# Supplementary

***Table S1. Summary of studies investigating the effect of polyphenols, prebiotics and probiotics on bile acids and lipid profiles/gut microbiota in animal models***

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| **Author** | **Animal Type –**  **Number (n) –**  **Study Duration/Design -** | **Diet/Daily Dose** | **Results** | | |
| **Bile Acids** | **Lipid Profile** | **Gut Microbiota** |
| **Polyphenols** | | | | | |
| (119) | Male F344 rats (4 weeks old)  n=50  Parallel, 4 weeks | **Group I:** Control diet  **Group II:** control diet with added 2.1% standard apple pomace with apple seeds  **Group III:** control diet with added 2.1% apple pomace without apple seeds  **Group IV:** control diet with added 6.5% standard apple pomace with seeds  **Group V:** control diet with added 6.5% apple pomace without apple seeds | **Group II/III/IV/V**: ↑faecal excretion of total and primary BAs | **Group II/III/IV**: ↓LDL-C/IDL-C  ↑Production of SCFA | N/A |
| (170) | Female Sprague–Dawley (SD) rats (6-months old)  n=24 per group  Parallel, 6 months | **Group I:** Drinking water containing 0% green tea polyphenols (GTP) (wt/vol).  **Group II:** Drinking water containing 0.5% GTP (wt/vol).  **Group III:** Drinking water containing 1.5% GTP (wt/vol).  All groups had standard chow diet. | **Group II/III vs Group I:** ↓bile constituents, suggesting that GTP downregulates synthesis and secretion of bile | **N/A** | **Group II/III vs Group I:** ↑gut metabolites indicating altered gut microbiome |
| (48) | Female C57BL/6J mice and ApoE/ mice with  a C57BL/6 genetic background (8 weeks old)  n=20  Parallel, 30 days | **Group I:** Standard chow diet  **Group II:** standard chow diet with resveratrol (0.4%)  **Group III:** standard chow diet with resveratrol (0.4%) and choline (1%) | **Group II/III:** ↑BA deconjugation and fecal excretion, ↓Ileal BA content | **N/A** | **Group II/III:** ↑gut Lactobacillus and  Bifidobacterium |
| (127) | Male C57BL/6N mice (5 weeks old)  n=24  Parallel, 8 weeks | **Group I:** Control diet  **Group II:** High fat diet  **Group III:** High fat diet with EGCG (0.32%) | **Group III:** ↓primary cholic acid and β-muricholic acid, ↑taurine conjugated CA/β-muricholic acid and DCA | **Group III vs Group II:** ↓TG | **Group III:** BA profile correlated with ↑Akkermansia and Desulfovibrionaceae |
| (171) | Specific pathogen free (SPF) male C57BL/6 mice (6 weeks old)  n=40  Parallel, 8 weeks | **Group I:** Control diet, daily gavage with water **Group II:** Control diet, daily gavage with dicaffeoylquinic acids (diCQAs) (3.3 mg/mouse)  **Group III:** High fat diet, daily gavage with water  **Group IV:** High fat diet, daily gavage with low dose of diCQAs  **Group V:** High fat diet, daily gavage with high dose of diCQAs | **Group II/IV/V:** induced functional differences of microbial communities including primary BA biosynthesis, secondary BA biosynthesis | **Group IV/V:** N/A | **Group II/IV/V:** ↑abundance of faecal Bifidobacterium |
| (172) | Pregnant Wister rats/Male Wister rats (30 days old)  n=10  Parallel, 140 days | **Group I:** Ad libitum standard diet with with low-fat condensed milk  **Group II:** Ad libitum standard diet with low fat condensed milk and Grape seed procyanidins oral supplement 25 mg/kg of body weight | **Group II:** ↓faecal excretion of BA | **Group II:** ↓high-density lipoprotein cholesterol (HDL-C) levels, ↑total C-to-HDL-C ratios and ↑fasting TG-to-HDL-C ratio, ↓faecal excretion of cholesterol  Impaired reverse cholesterol transport (RCT) in offspring of GSPE-treated dams | **N/A** |
| (173) | Specific pathogen-free male C57BL/6 wild-type (WT) mice (8 months old)  n=3  Parallel, 2 months | **Group I:** Western diet (21% fat, 34% sucrose, and 0.2% cholesterol, w/w) with control (PBS)  **Group II**: Control diet (CD, 5% fat, 12% sucrose, and 0.01% cholesterol, w/w) with control (PBS)  **Group III:** Western diet (21% fat, 34% sucrose, and 0.2% cholesterol, w/w) with EGCG daily 100 μg/d per gram body weight, orally  **Group IV**: Control diet (CD, 5% fat, 12% sucrose, and 0.01% cholesterol, w/w) with EGCG daily 100 μg/d per gram body weight, orally | **Group III:** ↓total serum BA’s and DCA, ↑CDCA, β-MCA, LCA and TLCA | **Group III:** ↓diet-increased obesity, visceral fat, and insulin resistance | **Group III/IV:** ↑Verrucomicrobiaceae and Enterococcaceae, ↓Deferribacteres and Proteobacteria |
| (109) | Male C57BL/6J mice (8 weeks old)  n=50  Parallel, 33 weeks | **Group I:** Low‐fat diet (LF, AIN93M diet with 10% calories from fat)  **Group II:** High fat western (HFW 60% calories from fat)  **Group III:** HFW + EGCG diet (HFWE, containing 3.2g EGCG kg–1 diet) | **Group III:** ↓intestinal BA content, ↑faecal excretion of bile acids, | **Group III:** ↓serum TC and severity of fatty liver after 17 weeks (less so by week 33), ↑faecal excretion of cholesterol and total lipids | **N/A** |
