

Poor *in-utero* growth, and reduced beta cell compensation and high fasting glucose from childhood, are harbingers of glucose intolerance in young Indians

Supplemental material: Index

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Supplementary Table 1: Cohort characteristics at 18, 12, 6 and 2 years, and newborn, infant and parent measurements

Measure	Statistic	MEN		WOMEN	
		(n=352)		(n=267)	
18 YEARS					
Age (years)	Mean (SD)	18.2	(0.5)	17.7	(0.6)
Height (cm)	Mean (SD)	169.6	(6.7)	156.9	(5.9)
Stunted (WHO z<-2)	N (%)	33	(9.4)	28	(10.5)
Weight (kg)	Mean (SD)	56.8	(10.7)	46.0	(7.8)
Body Mass Index (BMI, kg/m ²)	Mean (SD)	19.7	(3.3)	18.7	(3.1)
Underweight ^a (BMI<18.5 kg/m ²)	N (%)	146	(41.5)	151	(56.6)
Overweight/Obese ^b (BMI>25.0 kg/m ²)	N (%)	27	(7.7)	11	(4.1)
Overweight/Obese (BMI>23.0 kg/m ²)	N (%)	53	(15.1)	19	(7.1)
Waist circumference (cm)	Mean (SD)	72.9	(9.1)	68.0	(6.8)
Central obesity ^c	N (%)	21	(6.0)	13	(4.9)
Fat mass (kg)	Median (LQ, UQ)	7.1	(4.4, 11.8)	12.1	(9.3, 15.2)
Lean mass (kg)	Mean (SD)	44.5	(5.4)	30.4	(3.5)
Fat percentage (%)	Median (LQ, UQ)	13.1	(8.9, 20.4)	28.0	(22.9, 31.9)

Adipose ^d	N (%)	56	(16.1)	41	(15.5)
Fasting glucose (mmol/l)	Median (LQ, UQ)	5.4	(5.2, 5.6)	5.2	(5.0, 5.3)
30-min glucose (mmol/l)	Median (LQ, UQ)	8.2	(7.5, 9.4)	8.3	(7.5, 9.0)
120-min glucose (mmol/l)	Median (LQ, UQ)	6.1	(5.3, 7.0)	6.3	(5.5, 7.0)
Fasting insulin (pmol/l)	Median (LQ, UQ)	52.8	(39.0, 75.8)	63.6	(49.2, 81.0)
30-min insulin (pmol/l)	Median (LQ, UQ)	477.3	(331.1, 707.9)	579.0	(391.2, 768.6)
120-min insulin (pmol/l)	Median (LQ, UQ)	280.2	(177.0, 423.6)	392.4	(249.6, 579.0)
Impaired fasting glucose (IFG) ^e	N (%)	94	(26.7)	23	(8.6)
Impaired gluc tolerance (IGT) ^f	N (%)	37	(10.5)	30	(11.2)
Diabetes ^g	N (%)	0	(0)	1	(0.4)
Glucose Intolerant (DM+IFG+IGT)	N (%)	131	(37.2)	54	(20.2)
HOMA-S	Median (LQ, UQ)	86	(62, 118)	73	(58, 95)
HOMA-B	Median (LQ, UQ)	94	(75, 115)	115	(94,133)
Insulinogenic index ^h	Median (LQ, UQ)	1.7	(1.4, 2.1)	1.7	(1.4, 2.1)
Matsuda index ⁱ	Median (LQ, UQ)	13.3	(9.6, 19.2)	11.6	(8.7, 14.9)
(HOMA-B) * (HOMA-S) ^j	Median (LQ, UQ)	79	(68, 92)	84	(74, 95)
(Insulinogenic Index) * (Matsuda Index) ^k	Median (LQ, UQ)	4.3	(3.9, 4.9)	4.1	(3.7, 4.6)

12 YEARS					
Height (cm)	Mean (SD)	138.7	(8.5)	140.2	(8.4)
BMI (kg/m ²)	Mean (SD)	14.9	(1.7)	14.7	(2.2)
Waist (cm)	Mean (SD)	58.1	(5.4)	56.3	(5.3)
Fat percentage (%)	Median (LQ, UQ)	13.8	(11.1, 17.4)	17.5	(14.3, 22.2)
Fasting glucose (mmol/l)	Median (LQ, UQ)	4.9	(4.6, 5.1)	4.7	(4.5, 5.1)
Fasting insulin (pmol/l)	Median (LQ, UQ)	28.2	(18.0, 40.8)	34.0	(24.5, 47.2)
HOMA-S	Median (LQ, UQ)	161	(116, 249)	138	(101, 190)
HOMA-B	Median (LQ, UQ)	72	(51, 92)	88	(71, 108)
(HOMA-B) * (HOMA-S)	Median (LQ, UQ)	120	(102, 141)	120	(102, 140)
6 YEARS					
Height (cm)	Mean (SD)	110.3	(4.8)	109.3	(4.3)
BMI (kg/m ²)	Mean (SD)	13.5	(0.8)	13.2	(0.9)
Waist (cm)	Mean (SD)	50.4	(2.6)	50.1	(2.6)
Fat percentage (%)	Median (LQ, UQ)	17.5	(13.9, 20.5)	20.4	(17.6, 23.9)
Fasting glucose (mmol/l)	Median (LQ, UQ)	5.1	(4.7, 5.3)	4.8	(4.6, 5.2)
30-min glucose (mmol/l)	Median (LQ, UQ)	8.2	(6.9, 9.3)	8.1	(7.2, 9.2)
120-min glucose (mmol/l)	Median (LQ, UQ)	5.4	(4.6, 6.2)	5.6	(4.9, 6.3)
Fasting insulin (pmol/l)	Median (LQ, UQ)	17.9	(9.1, 27.3)	19.6	(9.7, 30.8)

