:1<br>• LysoPC C18:0/18:1 | (189) |
| Coffee | Coffee and tea | Coffee and tea consumption (from FFQ and 3-day food record) | Association study | 57 healthy women | HPLC-MS/MS (Targeted) | Plasma, urine | • Caffeic acid<br>• Chlorogenic acid | (190) |
| Coffee | Coffee | Preparation: 48 g coffee powder in 900 mL water; 350 mL consumed | Acute intervention | 13 healthy volunteers | HILIC-MS/MS (Targeted) | Plasma | • Trigonelline<br>• N-methylpyridinium | (191) |
| Coffee | Coffee vs. tea vs. water | Dose not specified | Acute intervention | 13 healthy volunteers | CE-ESI-TOF-MS, HPLC- | Urine | • Chlorogenic acid<br>• Caffeic acid<br>• Coumaric acid | (192) |

| Summary of Targeted Studies Presenting Candidate FIBs for Fermented Foods | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Fermented Food** | **All interventions** | **Dose** | **Study Design** | ***n*** | **Analytical Method** | **Biosample** | **Candidate FIBs[a]** | **Reference** |
| | | | | | MS/MS (Targeted) | | | |
| Coffee | Coffee | Preparation: 40 g coffee powder in 250 mL water' 190 mL consumed | Acute intervention | 6 healthy volunteers | HPLC-UV, LC-MS (Targeted) | Plasma, urine | • 3-, 4-, and 5-Caffeoylquinic acid (plasma)<br>• 3,4-, 3,5-, and 4,5-Dicaffeoylquinic acid (plasma)<br>• Feryloylquinic acid (plasma, only 1 volunteer)<br>• Dihydrocaffeic acid (urine)<br>• Gallic acid (urine)<br>• Isoferulic acid (urine)<br>• Ferulic acid (urine)<br>• Vanillic acid (urine)<br>• Caffeic acid (urine)<br>• 5-caffeoylquinic acid (urine)<br>• Sinapic acid (urine)<br>• P-hydroxybenzoic acid (urine)<br>• P-coumaric acid (urine) | (193) |
| Coffee | Instant coffee with low chlorogenic acids vs. medium chlorogenic acids vs. high chlorogenic acids | 3.4g coffee powder in 200 mL water | Acute, randomized, double-blind, controlled, crossover | 11 healthy volunteers | HPLC-PDA-MS/MS (Targeted) | Plasma, urine | • 3-Caffeoylquinic acid-O-sulfate<br>• Dihydrocaffeic acid-3-O-sulfate<br>• Dihydrocaffeic acid-3-O-glucuronide<br>• 4-caffeoylquinic acid-O-sulfate<br>• Caffeic acid-4-O-sulfate<br>• Dihydroferulic acid-4-O-sulfate<br>• Caffeic acid-3-O-sulfate<br>• Dihydrocaffeic acid<br>• Dihydroferulic acid-4-O-glucuronide<br>• Ferulic acid-4-O-sulfate<br>• 5-caffeoylquinic acid<br>• 3-feruloylquinic acid<br>• Isoferulic acid-3-O-sulfate<br>• Dihydroisoferulic acid-3-O-glucuronide<br>• Isoferulic acid-3-O-glucuronide<br>• Feruloylglycine<br>• 3-Caffeoylquinic acid lactone-O-sulfate<br>• 4-Caffeoylquinic acid lactone-O-sulfate<br>• 4-Feruloylquinic acid<br>• Dihydroferulic acid<br>• 5-Feruloylquinic acid | (194) |
| Coffee | Coffee at 3 doses | 2, 4, and 8 g coffee powder in 400 mL water | Acute, randomized, crossover | 10 healthy volunteers | LC-ESI-MS/MS (Targeted) | Plasma | • 3-Feruloylquinic acid<br>• 4-Feruloylquinic acid<br>• 5-Feruloylquinic acid<br>• 3-Caffeoylquinic acid<br>• 4-Caffeoylquinic acid<br>• 5-Caffeoylquinic acid | (195) |

| Summary of Targeted Studies Presenting Candidate FIBs for Fermented Foods | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Fermented Food** | **All interventions** | **Dose** | **Study Design** | ***n*** | **Analytical Method** | **Biosample** | **Candidate FIBs[a]** | **Reference** |
| | | | | | | | • Ferulic acid<br>• Caffeic acid<br>• Isoferulic acid<br>• Dihydroferulic acid<br>• Dihydrocaffeic acid | |
