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Supplementary appendix

Comparison of the effectiveness of probiotic supplementation in glucose metabolism, lipid profile, inflammation and oxidative stress in pregnant women[†]

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Appendix 1. The literature search strategy

PubMed

#1 ((((((((((((((((((("Probiotics" [Mesh] OR "Probiotics"[tiab] OR "probiotic"[tiab] OR "lactobacillus" OR "lactobacillus" [tiab] OR "bifidobacteria"[tiab] OR "Synbiotics" [Mesh] OR "Synbiotics" [Itab] OR "Synbiotic" [Itab] OR "Prebiotics" [Mesh] OR "Prebiotics" [Itab] OR "Synbiotics" [Itab] OR "Synbiotics" [Itab] OR "Prebiotics" [Itab] OR (Saccharomyces cerevisiae)) OR (FOS)) OR (FOS)) OR (Fruc-tooligosaccharide*)) OR (GOS)) OR (Galactooligosaccharide*)) OR (Galactooligosaccharide*)) OR (Xylooligosaccharide*)) OR (Itactionse)) OR (Itactionse)) OR (Itactionse)) OR (Itactionse)) OR (Soy oligosaccharide*) OR (Itactionse)) OR (Itactionse)) OR (Soy oligosaccharide*)

#3 (((((((((controlled trial[Title/Abstract])) OR (controlled trial[Title/Abstract])) OR (random[Title/Abstract])) OR (randomly[Title/Abstract])) OR (placebo[Title/Abstract])) OR (clinical trial[Title/Abstract])) OR (clinical trial[Title/Abstract])) OR (randomized clinical trial[Title/Abstract])) OR (RCT[Title/Abstract])) OR (trials[Title/Abstract])) OR (trial

#4 ((((("Pregnancy"[Mesh]) OR (Pregnancies[Title/Abstract])) OR (Gestation[Title/Abstract])) OR (((("Pregnant Women"[Mesh]) OR (Pregnant Woman[Title/Abstract])) OR (Woman, Pregnant[Title/Abstract])) OR (Woman, Pregnant[Title/Abstract])) OR (((((("Diabetes, Gestational"[Mesh]) OR (Diabetes, Pregnancy-Induced[Title/Abstract])) OR (Diabetes, Pregnancy Induced[Title/Abstract])) OR (Pregnancy-Induced Diabetes[Title/Abstract])) OR (Gestational Diabetes[Title/Abstract])) OR (Diabetes Mellitus, Gestational[Title/Abstract])) OR (Gestational Diabetes Mellitus[Title/Abstract])) OR (GDM[Title/Abstract]))

#5 #1 AND #2 AND #3 AND #4

Embase

#1 'probiotics'/exp OR 'probiotics' OR 'probiotic'/exp OR 'probiotic' OR 'lactobacillus'/exp OR 'lactobacillus' OR 'synbiotics' OR 'probiotics' OR 'prebiotics' OR 'prebiotic'/exp OR 'synbiotics' OR 'synbiotics' OR 'prebiotics' OR 'prebiotics' OR 'prebiotic'/exp OR 'prebiotic' OR 'enterococcus faecium'/exp OR 'enterococcus faecium' OR 'streptococcus thermophiles'/exp OR 'streptococcus thermophiles' OR 'saccharomyces cerevisiae' OR 'saccharomyces boulardii'/exp OR 'saccharomyces boulardii' OR 'escherichia coli nissle 1917' OR 'fos'/exp OR 'fos' OR 'fruc-tooligosaccharide*' OR 'fructo-oligosaccharide*' OR 'galactooligosaccharide*' OR 'streptococcus thermophiles' OR 'streptococcus thermophiles' OR 'galactooligosaccharide*' OR 'galactooligosaccharide*' OR 'trans-galactooligosaccharide*' OR 'inulin' OR 'lactitol'/exp OR 'lactitol' OR 'lactosucrose'/exp OR 'lactosucrose' OR 'soy oligosaccharide*'

#2 'pregnancy' OR 'pregnancies' OR 'gestation'/exp OR 'gestation' OR 'pregnant women'/exp OR 'pregnant women' OR 'pregnant woman'/exp OR 'pregnant woman' OR 'gestational diabetes'/exp OR 'gestational diabetes' or 'gestationa

#3 'controlled trial' OR 'randomized' OR 'placebo' OR 'clinical trial' OR 'trial' OR 'randomized clinical trial' OR 'trials'

#4 'mda'/exp OR 'mda' OR 'glutathione' OR 'tac' OR 'hs-crp' OR 'hscrp' OR 'fasting blood sugar'/exp OR 'fasting blood sugar' OR 'fbs'/exp OR 'fbs' OR 'fbs' OR 'fbg' OR 'fasting plasma glucose'/exp OR 'fasting plasma glucose' OR 'fpg' OR 'glycated hemoglobin'/exp OR 'glycated hemoglobin' OR 'hba1c'/exp OR 'fasting insulin'/exp OR 'fasting insulin' OR 'homeostasis model assessment of insulin resistance'

OR 'insulin resistance' OR 'glucose tolerance test'/exp OR 'glucose tolerance test' OR 'serum sirtuin1' OR 'quantitative insulin-sensitivity check index'/exp OR 'quicki'/exp OR 'quicki' OR 'insulin-sensitivity'/exp OR 'insulin-sensitivity' OR 'low-density lipoprotein cholesterol'/exp OR 'low-density lipoprotein cholesterol' OR 'ldl-c' OR 'total cholesterol'/exp OR 'total cholesterol' OR 'high-density lipoprotein cholesterol'/exp OR 'high-density lipoprotein cholesterol' OR 'high-density OR 'high-density lipoprotein cholesterol' OR 'high-density lipoprotein cholesterol' OR 'high-density OR 'high-density lipoprotein cholesterol' OR 'high-density OR 'high-d

#5 #1 AND #2 AND #3 AND #4

Cochrane Library

#1 Probiotics or Probiotics or Probiotic or Lactobacillus or Lactobacillus or Bifidobacteria or Synbiotics or Synbiotics or Synbiotic or Prebiotics or Prebiotics or Prebiotics or Prebiotics or Prebiotic or Enterococcus faecium or Streptococcus thermophiles or Bacillus clausii or Saccharomyces cerevisiae or Saccharomyces boulardii or Escherichia coli Nissle 1917 or Prebiotic or FOS or Fruc-tooligosaccharide* or Fructo-oligosaccharide* or GOS or Galactooligosaccharide* or Galacto-oligosaccharide* or XOS or Xylooligosaccharide* or Xylo-oligosaccharide* or ToS or Transgalactooligosaccharide* or Trans-galactooligosaccharide* or Inulin or Lactitol or Lactulose or Lactosucrose or Soy oligosaccharide*

#2 Pregnancy or Pregnancies or Gestation or Pregnant Women or Pregnant Woman or Woman, Pregnant or Women, Pregnant or Gestational Diabetes or Diabetes Mellitus, Gestational or Gestational Diabetes Mellitus or GDM

#3 controlled trial or Randomized or Random or Randomly or Placebo or clinical trial or Trial or randomized clinical trial or RCT or trials or trial

#4 Malondialdehyde or MDA or Glutathione or GSH or TAC or total antioxidant capacity or hs-CRP or hsCRP or fasting blood sugar or FBS or FBG or Fasting plasma glucose or FPG or glycated hemoglobin or HbA1C or Fasting insulin or homeostasis model assessment of insulin resistance or insulin resistance or glucose tolerance test or Serum Sirtuin1 or quantitative insulin-sensitivity check index or QUICKI or Insulin-sensitivity or low-density lipoprotein cholesterol or LDL-C or total cholesterol or TC or high-density lipoprotein cholesterol or HDL-C or Triglyceride or TG or very low density lipoprotein cholesterol or VLDL-C or Insulin or Glucose or BMI or OGTT or 1hBG or 2hBG or HOMA-B or NO or nitric oxide or body mass or body weight

#5 #1 AND #2 AND #3 AND #4

Web of science

#2 (((((((((((TS=(Pregnancy)) OR TS=(Pregnancies)) OR TS=(Gestation)) OR TS=("Pregnant Women")) OR TS=("Pregnant Woman")) OR TS=("Woman, Pregnant")) OR TS=("Woman, Pregnant")) OR TS=("Diabetes, Gestational")) OR TS=("Diabetes, Pregnancy-Induced")) OR TS=("Diabetes, Pregnancy Induced")) OR TS=("Diabetes")) OR TS=("Gestational Diabetes")) OR TS=(Diabetes Mellitus, Gestational)) OR TS=("Gestational Diabetes Mellitus")) OR TS=(GDM)

#3 (((((((((TS=("controlled trial")) OR TS=(randomized)) OR TS=(random)) OR TS=(randomly)) OR TS=(placebo)) OR TS=("clinical trial")) OR TS=(Trial)) OR TS=("randomized clinical trial")) OR TS=(RCT)) OR TS=(trials)) OR TS=(trial)

TS=(HbA1C)) OR TS=("Fasting insulin")) OR TS=("homeostasis model assessment of insulin resistance")) OR TS=("insulin resistance")) OR TS=("insulin resistance")) OR TS=("glucose tolerance test")) OR TS=("Serum Sirtuin1")) OR TS=("quantitative insulin-sensitivity check index")) OR TS=(QUICKI)) OR TS=(Insulin-sensitivity)) OR TS=("low-density lipoprotein cholesterol")) OR TS=(LDL-C)) OR TS=("total cholesterol")) OR TS=(TC)) OR TS=("high-density lipoprotein cholesterol")) OR TS=(HDL-C)) OR TS=(TG)) OR TS=("very low density lipoprotein cholesterol")) OR TS=(ULDL-C)) OR TS=(TG)) OR TS=("very low density lipoprotein cholesterol")) OR TS=(Insulin)) AND TS=(glucose)) OR TS=(BMI)) OR TS=("body mass")) OR TS=("body weight")) OR TS=(OGTT)) OR TS=(1hBG)) OR TS=(2hBG)) OR TS=(HOMA-B)

#5 #1 AND #2 AND #3 AND #4

Additional works that were found during preparation of meta-analysis but were not part of initial or subsequent searches were included. These works were discovered when attempting to locate full-text versions of other works or as references in other work.

Appendix 2. GRADE assessments

For both direct and indirect comparisons, the starting point for certainty in estimates was "high". The certainty in indirect estimates was inferred from the examination of the dominant lowest-order loop. We identified the dominant lowest order loop by per comparison contribution matrix which could show the contribution percentage of each direct comparison to each indirect comparison. The certainty rating chosen was the lowest of the direct estimates contributing to the indirect comparison. For example, consider a comparison of A vs. B that is informed by A vs. C and B vs. C. If A vs. C was rated as high certainty and B vs. C as moderate certainty, the overall indirect certainty rating was moderate (moderate from the B vs. C comparison).

Down rating the quality rating may be rated down by -1 (serious concern) or -2 (very serious concern) for the following reasons •**Risk of bias**: All studies blinded participants. Did not downgrade this item.

• Inconsistency/heterogeneity: In terms of heterogeneity, one level was downgraded when $50\% < I^2 < 90\%$, and two levels were downgraded when $I^2 \ge 90\%$.

• Indirectness: No significant indirectness was found.

• Imprecision: Among all outcomes, we rated down for imprecision among direct estimates if the credible interval passes through the invalid line.

• **Publication bias**: The findings of trim and fill method indicated that all results were reliable despite publication bias, so we have not downgraded the grade of evidence for publication bias.

GRADE certainty in estimates

High certainty: We are very confident that the true effect lies close to that of the estimate of the effect;

Moderate certainty: We are moderately confident in the effect estimate: the true effect is likely to be close to the estimate of the effect, but there is a possibility that it is substantially different;

Low certainty: Our confidence in the effect estimate is limited: the true effect may be substantially different from the estimate of the effect; Very low certainty: We have very little confidence in the effect estimate: the true effect is likely to be substantially different from the estimate of effect.

References

Puhan, M. A., Schünemann, H. J., Murad, M. H., et al. (2014). A GRADE Working Group approach for rating the quality of treatment effect estimates from network Meta-analysis. BMJ 349, g5630.

Figure.S1. Risk assessment of bias using the Cochrane risk of bias



The risk of bias items of all included studies are indicated as percentages. Turquoise = low risk of bias, pale goldenrod = unclear risk of bias, sienna = high risk of bias.

Figure.S2. Network plots for other outcome measures

The thickness of the lines represents the number of trials for a specific comparison, and the size of the nodes reflects the number of pregnant women involving a particular intervention.

Glycemic control



QUICKI, quantitative insulin-sensitivity check index; HOMA-B, homeostasis model assessment of beta cell; HbA1c, glycated hemoglobin A1c. LABB, Lactobacillus acidophilus and Bifidobacterium; LRB, Lacticaseibacillus rhamnosus and Bifidobacterium; LLB, Lactobacillus acidophilus, Lacticaseibacillus casei, and Bifidobacterium bifidum; MP1, four probiotics; MP2, six or more probiotics.

Lipid metabolism



HDLC, high-density lipoprotein cholesterol; TG, triglyceride; VLDLC, very low-density lipoprotein cholesterol; Total/HDLC, total cholesterol/high-density lipoprotein cholesterol. LABB, Lactobacillus acidophilus and Bifidobacterium; LRB, Lacticaseibacillus rhamnosus and Bifidobacterium; LLB, Lactobacillus acidophilus, Lacticaseibacillus casei, and Bifidobacterium bifidum; MP1, four probiotics.

Oxidative stress



GSH, glutathione; MDA, malondialdehyde; NO, nitric oxide. LABB, Lactobacillus acidophilus and Bifidobacterium; LRB, Lacticaseibacillus rhamnosus and Bifidobacterium; LLB, Lactobacillus acidophilus, Lacticaseibacillus casei, and Bifidobacterium bifidum; MP1, four probiotics.

Figure.S3. League tables of secondary outcomes

Insulin and QUICKI

			Insulin(µIU/mL)			
Lactobacillus	-4.27 (-8.8 to 0.5)	-2.47 (-5.62 to 1.08)	<u>-4.86</u> <u>(-7.89 to -1.44)</u>	-2.1 (-4.36 to 0.82)	<u>-6.66</u> (-10.45 to -2.28)	-0.6 (-2.36 to 1.73)
NR	LABB	1.84 (-3.05 to 6.84)	-0.64 (-5.46 to 4.2)	2.22 (-2.2 to 6.77)	-2.32 (-7.78 to 3.14)	3.7 (-0.36 to 7.91)
-0.01 (-0.03 to 0.01)	NR	LRB	-2.41 (-6.03 to 1.09)	0.33 (-2.66 to 3.51)	-4.2 (-8.54 to 0.29)	1.83 (-0.68 to 4.55)
0 (-0.02 to 0.02)	NR	<u>0.01</u> (0 to 0.02)	LLB	2.77 (-0.03 to 5.87)	-1.76 (-6.05 to 2.63)	<u>4.28</u> <u>(1.91 to 6.84)</u>
0.02 (-0.01 to 0.03)	NR	<u>0.02</u> (0.01 to 0.03)	<u>0.01</u> (0 to 0.02)	MP1	<u>-4.58</u> <u>(-8.48 to -0.66)</u>	1.47 (-0.2 to 3.14)
NR	NR	NR	NR	NR	MP2	<u>6.05</u> (2.47 to 9.55)
<u>0.02</u> (0 to 0.04)	NR	<u>0.03</u> (0.02 to 0.04)	<u>0.02</u> (0.01 to 0.02)	<u>0.01</u> (0 to 0.01)	NR	Placebo
			QUICKI			

League table: The values in the upper triangle correspond to the difference in mean (95% CI) in Insulin (µIU/mL) between the row and columns. The values in the lower triangle correspond to the difference in mean (95% CI) in QUICKI between the column and the row. Results with significant difference are highlighted in bold and underlined. NR represents this indicator was not reported in this method among the included studies.

QUICKI, quantitative insulin-sensitivity check index. LABB, Lactobacillus acidophilus and Bifidobacterium; LRB, Lactobacillus rhamnosus and Bifidobacterium; LLB, Lactobacillus acidophilus, Lacticaseibacillus casei, and Bifidobacterium bifidum; MP1, four probiotics; MP2, six or more probiotics.

HOMA-B and HbA1c

			HOMA-B			
Lactobacillus	NR	NR	13.08 (-27.47 to 50.43)	NR	NR	30.22 (-6.33 to 64.88)
NR	LABB	NR	NR	NR	NR	NR
NR	-0.01 (-0.6 to 0.6)	LRB	NR	NR	NR	NR
NR	NR	NR	LLB	NR	NR	<u>16.84</u> (1.19 to 34.19)
NR	NR	NR	NR	MP1	NR	NR
NR	0.28 (-0.24 to 0.82)	0.28 (-0.23 to 0.84)	NR	NR	MP2	NR
NR	-0.01 (-0.43 to 0.42)	0 (-0.43 to 0.42)	NR	NR	-0.29 (-0.62 to 0.01)	Placebo

HbA1c(µmol/L)

League table: The values in the upper triangle correspond to the difference in mean (95% CI) in HOMA-B between the row and columns. The values in the lower triangle correspond to the difference in mean (95% CI) in HbA1c (µmol/L)between the column and the row. Results with significant difference are highlighted in bold and underline. NR represents this indicator was not reported in this method among the included studies.

