

Supplementary material 5

Table: Characteristics of included randomised controlled trials

| First author (year) | Place | n R/C (M/F) | Population, diagnostic criteria | Age, years | Study design, length, weeks | Intervention (n=?) | Comparator (n=?) | Dose per day | Outcomes (mean +/- standard deviation, change from baseline) | | | |
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| LACTOFERMENTED KIMCHI/ GINSENG/ APPLE/ ASH KARDEH Lactic acid bacteria | | | | | | | | | Glucose | Lipid | Anthropometric | Inflammatory, gut microbiota, liver |
| Kim (2011) ⁽¹⁾ | South Korea | 22 (7/15) | Overweight or obese: BMI $\geq 25\text{kg/m}^2$ | 38.6 \pm 8.5 | CO, open, 4/2/4 | Fermented (10-day) kimchi (FeK): $4.3 \times 10^9 \pm 1.2 \times 10^9/\text{mL}$ <i>Lactobacilli</i> | Fresh (1-day) kimchi (FrK): $1.4 \times 10^7 \pm 3 \times 10^6/\text{mL}$ <i>Lactobacilli</i> | 300g | FeK vs FrK: \downarrow FBG (FeK -0.3 vs. FrK -0.2 mmol/L; p<0.05) FeK: \downarrow FBG, FBI (p<0.05) NSD: C-pep, 2hPPG, 2hPPI | FeK vs FrK: \downarrow TC (FeK -0.3 vs. FrK -0.1 mmol/L; p<0.05) FrK: \downarrow TC (p<0.05) NSD: TG, HDL-C, LDL-C | FeK vs FrK: \downarrow BFP (FeK -0.7 vs. FrK -0.3%; p<0.05), SBP (FeK -4.8 vs. FrK -3.7 mmHg; p<0.05), DBP (FeK -4.2 vs. FrK -1.7 mmHg; p<0.05) Both: \downarrow BW, BMI, BFP (p<0.05) FeK: \downarrow WHR (p<0.05) | NSD within or between groups: CRP, IL-6, IL-10, TNF- α Gut microbiota composition & liver markers not measured. |
| An (2012) ⁽²⁾ Abstract | South Korea | ?/20 | "Patients with T2DM" | NS | CO, open, 4/2/4 | Fermented (10-day) kimchi (FeK) | Fresh (1-day) kimchi (FrK) | NS | NSD between groups. FrK: \downarrow HbA1c (p<0.05) Unclear which other | Collected but not reported. | NSD between groups. FeK: \downarrow DBP (p<0.05) Unclear which other outcomes measured. | NSD within or between groups: unclear which inflammatory cytokines measured. Gut microbiota |

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| | | | | | | | | | outcomes measured. | | | composition & liver markers not measured. |
| An (2013) ⁽³⁾ | South Korea | 23/21 (7/14) | Prediabetes with MetS: ≥ 3 : TG ≥ 1.7 mmol/L; HDL-C ≤ 1.0 mmol/L (M), ≤ 1.3 mmol/L (F); BP $\geq 130/85$ mmHg; FBG ≥ 5.6 mmol/L; WC ≥ 90 cm (M), ≥ 80 cm (F) | 45.9 \pm 9.8 | CO, open, 8/4/8 | Fermented (10-day) kimchi (FeK) in 30 kcal/kg ideal BW meal | Fresh (1-day) kimchi (FrK) in 30 kcal/kg ideal BW meal | 300g | NSD between groups. Both: \downarrow HbA1c, HOMA-IR, FBI (all $p < 0.05$) NSD: FBG, 2hPPG, 2hPPI | Not measured. | NSD between groups. Both: \downarrow BW, BMI, WC, BFP ($p < 0.05$) FeK: \downarrow SBP, DBP ($p < 0.05$) NSD: WHR | NSD within or between groups: CRP, IL-6, IL-10, TNF-α Liver markers & gut microbiota composition not measured. |
| Lee (2013) ⁽⁴⁾ Abstract | South Korea | ?/16 | "Subjects with MetS" | NS | CO, open, 8/4/8 | Fermented (10-day) kimchi (FeK) | Fresh (1-day) kimchi (FrK) | NS | NSD within or between groups: FBG, FBI, HbA1c, HOMA-IR. | NSD within or between groups; unclear which outcomes measured. | FeK vs FrK: \downarrow DBP (FeK -3.7 mmHg vs. FrK not stated; $p = 0.037$) Unclear which outcomes measured. | FeK vs. FrK: \downarrow CRP (FeK - 208.5 $\mu\text{g/mL}$ vs. FrK not stated; $p = 0.048$) Unclear which outcomes measured. Gut microbiota composition & liver markers not measured. |