| Coffee | Coffee vs. no coffee | 1 cup (acute); daily consumption of coffee | Acute intervention | Healthy volunteers (number not specified) | HPLC-UV (Targeted) | Urine | • N-methyl-2-pyridone-5-carboxamide<br>• N-methyl-4-pyridone-5-carboxamide | (196) |
| Coffee | Hot coffee consumed slowly vs. cold coffee consumed slowly vs. cold coffee consumed fast vs. sugar-free energy drink consumed fast vs. sugar-free energy drink consumed slowly | 4.1 g coffee powder in 450 mL water; 450 mL energy drink | Acute, randomized, crossover | 24 healthy volunteers | LC-MS (Targeted) | Plasma | • Caffeine | (197) |
| Coffee | Coffee vs. soy beverage vs. coffee + soy beverage | 4 g coffee powder and/or 20 g soymilk powder in 200 mL water | Acute, randomized, crossover | 6 healthy volunteers | HPLC-DAD, LC-MS (Targeted) | Urine | • 3-Caffeoylquinic acid<br>• 4-Caffeoylquinic acid<br>• 5-Caffeoylquinic acid<br>• 3,4-Dicaffeoylquinic acid<br>• 3,5-Dicaffeoylquinic acid<br>• 4,5-Dicaffeoylquinic acid<br>• Ferulic acid<br>• Caffeic acid<br>• Isoferulic acid<br>• Dihydrocaffeic acid<br>• Gallic acid<br>• Vanillic acid<br>• Benzoic acid<br>• P-Hydroxybenzoic acid<br>• Siringic acid<br>• Sinapic acid<br>• 3,4-Dihydroxyphenilacetic acid<br>• Hippuric acid<br>• Trans-3-hydroxycinnamic acid | (198) |

| Summary of Targeted Studies Presenting Candidate FIBs for Fermented Foods | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Fermented Food** | **All interventions** | **Dose** | **Study Design** | ***n*** | **Analytical Method** | **Biosample** | **Candidate FIBs[a]** | **Reference** |
| | | | | | | | • 3-(4-Hydroxyphenyl) propanoic acid<br>• 2,4-Dihydroxybenzoic acid | |
| Coffee | Instant coffee | 1 cup containing 4 mg caffeine/kg body weight | Acute intervention | 6 healthy volunteers | HPLC-MS/MS (Targeted) | Urine | • AAMU/AFMU<br>• 1-Methyluric acid<br>• 1-Methylxanthine<br>• 1,3-Dimethyluric acid<br>• 1,7-Dimethyluric acid<br>• 1,3,7-Trimethyluric acid<br>• 3,7-Dimethylxanthine<br>• Paraxanthine<br>• 1,3-Dimethylxanthine<br>• 1,3,7-Trimethylxanthine | (199) |
| Coffee | Instant coffee | 400 mL | Acute intervention | 8 healthy volunteers | HPLC-MS/MS (Targeted) | Plasma | • 3,4-Dimethoxycinnamic acid | (200) |
| Coffee | Instant coffee | 4 g in 400 mL water | Acute intervention | Healthy volunteers (number not specified) | LC-MS/MS (Targeted) | Plasma | • Caffeic acid<br>• Dihydrocaffeic acid<br>• Ferulic acid<br>• Dihydroferulic acid<br>• Isoferulic acid | (201) |
| Coffee | Instant coffee | 3.4 g in 200 mL | Acute intervention | 11 healthy volunteers | HPLC-PDA-MS/MS (Targeted) | Plasma, urine | • 3-O-Caffeoylquinic acid-O-sulfate<br>• DIhydrocaffeic acid-3-O-sulfate<br>• DIhydrocaffeic acid-3-O-glucuronide<br>• 4-O-Caffeoylquinic acid-O-sulfate<br>• Caffeic acid-4-O-sulfate<br>• Dihydroferulic acid-4-O-sulfate<br>• Caffeic acid-3-O-sulfate<br>• Dihydrocaffeic acid<br>• Dihydroferulic acid-4-O-glucuronide<br>• Ferulic acid-4-O-sulfate<br>• 5-O-Caffeoylquinic acid<br>• 3-O-Feruloylquinic acid<br>• Isoferulic acid-3-O-sulfate<br>• Dihydro(iso)ferulic acid-3-O-glucuronide<br>• Isoferulic acid-3-O-glucuronide<br>• Feruloylglycine<br>• 3-O-Caffeoylquinic acid lactone-O-sulfate<br>• 4-O-Caffeoylquinic acid lactone-O-sulfate<br>• 4-O-Feruloylquinic acid<br>• Dihydroferulic acid<br>• 5-O-Feruloylquinic acid | (202) |