| (118) | Male lean (Fa/-) and obese (fa/fa) Zucker rats  Parallel, 21 days | **Group I:** Semi purified diet distributed as a moistened powder  **Group II:** Semi purified diet with 200g/kg lyophilized apple (Renetta Canada apples containing chlorogenic acid, 180; procyanidin B1, 34; procyanidin B2, 156; catechin, 11; epicatechin, 90; quercetin glycosides, 22, phloretin glycosides, 67 (mg/kg fresh weight)) | **Group II:** ↑intestinal pool and faecal excretion of bile acids in all rats | **Group II:** ↓plasma and LDL cholesterol, ↓triglyceride accumulation in heart and liver in obese rats | **N/A** |
| (142) | Wild‐type male (C57BL/6) and Fxr−/− mice (8-10 weeks old)  n = 12 (6 per experimental group)  Parallel, 14 hours or 3 days | **Group I:** Standard diet, oral gavage with water (control)  **Group II:** Standard diet, oral gavage with grape seed polyphenols (GSPE) (250 mg per kg).  For FGF15 expression mice were terminated at 2‐, 4‐, or 8 h post‐administration. For CYP7A1 protein levels, mice were gavaged with control or GSPE (250 mg/kg) for 3 days and terminated on day 3. | **Group II:** ↓serum levels of BAs, ↑faecal BAs | **Group II:** ↓serum TG, and TC |  |
| (144) | Crossbred female pigs (7 months old)  n=6  Crossover, 12 days | Standard diet of corn soy, and wheat (65% corn, 20% soy, 10% wheat and balanced with vitamin and mineral supplements) for 3 days, then intervention diet (standard diets supplemented with 1% w/w grape seed extract (GSE)) for 6 days, then post treatment control feeding (standard diet) for 3 days. | Treatment ↑faecal excretion of deoxycholic acid and lithocholic, ↑microbiota metabolites from secondary BAs (7‐hydroxy‐3‐oxo‐5β‐cholanoic acid) | Treatment ↑faecal TC and its metabolites (coprostanol and cholestenol) | **N/A** |
| (143) | Male Wistar rats (7 weeks old)  n = 5 (control diet), n = 8 (fructose diet)  Parallel, 8 weeks (+1 week oral gavage) | **Group I:** Modification of AIN-93G replacing all sucrose with starch  for 8 weeks, then water via oral gavage  **Group II:** Fructose diet (modification of AIN-93G replacing all sucrose and starch with fructose) for 8 weeks, then water via oral gavage  **Group III:** Modification of AIN-93G replacing all sucrose with starch  for 8 weeks, then GSPE (250 mg/kg) via oral gavage  **Group IV:** Fructose diet for 8 weeks, then GSPE (250 mg/kg) via oral gavage | **Group IV:** ↑faecal BA, ↓serum BAs | **Group IV:** ↓fructose elevated serum triglyceride levels, inhibited hepatic lipogenesis, ↑faecal TC and total lipids, ↑expression of genes involved in cholesterol synthesis, ↓hepatic TC but ↔ serum TC | **N/A** |
| (102) | Male Wistar rats  n=12 per group  Parallel, 1 week of adaptation, 4 weeks experimental diet | Semisynthetic control diet, 1 week of adaptation  **Group I:** drinking  Water (ad libitum)  **Group II:** apple pomace extraction juice instead of drinking water (ad libitum)  **Group III:** grape pomace extraction juice instead of drinking water (ad libitum)  **Group IV:** red beet pomace extraction juice instead of drinking water (ad libitum) | **Group II/III/IV:** intestinal contents contained ↑primary BAs, ↓secondary BAs | **Group II/IV:** ↑acetate and total short-chain fatty  acids  **Group II/III/IV:** intestinal contents contained ↑TC, and  cholesterol metabolites | **Group II:** ↑faecal counts of Lactobacillus and Bifidobacterium |
| (125) | Male Donryu rats (4 weeks old)  n=10 (control), n=8 (resveratrol)  Parallel, 10 days adaptation, 3 days experimental diet | **Group I:** 20% casein, 7% soybean oil, 13.2% α-cornstarch, 10% sucrose, 3.5% mineral mixture, 1% vitamin mixture, 0.25% choline bitartrate, 0.3% l-cystine and 5% cellulose powder with 39.75% β-cornstarch (control diet)  **Group II:** As above with resveratrol (10ppm) in place of cornstarch  **Group III:** As above with resveratrol (50ppm) in place of cornstarch | **Group II/III:** ↑excretion of total BAs into faeces | **Group II/III:** dose-dependently ↓ serum triglyceride and VLDL + LDLC, ↑excretion of neutral sterols | **N/A** |
| (139) | Female Wistar rats  n=6-7 per group (4 groups)  Parallel, 9 days | **Group I:** Saline by i.p. injection once daily (8 days)  **Group II:** Saline by i.p. injection once daily (8 days) with ethinylestradiol (5 mg/kg body weight) s.c. once daily for 5 days, starting on day 4  **Group III:** EGCG 50 mg/kg body weight (EGCG group) by i.p. injection once daily (8 days)  **Group IV:** EGCG 50 mg/kg body weight (EGCG group) by i.p. injection once daily (8 days) with ethinylestradiol (5 mg/kg body weight) s.c. once daily for 5 days, starting on day 4 | **Group III:** ↓bile flow, ↑plasma BAs | **N/A** | **N/A** |
| (124) | Adult male Sprague–Dawley rats (7-8 weeks old)  n=30 per group (3 groups)  Parallel, 15, 30 or 45 days | **Group I:** Basal feed diet **Group II:** high fat diet  **Group III:** high fat diet with Pu‐erh tea extract (PTE) 675 mg/kg administered by gavage daily | **Group III:** ↑faecal BAs | **Group III:** ↓hyperlipidemia from high fat diet, TC, TG, and LDL‐C levels similar to basal diet rats, ↑faecal TC |  |
