Supplementary Table ST1. Detailed Search Strategy in Each Database, last updated 28 September 2023**.**

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| Database | Search Strategy |
| PubMed | ((COVID-19[tiab] OR "COVID 19"[tiab:~1] OR SARS-CoV-2[tiab] OR 2019-nCoV[tiab] OR Coronavirus\*[tiab] OR "severe acute respiratory syndrome coronavirus" OR "Wuhan Virus"[tiab:~2] OR Omicron[tiab] OR "SARS-CoV-2"[Mesh] OR "COVID-19"[Mesh] OR "SARS-CoV-2 variants" [Supplementary Concept]) AND (microbiome[tiab] OR "Gastrointestinal Microbiome"[tiab:~1] OR "gastrointestinal flora"[tiab:~1] OR "Gastrointestinal Microbiome"[tiab:~1] OR "microbes"[tiab] OR "gut microbes"[tiab:~1] OR "Microbiota"[tiab] OR Gastrointestinal Microbiome[MeSH Terms] OR "Microbiota"[MeSH Terms]) AND ("Nutraceuticals"[tiab] OR "prebiotic\*"[tiab] OR "prebiotic"[tiab] OR "pre-biotic\*"[tiab] OR "probiotic\*"[tiab] OR "pro-biotic\*"[tiab] OR "synbiotic\*"[tiab] OR "symbiotic\*"[tiab] OR prebiotics[MeSH Terms] OR "probiotics"[MeSH Terms] OR "synbiotics"[MeSH Terms] OR "short-chain fatty acid"[tiab] OR "short-chain fatty acids"[tiab] OR SCFA[tiab] OR SCFAs[tiab] OR acetate[tiab] OR butyrate[tiab] OR lactate[tiab] OR propionate[tiab] OR "microbial agent\*"[tiab] OR "gut metabolites"[tiab] OR "bacterial metabolites"[tiab] OR postbiotic\*[tiab] OR "non-viable probiotic\*"[tiab] OR parabiotic\*[tiab] OR paraprobiotic\*[tiab] OR parapsychobiotic\*[tiab] OR "ghost probiotic\*"[tiab] OR metabiotic\*[tiab] OR "microbial fraction\*"[tiab] OR "functional protein\*"[tiab] OR polysaccharide\*[tiab] OR "teichoic acid"[tiab] OR muropeptide\*[tiab] OR pili\*[tiab] OR "heat-killed probiotic\*"[tiab] OR "tyndallized probiotic\*"[tiab] OR "bacterial lysate\*"[tiab] OR lysate\*[tiab] OR Streptococcus[tiab] OR Thermophilus[tiab] OR Bifidobacterium[tiab] OR Bacillus[tiab] OR Mycobacterium[tiab] OR Lactobacillus[tiab] OR Limosilactobacillus[tiab] OR Akkermansia[tiab] OR Lacticaseibacillus[tiab] OR Faecalibacterium[tiab] OR Bacteroides[tiab] OR Haemophiles[tiab] OR Streptococcus[tiab] OR Roseburia[tiab] OR Staphlycoccus[tiab] OR Moraxella[tiab] OR Arthrospira[tiab] OR Klebsiella[tiab] OR Eubacterium[tiab] OR Clostridium[tiab] OR Apilactobacillus[tiab] OR Saccharomyces[tiab] OR Escherichia[tiab] OR CLA[tiab] OR "conjugated linoleic acid"[tiab] OR PUFA[tiab] OR "polyunsaturated fatty acid"[tiab] OR FOS[tiab] OR Fructooligosaccharides[tiab] OR GOS[tiab] OR galactooligosaccharides[tiab] OR MOS[tiab] OR mannanoligosaccharide[tiab] OR XOS[tiab] OR Xylooligosaccharide[tiab] OR "Human milk oligosaccharides"[tiab] OR phenol\*[tiab] OR "phenolic acid"[tiab] OR phytochemical\*[tiab] OR polydextrose[tiab] OR inulin[tiab] OR "resistant dextrose"[tiab:~1] OR "α-linolenic acid"[tiab] OR "eicosapentaenoic acid"[tiab] OR "docosahexaenoic acid"[tiab] OR "linoleic acid"[tiab] OR "arachidonic acid"[tiab] OR "gamma-linolenic acid"[tiab] OR "resistant wheat starch"[tiab:~1] OR "resistant maltodextrin"[tiab] OR "resistant wheat"[tiab] OR "resistant starch"[tiab] OR "acacia gum"[tiab] OR "Acacia Senegal"[tiab] OR "Acacia fiber"[tiab] OR "soluble corn fiber"[tiab])) AND ("randomized controlled trial"[pt] OR "controlled clinical trial"[pt] OR randomized[tiab] OR placebo[tiab] OR "drug therapy"[sh] OR randomly[tiab] OR trial[tiab] OR groups[tiab]) |
