ORIGINAL ARTICLE

Relationship between Early Life Factors and Renal Function in Afro-Caribbean Young Adults: Analysis from the Jamaica 1986 Birth Cohort Study

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ABSTRACT

Objective: *To investigate the relationship between intrauterine growth and renal function among Jamaican young adults.*

Methods: *Data from 744 participants from the Jamaica 1986 Birth Cohort Study were analysed. We evaluated the relationship between infant characteristics (birthweight and gestational age), maternal characteristics at child's birth (age and socio-economic status), and renal function at ages 18–20 years (using estimated glomerular filtration rate (eGFR), calculated using the Schwartz-Lyon equation and urine albumin excretion), or prevalent chronic kidney disease (CKD; defined as eGFR < 60 ml/minute/1.73 m^2 or urinary albumin ≥ 30 mg/g creatinine). Associations were examined using multi-level mixed effects regression models.*

Results: *The mean eGFR was 86.3 ml/minute/1.73 m^2 among males and 102.4 ml/minute/1.73 m^2 among females (*p *< 0.001). The prevalence of CKD was 8.3% (7.4% males, 9.1% females,* p *= 0.387). Birthweight was not significantly associated with eGFR in unadjusted models, but after adjustment for potential confounders/mediators (gender, blood pressure, body mass index, maternal occupation and education), individuals born with a low birthweight (< 2.5 kg) had a 5.1% lower eGFR compared to those with a normal birthweight (ß = -0.052,* p *= 0.002). Furthermore, a one standard deviation increase in birthweight was associated with a 2.2% increase in eGFR (ß = 0.022,* p *= 0.044). No statistically significant associations were observed between early life factors and urinary albumin or CKD in adjusted models.*

Conclusion: *There was a high prevalence of CKD in this Afro-Caribbean young population. Lower birthweight was associated with reduced renal function in early adulthood, which may result in an increased risk of CKD later on in adulthood. Early life interventions may also be warranted in addressing the CKD epidemic.*

Keywords: Birthweight, Caribbean, chronic kidney disease, estimated glomerular filtration rate, intrauterine growth, Jamaica, urinary albumin

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Relación entre los factores de los primeros años de vida y la función renal en adultos jóvenes afrocaribeños: análisis del Estudio de Cohorte de Nacimientos de Jamaica en 1986

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RESUMEN

Objetivo: *Investigar la relación entre el crecimiento intrauterino y la función renal entre los adultos jóvenes jamaicanos.*

Métodos: *Se analizaron los datos de 744 participantes en el Estudio de Cohorte de Nacimientos de Jamaica en 1986. Se evaluó la relación entre las características infantiles (peso al nacer y edad gestacional), las características maternas a la hora del nacimiento del niño (edad y estado socioeconómico), y la función renal a la edad de 18 a 20 años (utilizando la tasa de filtración glomerular estimada (TFGe), calculada usando la ecuación Schwartz-Lyon y la excreción de albúmina urinaria), o la enfermedad renal crónica prevalente (ERC; definida como TFGe < 60 ml/min/1.73 m² o albúmina urinaria ≥ 30 mg/g creatinina). Las asociaciones se examinaron mediante modelos multinivel de regresión de efectos mixtos.*

Resultados: *El TFGe fue de 86.3 ml/min/1.73 m² entre los varones y 102.4 ml/min/1.73 m² entre las mujeres (*p *< 0.001). La prevalencia de ERC fue 8.3% (7.4% varones, 9.1% hembras,* p *= 0.387). El peso al nacer no se asoció significativamente con la TFGe en los modelos no ajustados, pero después de ajustar los factores de confusión/mediación potenciales (género, presión sanguínea, índice de masa corporal, ocupación y educación materna), los individuos con bajo peso al nacer (< 2.5 kg) tenían un TFGe 5.1% más bajo en comparación con aquellos con un peso normal al nacer (ß = -0.052,* p *= 0.002). Además, un aumento de la desviación estándar en el peso al nacer estuvo asociado con un aumento de 2.2% en TFGe (ß = 0.022,* p *= 0.044). No se observaron asociaciones estadísticamente significativas entre los factores de los primeros años de vida y la albúmina urinaria o ERC en los modelos ajustados.*

Conclusión: *Hubo una alta prevalencia de ERC en esta población de jóvenes afrocaribeños. Un peso más bajo al nacer estuvo asociado con una reducción de la función renal en la edad adulta temprana, lo que puede llevar a un mayor riesgo de ERC más tarde en la edad adulta. Las intervenciones en los primeros años de vida también pueden explicarse al abordar la epidemia de ERC.*