30-min insulin (pmol/l)	Median (LQ, UQ)	136.1	(86.1, 197.9)	161.5	(18,37)
120-min insulin (pmol/l)	Median (LQ, UQ)	49.9	(27.2, 81.6)	64.8	(37.6, 103.7)
HOMA-S	Median (LQ, UQ)	249	(167, 448)	228	(149, 440)
HOMA-B	Median (LQ, UQ)	50	(33, 71)	60	(37, 81)
Insulinogenic index ^h	Median (LQ, UQ)	1.6	(1.1, 2.1)	1.5	(1.1, 2.1)
Matsuda index ⁱ	Median (LQ, UQ)	55.4	(36.0, 80.2)	47.5	(32.7, 69.2)
(HOMA-B) * (HOMA-S) ^j	Median (LQ, UQ)	129	(105, 157)	137	(107, 173)
(Insulinogenic Index) * (Matsuda Index) ^k	Median (LQ, UQ)	6.8	(6.4, 7.1)	6.8	(6.5, 7.1)
2 YEARS					
Height (cm)	Mean (SD)	82.3	(3.4)	80.8	(3.2)
Weight (kg)	Mean (SD)	9.9	(1.1)	9.2	(1.1)
BIRTH					
Birth weight (g)	Mean (SD)	2700	(365)	2550	(371)
Birth length (cm)	Mean (SD)	47.8	(2.4)	47.1	(2.2)
Head circumference (cm)	Mean (SD)	33.3	(32.3, 34.1)	32.7	(31.8, 33.5)
Gestation (days)	Mean (SD)	271	(12)	272	(11)
SGA	N (%)	169	(48)	134	(50.2)
MOTHER (pre-pregnancy)		N=352		N=267	

Height (cms)	Mean (SD)	151.9	(5.03)	151.8	(4.8)
BMI (kg/m ²)	Mean (SD)	18.1	(1.8)	17.9	(1.9)
FATHER (during wife's pregnancy)		N=334		N=254	
Height (cms)	Mean (SD)	164.5	(6.6)	165.6	(5.3)
BMI (kg/m ²)	Mean (SD)	21.0	(3.2)	20.7	(3.2)

^aBMI <18.5 kg/m²; ^bBMI ≥25 kg/m²; ^cWaist circumference ≥90 cm in men and ≥80 cm in women; ^dFat percent (DXA) ≥25% (men) and ≥35% (women); ^eFasting glucose 100-125 mg/dl (5.6-6.9 mmol/l) (ADA criteria); ^f120-minute glucose 140-199 mg/dl (7.8-11.0 mmol/l) (ADA criteria); ^gFasting glucose ≥126 mg/dl (7.0 mmol/l) and/or 120-minute glucose ≥200 mg/dl (11.1 mmol/l) (ADA criteria); ^hln{Insulin(30-minute/fasting)/Glucose(30-minute/fasting)}; ⁱ10000/√{Glucose fasting x Insulin fasting x mean glucose (F, 30min, 120min) x mean insulin (F, 30min, 120min)} (glucose in mmol/l; insulin in pmol/l); ^j(HOMA-S X HOMA-β)/100; ^kInsulinogenic index + ln(Matsuda index). BMI: Body Mass Index; HOMA: Homeostatic Model Assessment models, SD: Standard deviation, LQ: Lower Quadrant, UQ: Upper Quadrant, IUGR: Intra-Uterine Growth Restriction, SGA: Small for Gestation Age.

Supplementary Table 2a: Lifecourse data in participants with NGT, IFG, IGT and both IFG+IGT (Males)

	MALES			
	NGT (221)	IFG (94)	IGT (13)	IFG+IGT (24)
	Median (25th, 75th)	Median (25th, 75th)	Median (25th, 75th)	Median (25th, 75th)
18 YEARS				
Height (cm)	170.1[165.7,174.3]	169.6[166.2,173.4]	165.6[160.8,168.4]	169.1[165.6,173.3]
BMI (kg/m ²)	18.79[16.97,20.95]	19.39[18.05,21.88]	20.25[18.79,22.65]	20.14[17.58,24.34]
Waist circumference (cm)	70.50[66.20,75.50]	71.95[67.32,78.35]	76.55[67.50,82.00]	75.90[69.05,86.00]
Fat (%)	12.5[8.4,18.3]	13.3[9.7,20.9]	22.2[11.6,24.5]	17.6[10.9,32.1]
Fasting plasma glucose (mmol/l)	5.22[5.05, 5.38]	5.66[5.55, 5.83]	5.27[5.11, 5.41]	5.83[5.60, 6.02]
30 min plasma glucose (mmol/l)	7.83[7.24, 8.55]	8.69[7.88, 9.55]	9.21[7.94,10.04]	9.32[8.77,10.12]
120 min plasma glucose (mmol/l)	5.72[5.05,6.44]	6.30[5.58,7.06]	8.21[7.94,8.80]	8.12[7.94,8.91]
Fasting plasma insulin (pmol/l)	48.0[36.0,66.0]	62.7[46.1,84.9]	85.8[62.4,113.7]	70.2[39.7,102.2]
30 min plasma insulin (pmol/l)	477.0[327.6,705.6]	466.5[333.6,681.7]	647.4[330.0,1049.7]	476.7[386.7,681.0]
120 min plasma insulin (pmol/l)	258[145.3,372.7]	280.8[177.0,407.7]	976.8[567.3,1244.4]	512.1[380.7,703.5]
HOMA-B	99.00[81.62,119.77]	100.90[77.72,118.62]	148.80[122.20,168.70]	100.30[77.55,144.38]
HOMA S	84.70[61.23,110.50]	62.15[46.78,84.12]	47.50[36.90,57.10]	51.70[38.85,82.60]
(HOMA-B) * (HOMA-S)	83.76[75.10,98.31]	64.99[57.62,71.31]	74.17[61.68,75.50]	60.87[54.68,67.49]
Insulinogenic index	1.83[1.56,2.15]	1.57[1.29,1.89]	1.60[1.30,1.83]	1.45[1.15,1.75]
Matsuda index	15.44[11.39,21.17]	12.06[9.34,16.74]	7.64[5.04,9.54]	8.51[7.12,12.81]