| (123) | Male Syrian hamsters (5-6 weeks old)  n = 14 (4 groups)  Parallel, 4 weeks | **Group I:** Control diet  **Group II:** high-fat/cholesterol (HF) diet **Group III:** HF diet with 0.5% Glossogyne tenuifolia (GT) Cassini herbal tea extracts  **Group IV:** HF diet with 1.5% Glossogyne tenuifolia (GT) Cassini herbal tea extracts | **Group III/IV:** ↑faecal BAs | **Group III/IV:** ↓reduced serum TC and LDL-C, ↓liver triacylglycerol, ↑faecal TC | **N/A** |
| (126) | Male ApoE‐deficient mice (5 weeks old)  n=13 per group (2 groups)  Parallel, 12 weeks | **Group I:** AIN‐93G phenolic‐free diet  **Group II:** AIN‐93G diet supplemented with cyanidin‐3‐O‐β‐glucoside (Cy‐3‐G) (0.06% w/w) (concentrations of anthocyanins - 130 mg/kg per day) | **Group II:** ↑faecal BAs | **Group II:** inhibited formation of aortic sinus plaque, ↓hypercholesterolemia |  |
| (140) | Male diabetic db/db and nondiabetic db/+ mice (7 weeks old)  n=9-10 per group (5 groups)  Parallel, 21 days | **Group I:** 5% buckwheat sprout (BS) (high in flavonoid compounds such as rutin and 4 C‐glucosyl flavon) diet based on AIN‐93G (diabetic mice)  **Group II:** 10% BS diet based on AIN‐93G (diabetic mice)  **Group III:** 10% BS diet based on AIN‐93G (non-diabetic mice)  **Group IV:** AIN‐93G diet (diabetic mice)  **Group V:** AIN‐93G diet (nondiabetic mice) | **Group I/II:** ↑faecal BAs compared to control diet in diabetic mice | **Group I/II:** ↓hepatic lipids, TC, triglyceride, and TBARS levels, ↑hepatic lipid regulation enzymes such as 3‐hydroxy‐3‐methylglutaryl‐CoA reductase (HMG‐CoAR) | **N/A** |
| (128) | ApoE-deficient male mice on a C57BL/6J background (8 weeks old)  n=24 (8 per group)  Parallel, 1 week adaptation, 8 weeks high fat diet, 10 weeks treatment diet | Diet of commercial chow during adaptation period, then high-fat diet to induce dyslipidemia  **Group I:** high fat diet with T0901317 (10 mg/kg/day, positive control) by oral administration  **Group II:** high fat diet with kaempferol (150 mg/kg/day) by oral administration  **Group III:** high fat diet with vehicle/control (PEG400:Tween 80, 4:1) by oral administration | **Group II:** ↑faecal BAs excretion, | **Group II:** ↑faecal TC excretion, ↓plasma triglyceride concentrations and ↑HDL-C compared with control | **N/A** |
| (129) | Male Wistar rats  n=20  Parallel, 1 week adaptation, 5 weeks treatment | **Group I:** AIN-93G diet  **Group II:** AIN-93G diet containing 0.4% quercetin | **Group II:** ↑faecal BAs | **Group II:** ↔ serum TC, TG, or HDL-C level, ↑serum LDL-C compared with control | **N/A** |
| (120) | Male C57BL/6 mice (21 days old)  n=8 per group (6 groups)  Parallel, 35 days | **Group I:** Control diet  **Group II**: control diet with the flavonoid- and saponin-rich extract (0·25 %)  **Group III:** control diet with cholesterol (0·5 %)  **Group IV:** control diet with cholesterol (0·5 %) and the extract (0·5 %)  **Group V**: control diet with cholesterol (0·5 %) and the extract (0·25 %)  **Group VI:** control diet with cholesterol (0·5 %) and simvastatin (0·03 %) | **Group IV/V:** ↑faecal BA secretion | **Group II/IV/V:** ↓levels of serum TC and HDL-C, especially in mice fed a high-cholesterol diet, ↓levels of LDL-C and TAG  **Group IV/V**: ↓hepatic lipid depots, ↑expression of the reverse cholesterol transporters | **N/A** |
| (121) | Male albino rats Sprague-Dawley Strain  n=12 rats per group (4 groups)  Parallel, 90 days | **Group I:** Control diet  **Group II:** 2% cholesterol diet (cholesterol control)  **Group III:** 2% cholesterol diet + leucodelphinidin derivative (100 mg/kg body wt/day)  **Group IV:** 2% cholesterol diet + quercetin (100 mg/kg body wt/day) | **Group III/IV:** ↑hepatic and faecal BAs | **Group III/IV:** ↑neutral sterols compared to the control cholesterol diet fed group, ↑cholesterogenesis, ↓atherogenic index, ↓serum TC, LDL-C and ↑HDL-C | **N/A** |
| (130) | Male albino rats Sprague-Dawley Strain  n= 12 rats per group (5 groups)  Parallel, 90 days | **Group I:** Control diet  **Group II:** 2% cholesterol diet (cholesterol control)  **Group III:** 2% cholesterol diet + leucodelphinidin derivative (100 mg/kg body wt/day)  **Group IV:** 2% cholesterol diet + leucocyanin derivative (100 mg/kg body wt/day)  **Group V:** 2% cholesterol diet + quercetin derivative (100 mg/kg body wt/day) | **Group II:** ↑hepatic BAs, ↑faecal BAs  **Group III/IV/V:** ↑hepatic and faecal BAs | **Group II:** ↑atherogenic index, ↑neutral sterols, ↓HMG CoA reductase and lipogenic enzyme activities in liver, ↓lipoprotien lipase activity in heart and adipose tissue, ↓plasma LCAT activity, ↓incorporation of labelled acetate into free and ester cholesterol in liver  **Group III/IV/V:** ↑hepatic and faecal neutral sterols, further ↓lipogenic enzyme glucose 6 phosphate dehydrogenase, all other effects of cholesterol diet were reversed | **N/A** |