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| Oh (2014) ⁽⁵⁾ | South Korea | 42/36 (28/14) | T2DM/IFG: FBG 5.6–7.8 mmol/L | 53.3 ± 8.4 | Parallel DB, 4 | Fermented red ginseng (FRG) extract capsule (n=21) <i>Lactiplanti-bacillus plantarum</i> | Placebo (dried yeast) (n=21) | 2.7g | FRG vs PI: ↓ 2hPPG (FRG -1.6 vs. PI -0.5 mmol/L; p=0.008), ↑ 2hPPI (FRG 17.1 vs. PI -2.6 μU/mL; p=0.040) FRG: ↓ FBG (p=0.039), 2hPPG (p=0.0001) NSD: FBI | NSD between groups. FRG: ↓ TC (p=0.008), HDL-C (p=0.014), LDL-C (p=0.025) PI: ↓ HDL-C (p=0.022), LDL-C (p=0.005) NSD: TG | Not measured. | Not measured. |
| Han (2015) ⁽⁶⁾ | South Korea | 24/23 | Women with obesity: BMI ≥25kg/m² | 44.3 ± 6.2 | Parallel, open, 8 | Fermented (10-day) kimchi (n=11) | Fresh (1-day) kimchi (n=12) | 180g | NSD within or between groups: FBG, FBI, HOMA-IR. | NSD between groups. FeK: ↓ HDL-C (p<0.05) NSD: TC, TG | NSD between groups. FrK: ↓ WC, BFP, DBP (p<0.05) FeK: ↓ SBP (p<0.05) NSD: BMI | NSD within or between groups: CRP Both: ↑ <i>Bifidobacterium</i> Sig. negative correlations: <i>Actinobacteria</i> /BFP; <i>B. longum</i> /WC; <i>Bifidobacterium</i> /BW & BMI - in FeK group, significant negative correlations between ACSL1, ANPEP genes/ SBP & DBP (p<0.05) |

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| Tenore (2019) ⁽⁷⁾ | Italy | 90/62 (51/39) | CVD risk factors: TC 5.2–6.7 mmol/L; HDL-C 0.8–1.2 mmol/L; LDL-C 3.9–4.7 mmol/L; TG 1.9–3.2 mmol/L; FBG 5–6.9 mmol/L | AAP: 45.1 ± 10.3; IfAAP: 46.2 ± 10.7; LAB: 48.2 ± 10.2 | Parallel, DB, 8 (with 4-wk run-in & 4-wk follow up) | LF Annurca apple puree (IfAAP) (n=26) 3.0 × 10 ⁸ CFU/ g <i>Lacticaseibacillus rhamnosus</i> LRH11 & <i>L. plantarum</i> SGL07 | Unfermented Annurca apple puree (AAP) (n=27); probiotic capsule (LAB) containing only 3.0 × 10 ⁸ CFU/ g <i>L. rhamnosus</i> LRH11 & <i>L. plantarum</i> SGL07 (n=27) | AAP & IfAAP: 125 g; LAB: 1 capsule | NSD within or between groups: FBG. | IfAAP vs. AAP vs. LAB: ↑ HDL-C (IfAAP 0.6 vs. AAP 0.5 vs. LAB 0.2 mmol/L; p<0.05) All subgroups: ↑ HDL-C (IfAAP p=0.0095; AAP p=0.0042; LAB p=0.0036) NSD: TC, LDL-C, TG | Not measured. | AAP vs. IfAAP vs. LAB: ↑ <i>Bifidobacterium</i> (AAP 7.7 x 10 ⁵ vs. IfAAP 5.0 x 10 ⁴ vs. LAB 3.8 x 10 ⁵ CFU/mL); LAB (AAP 1.1 x 10 ⁶ vs. IfAAP 3.5 x 10 ³ vs. LAB 1.4 x 10 ⁵ CFU/mL); ↓ <i>Bacteroides</i> (AAP -4.9 x 10 ³ vs. IfAAP -1.8 x 10 ³ vs. LAB -2.5 x 10 ³ CFU/mL); <i>Enterococcus</i> (AAP -3.5 x 10 ² vs. IfAAP -9.2 x 10 ² vs. LAB -3.4 x 10 ³ CFU/mL); p<0.05. Inflammatory & liver markers not measured. |
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| Salehi (2022) ⁽⁸⁾ | Iran | 48/46 (17/29) | T2DM: FBG ≥ 7 mmol/L; 2hPPG ≥ 11.1 mmol/L during OGTT; HbA1C $\geq 6.5\%$; random plasma glucose ≥ 11.1 mmol/L | AK: 52.91 ± 6.7 ; Control: 53.09 ± 8.4 ; Overall: 53 ± 7.5 | Parallel, open, 6 | Ash Kardeh (AK) (n=23) and routine diabetic treatment | Routine diabetic treatment control (n=23) | 250 g | AK vs. control: \downarrow FBG (AK - 1.1 ± 1.4 vs. control - 0.2 ± 0.5 mmol/L; $p=0.003$) | AK vs. control: \downarrow TC (AK -0.2 ± 0.5 vs. control 0.1 ± 0.3 mmol/L; $p=0.025$), TG (AK -0.3 ± 0.3 vs. control -0.1 ± 0.2 mmol/L; $p=0.003$), \uparrow HDL-C (AK 0.04 ± 0.1 vs. control -0.05 ± 0.2 mmol/L; $p=0.048$) NSD: LDL-C | AK vs. control: \downarrow SBP (AK -13.47 ± 14.01 vs. control -0.43 ± 5.62 mmHg; $p<0.001$). With adjusted changes, also \downarrow DBP (AK -3.89 ± 1.02 vs. control -0.01 ± 1.02 mmHg; $p=0.014$) | Not measured. |
| CHUNGKOOKJANG/ KOCHUJANG/ DOENJANG <i>Bacillus & Aspergillus spp.</i> | | | | | | | | | | | | |
| Back (2011) ⁽⁹⁾ | South Korea | 60/55 (11/49) | Overweight or obese: BMI ≥ 23 kg/m ² & WHR ≥ 0.90 (M), ≥ 0.85 (F) | 38.6 ± 1.5 | Parallel, DB, 12 | Chungkook-jang (CKJ) capsules (n=29) | Isocaloric placebo (n=26) | 26g | Not measured. | CKJ vs. Pl: \downarrow ApoB (CKJ - 0.2 vs. Pl -0.1 μ mol/L; $p=0.027$) CKJ: \downarrow ApoB ($p<0.001$) NSD: TC, TG, HDL-C, LDL-C, FFA, ApoA1, ApoB/ApoA1 | NSD within or between groups: BW, BMI, WHR, BFP, TFA, VFA, SFA | Not measured. |