Palabras clave: Peso al nacer, caribeño, enfermedad renal crónica, tasa de filtración glomerular estimada, crecimiento intrauterino, Jamaica, albúmina urinaria

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INTRODUCTION

The burden of chronic kidney disease (CKD) has been increasing steadily (1, 2). Globally, the number of deaths from kidney disease rose by 83% between 1990 and 2010, and the worldwide prevalence of CKD was estimated to be between 8% and 16% (2, 3). This high burden of CKD is likely to impact negatively on healthcare systems and result in more persons requiring renal replacement therapy in the future (1, 2). An improved understanding of the risk factors and antecedents for CKD will help in the development of interventions to address this emerging challenge to public health.

Early life factors may contribute to the development of CKD in later life (3). This was first hypothesized by Brenner *et al* who suggested that an insult during the fetal stage of life might result in adult

renal diseases later on in the life course (4). Proposed pathophysiological pathways suggested that the final endowment of nephrons in the kidney during early life was dependent on the intrauterine environment and gestational age at birth (4). Reductions in nephron numbers due to intrauterine growth restriction (IUGR) have been shown to result in continued impairment of renal function or progressive reduction in the glomerular filtration rate (GFR), which has been shown to lead to the development of glomerular hypertension and damage, resulting in CKD (5). Longitudinal studies conducted in metropolitan populations have shown that children who were born with a low birthweight had an increased risk of developing early renal disease during adolescence and adulthood (6, 7). It has been suggested that individuals born very prematurely, before the 36th week of gestation, tend to have less glomeruli at birth than individuals who are less preterm. A study conducted in a European population by Keijzer-Veen *et al* found an association between IUGR and renal function whereby individuals aged 19 years who were born prematurely were at an increased risk for progressive impairment of renal function, possibly leading to the development of renal failure later on in the life course (6).

While this hypothesis has been supported by studies conducted in diverse populations (8, 9), there are limited data from developing countries or in populations of African descent (10–12). Additionally, it has also been suggested that the development of CKD later on in life may also be as a result of confounding due to low maternal socio-economic status (SES) at child's birth and the presence of concurrent cardiovascular risk factors (3, 4). Studies which include data on early life SES would therefore be of value in clarifying these relationships.

In the Caribbean, the incidence of and mortality from adult renal disease have been rising annually (13). This has resulted in an increased demand for renal replacement therapy throughout the region, leading to notable economic and social costs to individuals and health systems in the Caribbean (13). To date, no study has evaluated the relationship between early life factors and renal function or CKD in the Caribbean and whether any associations were explained by their current cardiovascular risk factor status. This paper investigated the relationship between intrauterine growth and renal function among Jamaican young adults aged 18–20 years using data from the Jamaica 1986 Birth Cohort Study.

SUBJECTS AND METHODS

Participants and recruitment

A longitudinal analysis of data from the Jamaica 1986 Birth Cohort Study was conducted (14). Participants were a subset of the Jamaica Perinatal Mortality Survey (15) born in September or October 1986 and had been re-evaluated at ages 11–12 years, 15–16 years and 18–20 years. For this analysis, we included only participants who were seen at the follow-up at ages 18–20 years and had available data on renal function at their most recent visit. Renal function assessment was not available from previous evaluation. Ethical approval for this study was granted by The University of the West Indies Ethics Committee. Written informed consent was obtained from each participant prior to enrolment in the study.

Measurement

Growth measurements (gestational age, birthweight and birth length) were obtained from hospital records of the infants soon after their birth. Participant birthweights were categorized using the international reference categories by the World Health Organization (16). Gestational age was calculated as the number of weeks from the date of last menstrual period to the date of birth of the child. Data on maternal height and age were obtained from medical records at child's birth, while data on maternal SES (education and occupation) were obtained by questionnaires administered shortly after child's birth.

At the follow-up at ages 18–20 years, blood pressure was measured using a standardized protocol developed for the International Collaborative Study of Hypertension in Blacks (17). Height was measured using a portable stadiometer and weight measured using a portable digital scale (calibrated daily). An interviewer-administered questionnaire was conducted to obtain demographic data, SES, smoking status and family medical history. Fasting blood samples were obtained from each participant in plain fluoridated and heparinized tubes by research nurses. Within three hours of collection, each sample was processed and stored appropriately at the laboratory of the Tropical Medicine Research Institute (now called the Caribbean Institute for Health Research). Serum creatinine was measured on the Alcyon 300 Chemistry Analyser (Abbott) using Jaffe's reaction, while microalbumin was measured using a chemiluminescent immunoassay method, utilizing the Immulite Immunoassay system (Siemens). Analyses on all assays were conducted using standard quality control methods.