(Insulinogenic Index) * (Matsuda Index)	4.57[4.12,5.01]	4.11[3.68,4.46]	3.66[3.02,3.91]	3.83[3.33,4.17]
12 YEARS				
Height (cm)	138.9[132.9,144.8]	138.1[133.5,143.9]	131.4[128.8,134.7]	136.6[133.5,140.9]
BMI (kg/m ²)	14.60[13.82,15.66]	14.86[13.80,15.74]	13.87[13.28,14.4]	14.62[13.77,16.49]
Waist circumference (cm)	57.20[54.70,60.20]	57.50[54.70,61.00]	55.75[53.38,57.55]	56.80[54.15,61.15]
Fat (%)	13.4[10.8,17.0]	14.2[11.4,16.6]	16.9[12.9,20.7]	15.7[12.6,20.6]
Fasting plasma glucose (mmol/l)	4.8[4.6,5.1]	5.0[4.8,5.3]	4.9[4.7,5.3]	4.9[4.8,5.3]
Fasting plasma insulin (pmol/l)	27.6[17.8,39.0]	30.9[18.5,44.1]	37.2[20.9,45.5]	26.0[14.3,33.4]
HOMA-B	76.80[56.97,99.07]	78.20[54.38,96.92]	93.50[75.8,114.2]	81.40[44.75,89.65]
HOMA S	148.15[105.62,231.02]	134.00[91.90,223.32]	110.30[95.20,179.20]	158.80[124.50,266.45]
(HOMA-B) * (HOMA-S)	116.00[100.53,138.83]	105.94[85.71,134.81]	103.89[86.45,118.91]	125.00[105.90,137.79]
6 YEARS				
Height (cm)	110.0[107.0,113.3]	110.5[107.8,113.0]	107.4[106.0,110.1]	110.0[109.2,112.1]
BMI (kg/m ²)	13.45[12.92,14.07]	13.68[13.11,14.11]	13.20[13.02,13.26]	13.51[12.78,13.95]
Waist circumference (cm)	50.1[48.9,51.8]	50.6[49.2,52.6]	50.6[47.8,52.3]	50.6[48.1,52.5]
Fat (%)	17.17[13.53,20.46]	17.32[14.18,19.91]	18.90[16.91,20.47]	19.47[14.86,22.43]
Fasting plasma glucose (mmol/l)	4.9[4.6,5.3]	5.2[4.8,5.5]	4.9[4.7,5.2]	5.1[4.9,5.5]
30 min plasma glucose (mmol/l)	8.2[6.9,9.2]	8.1[7.1,9.3]	7.3[5.9,8.8]	8.8[6.8,10.6]

120 min plasma glucose (mmol/l)	5.3[4.5,6.1]	5.5[4.9,6.4]	5.2[4.7,6.2]	5.7[5.1,6.4]
Fasting plasma insulin (pmol/l)	16.8[8.0,26.4]	21.2[10.2,30.2]	14.7[7.8,35.3]	21.1[10.3,33.3]
30 min plasma insulin (pmol/l)	138.0[80.4,197.2]	130.9[92.4,206.9]	119.7[62.7,148.8]	148.7[91.3,201.4]
120 min plasma insulin (pmol/l)	47.8[25.1,76.8]	53.7[29.6,96.2]	51.6[28.4,89.4]	66.5[48.5,84.6]
HOMA-B	52.10[35.08,75.93]	55.20[36.80,73.85]	58.30[25.70,78.60]	53.25[37.12,79.90]
HOMA S	238.75[157.62,468.75]	191.10[135.80,377.70]	284.50[124.60,350.30]	195.30[128.55,389.55]
(HOMA-B) * (HOMA-S)	135.42[110.69,177.62]	119.71[93.67,151.00]	116.60[91.00,202.00]	107.56[95.94,146.62]
Insulinogenic index	2.85[2.43,3.12]	2.78[2.48,3.23]	2.67[2.48,2.99]	2.80[2.45,3.1]
Matsuda index	58.45[38.62,86.87]	53.32[32.92,74.97]	60.26[33.71,95.47]	46.52[28.95,58.89]
(Insulinogenic Index) * (Matsuda Index)	6.80[6.56,7.18]	6.71[6.32,7.05]	6.89[6.44,7.05]	6.45[6.32,6.79]
2 YEARS				
Height (cm)	82.2[80.6,84.5]	82.1[80.2,84.3]	82.0[76.6,82.9]	81.8[79.8,84.4]
Weight (kg)	9.92[9.25,10.60]	9.88[9.28,10.40]	9.70[8.80,10.18]	9.77[9.28,10.18]
AT BIRTH				
Weight (kg)	2.7[2.5,2.9]	2.7[2.5,2.9]	2.7[2.5,3.0]	2.6[2.2,2.98]
Length (cm)	48.2[46.6,49.5]	47.7[46.5,49.05]	47.4[44.7,48.8]	48.4[45.9,50.0]
Head circumference (cm)	33.4[32.4,34.2]	33.1[32.3,34.0]	33.3[32.2,33.5]	33.5[31.8,34.1]

