

**Table 2.0:** Compilation of the metabolomic studies in obesity, insulin resistance and type 2 diabetes, including the list of candidate metabolites/ pathways.

Metabolic Pathways	Metabolite	Model	Biological Sample	Analytical Tools	References
Fatty Acids	Fatty acids (+)	High-fat diet mouse	Liver	LC-MS and GC-MS	158
		Zucker rat	Liver	NMR	159
		Human	Serum	GC-MS	136
		Human	Plasma	GC-MS	113
		High-fat diet rat	Liver and Serum	GC-MS	160
		Human	Plasma	LC-MS and GC-MS	109
	Acetate (+)	STZ-induced-diabetic rat	Urine	NMR	161
	Carnitine (+)	Human	Plasma	LC-MS	125
		Human	Plasma	LC-MS	11
	Carnitine (-)	High-fat diet mouse	Serum	LC-MS and GC-MS	158
		Human	Plasma	LC-MS	156
	Acylcarnitine (+/-)	Human	Plasma	LC-MS	145
	Acylcarnitine (+)	Human	Plasma and Urine	Flow injection-MS	119
		Male Wistar rats	Serum	Flow injection-MS	142
		Human	Plasma	LC-MS	125
	Acylcarnitine (-)	Human	Plasma	LC-MS and GC-MS	129
	$\alpha$ -hydroxybutyrate (+)	Human	Plasma	LC-MS and GC-MS	109
		Human	Plasma	LC-MS and GC-MS	129
		Human	Plasma	LC-MS	130
	3-hydroxybutyrate (+)	Human	Serum	GC-MS	136
		Human	Plasma	GC-MS	113
		Human	Plasma	GC-MS	105
LysoPC (+)	High-fat diet mouse	Serum and Liver	LC-MS and GC-MS	158	

		Human	Plasma	LC-MS	11
	LysoPC (-)	High-fat diet mouse	Serum and Liver	LC-MS and GC-MS	158
		Human	Serum	LC-MS	154
		Human	Serum	LC-MS	162
	Acetone	STZ –induced diabetic rat	Urine	NMR	161
	Acetoacetate (+)	Human	Urine	NMR	107
		STZ –induced diabetic rat	Urine	NMR	161
Carbohydrates	Pyruvate (+)	High-fat diet rat	Urine	NMR	163
		High-fat diet mouse	Serum	NMR	164
		Human	Serum	GC-MS	136
		STZ –induced diabetic rat	Urine	NMR	161
	Lactate (+)	Human	Urine	LC-MS	165
		High-fat diet rat	Urine	NMR	163
		High-fat diet mouse	Serum	NMR	164
		Zucker rat	Urine and blood	NMR	166
		Ldlr <sup>-/-</sup> mouse	Liver	NMR	167
		Zucker rat	Liver and blood	NMR	159
		Human	Serum	GC-MS	136
		Human	Urine	NMR	168
	Lactate (-)	Zucker rat	Urine	NMR	134
		High-fat diet	Serum	NMR	169
		STZ –induced diabetic rat	Urine	NMR	161
		Human	Serum	GC-MS	170
Acetate (+)	Human	Serum	NMR	171	
	Zucker rat	Urine	NMR	166	

		Zucker rat	Blood	NMR	159
	Acetate (-)	High-fat diet mouse	Urine	NMR	172
		High-fat diet mouse	Serum	NMR	173
		High-fat diet mouse	Serum	NMR	169
	1,5-Anhydrogluticol (-)	Human	Serum	GC-MS	136
		Human	Serum	NMR, LC-MS, GC-MS	54
TCA cycle	Citrate (+)	High-fat diet rat	Serum	GC-MS	160
		High-fat diet rat	Urine	NMR	163
		Human	Urine	NMR	168
		STZ –induced diabetic rat	Urine	NMR	161
		High-fat diet mouse	Serum	NMR	173
		db/db mouse	Urine and Serum	GC-MS	174
		Human	Urine	NMR	107
		Human	Urine	NMR	134
	Citrate (-)	Zucker rat	Urine	NMR	171
		Human	Serum	NMR	160
		High-fat diet rat	Urine	GC-MS	174
		db/db mouse	Serum	GC-MS	175
		M391 mouse	Urine	NMR	160
		High-fat diet rat	Liver	GC-MS	164
	Succinate (+)	High-fat diet mouse	Serum	NMR	161
		STZ –induced diabetic rat	Urine	NMR	174
db/db mouse		Urine and Serum	GC-MS	107	
Human		Urine	NMR	165	
Succinate (-)	Human	Plasma	LC-MS		