Renal function outcome

Estimated glomerular filtration rate (eGFR) was calculated using the Schwartz-Lyon equation: eGFR = k x height / PCr where k = 37 for males aged > 13 years, k = 33 for others (males aged < 13 years and all females), PCr = plasma creatinine measured in mg/dL (creatinine in µmol/L was converted to mg/dL by dividing µmol/L by 88.4) (18). This equation has been shown to be the most reliable formula when used with young adults (19, 20). Urinary albumin and creatinine were used to calculate the albumin to creatinine ratio (ACR), and candidates were classified as having albuminuria if the ACR was ≥ 30 mg/g. Chronic kidney disease was defined using the 2012 Kidney Disease Improving Global Outcomes (KDIGO) guidelines as either eGFR < 60 ml/minute/1.73 m^2 or presence of albuminuria (21).

Statistical analysis

Analyses were limited to participants who were singleton births with complete data on birthweight, eGFR and urinary albumin as these were the main outcome and explanatory variables. Descriptive statistics were obtained for continuous and categorical variables. The data were stratified by gender categories to test for gender differences in characteristics. Differences in means were assessed using independent sample t-tests, while differences in proportions were assessed using Chi-square analysis. There was no evidence of interaction by gender or prematurity (< 37 gestational weeks) between males and females on the renal outcomes. Urinary albumin and eGFR were transformed to their logarithm form for multivariable analysis due to significant deviations from their normal distributions. Multi-level modelling using the participants' place of birth (hospital or other facilities) as the group variable was performed for all multivariable analyses using linear and logistic regression models. These models were designed to identify independent predictors of outcomes while controlling for confounding variables at the time of assessment of the renal function, including systolic and diastolic blood pressures, age, gender, triglycerides, high-density lipoprotein cholesterol, body mass index (BMI) and maternal SES. For these models, birthweight was entered as internally derived z-scores or dichotomized as low birthweight (< 2.5 kg) or normal birthweight. Missing data were handled using multiple imputations utilizing chained equations, and estimates were combined using Rubin's rules (22). Data analysis was performed using STATA 13.1 (Stata Corp, College Station Texas).

RESULTS

Maternal and participant characteristics at child's birth

Maternal and participant characteristics at child's birth are shown in Table 1. Males had a significantly higher birthweight and length compared to females. However, there was no statistically significant gender difference in terms of gestational age at birth, maternal age and proportion of low birthweight. There were no statistically significant gender differences in maternal education levels, but a higher proportion of females had mothers who had skilled or highly skilled occupations at the time of their birth.

Table 1: Participant and maternal characteristics at child's birth

Characteristics	Male (n = 339)	Female (n = 405)	*p*-value
Participants			
Birthweight (kg)	3.16 ± 0.6	3.02 ± 0.5	< 0.001
Birth length (cm)	49.43 ± 4.2	48.81 ± 4.0	0.012
Gestational age (weeks)	38.57 ± 2.8	38.59 ± 2.5	0.527
Low birthweight (< 2.5 kg)	36 (10.6%)	51 (12.6%)	0.402
Mothers			
Age at child's birth (years)	24.83 ± 6.2	25.40 ± 6.3	0.181
Occupation (n, %)			
Skilled	86 (27.0)	131 (34.3)	0.038
Semi/un-skilled	46 (14.5)	67 (17.5)	0.268
Unemployed	99 (31.1)	100 (26.2)	0.150
Housewife	87 (27.4)	84 (22.0)	0.102
Education (n, %)			
Primary/less	193 (27.0)	105 (26.7)	0.918
Secondary	193 (59.2)	221 (56.1)	0.401
Tertiary	45 (13.8)	68 (17.3)	0.201

Values are means ± standard deviation or number (%) where appropriate.