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| Shin (2011) (10) | South Korea | 45 (27/18) | IFG: FBG 5.6–6.9 mmol/L | 44.9 ± 3.1 | Parallel, DB, 3- arm, 8 | Chungkook- jang (CKJ); Red ginseng CKJ (RGCKJ) (n=15 each) capsules | Control (starch) 2g/d (n=15) | 20g | CKJ & RGCKJ vs. control: ↓ FBG (CKJ - 1.7 vs. RGCKJ - 1.1 vs. control 0.2 mmol/L; p<0.05) CKJ & RGCKJ: ↓ FBG (p<0.001) | NSD between groups. CKJ: ↓ TC, LDL-C, ApoB/ApoA1 (p<0.05) RGCKJ: ↓ TC (p<0.001), LDL-C (p<0.05) | Not measured. | Not measured. |
| Cha (2012); (11) Lee (2012); ⁽¹⁾ 2) Cha (2014) (13) | South Korea | 60/51 (8/43) | Overweight or obese: BMI ≥23 kg/m ² & WHR≥0.90 (M), ≥0.85 (F) | 41.0 ± 2.3 | Parallel, DB, 12 | Freeze-dried doenjang capsules (DE) (n=26) | Placebo (n=25) | 9.8g | Not measured. | NSD between groups. Both: ↓ TC (p<0.05); LDL-C, ApoB; ↑ ApoA1 (p<0.01) NSD: HDL-C, FFA | DE vs. PI: ↓ BW (DE -0.8 vs. PI - 0.3 kg; p<0.001), BFM (DE -0.7 vs. PI -0.4 kg; p<0.001), VFA (DE -8.6 vs. PI - 0.6 cm²; p=0.041) & BFP (DE -0.6 vs. PI - 0.4%; p=0.007) Both: ↓ TFA (DE p<0.001; PI p<0.05); SFA (DE p<0.01; PI p<0.05), WHR (p<0.05) DE: ↓ BW, BFM, BFP (all p<0.01); VFA (p<0.001) NSD: BMI | Not measured. |

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| Cha (2013); ⁽¹⁾ 4) Lee (2017) (15) | South Korea | 60/53 | Overweight or obese: BMI ≥ 23 kg/m ² & WHR ≥ 0.90 (M), ≥ 0.85 (F) | 43.0 \pm 2.2 | Parallel, DB, 12 | Kochujang capsules (KCJ) (n=30) | Placebo (n=30) | 32g | NSD within or between groups: FBG, FBI, HbA1c, HOMA-IR | KCJ vs. Pl: \downarrow TG (KCJ -0.2 vs. Pl 0.1 mmol/L; p=0.049) KCJ: \downarrow TG, ApoB, ApoB/ApoA1, \uparrow ApoA1 (p<0.05) Placebo: \uparrow ApoA1, \downarrow ApoB (p<0.05) NSD: TC, HDL-C, LDL-C, FFA | KCJ vs. Pl: \downarrow VFA (KCJ -4.8 vs. placebo -0.4 cm²; p=0.043) KCJ: \downarrow VFA (p<0.05) NSD: BP, BMI, WHR, BW, TFA, SFA | Not measured. |
| Byun (2016) (16) | South Korea | 120/83 (40/43) | Overweight or obese: BMI ≥ 23 kg/m ² or WC ≥ 90 cm (M), ≥ 80 cm (F) | 19 to 29 | CO, DB, 12/12/12 | Chungkook-jang capsules (CKJ) | Isocaloric placebo | 35g | Not measured. | NSD between groups. CKJ (F): \downarrow TG & ApoA1 (p=0.039), ApoB (p=0.001) Pl (F): \downarrow TC (p=0.007), LDL-C (p=0.054), HDL-C (p=0.02, FFA (p=0.031), ApoA1 (p=0.003) CKJ (M): \downarrow TC (p=0.004), TG (p=0.001), ApoA1 (p=0.0002) | Women CKJ vs. Pl: \downarrow WC (CKJ -1.05 vs. placebo 1.84 cm; p=0.0067), WHR (CKJ -0.01 vs. Pl 0.02; p=0.0083), BFP (CKJ -0.84 vs. Pl 0.2%; p=0.0488) Men CKJ: \downarrow WHR (p=0.0034) Men Pl: \downarrow WHR (p=0.0303) Women Pl: \downarrow WC (p=0.0120), WHR (p=0.0013). NSD: BMI, BW, TFA, SFA, VFA | Not measured. |