HOMA-B, homeostasis model assessment of beta cell; HbA1C, glycated hemoglobin A1c. LABB, *Lactobacillus acidophilus* and *Bifidobacterium*; LRB, *Lactobacillus caseibacillus rhamnosus* and *Bifidobacterium*; LLB, *Lactobacillus acidophilus, Lacticaseibacillus casei*, and *Bifidobacterium* bifidum; MP1, four probiotics; MP2, six or more probiotics.

HDLC and TG

			HDLC(mg/dl)			
Lactobacillus	-1.39 (-10.36 to 6.75)	-0.74 (-4.73 to 2.91)	0.85 (-2.33 to 3.89)	1.88 (-1.37 to 5.07)	NR	-0.35 (-2.32 to 1.54)
34.44 (-12.43 to 84.23)	LABB	0.48 (-8.04 to 10.13)	2.27 (-6.05 to 11.61)	3.23 (-4.97 to 12.82)	NR	1.01 (-6.96 to 10.07)
-3.14 (-17.9 to 7.38)	-37.79 (-87.63 to 9.65)	LRB	1.64 (-2.51 to 5.82)	2.62 (-1.49 to 6.96)	NR	0.41 (-2.74 to 3.84)
<u>41.23</u> (24.27 to 57.81)	7.3 (-44.95 to 58.19)	<u>44.27</u> (26.24 to 64.32)	LLB	1.01 (-2.66 to 4.68)	NR	-1.15 (-3.77 to 1.32)
<u>22.81</u> (6.36 to 36.3)	-11.51 (-60.02 to 37.39)	<u>26.39</u> (8.31 to 41.77)	-18.43 (-39.1 to 1.36)	MP1	NR	-2.22 (-4.83 to 0.36)
NR	NR	NR	NR	NR	MP2	NR
0.77 (-7.6 to 5.05)	-34 (-84.05 to 12.22)	3.77 (-6.87 to 14.73)	<u>-40.62</u> <u>(-56.69 to -25.59)</u>	<u>-22.44</u> (-34.37 to -7.48)	NR	Placebo
			TG(mg/dl)			

League table: The values in the upper triangle correspond to the difference in mean (95% CI) in HDLC (mg/dl) between the row and columns. The values in the lower triangle correspond to the difference in mean (95% CI) in TG (mg/dl) between the column and the row. Significant results are highlighted in bold and underlined. NR represents this indicator was not reported in this method among the included studies.

HDLC, high-density lipoprotein cholesterol; TG, triglyceride. LABB, *Lactobacillus acidophilus* and *Bifidobacterium*; LRB, *Lacticaseibacillus rhamnosus* and *Bifidobacterium*; LLB, *Lactobacillus acidophilus*, *Lacticaseibacillus casei*, and *Bifidobacterium bifidum*; MP1, four probiotics; MP2, six or more probiotics.

VLDLC and Total/HDLC

			VLDLC(mg/dl)			
Lactobacillus	NR	NR	-0.67 (-10.69 to 9.49)	2.41 (-7.57 to 12.65)	NR	7.65 (-1.41 to 16.76)
0.14 (-0.67 to 0.86)	LABB	NR	NR	NR	NR	NR
NR	NR	LRB	NR	NR	NR	NR
NR	NR	NR	LLB	2.98 (-3.19 to 9.23)	NR	<u>8.3</u> (3.97 to 12.6)
0.19 (-0.47 to 0.83)	0.06 (-0.64 to 0.78)	NR	NR	MP1	NR	<u>5.32</u> (0.88 to 9.68)
NR	NR	NR	NR	NR	MP2	NR
-0.19 (-0.71 to 0.28)	-0.32 (-0.9 to 0.26)	NR	NR	-0.39 (-0.81 to 0.03)	NR	Placebo
			T (1/1101 0			

Total/HDLC

League table: The values in the upper triangle correspond to the difference in mean (95% CI) in VLDLC (mg/dl) between the row and columns. The values in the lower triangle correspond to the difference in mean (95% CI) in Total/HDLC between the column and the row. Significant results are highlighted in bold and underline. NR represents this indicator was not reported in this method among the included studies.

VLDLC, very low-density lipoprotein cholesterol; Total/HDLC, total cholesterol/high-density lipoprotein cholesterol. LABB, *Lactobacillus acidophilus* and *Bifidobacterium*; LRB, *Lactobacillus casei*, and *Bifidobacterium*; LLB, *Lactobacillus acidophilus*, *Lacticaseibacillus casei*, and *Bifidobacterium* bifidum; MP1, four probiotics; MP2, six or more probiotics.

GSH and MDA

			GSH(µmol/L)			
Lactobacillus	-227.2 (-479.61 to 32.47)	NR	<u>-246.98</u> (-468.51 to -20.74)	<u>-295.04</u> (-526.58 to -55.59)	NR	<u>-297.81</u> (-509.67 to -76.83)
NR	LABB	NR	-21.18 (-151.98 to 110.27)	-69.28 (-208.89 to 77.38)	NR	-70.69 (-187.71 to 49.16)
NR	NR	LRB	NR	NR	NR	NR
-0.63 (-2.37 to 1.09)	NR	NR	LLB 0.01 (-1.06 to 1.26)	-47.68 (-143.36 to 49.94)	NR	-49.79 (-105.47 to 5.5)
-0.63 (-2.17 to 1.12)	NR	NR		MP1	NR	-2.69 (-84.05 to 76.73)
NR	NR	NR	NR	NR	MP2	NR
-1.12 (-2.6 to 0.33)	NR	NR	-0.49 (-1.38 to 0.38)	-0.5 (-1.36 to 0.17)	NR	Placebo
			MDA(µmol/L)			

League table: The values in the upper triangle correspond to the difference in mean (95% CI) in GSH (µmol/L) between the row and columns. The values in the lower triangle correspond to the difference in mean (95% CI) in MDA (µmol/L) between the column and the row. Significant results are highlighted in bold and underline. NR represents this indicator was not reported in this method among the included studies.

GSH, glutathione; MDA, malondialdehyde. LABB, Lactobacillus acidophilus and Bifidobacterium; LRB, Lacticaseibacillus rhamnosus and Bifidobacterium; LLB, Lactobacillus acidophilus, Lacticaseibacillus casei, and Bifidobacterium bifidum; MP1, four probiotics; MP2, six or more probiotics.

League table for NO has not been done, since there were few studies included.



Figure.S4. League tables for comparisons of means of intervention

League tables: The values correspond to the difference in mean (95% CI) between the row and columns. Significant results are highlighted in bold and underline. Food stands for supplements of probiotics in the form of food. Fortified substances mean that probiotics are supplemented by fortified substances. FBS, fasting blood sugar; HOMA-IR, the homeostasis model assessment of insulin resistance; QUICKI, quantitative insulin-sensitivity check index; HOMA-B, homeostasis model assessment of beta cell; HbA1c, glycated hemoglobin A1c; LDLC, low-density lipoprotein cholesterol; TC, total cholesterol; HDLC, highdensity lipoprotein cholesterol; TG, triglyceride; VLDLC, very low-density lipoprotein cholesterol; Total/HDLC, total cholesterol/high-density lipoprotein cholesterol; TAC, total antioxidant capacity; hs-CRP, high-sensitivity C-reactive protein; GSH, glutathione; MDA, malondialdehyde.

League table for NO has not been done, since few studies were included.

Figure.S5. Results of subgroup analysis

5.1 Study duration ($<12w vs. \ge 12w$)

Figure.S5.1.1 Subgroup analysis of FBS on study duration



Figure.S5.1.2 Subgroup analysis of HOMA-IR on study duration

		Tre	atment			Control				
Study	Total	Mean	SD	Total	Mean	SD	Mean Difference	MD	95%-CI	Weight
<12w										
Asemi 2013	37	-0.20	1.8200	33	0.70	1.1500		-0.90	[-1.61; -0.19]	771.6%
Lindsay 2014	63	0.32	1.4200	75	-0.01	1.6900		0.33	[-0.19; 0.85]	1426.8%
Lindsay 2014	52	0.31	1.2000	58	-0.19	2.2600		0.50	[-0.17; 1.17]	863.9%
Taghizadeh 2014	26	-0.13	1.8600	26	1.13	2.2700		-1.26	[-2.39; -0.13]	301.9%
Lindsay 2015	48	-0.30	1.2800	52	-0.42	2.1600		0.12	[-0.57; 0.81]	807.4%
Dolatkhah 2015	29	-0.40	0.1300	27	0.01	0.1200		-0.41	[-0.48; -0.34]	89598.4%
Karamali 2016	30	-0.40	0.9000	30	1.10	2.5000		-1.50	[-2.45; -0.55]	424.9%
Shahnaz 2016	35	-0.40	1.3000	35	1.10	2.7000		-1.50	[-2.49; -0.51]	389.8%
Jafarnejad 2016	37	-0.60	1.4000	35	0.50	1.2000	·	-1.10	[-1.70; -0.50]	1062.5%
Nabhani 2018	45	-0.40	2.0700	45	0.01	1.6500		-0.41	[-1.18; 0.36]	642.2%
Jmanawat 2019	28	0.25	0.3700	29	0.89	0.4600	-	-0.64	[-0.86; -0.42]	8206.2%
Babadi 2019	24	-0.40	0.5600	24	0.30	0.9500	(——— ——	-0.70	[-1.14; -0.26]	1973.5%
Jamilian 2019	29	-0.60	1.7300	28	0.00	0.7200		-0.60	[-1.28; 0.08]	821.6%
Amirani 2022	26	-0.40	0.5000	25	-0.10	0.3000		-0.30	[-0.53; -0.07]	7566.9%
Random effects model	509			522			*	-0.49	[-0.69; -0.29]	
Heterogeneity: $I^2 = 70\%$, τ^2	2 = 0.06	84, p <	0.01							
≥12w										
Laitinen 2009	76	0.19	3,5700	81	0.85	1.0600		-0.66	[-1.50: 0.18]	550.8%
Jamilian 2016	30	-0.30	0.9000	30	0.30	1.1000		-0.60	[-1.11; -0.09]	1485.1%
Pellonper 2019	93	0.65	0.7800	90	0.74	1.2600		-0.09	[-0.39; 0.21]	4135.3%
Random effects model	199			201			-	-0.36	[-0.76; 0.04]	
Heterogeneity: $l^2 = 47\%$, τ^2	2 = 0.05	99. p =	0.15						Carolina coli cultora a	
Heterogeneity: $l^2 = 67\%$, τ^2	2 = 0.06	04. p <	0.01							
							-2 -1 0 1 2			

Figure.S5.1.3 Subgroup analysis of LDLC on study duration

		T	reatment			Control								
Study	Total	Mean	SD	Total	Mean	SD		Mean	Differe	ence		MD	95%-CI	Weight
<12w									1					
Asemi 2012	37	-35.20	55.9200	33	-11.20	38.4700			_			-24.00	[-46.29; -1.71]	0.8%
Lindsay 2014	63	3.06	16.7500	75	4.32	19.4600			-			-1.26	[-7.30; 4.78]	10.5%
Lindsay 2014	52	3.60	14.4100	58	3.42	8.2900			+			0.18	[-4.28; 4.64]	19.3%
Taghizadeh 2014	26	-5.60	45.6000	26	-5.60	45.6000			-			0.00	[-24.79; 24.79]	0.6%
Lindsay 2015	48	1.44	18.2000	52	5.58	18.5600			-			-4.14	[-11.35; 3.07]	7.4%
Karamali 2016	30	10.20	24.4000	30	0.50	16.5000			-			9.70	[-0.84; 20.24]	3.5%
Shahnaz 2016	35	3.60	26,1000	35	1.20	15,1000			-	-)		2.40	[-7.59: 12.39]	3.8%
Nabhani 2018	45	6.30	31.4800	45	6.90	32.4900		0	+	-		-0.60	[-13.82; 12.62]	2.2%
Babadi 2019	24	-3.90	36,8700	24	3.10	33,5100		-		-		-7.00	[-26.93; 12.93]	1.0%
Jamilian 2019	29	1.80	34.1500	28	1.50	35.1100		-	-	_		0.30	[-17.69; 18.29]	1.2%
Amirani 2022	26	-20.80	30.8000	25	-0.20	16.8000	1.		-			-20.60	[-34.15: -7.05]	2.1%
Random effects model	415			431					-			-2.10	[-6.37: 2.17]	
Heterogeneity: $l^2 = 44\%$, τ^2	= 19.0	464, p =	0.06											
≥12w														
Hoppu 2014	76	20.36	16,1100	81	18.02	14.3200			-			2.34	[-2.44: 7.12]	16.8%
Jamilian 2016	30	-3.90	17,7000	30	0.30	32,9000		-	-			-4.20	[-17.57: 9.17]	2.1%
Random effects model	106			111					-			1.60	[-2.90: 6.10]	
Heterogeneity: $l^2 = 0.96 \tau^2$	= 0 0 =	0.37												
Heterogeneity: $l^2 = 40\% \tau^2$	= 13.2	533 p =	0.07					1	1	1				
		, P	194 CARD				-40	-20	0	20	40			

Figure.S5.1.4 Subgroup analysis of TC on study duration



Figure.S5.1.5 Subgroup analysis of hs-CRP on study duration

Treatment

		Tre	atment			Control				
Study	Total	Mean	SD	Total	Mean	SD	Mean Difference	MD	95%-CI	Weight
<12w							1			
Asemi 2011	37	-3.00	8.1300	33	1.96	9.4400 -		-4.96	[-9.11; -0.81]	22.3%
Taghizadeh 2014	26	-0.48	1.5816	26	-1.07	4.1481		0.59	[-1.12; 2.30]	131.9%
Jafarneiad 2016	37	-0.80	1.0872	35	0.98	1,1212	-	-1.77	[-2.28: -1.26]	1473.6%
Karamali 2018	30	-1.90	4.2000	30	1.10	3,5000		-3.00	[-4.96; -1.04]	100.4%
Badehnoosh 2018	30	-2.20	2,7000	30	0.50	2,4000		-2.70	[-3.99; -1.41]	229.9%
Hajifaraji 2018	29	-0.70	4 3800	27	0.83	4 3600		-1.53	1-3.82 0.761	73.2%
Jamilian 2019	29	-1.00	1.6800	28	0.50	2,2000		-1.50	[-2.52: -0.48]	370.1%
Nabhani 2022	45	-0.12	6 5800	45	0.73	3 9000		-0.85	[-3.08: 1.38]	76.9%
Random effects model	263			254			*	-1.71	[-2.44: -0.98]	
Heterogeneity: $l^2 = 50\%$, τ^2	2 = 0.46	73, p =	0.05							
≥12w										
Jamilian 2016	30	-1.00	2,6000	30	1.70	4,3000		-2.70	[-4.50: -0.90]	118.8%
Houttu 2020	94	-0.31	0.7950	92	-0.30	0.7720	+	-0.01	1-0.24: 0.221	7574.7%
Hasain 2022	66	-1.25	2.9400	66	0.70	2,9200		-1.95	[-2.95: -0.95]	384.4%
Random effects model Heterogeneity: $l^2 = 91\% \tau^2$	190	85 n <	0.01	188			-	-1.41	[-3.16; 0.34]	
Heterogeneity: $l^2 = 88\% \tau^2$	= 1.51	25 0 <	0.01							
							-5 0 5			

Figure.S5.1.6 Subgroup analysis of TAC on study duration

0		0			-			-			
			Treatment			Control					
Study	Total	Mean	SD	Total	Mean	SD	Mean Differ	ence	MD	95%-CI	Weight
<12w							Ĩ				
Asemi 2012	37	-29.00	192.5000	33	-63.80	172.6000	S		34.80	[-50.73; 120.33]	0.1%
Taghizadeh 2014	26	-8.30	305.0000	26	31.90	218,8000		-	-40.20	I-184.48: 104.081	0.0%
Karamali 2018	30	70.10	130,9000	30	-19.70	124,6000		+	89.80	[25.13; 154.47]	0.1%
Badehnoosh 2018	30	65.40	103.2000	30	-37.20	143.7000	<u> </u>		102.60	[39.29; 165.91]	0.1%
Haiifaraii 2018	29	0.15	0.2630	27	-0.01	0.3140			0.16	[0.01: 0.31]	16565.0%
Nabhani 2018	45	0.10	0.2000	45	0.01	0.2600			0.09	[-0.01; 0.19]	41821.6%
Babadi 2019	24	47.70	93,2000	24	-4.00	121.3600			51,70	[-9.52: 112.92]	0.1%
Jamilian 2019	29	16.00	225,4600	28	-18.20	124.5700		_	34.20	[-59.94: 128.34]	0.0%
Random effects model	250			243					0.13	[-0.23; 0.49]	
Heterogeneity: $I^2 = 68\%$, τ^2	= 0.064	41, p < 0	.01								
≥12w											
Jamilian 2016	30	171.90	187.6000	30	-51.90	208.8000			223.80	[123.36; 324.24]	0.0%
Random effects model Heterogeneity: not applicabl	30 le			30					223.80	[123.36; 324.24]	
Heterogeneity: $l^2 = 81\% \tau^2$	= 0 14	$01 \ o < 0$	01				TIT	1 1 1			
			100				300-200-100 0	00 200 300)		
							000 E00 100 0				