Participants' characteristics at ages 18–20 years

Table 2 presents data of the participants' physiologic and biochemical characteristics by gender groups. Males had significantly higher systolic and diastolic blood pressures, fasting blood glucose, triglycerides and creatinine, while females had higher high-density lipoprotein cholesterol and urinary albumin excretion rate. Statistically significant gender differences were observed for eGFR, with males having a lower mean eGFR of 86.3 ml/minute/1.73 m^2 compared to 102.4 ml/minute/1.73m^2 for females ($p < 0.001$). A significantly greater proportion of males had eGFR less than 60 ml/minute/1.73 m^2 (3.5% *vs* 0.2%, $p = 0.002$). On the other hand, more females had albuminuria (8.9% *vs* 4.7%, $p = 0.023$). The overall prevalence of CKD was 8.3% (95% confidence level:

Table 2: Demographic, physiologic and biochemical characteristics of study participants at ages 18–20 years

	Male (n = 339)	Female (n = 405)	*p*-value
	Mean ± SD	Mean ± SD	
Age (years)	18.8 ± 0.6	18.7 ± 0.6	0.114
Body mass index (kg/m^2)	22.6 ± 4.2	23.3 ± 5.6	0.907
Systolic blood pressure (mmHg)	114.1 ± 10.4	107.6 ± 9.0	< 0.001
Diastolic blood pressure (mmHg)	69.3 ± 9.9	67.1 ± 9.4	0.001
Fasting blood glucose (mmol)	4.7 ± 0.6	4.4 ± 0.4	< 0.001
High-density lipoprotein cholesterol (mmol)	1.2 ± 0.2	1.3 ± 0.3	< 0.001
Triglycerides (mmol)	0.61 ± 0.27	0.56 ± 0.25	0.016
Creatinine (μmol/L)	79.9 ± 15.9	56.3 ± 13.7	< 0.001
Urinary albumin (mg/g creatinine)	3.7 (2.5–7.1)	4.5 (2.5–10.6)	0.006
Estimated glomerular filtration rate* (eGFR, ml/minute/1.73 m^2)	86.3 ± 24.9	102.4 ± 29.2	< 0.001
	n (%)	n (%)	
Reduced eGFR (< 60 ml/minute/1.73 m^2)	12 (3.5)	1 (0.2)	0.002
Albuminuria (n, %)	16 (4.7)	36 (8.9)	0.023
Chronic kidney disease**	25 (7.4)	37 (9.1)	0.387
Education			
Primary	49 (14.5)	29 (7.2)	0.002
Secondary	248 (73.2)	281 (69.4)	0.257
Tertiary	42 (12.4)	95 (23.5)	< 0.001

Values are means ± standard deviation or number (%) where appropriate. For urinary albumin, values are median (interquartile range).
* Calculated using the Schwartz-Lyon equation.
** Defined as eGFR < 60 ml/minute/1.73 m^2 or presence of proteinuria.

6.6%, 10.6%) and was higher in females compared to males (9.1% *vs* 7.4%, $p = 0.387$).

Bivariable and multivariable analyses

Table 3 describes associations between renal function and early life factors of participants using bivariable and multivariable analyses. Multivariable models with log eGFR as the outcome were adjusted for confounders including gender, age, level of education of participant at last follow-up, BMI, systolic and diastolic blood pressures, high-density lipoprotein cholesterol, triglycerides, and maternal occupation and education at child's birth. Our analyses showed that individuals who were born with a low birthweight (< 2.5 kg) had, on average, a 5.1% lower eGFR compared to those with a normal birthweight ($\beta = -0.052$, $p = 0.002$). When the models were rerun with birthweight entered as internally derived z-scores, a one standard deviation increase in birthweight was associated with an increase in eGFR by 2.2% ($\beta = 0.022$, $p = 0.044$). Multivariable models with log-transformed urinary albumin excretion rate as the outcome showed no statistically significant associations with early life factors.

Table 4 presents the relationship between early life factors and the presence of CKD. Unadjusted analysis revealed that participants born with a low birthweight had an increased odds of developing CKD (odds ratio: 3.6; $p < 0.001$). Additionally, a one standard deviation increase in birthweight was associated with a statistically significantly lower odds of developing CKD (odds ratio: 0.67; $p < 0.001$). However, after controlling for confounding covariates including gender, age of participant at last follow-up, systolic and diastolic blood pressures, fasting blood glucose and BMI, these associations were attenuated and were no longer statistically significant.

DISCUSSION

We found a high prevalence of CKD (8.3%) among young adults in Jamaica and that eGFR was associated with birthweight. A one standard deviation increase (approximately 550 g) in birthweight was associated with a 2.2% increase in eGFR. Additionally, participants with a low birthweight were found to have a 5.1% reduction in eGFR. Urinary albumin and the presence of CKD were not associated with the early life factors examined in this study. We are unaware of any other studies examining the relationship between early life factors and renal function in the Caribbean.

