

**Adolescent Kingston girls' school achievement:
nutrition, health and social factors**

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**Les résultats scolaires des jeunes adolescentes de Kingston:
rôle de la nutrition, de l'état de santé et des données sociales**

RÉSUMÉ

Dans de nombreux pays en développement on a peu d'information sur l'état nutritionnel des adolescents et sur la manière dont celui-ci peut affecter leurs résultats scolaires. Nous avons étudié l'état nutritionnel et les comportements liés à la santé chez des adolescentes de familles à faibles revenus de Kingston, Jamaïque. Nous avons ensuite déterminé les relations entre ces variables et les résultats scolaires, ainsi que l'abandon scolaire. L'échantillon comprenait 452 filles de 13–14 ans, choisies, par randomisation parmi celles de toutes les 8èmes classes éligibles (la 4ème en France) de la ville de Kingston. Ont été mesurés la taille des enfants, leur poids, et le pli cutané du triceps et du sous-scapulaire; on a calculé leur taille pour âge et l'indice de masse corporelle (BMI). Le statut en fer a été évalué en dosant l'hémoglobine, la ferritine sérique et la protoporphyrine des érythrocytes libres, et un questionnaire a été administré pour obtenir des informations sur les comportements liés à la santé, les expériences de faim et le contexte social. Les résultats scolaires des enfants ont été évalués par le Wide Range Achievement Test.

La taille et le BMI des filles étaient semblables à ceux de la population de référence américaine; cependant le pli cutané était plus petit, même si on le comparait aux données concernant les noirs seulement. La faim sur de courtes périodes était un problème pour un certain nombre de ces enfants, ainsi 33% allaient se coucher en ayant faim, et 36% venaient à l'école sans avoir pris de petit-déjeuner au moins une fois par semaine. Seize pour cent de ces filles étaient anémiées (Hb <115 g/l), et 17% avaient des niveaux de ferrine bas. Le déroulement de la menstruation était associé au statut en fer.

Au moment de l'entretien quatre-vingt-dix filles (20%) ont déclaré avoir eu des relations sexuelles. Un contexte de violence à la maison, à l'école et dans la communauté, et des châtiments corporels par les parents et les professeurs étaient courants. Trente-sept pour cent des filles avaient été impliquées dans des bagarres au cours de l'année scolaire.

Bien que ces filles aient été en 8ème classe, la moyenne de leurs résultats scolaires n'était que de 5.1 (ET 2.1). La taille pour âge, l'hémoglobine et la faim étaient corrélées avec les résultats scolaires. Dans les analyses à régression multiple plusieurs variables sociales et de comportement étaient associées avec les résultats scolaires. Dans résultats meilleurs étaient associés avec la possession de matériel scolaire (stylos ou crayons, cahiers et manuels scolaires), un indice de stimulation de la lecture (livres à la maison autres que des manuels scolaires, journaux et utilisation de bibliothèques), et la

participation à des activités de groupe telles que le sport, le théâtre ou les activités paroissiales. Les filles qui avaient davantage de tâches ménagères à accomplir avant l'école, qui étaient déjà sexuellement actives ou qui étaient plus agressives avaient des résultats scolaires plus faibles. Après le contrôle de toutes ces variables, l'anémie était encore associée significativement avec les résultats.

A la fin de la 9^{ème} classe cinquante filles avaient abandonné l'école. Une régression logistique multiple a servi à déterminer les facteurs de risque pour l'abandon scolaire. L'absentéisme fréquent en 8^{ème} classe, l'activité sexuelle précoce et le fait de ne pas vivre avec ses deux parents prédisaient l'abandon scolaire.

En conclusion, l'anémie et la faim étaient des problèmes nutritionnels significatifs chez les adolescentes de Kingston. L'anémie contribuait à des résultats scolaires faibles; cependant, il est possible que les facteurs sociaux et de comportement soient des déterminants encore plus importants des résultats scolaires dans l'adolescence. Une évaluation de stratégies pour réduire le niveau d'anémie dans cette population, pour améliorer l'éducation sexuelle et pour réduire les châtiments corporels est nécessaire, elle pourrait avoir un retentissement favorable sur les résultats scolaires.

In many developing countries there is little information on the nutritional status of adolescents. In general, research in this area has been neglected and attention focused on younger children who are most vulnerable to malnutrition. However, adolescence is a period of rapid growth and nutritional deficiencies may occur. In particular with menarche, Fe deficiency may be a problem among adolescent girls (Brabin & Brabin, 1992).

Poor levels of school achievement are a major problem in developing countries. Many social factors may affect school achievement, including parental attitudes to education, and the educational and occupational levels of the parents (Wagner *et al.* 1985). School characteristics such as teachers' training and availability of textbooks are also important (Schiefelbein & Simmons, 1979; Fuller, 1987). There is increasing recognition, however, that health and nutrition may contribute to poor school performance, either through effects on attendance, or by affecting children's ability to learn through poor attention and cognitive function (Pollitt, 1990).

Health and nutrition variables have been included in some studies of the determinants of school performance among primary-school children in developing countries. After controlling for socio-economic factors, height-for-age was associated with achievement in several studies (Mooch & Leslie, 1986; Agarwal *et al.* 1987; Florencio, 1988; Clarke *et al.* 1991) and weight-for-height was associated with achievement in one study (Popkin & Lim-Ybanez, 1982). Anaemia and missing breakfast or feeling hungry, also, have been reported to affect school performance (Popkin & Lim-Ybanez, 1982; Florencio, 1988; Clarke *et al.* 1991). Most of the children in these studies were of primary-school age and there is relatively little information on the extent to which health and nutrition affect achievement in adolescents.