| (122) | Specific-pathogen-free (SPF) male C57BL/6 mice (6 weeks old)  n=8 per group (7 groups)  Parallel, 1 week adaptation, 10 weeks treatment | **Group I:** Control diet  **Group II:** high-fat diet (HFD)  **Group III:** HFD with lovastatin (Lv, 10 mg/kg)  **Group IV:** HFD with Xuezhikang (XZK), an extract of red yeast rice (1200 mg/kg, equivalent to 10 mg/kg of lovastatin)  **Group V:** HFD with Fraction 1\* (F1, 27.5 mg/kg)  **Group VI:** HFD with Fraction 2\* (F2, 11.3 mg/kg)  **Group VII:** HFD with Fraction 3\* (F3, 35.0 mg/kg).  \*3 fractions F1, F2 and F3 (containing isoflavones, monacolins or phytosterols, respectively) extracted from XZK capsules. | **Group IV**: ↑faecal BAs  **Group V:** ↑faecal BAs  **Group VII:** ↓intestinal absorption of DC by ↓NPC1L1 | **Group IV**: ↑faecal lipids, ↓serum TC, TG and LDL-C, ↑serum HDL-C  **Group V:** ↓serum TC and TG  **Group VII:** ↓serum TC, TG and LDL-C, ↑serum HDL-C, ↑excretion of TC, free cholesterol (FC) and cholesterol ester (CE) | **N/A** |
| **Probiotics** | | | |  |  |
| (65) | Male Sprague-Dawley rats, (5 weeks old)  n=40 (10 per group)  Parallel, 8 weeks (HF diet administered for four weeks followed by saline (Group II) or probiotics administration (Group III/IV) for another four weeks except in Group I) | **Group I:** normal diet  **Group II:** High-fat model diet (HF)  **Group III:** HF with a single probiotic (L. rhamnosus LV108)-fermented milk  **Group IV:** HF with a combined probiotic-fermented milk (the mixture consisted of L. rhamnosus LV108-fermented milk, L. casei grx12-fermented milk, and L. fermentum grx08-fermented milk) | **Group III/IV vs Group II:** ↑total BAs in liver and small intestine | **Group II/III/IV:**  ↑body weight, liver index value  **Group II vs Group I:** ↑serum TC, TG, VLDL-C, LDL-C, and TBA values, liver and small intestine TC, TG, and TBA  **Group III/IV vs Group II:** ↓serum TC, TG, VLDL-C, LDL-C, and TBA values, liver and small intestine TC, TG, and TBA | **N/A** |
| (66) | Male Syrian hamsters, (6 weeks old)  n=8 per group  Parallel, 28 days | **Group I**: High-cholesterol diet (HCD)(0.4 % cholesterol in AIN 93 M diet)  **Group II:** HCD + 1-mL bacterial cell suspensions of L. brevis CAAS 18052 (109 CFU/mL each) daily  **Group III:** HCD + L. fermentum CAAS18087 (109 CFU/mL each) daily  **Group IV:** HCD + L. plantarum CAAS 18008 (109 CFU/mL each) daily | **Group II/Group III vs Group I:** ↔ faecal total BA excretion  **Group IV vs Group I:** ↑faecal total BA excretion | **Group II/III/IV vs Group I:** ↔ serum HDL-C, fecal total neutral sterol excretion or small intestinal NPC1L1 protein  **Group II/Group III vs Group I:** ↔ serum LDL-C/TC and hepatic TC  **Group IV vs Group I:** ↓serum LDL-C, TC and hepatic TC |  |
| (174) | Male C57BL/6J mice (9 weeks-old)  n=8 per group  Parallel, 10 days (normal diet for 7 days, High fat diet (HFD) diet for Group II and III for 3 days) | **Group I:** Control diet supplemented with a daily dose of the placebo (skimmed milk) in the drinking water.  **Group II:** HFD 60% lipids  (soybean oil and lard), 20% protein, and 20% carbohydrates as energy content supplemented with a daily dose of the placebo (skimmed milk) in the drinking water.  **Group III:** HFD with B. animalis IPLA R1 strain bifidobacteria (5x108 cfu) suspended in 10%- skimmed milk daily for 3 days | **Group II vs Group I:** ↑faecal BAs  **Group III vs Group II:** ↔ faecal BAs | **Group II vs Group I:** ↑body weight; energy intake, visceral and subcutaneous adipose tissues, serum TC, HDL-CHO, liver stearic and arachidic acids, ↓hepatic MUFA and PUFA  **Group III vs Group II:** ↔ body weight, energy intake, visceral and subcutaneous adipose tissues, TC, HDL-C, ↓hepatic lipid content and triglycerides, liver stearic and arachidic acids and hepatic PUFA,  ↑hepatic MUFA | **Group II vs Group I:**  ↓caecal Bacteroides- Prevotella  **Group III vs Group II:** ↑faecal and caecal bifidobacteria, Bacteroides- Prevotella community, no change in total bacteria, Roseburia and A. muciniphila  levels |
| (175) | *Study 1-2:* Male C57BL/6 J mice, (5 weeks old)  Parallel, 9 weeks.  *Study 3:* Male C57BL/6J germ-free (GF) mice colonized with altered Schaedler flora (ASF), (5 weeks old)  Parallel, 7 weeks  *Study 4:* Male C57BL/6 J mice, (5 weeks old) | *Study 1:*  **Group I:** Purified control diet  **Group II**: High fat diet (HFD, 38% fat, dominantly milk fat)  *Study 2:*  **Group I:** Purified control diet for 2 weeks followed by *B. wadsworthia* media for 3 days and after 1 week inoculated with *L. rhamnosus* media for 5 weeks  **Group II:** HFD for 2 weeks followed by *B. wadsworthia* ATCC 49260 inoculation (~107 CFU) for 3 days (HFDBw+) and after 1 week inoculated with *L. rhamnosus* (109 CFU) for 5 weeks (HFDBw+LR+).  *Study 3:*  **Group I:** GF colonized mice on CD and after 3 weeks inoculated with *B. wadsworthia* medium for 3 days (HFDBw+) and after 1 week inoculated with *L. rhamnosus* media for 4 weeks (HFDBw+LR+).  **Group II:** GF colonized mice on HFD and after 3 weeks inoculated with *B.