Figure.S5.1.7 Subgroup analysis of Insulin on study duration

		11	reatment			Control							
Study	Total	Mean	SD	Total	Mean	SD		Mean	Difference		MD	95%-CI	Weight
<12w									- F				
Asemi 2013	37	1.20	7.3000	33	5.00	6.3200		-	_		-3.80	[-6.99; -0.61]	37.7%
Lindsay 2014	63	1.78	5.6900	75	0.21	7.0400			-		1.57	[-0.55; 3.69]	85.1%
Lindsay 2014	52	1.79	5.1700	58	-0.36	8.9900					2.15	[-0.56; 4.86]	52.4%
Taghizadeh 2014	26	-0.26	8.7200	26	6.34	9.8300	10				-6.60	[-11.65; -1.55]	15.1%
Lindsay 2015	48	-0.84	5.8500	52	-1.03	8.6500		-			0.19	[-2.69; 3.07]	46.5%
Karamali 2016	30	-0.80	3.1000	30	4.50	10.6000					-5.30	[-9.25; -1.35]	24.6%
Shahnaz 2016	35	-1.50	5.9000	35	4.80	11.5000	-		-0.		-6.30	[-10.58; -2.02]	21.0%
Jafarneiad 2016	37	-2.50	5,1000	35	3.60	5,5000		-			-6.10	[-8.55: -3.65]	63.8%
Nabhani 2018	45	-0.10	9.2600	45	0.90	7.3900			-		-1.00	[-4.46: 2.46]	32.1%
Babadi 2019	24	-1.50	2.3000	24	0.90	3.3150		-	-		-2.40	[-4.01: -0.79]	147.4%
Jamilian 2019	29	-1.40	7.2100	28	-0.20	2.7200		2	-		-1.20	[-4.01; 1.61]	48.6%
Amirani 2022	26	-1.40	1.7000	25	-0.20	1.1000			-		-1.20	[-1.98; -0.42]	626.7%
Random effects model	452			466				-	>		-2.12	[-3.54: -0.69]	
Heterogeneity: $l^2 = 76\%$, τ^2	2 = 4.18	802, p <	0.01										
≥12w													
Laitinen 2009	76	1.28	11.9420	81	4.21	4.8900		-			-2.93	[-5.82:-0.04]	46.0%
Jamilian 2016	30	-1.50	4,8000	30	1.30	5,2000		_	-		-2.80	[-5.33: -0.27]	59.9%
Pellonper 2019	93	5,50	6.3200	90	6.40	10,9100		-			-0.90	[-3.49: 1.69]	57.1%
Random effects model	199			201				-	-		-2.17	[-3.71; -0.64]	
Heterogeneity: $l^2 = 0\%$, τ^2 =	= 0. p =	0.49										-	
Heterogeneity: $l^2 = 71\%$, τ^2	2 = 3.27	98. 0 <	0.01					1	1 1				
							-10	-5	0 5	10			

Figure.S5.1.8 Subgroup analysis of QUICKI on study duration

		110	eaument			Control					
Study	Total	Mean	SD	Total	Mean	SD	Mean Dif	ference	MD	95%-CI	Weight
<12w							1				
Taghizadeh 2014	26	0.00	0.0300	26	-0.02	0.0400			- 0.02	[0.00; 0.04]	1040000.0%
Dolatkhah 2015	29	0.01	0.0030	27	0.00	0.0020			0.01	[0.00; 0.01]	218105849.6%
Karamali 2016	30	0.01	0.0100	30	-0.01	0.0200			0.02	[0.01: 0.03]	6000000.0%
Shahnaz 2016	35	0.01	0.0100	35	-0.01	0.0200			0.02	[0.01: 0.02]	7000000.0%
Nabhani 2018	45	0.00	0 0780	45	0.00	0.0350			0.00	1-0 02 0 021	615679.3%
Babadi 2019	24	0.01	0 0095	24	0.00	0 0 1 0 0			0.01	10 00 0 021	12614980.3%
Jamilian 2019	29	0.01	0.0436	28	0.00	0.0095	1		0.01	[-0.01: 0.03]	1454047.2%
Amirani 2022	26	0.01	0 0090	25	0.00	0.0060			0.01	[0 00 0 01]	21952043.2%
Random effects model	244			240	0.00			-	0.01	[0.01: 0.01]	
Heterogeneity: $l^2 = 63\%$, τ^2	2 = < 0.0	0001, p	< 0.01								
≥12w											
Laitinen 2009	76	-0.01	0.0269	81	-0.04	0.0272			- 0.03	[0.02: 0.04]	5360489.9%
Jamilian 2016	30	0.01	0.0500	30	-0.01	0.0200			- 0.02	10.00: 0.041	1034482.8%
Random effects model	106			111					0.03	[0.02: 0.04]	
Heterogeneity: $l^2 = 0\% \tau^2$	= 0 0 =	0.35					44				
Heterogeneity $l^2 = 82\%$ t	2 < 0.00	01 n <	0.01					1			
			0000			-0	04 -0.02 0	0.02 (0.04		

Figure.S5.1.9 Subgroup analysis of HOMA-B on study duration



Figure.S5.1.10 Subgroup analysis of HbA1c on study duration



Figure.S5.1.11 Subgroup analysis of HDLC on study duration

		TI	reatment			Control									
Study	Total	Mean	SD	Total	Mean	SD		Mean	Differ	ence		MD	9	5%-CI	Weight
<12w															
Asemi 2012	37	-9.80	14.1500	33	-8.40	21.2500	10					-1.40	[-9.96;	7.16]	1.1%
Lindsay 2014	63	-2.52	8.4700	75	-2.52	9.0100			+	-		0.00	[-2.92;	2.92]	9.8%
Lindsay 2014	52	-1.98	4,1400	58	-2.52	3,4200			-			0.54	[-0.89;	1.971	41.1%
Taghizadeh 2014	26	0.30	17.5000	26	-5.10	10,7000			-	*		- 5.40	[-2.48;	13.28]	1.4%
Lindsay 2015	48	-0.90	6.6700	52	-0.18	6.1300		3				-0.72	[-3.24;	1.80]	13.3%
Karamali 2016	30	-0.30	7.2000	30	-2.30	7.6000				- 22		2.00	[-1.75;	5.75	6.0%
Shahnaz 2016	35	-0.20	6,1000	35	-2.10	7.1000			-			1.90	I-1.20:	5.001	8.7%
Nabhani 2018	45	5.20	10.9000	45	1.30	11.3300			15.000		- 11	3.90	[-0.69;	8.491	4.0%
Babadi 2019	24	1.90	10,4400	24	-2.50	5.8600			-	-		4.40	1-0.39:	9,191	3.7%
Jamilian 2019	29	0.30	11,4900	28	-1.30	13,9100		-	+		2	1.60	I-5.04:	8.241	1.9%
Amirani 2022	26	-0.10	7.1000	25	-0.40	3.5000			-			0.30	[-2.75;	3.35]	9.0%
Fixed effect model	415			431					-			0.84	[-0.07:	1.76]	100.0%
Heterogeneity: $l^2 = 0.9$	$6, \tau^2 = 1$	0, p = 0.	60												
≥12w															
Hoppu 2014	76	0.72	6.4900	81	1.26	6.4500			-			-0.54	[-2.56;	1,49]	83.3%
Jamilian 2016	30	-1.20	6,7000	30	-0.20	10,7000		-	-	-		-1.00	1-5.52	3.521	16.7%
Fixed effect model	106			111					+			-0.62	[-2.46;	1.23]	100.0%
Heterogeneity: $l^2 = 0.9$	$6 \tau^2 = 1$	p = 0	86										S. 2		
Heterogeneity: $l^2 = 0.9$	$6.\tau^2 = 0$	D = 0	59				100	18	15	13					
							-10	-5	0	5	10				

Figure.S5.1.12 Subgroup analysis of TG on study duration

		T	reatment			Control					
Study	Total	Mean	SD	Total	Mean	SD	Mean Differ	ence	MD	95%-CI	Weight
<12w							_ 1				
Asemi 2012	37	-42.80	91.0000	33	-10.00	106.1500	+ +		-32.80	[-79.40; 13.80]	0.2%
Lindsay 2014	63	3.78	11.1700	75	1.98	11.7100	+		1.80	[-2.03; 5.63]	26.3%
Lindsay 2014	52	3.78	6.1300	58	2.52	9.3700			1.26	[-1.67; 4.19]	44.7%
Taghizadeh 2014	26	-1.50	70,7000	26	36.40	64,9000			-37.90	[-74.79: -1.01]	0.3%
Lindsay 2015	48	7.03	16.2100	52	7.75	14.3400	+		-0.72	[-6.74; 5.30]	10.6%
Karamali 2016	30	-1.60	59.4000	30	27.10	37.9000			-28.70	[-53.91: -3.49]	0.6%
Shahnaz 2016	35	-14.80	56,5000	35	30.40	37,8000			-45.20	[-67.72: -22.68]	0.8%
Nabhani 2018	45	20.00	65.4600	45	25.70	67.4000		-	-5.70	[-33.15; 21.75]	0.5%
Babadi 2019	24	-2.80	48,1900	24	17.10	68.0400			-19.90	[-53.26: 13.46]	0.3%
Jamilian 2019	29	-7.50	60,5000	28	14.70	41,2300			-22.20	[-49.00: 4.60]	0.5%
Amirani 2022	26	-16.60	44,4000	25	14.90	26,4000			-31.50	[-51.46; -11.54]	1.0%
Random effects model	415			431			-		-10.80	[-17.86: -3.73]	
Heterogeneity: $l^2 = 76\%$, τ^2	= 59.7	412, p <	0.01								
≥12w							10				
Hoppu 2014	76	24.68	12.3400	81	20.90	12.9530	-+-		3.78	[-0.17: 7.74]	24.5%
Jamilian 2016	30	-14.70	46,5000	30	37.30	74.2000 -			-52.00	[-83.33: -20.67]	0.4%
Random effects model	106			111					-21.85	[-76.34; 32.63]	-
Heterogeneity: $I^2 = 92\%$, τ^2	= 142	5.9801. p	< 0.01				14-	2.2		March 1 March 199	
Heterogeneity: $l^2 = 78\%$, τ^2	= 54.6	143. p <	0.01				1 1	10			
							-50 0	50			

Figure.S5.1.13 Subgroup analysis of VLDLC on study duration

		T	reatment			Control					
Study	Total	Mean	SD	Total	Mean	SD	Mean Differenc	е	MD	95%-CI	Weight
<12w							1				
Taghizadeh 2014	26	-0.30	14.1000	26	7.20	12.9000			-7.50	[-14.85; -0.15]	7.1%
Karamali 2016	30	-0.30	11.9000	30	5.40	7.6000			-5.70	[-10.75; -0.65]	15.0%
Shahnaz 2016	35	-3.00	11.3000	35	6.10	7.6000			-9.10	[-13.61; -4.59]	18.9%
Babadi 2019	24	-0.60	9.6600	24	3.40	13.6100			-4.00	[-10.68; 2.68]	8.6%
Jamilian 2019	29	-1.50	12.1000	28	3.00	8.2200			-4.50	[-9.85; 0.85]	13.4%
Amirani 2022	26	-3.40	8.9000	25	3.00	5.3000			-6.40	[-10.40; -2.40]	24.0%
Random effects model	170			168			-		-6.42	[-8.53; -4.32]	
Heterogeneity: $I^2 = 0\%$, $\tau^2 =$	0, p =	0.77									
≥12w											
Jamilian 2016	30	-2.90	9.3000	30	7.40	14.8000			-10.30	[-16.55; -4.05]	9.8%
Random effects model	30			30					-10.30	[-16.55; -4.05]	
Heterogeneity: not applicab	le						10				
Heterogeneity: $l^2 = 0\%$, $\tau^2 =$	0.p=	0.70									
							-15 -10 -5 0 5	10 15			

Figure.S5.1.14 Subgroup analysis of Total/HDLC on study duration

		Tre	eatment			Control									
Study	Total	Mean	SD	Total	Mean	SD		Mean	Differe	nce		MD	95%	CI	Weight
<12w									, Î						
Asemi 2012	37	-0.30	0.6080	33	0.02	0.5740		-	<u> </u>			-0.32	[-0.60; -0.0)4]	5006.2%
Taghizadeh 2014	26	-0.10	0.9000	26	0.40	1.4000		-				-0.50	[-1.14; 0.*	14]	938.6%
Lindsay 2015	48	0.30	0.9870	52	0.34	1.0000			-	-		-0.04	[-0.43; 0.3	351	2530.0%
Babadi 2019	24	-0.20	0.9200	24	0.30	0.9200	-	-				-0.50	I-1.02: 0.0	21	1417.8%
Jamilian 2019	29	-0.10	0.8500	28	0.10	1.2000		2		-		-0.20	[-0.74: 0.3	341	1309.9%
Nabhani 2022	45	-0.28	1.7100	45	0.19	1.2200	-					-0.47	[-1.08: 0.1	141	1019.8%
Random effects model	209			208				-	-			-0.30	[-0.47: -0.1	21	
Heterogeneity: $l^2 = 0\%$, τ^2	= 0, p =	0.69												1	
Heterogeneity: $l^2 = 0\% \tau^2$	= 0 n =	0.69						1	6	15	1				
	-10						-1	-0.5	0	0.5	1				

Figure.S5.1.15 Subgroup analysis of GSH on study duration

		5	Freatment			Control					
Study	Total	Mean	SD	Total	Mean	SD	Mea	n Difference	MD	95%-CI	Weight
<12w								5			
Asemi 2012	37	67.90	152.0000	33	-1.90	204.2000			69.80	[-15.36; 154.96]	0.1%
Taghizadeh 2014	26	19.70	393.7000	26	-281.30	330.7000			- 301.00	[103.37; 498.63]	0.0%
Karamali 2018	30	28.70	61.5000	30	-14.90	85.3000		-	43.60	[5.97; 81.23]	0.3%
Badehnoosh 2018	30	-4.60	67.0000	30	-39.70	130.6000		+	35.10	[-17.42; 87.62]	0.1%
Babadi 2019	24	-17.70	116,4100	24	-16.60	97.2200		-	-1.10	[-61.78; 59.58]	0.1%
Jamilian 2019	29	10.60	57.8700	28	-0.40	253.8700			11.00	[-85.36; 107.36]	0.0%
Random effects model	176			171				-	41.48	[2.92; 80.03]	
Heterogeneity: $l^2 = 46\%$, τ^2	= 975.	9748, p	= 0.10								
≥12w											
Jamilian 2016	30	34.30	71,6000	30	-36.90	108.3000		-	71.20	[24.74: 117.66]	0.2%
Random effects model	30			30				-	71.20	[24.74; 117.66]	
Heterogeneity: not applicab	le										
Heterogeneity: $l^2 = 45\%$, τ^2	= 777.	0832. p	= 0.09				1, 1	1 1	1		
							-400 -200	0 200 41	00		

Figure.S5.1.16 Subgroup analysis of MDA on study duration

		Tre	eatment			Control								
Study	Total	Mean	SD	Total	Mean	SD		Mean	Differe	nce		MD	95%-C	Weight
≥12w														
Jamilian 2016	30	-0.60	1.2000	30	-0.10	1.3000		1.2				-0.50	[-1.13; 0.13]	958.5%
Si 2019	113	-1.12	1.3000	113	0.00	1.4200		-				-1.12	[-1.47; -0.77]	3048.8%
Random effects model	143			143					-			-0.87	[-1.46; -0.27]	
Heterogeneity: $l^2 = 64\%$, τ^2	= 0.12	36, p =	0.09											
<12w														
Karamali 2018	30	-0.10	0.6000	30	0.30	0.7000		-	-			-0.40	[-0.73; -0.07]	3529.4%
Badehnoosh 2018	30	-0.10	0.8000	30	0.50	1.5000		-	-			-0.60	[-1.21; 0.01]	1038.1%
Hajifaraji 2018	29	-0.95	2.0500	27	0.85	1.4600 -	-	-				-1.80	[-2.73; -0.87]	446.7%
Babadi 2019	24	-0.40	0.2000	24	0.20	0.7500		-	-			-0.60	[-0.91; -0.29]	3983.4%
Jamilian 2019	29	-0.10	0.5600	28	0.20	0.9500		-	-			-0.30	[-0.71; 0.11]	2323.1%
Nabhani 2022	45	0.07	0.7100	45	-0.01	0.4600			-			0.08	[-0.17; 0.33]	6287.6%
Random effects model	187			184				-	-			-0.47	[-0.83; -0.12]	
Heterogeneity: $l^2 = 79\%$, τ^2	= 0.14	20. p <	0.01					_						
Heterogeneity: /2 = 83%, t	= 0.19	31. p <	0.01				18	ा	1	1	1			
-							-2	-1	0	1	2			