Our findings suggest that persons who were born with a higher birthweight may have an advantage when it comes to the risk of CKD later in life as they enter adulthood with a higher eGFR. These results are similar to findings from studies conducted in other black young adult populations and in Europe, which have reported associations between lower birthweight and eGFR (11, 23–25). A study conducted by Cassidy-Bushrow *et al* found that lower birthweights among an African-American population were associated with impairment of renal function (23). Furthermore, in a cohort of young adults aged 19 years from The Netherlands, it was found that lower birthweights were associated with higher serum creatinine levels and lower eGFR (5).

The association showing that longer gestational age resulting in a reduction in eGFR was an unexpected finding in our study. Studies conducted in populations of similar ages have shown that prematurity, and not increased gestational age, was associated with a reduced eGFR (26, 27). This suggests that the finding in our study may be due to chance and should be interpreted with caution.

Table 3: Multi-level linear regression models for early life factors, estimated glomerular filtration rate and urinary albumin

	Regression coefficient (β)	Exponential of β	Percentage change (%)	*p*-value
Outcome – log estimated glomerular filtration rate (eGFR)				
Bivariable analysis				
Low birthweight (< 2.5 kg)	-0.022	0.978	-2.18	0.116
Birthweight z-score	-0.002	0.998	-0.2	0.610
Birth length (cm)	0.003	1.003	0.33	0.001
Gestational age (weeks)	-0.001	0.1	-0.12	0.750
Multivariable model 1*				
Low birthweight (< 2.5 kg)	-0.052	0.949	-5.06	0.002
Birth length (cm)	0.003	1.003	0.29	0.057
Gestational age (weeks)	-0.007	0.993	-0.742	0.042
Multivariable model 2**				
Birthweight z-score	0.022	1.022	2.23	0.044
Birth length (cm)	0.002	1.002	0.16	0.522
Gestational age (weeks)	-0.008	0.992	-0.83	0.033
Outcome – log albumin				
Bivariable analysis				
Low birthweight (< 2.5 kg)	-0.012	0.99	-1.19	0.839
Birthweight z-score	0.018	1.018	1.81	0.329
Birth length (cm)	0.001	-0.095	0.92	0.840
Gestational age (weeks)	0.011	1.011	1.14	0.451
Multivariable model 1*				
Low birthweight (< 2.5 kg)	0.137	1.146	14.63	0.498
Birth length (cm)	-0.001	0.999	-0.12	0.852
Gestational age (weeks)	0.020	1.020	1.97	0.092
Multivariable model 2**				
Birthweight z-score	-0.083	0.921	-7.93	0.088
Birth length (cm)	0.004	1.004	0.45	0.680
Gestational age (weeks)	0.025	1.026	2.58	0.149

* Model 1: low birthweight as explanatory variable controlling for birth length, gestational age, gender, age and level of education of participant at last follow-up, body mass index, systolic and diastolic blood pressures, high-density lipoprotein cholesterol, triglycerides and maternal occupation and education at child's birth.

** Model 2: birthweight z-score as explanatory variable controlling for birth length, gestational age, gender, age of participant at last follow-up, body mass index, systolic and diastolic blood pressures and triglycerides.

Note (models for log eGFR): bivariable analysis of confounders showed significant associations ($p < 0.05$) among log eGFR, blood pressure and triglycerides.

Note (models for log albumin): univariable analysis of confounders showed significant associations ($p < 0.05$) among log albumin, diastolic blood pressure and body mass index. Maternal socio-economic status was removed from model 2 as this confounder did not add anything to the model.

We observed a statistically non-significant inverse association between higher birthweight z-scores and urinary albumin levels. Gestational age also had a weak non-significant association with urinary albumin in this population. This finding is consistent with the work of Silverwood *et al* who reported a weak association between birthweight and albuminuria (25). It has been suggested that IUGR is associated with a higher risk of microalbuminuria during infancy; however, the longitudinal effects up to early adulthood in individuals of African descent have not yet been conducted (28).