	Fumarate (+)	STZ –induced diabetic rat	Urine	NMR	161
	Fumarate (-)	Human	Urine	NMR	107
	2-oxoglutarate (-)	M391 mouse	Urine	NMR	175
		STZ –induced diabetic rat	Urine	NMR	161
	$\alpha$ -ketoglutarate (-)	Human	Plasma	LC-MS	165
	Malate (-)	Human	Urine	NMR	107
	Aconitate	db/db mouse	Urine	GC-MS	174
Amino Acids	Leucine (+)	Human	Plasma	UPLC-MS	11
		High-fat diet rat	Liver and Urine	GC-MS	160
		Human	Plasma	GC-MS	113
		Human	Plasma	LC-MS	165
		Human	Serum	NMR, LC-MS and GC-MS	54
		Human	Blood and Urine	GC-MS	119
	Leucine (-)	Human	Plasma	LC-MS and GC-MS	109
		High-fat diet mouse	Serum	NMR	173
		Human	Urine	NMR	107
		High-fat diet mouse	Urine	NMR	172
		High-fat diet mouse	Serum	NMR	169
		Human	Serum	NMR	171
	Isoleucine (+)	High-fat diet rat	Liver	GC-MS	160
		Human	Serum	NMR, LC-MS and GC-MS	54
		Human	Blood and urine	GC-MS	119
		Human	Plasma	LC-MS and GC-MS	109
Isoleucine (-)	Human	Urine	NMR	171	
	Human	Serum	NMR	107	

	High-fat diet mouse	Urine	NMR	172
Valine (+)	Human	Serum	GC-MS	170
	Human	Serum	NMR, LC-MS and GC-MS	54
	High-fat diet rat	Liver	GC-MS	160
	Human	Blood and Urine	GC-MS	119
	Human	Plasma	LC-MS and GC-MS	109
Valine (-)	High-fat diet rat	Urine	GC-MS	160
	Human	Serum	NMR	171
Lysine (+)	Human	Plasma	LC-MS	11
Lysine (-)	High-fat diet mouse	Serum	NMR	173
	Human	Serum	NMR	171
	Human	Plasma	GC-MS	113
	Human	Serum	GC-MS	170
Methionine (+)	Zucker rat	Liver	NMR	159
	Human	Serum	GC-MS	136
Methionine (-)	High-fat diet mouse	Serum	NMR	169
	Human	Serum	NMR	171
	High-fat diet mouse	Liver	NMR and LC-MS	176
Tyrosine (+)	Human	Blood	UPLC-MS	112
	High-fat diet rat	Urine	GC-MS	160
	High-fat diet mouse	Serum	LC-MS and GC-MS	123
Tyrosine (-)	Human	Serum	NMR	171
	High-fat diet rat	Liver	GC-MS	160
Glycine (-)	Human	Serum	LC-MS	154
	Berlin Fat Mouse Inbred line	Serum	LC-MS	177
	High-fat diet rat	Liver and Serum	GC-MS	160

	High-fat diet mouse	Liver	NMR and LC-MS	176
	STZ –induced diabetic rat	Urine	NMR	161
	Human	Plasma	GC-MS	113
	Zucker rat	Blood	NMR	166
	Human	Serum	LC-MS	13
Dimethylglycine (-)	STZ –induced diabetic rat	Urine	NMR	161
Serine (+)	Human	Plasma	UPLC-MS	11
Serine (-)	High-fat diet mouse	Liver	NMR and LC-MS	176
	Berlin Fat Mouse Inbred line	Serum	LC-MS	177
Phenylalanine (+)	Human	Serum	LC-MS	154
	Human	Serum	GC-MS	136
	Human	Plasma	LC-MS and GC-MS	109
Phenylalanine (-)	High-fat diet mouse	Urine	NMR	172
	Human	Serum	NMR	171
Alanine (+)	High-fat diet rat	Liver and Serum	GC-MS	160
	High-fat diet mouse	Serum	LC-MS and GC-MS	123
	Human	Urine	NMR	168
	Human	Plasma	LC-MS and GC-MS	109
Alanine (-)	Human	Serum	NMR	171
	STZ –induced diabetic rat	Urine	NMR	161
Glutamine (+)	Human	Plasma	LC-MS and GC-MS	109
Glutamine (-)	Human	Serum	LC-MS	178
	Human	Plasma	LC-MS	179
Glutamate (+)	Human	Serum	GC-MS	170
Glutamate (-)	Zucker rat	Blood	NMR	166
	Human	Serum	GC-MS	136