Figure.S5.1.17 Subgroup analysis of NO on study duration

Troatmont

		110	adificit			Control					
Study	Total	Mean	SD	Total	Mean	SD	Mean Diff	erence	MD	95%-CI	Weight
<12w							1				
Karamali 2018	30	0.20	3.0000	30	-0.80	3.8000	3. 	-	1.00	[-0.73; 2.73]	128.0%
Badehnoosh 2018	30	-0.50	3.1000	30	-1.50	22.8000		•	- 1.00	[-7.23; 9.23]	5.7%
Babadi 2019	24	1.20	4.3900	24	-0.60	3.1000	+	-	1.80	[-0.35; 3.95]	83.1%
Jamilian 2019	29	0.70	5.0700	28	-0.20	3.9200	-		0.90	[-1.45; 3.25]	69.7%
Random effects model Heterogeneity: $l^2 = 0\%$, τ^2	113 = 0, <i>p</i> =	0.94		112			1	•	1.21	[0.05; 2.37]	=
≥12w											
Jamilian 2016	30	6.80	9.3000	30	6.80	9.3000	-		0.00	[-4.71; 4.71]	17.3%
Random effects model Heterogeneity: not applicat Heterogeneity: $l^2 = 0\%$, τ^2	30 ble = 0, p =	0.96		30					0.00	[-4.71; 4.71]	
							-5 0	5			

Control

5.2 Study population (GDM vs. pregnant women)

Figure.S5.2.1 Subgroup analysis of FBS on the study population





Figure.S5.2.2 Subgroup analysis of HOMA-IR on the study population

Figure.S5.2.3 Subgroup analysis of LDLC on the study population



Figure.S5.2.4 Subgroup analysis of TC on the study population

		T	reatment			Control				
Study	Total	Mean	SD	Total	Mean	SD	Mean Difference	MD	95%-CI	Weight
GDM										
Lindsay 2015	48	4.86	18.7400	52	9.01	20.0000		-4.15	[-11.74; 3.44]	6.7%
Karamali 2016	30	9.60	27.8000	30	3.50	20.4000		6.10	[-6.24; 18.44]	2.5%
Shahnaz 2016	35	0.40	28,0000	35	5.20	18,7000		-4.80	[-15.95: 6.35]	3.1%
Nabhani 2018	45	12.89	38,1500	45	16.20	37,3300		-3.31	[-18.90: 12.28]	1.6%
Babadi 2019	24	-2.50	40,4400	24	4.00	41,6400		-6.50	[-29,72: 16,72]	0.7%
Jamilian 2019	29	0.50	36.9100	28	3.20	37.5100		-2.70	[-22.03; 16.63]	1.0%
Amirani 2022	26	-24.20	29.2000	25	4.50	18,7000		-28.70	[-42.11: -15.29]	2.1%
Random effects model	237			239				-6.22	[-14.27: 1.83]	
Heterogeneity: $I^2 = 61\%$, τ^2	2 = 66.4	070, p =	0.02							
Pregnant women										
Asemi 2012	37	-53.70	65.0200	33	-21.60	55.5400 -		-32.10	[-60.35; -3.85]	0.5%
Lindsav 2014	63	1.44	19.2800	75	3.06	19.8200	-	-1.62	[-8.16; 4.92]	9.0%
Lindsay 2014	52	2.34	13,5100	58	1.98	9.1900		0.36	[-4.01: 4.73]	20.1%
Taghizadeh 2014	26	-5.40	47.8000	26	-0.30	47,8000		-5.10	[-31.08: 20.88]	0.6%
Hoppu 2014	76	33.15	16.9700	81	20.01	15.6000		13,14	[8.03; 18.25]	14.7%
Jamilian 2016	30	-8.10	25,4000	30	7.60	43,4000		-15.70	[-33.69; 2.29]	1.2%
Random effects model	284			303			-	-1.80	[-10.66: 7.07]	
Heterogeneity: $l^2 = 83\%$ τ^2	= 77 5	998 n <	0.01							
Heterogeneity: $l^2 = 78\%$ τ	= 81.8	564 n <	0.01			Г				
fictor ogonowy. r	01.0		0.01			-60	-40 -20 0 20 40	60		

Figure.S5.2.5 Subgroup analysis of hs-CRP on the study population

		1 re	atment			Control				
Study	Total	Mean	SD	Total	Mean	SD	Mean Difference	MD	95%-CI	Weight
Pregnant women							1			
Asemi 2011	37	-3.00	8.1300	33	1.96	9.4400 -		-4.96	[-9.11; -0.81]	22.3%
Taghizadeh 2014	26	-0.48	1.5816	26	-1.07	4.1481	-	0.59	[-1.12; 2.30]	131.9%
Jamilian 2016	30	-1.00	2.6000	30	1.70	4.3000		-2.70	[-4.50; -0.90]	118.8%
Houttu 2020	94	-0.31	0.7950	92	-0.30	0.7720	+	-0.01	[-0.24: 0.22]	7574.7%
Random effects model	187			181				-1.12	[-2.84; 0.60]	
Heterogeneity: $I^2 = 79\%$, τ^2	= 2.13	66, p <	0.01						CONTRACTOR OF	
GDM										
Jafarnejad 2016	37	-0.80	1.0872	35	0.98	1.1212	-	-1.77	[-2.28; -1.26]	1473.6%
Karamali 2018	30	-1.90	4.2000	30	1.10	3.5000		-3.00	[-4.96; -1.04]	100.4%
Badehnoosh 2018	30	-2.20	2.7000	30	0.50	2.4000		-2.70	[-3.99; -1.41]	229.9%
Hajifaraji 2018	29	-0.70	4.3800	27	0.83	4.3600		-1.53	[-3.82; 0.76]	73.2%
Jamilian 2019	29	-1.00	1.6800	28	0.50	2.2000		-1.50	[-2.52: -0.48]	370.1%
Nabhani 2022	45	-0.12	6.5800	45	0.73	3.9000		-0.85	[-3.08; 1.38]	76.9%
Hasain 2022	66	-1.25	2.9400	66	0.70	2.9200		-1.95	[-2.95; -0.95]	384.4%
Random effects model	266			261			٠	-1.85	[-2.23; -1.47]	
Heterogeneity: $I_{a}^{*} = 0\%$, τ^{*}	= 0, p =	0.62								
Heterogeneity: $I^2 = 88\%$, τ^4	= 1.51	25, p <	0.01							
							-5 0 5			

Figure.S5.2.6 Subgroup analysis of TAC on the study population



Figure.S5.2.7 Subgroup analysis of Insulin on the study population



Figure.S5.2.8 Subgroup analysis of QUICKI on the study population

		Tre	atment			Control					
Study	Total	Mean	SD	Total	Mean	SD	Mean D	ifference	MD	95%-CI	Weight
Pregnant women											
Laitinen 2009	76	-0.01	0.0269	81	-0.04	0.0272			- 0.03	[0.02; 0.04]	5360489.9%
Taghizadeh 2014	26	0.00	0.0300	26	-0.02	0.0400		-	- 0.02	[0.00; 0.04]	1040000.0%
Jamilian 2016	30	0.01	0.0500	30	-0.01	0.0200		-	- 0.02	[0.00; 0.04]	1034482.8%
Random effects model	132			137					- 0.03	[0.02; 0.03]	
Heterogeneity: $I^2 = 0\%$, τ^2	= 0, p =	0.54						Contraction of the second			
GDM											
Dolatkhah 2015	29	0.01	0.0030	27	0.00	0.0020			0.01	[0.00; 0.01]	218105849.6%
Karamali 2016	30	0.01	0.0100	30	-0.01	0.0200			0.02	[0.01; 0.03]	6000000.0%
Shahnaz 2016	35	0.01	0.0100	35	-0.01	0.0200			0.02	[0.01; 0.02]	7000000.0%
Nabhani 2018	45	0.00	0.0780	45	0.00	0.0350		-	0.00	[-0.02; 0.02]	615679.3%
Babadi 2019	24	0.01	0.0095	24	0.00	0.0100			0.01	[0.00; 0.02]	12614980.3%
Jamilian 2019	29	0.01	0.0436	28	0.00	0.0095	100		0.01	[-0.01: 0.03]	1454047.2%
Amirani 2022	26	0.01	0.0090	25	0.00	0.0060			0.01	[0.00; 0.01]	21952043.2%
Random effects model	218			214				-	0.01	[0.01; 0.01]	
Heterogeneity: $l^2 = 64\%$, τ^2	= < 0.	0001. p	= 0.01						Crassin.		
Heterogeneity: $l^2 = 82\%$, τ^2	< 0.00	01.p<	0.01			1	1	1 1			
a contrata de la contrata de						-0.	04 -0.02	0 0.02	0.04		

Figure.S5.2.9 Subgroup analysis of HOMA-B on the study population



Figure.S5.2.10 Subgroup analysis of HbA1c on the study population



Figure.S5.2.11 Subgroup analysis of HDLC on the study population

		T	reatment			Control									
Study	Total	Mean	SD	Total	Mean	SD		Mear	Differ	ence		MD	9	5%-CI	Weight
GDM															
Lindsay 2015	48	-0.90	6.6700	52	-0.18	6.1300		1	-			-0.72	[-3.24;	1.80]	28.5%
Karamali 2016	30	-0.30	7.2000	30	-2.30	7.6000			-			2.00	[-1.75;	5.75]	12.9%
Shahnaz 2016	35	-0.20	6.1000	35	-2.10	7.1000			-			1.90	[-1.20;	5.00]	18.8%
Nabhani 2018	45	5.20	10.9000	45	1.30	11.3300			-		_	3.90	[-0.69;	8.49]	8.6%
Babadi 2019	24	1.90	10.4400	24	-2.50	5.8600			3	-	215	4.40	[-0.39;	9.19]	7.9%
Jamilian 2019	29	0.30	11.4900	28	-1.30	13.9100		-			11	1.60	[-5.04;	8.24]	4.1%
Amirani 2022	26	-0.10	7.1000	25	-0.40	3.5000				-		0.30	[-2.75;	3.351	19.3%
Fixed effect model	237			239					-			1.21	[-0.13;	2.56]	100.0%
Heterogeneity: $I^2 = 0\%$	$t_{0}, \tau^{2} = 0$), p = 0.	42												
Pregnant women															
Asemi 2012	37	-9.80	14.1500	33	-8.40	21.2500	10					-1.40	[-9.96;	7.16]	1.5%
Lindsay 2014	63	-2.52	8.4700	75	-2.52	9.0100						0.00	[-2.92;	2.92]	12.6%
Lindsay 2014	52	-1.98	4.1400	58	-2.52	3.4200			-			0.54	[-0.89;	1.97]	52.7%
Taghizadeh 2014	26	0.30	17.5000	26	-5.10	10.7000			283 BA			- 5.40	[-2.48;	13.28]	1.7%
Hoppu 2014	76	0.72	6.4900	81	1.26	6.4500						-0.54	[-2.56;	1.49]	26.2%
Jamilian 2016	30	-1.20	6.7000	30	-0.20	10.7000		8	-	-32		-1.00	[-5.52;	3.52]	5.3%
Fixed effect model	284			303					+			0.16	[-0.87;	1.20]	100.0%
Heterogeneity: $I_{1}^{2} = 0\%$	$t_{1}^{2} = 0$	p = 0	73					20		10					
Heterogeneity: $l^2 = 0\%$	$5, \tau^2 = 0$	p = 0	59				13	15	1	15	1				
							-10	-5	0	5	10				

Figure.S5.2.12 Subgroup analysis of TG on the study population

			eaunem			Control				
Study	Total	Mean	SD	Total	Mean	SD	Mean Difference	ce MD	95%-CI	Weight
GDM							- I			
Lindsay 2015	48	7.03	16.2100	52	7.75	14.3400		-0.72	[-6.74; 5.30]	10.6%
Karamali 2016	30	-1.60	59.4000	30	27.10	37.9000		-28.70	[-53.91; -3.49]	0.6%
Shahnaz 2016	35	-14.80	56.5000	35	30.40	37.8000		-45.20	[-67.72; -22.68]	0.8%
Nabhani 2018	45	20.00	65.4600	45	25.70	67.4000	-	-5.70	[-33.15; 21.75]	0.5%
Babadi 2019	24	-2.80	48.1900	24	17.10	68.0400		-19.90	[-53.26; 13.46]	0.3%
Jamilian 2019	29	-7.50	60.5000	28	14.70	41.2300		-22.20	[-49.00; 4.60]	0.5%
Amirani 2022	26	-16.60	44.4000	25	14.90	26.4000	-	-31.50	[-51.46; -11.54]	1.0%
Random effects model	237			239				-21.21	[-36.95; -5.47]	
Heterogeneity: $l^2 = 77\%$, τ^2	2 = 311.	6220, p	< 0.01							
Pregnant women										
Asemi 2012	37	-42.80	91.0000	33	-10.00	106.1500		-32.80	[-79.40; 13.80]	0.2%
Lindsay 2014	63	3.78	11.1700	75	1.98	11.7100	1	1.80	[-2.03; 5.63]	26.3%
Lindsay 2014	52	3.78	6.1300	58	2.52	9.3700	-	1.26	[-1.67: 4.19]	44.7%
Taghizadeh 2014	26	-1.50	70.7000	26	36.40	64.9000		-37.90	[-74.79; -1.01]	0.3%
Hoppu 2014	76	24.68	12.3400	81	20.90	12.9530		3.78	[-0.17; 7.74]	24.5%
Jamilian 2016	30	-14.70	46.5000	30	37.30	74.2000 -		-52.00	[-83.33; -20.67]	0.4%
Random effects model	284			303				-0.65	[-6.21; 4.91]	
Heterogeneity: $l^2 = 74\%$, t	= 22.4	509 p <	0.01				15			
Heterogeneity: $I^2 = 78\%$, τ	= 54.6	143.0 <	0.01				l l			
		A STATE OF					-50 0	50		

Figure.S5.2.13 Subgroup analysis of VLDLC on the study population



Figure.S5.2.14 Subgroup analysis of Total/HDLC on the study population



Figure.S5.2.15 Subgroup analysis of GSH on the study population

		83	Freatment			Control					
Study	Total	Mean	SD	Total	Mean	SD	Mean D	ifference	MD	95%-CI	Weight
Pregnant women								1			
Asemi 2012	37	67.90	152.0000	33	-1.90	204.2000			69.80	[-15.36; 154.96]	0.1%
Taghizadeh 2014	26	19.70	393.7000	26	-281.30	330.7000			- 301.00	[103.37; 498.63]	0.0%
Jamilian 2016	30	34.30	71.6000	30	-36.90	108.3000			71.20	[24.74; 117.66]	0.2%
Random effects model	93			89					102.17	[18.66; 185.67]	
Heterogeneity: $I^2 = 60\%$, τ^2	= 3083	3.5284, p	= 0.08								
GDM											
Karamali 2018	30	28.70	61.5000	30	-14.90	85.3000		-	43.60	[5.97; 81.23]	0.3%
Badehnoosh 2018	30	-4.60	67.0000	30	-39.70	130,6000			35.10	[-17.42: 87.62]	0.1%
Babadi 2019	24	-17.70	116,4100	24	-16.60	97.2200	14	.	-1.10	[-61,78: 59,58]	0.1%
Jamilian 2019	29	10 60	57 8700	28	-0.40	253 8700		_	11 00	[-85 36: 107 36]	0.0%
Random effects model	113			112				•	30.66	[4.38; 56.94]	
Heterogeneity: $l^2 = 0\%$, $\tau^2 =$	= 0, p =	0.64						3 10 L			
Heterogeneity: $l^2 = 45\%$, τ^2	= 777.	0832. p	= 0.09				1 1				
							-400 -200	0 200 40	00		

