Records identified through database searching (n = 130)

PubMed (n = 63); Medline (n = 10); CINAHL (n = 19); Scopus (n = 38)

Identification

Records after duplicates removed (n = 94)

Screening

Records screened

(n = 94)

Records excluded, with reason

(n = 65)

* Study design
* Reviews/guidelines
* not directly related

Fuly text articles assessed for eligibility

(n = 29)

Full text articles assessed for eligibility (n = 18)

Eligibility

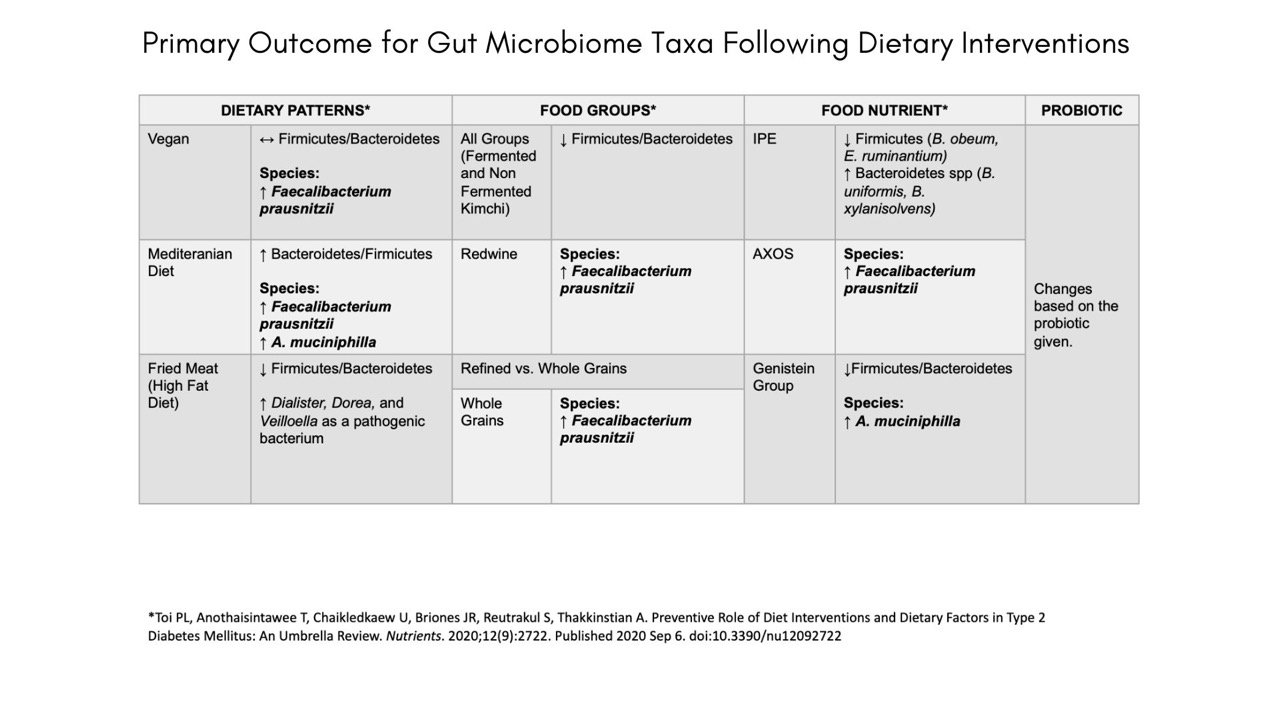
Full text articles excluded with reasons

(n = 11)

(study duration < 4 weeks; non RCTs; individuals with diabetes, NAFLD, menopausal woman, coronary heart disease; not reported the fecal microbiome analysis, not compared with control/placebo group)

