Supplementary Table 2 *- Metabolites in hepatic galactose metabolism.*

Id	Name (mass) Annotation	Initial Concentration	Concentrations, Comments
glc	**D-glucose** C6H12O6 Charge: 0 (M_w 180.2) CHEBI:4167 KEGG:C00031	**5.5mM**	[**glc**] = **5.5mM** (König, et al., 2012) 3-10mM (depending on physiological state)
gal	**D-galactose** C6H12O6 Charge: 0 (M_w 180.2) CHEBI:28061 KEGG:C00124	**0.00012mM** (no galactose) **0.00144mM** (GALT deficient) **0.0013-0.0027mM** (GALE deficient)	**plasma of post-absorptive humans** (data considerable lower (3-18-fold) than conventional enzymatic assay) (Schadewaldt, et al., 2000) **[gal] = 0.12±0.03µM** (n=16) healthy subjects [**gal**] = **1.44±0.54µM** (n=10) classical galactosemia (**GALT deficiency**) **[gal] = 0.17±0.07µM (n=5)** obligate heterozygous parents of classical galactosemia [gal] = 0.11±0.04µM (n=15) diabetic patients **GALE deficient patients** (blood) (Yamaguchi, et al., 1989) **[gal]**=24-29mg/L (**0.013-0.016mM**) [**gal**]= 48mg/L (**0.027mM**) **Neonatal control (blood):** [gal]=13±6 mg/L (**0.0072±0.0033mM**) (Yamaguchi, et al., 1989) **normal values**: [gal]=**0.015±0.009mM** (range 0-0.044mM) (Orfanos, et al., 1986) Cut-off values for newborn screening blood for galactosemias: "If gal > 60mg/L (0.033mM) or gal1P > 150mg/L (0.058mM)." (Yamaguchi, et al., 1989)
glc1p	**D-glucose 1-phosphate** C6H11O9P Charge: -2 (M_w 258.1) CHEBI:58601 KEGG:C00103	**0.012mM** (no galactose) **0.011mM** (1h galactose) **0.012mM** (1h galactose, GALE inhibition)	[**glc1p**] = **0.012mM** (König, et al., 2012) (Keppler, et al., 1970) **[glc1p] =0.010 ±0.004µmol/g_{ww}** (**~0.011mM**) (starved + galactose 1h, rat, liver) **[glc1p] =0.011 ±0.005µmol/g_{ww}** (**~0.012mM**) (ethanol, starved + galactose 1h, rat, liver) (Guynn, et al., 1974) **[glc1p] = 0.0075±0.0010 µmol/g_{ww}** (**~0.0083mM**) (rat liver, starved) **[glc1p] = 0.0115±0.008 µmol/g_{ww}** (**~0.0127mM**) (rat liver, fed ad libitum) **[glc1p] = 0.0132±0.0007 µmol/g_{ww}** (**~0.0146mM**) (rat liver, meal fed) **[glc6p]/[glc1p] ~10-12**
glc6p	**D-glucose 6-phosphate** C6H11O9P Charge: -2 (M_w 258.1) CHEBI:58225 KEGG:C00668	**0.12mM** (no galactose) **0.29mM** (1h galactose) **0.30mM** (1h galactose, GALE inhibition)	[**glc6p**] = **0.12mM** (König, et al., 2012) (Guynn, et al., 1974) **[glc6p] = 0.078±0.011 µmol/g_{ww}** (**~0.086mM**) (rat liver, starved) **[glc6p] = 0.147±0.012 µmol/g_{ww}** (**~0.163mM**) (rat liver, fed ad libitum) **[glc6p] = 0.157±0.007 µmol/g_{ww}** (**~0.174mM**) (rat liver, meal fed) **[glc6p]/[glc1p] ~10-12** (Keppler, et al., 1970) **[glc6p] =0.26 ±0.06µmol/g_{ww}** (**~0.29mM**) (starved + galactose 1h, rat, liver)