Figure.S5.2.16 Subgroup analysis of MDA on the study population

		Tre	atment			Control									
Study	Total	Mean	SD	Total	Mean	SD		Mean	Diffe	rence		MD	ç	5%-CI	Weigh
GDM									1						
Karamali 2018	30	-0.10	0.6000	30	0.30	0.7000		15				-0.40	[-0.73;	-0.07]	3529.4%
Badehnoosh 2018	30	-0.10	0.8000	30	0.50	1.5000			-			-0.60	[-1.21;	0.01]	1038.1%
Hajifaraji 2018	29	-0.95	2.0500	27	0.85	1.4600 -						-1.80	[-2.73;	-0.87]	446.7%
Si 2019	113	-1.12	1.3000	113	0.00	1.4200						-1.12	[-1.47;	-0.77]	3048.8%
Babadi 2019	24	-0.40	0.2000	24	0.20	0.7500						-0.60	[-0.91;	-0.29]	3983.4%
Jamilian 2019	29	-0.10	0.5600	28	0.20	0.9500		100				-0.30	[-0.71;	0.11]	2323.1%
Nabhani 2022	45	0.07	0.7100	45	-0.01	0.4600			+			0.08	[-0.17;	0.33]	6287.6%
Random effects model	300			297				-				-0.60	[-0.98;	-0.21]	-
Heterogeneity: $l^2 = 85\%$, τ^2	= 0.21	16, <i>p</i> <	0.01												
Pregnant women															
Jamilian 2016	30	-0.60	1.2000	30	-0.10	1.3000		-	-			-0.50	[-1.13;	0.131	958.5%
Random effects model Heterogeneity: not applicat	30 ale			30				-				-0.50	[-1.13;	0.13]	-
Heteroneneity: $l^2 = 83\%$ τ^2	= 0.19	31 0 4	0.01				-	1		T					
notorogeneity. r = cont, r	0.10	on p	0.01				-2	-1	0	1	2				

Figure.S5.2.17 Subgroup analysis of NO on the the study population

		Tre	atment			Control					
Study	Total	Mean	SD	Total	Mean	SD	Mea	n Difference	MD	95%-CI	Weight
GDM											
Karamali 2018	30	0.20	3.0000	30	-0.80	3.8000			1.00	[-0.73; 2.73]	128.0%
Badehnoosh 2018	30	-0.50	3.1000	30	-1.50	22.8000	12	-	- 1.00	[-7.23; 9.23]	5.7%
Babadi 2019	24	1.20	4.3900	24	-0.60	3.1000		-	1.80	[-0.35; 3.95]	83.1%
Jamilian 2019	29	0.70	5.0700	28	-0.20	3.9200			0.90	[-1.45; 3.25]	69.7%
Random effects model Heterogeneity: $l^2 = 0\%$, $\tau^2 =$	113 = 0, p =	0.94		112				~	1.21	[0.05; 2.37]	
Pregnant women								12			
Jamilian 2016	30	6.80	9.3000	30	6.80	9.3000	1		0.00	[-4.71; 4.71]	17.3%
Random effects model Heterogeneity: not applicab	30 le	0.96		30			 		0.00	[-4.71; 4.71]	
	*, p =	0.00					-5	0 5			

5.3 Treatment type (synbiotics vs. probiotics) Figure.S5.3.1 Subgroup analysis of FBS on treatment type

			outilione			00111101								
Study	Total	Mean	SD	Total	Mean	SD		Mean	Differen	ce		MD	95%-0	Weight
Probiotics									[
Asemi 2013	37	-21.30	25.5500	33	-16.30	22.4000	-		- 6 - 8			-5.00	[-16.23; 6.23	3.0%
Lindsay 2014	63	-1.62	7.4900	75	-1.26	8.3800			-			0.36	[-3.01; 2.29	54.7%
Lindsay 2014	52	-1.26	7.3900	58	-1.98	4.8600			-			0.72	[-1.65; 3.09	68.6%
Lindsay 2015	48	-3.42	7.8500	52	-4.86	9.4900						1.44	[-1.96; 4.84	33.2%
Dolatkhah 2015	29	-15.27	1.8300	27	-7.30	3.0400		-				-7.97	[-9.30: -6.64	218.5%
Karamali 2016	30	-9.20	9.2000	30	1.10	12.2000	1				-1	0.30	[-15.77: -4.83	1 12.8%
Jamilian 2016	30	-1.20	8.3000	30	-0.20	4.9000		10	-			-1.00	[-4.45; 2.45	32.3%
Jafarnejad 2016	37	-2.30	4.1000	35	-4.80	3.6000			-			2.50	[0.72; 4.28] 121.3%
Badehnoosh 2018	30	-5.30	6.7000	30	0.03	9.0000						-5.33	[-9.34; -1.32	23.8%
Ebrahimi 2019	42	-3.10	8.9800	42	1.20	12.8000		-				4.30	[-9.03; 0.43	1 17.2%
Jmanawat 2019	28	0.68	5.8800	29	4.62	7.7800			-			-3.94	[-7.51; -0.37	30.1%
Pellonper 2019	93	-2.52	6.1300	90	-3.06	7.0300			3. . .			0.54	[-1.37; 2.45	104.9%
Babadi 2019	24	-3.00	10.2500	24	1.00	7.9500		-	-			4.00	[-9.19: 1.19	1 14.3%
Jamilian 2019	29	-10.10	6.5900	28	-1.10	7.1700						9.00	[-12.58; -5.42	30.0%
Asgharian 2020	64	-0.70	7.3000	64	3.80	9.8000						4.50	[-7.49: -1.51	42.9%
Amirani 2022	26	-4.50	5.8000	25	-1.20	4.3000		-	-			-3.30	[-6.09: -0.51	49.2%
Hasain 2022	66	-3.60	12.3200	66	11.53	23.6000	-				-1	15.13	[-21.55; -8.71	9.3%
Random effects model	728			738				4				-3.68	[-5.96; -1.41]
Heterogeneity: $l^2 = 90\%$, τ^2	2 = 18.8	337, p <	0.01											5
Synbiotics									-					
Taghizadeh 2014	26	-2.38	23.3900	26	-2.88	13.6700		20	-			0.50	[-9.91; 10.91] 3.5%
Shahnaz 2016	35	-1.70	9.3000	35	1.40	11.4000		-				-3.10	[-7.97: 1.77	1 16.2%
Nabhani 2018	45	-1.30	11.8000	45	1.10	9.6000		12				-2.40	[-6.84; 2.04	1 19.4%
Random effects model	106			106					-			2.43	[-5.56; 0.71	i
Heterogeneity: $l^2 = 0\%$, τ^2	= 0, p =	0.83							CO.S.				C. C	
Heterogeneity: $l^2 = 88\%$, τ	= 17.5	185, p <	0.01				_	1		1				
an a							-20	-10	0	10	20			

Figure.S5.3.2 Subgroup analysis of HOMA-IR on treatment type

		Ire	eatment			Control						
Study	Total	Mean	SD	Total	Mean	SD		Mean	Difference	MD	95%-CI	Weight
Probiotics									1			
Laitinen 2009	76	0.19	3.5700	81	0.85	1.0600	57			-0.66	[-1.50; 0.18]	550.8%
Asemi 2013	37	-0.20	1.8200	33	0.70	1.1500			- 1	-0.90	[-1.61; -0.19]	771.6%
Lindsay 2014	63	0.32	1.4200	75	-0.01	1.6900				0.33	[-0.19; 0.85]	1426.8%
Lindsay 2014	52	0.31	1.2000	58	-0.19	2.2600				0.50	[-0.17; 1.17]	863.9%
Lindsay 2015	48	-0.30	1.2800	52	-0.42	2.1600		6		0.12	[-0.57; 0.81]	807.4%
Dolatkhah 2015	29	-0.40	0.1300	27	0.01	0.1200			8	-0.41	[-0.48; -0.34]	89598.4%
Karamali 2016	30	-0.40	0.9000	30	1.10	2.5000		-		-1.50	[-2.45; -0.55]	424.9%
Jamilian 2016	30	-0.30	0.9000	30	0.30	1.1000				-0.60	[-1.11; -0.09]	1485.1%
Jafarnejad 2016	37	-0.60	1.4000	35	0.50	1.2000	8			-1.10	[-1.70; -0.50]	1062.5%
Jmanawat 2019	28	0.25	0.3700	29	0.89	0.4600		-	- C.	-0.64	[-0.86; -0.42]	8206.2%
Pellonper 2019	93	0.65	0.7800	90	0.74	1.2600				-0.09	[-0.39; 0.21]	4135.3%
Babadi 2019	24	-0.40	0.5600	24	0.30	0.9500			-	-0.70	[-1.14; -0.26]	1973.5%
Jamilian 2019	29	-0.60	1.7300	28	0.00	0.7200		-		-0.60	[-1.28; 0.08]	821.6%
Amirani 2022	26	-0.40	0.5000	25	-0.10	0.3000		5	-	-0.30	[-0.53; -0.07]	7566.9%
Random effects model	602			617				-	•	-0.42	[-0.60; -0.24]	
Heterogeneity: $I^2 = 69\%$, τ^2	² = 0.05	56, p <	0.01									
Synbiotics												
Tachizadeh 2014	26	-0.13	1.8600	26	1.13	2.2700				-1.26	[-2.39: -0.13]	301.9%
Shahnaz 2016	35	-0.40	1.3000	35	1.10	2.7000	_	100		-1.50	[-2.49; -0.51]	389.8%
Nabhani 2018	45	-0.40	2.0700	45	0.01	1.6500		-		-0.41	[-1.18: 0.36]	642.2%
Random effects model	106			106			-	-	-	-0.98	[-1.69; -0.27]	
Heterogeneity: $l^2 = 40\%$, τ^2	= 0.15	79. p =	0.19									
Heterogeneity: $l^2 = 67\%$, τ^2	2 = 0.06	04. p <	0.01					2	1 1	٦		
		Sector Sector	0585.0				-2	-1	0 1	2		

Figure.S5.3.3 Subgroup analysis of LDLC on treatment type



Figure.S5.3.4 Subgroup analysis of TC on treatment type

Study Tol Probiotics Asemi 2012 : Lindsay 2014	tal 37	Mean	SD	Total	Mean	SD		Mean D	fference		MD	95%-CI	Weight
Probiotics Asemi 2012 Lindsay 2014	37	50 70											
Asemi 2012 Lindsay 2014	37	E0.70							ľ.				
Lindsay 2014	00	-53.70	65.0200	33	-21.60	55.5400 -					-32.10	[-60.35; -3.85]	0.5%
	03	1.44	19.2800	75	3.06	19.8200		8 44	100		-1.62	[-8.16: 4.92]	9.0%
Lindsay 2014	52	2.34	13.5100	58	1.98	9,1900					0.36	[-4.01: 4.73]	20.1%
Hoppu 2014	76	33,15	16,9700	81	20.01	15,6000			-		13.14	[8.03: 18.25]	14.7%
Lindsay 2015	48	4.86	18,7400	52	9.01	20.0000		-	-		-4.15	[-11.74: 3.44]	6.7%
Karamali 2016	30	9.60	27.8000	30	3.50	20.4000		-	-		6.10	[-6.24; 18.44]	2.5%
Jamilian 2016	30	-8.10	25,4000	30	7.60	43,4000	2		-		-15.70	[-33.69: 2.29]	1.2%
Babadi 2019	24	-2.50	40,4400	24	4.00	41.6400			10		-6.50	[-29.72: 16.72]	0.7%
Jamilian 2019	29	0.50	36,9100	28	3.20	37,5100		-	-		-2.70	[-22.03: 16.63]	1.0%
Amirani 2022	26	-24.20	29,2000	25	4.50	18,7000	-	-			-28.70	[-42.11: -15.29]	2.1%
Random effects model 4	15			436				<	-		-4.41	[-11.79: 2.97]	
Heterogeneity: $I^2 = 83\%$, $\tau^2 = 9$	6.05	530, p <	0.01										
Synbiotics													
Taghizadeh 2014	26	-5.40	47,8000	26	-0.30	47.8000		-			-5.10	[-31.08: 20.88]	0.6%
Shahnaz 2016	35	0.40	28.0000	35	5.20	18,7000		1	-		-4.80	[-15.95: 6.35]	3.1%
Nabhani 2018	45	12.89	38,1500	45	16.20	37,3300		8			-3.31	[-18.90: 12.28]	1.6%
Random effects model 10	06			106				-	-		-4.38	[-12.95: 4.18]	-
Heterogeneity: $l^2 = 0\% \tau^2 = 0$	0 =	0.99										- Second States	
Heterogeneity: $l^2 = 78\%$, $\tau^2 = 8$	1.85	564. p <	0.01			F	1	1	1	1			
						-60	0 -40	-20	0 20	40	60		

Figure.S5.3.5 Subgroup analysis of hs-CRP on treatment type

		Tre	atment			Control					
Study	Total	Mean	SD	Total	Mean	SD	Mea	n Difference	MD	95%-CI	Weight
Synbiotics								- I			
Taghizadeh 2014	26	-0.48	1.5816	26	-1.07	4.1481			0.59	[-1.12; 2.30]	131.9%
Karamali 2018	30	-1.90	4.2000	30	1.10	3.5000	8 - B		-3.00	[-4.96; -1.04]	100.4%
Nabhani 2022	45	-0.12	6.5800	45	0.73	3.9000			-0.85	[-3.08; 1.38]	76.9%
Random effects model	101			101			-		-1.05	[-3.22; 1.11]	
Heterogeneity: $l^2 = 73\%$, τ^2	2 = 2.66	13, p =	0.03								
Probiotics											
Asemi 2011	37	-3.00	8.1300	33	1.96	9.4400 -	-	36	-4.96	[-9.11; -0.81]	22.3%
Jamilian 2016	30	-1.00	2.6000	30	1.70	4.3000	-		-2.70	[-4.50; -0.90]	118.8%
Jafarnejad 2016	37	-0.80	1.0872	35	0.98	1.1212		-	-1.77	[-2.28; -1.26]	1473.6%
Badehnoosh 2018	30	-2.20	2,7000	30	0.50	2.4000	1	-	-2.70	[-3.99: -1.41]	229.9%
Hajifaraji 2018	29	-0.70	4.3800	27	0.83	4.3600	12	-	-1.53	[-3.82; 0.76]	73.2%
Jamilian 2019	29	-1.00	1.6800	28	0.50	2.2000			-1.50	[-2.52: -0.48]	370.1%
Houttu 2020	94	-0.31	0.7950	92	-0.30	0.7720			-0.01	[-0.24: 0.22]	7574.7%
Hasain 2022	66	-1.25	2.9400	66	0.70	2.9200	100	-	-1.95	[-2.95; -0.95]	384.4%
Random effects model	352			341				~	-1.81	[-2.82; -0.79]	-
Heterogeneity: $I_{2}^{e} = 91\%$, τ_{1}^{e}	= 1.56	50, p <	0.01				-	-			
Heterogeneity: $I^2 = 88\%$, τ^2	= 1.51	25, p <	0.01				2.0	1.0			
							-5	0 5			

Figure.S5.3.6 Subgroup analysis of TAC on treatment type



Figure.S5.3.7 Subgroup analysis of Insulin on treatment type

		TI	reatment			Control							
Study	Total	Mean	SD	Total	Mean	SD		Mea	n Difference		MD	95%-CI	Weight
Probiotics									- F				
Laitinen 2009	76	1.28	11.9420	81	4.21	4.8900		-			-2.93	[-5.82;-0.04]	46.0%
Asemi 2013	37	1.20	7.3000	33	5.00	6.3200		-			-3.80	[-6.99; -0.61]	37.7%
Lindsay 2014	63	1.78	5.6900	75	0.21	7.0400					1.57	[-0.55; 3.69]	85.1%
Lindsay 2014	52	1.79	5.1700	58	-0.36	8.9900			-		2.15	[-0.56; 4.86]	52.4%
Lindsay 2015	48	-0.84	5.8500	52	-1.03	8.6500			-		0.19	[-2.69; 3.07]	46.5%
Karamali 2016	30	-0.80	3.1000	30	4.50	10.6000		-			-5.30	[-9.25; -1.35]	24.6%
Jamilian 2016	30	-1.50	4.8000	30	1.30	5.2000		-	-		-2.80	[-5.33; -0.27]	59.9%
Jafarneiad 2016	37	-2.50	5,1000	35	3.60	5,5000	1	-			-6.10	[-8.55: -3.65]	63.8%
Pellonper 2019	93	5.50	6.3200	90	6.40	10,9100			-		-0.90	[-3.49; 1.69]	57.1%
Babadi 2019	24	-1.50	2.3000	24	0.90	3.3150		1	-		-2.40	[-4.01: -0.79]	147.4%
Jamilian 2019	29	-1.40	7.2100	28	-0.20	2.7200		-	-		-1.20	[-4.01; 1.61]	48.6%
Amirani 2022	26	-1.40	1.7000	25	-0.20	1.1000			=		-1.20	[-1.98; -0.42]	626.7%
Random effects model	545			561					*		-1.76	[-2.97: -0.54]	
Heterogeneity: $I^2 = 72\%$, τ^2	2 = 2.97	32, p <	0.01										
Synbiotics													
Taghizadeh 2014	26	-0.26	8,7200	26	6.34	9.8300		-			-6.60	[-11.65: -1.55]	15.1%
Shahnaz 2016	35	-1.50	5 9000	35	4 80	11 5000					-6.30	[-10 58: -2 02]	21.0%
Nabhani 2018	45	-0.10	9,2600	45	0.90	7.3900		-			-1.00	[-4.46: 2.46]	32.1%
Random effects model	106			106			1		-		-4.35	[-8.20: -0.49]	-
Heterogeneity: $l^2 = 60\%$, τ^2	= 6.94	65. p =	0.08										
Heterogeneity: $l^2 = 71\%$, τ^2	= 3.27	98. p <	0.01				1	ų.,	1 1	1			
		2015 3					-10	-5	0 5	10			