| **Summary of Targeted Studies Presenting Candidate FIBs for Fermented Foods** | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Fermented Food** | **All interventions** | **Dose** | **Study Design** | ***n*** | **Analytical Method** | **Biosample** | **Candidate FIBs**[a] | **Reference** |
| Coffee | Instant coffee in water vs. instant coffee in milk vs. water | 4 g in 200 mL water or milk | Acute, randomized, crossover | 5 healthy volunteers | HPLC-DAD, LC-MS (Targeted) | Urine | • Hippuric acid<br>• 3,4-Dihydroxyphenylacetic acid<br>• Dihydrocaffeic acid<br>• Vanillic acid<br>• Gallic acid<br>• Isoferulic acid<br>• 4-Hydroxybenzoic acid<br>• 2,4-Hydroxybenzoic acid<br>• Trans-3-hydroxycinnamic acid<br>• P-Coumaric acid<br>• Syringic acid<br>• Sinapinic acid | (203) |
| Coffee | Freshly brewed coffee | 30 g in 500 mL water | Acute intervention | 10 healthy volunteers | HPLC-ESI-MS/MS (Targeted) | Urine | • Nicotinic acid<br>• Nicotinamide<br>• N-methylnicotinamide<br>• N-methyl-2-pyridone-5-carboxamide<br>• Nicotinuric acid | (204) |
| Coffee | Green-roasted coffee | 3.5 gin 250 mL water | Acute intervention | 12 healthy volunteers | HPLC-DAD, LC-MS-QTOF (Targeted) | Plasma, urine | • Caffeine<br>• Paraxanthine<br>• Theobromine<br>• Theophylline<br>• 1-Methylxanthine<br>• 3-Methylxanthine<br>• 7-Methylxanthine<br>• 1-Methyluric acid<br>• 1,3-Methyluric acid<br>• 1,7-Methyluric acid<br>• 1,3,7-Methyluric acid | (205) |
| Coffee | Instant coffee | 8 g in 400 mL water | Acute intervention | 10 healthy volunteers | LC-ESI-MS/MS (Targeted 56 phenolic compounds) | Plasma | • Total phenolic acids, methyls, glucuronides, sulfates, and lactones (ferulic acid, caffeic acid, and all metabolites thereof) | (206) |
| Coffee | Instant coffee | 4 g in 400 mL water | Acute intervention | 9 healthy volunteers | ESI-LC-ESI-MS/MS (Targeted) | Plasma | • Ferulic acid<br>• Caffeic acid<br>• Isoferulic acid<br>• Dihydrocaffeic acid<br>• Dihydroferulic acid | (207) |
| Coffee | Instant coffee vs. green tea | 4 g in 400 mL water; 1.25% tea infusion | Acute crossover | 9 healthy volunteers | ESI-LC-ESI-MS/MS (Targeted) | Plasma | • Ferulic acid<br>• Caffeic acid<br>• Isoferulic acid<br>• Dihydrocaffeic acid<br>• Dihydroferulic acid | (208) |

| **Summary of Targeted Studies Presenting Candidate FIBs for Fermented Foods** | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Fermented Food** | **All interventions** | **Dose** | **Study Design** | ***n*** | **Analytical Method** | **Biosample** | **Candidate FIBs[a]** | **Reference** |
| Coffee | Instant coffee vs. instant coffee in whole milk vs. instant coffee with sugar and non-dairy creamer vs. no coffee | 4 g in 400 mL water or 360 mL water + 40 mL whole milk or 30.5 g premixed instant coffee with sugar | Acute, randomized, crossover | 9 healthy volunteers | ESI-LC-ESI-MS/MS (Targeted) | Plasma | • Ferulic acid<br>• Caffeic acid<br>• Isoferulic acid | (209) |
| Coffee | Coffee | 0, 1, 2, or 3 cups/day | Cross-sectional | 15 healthy men | LC-MS/MS (Targeted) | Urine | • Hippuric acid | (210) |
| Coffee | Nescafe Green Blend coffee | 3.5 g in 240 mL water | Acute intervention | 12 healthy volunteers | LC-MS-QTOF (Targeted) | Plasma, urine | • Caffeic acid and metabolites<br>• Ferulic acid and metabolites<br>• Coumaric acid and metabolites<br>• Dimethoxycinnamic acid and metabolites<br>• Lactone derivatives<br>• Phenolic acids | (211) |