Included

**Figure 1. Flowchart Diagram for Study Selection of Systematic Review (based on PRISMA Guideline)**



**Figure 2. Primary Outcome for Gut Microbiome Taxa Following Dietary Interventions**

**Table 1. Characteristic of Studies**

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Author** | **Design** | **Location** | **N (subject)** | | **n, GM was analyzed** | **age (years)** | **BMI** | **Health Status** | **Intervention** | **Duration** |
| **pre** | **post** | **(kg/m2)** |
|
| **Dietary pattern** | | | | | | | | | | |
| Fava,2013 | SB-RCT | UK | 130 | 88 (HS group = 11, HM/HGI group = 17, HM/LGI gorup = 22, HC/HGI group = 21, HC/LGI group = 17) | 88 (HS group = 11, HM/HGI group = 17, HM/LGI gorup = 22, HC/HGI group = 21, HC/LGI group = 17) | 54±9,5 | 28,8±4,9 | obese with metabolic syndrome | Following a high saturated fat diet (HS) - high glycemic index (GI) diet (total fat 38%E fat, SFA 18%E, MUFA 12%E, PUFA 6%E, CHO 45%E, GI 64%), after which participants were randomly assigned to one of four experimental diets (HM/HGI: total fat 38%E, SFA 10%E, MUFA 20%E, PUFA 6%E, CHO 45%E, GI 64%; HM/LGI: total fat 38%E, SFA 10%E, MUFA 20%E, PUFA 6%E, CHO 45%E, GI 53%; HC/HGI: total fat 28%E, SFA 10%E, MUFA 11%E, PUFA 6%E, CHO 55%E, GI 64%; HC/LGI: total fat 28%E, SFA 10%E, MUFA 11%E, PUFA 6%E, CHO 55%E, GI 51%) | 28 weeks (4 weeks run out HS diet, 24 weeks one of four diet intervention HM/HGI; HM/LGI; HC/HGI; HC/LGI) |
| Marungruang,2017 | RCT | Sweden | 52 (multifunctional diet = 25, control diet = 27) | 47 (multifunctional diet = 23, control diet = 24) | 47 (multifunctional diet = 23, control diet = 24) | 50-73 | 25-33 | obese | MFD group were given foods rich in natural antioxidants, omega-3 fatty acids, high-(prebiotic) fiber, low glycemic, blood cholesterol-normalizing ingredients. MFD provided 2 g stanol/d for women and 2,7 g/d for males. Total dietary fiber content was 62 g/day vs control. Both diets were designed in agreement with the Nordic  Nutrition Recommendations and supplied 2500–2600  Kcal/day for men and 2000–2100 Kcal/day for women, combining foods from plant and animal origins. | 8 weeks |
| Kahleova, 2020 | opened label-RCT | Columbia | 168 (vegan group =84; control group = 84) | 115 (vegan group =65; control group = 50) | 115 (vegan group =65; control group = 50) | >18 | 28-40 | healthy overweight adult | low fat vegan diet vs control. Vitamin B12 was supplemented for vegan group (500µg/day) | 16 weeks |
| Vitale,2020 | DB-RCT Parallel Group | Italy | Mediteranian diet = 16; Control Diet (western diet) = 13 | Mediteranian diet = 16; Control Diet (western diet) = 13 | Mediteranian diet = 16; Control Diet (western diet) = 13 | Mediteranian diet = 41.6 ± 12.3; control diet = 45.9 ± 13.0 | Mediteranian Diet = 28,9,1±2,3 ; Control Diet = 29,3±3,5) | ow/obese | The control diet was instructed to keep their habitual diet unvaried during the intervention and did not consume extra virgin olive oil Mediterranean Diet was designed to have fruit and vegetable 500gr/day, nuts 30gr/day, refined cereal products replaced with wholegrain products 200gr/day, meat and derived meat products, fish 300gr/day, legumes 200gr/day, extra virgin olive oil | 8 weeks |