Figure.S5.3.8 Subgroup analysis of QUICKI on treatment type

		Tre	atment			Control					
Study	Total	Mean	SD	Total	Mean	SD	Mean Di	fference	MD	95%-CI	Weight
Synbiotics								1			
Taghizadeh 2014	26	0.00	0.0300	26	-0.02	0.0400			- 0.02	[0.00; 0.04]	1040000.0%
Shahnaz 2016	35	0.01	0.0100	35	-0.01	0.0200			0.02	[0.01; 0.02]	7000000.0%
Nabhani 2018	45	0.00	0.0780	45	0.00	0.0350		-	0.00	[-0.02; 0.02]	615679.3%
Random effects model	106			106					0.02	[0.01; 0.02]	
Heterogeneity: $I^2 = 0\%$, τ^2	= < 0.00	001, p =	0.37								
Probiotics											
Laitinen 2009	76	-0.01	0.0269	81	-0.04	0.0272			- 0.03	[0.02; 0.04]	5360489.9%
Dolatkhah 2015	29	0.01	0.0030	27	0.00	0.0020		•	0.01	[0.00; 0.01]	218105849.6%
Karamali 2016	30	0.01	0.0100	30	-0.01	0.0200			0.02	[0.01; 0.03]	6000000.0%
Jamilian 2016	30	0.01	0.0500	30	-0.01	0.0200			- 0.02	[0.00; 0.04]	1034482.8%
Babadi 2019	24	0.01	0.0095	24	0.00	0.0100			0.01	[0.00; 0.02]	12614980.3%
Jamilian 2019	29	0.01	0.0436	28	0.00	0.0095	3 1		0.01	[-0.01; 0.03]	1454047.2%
Amirani 2022	26	0.01	0.0090	25	0.00	0.0060			0.01	[0.00; 0.01]	21952043.2%
Random effects model	244			245					0.01	[0.01; 0.02]	
Heterogeneity: $I^2 = 85\%$, τ^2	= < 0.0	0001.p	< 0.01					a	10		
Heterogeneity: $I^2 = 82\%$, τ^2	< 0.00	01. p <	0.01					1 1			
						-0	04 -0.02	0.02	0.04		

Figure.S5.3.9 Subgroup analysis of HOMA-B on treatment type

			reatment			Control				
Study	Total	Mean	SD	Total	Mean	SD	Mean Difference	MD	95%-CI	Weight
Synbiotics										
Taghizadeh 2014	26	5.30	49.3100	26	34.22	49.4300		-28.92	[-55.76; -2.08]	0.5%
Shahnaz 2016	35	-5.10	24.2000	35	18.90	45.6000		-24.00	[-41.10; -6.90]	1.3%
Random effects model	61			61				-25.42	[-39.84; -11.00]	
Heterogeneity: $l^2 = 0\%$, τ^2	= 0, p =	= 0.76								
Probiotics							1.00			
Karamali 2016	30	1.10	9.8000	30	18.00	42.5000		-16.90	[-32.51; -1.29]	1.6%
Jamilian 2016	30	-7.20	23.1000	30	5.30	22.6000		-12.50	[-24.06; -0.94]	2.9%
Random effects model	60			60				-14.06	[-23.35; -4.77]	
Heterogeneity: $l_{2}^{2} = 0\%$, τ_{2}^{2}	= 0, p =	= 0.66								
Heterogeneity: $I^2 = 0\%$, τ^2	= 0, p =	= 0.58								
							-40 -20 0 20 40	E		

Figure.S5.3.10 Subgroup analysis of HDLC on treatment type



Figure.S5.3.11 Subgroup analysis of TG on treatment type

		TI	reatment			Control				
Study	Total	Mean	SD	Total	Mean	SD	Mean Difference	MD	95%-CI	Weight
Probiotics							1			
Asemi 2012	37	-42.80	91.0000	33	-10.00	106.1500 -	•	-32.80	[-79.40; 13.80]	0.2%
Lindsay 2014	63	3.78	11.1700	75	1.98	11.7100		1.80	[-2.03; 5.63]	26.3%
Lindsay 2014	52	3.78	6.1300	58	2.52	9.3700		1.26	[-1.67; 4.19]	44.7%
Hoppu 2014	76	24.68	12.3400	81	20.90	12.9530	—	3.78	[-0.17; 7.74]	24.5%
Lindsay 2015	48	7.03	16.2100	52	7.75	14.3400	+	-0.72	[-6.74; 5.30]	10.6%
Karamali 2016	30	-1.60	59.4000	30	27.10	37.9000		-28.70	[-53.91; -3.49]	0.6%
Jamilian 2016	30	-14.70	46.5000	30	37.30	74.2000 -		-52.00 [-83.33; -20.67]	0.4%
Babadi 2019	24	-2.80	48.1900	24	17.10	68.0400		-19.90	-53.26; 13.46]	0.3%
Jamilian 2019	29	-7.50	60.5000	28	14.70	41.2300		-22.20	[-49.00; 4.60]	0.5%
Amirani 2022	26	-16.60	44.4000	25	14.90	26,4000		-31.50 [-51.46; -11.54]	1.0%
Random effects model	415			436			۲	-4.68	[-10.13; 0.78]	
Heterogeneity: $l^2 = 75\%$, τ^2	= 33.7	615, p <	0.01							
Synbiotics										
Taghizadeh 2014	26	-1.50	70.7000	26	36.40	64.9000		-37.90	[-74.79; -1.01]	0.3%
Shahnaz 2016	35	-14.80	56.5000	35	30.40	37.8000		-45.20 [-67.72; -22.68]	0.8%
Nabhani 2018	45	20.00	65.4600	45	25.70	67.4000		-5.70	-33.15: 21.75]	0.5%
Random effects model	106			106				-29.70	[-55.43; -3.98]	-
Heterogeneity: $I^2 = 59\%$, τ^2	= 304.	5873. p	= 0.09							
Heterogeneity: $l^2 = 78\%$, τ^2	= 54.6	143.0 <	0.01							
		1. 1. 1. 1. 1. 1. 1. 1. 1. 1. 1. 1. 1. 1					-50 0 50			

Figure.S5.3.12 Subgroup analysis of VLDLC on treatment type

		T	reatment			Control				
Study	Total	Mean	SD	Total	Mean	SD	Mean Difference	MD	95%-CI	Weight
Synbiotics										
Taghizadeh 2014	26	-0.30	14.1000	26	7.20	12.9000		-7.50	[-14.85; -0.15]	7.1%
Shahnaz 2016	35	-3.00	11.3000	35	6.10	7.6000		-9.10	[-13.61; -4.59]	18.9%
Random effects model	61			61				-8.66	[-12.51; -4.82]	
Heterogeneity: $l^2 = 0\%$, $\tau^2 = 0\%$	= 0, p =	0.72					THAT AND		12 10 10 10 10 10 10 10 10 10 10 10 10 10	
Probiotics										
Karamali 2016	30	-0.30	11.9000	30	5.40	7.6000		-5.70	[-10.75; -0.65]	15.0%
Jamilian 2016	30	-2.90	9.3000	30	7.40	14.8000		-10.30	[-16.55; -4.05]	9.8%
Babadi 2019	24	-0.60	9.6600	24	3.40	13.6100		-4.00	[-10.68; 2.68]	8.6%
Jamilian 2019	29	-1.50	12.1000	28	3.00	8.2200		-4.50	[-9.85; 0.85]	13.4%
Amirani 2022	26	-3.40	8.9000	25	3.00	5.3000		-6.40	[-10.40; -2.40]	24.0%
Random effects model	139			137			-	-6.14	[-8.47;-3.81]	(77)
Heterogeneity: $I^{-} = 0\%$, τ^{-} :	= 0, p =	0.64					PTT PT	-		
Heterogeneity: $I^{-} = 0\%$, τ^{-} :	= 0, p =	= 0.70					15 10 5 0 5 10	15		
							-15 -10 -5 0 5 10	15		

Figure.S5.3.13 Subgroup analysis of Total/HDLC on treatment type



Figure.S5.3.14 Subgroup analysis of GSH on treatment type

			Treatment			Control					
Study	Total	Mean	SD	Total	Mean	SD	M	lean Difference	MD	95%-CI	Weight
Synbiotics								1			
Taghizadeh 2014	26	19.70	393.7000	26	-281.30	330.7000			- 301.00	[103.37; 498.63]	0.0%
Karamali 2018	30	28.70	61.5000	30	-14.90	85.3000			43.60	[5.97; 81.23]	0.3%
Random effects model	56			56					153.27	[-96.21; 402.74]	
Heterogeneity: $l^2 = 84\%$, τ^2	= 2785	59.1863,	p = 0.01								
Probiotics											
Asemi 2012	37	67.90	152.0000	33	-1.90	204.2000			69.80	[-15.36; 154.96]	0.1%
Jamilian 2016	30	34.30	71.6000	30	-36.90	108.3000		-	71.20	[24.74; 117.66]	0.2%
Badehnoosh 2018	30	-4.60	67.0000	30	-39.70	130.6000			35.10	[-17.42; 87.62]	0.1%
Babadi 2019	24	-17.70	116,4100	24	-16.60	97.2200		-	-1.10	[-61.78; 59.58]	0.1%
Jamilian 2019	29	10.60	57.8700	28	-0.40	253.8700		-	11.00	[-85.36; 107.36]	0.0%
Random effects model	150			145				•	41.34	[12.62; 70.07]	
Heterogeneity: $l^2 = 8\%$, τ^2	= 84.94	48, p = (0.36				-				
Heterogeneity: $l^2 = 45\%$, τ^2	= 777.	0832, p	= 0.09				1	1 1 1 1			
							-400 -2	200 0 200 40	0		

Figure.S5.3.15 Subgroup analysis of MDA on treatment type

		Tre	atment			Control								
Study	Total	Mean	SD	Total	Mean	SD		Mear	n Differ	ence		MD	95%-CI	Weight
Probiotics									1					
Jamilian 2016	30	-0.60	1.2000	30	-0.10	1.3000		192				-0.50	[-1.13; 0.13]	958.5%
Badehnoosh 2018	30	-0.10	0.8000	30	0.50	1.5000		-	-			-0.60	[-1.21; 0.01]	1038.1%
Hajifaraji 2018	29	-0.95	2.0500	27	0.85	1.4600 -	-					-1.80	[-2.73; -0.87]	446.7%
Si 2019	113	-1.12	1.3000	113	0.00	1.4200						-1.12	[-1.47; -0.77]	3048.8%
Babadi 2019	24	-0.40	0.2000	24	0.20	0.7500		1	-			-0.60	[-0.91; -0.29]	3983.4%
Jamilian 2019	29	-0.10	0.5600	28	0.20	0.9500			-			-0.30	[-0.71; 0.11]	2323.1%
Random effects model	255			252				-				-0.74	[-1.09; -0.40]	
Heterogeneity: $l^2 = 67\%$, τ^2	= 0.11	49, p <	0.01											
Synbiotics														
Karamali 2018	30	-0.10	0.6000	30	0.30	0.7000		1				-0.40	[-0.73; -0.07]	3529.4%
Nabhani 2022	45	0.07	0.7100	45	-0.01	0.4600						0.08	[-0.17: 0.33]	6287.6%
Random effects model	75			75				20	-			-0.15	[-0.62; 0.32]	
Heterogeneity: $l^2 = 81\%$, τ^2	= 0.09	31. p =	0.02				101		1000		265			
Heterogeneity: $l^2 = 83\%$, τ^2	= 0.19	31.0 <	0.01					1	1					
							-2	-1	0	1	2			

Figure.S5.3.16 Subgroup analysis of NO on treatment type

		Tre	atment			Control					
Study	Total	Mean	SD	Total	Mean	SD	Mean [Difference	MD	95%-CI	Weight
Synbiotics								1			
Karamali 2018	30	0.20	3.0000	30	-0.80	3.8000			1.00	[-0.73; 2.73]	128.0%
Random effects model Heterogeneity: not applicat	30 ble			30				-	1.00	[-0.73; 2.73]	(77)
Probiotics											
Jamilian 2016	30	6.80	9.3000	30	6.80	9.3000		+	0.00	[-4.71; 4.71]	17.3%
Badehnoosh 2018	30	-0.50	3.1000	30	-1.50	22.8000			- 1.00	[-7.23; 9.23]	5.7%
Babadi 2019	24	1.20	4.3900	24	-0.60	3.1000			1.80	[-0.35: 3.95]	83.1%
Jamilian 2019	29	0.70	5.0700	28	-0.20	3.9200		-	0.90	[-1.45; 3.25]	69.7%
Random effects model	113			112				-	1.24	[-0.24; 2.72]	
Heterogeneity: $I^2 = 0\%$, τ^2 :	= 0, p =	0.89					-				
neterogeneity: / = 0%, t	= u, p =	0.30					-5	0 5			

5.4 Degree of obesity (non-obese vs. overweight/obese) Figure.S5.4.1 Subgroup analysis of FBS on degree of obesity



Figure.S5.4.2 Subgroup analysis of HOMA-IR on degree of obesity

		116	aument			CONTROL							
Study	Total	Mean	SD	Total	Mean	SD		Mean	Difference		MD	95%-CI	Weight
Non-obese									- Ú				
Laitinen 2009	76	0.19	3.5700	81	0.85	1.0600		-	-		-0.66	[-1.50; 0.18]	550.8%
Asemi 2013	37	-0.20	1.8200	33	0.70	1.1500	0				-0.90	[-1.61; -0.19]	771.6%
Lindsay 2014	63	0.32	1.4200	75	-0.01	1.6900					0.33	[-0.19; 0.85]	1426.8%
Taghizadeh 2014	26	-0.13	1.8600	26	1.13	2.2700	-		-		-1.26	[-2.39; -0.13]	301.9%
Lindsay 2015	48	-0.30	1.2800	52	-0.42	2.1600		-			0.12	[-0.57; 0.81]	807.4%
Dolatkhah 2015	29	-0.40	0.1300	27	0.01	0.1200		3	9		-0.41	[-0.48; -0.34]	89598.4%
Karamali 2016	30	-0.40	0.9000	30	1.10	2.5000			8		-1.50	[-2.45; -0.55]	424.9%
Shahnaz 2016	35	-0.40	1.3000	35	1.10	2.7000		-			-1.50	[-2.49; -0.51]	389.8%
Jamilian 2016	30	-0.30	0.9000	30	0.30	1.1000					-0.60	[-1.11; -0.09]	1485.1%
Jafarnejad 2016	37	-0.60	1.4000	35	0.50	1.2000		-	4		-1.10	[-1.70; -0.50]	1062.5%
Nabhani 2018	45	-0.40	2.0700	45	0.01	1.6500			<u> </u>		-0.41	[-1.18; 0.36]	642.2%
Jmanawat 2019	28	0.25	0.3700	29	0.89	0.4600		-			-0.64	[-0.86; -0.42]	8206.2%
Babadi 2019	24	-0.40	0.5600	24	0.30	0.9500		-	-		-0.70	[-1.14; -0.26]	1973.5%
Jamilian 2019	29	-0.60	1.7300	28	0.00	0.7200		-			-0.60	[-1.28; 0.08]	821.6%
Amirani 2022	26	-0.40	0.5000	25	-0.10	0.3000		-	-		-0.30	[-0.53; -0.07]	7566.9%
Random effects model	563			575				0			-0.55	[-0.72; -0.37]	-
Heterogeneity: $I^2 = 61\%$, τ^2	² = 0.04	86, p <	0.01										
Overweight/obese									-				
Lindsay 2014	52	0.31	1.2000	58	-0.19	2.2600					0.50	[-0.17; 1.17]	863.9%
Pellonper 2019	93	0.65	0.7800	90	0.74	1.2600					-0.09	[-0.39; 0.21]	4135.3%
Random effects model	145			148					-		0.13	[-0.43; 0.69]	_
Heterogeneity: $l^2 = 60\%$, τ^2	2 = 0.10	41. p =	0.11						1.1			-	
Heterogeneity: $I^2 = 67\%$, τ^2	= 0.06	04. 0 <	0.01					1	1	1			
							-2	-1	0 1	2			