In our regression model, bivariable analysis showed higher birthweights to be strongly associated with lower odds of developing CKD. However, when controlled for covariates in multivariable analysis, this association was severely attenuated. A longer gestational age increased the risk of developing CKD, though this was weak and not statistically significant. Several studies that examined the impact of birthweight on CKD development have reported similar effects between gestational age and risk of developing CKD (29, 30). The weak associations found between early life factors and CKD may

Table 4: Multi-level logistic regression models for early life factors and presence of chronic kidney disease

Outcome – chronic kidney disease	Odds ratio	95% confidence level	*p*-value
Bivariable analysis			
Birthweight z-score	0.67	0.58, 0.78	< 0.001
Low birthweight (< 2.5 kg)	3.57	2.41, 5.28	< 0.001
Birth length (cm)	0.88	0.85, 0.92	< 0.001
Gestational age (weeks)	1.03	0.92, 1.15	0.587
Multivariable model 1*			
Low birthweight (< 2.5 kg)	1.59	0.67, 3.77	0.292
Birth length (cm)	1.01	0.94, 1.09	0.741
Gestational age (weeks)	1.07	0.94, 1.22	0.300
Multivariable model 2**			
Birthweight z-score	0.78	0.55, 1.12	0.177
Birth length (cm)	1.03	0.94, 1.11	0.497
Gestational age (weeks)	1.09	0.95, 1.25	0.231

* Model 1: low birthweight as explanatory variable controlling for birth length, gestational age, gender, age of participant at last follow-up at ages 18–20 years, systolic and diastolic blood pressures, fasting blood glucose, body mass index and total cholesterol.

** Model 2: birthweight z-score as explanatory variable controlling for birth length, gestational age, gender, age of participant at last follow-up at ages 18–20 years, systolic and diastolic blood pressures, fasting blood glucose and body mass index.

Note: maternal socio-economic status was removed from model 2 as this confounder did not add anything to the model.

be due to the small number of persons who were found to have CKD in the sample and the fact that the participants of this study were of a relatively young age, thereby reducing the probability of CKD development. Based on the results of our models, we speculate that the covariates which acted as mediators and possibly influenced the relationship between early life factors and renal function were BMI, high-density lipoprotein cholesterol and triglycerides. Further research is needed to explore the effect of these mediators on the long-term impact of renal function in this cohort.

Overall, the high prevalence of CKD (8.3%) among this age group was an unexpected finding compared to prevalence estimates reported in Westernized populations (23). This suggests that the burden of CKD in Jamaica and countries with similar data may rise in the future, especially in light of the increasing prevalence of chronic non-communicable diseases and their risk factors in the Caribbean region. Further studies are needed to corroborate these findings and to inform appropriate interventions in addressing this epidemic.

This study had several strengths. Data were collected prospectively, thereby providing a clear temporal relationship for the association between early life exposures and renal function outcomes. Potential confounders as determined from previously published literature identifying participant and maternal SES, anthropometrics, physiologic and biochemical measures (9) were included in the analysis. The inclusion of all births over a two-month period during the initial recruitment stages of the cohort was an additional strength to this study. Additionally, the use of multiple imputations in accounting for missing data for exposure and confounding variables allowed for a greater sample of participants to be analysed. The variables used for imputations were predictive enough to suggest that the data for confounding variables were missing at random. Similar findings were seen in the multivariable regression models with and without imputed variables, thus adding to the plausibility of our findings.

Our study had limitations which should be considered when interpreting the results obtained. There was some loss to follow-up at each follow-up period from the commencement of the study. However, participants at the follow-up at ages 18–20 years were generally similar to the original study population, except that there was a higher proportion of females and persons in higher SES (14). Additionally, there were some significant differences in the participants with complete data on renal outcomes and birth data and those with missing data at the follow-up at ages 18–20 years, which may have attenuated or amplified the association between birthweight and renal function outcomes. Another limitation is that the population which was studied was of a young age, limiting the probability of finding individuals with impaired renal function at such a young age. We also acknowledge that renal function was assessed at a single time point; hence, the definition of CKD using low GFR and kidney damage for a period of three months continuously was not applied in our study.

In conclusion, there was an association between birthweight and eGFR in Afro-Caribbean young adults. Our findings are consistent with the hypothesis that a lower birthweight, presumably as a result of fetal undernutrition or immaturity, may cause structural changes to the kidneys resulting in an increased risk of impairment of renal function and associated complications later in the life course. This study adds to the existing body of knowledge on the aetiology of CKD in the Caribbean. Early implementation of interventions in this population through lifestyle and diet modifications may help in reducing the potentially adverse outcomes of renal-related diseases in Jamaica and the wider Caribbean region. Improved maternal and child care with the directive of reducing the incidence of low birthweights are

additional possible interventions to aid in reducing the risk of developing CKD later in life.

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