Supplementary Table 2b: Lifecourse data in participants with NGT, IFG, IGT and both IFG+IGT (Females)

	FEMALES			
	NGT (213)	IFG (23)	IGT (23)	IFG+IGT (7)
	Median (25th, 75th)	Median (25th, 75th)	Median (25th, 75th)	Median (25th, 75th)
18 YEARS				
Height (cm)	157.2[153.4,161.0]	157.2[152.4,161.4]	157.5[155.7,160.5]	153.6[152.5,157.8]
BMI (kg/m ²)	18.08[16.86,20.21]	17.46[16.89,19.07]	17.98[16.52,19.76]	17.29[15.99,18.86]
Waist circumference (cm)	67.45[63.3,71.8]	65.85[64.5,68.9]	68.05[62.23,70.32]	66.65[63.75,71.45]
Fat (%)	28.1[23.35,31.68]	24.5[21.55,30.49]	28.91[24.64,33.74]	24.54[23.2,28.15]
Fasting plasma glucose (mg/dl)	5.1[4.9,5.3]	5.7[5.6,5.8]	5.2[4.9,5.3]	5.7[5.6,6.3]
30 min plasma glucose (mg/dl)	7.9[7.3,8.7]	8.9[8.2,9.8]	9.1[8.6,9.7]	9.9[8.4,10.8]
120 min plasma glucose (mg/dl)	6.0[5.4,6.7]	6.7[6.3,7.3]	8.3[7.9,9.3]	8.5[8.2,8.6]
Fasting plasma insulin (pmol/l)	63.0[46.8,80.4]	76.8[45.3,83.1]	66.6[55.8,83.4]	62.4[46.2,81.6]
30 min plasma insulin (pmol/l)	578.4[40.7,4,774.0]	510.6[313.5,798.6]	605.4[385.6,719.4]	383.8[,246.6,751.2]
120 min plasma insulin (pmol/l)	360.0[236.5,509.4]	429.6[350.1,616.2]	903.0[523.8,1012.2]	717.0[494.4,1150.2]
HOMA-B	125.5[101.7,143.7]	110.9[87.1,120.6]	128.9[117.45,138.75]	98.1[86.55,112.05]
HOMA S	65.2[51.2,86.75]	51.6[48,79.4]	60.6[49.15,68.95]	63.1[55.95,79.8]
(HOMA-B) * (HOMA-S)	83.67[74.11,96.7]	64.53[59.59,67]	79.38[74.24,86.19]	63.93[57.72,71.54]
Insulinogenic index	1.77[1.44,2.12]	1.58[1.25,1.98]	1.54[1.26,1.65]	1.18[1.12,1.51]
Matsuda index	12.23[9.36,15.55]	10.32[7.93,14.16]	8.41[7.67,10.11]	10.96[6.89,11.6]

(Insulinogenic Index) * (Matsuda Index)	4.27[3.88,4.67]	4.08[3.51,4.27]	3.65[3.55,3.77]	3.56[3.41,3.77]
12 YEARS				
Height (cm)	139.6[134.6,146.75]	140.7[135.05,143.48]	138.7[133.15,143]	133.8[129.9,142.95]
BMI (kg/m ²)	14.37[13.21,15.97]	14.25[13.27,15.81]	14.21[13.29,15.33]	13.73[12.83,14.6]
Waist circumference (cm)	56[52.72,59.25]	54.75[51.62,55.9]	56.05[52.62,58.2]	54.25[52.12,55.25]
Fat (%)	17.81[14.31,22.85]	16.44[13.84,18.3]	18.84[16.5,21.91]	13.66[11.61,19.16]
Fasting plasma glucose (mg/dl)	4.7[4.4,4.9]	5.1[4.7,5.3]	4.9[4.7,5.2]	5.2[4.8,5.4]
Fasting plasma insulin (pmol/l)	33.9[24.6,47.4]	35.2[27.8,40.8]	37.8[24.5,56.9]	21.0[10.2,40.7]
HOMA-B	96.7[76.95,116.95]	82.85[72.15,98.75]	97.5[72.3,121.65]	52.6[43,83.35]
HOMA S	121.8[88.25,170.15]	115.25[100.8,141.8]	109.4[77.6,157.55]	187.9[122.2,336.85]
(HOMA-B) * (HOMA-S)	114.5[100.82,136.6]	100.78[88.35,117.25]	110.57[87.51,123.78]	116[95.35,122.21]
6 YEARS				
Height (cm)	109.4[106.8,112.7]	107.6[105.2,110.65]	110[107.6,111.4]	106.7[106.35,107.1]
BMI (kg/m ²)	13.15[12.6,13.79]	12.89[12.28,13.46]	12.7[12.31,13.49]	13.05[12.87,13.15]
Waist circumference (cm)	50[48.5,52.1]	48.9[47.4,50.55]	49.9[47.6,50.9]	49.6[49.05,50.75]
Fat (%)	20.4[17.74,24.07]	19.73[17.2,22.62]	22[19.42,23.48]	16.63[14.14,18.52]
Fasting plasma glucose (mg/dl)	4.8[4.6,5.2]	5.1[4.8,5.4]	4.8[4.4,4.9]	5.3[4.5,5.3]
30 min plasma glucose (mg/dl)	8.1[7.2,9.1]	9.2[7.9,10.3]	8.1[7.3,9.5]	8.7[7.2,9.1]