| Coffee | Coffee | Caffeinated coffee, other caffeinated drinks, decaffeinated coffee consumption (never, 1-4X/month, 1-4X/week, 5X/week, ≥1X/day) (from FFQ) | Association study | 598 volunteers rom the SKIPOGH cohort | HPLC-MS/MS (Targeted) | Urine | • Caffeine<br>• Paraxanthine<br>• Theophylline | (212) |
| Coffee | Instant coffee | 3.4 g in 200 mL water | Acute intervention | 11 healthy volunteers | HPLC-PDA-MS (Targeted) | Urine | • Caffeic acid-3-O-sulfate<br>• Caffeic acid-3-O-sulfate<br>• Ferulic acid-4-O-sulfate<br>• Isoferulic acid-3-O-glucuronide<br>• Isoferulic acid-3-O-sulfate<br>• Dihydrocaffeic acid-3-O-glucuronide<br>• Dihydrocaffeic acid-3-O-sulfate<br>• Dihydroferulic acid<br>• Dihydroferulic acid-4-O-glucuronide<br>• Dihydroferulic acid-4-O-sulfate | (213) |
| Coffee | Coffee enema vs. ready-to-drink coffee beverage | 500 mL (coffee enema); 180 mL (RTD coffee) | Acute crossover | 11 healthy men | HPLC-UV (Targeted) | Plasma | • Caffeine | (214) |

| Summary of Targeted Studies Presenting Candidate FIBs for Fermented Foods | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Fermented Food** | **All interventions** | **Dose** | **Study Design** | ***n*** | **Analytical Method** | **Biosample** | **Candidate FIBs[a]** | **Reference** |
| Coffee | Decaffeinated coffee with high chlorogenic acids vs. medium vs. low | Coffee dose not reported; 4525, 2219, and 1052 umol chlorogenic acids in high, medium, and low doses, respectively | Acute, randomized, double-blind, crossover | 5 healthy womn | HPLC-DAD-ESI-MS, ESI-MS/MS (Targeted) | Plasma, ileal effluent, urine | • Chlorogenic acid metabolites (caffeoylquinic acids, feruloylquinic acids, caffeic acids, dihydrocaffeic acids, ferulic acids, isoferulic acids, dihydroferulic acids) | (215) |
| Coffee | Instant coffee | 400 mL (1% w/v) | Acute intervention | 10 healthy volunteers | LC-MS (Targeted) | Plasma | • Caffeic acid<br>• Dihydrocaffeic acid<br>• Ferulic acid<br>• Isoferulic acid<br>• Dihydroferulic acid<br>• Dimethoxycinnamic acid<br>• Dimethoxydihydrocinnamic acid | (216) |
| Coffee | Coffee | 2 cups | Acute intervention | 14 healthy volunteers | 2D-HR-GC-MS (Targeted) | Urine | • 4-Ethylguaiacol<br>• 4-Vinylguaiacol<br>• (E)-Beta-damascenone<br>• Dimethyl trisulfide<br>• Furfuryl alcohol<br>• Guaiacol<br>• Indole<br>• Methional<br>• Oct-1-en-3-one<br>• Skatole<br>• Vanillin | (217) |
| Coffee | Mocha coffee vs. caffeinated soft drink vs. low-dose caffeine in aqeuous solution vs. high-dose caffeine in aqueous solution | 190 mL (soft drink), 50 mL (mocha), 70 mL (aqueous solution | Acute, randomized, crossover | 4 healthy men | HPLC (detector not specified) (Targeted) | Plasma | • Caffeine<br>• Theophylline<br>• Paraxanthine<br>• Theobromine<br>• 1,3-Dimethylxanthine<br>• 1,7-Dimethylxanthine<br>• 3,7-Dimethylxanthine | (218) |
| Coffee | Coffee (brewed or canned) | 150 mL (brewed coffee) or 187 mL (canned coffee) | Acute intervention | 10 healthy volunteers | FOX-I method (Targeted) | Urine | • Hydrogen peroxide | (219) |

| Summary of Targeted Studies Presenting Candidate FIBs for Fermented Foods | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Fermented Food** | **All interventions** | **Dose** | **Study Design** | ***n*** | **Analytical Method** | **Biosample** | **Candidate FIBs[a]** | **Reference** |