Figure.S5.4.3 Subgroup analysis of insulin on degree of obesity

		T	eatment			Control								
Study	Total	Mean	SD	Total	Mean	SD		Mean	Difference		MD	959	6-CI	Weight
Non-obese														
Laitinen 2009	76	1.28	11.9420	81	4.21	4.8900		-	_		-2.93	[-5.82;-0	.04]	46.0%
Asemi 2013	37	1.20	7.3000	33	5.00	6.3200					-3.80	[-6.99;-0	.61]	37.7%
Lindsay 2014	63	1.78	5.6900	75	0.21	7.0400					1.57	[-0.55; 3	.69]	85.1%
Taghizadeh 2014	26	-0.26	8.7200	26	6.34	9.8300	10 1	A. 1			-6.60	[-11.65; -1	.55]	15.1%
Lindsay 2015	48	-0.84	5.8500	52	-1.03	8.6500		3	-		0.19	[-2.69; 3	.07]	46.5%
Karamali 2016	30	-0.80	3.1000	30	4.50	10.6000	10	-	20		-5.30	[-9.25; -1	.351	24.6%
Shahnaz 2016	35	-1.50	5.9000	35	4.80	11.5000	-		à l		-6.30	[-10.58; -2	.02]	21.0%
Jamilian 2016	30	-1.50	4.8000	30	1.30	5.2000		-			-2.80	1-5.33:-0	.271	59.9%
Jafarnejad 2016	37	-2.50	5.1000	35	3.60	5.5000	-	-			-6.10	[-8.55:-3	.651	63.8%
Nabhani 2018	45	-0.10	9,2600	45	0.90	7.3900		_	-		-1.00	1-4.46: 2	461	32.1%
Babadi 2019	24	-1.50	2.3000	24	0.90	3.3150			-		-2.40	[-4.01:-0	791	147.4%
Jamilian 2019	29	-1.40	7.2100	28	-0.20	2.7200		-	-		-1.20	[-4.01: 1	611	48.6%
Amirani 2022	26	-1.40	1,7000	25	-0.20	1,1000		-	-		-1.20	[-1.98:-0	.421	626.7%
Random effects model	506	1000		519	100000	0.000.034		-	>		-2.52	[-3.76: -1	281	
Heterogeneity: $I^2 = 70\%$, τ^2	2 = 3.08	57, p <	0.01									1	123	
Overweight/obese														
Lindsay 2014	52	1.79	5.1700	58	-0.36	8.9900					2.15	[-0.56; 4	.861	52.4%
Pellonper 2019	93	5.50	6.3200	90	6.40	10.9100		(2 			-0.90	[-3.49; 1	.69]	57.1%
Random effects model	145			148				-			0.60	[-2.39: 3	.591	
Heterogeneity: $l^2 = 61\%$, τ^2 Heterogeneity: $l^2 = 71\%$, τ^2	² = 2.82 ² = 3.27	15, p = 98, p <	0.11 0.01				-	1	1 1	1		, .		
							-10	-5	0 5	10				

Figure.S5.4.4 Subgroup analysis of LDLC on degree of obesity



Figure.S5.4.5 Subgroup analysis of TC on degree of obesity

		TI	reatment			Control								
Study	Total	Mean	SD	Total	Mean	SD	I	Mean Di	ifference		MD	9	5%-CI	Weight
Non-obese									1					
Asemi 2012	37	-53.70	65.0200	33	-21.60	55.5400 -					-32.10	[-60.35;	-3.85]	0.5%
Lindsay 2014	63	1.44	19.2800	75	3.06	19.8200					-1.62	[-8.16;	4.92]	9.0%
Taghizadeh 2014	26	-5.40	47.8000	26	-0.30	47.8000		•			-5.10	[-31.08; 1	20.88]	0.6%
Hoppu 2014	76	33.15	16.9700	81	20.01	15.6000			-		13.14	[8.03;	18.25]	14.7%
Lindsay 2015	48	4.86	18.7400	52	9.01	20.0000		200	+		-4.15	[-11.74;	3.44]	6.7%
Karamali 2016	30	9.60	27.8000	30	3.50	20.4000		-			6.10	[-6.24;	18.44]	2.5%
Shahnaz 2016	35	0.40	28.0000	35	5.20	18,7000			-		-4.80	[-15.95;	6.35]	3.1%
Jamilian 2016	30	-8.10	25,4000	30	7.60	43,4000	1		1		-15.70	[-33.69;	2.291	1.2%
Nabhani 2018	45	12.89	38,1500	45	16.20	37,3300		-	-		-3.31	[-18.90; ·	12.281	1.6%
Babadi 2019	24	-2.50	40,4400	24	4.00	41,6400			-		-6.50	1-29.72:	16.721	0.7%
Jamilian 2019	29	0.50	36.9100	28	3.20	37.5100					-2.70	[-22.03;	16.63]	1.0%
Amirani 2022	26	-24.20	29.2000	25	4.50	18,7000		-			-28.70	1-42.11: -	15.291	2.1%
Random effects model	469			484				<	≱		-5.29	[-12.92;	2.35]	
Heterogeneity: $l^2 = 80\%$, τ^2	= 122.	7635, p	< 0.01											
Overweight/obese														
Lindsay 2014	52	2.34	13.5100	58	1.98	9,1900					0.36	[-4.01:	4.731	20.1%
Random effects model	52			58					\$		0.36	[-4.01:	4.731	
Heterogeneity: not applicab	ole													
Heterogeneity: $l^2 = 78\%$ t ²	= 81.8	564 n <	0.01							1	1			
2 200 0000		P	250434403			-61	0 -40	-20	0 20	40 6	0			

Figure.S5.4.6 Subgroup analysis of HDLC on degree of obesity

		T	reatment			Control								
Study	Total	Mean	SD	Total	Mean	SD		Mean Di	ferenc	е	MD	95	5%-CI	Weight
Non-obese														
Asemi 2012	37	-9.80	14.1500	33	-8.40	21.2500	1	•			-1.40	[-9.96;	7.16]	1.4%
Lindsay 2014	63	-2.52	8.4700	75	-2.52	9.0100			<u> </u>		0.00	[-2.92;	2.92]	11.8%
Taghizadeh 2014	26	0.30	17.5000	26	-5.10	10.7000		1			- 5.40	[-2.48; 1	3.28]	1.6%
Hoppu 2014	76	0.72	6.4900	81	1.26	6.4500		1	200		-0.54	[-2.56;	1.49]	24.5%
Lindsay 2015	48	-0.90	6.6700	52	-0.18	6.1300			-		-0.72	[-3.24;	1.80]	15.9%
Karamali 2016	30	-0.30	7.2000	30	-2.30	7.6000		-			2.00	[-1.75;	5.75]	7.2%
Shahnaz 2016	35	-0.20	6.1000	35	-2.10	7.1000		<u>0</u> =	-		1.90	[-1.20;	5.00]	10.5%
Jamilian 2016	30	-1.20	6.7000	30	-0.20	10.7000			-		-1.00	[-5.52;	3.52]	4.9%
Nabhani 2018	45	5.20	10.9000	45	1.30	11.3300		-		100	3.90	[-0.69;	8.49]	4.8%
Babadi 2019	24	1.90	10.4400	24	-2.50	5.8600		-			4.40	[-0.39;	9.19]	4.4%
Jamilian 2019	29	0.30	11.4900	28	-1.30	13.9100		-			1.60	[-5.04;	8.24]	2.3%
Amirani 2022	26	-0.10	7.1000	25	-0.40	3.5000		- 6 <u>9 - 6</u>			0.30	[-2.75;	3.35]	10.8%
Fixed effect model	469			484					•		0.56	[-0.44;	1.57]	100.0%
Heterogeneity: $I^2 = 0$ %	$6, \tau^2 = 0$	0, <i>p</i> = 0.	51											
Overweight/obese														
Lindsay 2014	52	-1.98	4.1400	58	-2.52	3.4200		-	-2		0.54	[-0.89;	1.97]	100.0%
Fixed effect model	52			58				-			0.54	[-0.89;	1.97]	100.0%
Heterogeneity: not app	olicable											A BASSING	201212	
Heterogeneity: $l^2 = 0$ %	$t_{0}^{2} = 0$	p = 0	59					1						
							-10	-5 () 5	10				

Figure.S5.4.7 Subgroup analysis of TG on degree of obesity

		T	reatment			Control					
Study	Total	Mean	SD	Total	Mean	SD	Mean D	Difference	MD	95%-CI	Weight
Non-obese								1			
Asemi 2012	37	-42.80	91.0000	33	-10.00	106.1500		<u></u>	-32.80	[-79.40; 13.80]	0.2%
Lindsay 2014	63	3.78	11.1700	75	1.98	11.7100		#	1.80	[-2.03; 5.63]	26.3%
Taghizadeh 2014	26	-1.50	70.7000	26	36.40	64.9000			-37.90	[-74.79; -1.01]	0.3%
Hoppu 2014	76	24.68	12.3400	81	20.90	12.9530		-	3.78	[-0.17; 7.74]	24.5%
Lindsay 2015	48	7.03	16.2100	52	7.75	14.3400		+	-0.72	[-6.74; 5.30]	10.6%
Karamali 2016	30	-1.60	59.4000	30	27.10	37.9000		-	-28.70	[-53.91; -3.49]	0.6%
Shahnaz 2016	35	-14.80	56.5000	35	30.40	37.8000			-45.20	[-67.72; -22.68]	0.8%
Jamilian 2016	30	-14.70	46.5000	30	37.30	74.2000			-52.00	[-83.33; -20.67]	0.4%
Nabhani 2018	45	20.00	65.4600	45	25.70	67.4000	1	•	-5.70	[-33.15; 21.75]	0.5%
Babadi 2019	24	-2.80	48.1900	24	17.10	68.0400		+	-19.90	[-53.26; 13.46]	0.3%
Jamilian 2019	29	-7.50	60.5000	28	14.70	41.2300		1999	-22.20	[-49.00; 4.60]	0.5%
Amirani 2022	26	-16.60	44.4000	25	14.90	26.4000		ř.	-31.50	[-51.46; -11.54]	1.0%
Random effects model	469			484			0	5	-14.55	[-22.71; -6.39]	an suffe
Heterogeneity: $l^2 = 80\%$, τ^2	= 98.8	597, p <	0.01								
Overweight/obese											
Lindsay 2014	52	3.78	6,1300	58	2.52	9.3700			1.26	[-1.67: 4.19]	44.7%
Random effects model	52			58				\$	1.26	[-1.67; 4.19]	-
Heterogeneity: $l^2 = 78\% \tau^2$	= 54 6	143 n <	0.01								
notorogeneity. r = rove, r	54.0	o, p .	0.01				-50	0 50			

Figure.S5.4.8 Subgroup analysis of hs-CRP on degree of obesity

		110	aunent			Control					
Study	Total	Mean	SD	Total	Mean	SD	Mea	n Difference	MD	95%-CI	Weight
Non-obese								ſ			
Asemi 2011	37	-3.00	8.1300	33	1.96	9.4400 -			-4.96	[-9.11; -0.81]	22.3%
Taghizadeh 2014	26	-0.48	1.5816	26	-1.07	4.1481			0.59	[-1.12; 2.30]	131.9%
Jamilian 2016	30	-1.00	2.6000	30	1.70	4.3000		-	-2.70	[-4.50: -0.90]	118.8%
Jafarneiad 2016	37	-0.80	1.0872	35	0.98	1.1212		+	-1.77	[-2.28: -1.26]	1473.6%
Karamali 2018	30	-1.90	4.2000	30	1.10	3.5000		_	-3.00	[-4.96; -1.04]	100.4%
Badehnoosh 2018	30	-2.20	2,7000	30	0.50	2,4000	-	-	-2.70	[-3.99: -1.41]	229.9%
Haiifaraii 2018	29	-0.70	4.3800	27	0.83	4.3600	-	-	-1.53	[-3.82; 0.76]	73.2%
Jamilian 2019	29	-1.00	1.6800	28	0.50	2 2000			-1.50	[-2 52 -0 48]	370.1%
Nabhani 2022	45	-0.12	6.5800	45	0.73	3.9000		-	-0.85	[-3.08; 1.38]	76.9%
Hasain 2022	66	-1.25	2.9400	66	0.70	2.9200		-	-1.95	[-2.95: -0.95]	384.4%
Random effects model	359			350				4	-1.82	[-2.39; -1.25]	-
Heterogeneity: $I^2 = 41\%$, τ^2	= 0.29	27, p =	0.09								
Overweight/obese								124			
Houtty 2020	94	-0.31	0.7950	92	-0.30	0.7720		+	-0.01	[-0.24: 0.22]	7574.7%
Random effects model	94			92				4	-0.01	[-0.24: 0.22]	_
Heterogeneity: not applicab	e										
Heterogeneity: $l^2 = 88\% \tau^2$	= 1.51	25 n <	0.01				1				
							-5	0 5			

Figure.S6. Results of sensitivity analysis



HOMA-IR



LDLC



TC



hs-CRP



TAC



Insulin



QUICKI



HOMA-B



HbA1c



HDLC













TG

GSH



MDA



NO



Figure.S7. Publication bias: funnel plot

Outcome: FBS



Notes: A = "Placebo"; B = "Lactobacillus"; C = "LABB"; D = "LRB"; E = "LLB"; F = "MP1"; G = "MP2"

P = 0.023 (Egger)

Outcome: HOMA-IR



Notes: A = "Placebo"; B = "Lactobacillus"; C = "LABB"; D = "LRB"; E = "LLB"; F = "MP1"; G = "MP2"

P = 0.955 (Egger)





Notes: A = "Placebo"; B = "Lactobacillus"; C = "LABB"; D = "LRB"; E = "LLB"; F = "MP1"

P = 0.002(Egger)

Outcome: TC



Notes: A = "Placebo"; B = "Lactobacillus"; C = "LABB"; D = "LRB"; E = "LLB"; F = "MP1"

P = 0.014 (Egger)

Outcome: hs-CRP



Notes: A = "Placebo"; B = "Lactobacillus"; C = "LABB"; D = "LRB"; E = "LLB"; F = "MP1"; G = "MP2"

P = 0.089 (Egger)

Outcome: Insulin



Notes: A = "Placebo"; B = "Lactobacillus"; C = "LABB"; D = "LRB"; E = "LLB"; F = "MP1"; G = "MP2"

P = 0.486 (Egger)

Outcome: QUICKI



Notes: A = "LLB"; B = "LRB"; C = "Lactobacillus"; D = "MP1"; E = "Placebo"

P = 0.099 (Egger)

Outcome: HDLC



Notes: A = "LABB"; B = "LLB"; C = "LRB"; D = "Lactobacillus"; E = "MP1"; F = "Placebo"

P = 0.144 (Egger)





Notes: A = "LABB"; B = "LLB"; C = "LRB"; D = "Lactobacillus"; E = "MP1"; F = "Placebo"

P = 0.072 (Egger)

There were less than 10 studies on other indicators. Funnel plots were not done.

Outcome: TAC	P = 0.252 (Egger)
Outcome: MDA	P = 0.143 (Egger)
Outcome: GSH	P = 0.044 (Egger)
Outcome: VLDLC	P = 0.362 (Egger)
Outcome: Total/HDLC	P = 0.572 (Egger)
Outcome: NO	P = 0.054 (Egger)
Outcome: HOMA-B	P = 0.642 (Egger)
Outcome: HbA1c	<i>P</i> = 0.230 (Egger)

Figure.S8. Certainty of evidence for direct and indirect estimates

FBS

	Comparison	Number of	Risk of bias	Publication bias	Indirectness	Imprecision	Inconsistency	Confidence rating
	Lactobacillus: Placebo	4	no	no	no	serious	no	moderate
Direct comparisons	LABB: Placebo	4	no	no	no	serious	no	moderate
	LRB: Placebo	1	no	no	no	serious	no	moderate
	LLB: Placebo	4	no	no	no	no	serious	moderate
	MP1: Placebo	5	no	no	no	no	serious	moderate
	MP2: Placebo	2	no	no	no	serious	very serious	very low
	LABB: Lactobacillus	0						moderate
	LRB: Lactobacillus	0						moderate
Indirect	LLB: Lactobacillus	0						moderate
comparisons	MP1: Lactobacillus	0						moderate
	MP2: Lactobacillus	0						very low
	LRB: LABB	0						moderate
	LLB: LABB	0						moderate
	MP1: LABB	0						moderate
	MP2: LABB	0						very low
	LLB: LRB	0						moderate
	MP1: LRB	0						moderate
	MP2: LRB	0						very low
	MP1: LLB	0						moderate
	MP2: LLB	0						very low
	MP1:MP2	0						very low

FBS, fasting blood sugar. LABB, Lactobacillus acidophilus and Bifidobacterium; LRB, Lacticaseibacillus rhamnosus and Bifidobacterium; LLB, Lactobacillus acidophilus, Lacticaseibacillus casei, and Bifidobacterium bifidum; MP1, four probiotics; MP2, six or more probiotics

HOMA-IR

	Comparison	Number of	Risk of bias	Publication bias	Indirectness	Imprecision	Inconsistency	Confidence rating
	Lactobacillus: Placebo	4	no	no	no	serious	serious	low
	LABB: Placebo	2	no	no	no	no	no	high
Direct	LRB: Placebo	2	no	no	no	serious	no	moderate
comparisons	LLB: Placebo	3	no	no	no	no	serious	moderate
	MP1: Placebo	5	no	no	no	no	no	high
	MP2: Placebo	1	no	no	no	no	no	high
	LABB: Lactobacillus	0						low
	LRB: Lactobacillus	0						low
Indirect	LLB: Lactobacillus	0						low
comparisons	MP1: Lactobacillus	0						low
	MP2: Lactobacillus	0						low
	LRB: LABB	0						moderate
	LLB: LABB	0						moderate
	MP1: LABB	0						high
	MP2: LABB	0						high
	LLB: LRB	0						moderate
	MP1: LRB	0						moderate
	MP2: LRB	0						moderate
	MP1: LLB	0						moderate
	MP2: LLB	0						moderate
	MP1:MP2	0						high

HOMA-IR, the homeostasis model assessment of insulin resistance. LABB, *Lactobacillus acidophilus* and *Bifidobacterium*; LRB, *Lactobacillus acidophilus*, *Lacticaseibacillus casei*, and *Bifidobacterium*; MP1, four probiotics; MP2, six or more probiotics.