120 min plasma glucose (mg/dl)	5.6[4.9,6.2]	5.3[4.9,6.7]	6.0[5.3,6.8]	5.1[4.3,5.5]
Fasting plasma insulin (pmol/l)	20.0[9.9,31.3]	16.2[9.0,20.9]	21.8[8.40,37.5]	19.6[8.3,29.3]
30 min plasma insulin (pmol/l)	163.5[109.9,202.8]	176.2[108.8,264.0]	138.1[115.3,213.5]	132.5[98.2,202.0]
120 min plasma insulin (pmol/l)	66.1[39.5,97.9]	45.0[22.7,104.9]	119.5[47.6,172.3]	33.3[30.1,61.6]
HOMA-B	65.3[44.75,89.1]	47.4[36.27,72.52]	72.25[46.83,85.57]	48.1[29.3,91.7]
HOMA S	199.35[130.7,388.1]	242.25[197.25,419.97]	192.3[115.05,361.2]	200.3[151.35,464.15]
(HOMA-B) * (HOMA-S)	132.33[102.11,175.87]	118.67[94.24,144.88]	129.25[98.25,167.65]	134[114.1,146.5]
Insulinogenic index	2.96[2.67,3.3]	2.91[2.65,3.36]	2.77[2.61,3.22]	2.93[2.44,3.19]
Matsuda index	46.8[32.78,67.31]	50.13[38.84,61.82]	53.53[25.41,72.58]	43.86[38.25,77.93]
(Insulinogenic Index) * (Matsuda Index)	6.8[6.47,7.11]	6.76[6.56,7.06]	6.72[6.27,6.94]	6.77[6.71,6.92]
2 YEARS				
Height (cm)	81.3[78.7,83.1]	80.2[77.8,81.4]	79.6[78.5,82.7]	78.9[78.1,80.7]
Weight (kg)	9.22[8.61,10.07]	8.69[8.05,9.54]	9.04[8.33,10.01]	8.64[8.41,9.38]
AT BIRTH				
Weight (kg)	2.55[2.34,2.8]	2.3[2.16,2.5]	2.75[2.5,2.9]	2.5[2.08,2.7]
Length (cm)	47.4[46.3,48.5]	46[45.2,47.95]	47.5[45.45,48.15]	45.8[44.95,46.5]
Head circumference (cm)	32.7[31.9,33.5]	32.2[31.35,33.1]	33.1[31.8,33.7]	32.2[30.75,32.5]

Supplementary Table 3: Associations of lifecourse measurements with IFG and IGT, each compared with NGT, at 18 years

	Males				Females			
	IFG (94)		IGT (13)		IFG (23)		IGT (23)	
	Beta	P-value	Beta	P-value	Beta	P-value	Beta	P-value
18 YEARS								
Height (cm)	-0.02	0.711	-0.075	0.17	-0.058	0.353	-0.002	0.972
BMI (kg/m ²)	0.102	0.061	0.096	0.079	-0.006	0.927	-0.038	0.537
Fat (%)	0.109	0.043	0.164	0.003	-0.053	0.396	0.049	0.437
Fasting plasma glucose (mg/dl)	0.729	<0.000	0.095	0.009	0.614	<0.000	0.068	0.163
30 min plasma glucose (mg/dl)	0.314	<0.000	0.208	<0.000	0.224	<0.000	0.255	<0.000
120 min plasma glucose (mg/dl)	0.205	<0.000	0.509	<0.000	0.143	0.004	0.563	<0.000
Fasting plasma insulin (pmol/l)	0.188	<0.000	0.137	0.011	0.029	0.64	0.086	0.168
30 min plasma insulin (pmol/l)	-0.013	0.812	0.078	0.156	-0.093	0.136	-0.023	0.719
120 min plasma insulin (pmol/l)	0.037	0.459	0.398	<0.000	0.08	0.173	0.34	<0.000
HOMA-B	-0.05	0.366	0.151	0.006	-0.225	<0.000	0.055	0.371
HOMA S	-0.235	<0.000	-0.175	0.001	-0.058	0.354	-0.089	0.153
(HOMA-B) * (HOMA-S)	-0.548	<0.000	-0.153	0.001	-0.418	<0.000	-0.108	0.064
Insulinogenic index	-0.194	<0.000	-0.084	0.119	-0.094	0.128	-0.142	0.022
Matsuda index	-0.199	<0.000	-0.262	<0.000	-0.103	0.09	-0.235	<0.000
(Insulinogenic Index) * (Matsuda Index)	-0.176	0.001	-0.177	0.001	-0.143	0.017	-0.255	<0.000