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| Han (2022) (17) | South Korea | 58/54 (20/38) | Overweight / obese: BMI ≥ 23 kg/m ² or BFP $\geq 25\%$ (M), $\geq 30\%$ (F) | HTK: 41.58 \pm 9.19; LTK: 41.1 \pm 10.08; CK: 37.16 \pm 11.21 | Parallel, DB, 6 | High effective microorganisms traditional kochujang (HTK) (n=19); low effective microorganisms traditional kochujang (LTK) (n=18) | Commercial kochujang (CK) (n=17) | 25.3g (19g KCJ) | No between group statistical analysis reported. NSD: FBG. | No between group statistical analysis reported. HTK: \downarrow TC (p=0.011); LDL-C (p=0.020), HDL-C (p=0.003), TG (p=0.003) | No between group statistical analysis reported. HTK: \downarrow WC (p=0.006), VFA (p=0.021) CK: \downarrow WHR (p=0.024), WC (p=0.002) NSD: BW, BMI, BFP, BFM SFA | No between group statistical analysis reported. NSD: hs-CRP, AST, ALT, GGT; presence of beneficial, harmful and other faecal microorganisms. |
| SHIOKOJI/ MISO/ KOCHUJANG/ AMAZAKE/ TOUCHI <i>Aspergillus oryzae</i> | | | | | | | | | | | | |
| Fujita (2001) (18) | Japan | 38/36 (15/21) | Borderline/ mild T2DM: FBG 5.5–7.4 mmol/L; HbA1c 5.0 – 8.0% | 63.3 \pm 2.4 | Parallel, DB, 12 | Touchi-extract supplemented Houji tea (TE) (n=18) | Houji tea (HT; n=18) | 0.3g | TE vs. HT: \downarrow FBG (TE - 0.5 vs. HT 0.2 mmol/L; p<0.05), HbA1c (TE -0.5 vs. HT 0.1 mmol/L; p<0.01). TE: \downarrow FBG (p<0.05), HbA1c (p<0.01). | NSD within or between groups: TC, HDL-C, TG. | NSD within or between groups: BW, BMI. | Not measured. |

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| Lim (2015) (19) | South Korea | 30/26 (13/17) | Mild hyperlipidaemia: LDL-C 2.8–4.9 mmol/L or TC 5.2–6.7 mmol/L | 42.0 ± 7.7 | Parallel, DB, 12 | <i>A. oryzae</i> -fermented Kochujang (KCJ) (n=13) | Placebo (n=13) | 34.5g | Not measured. | KCJ vs. placebo: ↓ TC (KCJ -0.5 vs. PI -0.2 mmol/L; p=0.045) KCJ: ↓ TC (p<0.001) NSD: TG, HDL-C | NSD within or between groups: BFM, BFP, BMI, WHR . | Not measured. |
| Kondo (2019) (20) | Japan | 40/38 (28/10) | High-normal BP (130–139/85–89 mmHg) to untreated stage I hypertension (140–159/90–99 mmHg) | Miso: 54 ± 7; Control: 53 ± 7 | Parallel, DB, 8 | Mixture of Nenrin & MK-24-1 miso (3.8 g salt/ day) (n=19) | Soy food (0.2 g salt/day) (n=19) | Miso: 32 g; soy food 14.4 g | NSD within or between groups: FBG. | NSD between groups. Miso: ↑ LDL-C (p<0.05) NSD: TC, TG, HDL-C | Miso vs. control: ↓ overall nighttime SBP & DBP (p<0.05); ↓ BW (miso 0.636 vs. control 0.073 kg; p<0.05) Miso: ↓ Nighttime SBP & DBP (p<0.05) Control: ↑ Nighttime DBP (p<0.05) NSD: Daytime DBP, SBP, BW | NSD within or between groups: ALT, AST, GGT. Inflammatory markers & gut microbiota composition not measured. |
| Nakamura (2020) (21) | Japan | 49/47 (35/12) | Mild hyperglycaemia: FBG 5.6–6.9 mmol/L | Shiokoji: 54.7 ± 8.8; placebo: 58.1 ± 7.4 | Parallel, DB, 12 | Shiokoji (n=16) | Placebo (n=14) | 15 g | NSD between groups. PI: ↑ FBG (p=0.003, 12 w) NSD: HbA1c, HOMA-IR | Collected but not reported. | Collected but not reported. | Not measured. |