			[glc6p] =0.30 ±0.13µmol/g_{ww} (**~0.33mM**) (ethanol, starved + galactose 1h, rat, liver) **[glc6p]/[glc1p] =22.2 ±5.9** (starved + galactose 1h, rat, liver) **[glc6p]/[glc1p] =22.8 ±5.9** (ethanol, starved + galactose 1h, rat, liver)
gal1p	**D-galactose 1-phosphate** C6H11O9P Charge: -2 (M_w 258.1) CHEBI:58336 KEGG:C00446	**0.001mM** (no galactose) **0.20mM** (1h galactose) **0.77mM** (1h galactose, GALE inhibition) **1.2mM** (GALT deficient, glucose) **5.2mM** (GALT deficient, galactose)	(Lai, et al., 2003) (human cells) [**gal1p**] = **ND** (not detectable) (Control glucose medium) [**gal1p**] = **0.2±0.01mM** (Control galactose medium) (Keppler, et al., 1970) **[gal1p] =0.18 ±0.04µmol/g_{ww}** (**~0.2mM**)(starved + galactose 1h, rat, liver) **[gal1p] =0.69 ±0.11µmol/g_{ww}** (**~0.77mM**) (ethanol, starved + galactose 1h, rat, liver) (Lai, et al., 2003) (human cells) [**gal1p**] = **1.2±0.4mM** (**GALT-deficient** glucose medium) [**gal1p**] = **5.2±0.02mM** (**GALT-deficient** galactose medium) **GALT deficiency** detected (blood) [gal1p] > **3.0mM** (human cells) (Diepenbrock, et al., 1992) **GALE deficient patients** (blood) (Yamaguchi, et al., 1989) [gal1p]=330-360mg/L (**1.28-1.39mM**) [gal1p]=474 mg/L (**1.84mM**) (Yamaguchi, et al., 1989) **Neonatal control (blood):** gal1P=15±11 mg/L (**0.058±0.042mM**) (Yamaguchi, et al., 1989) **normal values:** gal1P = **0.038±0.027 mM** (range 0-0.096µM) (Orfanos, et al., 1986) Mean concentration of gal1p (blood) was **0.15mM** in cases below the cut-off of 0.74mM (Diepenbrock, et al., 1992)
udpglc	**UDP-D-glucose** C15H22N2O17P2 Charge: -2 (M_w 564.3) CHEBI:58885 KEGG:C00029	**0.34mM** (no galactose) **0.27mM** (1h galactose) **0.17mM** (1h galactose, GALE inhibition)	[**udpglc**] = **0.38mM** (König, et al., 2012) **[udpglc] = 0.32±0.05 µmol/g_{ww}** (~**0.36mM**) (rat liver) (Keppler and Decker, 1969) **[udpglc] = 0.26±0.07 µmol/g_{ww}** (**~0.29mM**) (rat liver) (Keppler, et al., 1969) (Keppler, et al., 1970) **[udpglc] =0.32 ±0.04µmol/g_{ww}** (**~0.36mM**) (fed, rat, liver) **[udpglc] =0.29 ±0.05µmol/g_{ww}** (**~0.32mM**) (starved, rat, liver) **[udpglc] =0.24 ±0.09µmol/g_{ww}** (**~0.27mM**) (starved + galactose 1h, rat, liver) **[udpglc] =0.15 ±0.03µmol/g_{ww}** (**~0.17mM**) (ethanol, starved + galactose 1h, rat, liver) (Guynn, et al., 1974) **[udpglc] = 0.342±0.024 µmol/g_{ww}** (**~0.38mM**) (rat liver, starved) **[udpglc] = 0.433±0.023 µmol/g_{ww}** (**~0.48mM**) (rat liver, fed ad libitum) **[udpglc] = 0.347±0.027 µmol/g_{ww}** (**~0.39mM**) (rat liver, meal fed) (Lai, et al., 2003) (human cells, in µmol/100g(cell protein)) [udpglc] = 236±25 (Control glucose medium) [udpglc] = 179±24 (**76% glucose**) (Control galactose medium)