12 YEARS								
Height (cm)	-0.01	0.856	-0.134	0.015	-0.045	0.472	-0.075	0.233
BMI (kg/m ²)	0.064	0.249	-0.058	0.294	-0.007	0.915	-0.049	0.435
Fat (%)	0.029	0.608	0.126	0.028	-0.061	0.342	0.022	0.735
Fasting plasma glucose (mg/dl)	0.206	<0.000	-0.027	0.627	0.247	<0.000	0.201	0.001
Fasting plasma insulin (pmol/l)	0.003	0.951	-0.014	0.807	-0.067	0.286	-0.004	0.944
HOMA-B	-0.069	0.215	-0.005	0.926	-0.165	0.008	-0.084	0.172
HOMA S	-0.011	0.838	0.016	0.776	0.049	0.435	-0.008	0.901
(HOMA-B) * (HOMA-S)	-0.126	0.023	0.018	0.744	-0.129	0.037	-0.132	0.032
6 YEARS								
Height (cm)	0.036	0.519	-0.034	0.536	-0.137	0.027	-0.026	0.674
BMI (kg/m ²)	0.108	0.05	-0.089	0.106	-0.073	0.24	-0.072	0.243
Fat (%)	0.012	0.823	0.116	0.036	-0.106	0.088	0.046	0.456
Fasting plasma glucose (mg/dl)	0.184	<0.000	0.056	0.276	0.185	0.003	-0.007	0.114
30 min plasma glucose (mg/dl)	0.066	0.235	-0.005	0.932	0.151	0.015	-0.022	0.728
120 min plasma glucose (mg/dl)	0.088	0.11	0.057	0.301	-0.012	0.841	0.111	0.076
Fasting plasma insulin (pmol/l)	0.114	0.038	0.03	0.579	-0.057	0.361	-0.004	0.954
30 min plasma insulin (pmol/l)	0.079	0.149	-0.081	0.139	0.066	0.293	-0.039	0.534
120 min plasma insulin (pmol/l)	0.072	0.188	0.056	0.309	-0.15	0.015	0.114	0.064
HOMA-B	0.026	0.645	0.001	0.99	-0.122	0.052	0.008	0.133

HOMA S	-0.111	0.046	-0.032	0.564	0.042	0.508	-0.006	0.921
(HOMA-B) * (HOMA-S)	-0.18	0.001	-0.067	0.219	-0.073	0.245	-0.016	0.804
Insulinogenic index	0.083	0.134	-0.079	0.155	0.026	0.676	-0.014	0.823
Matsuda index	-0.154	0.005	-0.013	0.816	-0.001	0.993	0.024	0.699
(Insulinogenic Index) * (Matsuda Index)	-0.107	0.051	-0.11	0.046	0.037	0.549	-0.074	0.238
2 YEARS								
Height (cm)	-0.003	0.950	-0.083	0.132	-0.097	0.116	-0.088	0.154
Weight (kg)	0.009	0.874	-0.070	0.204	-0.153	0.013	-0.057	0.357
AT BIRTH								
Weight (kg)	-0.033	0.563	-0.048	0.399	-0.237	<0.000	0.081	0.196
Length (cm)	-0.021	0.708	-0.044	0.425	-0.155	0.012	-0.067	0.267
Head circumference (cm)	-0.097	0.08	-0.035	0.525	-0.148	0.017	0.022	0.722

Beta and p-values are generated using linear regression model with IFG and IGT as separate exposures, models are separately analysed for sex.

Supplementary Table S4: Methods for anthropometry and body composition measurements in children

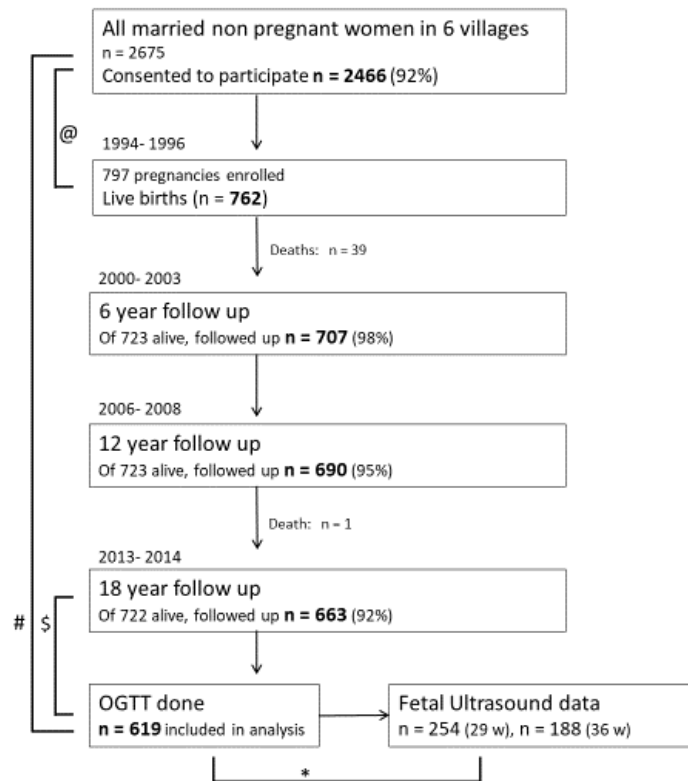
Anthropometry			
Measurement	Time point	Method	Least count
Weight	Within 72 hours of birth	Salter spring balance (Salter Abbey, Suffolk, U.K.)	Nearest 50 g
	6 monthly intervals up to 18 years	Electronic weighing scales (ATCO Healthcare Ltd, Mumbai, India)	Nearest 10 g
Crown heel length (Supine)	Within 72 hours of birth and 6 monthly upto 2 years	Portable Pedobaby Babymeter (ETS J.M.B., Brussels, Belgium)	Nearest 0.1 cm
Standing height	6 monthly intervals from 2- 5 years	Portable Harpenden stadiometer (Microtoise, CMS Instruments Ltd, London, UK)	Nearest 0.1 cm
	6 monthly intervals from 5-18 years	Wall-mounted stadiometer (Microtoise, CMS Instruments Ltd, London, UK)	Nearest 0.1 cm
Body composition by Dual Energy X-ray Absorptiometry (DXA)			
Total fat and lean mass; % body fat	6, 12 year follow up in children	Lunar DPX-IQ 240, Lunar Corporation, Madison, USA	NA
	18 year follow up	Lunar Prodigy, GE Healthcare, Madison, USA	NA