| Coffee | Instant coffee | 2.5 g instant coffee in 200 mL water | Acute intervention | 10 healthy volunteers | FOX assay (Targeted) | Urine | • Hydrogen peroxide | (220) |
| Coffee | Instant coffee | 2 cups, each with 4 g instant coffee powder in 250 mL water | Acute intervention | 5 healthy men | HPLC-UV (Targeted) | Urine | • Caffeic acid<br>• Ferulic acid<br>• Isoferulic acid<br>• Dihydroferulic acid<br>• 3-4-Hydroxy-3-methoxyphenyl-propanoic acid<br>• Vanillic acid<br>• Hippuric acid<br>• 3-Hydroxyhippuric acid | (221) |
| Coffee | High roasted coffee vs. low roasted coffee vs. unroasted coffee vs. in vitro hydrolyzed unroasted coffee | 3.4 to 4.5 g of instant coffee in 200 mL water | Acute, randomized, double-blind, crossover | 12 healthy volunteers | LC-ESI-MS/MS (Targeted) | Plasma | • Dihydroferulic acid<br>• Caffeic acid-3-O-sulfate<br>• Isoferulic-3-O-glucuronide<br>• 5-4-Dihydro-m-coumaric acid | (222) |
| Coffee | Decaffeinated coffee vs. regular coffee vs. stronger coffee vs. hot water vs. no intervention | 17.5 to 25 g of coffee in 300 mL water | Acute, randomized, single-blind, crossover | 8 healthy volunteers | HPLC (detector not specified) (Targeted) | Plasma | • Caffeine | (223) |
| Coffee | Coffee | 4X7.5 g coffee pads and 500 mL water | Acute intervention | 10 healthy volunteers | HPLC-ESI-MS/MS (Targeted) | Urine | • Pyrazine-2-carboxylic acid<br>• 5-Hydroxypyrazine-2-carboxylic acid<br>• 5-Methylpyrazine-2-carboxylic acid<br>• 6-Methylpyrazine-2-carboxylic acid | (224) |
| Coffee | Coffee drinkers vs. non-coffee drinkers | 350 mL coffee or water | Acute, parallel | 6 healthy volunteers | UPLC-HDMS (Untargeted) | Urine | • Trigonelline<br>• N-methylpyridinium<br>• Dimethylxanthines<br>• Monomethylxanthines<br>• 1,3-Dimethyluric acid<br>• 1,7-Dimethyluric acid<br>• Ferulic acid conjugates | (225) |
| | Caffeinated coffee | 48 g coffee powder in 900 mL water | Acute intervention | 13 healthy volunteers | UPLC-MS/MS (Targeted) | Plasma | • 5-O-Caffeoyl quinic acid<br>• Ferulic acid<br>• Iso-ferulic acid<br>• Feruloylsulfate<br>• Iso-feruloylsulfate | |

| Summary of Targeted Studies Presenting Candidate FIBs for Fermented Foods | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Fermented Food** | **All interventions** | **Dose** | **Study Design** | ***n*** | **Analytical Method** | **Biosample** | **Candidate FIBs[a]** | **Reference** |
| | | | | | | | • Feruloylglucuronide<br>• Feruloylglycine<br>• Dihydroferulic acid<br>• Dihydroferuloylsulfate<br>• Dihydroferuloylglucuronide<br>• Dihydrocaffeoylsulfate (sum of isomers)<br>• Catecholsulfate<br>• Catecholglucuronide<br>• Guaiacolsulfate<br>• Guaiacolglucuronide<br>• Trigonelline<br>• N-methylpyridinium<br>• N-methylnicotinamide<br>• N-methyl-4-pyridone-5-carboxamide<br>• N-methyl-2-pyridone-5-carboxamide<br>• Caffeine<br>• Theophylline<br>• Paraxanthine<br>• Theobromine<br>• 3-Methylxanthine<br>• 7-Methylxanthine<br>• 1,7-Dimethyluric acid | |
| Coffee, cocoa | Green tea vs. grape-skin extract vs. cocoa beverage vs. instant coffee coffee vs. grape fruit juice vs. orange juice vs. hot water | 4 g (instant coffee), 10 g (cocoa powder) in 200 mL water | Acute, randomized, crossover | 9 healthy volunteers | HPLC-ESI-MS/MS (Targeted) | Urine | • Chlorogenic acid<br>• Caffeic acid<br>• M-coumaric acid<br>• 4-O-methylgallic acid<br>• Epicatechin<br>• Naringenin<br>• Enterodiol<br>• Enterolactone | (226) |