*  *wadsworthia* for 3 days (HFDBw+) and after 1 week inoculated with *L. rhamnosus* (109 CFU) for 4 weeks (HFDBw+LR+).  *Study 4:*  **Group I:** Purified control diet for 2 weeks followed by *B. wadsworthia* media for 3 days and after 1 week injected i.p. with vehicle 3x a week for 5 weeks  **Group II:** HFD for 2 weeks followed by *B. wadsworthia* ATCC 49260 inoculation (~107 CFU) for 3 days (HFDBw+) and after 1 week injected i.p. with ciclosporine (25 mg/kg;  or vehicle (PBS) 3x a week for 5 weeks | *Study 1:*  **Group II:** ↑BAs and primary BA conjugates, taurocholic acid (TCA), ↓Deoxycholic acid (DCA), Hyodeoxycholic acid (HDCA)  *Study 2:*  **HFD (Study 1) vs HFDBw+ (Study 2):**  ↑taurocholic acid (TCA), UDCA and MCA-β, sCD14  **HFDBw+  vs HFDBw+LR+** ↓taurocholic acid (TCA), total BAs | *Study 1:*  **Group II:** ↑weight gain, hepatic triglycerides, plasma TC and HDL-C  *Study 2:*  **HFD (Study 1) vs HFDBw+ (Study 2):**  ↔ weight gain, ↑hepatic lipid content and TG, ↓butyrate metabolism pathway  **HFD (Study 1) vs HFDBw+LR+(Study 2):** ↔ weight gain  **HFDBw+  vs HFDBw+LR+** ↔ weight gain, ↑butyrate and propionate  *Study 3:*  **HFD vs HFDBw+ :**  Altered expression of 1630 genes of fat and glucose metabolism and regulation, ↓butyrate metabolism pathway  **HFDBw+  vs HFDBw+LR+**  Reversal of altered fat metabolism and regulation, butyrate metabolism pathway  *Study 4:*  **HFDBw+ vs HFD-CiBw+ :**  ↓weight gain  **HFD vs HFD-Ci**  ↓weight gain | *Study 1:*  **Group II:** ↑faecal *B. wadsworthia* level  *Study 2:*  **HFD (Study 1) vs HFDBw+ (Study 2):**  ↑faecal *B. wadsworthia* level  **HFD (Study 1) vs HFDBw+LR+(Study 2)**  ↓faecal *B. wadsworthia* level  *Study 4:*  **HFDBw+ vs HFD-CiBw+ :** ↔ *B. wadsworthia* density |
| (67) | Male Sprague Dawley rats, (5 weeks old)  n=5 per group  Parallel, 35 days | **Group I:** Normal diet (ND) standard chow diet and PBS (1.0 mL/d)  **Group II:** High-fat diet (normal diet (66.5%, wt/wt), lard (10.0%), sucrose (20.0%), cholesterol (2.5%), and sodium cholate (1.0%))  (HFD) and PBS (1.0 mL/d)  **Group III:** HFD with *E. faecium* WEFA23 (5.0 × 109 cfu/mL in PBS, 1 mL/d) | **Group III vs Group II:** ↓ ratio of conjugated to nonconjugated bile acids, ↑ faecal TBA | **Group II vs Group I:** ↑serum TG, TC, LDL-c and TC level in liver, ↓serum HDL-c  **Group III vs Group II:** ↓serum TG, TC, LDL-C, ↓TC level in liver, ↑serum HDL-C | **Group II vs Group I:** ↑Veillonelaceae growth in intestine, ↓ α diversity of intestinal microbiota  **Group III vs Group II: ↑**Helicobacteraceae growth in intestine, prevented reduction of α diversity of intestinal microbiota |
| (76) | Male C57BL/6 J mice (8 weeks old)  n=18 (Six for baseline data and 12 for study)  Parallel, 14 days | **Group I:** High fat diet (HFD) containing 21% (w/w) pork lard supplemented  with 0.15% (w/w) cholesterol (10 g/cage/day (44.50 kcal/cage/day) and cages were checked daily for surplus food)  **Group II:** HFD supplemented with 5 × 108 cfu/mouse/day of Lab4 plus *L. plantarum* CUL66. | **Group II:** ↑total and unconjugated BAs in the faeces | **Group II:** ↓plasma total cholesterol levels and diet-induced weight gain, ↔ plasma VLDL/LDL, HDL, TG | **N/A** |
| (68) | Male Sprague-Dawley rats, (6 weeks old)  n=8 per group  Parallel, 4 weeks | **Group I:** Normal diet (ND) control group  **Group II:** High-cholesterol diet (HCD): 1% cholesterol, 10% lard, 5% sucrose, 0.3% sodium cholate and 83.7% regular chow  **Group III:** HCD with *E. durans* KLDS 6.0930 (2 × 109cfu ml-1) (Enterococcus strain) | **Group II vs Group I:** ↑faecal total BAs  **Group III vs Group II:** ↑faecal total BAs | **Group II vs Group I:** ↔ body weight gain or serum HDL-C, ↑serum TC, LDL-C, and TG levels  **Group III vs Group II:** ↔ body weight gain, serum TG and HDL-C, ↓serum TC and LDL-C |  |
| (77) | Male C57BL/6J mice, (7–8 weeks old)  n=8 per group  Parallel, 4 weeks adaptation, 32 days treatment | **Group I:** Normal diet  **Group II:** Atherogenic diet (HCD): 40 kcal % fat, 1.25% cholesterol and 0.5% cholic acid  **Group III** HCD for 4 weeks, then HCD with KID7 (3 × 108 cfu/ml) for 32 days  **Group IV** HCD for 4 weeks then HCD with *L. acidophilus* ATCC43121 (3 × 108 cfu/ml) for 32 days | **Group II vs Group I:** ↔ faecal cholic acid content  **Group III vs Group II:** ↑faecal cholic acid content  **Group IV vs Group II:** ↔ faecal cholic acid content | **Group II vs Group I:** ↔ body weight gain, serum HDL-C and TG level, faecal TC, ↑serum TC and LDL-C, liver TC and TG levels  **Group III vs Group II:** ↔ body weight gain, serum HDL-C and TG level, liver TG, faecal TC, ↓serum TC and LDL-C, liver TC levels  **Group IV vs Group II:** ↔ serum HDL-C and TG, liver TG, faecal TC, ↓serum LDL-C | **N/A** |