| Gao Jian, 2021 | DB-RCT | China | 117 (control group = 58; fried meat group = 59) | 117 (control group = 58; fried meat group = 59) | 117 (control group = 58; fried meat group = 59) | Control group = 21,73; fried meat group = 21,13 | Control group = 26,39; fried meat group = 26,06 | healthy overweight adult | Fried meat was provided four times per week in the experimental the group with cooking methods, which was frying at 150 C for <3 min; and boiling, steaming, or dressing with sauce at 100 C in the control group. | 4 weeks |
| Muralidharan,2021 | DB-RCT | Spain | 400 (intervention group = 200; control group = 200) | 400 (intervention group = 200; control group = 200) | 262 (intervention group = 183; control group = 179) | intervention group = 64.3 ± 5.1; control group = 65.1 ± 4.9 | intervention group = 33.4; control group = 32.9 | ow/ob with metabolic syndrome | intervention group = individualized behavioral support, restricted caloric Mediteranian Diet, and physical activity promotion; control group = information on maintaining ad libitum unrestricted caloric Mediteranian Diet with no advice on weight loss strategies | 1 year |
| Tagliamonte,2021 | DB-RCT | Italy | 82 (Mediteranian Diet = 43, Control Diet =39) | 82 (Mediteranian Diet = 43, Control Diet =39) | 82 (Mediteranian Diet = 43, Control Diet =39) | Mediteranian Diet = 43±1,4 ; Control Diet = 43±1,9) | Mediteranian Diet = 31,1±0,5 ; Control Diet = 31,2±2,0) | ow/obese | group 1 = Isocaloric Tailored Mediteranian Diet; group 2 = control | 8 weeks |
| **Food groups** | | | | | | | | | | |
| Han, 2015 | RCT | Korea | fresh kimchi group = 12; fermented kimchi group = 11 | fresh kimchi group = 12; fermented kimchi group = 11 | fresh kimchi group = 10; fermented kimchi group = 10 | 30 - 60 | fresh kimchi group = 28 ± 2.31; fermented kimchi group = 27.8 ± 2.20 | ow/obese | consuming 180 g of fresh or fermented kimchi per day (60 g/pkg × 3 meals) | 8 weeks |
| Moreno,2016 | RCT-cross over | Spain | MetS group = 10, control group = 10 | MetS group = 10, control group = 10 | MetS group = 10, control group = 10 | 48±2 | MetS vs control group: 35,24±4,21 vs 27,52±2,10 (washout period); 34,49±4,17 vs 27,34±2,31 (red wine period); 34,53±4,23 vs 27,27±2,19 (de-alcoholized red wine period) | metabolic syndrome | Divided into three periods; the first period was the washout period (participants did not consume any red wine), the second period was drunk only red wine (272 ml/d), the third period was drunk de-alcoholized red wine (272 ml/d) | 10 weeks (two weeks/15 days of washout period, followed by two intervention periods of 30 days each) |
| Lambert,2017 | DB-RCT | Canada | 53 (pea fiber group = 29; placebo group = 24) | 44 (pea fiber group = 22, placebo group = 22) | pea fiber group = 22, placebo group = 22 | 44±15 | 33,4±1,3 (PG); 32,8±1,3 (Pea fiber group) | obesity | The pea fiber group received 15g/d pea fiber supplementation with the dose was increased incrementally during the first 3 weeks of the study (week 1 ¼ 5 g/d; week 2 ¼ 10 g/d; week 3 ¼ 15 g/d. Pea fiber is packaged in wafers containing 5 g/serving of yellow pea fiber vs placebo group received an isocaloric dose of control wafers with no pea fiber | 12 weeks |