| Coffee, wine | Coffee, chocolate, wine, dark bread, and other conventional foods | Continuous intake of various foods (from 2-day dietary record) | Association study | 53 volunteers from the SU.VI.MAX cohort | HPLC-ESI-MS/MS (Targeted) | Urine | • Chlorogenic acid<br>• Caffeic acid<br>• Gallic acid<br>• 4-O-methylgallic acid<br>• Enterolactone<br>• Enterodiol | (227) |
| Coffee, wine (polyphenol-rich foods) | Citrus fruits, apple and pear, olives, coffee tea, all wine, red wine | Continuous intake of citrus fruits, apple and pear, olives, coffee tea, all | Association study | 475 volunteers from the EPIC cohort | U(H)PLC-ESI-MS/MS (Targeted 34 polyphenols) | Urine | • Protocatechuic acid, 3,4-dihydroxyphenylpropionic acid, ferulic acid, and caffeic acid highly associated with coffee intake (also: gallic acid, apigenin, quercetin, homovanillic acid, protocatechuic acid, m-coumaric acid, hydroxytyrosol, and daidzein, based on ranked method) | (228) |

| Summary of Targeted Studies Presenting Candidate FIBs for Fermented Foods | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Fermented Food** | **All interventions** | **Dose** | **Study Design** | ***n*** | **Analytical Method** | **Biosample** | **Candidate FIBs[a]** | **Reference** |
| | | wine, red wine (from 24-h recalls and dietary questionnaire) | | | | | • Hydroxytyrosol, tyrosol, resveratrol, gallic acid, and gallic acid ethyl ester highly associated with wine/red wine intake (also: homovanillic acid, 3-hydroxybenzoic acid, naringenin, 3,4-dihydroxyphenylpropanoic acid, 3,4-dihydroxyphenylacetic acid, p-coumaric acid, enterolactone, and catechin, based on ranked method) | |
| Coffee, wine, cocoa (polyphenol-rich foods) | Coffee, tea, red wine, citrus fruit, apples and pears, and chocolate products | Continuous intake of coffee, tea, red wine, citrus fruit, apples and pears, and chocolate products (from 24-h recall and FFQ) | Association study | 481 volunteers from the EPIC cohort | U(H)PLC-QTOF-MS (Targeted) | Urine | • Dihydroferulic acid sulfate, guaiacol glucuronide, feruloylquinic acid, ferulic acid sulfate, feruloylquinic acid glucuronide, 3-O-caffeoylquinic acid, p-coumaric acid sulfate, caffeic acid sulfate, ferulic acid glucuronide, hydroxyhippuric acid, dihydrocaffeic acid sulfate, m-coumaric acid sulfate, dihydroferulic acid glucuronide, p-hydroxyphenyllactic acid, guaiacol sulfate, ethylcatechol glucuronide associated with coffee intake<br>• M-coumaric acid, gallic acid ethyl ester sulfate, hydroxytyrosol sulfate, dihydroresveratrol glucuronide, syringic acid sulfate, methylgallic acid sulfate, 4-O-methylgallic acid associated with red wine intake<br>• Methyl(epi)catechin sulfate, 4-hydroxy-(3'4'-dihydroxyphenyl)valeric acid sulfate, dihydroxyphenyl-gamma-valerolactone glucuronide, vanillic acid sulfate associated with chocolate intake | (229) |
| Coffee, bread, cheese (general diet) | Wholegrain bread, non-wholegrain bread, lowfat cheese, highfat cheese, regular coffee, decaffeinated coffee, and other (non-fermented) food groups | Continuous intake of 45 different food groups (from FFQ) | Association study | 2380 volunteers from the EPIC-Potsdam cohort | FIA-MS/MS (Targeted 127 metabolites, including acylcarnitines, amino acids, diacyl-phosphatidylcholines, acyl-alkyl-phosphatidylcholines, lyso-phosphatidylcholines, sphingomyelins, and hexoses) | Serum | • Amino acids associated with all dairy<br>• Hexoses with non-wholegrain bread<br>• Acyl-alkyl-phosphatidylcholines and lyso-phosphatidylcholines with high-fat dairy<br>• Sphingomyelins with coffee | (230) |