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| Akamine (2022) (22) | Japan | MetS: 40 (20/20) Fecal: 40/34 SCFA: 40/35 | MetS: BMI ≥25 kg/m ² and any 2 of: (1) TG ≥1.7 mmol/L; (2) HDL-C ≤1.0 mmol/L; (3) SBP ≥130 mmHg +/- DBP ≥85 mmHg; or (4) FBG ≥5.6 mmol/L | BA: 56.7 ± 2.2; WA 58.5 ± 2.2 | Parallel, open, 4 | Brown rice amazake (BA) (n=21) | White rice amazake (WA) (n=19) | 350 g | NSD within or between groups: FBG, HbA1c, FBI, HOMA-IR. | NSD within or between groups: TC, HDL-C, LDL- C, TG. | NSD within or between groups: BW, BMI, WC, SBP, DBP. | BA vs. WA: BA ↑/ WA ↓ bacteria from <i>Porphyromona</i> <i>da-ceae</i> (p=0.013); <i>Parabacteroides</i> (p=0.011); <i>Sutterella</i> (p=0.001); <i>Sutterella</i> <i>wadsworthensis</i> (p=0.001); <i>Lactobacillales</i> bacterium DJF B280 (p=0.005); <i>Firmicutes</i> bacterium DJF VP44 (p=0.038); <i>Butyricicoccus</i> (p=0.012); <i>Eubacterium</i> spp. A2 207 (p=0.012). Significant negative correlations: <i>Sutterella</i> <i>wadsworthensis</i> / FBG (p=0.032); <i>Lactobacillales</i> bacterium DJF B280/ TG (p=0.006); <i>Eubacterium</i> |
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| | | | | | | | | | | | | <p>spp. A2 207/ TG (p=0.001). Significant positive correlations: <i>Lactobacillales</i> bacterium DJF B280/ HDL-C (p=0.037); <i>Eubacterium</i> spp. A2 207/ LDL-C (p=0.046). WA: significant increase in <i>Flavonifractor plautii</i> species (p=0.026)</p> <p>Inflammatory & liver markers not measured.</p> |
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| TEMPEH <i>Rhizopus</i> spp. | | | | | | | | | | | | |
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| Wira-wanti (2017) (23) | Indo-nesia | 54/51 (22/29) | Hyperchol: TC \geq 5.2 mmol/L | 25-45 (64.7%); 46-55 (35.3%) | Parallel, open, 4 | Tempe A drink, local soybeans (TA) (n=17); Tempe B drink, imported soybeans (TB) (n=17) | Control (no intervention) (n=17) | 95.46 g | Not measured. | TA vs. TB vs. control: ↓ LDL-C (TA - 0.1 vs. TB - 0.03 vs. control 0.2 mmol/L; p=0.01) TA & TB: ↓ TC (p=0.00) Control: ↓ LDL-C (p=0.00), HDL-C (p=0.04) NSD: TG | Not measured. | Not measured. |
| Afifah (2020) (24) | Indo-nesia | 45/41 | Women with hyperlipida- emia: TC \geq 5.2 mmol/L &/or LDL- C \geq 2.6 mmol/L | T1: 46.38 \pm 7.44; T2: 48.31 \pm 6.03; Control: 45.13 \pm 6.65 | Parallel, open, 2 | Treatment 1 (T1): 103 g tempeh gembus (n=13); Treatment 2 (T2): 206 g tempeh gembus (n=13) | Control (10 mg simvastatin) (n=15) | 103 or 206 g | Not measured. | T1 vs. T2 vs. control: ↓ LDL-C (T1 - 1.1 vs. T2 -1.3 vs. control - 0.7 mmol/L; p=0.035) T2 vs. control: ↓ LDL-C (-0.6 mmol/L; p=0.011) All: ↓ TC (T1 & T2 p=0.000; control p=0.001), LDL-C (T1 & T2 p=0.000; control | Not measured. | Not measured. |

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| | | | | | | | | | | p=0.002) NSD: TG, HDL-C | | |
| Nadia (2021); ⁽²⁾ 5) Wati (2020) ⁽²⁶⁾ | Indo- nesia | 40 | Women with obesity: BMI \geq 23 kg/m ² | Tempeh: 36.50 \pm 9.37; Control: 35.05 \pm 8.54 | Parallel, open, 4 | Isocaloric diet 30 kcal/kg of BW/day with added tempeh gembus | Isocaloric diet 30 kcal/kg of BW/day | 150 g | Tempeh vs. control: \downarrow FBG (tempeh - 2.3 vs. control -0.4 mmol/L; p=0.00), HOMA-IR (tempeh - 18.4 vs. control -0.6; p=0.00), FBI (tempeh - 14.2 vs. control -0.7 μIU/L; p=0.00) Both: \downarrow FBG (p=0.00), FBI (p=0.000), HOMA-IR (p=0.00) | Tempeh vs. control: \downarrow TG (tempeh -0.1 vs. control 0.03 mmol/L; p=0.01), hsCRP (tempeh -1.94 vs. control - 1.65 mg/L; p=0.03); \uparrow HDL-C (tempeh 0.2 vs. control 0.2 mmol/L; p=0.00) Both: \downarrow TG (p=0.000); \uparrow HDL-C, \downarrow hsCRP (all p=0.00). | Not measured. | Not measured. |