| Roager,2017 | DB-RCT crossover | Denmark | 60 | 60 | 50 ( men = 18; women = 32 ) | 20-65 | 25-35 | ow/ob at risk of developing metabolic syndrome | group 1 = whole-grain ≥ 75 gr/day; group 2 = < 10gr/day of refined grain | 8 weeks for each group, with washout period 6 weeks |
| **Food nutrients** | | | | | | | | | | |
| Chambers, et al.2019 | DB-RCT-cross over | UK | 14 | 12 | 12 | 18-65 | 29,8±0,9 | ow/obese | 20 g/day of inulin , 20 g/day inulin- propionate ester / IPE (14,6 g/day of inulin and 5,4 g/day of esterified propionate vs 20 g/day of cellulose (placebo - negative control) | 42 days each in random order. The washout period for the next intervention was carried out for 28 days |
| Kjolbaek,2019 | Opened label RCT-cross over | Denmark | 30 | 27 | 27 (completed all study interventions, AXOS, and PUFA intervention ) | 18 - 60 | 25-40 | central obese and one criterion of metabolic syndrome | phase 1 (AXOS intervention) consumed a powder supplement of 15 g of wheat bran extract with 4 biscuits/cracker per day; phase 2 (PUFA intervention) consumed fish oil supplement (capsules), containing 3,6 g/d g of N-3 PUFA | 12 weeks (two diet periods of 4 weeks each separated by a 4-week washout period) |
| Guevara,2020 | DB-RCT | Mexico | 45 (PG = 23; GTG = 22) | 45 (PG = 23; GTG = 22) | 45 (PG = 23; GTG = 22) | 20-60 | PG = 34.5 ± 0.98; GTG = 34.6 ± 0.86 | obese with insulin resistance | The subjects were randomly selected to form part of the placebo group (PG) or the genistein-treated group (GTG) with genistein capsules (50mg/day) | 8 weeks |
| **Probiotic** | | | | | | | | | | |
| Rajkumar,2014 | DB-RCT | India | placebo (n = 15), VSL#3 probiotic capsules (n = 15), omega-3 fatty acid capsules (n = 15), or omega-3 capsule + VSL#3 probiotic capsule (n = 15) | placebo (n = 15), VSL#3 probiotic capsules (n = 15), omega-3 fatty acid capsules (n = 15), or omega-3 capsule + VSL#3 probiotic capsule (n = 15) | placebo (n = 15), VSL#3 probiotic capsules (n = 15), omega-3 fatty acid capsules (n = 15), or omega-3 capsule + VSL#3 probiotic capsule (n = 15) | 40-60 | ± 28,79 (range 27-30) | obese, dyslipidemia and insulin resistance | Group 1 = nothing; group 2 = 1 capsule probiotic of VSL#3 everyday; group 3 = 1 capsule of omega 3 everyday; group 4 = 1 capsule of omega 3 and VSL#3 probiotic everyday | 6 weeks |
| Simon,2015 | DB-RCT | Jerman | 21 | 21 | 21 (men = 10, women = 11) | lean group = 49 ± 7; obese = 51 ± 7 | lean group = 19-25, obese group = 30-45 | obese | placebo group = receive Nutraceutix capsule placebo; intervention group = Nutraceutix capsule contain 10^10 cells of L. reuteri | 8 weeks |
| Depomnier et al 2019 | DB-RCT | Belgium | 40 | 32 (n placebo = 11; n pasteurized = 12; n alive = 9) | 32 | 18-70 | placebo = 37,63±5,82; pasteurized = 39,81±4,77; alive = 36,82±3,68 | ow/obese with insulin resistance and metabolic syndrome | Alive *A. muciniphila* (live 1010 bacteria per day); pasteurized *A. muciniphila* (pasteurized 1010 bacteria per day); Placebo | 12 weeks |
| Teronio,2019 | DB RCT-crossover | Spanyol | 53 (group 1 = 28, group 2 = 25) | 53 (group 1 = 28, group 2 = 25) | 53 (group 1 = 28, group 2 = 25) | 18-65 | > 30 | obese with metabolic syndrome | placebo group = maltodextrin; intervention group = probiotic *Lactobacillus spp* 9 log10 cfu/capsule, 1 capsule/day, with wash out periode (6 weeks) | 12 weeks |