| Coffee, wine | Coffee, tea, wine, cereal, fruit, vegetable, | Continuous intake of coffee, tea, wine, cereal, fruit, vegetable, other | Association study | 61 volunteers, most with CV risk; 2672 | HPLC-UV (Targeted) | Plasma | • Zeaxanthin<br>• Beta-carotene<br>• Alpha-carotene | (231) |

| Summary of Targeted Studies Presenting Candidate FIBs for Fermented Foods | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Fermented Food** | **All interventions** | **Dose** | **Study Design** | ***n*** | **Analytical Method** | **Biosample** | **Candidate FIBs[a]** | **Reference** |
| | other food intake | foods (from 7-day weighted diet records); from FFQ | | volunteers from the NORKOST 2 cohort | | | | |
| Coffee, cocoa | Espresso coffee vs. espresso coffee + cocoa-based products containing coffee | 3 cups espresso vs. 1 cup espresso + 2 cups cocoa-based products containing coffee | 1-month, randomized, crossover | 21 healthy volunteers | UHPLC-ESI-MS (Targeted) | Plasma, urine | • Trigonelline (coffee)<br>• N-methylpyridinium (coffee)<br>• N-methylnicotinamide (coffee)<br>• N-methyl-4-pyridone-5-carboxamide (coffee) | (232) |
| Vinegar | Vinegar capsules vs. vinegar drink vs. non-carbonated mineral water | 9 capsules (750 mg acetic acid); 100 mL vinegar (750 mg acetic acid); 150 mL water | Acute, randomized, controlled, crossover | 30 healthy volunteers | GC-2010 (Targeted) | Serum | • Acetate | (233) |
| Vinegar | Red wine vinegar vs. apple cider vinegar tablet | 4 tablespoons/day (3.6 g acetic acid/day); 2 tablets/day (0.045 g acetic acid/day) | 8-week, randomized, controlled, parallel | 45 healthy volunteers with high waist circumference and at increased risk for metabolic complications | GC-MS, LC-MS/MS (Targeted) | Plasma | • Amino valerate<br>• Indole-3-acetic acid<br>• dTMP | (234) |
| Sauerkraut | Sauerkraut | 5-6 g/kg body weight | Acute intervention | 4 volunteers | LC-MS (Targeted) | Plasma, urine | • D-phenyllactic acid | (235) |
| Cider | Thatchers Redstreak apple cider | 500 mL | Acute intervention | 9 healthy and 5 ileostomy volunteers | HPLC-PDA-MS (Targeted) | Plasma, urine, ileal fluid | • Phloretin-2’-glucuronide<br>• Phloretin-O-glucuronide-O-sulfate<br>• Phoretin-O-sulfate | (236) |
| Fermented orange juice | Fermented orange juice (fermented using yeast: *Pichia kluyveri* var. *kluyveri*) vs. unfermented orange juice | 500 mL | Acute, randomized, controlled, crossover | 7 healthy volunteers | HPLC-DAD (Targeted) | Plasma | • Beta-cryptoxanthin<br>• Lutein | (237) |

| **Summary of Targeted Studies Presenting Candidate FIBs for Fermented Foods** | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Fermented Food** | **All interventions** | **Dose** | **Study Design** | ***n*** | **Analytical Method** | **Biosample** | **Candidate FIBs**[a] | **Reference** |
| Fermented ginseng | Fermented vs. non-fermented ginseng | 3 g | Open-label, randomized, single-dose, crossover | 24 healthy volunteers | LC-MS/MS (Targeted) | Plasma | • Ginsenoside metabolite IH-901 (20-O-beta-D-glucopyranosyl-20(S)-protopanaxodiol) | (238) |
