

Describing differences in weight and length growth trajectories between White and Pakistani Infants in the UK: Analysis of the Born in Bradford birth cohort study using multilevel linear spline models

Supplementary Web tables

Table S1: Summary of measurements included in the growth models for 1434 White British and Pakistani infants

	Number of children with at least one measurement per growth period	Total number of measurements	% from health visitor records	Median (IQR) number of measurements per child
Weight				
Overall	1434	11432	55.8%	7 (6 to 9)
0-4 months	1265	3560	100.0%	2 (2 to 3)
4-9 months	1240	2581	58.1%	2 (1 to 2)
9-24 months	1316	3857	34.2%	3 (2 to 4)
Length*				
Overall	1372	5414	35.7%	4 (3 to 5)
0-4 months	725	860	100.0%	1 (1 to 1)
4-9 months	1125	1343	20.1%	1 (1 to 1)
9-24 months	1289	3211	25.1%	2 (2 to 3)

* Note: Length not routinely recorded at birth
IQR, interquartile range

Table S2: Comparing actual measurements with measurements predicted by the models for weight and length overall and for each ethnicity and sex group (unadjusted model)

Time period	Group	No. Measurements	Mean actual measurement (SD)	Mean difference (actual – predicted)	95% level of agreement	Residual SD*
Weight						
Birth (kg)	All	1434	3.22 (0.55)	0.023	-0.25 to 0.30	0.13
	White British boys	314	3.38 (0.59)	0.009	-0.30 to 0.32	0.13
	Pakistani boys	383	3.19 (0.52)	0.024	-0.23 to 0.28	0.12
	White British girls	328	3.26 (0.56)	0.030	-0.25 to 0.31	0.13
	Pakistani girls	409	3.08 (0.51)	0.026	-0.22 to 0.27	0.13
0-4 months (kg)	All	3560	4.50 (1.12)	-0.002	-0.30 to 0.30	0.17
	White British boys	906	4.81 (1.22)	0.006	-0.31 to 0.32	0.16
	Pakistani boys	830	4.48 (1.12)	0.0003	-0.30 to 0.30	0.16
	White British girls	927	4.51 (1.07)	-0.007	-0.33 to 0.32	0.19
	Pakistani girls	897	4.18 (0.98)	-0.007	-0.25 to 0.24	0.16
4-9 months (kg)	All	2581	7.83 (1.19)	-0.012	-0.34 to 0.31	0.12
	White British boys	658	8.19 (1.18)	-0.021	-0.34 to 0.30	0.11
	Pakistani boys	619	8.12 (1.20)	-0.019	-0.36 to 0.32	0.13
	White British girls	686	7.55 (1.13)	-0.002	-0.31 to 0.31	0.12
	Pakistani girls	618	7.46 (1.06)	-0.005	-0.34 to 0.33	0.13
9-24 months (kg)	All	3857	10.67 (1.83)	0.001	-0.55 to 0.55	0.09
	White British boys	780	11.08 (1.67)	0.003	-0.54 to 0.55	0.09
	Pakistani boys	1046	10.87 (1.91)	0.001	-0.59 to 0.59	0.10
	White British girls	880	10.39 (1.72)	-0.001	-0.52 to 0.52	0.09
	Pakistani girls	1151	10.44 (1.88)	-0.0003	-0.52 to 0.52	0.09
Length						
0-4 months (cm)	All	860	51.30 (3.44)	-0.050	-2.54 to 2.44	1.27
	White British boys	150	52.15 (4.18)	-0.067	-2.92 to 2.79	1.45
	Pakistani boys	214	51.37 (3.34)	-0.075	-2.70 to 2.55	1.25
	White British girls	220	51.16 (3.31)	-0.020	-2.68 to 2.64	1.44
	Pakistani girls	276	50.88 (3.09)	-0.044	-2.06 to 1.97	1.01
4-9 months (cm)	All	1343	69.24 (3.19)	0.053	-2.42 to 2.53	1.16
	White British boys	290	69.62 (3.08)	0.041	-2.33 to 2.41	1.12
	Pakistani boys	368	70.52 (3.08)	0.059	-2.60 to 2.71	1.18
	White British girls	315	67.61 (3.12)	0.043	-2.43 to 2.52	1.25
	Pakistani girls	370	69.07 (2.78)	0.064	-2.32 to 2.45	1.11
9-24 months (cm)	All	3211	80.15 (5.75)	-0.013	-2.78 to 2.76	1.12
	White British boys	665	80.83 (5.48)	-0.007	-2.63 to 2.62	1.06
	Pakistani boys	879	81.05 (5.79)	-0.008	-2.84 to 2.82	1.09
	White British girls	721	78.77 (5.70)	-0.019	-2.59 to 2.56	1.10
	Pakistani girls	946	79.87 (5.73)	-0.016	-2.99 to 2.95	1.20

*The residual SD is the SD of the level 1 residuals, i.e. measurement error, so greater residual SD represents worse model fit. The overall residual SD is 0.13 for weight and 1.15 for length.