| OTHERS | | | | | | | | | | | | |
|---|-------------|--------------------|---|----------------|---------------------------------------|--|--|--------------------|--|---|---|---|
| Kim (2011) (27) | South Korea | 30 (16/14) | FBG ≥ 7 mmol/L or ≥ 11.1 mmol/L in OGTT | 49.5 \pm 6.3 | Parallel, DB, 12 | Brown rice lees powder (LB) (n=15) ? <i>microorganisms</i> | Mixed-grain product powder (MG) (n=15) | LB: 40 g; MG: 45 g | NSD between groups. Both: \downarrow HbA1c (p<0.05) NSD: FBG, C-pep., FBI, 2hPPI, HOMA-IR | LB vs. MG: \downarrow TC (LB 0.3 vs. MG -0.2 mmol/L; p<0.05), LDL-C (LB 0.2 vs. MG -0.3 mmol/L; p<0.05) MG: \downarrow TC, LDL-C (p<0.05) NSD: TG, FFA | LB vs. MG: \downarrow WC (LB -2.8 vs. MG -0.9 cm; p<0.05) LB: \downarrow WC (p<0.05) MG: \downarrow SBP (p<0.05) NSD: BW, BMI, BFP, DBP | LB vs. MG: \downarrow AST (LB -4.5 vs. MG -0.1 IU/mL; p<0.05), ALT (LB -6.7 vs. MG 0.1 IU/mL; p<0.05) MG: \downarrow AST, ALT (p<0.05) NSD: IL-10, IL-7, TNF-a, CRP Gut microbiota composition not measured. |
| Somanah (2012); (28) Somanah (2014) (29) | Mauritius | 127/100 (53/47) | Neo-diabetes: FBG 5.1–5.9 mmol/L | 25 to 60 | Parallel, open, 14 (+ 2-wk follow up) | Fermented papaya preparation (FPP) (n=44) ? <i>yeast</i> | Control (water) (n=57) | 6g | NSD within or between groups: FBG, HbA1c. | NSD between groups. FPP (M): \uparrow TG (p<0.05) Control (M): \downarrow TC, LDL-C (both p<0.05), HDL-C (p<0.001) Control (F): \downarrow TC, LDL-C (both p<0.001), HDL-C (p<0.01) | NSD between groups. FPP (F): \downarrow BMI, DBP (p<0.05) Control (M): \downarrow SBP, DBP (p<0.05) NSD: WHR | FPP vs. control: \downarrow CRP (FPP p=0.018) NSD: AST, ALT Gut microbiota composition not measured. |

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|----------------------------------|------|------------------|--|---|--------------------|---|---|-------------------------------|--|--|---|--|
| Jung (2021) (30) | USA | 29/27 (6/21) | CVD risk biomarkers: ≥2: smoking; SBP ≥140/90 mmHg; LDL-C ≥2.9 mmol/L; HDL-C ≥1.0 mmol/L; TG ≥1.7 mmol/L; FBG ≥6.1 mmol/L; BMI ≥25 kg/m ² ; family history of heart disease | FS first: 50.3 ± 12.3; GBR first: 52.5 ± 14.8 | CO, DB, 12/2/12 | Fermented soy powder (FS) Q-Can Natural ? <i>microorganism</i> s | Germinated brown rice powder (GBR) | Soy 12.5 g; GBR 15 g | NSD within or between groups: FBG, FBI, HOMA. | FS vs. GBR: ↓ TC (FS -0.23 vs. GBR 0.14 mmol/L; p=0.0024), LDL-C (FS - 0.18 vs. GBR 0.4 mmol/L; p=0.0317), HDL-C (FS - 0.03 vs. GBR 0.09 mmol/L; p=0.0036), ApoA1 (FS - 0.04 vs. GBR 0.04 g/L; p=0.0390) FS: ↓ TC (p=0.0073), LDL-C (p=0.0132), ApoB (p=0.0303) GBR: ↑ HDL- C (p=0.0026) NSD: TG, ApoB: ApoA1 | NSD within or between groups: BP, BMI, WC, BFP . | Not measured. |
| Moham- madi (2022) (31) | Iran | 44/36 (15/21) | H/T: SBP ≥130 mmHg ± DBP ≥80 mmHg, or consuming antihyper- tensive drug | Overall: 51.92 ± 8.5; GEC first: 54 ± 9.6; placebo first: 51.9 ± 7.7 | CO, DB, 6/3/6 | Fermented garlic extract dark chocolate (GEC) ? <i>microorganism</i> s | Dark chocolate | 650 mg | Not measured. | NSD within or between groups: TC, TG, LDL-C, HDL-C. | NSD within or between groups: BP, BMI, WC, BW. | NSD within or between groups: CRP. Inflammatory markers & gut microbiota composition not measured. |