| Fermented Red Beet Juice | Fermented red beet juice | 200 mL/60 kg body weight | 6-week, uncontrolled, intervention | 24 healthy volunteers | Micro-HPLC-MS/MS (Targeted) | Plasma, urine | • Betalain and derivatives (isobetanin, isobetanidin, 17-decarboxy-betanin, 17-decarboxy-isobetanin, 17-decarboxy-neobetanin, neobetanin, 2,17-bidecarboxyneobetanin, 2,15,17-tiidecarboxyneobetanin, 2,17-bidecarboxyneobetanin, 2,15,17-tiidecarboxybetanin, 6'-O-feruloyl-betanin/isobetanin, , 2,15,17-tiidecarboxy-2,3-dehydro-neobetanin) | (239) |
| Salgam, boza, kimiz, kefir | Salgam, boza, kimiz, kefir | 300 mL | Acute, crossover | 12 healthy volunteers | HS-GC-FID (blood ethanol); LC-MS/MS (urine ethyl glucuronide and sulfate) (Targeted) | Whole blood, urine | • No change in blood alcohol levels or ethanol metabolites in urine | (240) |
| Fermented red cabbage | Fermented red cabbage vs. fresh red cabbage | 240 g | Acute, randomized, controlled, crossover | 13 healthy volunteers | HPLC-MS/MS (Targeted) | Plasma, urine | • Cyanidin derivatives | (241) |
| Fermented rooibos tea | Fermented vs. unfermented rooibos tea | 500 mL | Acute, randomized, controlled, crossover | 10 healthy volunteers | HPLC-MS (Targeted) | Plasma, urine | • C-linked dihydrochalcone and flavanone glucosides (O-methyl, sulfate, glucuronide metabolites of aspalathin and eriodictyol-O-sulfate | (242) |
| Pu-erh tea | Pu-erh tea | 200 mL (containing 10 g of tea powder) | Acute and 2-week, randomized, controlled | 20 healthy volunteers | U(H)PLC-QTOF-MS (Targeted) | Urine | • Inositol<br>• Myristic acid<br>• 5-Hydroxytryptophan<br>• 4-Methyloxyphenylacetic acid<br>• Pyroglutamic acid | (243) |

Abbreviations: AR, alkenylresorcinol; CE, capillary electrophoresis; CEAD, coulometric electrode array detector; CVD, cardiovascular disease; DHA, docosahexaenoic acid; DAD, diode array detector; DHBA, 3,5-dihydroxybenzoic acid; DHPPA, 3-(3,5-dihydroxyphenyl)-1-propanoic acid); DHPPTA, 5-(3,5-dihydroxyphenyl) pentanoic acid; DHPV, 5-(3,4-dihydroxyphenyl)-γ-valerolactone; EAD, enzyme activity/affinity detector; ECD, electrochemical detector; ELISA, enzyme-linked immunosorbent assay; EPA, eicosapentaenoic acid; ESI, electrospray ionization; FFQ, food frequency questionnaire; FIA, flow injection analysis; FIB, food intake biomarker; FID, flame ionization detector; FLD, fluorescence/fluorometric detector; FOX, ferrous ion oxidation xylenol orange; GC, gas chromatography; GLC, gas-liquid chromatography; HDMS, high definition mass spectrometry; HILIC, hydrophilic interaction liquid chromatography; HPLC, high-performance liquid chromatography; HR, high resolution; HS, headspace; LC, liquid chromatography; LDL, low-density lipoprotein; MHPV, 3′-methoxy-4′-hydroxyphenylvalerolactone; MS, mass spectrometry; MS/MS, tandem mass spectrometry; MUFA, monounsaturated fatty acid; NMR, nuclear magnetic resonance; PC, phosphatidylcholine; PDA, photometric diode array; PUFA, polyunsaturated fatty acid; QTOF, quadrupole time-of-flight; RP, reverse phase; SCFA, short chain fatty acid; SFA, saturated fatty acid; TOF, time-of-flight; U(H)PLC, ultra-high performance liquid chromatography; UV, ultraviolet; VIS, visible.

[a] Candidate FIBs that are significantly increased compared to control or baseline in each study are reported.

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