| (78) | Wild-type C57BL/6J male mice  n=6 per group (2 groups)  Parallel, 21 days | **Group I:** Standard rodent chow and water ad libitum with daily oral gavage of saline  **Group II:** Standard rodent chow and water ad libitum with oral gavage of VSL#3 mixture (50 × 109 cfu/day) (VSL #3 is a commercial product containing three genera and a eight different species of bacteria: lactobacilli (*L. casei, L. plantarum, L. acidophilus*, and *L. delbrueckii*), *Bifidobacteria* (*B. longum, B. breve,* and *B. infantis*), and *Streptococcus* (*S. salivarius*)) | **Group II**: ↑BA deconjugation and fecal excretion, Treatment with FXR agonist normalized faecal BA levels in VSL#3 mice, alterations in BA metabolism were abolished upon FXR and FGF15 deficiency | **N/A** | **N/A** |
| (176) | Specific pathogen-free wild type C57BL/6 male mice, IL10+/+ (wild type) and IL10−/− male mice  n=4 Study 1, n=6 Study 2, n=9-14 Study 3  Parallel, Study 1 3 weeks, Study 2 and Study 3 acclimated to AIN-93G diet for 1 week then 3 weeks | **Group I:** AIN93G diet  **Group II:** AIN93G diet with 50g/kg inulin  **Group III:** AIN93G diet with food-grade probiotics, Bb12 (5.2×1011 colon forming unit (cfu)/g)  **Group IV:** AIN93G diet with food-grade probiotics, Bb12 (5.2×1011 colon forming unit (cfu)/g)  (3 studies, study 1 – wildtype all 4 groups, study 2 – wildtype group I, II and III, study 3 – wildtype/IL10-/- group I, II and III) | **Group II/IV vs Group I/III**: ↑bacterial deconjugation of taurine from primary BAs, ↑BA sulfation by intestinal cells.  **Group III vs all other groups:** ↔ BA deconjugation and little effect on other intestinal indices. | **N/A** | **N/A** |
| (75) | Male C57BL/6 mice (4–6 weeks old)  n=16 groups I and II, n=6 groups 3, 4 and 5  Parallel, 12 weeks | **Group 1:** drinking water containing (CH3COO)2Pb·3H2O at 1 g Pb L−1 for 8 weeks, then replaced with plain water and 0.5 ml of skim milk daily via gavage  **Group II:** drinking water containing (CH3COO)2Pb·3H2O at 1 g Pb L−1 for 8 weeks, then replaced with plain water and *L. plantarum* CCFM8661 at 1 × 109 cfu in 0.5 ml of skim milk daily via gavage for 4 weeks  **Group III:** drinking water containing (CH3COO)2Pb·3H2O at 1 g Pb L−1 for 8 weeks, then replaced with plain water, standard mouse chow replaced with diet supplemented with 2% w/w cholesterol and 0.5 ml of skim milk daily via gavage for 4 weeks.  **Group IV:** identical to Group II group and GW4064 75 mg per kg per body weight daily via gavage for 2 days at end of the experiment  **Group V:** cocktail of antibiotics (kanamycin 0.4 mg mL−1, gentamicin 0.035 mg mL−1, colistin 850 U mL−1, metronidazole 0.215 mg mL−1 and vancomycin 0.045 mg mL−1) to deplete gut microbiota in drinking water for 3 days prior to *L. plantarum* administration (diet identical to that of the Group II) | **Group II vs other groups:** ↑hepatic BA synthesis, ↑bile flow and biliary glutathione output, ↑fecal BA excretion  **Group V vs Group II:** abolished effects on BAs  **Group III vs Group I**: ↑faecal BA levels | **N/A** | **N/A** |
| (70) | Male Sprague-Dauley rats (4 weeks old)  n=20  Parallel, 12 days | **Group I:** cholesterol-enriched diet plus water (cholesterol-enriched diet was (g/100 g): casein 20, safflower oil 10, vitamin mixture (AIN-76) 1, mineral mixture (AIN-76) 4, choline chloride 0.2, sodium cholate 0.12, cellulose powder 2, sucrose 62.17 and cholesterol 0.5  **Group II:** cholesterol-enriched diet plus skim milk *ad libitum*  **Group III:** cholesterol-enriched diet plus fermented milk of *Lactococcus lactis* (lactis IS-29862) *ad libitum*  **Group IV**: cholesterol-enriched diet plus fermented milk of *Lactococcus lactis* (lactis IS-10285) *ad libitum* | **Group IV vs Group I:** ↓serum total BAs | **Group IV vs Group I:** ↓serum TC and LDL-C  **All groups:** ↔ HDL-C  **Group IV vs Group III:** ↓TAG and phospholipid levels | **Group I vs other groups: ↓**anaerobic lactic acid bacteria and ↑coliforms in the faeces |
| (71) | C57BL/6 male mice (6 weeks old)  n=7 per group (3 groups)  Parallel, 1 week adaptation, 4 weeks treatment | **Group I:** commercial chow diet  **Group II:** commercial chow diet and 109 colony-forming units of live *L. plantarum* KCTC3928  **Group III:** commercial chow diet and 109 colony-forming units of dead *L. plantarum* KCTC3928 | **Group II vs Group I/III:** ↑faecal BA excretion | **Group II vs Group I/III,** ↓LDL-C and plasma TAG | **N/A** |
| (177) | Male C57BL/6J mice (8 weeks old)/Mdr2−/− (FVB.129P2‐Abcb4tm1Bor/J) mice (7 weeks old)  n=7 per group (6 groups)  Parallel, 2 weeks | **Group I:** sham operated mice, saline by oral gavage daily  **Group II:** bile duct ligation, saline by oral gavage daily  **Group III:** bile duct ligation, *Lactobacillus rhamnosus* GG by oral gavage at a dose of 109 colony‐forming units (CFU)/day  **Group IV:** *Lactobacillus rhamnosus* GG by oral gavage at a dose of 109 colony‐forming units (CFU)/day  **Group V:** bile duct ligation, *Lactobacillus rhamnosus* GG by oral gavage at a dose of 109 colony‐forming units (CFU)/day, (Z)‐Guggulsterone 10 mg/kg body (global FXR inhibitor)  **Group VI:** bile duct ligation, Lactobacillus rhamnosus GG by oral gavage at a dose of 109 colony‐forming units (CFU)/day, glycine‐β‐muricholic acid 10 mg/kg body (intestine specific FXR inhibitor)  (All groups: normal chow diet and water) | **Group II:** ↑hepatic taurine‐β‐muricholic acid (T‐βMCA), ↓chenodeoxycholic acid, ↑BAs in urine  **Group III:** ↓hepatic taurine‐β‐muricholic acid (T‐βMCA) in, an FXR agonist, normalized chenodeoxycholic acid levels, ↑faecal total BAs, ↑BAs in urine  **Group V/VI:** Probiotic induced changes in BA synthesis reversed | **N/A** | **Group III: ↑**phylum levels of Firmicutes and Actinobacteria, no change in Bacteroidetes, |