			(Lai, et al., 2003) (human cells, in µmol/100g(cell protein)) [udpglc] = 157±10 (GALT-deficient glucose medium) [udpglc] = 110±10 (**70% glucose**) (GALT-deficient galactose medium)
udpgal	**UDP-D-galactose** C15H22N2O17P2 Charge: -2 (M_w 564.3) CHEBI:66914 KEGG:C00052	**0.11mM** (no galactose) **0.36mM** (1h galactose) **1.39mM** (1h galactose, GALE inhibition)	Both the levels and approximate ratio of 1:3 of udpgal and udpglc are very tightly controlled in normal human cells. (Fridovich-Keil, 2006; Segal, 1995) (1:3 rule udpglc) (Keppler, et al., 1970) **[udpgal] =0.09 ±0.01µmol/g_{ww}** (**~0.10mM**) (fed, rat, liver) **[udpgal] =0.09 ±0.01µmol/g_{ww}** (**~0.10mM**) (starved, rat, liver) **[udpgal] =0.32 ±0.07µmol/g_{ww}** (**~0.36mM**) (starved + galactose 1h, rat, liver) **[udpgal] =1.25 ±0.16µmol/g_{ww}** (**~1.39mM**) (ethanol, starved + galactose 1h, rat, liver) (Keppler, et al., 1970) **[udpgal]/[udpglc] =3.4 ±0.3 (**fed, rat, liver) **[udpgal]/[udpglc] =3.3 ±0.3 (**starved, rat, liver) **[udpgal]/[udpglc] =0.78 ±0.39 (**starved + galactose 1h, rat, liver) **[udpgal]/[udpglc] =0.11 ±0.02 (**ethanol, starved + galactose 1h, rat, liver) **[udpgal]/[gal1p] =1.94 ±0.35 (**starved + galactose 1h, rat, liver) **[udpgal]/[gal1p] =1.85 ±0.27 (**ethanol, starved + galactose 1h, rat, liver) (Lai, et al., 2003) (human cells, in µmol/100g(cell protein)) [udpgal] = 82±10 (Control glucose medium) [udpgal] = 46±4 (**56% glucose**) (Control galactose medium 24h) (Lai, et al., 2003) (human cells, in µmol/100g(cell protein)) [udpgal] = 25±5 (GALT-deficient glucose medium) [udpgal] = 17±3 (**68% glucose**) (GALT-deficient galactose medium 24h)
galtol	**D-galactitol** C6H14O6 Charge: 0 (M_w 182.2) CHEBI:16813 KEGG:C01697	**0.001mM** (no galactose) **~8mM** (GALT deficiency)	**[galtol]**=4.8-40µmol/g (**~5.3-44mM**) (occupational gray matter, human) [**galtol]**=17.6µmol/g (~)(basal ganglia, human) (Wang, et al., 2001) **[galtol]=12.9µmol/g (~14.3mM)** (Wang, et al., 2001) (Wells, et al., 1965) **[galtol]=22.18µmol/g (~24.6mM)** (Wang, et al., 2001) (Quan-Ma, et al., 1966) Galactitol measured directly in **GALT-deficient mice** are lower (**2mM**) than levels detected by MRS in **human subjects** (**8mM**) (Leslie, 2003; Wang, et al., 2001)
atp	**ATP** C10H12N5O13P3 Charge: -4 (M_w 503.2) CHEBI:30616 KEGG:C00002	**2.7mM** (no galactose) **2.9mM** (1h galactose) **2.9mM** (1h galactose, GALE inhibition)	[**atp**] = **2.8mM** (König, et al., 2012) (Guynn, et al., 1974) **[atp] = 2.49±0.12 µmol/g_{ww}** (**~2.77mM**) (rat liver, starved) **[atp] = 2.56±0.09 µmol/g_{ww}** (**~2.84mM**) (rat liver, fed ad libitum) **[atp] = 2.32±0.07 µmol/g_{ww}** (**~2.58mM**) (rat liver, meal fed) **[atp] = 2.42±0.50 µmol/g_{ww}** (**~2.69mM**) (rat liver) (Keppler, et al., 1969) (Keppler, et al., 1970) **[atp] =2.60 ±0.16µmol/g_{ww}** (**~2.89mM**) (starved + galactose 1h, rat, liver) **[atp] =2.81 ±0.15µmol/g_{ww}** (**~3.12mM**) (ethanol, starved + galactose 1h, rat, liver)