Supplementary Table S5: Quality assessments for glucose and insulin measurements in the Pune Maternal Nutrition Study (1993- 2013).

	1994-97	2000-02	2006-08	2013-14
Glucose measurement				
Method	GOD-POD	GOD-POD	GOD-POD	GOD-POD
Equipment	Spectrum; Abbott, Irving, TX	Spectrum; Abbott, Irving, TX	Alcyon; Abbott, Irving, TX	Hitachi 902, Roche Diagnostics GmbH, Germany
Centrifugation temperature	Room temperature	Room temperature	4°C	4°C
Processed on	Same day	Same day	Same day	Same day
Internal QC	Yes	Yes	Yes	Yes
Internal CV (%)	<3	<3	<3	<3
External QC	NA	NA	BioRad EQAS	BioRad EQAS
EQAS CV (%)	NA	NA	3.4	2.7
Insulin measurements				
Method	1-step chemiluminescent immunoenzymatic assay*	2 site fluoroimmunoassay	2 site fluoroimmunoassay	ELISA
Equipment	Access Immunoassay System (Sanofi Pasteur Diagnostics, Chaska, Minn)	Delfia technique	Delfia technique	Mercodia AB, SE-754 50 Uppsala, Sweden
Centrifugation temperature	Room temperature	Room temperature	4°C	4°C

Sensitivity	2.3 pM/L	3 pM/L	3 pM/L	6 pM/L
Calibrated against	WHO 1 st IRP (66/304)	WHO 1 st IRP (66/304)	WHO 1 st IRP (66/304)	WHO 1 st IRP (66/304)
Internal QC	Yes	Yes	Yes	Yes
Internal CV	NA	NA	7.7%.	6.7%
External QC	No	UKEQAS	UKEQAS	UKEQAS
External CV	NA	<20 pM/L: 8.9% 45-90 pM/L: 6.8%	<20 pM/L: 8.2% 20-45 pM/L: 6.9% >45 pM/L: 8.6%	<20 pM/L: 6.4% 20-45 pM/L: 7.6% >45 pM/L: 5.5%

GOD POD: Glucose oxidase peroxidase; QC: Quality control, CV: Coefficient of variation



Supplementary figure S1: STROBE flow diagram for the Pune Maternal Nutrition Study.

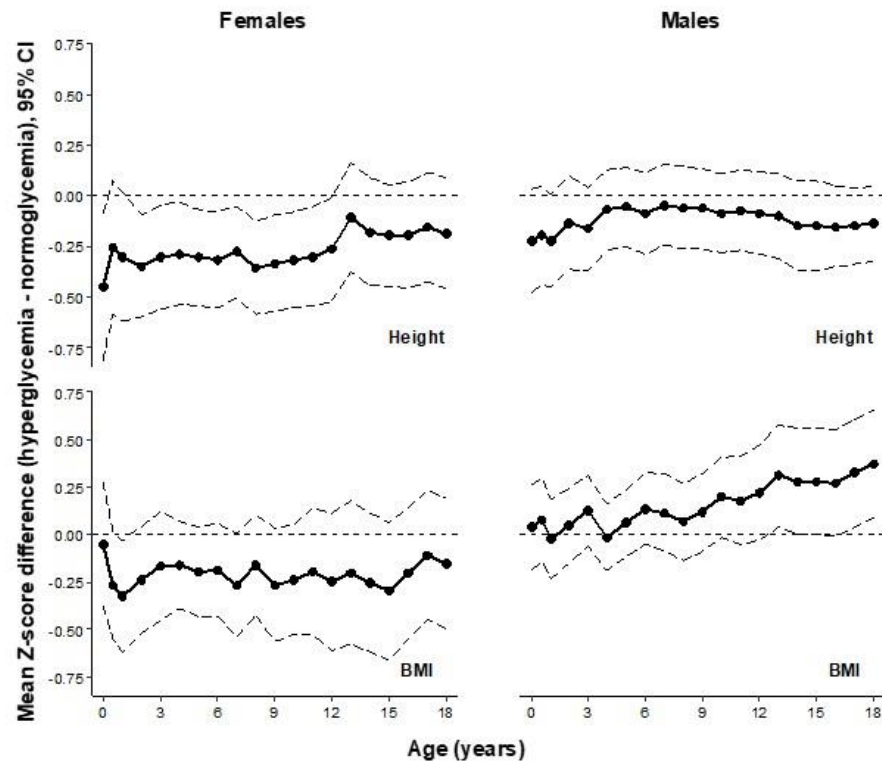
Legend:

@: The 797 pregnant F0 women included in the PMNS had similar education and height but were younger (20y vs 22y) and thinner (18.1 vs 18.4 kg/m²) compared to those excluded.