IPE: inulin propionate ester, MD: Mediteranian Diet, CD: Control Diet, MFD: Multi Functional Diet, HS: high saturated fat diet, HC: High Carbo, HGI: High glycemic index, HF: high fiber, AXOS: arabinoxylan oligosaccharides, ow/ob = overweight/obese

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Table 2. Primary Outcome for Gut Microbiome Following Dietary Interventions (Alpha-Beta Diversity)** | | | | | | | | | |
| **Author** | **Health Status** | **Dietary pattern** | **Food Groups** | **Food Nutrient** | **Probiotic** | **Dietary pattern** | **Food Groups** | **Food Nutrient** | **Probiotic** |
| **Alpha Diversity** | | | | **Beta Diversity** | | | |
| Fava,2013 | Obese Mets | - |  |  |  | - |  |  |  |
| Rajkumar,2014 | Ob, dislipid, IR |  |  |  | - |  |  |  | - |
| Han, 2015 | Ow/ob |  | - |  |  |  | - |  |  |
| Simon,2015 | Ob |  |  |  | Not changed |  |  |  | Not changed |
| Moreno,2016 | Mets |  | - |  |  |  | - |  |  |
| Lambert,2017 | Obesity |  | - |  |  |  | - |  |  |
| Marungruang,2017 | Obese | Not changed |  |  |  | Not changed |  |  |  |
| Roager,2017 | Ow/ob Mets risk |  | Not changed |  |  |  | - |  |  |
| Chambers, et al.2019 | Ow/ob |  |  | Changed |  |  |  | - |  |
| Depomnier et al 2019 | Ob, IR. Mets |  |  |  | - |  |  |  | - |
| Kjolbaek,2019 | Healthy ow |  |  | Not changed |  |  |  | Changed |  |
| Guevara,2020 | Ob IR |  |  | Changed |  |  |  | Changed |  |
| Teronio,2019 | Mets |  |  |  | Not changed |  |  |  | Not changed |
| Kahleova, 2020 | Healthy ow | Not changed |  |  |  | - |  |  |  |
| Vitale,2020 | Ow/ob | Changed |  |  |  | - |  |  |  |
| Gao Jian, 2021 | Healthy ow | Changed |  |  |  | Changed |  |  |  |
| Muralidharan,2021 | Mets | Not changed |  |  |  | Not changed |  |  |  |
| Tagliamonte,2021 | Ow/ob | - |  |  |  | - |  |  |  |

Ow/ob: overweight/obese, Mets: metabolic syndrome, IR: insulin resistance

**Table 3. Quality Assessment of Studies**

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Author | C1 | C2 | C3 | C4 | C5 | C6 | C7 | C8 | C9 | C10 | C11 | C12 | C13 | C14 | Quality |
| Fava,2013 | Y | Y | NR | N | CD | N | N | Y | Y | Y | Y | Y | N | N | Poor |
| Rajkumar,2014 | Y | NR | N | Y | Y | Y | Y | Y | CD | Y | Y | Y | Y | Y | Fair |
| Han, 2015 | Y | NR | NR | NR | NR | Y | Y | Y | Y | Y | Y | Y | N | N | Fair |
| Simon,2015 | Y | N | N | Y | N | Y | Y | Y | Y | Y | Y | Y | N | Y | Fair |
| Moreno,2016 | Y | NR | NR | NR | NR | N | Y | Y | Y | Y | Y | NR | NR | Y | Fair |
| Lambert,2017 | Y | Y | Y | Y | Y | Y | Y | Y | Y | NA | Y | Y | Y | N | Fair |
| Marungruang,2017 | Y | Y | Y | NR | NR | Y | Y | Y | NR | NA | Y | Y | Y | N | Fair |
| Roager,2017 | Y | N | N | N | Y | Y | Y | Y | Y | Y | Y | Y | N | Y | Poor |
| Chambers, et al.2019 | Y | N | Y | Y | Y | Y | Y | Y | Y | Y | Y | Y | NA | Y | Good |
| Depomnier et al 2019 | Y | Y | Y | Y | Y | Y | Y | Y | Y | Y | Y | Y | N | N | Fair |
| Kjolbaek,2019 | Y | Y | N | N | N | Y | Y | Y | Y | Y | Y | Y | Y | N | Poor |
| Guevara,2020 | Y | CD | N | Y | Y | Y | Y | Y | NR | Y | Y | NR | Y | Y | Fair |
| Teronio,2019 | Y | N | NR | NR | NR | Y | Y | Y | Y | Y | Y | Y | N | Y | Fair |
| Kahleova, 2020 | Y | Y | N | N | Y | Y | N | N | Y | Y | Y | Y | N | N | Poor |
| Vitale,2020 | Y | Y | Y | Y | NR | Y | Y | Y | Y | Y | Y | Y | N | Y | Good |
| Gao Jian, 2021 | Y | Y | Y | Y | Y | Y | Y | Y | Y | Y | Y | Y | Y | Y | Good |
| Muralidharan,2021 | Y | Y | Y | Y | Y | Y | N | N | Y | Y | Y | Y | N | N | Poor |
| Tagliamonte,2021 | Y | Y | N | Y | Y | Y | Y | Y | Y | Y | Y | Y | N | Y | Fair |