| Scopus | (((((TITLE-ABS ( COVID-19 OR COVID W/1 19 OR SARS-CoV-2 OR 2019-nCoV OR Coronavirus\* OR "severe acute respiratory syndrome coronavirus" OR Wuhan W/1 Virus OR Omicron)) OR (INDEXTERMS("SARS-CoV-2" OR "COVID-19" OR "SARS-CoV-2 variants"))) AND ((TITLE-ABS (microbiome OR Gastrointestinal W/1 Microbiome OR gastrointestinal W/1 flora OR Gastrointestinal W/1 Microbiome OR microbes OR gut W/1 microbes OR Microbiota)) OR INDEXTERMS(Gastrointestinal Microbiome OR Microbiota)) AND ((TITLE-ABS (Nutraceuticals OR prebiotic\* OR prebiotic OR pre-biotic\* OR probiotic\* OR pro-biotic\* OR synbiotic\* OR symbiotic\*)) OR (INDEXTERMS(prebiotics OR probiotics OR synbiotics)) OR (TITLE-ABS ("short-chain fatty acid" OR "short-chain fatty acids" OR scfa OR acetate OR butyrate OR lactate OR propionate OR "microbial agent\*" OR "gut metabolites" OR "bacterial metabolites" OR postbiotic\* OR "non-viable probiotic\*" OR parabiotic\* OR paraprobiotic\* OR parapsychobiotic\* OR "ghost probiotic\*" OR metabiotic\* OR "microbial fraction\*" OR "functional protein\*" OR polysaccharide\* OR muropeptide\* OR pili\* OR "heat-killed probiotic\*" OR "tyndallized probiotic\*" OR "bacterial lysate\*" OR lysate\* OR Streptococcus OR Thermophilus OR Bifidobacterium OR Bacillus OR Mycobacterium OR Lactobacillus OR Limosilactobacillus OR Akkermansia OR Lacticaseibacillus OR Faecalibacterium OR Bacteroides OR Haemophiles OR Streptococcus OR Roseburia OR Staphlycoccus OR Moraxella OR Arthrospira OR Klebsiella OR Eubacterium OR Clostridium OR Apilactobacillus OR Saccharomyces OR Escherichia OR cla OR pufa OR for OR Fructooligosaccharides OR gos OR galactooligosaccharides OR most OR mannanoligosaccharide OR cos OR Xylooligosaccharide OR "Human milk oligosaccharides" OR phenol\* OR phytochemical\* OR polydextrose OR inulin OR resistant W/1 dextrose OR "resistant wheat starch" OR "resistant maltodextrin" OR "resistant wheat" OR "resistant starch" OR "acacia gum" OR "Acacia Senegal" OR "Acacia fiber" OR "soluble corn fiber" OR ((phenolic OR teichoic OR "polyunsaturated fatty" OR "conjugated linoleic" OR phenolic OR α-linolenic OR eicosapentaenoic OR docosahexaenoic OR linoleic OR arachidonic OR gamma-linolenic) W/1 Acid)))) AND (( INDEXTERMS ( "clinical trials" OR "clinical trials as a topic" OR "randomized controlled trial" OR "Randomized Controlled Trials as Topic" OR "controlled clinical trial" OR "Controlled Clinical Trials" OR "random allocation" OR "Double-Blind Method" OR "Single-Blind Method" OR "Cross-Over Studies" OR "Placebos" OR "multicenter study" OR "double blind procedure" OR "single blind procedure" OR "crossover procedure" OR "clinical trial" OR "controlled study" OR "randomization" OR "placebo" ) ) OR ( TITLE-ABS-KEY ( ( "clinical trials" OR "clinical trials as a topic" OR "randomized controlled trial" OR "Randomized Controlled Trials as Topic" OR "controlled clinical trial" OR "Controlled Clinical Trials as Topic" OR "random allocation" OR "randomly allocated" OR "allocated randomly" OR "Double-Blind Method" OR "Single-Blind Method" OR "Cross-Over Studies" OR "Placebos" OR "cross-over trial" OR "single blind" OR "double blind" OR "factorial design" OR "factorial trial" ) ) ) OR ( TITLE-ABS ( clinical trial\* OR trial\* OR rct\* OR random\* OR blind\* ) ))) |
| Web of Science | ((TI=( COVID-19 OR COVID NEAR/1 19 OR SARS-CoV-2 OR 2019-nCoV OR Coronavirus\* OR severe acute respiratory syndrome coronavirus OR Wuhan NEAR/1 Virus OR Omicron\*) OR AB=(COVID-19 OR COVID NEAR/1 19 OR SARS-CoV-2 OR 2019-nCoV OR Coronavirus\* OR severe acute respiratory syndrome coronavirus OR Wuhan NEAR/1 Virus OR Omicron\* )) AND (TI=(microbiome OR Gastrointestinal NEAR/1 Microbiome OR gastrointestinal NEAR/1 flora OR Gastrointestinal NEAR/1 Microbiome OR microbes OR gut NEAR/1 microbes OR Microbiota) OR AB=(microbiome OR Gastrointestinal NEAR/1 Microbiome OR gastrointestinal NEAR/1 flora OR Gastrointestinal NEAR/1 Microbiome OR microbes OR gut NEAR/1 microbes OR Microbiota))) AND ((TI=(Nutraceuticals OR prebiotic\* OR prebiotic OR pre-biotic\* OR probiotic\* OR