#: The mothers of the 619 participants who had an OGTT at 18 years were similar in height and education at baseline to the 1,847 of 2,466 women who did not become pregnant during the initial study and hence did not get enrolled in the PMNS, $p > 0.05$ for both.

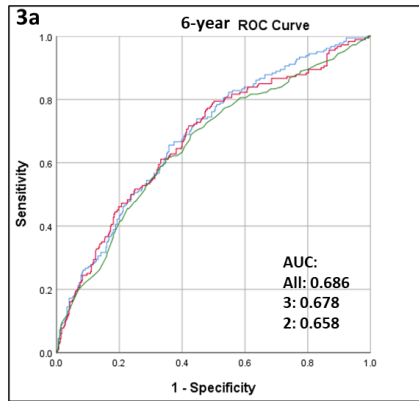
\$. The 619 participants who had an OGTT at 18 years were similar to the 103 who did not have an OGTT, in birth length and birth weight, $p > 0.05$ for both. Their parents were similar in socioeconomic status (SLI Median 27 in both, $p > 0.05$). OGTT: Oral Glucose Tolerance Test.

Supplementary figure S2: Comparative sizes across lifecourse of participants with glucose intolerance

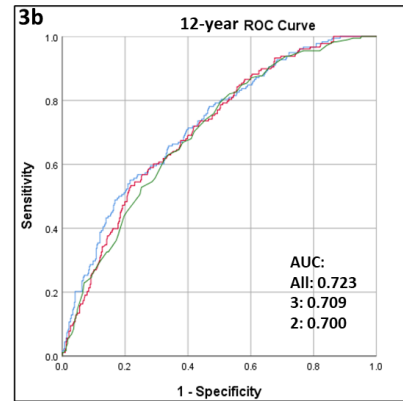


Plots show comparative size (height and BMI expressed as Z scores) of men and women with glucose intolerance at age 18 years relative to those with normal glucose tolerance (represented by the 0 line). Z scores were derived using the WHO growth reference. The dark line represents the median and the dashed lines represent 95% confidence intervals.

Supplementary figure S3: ROC curves showing the prediction of glucose intolerance at 18 years (outcome) by 6-year (5a) and 12-year (5b) fasting plasma glucose, and other predictors, in the PMNS cohort

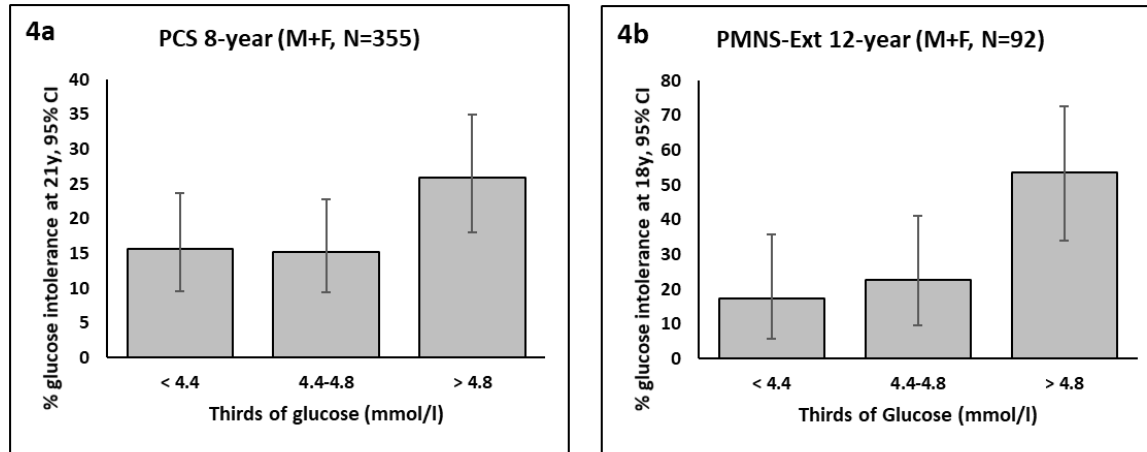


- All predictors: Parental glucose intolerance, underweight & overweight/obesity, birth length, fasting glucose at 6y, child's SLI, height & DXA fat % at 18y, and sex
- 3 predictors: Birth length, , fasting glucose at 6y and sex
- 2 predictors: fasting glucose at 6y and sex



- All predictors: Parental glucose intolerance, underweight & overweight/obesity, birth length, fasting glucose at 12y, child's SLI, height & DXA fat % at 18y, and sex
- 3 predictors: Birth length, , fasting glucose at 12y and sex
- 2 predictors: fasting glucose at 12y and sex

Supplementary figure S4: Glucose intolerance in the PCS and Extended PMNS cohorts



Figures 4a and 4b show the prevalence of glucose intolerance at 21y in the PCS and at 18y in the extended PMNS cohort according to thirds of fasting plasma glucose at 8y and 12y respectively.