	Arginine (-)	High-fat diet mouse	Serum	NMR	173
		Berlin Fat Mouse Inbred line	Serum	LC-MS	177
	Histidine (-)	Human	Urine	NMR	107
		Human	Serum	NMR	171
	Tryptophan (-)	Human	Urine	NMR	107
	Proline (+)	Human	Plasma	LC-MS and GC-MS	109
	Kynurenic acid (-)	Human	Urine	LC-MS	165
	Xanthurenic acid (-)	Human	Urine	LC-MS	165
	Uric Acid (+)	High-fat diet mouse	Serum	LC-MS and CG-MS	158
	Uric Acid (-)	Human	Plasma	LC-MS	165
	Creatine (+)	Zucker rat	Urine	NMR	134
		High-fat diet mouse	Serum	NMR	164
		M391 mouse	Urine	NMR	175
	Creatinine (+)	High-fat diet mouse	Urine	NMR	172
		M391 mouse	Urine	NMR	175
	Creatinine (-)	STZ –induced diabetic rat	Urine	NMR	161
	Dimethylamine (+/-)	STZ –induced diabetic rat	Urine	NMR	161
Choline Intermediates	Choline (+)	Zucker rat	Blood	NMR	166
		High-fat diet mouse	Liver	NMR and LC-MS	176
		Zucker rat	Urine	NMR	134
		Berlin Fat Mouse Inbred line	Serum	LC-MS	177
		Human	Urine	NMR	107
	Trimethylamine N-oxide (TMAO) (+)				

		Human	Urine	NMR	168
		M391 mouse	Urine	NMR	175
	TMAO (-)	High-fat diet mouse	Serum	NMR	169
		High-fat diet mouse	Urine	NMR	172
		Zucker rat	Urine	NMR	166
		High-fat diet mouse	Serum	NMR	173
	Sphingosine-1-phosphate (S1P)	Human	Plasma	LC-MS	165
	TMAO (+/-)	STZ –induced diabetic rat	Urine	NMR	161
	Betaine (+)	Human	Urine	NMR	168
		High-fat diet rat	Urine	NMR	163
		STZ –induced diabetic rat	Urine	NMR	161
	Betaine (-)	Zucker rat	Liver	NMR	159
		Zucker rat	Urine	NMR	166
		High-fat diet mouse	Liver	LC-MS and GC-MS	158
	Hippurate (+)	Human	Urine	NMR	168
	Hippurate (-)	Human	Urine	NMR	180
		High-fat diet mouse	Serum	NMR	173
	Sarcosine (+)	High-fat diet mouse	Liver	NMR	176
Bile Acids	Deoxycholate (+)	Human	Serum	NMR, LC-MS and GC-MS	54
	Cholate (-)	Human	Serum	NMR, LC-MS and GC-MS	54
	Taurine (+)	High-fat diet mouse	Serum	NMR	164
		Zucker rat	Urine	NMR	134



	High-fat diet rat	Urine	NMR	163
	High-fat diet mouse	Liver	NMR	172
	High-fat diet mouse	Liver	NMR	175
	High-fat diet	Liver	NMR and LC-MS	176
Taurine (-)	M391 mouse	Urine and Liver	NMR	175
	High-fat diet mouse	Serum	NMR	169
	Zucker rat	Urine	NMR	166
	Zucker rat	Urine	LC-MS	181
	Human	Plasma	LC-MS	165

Note: (+) signifies increase while (-) signifies decrease.