			[atp]/[adp] =3.14 ±0.52 (starved + galactose 1h, rat, liver) **[atp]/[adp] =3.10 ±0.53** (ethanol, starved + galactose 1h, rat, liver)
adp	**ADP** C10H12N5O10P2 Charge: -3 (M_w 424.2) CHEBI:456216 KEGG:C00008	**1.2mM** (no galactose) **1.0mM** (1h galactose) **1.0mM** (1h galactose, GALE inhibition)	[**adp**] = **0.8mM** (König, et al., 2012) (Guynn, et al., 1974) **[adp] = 1.38±0.08µmol/g_{ww}** (**~1.53mM**) (rat liver, starved) **[adp] = 1.06±0.03µmol/g_{ww}** (**~1.18mM**) (rat liver, fed ad libitum) **[adp] = 1.24±0.04µmol/g_{ww}** (**~1.38mM**) (rat liver, meal fed) **[adp] = 1.08±0.12 µmol/g_{ww}** (**~1.20mM**) (rat liver) (Keppler, et al., 1969) (Keppler, et al., 1970) **[adp] =0.88 ±0.17µmol/g_{ww}** (**~0.98mM**) (starved + galactose 1h, rat, liver) **[adp] =0.97 ±0.19µmol/g_{ww}** (**~1.08mM**) (ethanol, starved + galactose 1h, rat, liver)
utp	**UTP** C9H11N2O15P3 Charge: -4 (M_w 480.1) CHEBI:46398 KEGG:C00075	**0.27mM** (no galactose)	[**utp**] = **0.27mM** (König, et al., 2012) (Guynn, et al., 1974) **[utp] = 0.362±0.014 µmol/g_{ww}** (**~0.40mM**) (rat liver, starved) **[utp] = 0.494±0.038 µmol/g_{ww}** (**~0.55mM**) (rat liver, fed ad libitum) **[utp] = 0.443±0.039 µmol/g_{ww}** (**~0.49mM**) (rat liver, meal fed)
udp	**UDP** C9H11N2O12P2 Charge: -3 (M_w 401.1) CHEBI:58223 KEGG:C00015	**0.09mM** (no galactose)	[**udp**] = **0.09mM** (König, et al., 2012) **[utp+udp] = 0.35±0.07 µmol/g_{ww}** (**~0.39mM**) (rat liver) (Keppler, et al., 1969) **[utp+udp] = 0.35±0.05 µmol/g_{ww}** (**~0.39mM**) (rat liver) (Keppler and Decker, 1969) (Keppler, et al., 1970) **[utp+udp] =0.34 ±0.05µmol/g_{ww}** (**~0.38mM**) (fed, rat, liver) **[utp+udp] =0.23 ±0.05µmol/g_{ww}** (**~0.26mM**) (starved, rat, liver) **[utp+udp] =0.15 ±0.03µmol/g_{ww}** (**~0.17mM**) (starved + galactose 1h, rat, liver) **[utp+udp] =0.11 ±0.02µmol/g_{ww}** (**~0.39mM**) (ethanol, starved + galactose 1h, rat, liver) Marked decrease in [utp+udp] under galactose challenge.
phos	**Phosphate** HO4P Charge: -2 (M_w 96.0) CHEBI:43474 KEGG:C00009	**5.0mM**	[**phos**] = **5.0mM** (König, et al., 2012) (Guynn, et al., 1974) **[phos] = 4.37±0.16 µmol/g_{ww}** (**~4.86mM**) (rat liver, starved) **[phos] = 3.64±0.32 µmol/g_{ww}** (**~4.04mM**) (rat liver, fed ad libitum) **[phos] = 4.41±0.10 µmol/g_{ww}** (**~4.90mM**) (rat liver, meal fed) **[phos] = 3.18±0.56 µmol/g_{ww}** (**~3.53mM**) (rat liver) (Keppler and Decker, 1969)
ppi	**Pyrophosphate** HO7P2 Charge: -3 (M_w 175.0) CHEBI:33019 KEGG:C00013	**0.008mM**	[**pp**] = **0.008mM** (König, et al., 2012) (Guynn, et al., 1974) **[pp] = 0.0023±0.0003 µmol/g_{ww}** (**~0.0026mM**) (rat liver, starved) **[pp] = 0.0038±0.0004 µmol/g_{ww}** (**~0.0042mM**) (rat liver, fed ad libitum) **[pp] = 0.0049±0.0006 µmol/g_{ww}** (**~0.0054mM**) (rat liver, meal fed) **[pp] = 0.0065±0.00086 µmol/g_{ww}** (**~0.0072mM**) (rat total liver)

nadp	**NADP** C21H25N7O17P3 Charge: -3 (M_w 740.4) CHEBI:58349 KEGG:C00006	**0.1mM**	
nadph	**NADPH** C21H26N7O17P3 Charge: -4 (M_w 741.4) CHEBI:57783 KEGG:C00005	**0.1mM**	
h2o	**H2O** H2O Charge: 0 CHEBI:15377 KEGG:C00001	-	Boundary species, included for mass and charge bilance.
hydron	**H+** H Charge: +1 (M_w 1.0) CHEBI:15378 KEGG:C00080	-	Boundary species, included for mass and charge bilance.
h2	**H2** H2 Charge: 0 CHEBI:18276 KEGG:C00282	-	Boundary species, included for mass and charge bilance.
suc	**Sucrose** C12H22O11 Charge: 0 (M_w 342.3) CHEBI:17992 KEGG:C00089	-	Multiple indicator dilution tracer. Concentration set based on experimental condition.
alb	**albumin** UniProt:P02768	-	Multiple indicator dilution tracer. Concentration set based on experimental condition.
rbc	**red blood cell** BTO:0000424	-	Multiple indicator dilution tracer. Concentration set based on experimental condition.
galnat	**D-galactonate** (M_w 195.1) CHEBI:12931 KEGG:C00880		
galn	**galactosamine**	-	Uptake of galactosamine by rat liver is a~0.4µmol/g(liver)/min as measured by the disappearance of galactosamine from the medium (Keppler, et al., 1969) Time-dependent decrease in uridine nucleotides in isolated perfused rat livers after galactosamine addition. (Keppler, et al., 1969)
amp	**AMP**	-	**[amp] = 0.28±0.06 µmol/g_{WW}** (**~0.31mM**) (rat liver) (Keppler, et al., 1969)

			(Keppler, et al., 1970) **[amp] =0.15 ±0.09µmol/g_{ww}** (**~0.167mM**) (starved + galactose 1h, rat, liver) **[amp] =0.19 ±0.07µmol/g_{ww}** (**~0.21mM**) (ethanol, starved + galactose 1h, rat, liver)
ump	**UMP**	-	[**ump**] = **0.04 µmol/g_{ww}** (**~0.044mM**) (rat liver) (Segal and Rogers, 1971)

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