Table S3: Predicted weight (kg) and length (cm) and 95% CIs for each ethnicity and sex group at each of the knot points (unadjusted model)

Age	Mean predicted weight/length (95%CI)			
	White British boys	Pakistani boys	White British girls	Pakistani girls
Weight (kg)				
Birth	3.30 (3.24, 3.37)	3.10 (3.04, 3.15)	3.16 (3.10, 3.22)	2.98 (2.93, 3.03)
4 months	7.21 (7.10, 7.32)	7.00 (6.90, 7.10)	6.48 (6.37, 6.58)	6.27 (6.17, 6.36)
9 months	9.31 (9.18, 9.43)	9.03 (8.92, 9.14)	8.69 (8.57, 8.81)	8.40 (8.29, 8.51)
24 months	12.63 (12.44, 12.82)	12.57 (12.40, 12.74)	11.93 (11.75, 12.11)	12.05 (11.89, 12.21)
Length (cm)				
Birth	48.85 (48.44, 49.26)	48.34 (48.00, 48.68)	48.35 (48.02, 48.67)	47.89 (47.58, 48.17)
4 months	64.41 (63.86, 64.97)	65.15 (64.61, 65.69)	62.52 (61.99, 63.05)	63.64 (63.12, 64.16)
9 months	72.48 (72.11, 72.85)	72.85 (72.52, 73.18)	70.67 (70.31, 71.03)	71.55 (71.23, 71.88)
24 months	86.41 (85.96, 86.87)	87.03 (86.62, 87.44)	84.75 (84.31, 85.20)	85.81 (85.41, 86.20)

Below is an example of the equation used to model the association between ethnicity (Pakistani versus White British) with weight growth in infants. Equivalent models were run for length, with and without adjustment for confounders

$$\begin{aligned} \text{weight}_{ij} = & (\beta_0 + u_{0j} + e_{0ij}) + (\beta_1 + u_{1j})(G1_{ij}) + (\beta_2 + u_{2j})(G2_{ij}) + (\beta_3 + u_{3j})(G3_{ij}) + (\beta_4 + e_{1ij})(\text{WhiteBritishFemales}_j) \\ & + \beta_5(\text{WhiteBritishFemales}_j * G1_{ij}) + \beta_6(\text{WhiteBritishFemales}_j * G2_{ij}) + \beta_7(\text{WhiteBritishFemales}_j * G3_{ij}) + \\ & (\beta_8 + e_{3ij})(\text{PakistaniMales}_j) + \beta_9(\text{PakistaniMales}_j * G1_{ij}) + \beta_{10}(\text{PakistaniMales}_j * G2_{ij}) + \\ & \beta_{11}(\text{PakistaniMales}_j * G3_{ij}) + (\beta_{12} + e_{2ij})(\text{PakistaniFemales}_j) + \beta_{13}(\text{PakistaniFemales}_j * G1_{ij}) + \\ & \beta_{14}(\text{PakistaniFemales}_j * G2_{ij}) + \beta_{16}(\text{PakistaniFemales}_j * G3_{ij}) + (\beta_{16} + e_{4ij})(\text{Source}_{ij}) + \beta_{17}(C_j) + \\ & \beta_{18}(C * G1_{ij}) + \beta_{19}(C * G2_{ij}) + \beta_{20}(C * G3_{ij}) + e_{5ij}(\text{agewk}_{ij}) \end{aligned}$$

Where, for individual j at measurement occasion i:

β_0 =average estimate of birth weight in kilograms in male White British children

β_1 to β_3 =average estimates of weight growth rates for the four periods of growth in kilograms per month in male White British children (G1=birth to 4 months, G2=4 to 9 months, G3=9 to 24 months)

β_4 =average difference in birth weight comparing female White British children with male White British children (WhiteBritishFemales is a dummy variable, coded 1 for female White British children, and 0 for all others)

β_5 to β_7 =average difference in growth rates comparing female White British children with male White British children

β_8 to β_{11} =average differences in birth weight and growth rates comparing male Pakistani children with male White British children (PakistaniMales is a dummy variable, coded 1 for male Pakistani children, and 0 for all others)

β_{12} to β_{15} =average differences in birth weight and growth rates comparing female Pakistani children with male White British children (PakistaniFemales is a dummy variable, coded 1 for female Pakistani children, and 0 for all others)

β_{16} is measurement source (coded 1 for health visitor measurements, 0 for research clinic measurements)

β_{17} is the association between C, representing a set of confounders, and birth weight

β_{18} – β_{20} is the association between C, representing a set of confounders, and growth rates

u=individual level random effects

e=occasion level random effects

agewk=age in weeks, which is fitted as a random-effect at the occasion level (i) in order to allow for the variance of weight to change with age