n: number; R/C: randomized/ completed; M/F: male/ female; BMI: body mass index; CO: crossover; Pl: placebo; FBG: fasting blood glucose; FBI: fasting blood insulin; NSD: no significant difference; C-pep: C-peptide; 2hPPG: 2-hour postprandial glucose; 2hPPI: 2-hour postprandial insulin; TC: total cholesterol; HDL-C: high density lipoprotein cholesterol; LDL-C: low density lipoprotein cholesterol; BFP: body fat percentage; SBP: systolic blood pressure; DBP: diastolic blood pressure; BW: body weight; WHR: waist-hip ratio; NS: not stated; T2DM: type 2 diabetes mellitus; TG: triglycerides; BP: blood pressure; WC: waist circumference; HbA1c: haemoglobin A1c; HOMA-IR: Homeostatic Model Assessment of Insulin Resistance; CRP: C-reactive protein; IL-6: interleukin-6; IL-10: interleukin-10; TNF- α : tumour necrosis factor alpha; MetS: metabolic syndrome; IFG: impaired fasting glucose; DB: double blinded; ACSL1: Acyl-CoA Synthetase Long Chain Family Member 1; ANPEP: Alanyl Aminopeptidase, Membrane; wk: week; LAB: lactic acid bacteria; ApoB: apolipoprotein B; ApoA1: apolipoprotein A1; TFA: total fat area; VFA: visceral fat area; SFA: subcutaneous fat area; BFM: body fat mass; FFA: free fatty acids; hs-CRP: high-sensitivity C-reactive protein; AST: aspartate aminotransferase; ALT: alanine transaminase; GGT: *gamma-glutamyl transferase* ; IL-7: interleukin-7.; FS: fermented soy; Hyperchol: hypercholesterolaemia; H/T: hypertension.

1. Kim EK, An S-Y, Lee M-S et al. (2011) Fermented kimchi reduces body weight and improves metabolic parameters in overweight and obese patients. *Nutr Res* **31**, 436–443.
2. An S.-Y., Lee M.S., Choi Y.J. et al. (2012) Favorable effects of kimchi on metabolic parameters and cytokine levels in patients with type 2 diabetes mellitus. *Diabetes*, 72nd Scientific Sessions of the American Diabetes Association. Philadelphia, PA United States. **61**, A190.
3. An S-Y, Lee MS, Jeon JY et al. (2013) Beneficial effects of fresh and fermented kimchi in prediabetic individuals. *Ann Nutr Metab* **63**, 111–119.
4. Lee M.S., An S.-Y., Jeon J.Y. et al. (2013) Beneficial effects of Kimchi on metabolic parameters in subjects with metabolic syndrome. *Diabetes*, 73rd Scientific Sessions of the American Diabetes Association. Chicago, IL United States. **62**, A191.
5. Oh M-R, Park S-H, Kim S-Y et al. (2014) Postprandial glucose-lowering effects of fermented red ginseng in subjects with impaired fasting glucose or type 2 diabetes: a randomized, double-blind, placebo-controlled clinical trial. *BMC Complement Altern Med* **14**, 237.
6. Han K, Bose S, Wang J et al. (2015) Contrasting effects of fresh and fermented kimchi consumption on gut microbiota composition and gene expression related to metabolic syndrome in obese Korean women. *Mol Nutr Food Res* **59**, 1004–1008.
7. Tenore GC, Caruso D, Buonomo G et al. (2019) Lactofermented Annurca apple puree as a functional food indicated for the control of plasma lipid and oxidative amine levels: Results from a randomised clinical trial. *Nutrients* **11**, 122.
8. Salehi SO, Karimpour F, Imani H et al. (2022) Effects of an Iranian traditional fermented food consumption on blood glucose, blood pressure, and lipid profile in type 2 diabetes: a randomized controlled clinical trial. *Eur J Nutr* **61**, 3367–3375.
9. Back H-I, Kim S-R, Yang J-A et al. (2011) Effects of Chungkookjang Supplementation on Obesity and Atherosclerotic Indices in Overweight/Obese Subjects: A 12-Week, Randomized, Double-Blind, Placebo-Controlled Clinical Trial. *J Med Food* **14**, 532–537.
10. Shin S.-K., Kwon J.-H., Jeong Y.-J. et al. (2011) Supplementation of Cheonggukjang and red ginseng Cheonggukjang can improve plasma lipid profile and fasting blood glucose concentration in subjects with impaired fasting glucose. *J Med Food* **14**, 108–113.
11. Cha Y-S, Yang J-A, Back H-I et al. (2012) Visceral fat and body weight are reduced in overweight adults by the supplementation of Doenjang, a fermented soybean paste. *Nutr Res Pract* **6**, 520–526.
12. Lee M, Chae S, Cha Y et al. (2012) Supplementation of Korean fermented soy paste doenjang reduces visceral fat in overweight subjects with mutant uncoupling protein-1 allele. *Nutr Res* **32**, 8–14.