pro-biotic\* OR synbiotic\* OR symbiotic\*) OR AB=(Nutraceuticals OR prebiotic\* OR prebiotic OR pre-biotic\* OR probiotic\* OR pro-biotic\* OR synbiotic\* OR symbiotic\*)) OR (TI=(short-chain fatty acid OR short-chain fatty acids OR scfa OR acetate OR butyrate OR lactate OR propionate OR microbial agent\* OR gut metabolites OR bacterial metabolites OR postbiotic\* OR non-viable probiotic\* OR parabiotic\* OR paraprobiotic\* OR parapsychobiotic\* OR ghost probiotic\* OR metabiotic\* OR microbial fraction\* OR functional protein\* OR polysaccharide\* OR muropeptide\* OR pili\* OR heat-killed probiotic\* OR tyndallized probiotic\* OR bacterial lysate\* OR lysate\* OR Streptococcus OR Thermophilus OR Bifidobacterium OR Bacillus OR Mycobacterium OR Lactobacillus OR Limosilactobacillus OR Akkermansia OR Lacticaseibacillus OR Faecalibacterium OR Bacteroides OR Haemophiles OR Streptococcus OR Roseburia OR Staphlycoccus OR Moraxella OR Arthrospira OR Klebsiella OR Eubacterium OR Clostridium OR Apilactobacillus OR Saccharomyces OR Escherichia OR cla OR pufa OR for OR Fructooligosaccharides OR gos OR galactooligosaccharides OR most OR mannanoligosaccharide OR cos OR Xylooligosaccharide OR Human milk oligosaccharides OR phenol\* OR phytochemical\* OR polydextrose OR inulin OR resistant W/1 dextrose OR resistant wheat starch OR resistant maltodextrin OR resistant wheat OR resistant starch OR acacia gum OR Acacia Senegal OR Acacia fiber OR soluble corn fiber OR phenolic Acid OR teichoic Acid OR polyunsaturated fatty Acid OR conjugated linoleic Acid OR phenolic Acid OR α-linolenic Acid OR eicosapentaenoic Acid OR docosahexaenoic Acid OR linoleic Acid OR arachidonic Acid OR gamma-linolenic Acid) OR AB=(short-chain fatty acid OR short-chain fatty acids OR scfa OR acetate OR butyrate OR lactate OR propionate OR microbial agent\* OR gut metabolites OR bacterial metabolites OR postbiotic\* OR non-viable probiotic\* OR parabiotic\* OR paraprobiotic\* OR parapsychobiotic\* OR ghost probiotic\* OR metabiotic\* OR microbial fraction\* OR functional protein\* OR polysaccharide\* OR muropeptide\* OR pili\* OR heat-killed probiotic\* OR tyndallized probiotic\* OR bacterial lysate\* OR lysate\* OR Streptococcus OR Thermophilus OR Bifidobacterium OR Bacillus OR Mycobacterium OR Lactobacillus OR Limosilactobacillus OR Akkermansia OR Lacticaseibacillus OR Faecalibacterium OR Bacteroides OR Haemophiles OR Streptococcus OR Roseburia OR Staphlycoccus OR Moraxella OR Arthrospira OR Klebsiella OR Eubacterium OR Clostridium OR Apilactobacillus OR Saccharomyces OR Escherichia OR cla OR pufa OR for OR Fructooligosaccharides OR gos OR galactooligosaccharides OR most OR mannanoligosaccharide OR cos OR Xylooligosaccharide OR Human milk oligosaccharides OR phenol\* OR phytochemical\* OR polydextrose OR inulin OR resistant W/1 dextrose OR resistant wheat starch OR resistant maltodextrin OR resistant wheat OR resistant starch OR acacia gum OR Acacia Senegal OR Acacia fiber OR soluble corn fiber OR phenolic Acid OR teichoic Acid OR polyunsaturated fatty Acid OR conjugated linoleic Acid OR phenolic Acid OR α-linolenic Acid OR eicosapentaenoic Acid OR docosahexaenoic Acid OR linoleic Acid OR arachidonic Acid OR gamma-linolenic Acid))) AND (TS= clinical trial\* OR TS=research design OR TS=comparative stud\* OR TS=evaluation stud\* OR TS=controlled trial\* OR TS=follow-up stud\* OR TS=prospective stud\* OR TS=random\* OR TS=placebo\* OR TS=(single blind\*) OR TS=(double blind\*))) |

Supplementary Table ST2. References list from the full text screening, 27 of which were included in the review and 9 of which were not**.**

|  |  |
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