| **Prebiotics** | | | |  |  |
| (178) | Specific‐pathogen free Wistar rats (21 days old)  n=9 per group (5 groups)  Parallel, 4 weeks | **Group I:** AIN 93G diet **Group II:** AIN 93‐G diet with 2.5% of cellulose and 2.5% of inulin  **Group III:** AIN 93‐G diet with 2.5% cellulose and 2.5% taioba fiber  **Group IV:** AIN 93‐G diet with 5% of cellulose and 2.5% of taioba fiber  **Group V**: AIN 93‐G diet with 5% of cellulose and 2.5% of inulin | **Group III/IV:** improved colonic BA profiles by ↓secondary BAs in colon, ↔ total colonic BAs | **Group III/IV:** ↑faecal mass and fat excretion, ↔ TG or plasma insulin among groups except ↓TC (ns) | **N/A** |
| (179) | Male rats  n=10 per group (3 groups)  Parallel, 70 days | **Group I:** RS-free standard diet  **Group II:** diet with partially debranched and retrograded maltodextrin from potato (RSA, resistant starches type 3 content in diet, 5.7 g/100 g)  **Group III:** diet with modified, retrograded potato starch (RSB, resistant starches type 3 content in diet, 5.7 g/100 g). | **Group II/III:** ↑secondary BAs in the colon  **Group II**: ↓BAs reabsorption in large bowel, ↓secondary BAs compared with Group III and Group I  **Group I**: ↑secondary BAs 3-fold | **N/A** | **Group II/III:** ↑the rate of fermentation (↑total SCFA levels in cecum and colon, especially in Group II) |
| (94) | Wistar albino rats (6 months old) with dimethylhydrazine (DMH) induced colon cancer  n=12 per group (5 groups)  Parallel, 8 weeks | **Group I:** High fat (HF) diet  **Group II:** HF diet with oligofructose enriched inulin (2%)  **Group III:** HF diet with inulin (2%) with extract of horse chestnut (HES, 1%)  **Group IV:** HF diet with inulin (2%) with flaxseed (2%)  **Group V:** HF diet with all selected substances | **Group II/IV/V:**  ↓circulating BAs | **Group II:** ↓TC and TAG | **Group II/III/IV/V:** ↓activity of glycolytic bacterial enzyme β-glucuronidase and ↑activities of β-galactosidase and β-glucosidase  **Group II:** ↑lactobacilli, ↑SCFA production  **Group III/IV/V:** ↓number of coliforms |
| (180) | Wistar Hannover rats (4 weeks old)  n=12 per group (2 groups)  1 week adaptation, 4 weeks treatment | Commercial chow diet (adaptation)  **Group I:** High cholesterol (10g/kg) diet  **Group II:** high cholesterol (10g/kg) diet with 20% fibre from okara | **Group II:** ↑faecal excretion of BAs | **Group II:** ↓serum and liver TAG levels, ↑faecal excretion of total lipids, TAG, ↑SCFAs | **N/A** |
| (87) | Male C57BL/6 mice (7 weeks old)  n=8 per group (7 groups)  Parallel, 43 days | **Group I:** AIN-93 diet **Group II:** High-cholesterol diet (HCD, AIN-93 with 0.5% cholesterol)  **Group III:** HCD with simvastatin (0.03 g/100 g)  **Group IV:** HCD with extract of Ganoderma lucidum (Gl-1, cultivated on the control substrate) low dose (0.5%)  **Group V:** HCD with Gl-1 high dose (1.0%)  **Group VI**: HCD with Gl-2 (cultivated on the treated substrate, acetylsalicylic acid, 10 mM) low dose (0.5%)  **Group VII:** HCD with Gl-2 high dose (1.0%) | **Group IV, V, VI, VII vs Group II:** ↑faecal BAs | **Group IV, V, VI, VII vs Group II:** ↓serum TC, LDL-C, TAG, hepatic TC and hepatic TAG  **Group III/IV/V/VI/VII vs Group II:** ↑faecal TC excretion | **Group IV, V, VI, VII vs Group II/III:** ↑*Lactobacillaceae* family and *Lactobacillus* genus level |
| (88) | Dunkin Hartley female guinea pigs  n=8 per group, 3 groups  1 week acclimation, 4 weeks treatment | **Group I:** Isocaloric diet with 12g/100g cellulose daily  **Group II:** Isocaloric diet with 12g/100g digestion-resistant maltodextrin (Fibersol-2b) daily  **Group III:** Isocaloric diet with 12g/100g Chitosan daily | **Group III vs Group I:** ↑BA excretion, ↓intestinal bioconversion of cholesterol and primary BAs to secondary  **Group II vs Group I:** ↔ BA excretion | **Group III vs Group I:** ↑excretion of lauric, myristic, oleic, linoleic, α-linolenic acid and palmitic fatty acids, ↔ stearic acid excretion, ↑neutral sterol excretion  **Group II vs Group I:** non-significant ↑in MUFA and PUFA excretion, ↑neutral sterol excretion | **Group II vs Group I:** ↑in SFA excretion (more evident in long-chain SFAs, such as palmitic and stearic acids) |