13. Cha Y-S, Park Y, Lee M et al. (2014) Doenjang, a Korean Fermented Soy Food, Exerts Antiobesity and Antioxidative Activities in Overweight Subjects with the PPAR- γ 2 C1431T Polymorphism: 12-Week, Double-Blind Randomized Clinical Trial. *J Med Food* **17**, 119–127.
14. Cha Y-S, Kim S-R, Yang J-A et al. (2013) Kochujang, fermented soybean-based red pepper paste, decreases visceral fat and improves blood lipid profiles in overweight adults. *Nutr Metab* **10**, 24.
15. Lee Y, Cha Y-S, Park Y et al. (2017) PPAR γ 2 C1431T Polymorphism Interacts with the Antiobesogenic Effects of Kochujang, a Korean Fermented, Soybean-Based Red Pepper Paste, in Overweight/Obese Subjects: A 12-Week, Double-Blind Randomized Clinical Trial. *J Med Food* **20**, 610–617.
16. Byun M-S, Yu O-K, Cha Y-S et al. (2016) Korean traditional Chungkookjang improves body composition, lipid profiles and atherogenic indices in overweight/obese subjects: a double-blind, randomized, crossover, placebo-controlled clinical trial. *Eur J Clin Nutr* **70**, 1116–1122.
17. Han AL, Jeong SJ, Ryu MS et al. (2022) Anti-Obesity Effects of Traditional and Commercial Kochujang in Overweight and Obese Adults: a Randomized Controlled Trial. *Nutrients* **14**,.
18. Fujita H, Yamagami T & Ohshima K (2001) Long-Term Ingestion of a Fermented Soybean-Derived Touchi-Extract with α -Glucosidase Inhibitory Activity Is Safe and Effective in Humans with Borderline and Mild Type-2 Diabetes. *J Nutr* **131**, 2105–2108.
19. Lim J-H, Jung E-S, Choi E-K et al. (2015) Supplementation with *Aspergillus oryzae*-fermented kochujang lowers serum cholesterol in subjects with hyperlipidemia. *Clin Nutr* **34**, 383–387.
20. Kondo H, Sakuyama Tomari H, Yamakawa S et al. (2019) Long-term intake of miso soup decreases nighttime blood pressure in subjects with high-normal blood pressure or stage I hypertension. *Hypertens Res* **42**, 1757–1767.
21. Nakamura A, Kitagawa M, Yamamoto T et al. (2020) Fasting blood glucose-lowering effects of salted rice koji (Shiokoji) in mildly hyperglycemic adults - a randomized, double-blind, placebo-controlled parallel-group study. *Jpn Pharmacol Ther* **48**, 215–224.
22. Akamine Y, Millman JF, Uema T et al. (2022) Fermented brown rice beverage distinctively modulates the gut microbiota in Okinawans with metabolic syndrome: A randomized controlled trial. *Nutr Res* **103**, 68–81.
23. Wirawanti IW, Hardinsyah H, Briawan D et al. (2017) Efek intervensi minuman tempe terhadap penurunan kadar low density lipoprotein. *J Gizi Dan Pangan* **12**, 9–16.
24. Afifah DN, Nabilah N, Supraba GT et al. (2020) The effects of tempeh gembus, an Indonesian fermented food, on lipid profiles in women with hyperlipidemia. *Curr Nutr Food Sci* **16**, 56–64.

25. Nadia FS, Wati DA, Isnawati M et al. (2020) The effect of processed tempeh gembus to triglycerides levels and insulin resistance status in women with obesity. *Food Res* **4**, 1000-1010.
26. Wati DA, Nadia FS, Isnawati M et al. (2020) The effect of processed Tempeh gembus to high sensitivity c-reactive protein (hsCRP) and high-density lipoprotein (HDL) levels in women with obesity. *Potravinarstvo Slovak J Food Sci* **14**, 8–16.
27. Kim T.H., Kim E.K., Lee M.-S. et al. (2011) Intake of brown rice lees reduces waist circumference and improves metabolic parameters in type 2 diabetes. *Nutr Res* **31**, 131–138.
28. Somanah J, Aruoma OI, Gunness TK et al. (2012) Effects of a short term supplementation of a fermented papaya preparation on biomarkers of diabetes mellitus in a randomized Mauritian population. *Prev Med, Dietary Nutraceuticals and Age Management Medicine* **54**, S90–S97.
29. Somanah J, Bourdon E, Rondeau P et al. (2014) Relationship between fermented papaya preparation supplementation, erythrocyte integrity and antioxidant status in pre-diabetics. *Food Chem Toxicol* **65**, 12–17.
30. Jung SM, Haddad EH, Kaur A et al. (2021) A non-probiotic fermented soy product reduces total and LDL cholesterol: A randomized controlled crossover trial. *Nutrients* **13**, 535.
31. Mohammadi S, Mazloomi SM, Niakousari M et al. (2022) Evaluating the effects of dark chocolate formulated with micro-encapsulated fermented garlic extract on cardio-metabolic indices in hypertensive patients: A crossover, triple-blind placebo-controlled randomized clinical trial. *Phytother Res* **36**, 1785–1796.