LDLC

	Comparison	Number of	Risk of bias	Publication bias	Indirectness	Imprecision	Inconsistency	Confidence rating
	Lactobacillus: Placebo	4	no	no	no	serious	no	moderate
Discret	LABB: Placebo	1	no	no	no	no	no	high
comparisons	LRB: Placebo	1	no	no	no	serious	no	moderate
	LLB: Placebo	3	no	no	no	serious	no	moderate
	MP1: Placebo	4	no	no	no	serious	no	moderate
	LABB: Lactobacillus	0						moderate
	LRB: Lactobacillus	0						moderate
Indirect	LLB: Lactobacillus	0						moderate
comparisons	MP1: Lactobacillus	0						moderate
	LRB: LABB	0						moderate
	LLB: LABB	0						moderate
	MP1: LABB	0						moderate
	LLB: LRB	0						moderate
	MP1: LRB	0						moderate
	MP1: LLB	0						moderate

LDLC, low-density lipoprotein cholesterol. LABB, Lactobacillus acidophilus and Bifidobacterium; LRB, Lacticaseibacillus rhamnosus and Bifidobacterium; LLB, Lactobacillus acidophilus, Lacticaseibacillus casei, and Bifidobacterium bifidum; MP1, four probiotics

TC

	Comparison	Number of	Risk of bias	Publication bias	Indirectness	Imprecision	Inconsistency	Confidence rating
	Lactobacillus: Placebo	4	no	no	no	serious	no	moderate
Direct	LABB: Placebo	1	no	no	no	serious	no	moderate
Direct	LRB: Placebo	1	no	no	no	serious	no	moderate
comparisons	LLB: Placebo	3	no	no	no	serious	serious	low
	MP1: Placebo	4	no	no	no	no	serious	moderate
	LABB: Lactobacillus	0						moderate
	LRB: Lactobacillus	0						moderate
Indirect	LLB: Lactobacillus	0						low
comparisons	MP1: Lactobacillus	0						moderate
	LRB: LABB	0						moderate
	LLB: LABB	0						low
	MP1: LABB	0						moderate
	LLB: LRB	0						low
	MP1: LRB	0						moderate
	MP1: LLB	0						low

TC, total cholesterol.LABB, Lactobacillus acidophilus and Bifidobacterium; LRB, Lacticaseibacillus rhamnosus and Bifidobacterium; LLB, Lactobacillus acidophilus, Lacticaseibacillus casei, and Bifidobacterium bifidum; MP1, four probiotics

hs-CRP

	Comparison	Number of	Risk of bias	Publication bias	Indirectness	Imprecision	Inconsistency	Confidence rating
	Lactobacillus: Placebo	1	no	no	no	serious	no	moderate
	LABB: Placebo	1	no	no	no	no	no	high
Direct	LRB: Placebo	1	no	no	no	serious	no	moderate
comparisons	LLB: Placebo	3	no	no	no	no	no	high
	MP1: Placebo	3	no	no	no	no	no	high
	MP2: Placebo	2	no	no	no	no	no	high
	LABB: Lactobacillus	0						moderate
	LRB: Lactobacillus	0						moderate
Indirect	LLB: Lactobacillus	0						moderate
comparisons	MP1: Lactobacillus	0						moderate
	MP2: Lactobacillus	0						moderate
	LRB: LABB	0						moderate
	LLB: LABB	0						high
	MP1: LABB	0						high
	MP2: LABB	0						high
	LLB: LRB	0						moderate
	MP1: LRB	0						moderate
	MP2: LRB	0						moderate
	MP1: LLB	0						high
	MP2: LLB	0						high
	MP1:MP2	0						high

hs-CRP, high-sensitivity C-reactive protein. LABB, Lactobacillus acidophilus and Bifidobacterium; LRB, Lacticaseibacillus rhamnosus and Bifidobacterium; LLB, Lactobacillus acidophilus, Lacticaseibacillus casei, and Bifidobacterium bifidum; MP1, four probiotics; MP2, six or more probiotics

TAC

	Comparison	Number of	Risk of bias	Publication bias	Indirectness	Imprecision	Inconsistency	Confidence rating
	Lactobacillus: Placebo	1	no	no	no	serious	no	moderate
Direct	LABB: Placebo	1	no	no	no	serious	no	moderate
comparisons	LLB: Placebo	3	no	no	no	no	serious	moderate
	MP1: Placebo	4	no	no	no	serious	serious	low
	LABB: Lactobacillus	0						moderate
	LLB: Lactobacillus	0						moderate
Indirect	MP1: Lactobacillus	0						low
comparisons	LLB: LABB	0						moderate
	MP1: LABB	0						low
	MP1: LLB	0						low

TAC, total antioxidant capacity. LABB, Lactobacillus acidophilus and Bifidobacterium; LLB, Lactobacillus acidophilus, Lacticaseibacillus casei, and Bifidobacterium bifidum; MP1, four probiotics

	Outcomes	Description
Glycemic indices	Fasting blood sugar	The abbreviation was "FBS ".
		The unit was standardized as "mg/dl".
	The homeostasis model assessment of	The abbreviation was "HOMA-IR ".
	insulin resistance	
	Insulin	The unit was standardized as "µIU/mL".
	Quantitative insulin-sensitivity check index	The abbreviation was "QUICKI ".
	Homeostasis model assessment of beta cell	The abbreviation was "HOMA-B ".
	Glycated hemoglobin A1c	The abbreviation was "HbA1c ".
		The unit was standardized as "µmol/L".
Lipid parameters	Low-density lipoprotein cholesterol	The abbreviation was "LDLC ".
		The unit was standardized as "mg/dl".
	Total cholesterol	The abbreviation was "TC ".
		The unit was standardized as "mg/dl".
	High-density lipoprotein cholesterol	The abbreviation was "HDLC ".
		The unit was standardized as "mg/dl".
	Triglyceride	The abbreviation was "TG ".
		The unit was standardized as "mg/dl".
	Very low-density lipoprotein cholesterol	The abbreviation was "VLDLC ".
		The unit was standardized as "mg/dl".
	Total cholesterol/high-density	The abbreviation was "Total/HDLC".
	lipoprotein cholesterol	
Inflammation and oxidative stress	Glutathione	The abbreviation was "GSH ".
indices		The unit was standardized as "µmol/L".
	High-sensitivity C-reactive protein	The abbreviation was "hs-CRP ".
		The unit was standardized as "µg/mL".
	I otal antioxidant capacity	I he abbreviation was "I AC ".
	Malay dialalah yala	I ne unit was standardized as "mmol/L".
	Maiondiaidenyde	I ne appreviation was "MDA".
	Niteia avida	The unit was standardized as "µmol/L".
	INITIC OXIDE	The unit was standardized as "was all."
		The unit was standardized as "µmol/L".

Table S1. Description of outcomes

Treatment	Detailed definition	Abbreviation	Number of studies
Lactobacillus	A genus of Lactobacillus was used alone.	Lactobacillus	6
Lactobacillus acidophilus and Bifidobacterium	Lactobacillus acidophilus and Bifidobacterium_were used together.	LABB	7
Lacticaseibacillus rhamnosus and Bifidobacterium Lactobacillus acidophilus	Lacticaseibacillus rhamnosus and Bifidobacterium were used together.	LRB	4
Lacticaseibacillus casei, and Bifidobacterium bifidum	Lactobacillus acidophilus, Lacticaseibacillus casei, and Bifidobacterium bifidum were used.	LLB	5
Four probiotics	Four kinds of probiotics were used.	MP1	8
Six or more probiotics	Six or more kinds of probiotics were used.	MP2	2

Table S2. Definition of treatments

study	Random sequence generation (selection bias)	Allocation concealment (selection bias)	Blinding of participants and personnel (performan ce bias)	Blinding of outcome assessment (detection bias)	Incomplete outcome data (attrition bias)	Selective reporting (reporting bias)	Other bias	Over all
Lindsay								low
et al 2015	IOW	IOW	IOW	IOW	IOW	IOW	low	
Lindsay	unclear	low	low	low	low	low	low	low
Lindsav	uncical	IOW	1010	1010	10 W	1011	10 00	
et al 2014	low	unclear	low	unclear	low	low	low	low
Taghizadeh								laur
et al 2014	low	low	low	low	low	low	low	IOW
Taghizadeh								low
et al 2014	low	low	low	low	low	low	low	1011
Si et al.	low	low	low	low	low	low	low	low
2019 Ebrohimi	10 W	IOW	10 W	IOW	IOW	IOW	10 W	
et al 2019	low	low	low	low	low	low	low	low
Asgharian		1011			1011	.011	.011	
et al 2020	low	low	low	low	low	low	low	low
Asemi								high
et al 2012	low	unclear	high	unclear	low	low	low	nign
Asemi			1.1.1		1.	1.	1.	hiah
et al 2013	IOW	unclear	nıgn	unclear	IOW	IOW	IOW	, and the second s
Asemi at al 2011	low	unclear	high	unclear	low	low	low	high
Asemi	10 W	unciear	riigit	unciear	10 W	10 W	10 00	
et al 2012	low	unclear	high	unclear	low	low	low	high
Jmanawat			J					law
et al 2019	low	unclear	low	low	low	low	low	IOW
Pellonper				_				low
et al 2019	low	unclear	low	low	low	low	low	10 10
Houttu	laur	unalaar	laur	law	law	law	laur	low
et al 2020	IOW	unclear	IOW	IOW	IOW	IOW	IOW	
Lailinen	low	low	low	low	low	low	low	low
Hoppu	1011	101	1011	1011	1011	1011	1011	
et al 2014	low	low	low	low	low	low	low	low
Karamali								low
et al 2018	low	low	low	unclear	low	low	low	IOW

Table S3. The individual assessment of risk of bias

study	Random sequence generation (selection bias)	Allocation concealment (selection bias)	Blinding of participants and personnel (performan ce bias)	Blinding of outcome assessment (detection bias)	Incomplete outcome data (attrition bias)	Selective reporting (reporting bias)	Other bias	Over all
Karamali								low
et al 2016	IOW	IOW	IOW	IOW	IOW	IOW	low	
Shahnaz	low	low	low	uncloor	low	low	low	low
et al 2016 Redebrooch	IOW	IOW	IOW	unciear	IOW	IOW	IOW	
ot al 2018	low	low	low	unclear	low	low	low	low
lamilian	10 00	10 W	10 00	unciear	10 W	10 10	10 10	
et al 2016	low	low	low	unclear	low	low	low	low
Haiifaraii								
et al 2018	low	low	low	low	low	low	low	IOW
Dolatkhah								low
et al 2015	low	low	low	low	low	low	low	IOW
Hajifaraji								low
et al 2017	low	low	low	low	low	low	low	10 10
Nabhani	1.		1.	1.		1.	1.	low
et al 2022	IOW	IOW	IOW	IOW	IOW	IOW	IOW	
Nabhani	low	low	low	low	low	low	low	low
et al 2018 Robadi	IOW	IOW	IOW	IOW	IOW	IOW	IOW	
et al 2019	low	low	low	low	low	low	low	low
Amirani		1011	.011	.011			1011	
et al 2022	low	low	low	low	low	low	low	low
Jamilian								т.
et al 2019	low	low	low	unclear	low	low	low	IOW
Hasain								low
et al 2022	low	low	low	low	low	low	low	10 W
Jafarnejad								low
et al 2016	low	low	low	unclear	low	low	low	10 W

Table S3. The individual assessment of risk of bias (Continued)

Table S4. The SUCRAs of secondary outcomes

Treatment —	Glycemic indices					
	Insulin (%)	QUICKI (%)	НОМА-В (%)	HbA1c (%)		
Lactobacillus	8.2	69.4	85.1	NR		
LABB	69.7	NR	NR	38.3		
LRB	45.7	93.3	NR	35.7		
LLB	77.4	59.1	62.5	NR		
MP1	41.7	27.6	NR	NR		
MP2	92.6	NR	NR	93.2		
Placebo	14.7	0.6	3.4	32.9		

Glycemic indices

The strategies ranking first are marked in bold. NR represents this indicator was not reported in this method among the included studies. SUCRA, surface under the cumulative ranking probabilities analysis. QUICKI, quantitative insulin-sensitivity check index; HOMA-B, homeostasis model assessment of beta cell; HbA1c, glycated hemoglobin A1c. LABB, *Lactobacillus acidophilus* and *Bifidobacterium*; LRB, *Lacticaseibacillus rhamnosus* and *Bifidobacterium*; LLB, *Lactobacillus acidophilus*, *Lacticaseibacillus casei*, and *Bifidobacterium bifidum*; MP1, four probiotics; MP2, six or more probiotics.

Lipid parameters

Treatment -	Lipid parameters					
	HDLC (%)	TG (%)	VLDLC (%)	Total/HDLC (%)		
Lactobacillus	47.6	25.1	67.8	47.8		
LABB	33.3	77.8	NR	65.0		
LRB	29.4	8.5	NR	NR		
LLB	69.6	91.5	81.0	NR		
MP1	83.9	66.4	48.9	76.6		
MP2	NR	NR	NR	NR		
Placebo	36.2	30.7	2.3	10.6		

The strategies ranking first are marked in bold. NR represents this indicator was not reported in this method among the included studies. SUCRA, surface under the cumulative ranking probabilities analysis. HDLC, high-density lipoprotein cholesterol; TG, triglyceride; VLDLC, very lowdensity lipoprotein cholesterol; Total/HDLC, total cholesterol/high-density lipoprotein cholesterol. LABB, *Lactobacillus acidophilus* and *Bifidobacterium*; LRB, *Lacticaseibacillus rhamnosus* and *Bifidobacterium*; LLB, *Lactobacillus acidophilus*, *Lacticaseibacillus casei*, and *Bifidobacterium* bifidum; MP1, four probiotics; MP2, six or more probiotics.

Oxidative stress indices

Trootmont —		Oxidative stress	indices	
Ireatment	GSH (%)	MDA (%)	NO (%)	
Lactobacillus	99.0	86.8	NR	
LABB	60.7	NR	NR	
LRB	NR	NR	NR	
LLB	55.3	52.3	18.2	
MP1	20.8	55.4	54.8	
MP2	NR	NR	NR	
Placebo	15.2	6.6	77.0	

The strategies ranking first are marked in bold. NR represents this indicator was not reported in this method among the included studies. SUCRA, the surface under the cumulative ranking probabilities analysis. GSH, glutathione; MDA, malondialdehyde; NO, nitric oxide. LABB,

Lactobacillus acidophilus and Bifidobacterium; LRB, Lacticaseibacillus rhamnosus and Bifidobacterium; LLB, Lactobacillus acidophilus, Lacticaseibacillus

casei, and Bifidobacterium bifidum; MP1, four probiotics; MP2, six or more probiotics.

lus di s s s		Treatment						
indices —	Food (%)	Fortified substances (%)	Placebo (%)					
FBS	74.7	71.6	3.6					
HOMA-IR	96.2	53.7	0.1					
Insulin	95.9	53.5	0.6					
QUICKI	86.2	62.3	1.5					
HOMA-B	88.4	60.7	0.9					
HbA1c	34.0	90.0	26.0					
LDLC	95.4	33.0	21.6					
TC	90.3	48.3	11.4					
HDLC	74.0	59.5	16.5					
TG	90.4	57.4	2.2					
VLDLC	78.1	70.4	1.5					
Total/HDLC	86.1	62.7	1.2					
hs-CRP	45.6	90.2	15.2					
TAC	65.5	67.6	17.9					
GSH	96.5	53.2	0.2					
MDA	95.7	53.9	0.4					

Table.S5. The SUCRAs for comparison of means of intervention

The strategies ranking first are marked in bold. Food stands for supplements of probiotics in the form of food. Fortified substances mean that probiotics are supplemented by fortified substances.

SUCRA, surface under the cumulative ranking probabilities analysis. FBS, fasting blood sugar; HOMA-IR, the homeostasis model assessment of insulin resistance; QUICKI, quantitative insulin-sensitivity check index; HOMA-B, homeostasis model assessment of beta cell; HbA1c, glycated hemoglobin A1c; LDLC, low-density lipoprotein cholesterol; TC, total cholesterol; HDLC, high-density lipoprotein cholesterol; TG, triglyceride; VLDLC, very low-density lipoprotein cholesterol; Total/HDLC, total cholesterol/high-density lipoprotein cholesterol; TAC, total antioxidant capacity; hs-CRP, high-sensitivity C-reactive protein; GSH, glutathione; MDA, malondialdehyde.