| (95) | Duroc × Danish Landrace × Yorkshire hypercholesteraemic pigs (4 months old)  n=8 (Group I) n=9 (Group II)  Parallel, 2 weeks atherogenic selection diet, 2 weeks wheat‐flour based wash‐out diet, 6 weeks (Group I)/7 weeks (Group II) treatment | **Group I:** Rye buns\* (310g rye wholemeal and 400g rye bran) at an initial level of 2 kg d−1 increasing to 3 kg d−1 for the last 2.5 weeks of the study, where the buns were ground with chromic oxide (2 g kg−1 on as‐is basis)  **Group II:** Wheat buns\* (528g white wheat flour, 25g whey protein, 157g Vitalcel WF 600) at an initial level of 2 kg d−1 increasing to 3 kg d−1 for the last 2.5 weeks of the study, where the buns were ground with chromic oxide (2 g kg−1 on as‐is basis)  \*buns made using same recipe for both groups except for substitution of rye/wheat flours | **Group I vs Group II:** no effect on plasma BAs | **Group I vs Group II:** ↓plasma TC/LDL-C, HDL cholesterol, ↓small intestinal OM and HCl‐fat digestibility (↑HCl‐fat excretion), ↔ plasma SCFAs | **N/A** |
| (89) | Male Sprague–Dawley rats (9 weeks old)  n=16 per group (4 groups)  Parallel, 17 weeks | **Group I:** High corn oil diet with cellulose (75g/kg) daily  **Group II:** Low corn oil diet with cellulose (75g/kg) daily  **Group III:** High corn oil diet with broccoli fibre (75g/kg) daily  **Group IV:** Low corn oil diet with broccoli fibre (75g/kg) daily | **Group I/III vs Group II/IV:** ↑faecal BAs  **Group III vs other groups:** ↑faecal BAs | **Group I/III vs Group II/IV:** ↓serum TC and TAG  **Group III/IV vs Group I/II:** ↓serum TC and TAG | **N/A** |
| (92) | Male Wistar rats  n=10 per group (6 groups)  Parallel, 1 week adaptation, 6 weeks treatment | **Group I:** Daily diet composed of casein 200g/kg, wheat starch 600g/kg, sunﬂower-seed oil 50g/kg, microcrystalline cellulose 50g/kg, mineral mixture 50g/kg, vitamin mixture 20g/kg  **Group II:** Daily diet composed of casein 200g/kg, wheat starch 130g/kg, sunﬂower-seed oil 50g/kg, microcrystalline cellulose 50g/kg, mineral mixture 50g/kg, vitamin mixture 20g/kg and 500g oat-based extrudates oat ﬂour  **Group III:** Daily diet same as Group II and 500g oat ﬂour/Novelose (80:20w/w)  **Group IV:** Daily diet same as Group II and 500g oat bran  **Group V:** Daily diet same as Group II and 500g oat bran/Novelose (80:20w/w)  **Group VI:** Daily diet same as Group II and 500g oat flour (autoclaved) | **Group II/III/V vs Group I:** ↑BAs in caecal and colonic contents, as well as in the faeces, ↑primary BAs in intestinal contents  **Group IV/V vs other groups:** greatest excretion of BAs | **Group II/III/V vs Group I:** ↓serum TC  **Group VI vs other groups:** lowest concentration of steroids | **Group II/III/V vs Group I:** ↑biﬁdobacteria, ↓coliforms,↑caecal concentrations of acetate, propionate, butyrate and total SCFAs |
| (90) | Male piglets (Seghers Hybrid × Piétrain), (28 days old)  n=3 per group  Parallel, 28 days | **Group I:** control diet (palm oil (9% dry matter (DM)), sunflower seed oil (1.2% DM), whole egg powder as a source of cholesterol (15% DM), cellulose fiber (6–9% DM), vitamins and minerals, acid-insoluble ash (20 g/kg) as an indigestible marker)  **Group II:** control diet with oat β-glucan (BG) (7% of feed) | **Group II vs Group I:** ↓plasma total BAs, ↓BA active transport across ex vivo ileum after 40 min, ↑faecal UDCA, changes in faecal HDCA and LCA were not significant, ↓total faecal BAs, LCA ↓ in the cecum | **Group II vs Group I:** ↓TC and LDL-C, ↑caecal total neutral sterols including cholesterol | **N/A** |
| (181) | Large White male pigs, (8 weeks old)  n=5 per group  Crossover, 1 week adaptation, 4 weeks treatment, 6 weeks washout | Western‐style diet mixture of commercially available human food ingredients (WD)  **Group I:** WD lower, 23.6% dry matter (DM) in cooked dry red meat with 8% starch  **Group II:** WD higher, 30.0% DM in cooked dry red meat with 8 % starch  **Group III:** WD lower, 23.6% dry matter (DM) in cooked dry red meat with a soluble arabinoxylan‐rich fraction (AXRF) from wheat (8% arabinoxylan as soluble dietary fibre)  **Group IV:** WD higher, 30.0% DM in cooked dry red meat with a soluble AXRF from wheat (8% arabinoxylan as soluble dietary fibre) | **Group III/IV:** ↓total BAs in the hepatic portal vein, jugular vein, bile and small intestine, ↔ ileal BAs excretion,  ↑deoxycholic and ursodeoxycholic acid in gall bladder, ↔ primary BAs, chenodeoxycholic acid or hyocholic acid. | **Group III/IV:** ↓blood TAG levels, ↔ LDL‐, HDL‐ or TC | **N/A** |

**Abbreviations:** APO, Apolipoprotein. BA, bile acid. BAR, bile acid receptor. BSH, bile salt hydrolysing. DCA, deoxycholic acid. FGF-15, Fibroblast growth factor 15. FXR, Farnesoid X Receptor. HDCA, Hyodeoxycholic acid. HDL-C, high density lipoprotein-cholesterol. HFD, high fat diet. LCA, lithocholic acid. LDL-C, low density lipoprotein-cholesterol. MUFA, Monounsaturated Fatty Acids. PAs, proanthocyanidins. PUFA, Polyunsaturated Fatty Acids. SCFA, short chain fatty acid. SFA, saturated fatty acid. Srebp, Sterol Regulatory Element-binding Protein. TAG, triacylglycerol. TC, total cholesterol. WD, western diet. UDCA, Ursodeoxycholic acid.