THE KINGSTON STUDY

This study was conducted to assess the nutritional status and health-related behaviours of adolescent girls in Kingston, Jamaica, and to determine whether they were related to

school achievement, attendance and drop-out. Nine schools were identified in inner-city Kingston which had at least forty girls enrolled in grade 8. There were 1061 girls in grade 8 who were aged 13–14 years, and who had attended school in September and October of that school year, that were eligible for the study. A group of 452 girls were selected by proportionate random sampling of all nine schools.

The children's school achievement was measured with the Wide Range Achievement Test (WRAT; Jastak & Bijou, 1946). This test consists of three sections: spelling, reading and arithmetic. Scores on the test were converted to grade levels. Attendance records were collected for the current and subsequent school years (grades 8 and 9) and all girls who dropped out of school up to the end of grade 9 were identified.

Weight, height and triceps and subscapular skinfolds were measured according to standard protocols (Lohman *et al.* 1988). Z-scores for height-for-age were calculated using the National Center for Health Statistics references (Hamill *et al.* 1977) and BMI (weight/height²) calculated. Haemoglobin, serum ferritin, and free erythrocyte protoporphyrin (FEP) were measured to assess Fe status (Cook & Finch, 1979).

A questionnaire was administered to obtain information on health-related behaviours, experiences of hunger, and social background. All interviews were conducted in private by one of five female interviewers. Test re-test agreement was >85% for all questions and inter-observer agreement was 98.5%. The validity of some of the social-background questions was checked by visiting the homes of eighteen girls and observing the conditions and questioning the mothers. Further details of the questionnaire and ratings used in the analyses have been reported (Walker *et al.* 1994).

NUTRITIONAL STATUS

Anthropometry

The anthropometric data are summarized in Table 1. The heights and BMI of the girls were similar to those of the US reference population (Hamill *et al.* 1977; Must *et al.* 1991); however, they had smaller triceps and subscapular skinfolds compared with the reference population (Johnson *et al.* 1981; Must *et al.* 1991). The Jamaican girls' skinfolds were also smaller when compared with the reference data for US blacks which suggests that their lower triceps skinfolds were not due to differences in fat patterning (Harsha *et al.* 1980).

Undernutrition as measured by weight and height was, therefore, not a problem in this population, although the poorest children may be less likely to enrol in secondary level education (enrolment in grade 8 is about 87% of eligible children; Statistical Institute of Jamaica, 1989). The Jamaican girls were leaner than North American adolescents, which suggests that their energy intakes may be marginal; however, the desirability and appropriateness of the levels of fat in the reference population is questionable.

Iron status

Of the girls, 16% were anaemic (Table 2) and 17% had low ferritin levels, indicating low Fe stores. Of the girls, 80% had reached menarche. There were modest associations between the girls' menstrual history and their Fe status (Table 3). Girls who had reached menarche had lower ferritin levels, and those who reported having heavy or longer periods also had poorer Fe status. These associations suggest that the Fe status of the girls may become worse as they get older.

Table 1. *Nutritional status of 13–14-year-old schoolgirls in inner-city Kingston, Jamaica**

(Mean values and standard deviations for 450 subjects)

	Mean	SD	Median
Age at measurement (years)	14.2	0.4	14.2
Height-for-age (Z-scores)†	-0.11	0.92	-0.04
BMI (kg/m ²)	19.7	3.1	19.0
Triceps skinfold (mm)	10.9	4.3	10.0
Subscapular skinfold (mm)	10.1	4.2	9.0

* For details of procedures, see p. 335.

† Calculated using the National Center for Health Statistics references (Hamill *et al.* 1977).Table 2. *Iron status of 13–14-year-old schoolgirls in inner-city Kingston, Jamaica**

(Medians and ranges for 434 subjects)

	Median	Range	Percentage below cut-off values
Haemoglobin (g/l)	124	70–160	16 (<115)†
Serum ferritin (µg/l)	25.6	2.4–197.1	17 (<10)†
Free erythrocyte protoporphyrin (µg/l RBC)	390	111–4004	10 (>70)†

RBC, erythrocytes.

* For details of subjects and procedures, see Table 1 and p. 335.

† Cut-off values (International Nutritional Anemia Consultative Group, 1985).

Table 3. *Correlation coefficients for iron status v. menstrual history for 13–14-year-old schoolgirls in inner-city Kingston, Jamaica†*

	Started periods	Length of periods	Heavy periods
Haemoglobin	0.01	-0.05	-0.10*
Serum ferritin	-0.12*	-0.09*	-0.03
Free erythrocyte protoporphyrin	-0.04	-0.12*	-0.03

* $P < 0.05$.

† For details of subjects and procedures, see Table 1 and p. 335.

EXPERIENCES OF HUNGER

There have been few studies of children's experiences of hunger. In one study in the USA, children who experienced hunger had more health problems such as fatigue, inability to concentrate and frequent colds (Hamre & Rode, 1990). We developed a series of questions concerning hunger and the adequacy of food during the school day. Although few of the girls were undernourished as measured by weight and height, hunger was reported fairly frequently (Table 4). For example, 33% of the girls said they went to bed hungry at least once per week and 36% came to school without breakfast once per week or more.

A hunger rating was computed from hunger before school, the adequacy of food at school, and the number of days per week the girl went to bed hungry. This rating and several of the individual hunger indices were modestly correlated with measures of nutritional status (Table 5). This provides some validation of the method used to assess hunger in the present study.

SOCIAL BACKGROUND AND BEHAVIOURS

The effects of nutrition and health on children's achievement cannot be evaluated without taking into account their home environment and other behavioural characteristics which may be related to school performance. During the interview we obtained information on the girls' socio-economic status, family structure, and the availability of educational materials in the home and for school. We also asked the girls to report on health-related behaviours such as sexual experience, use of alcohol and drugs, experience of violence and their own aggressive behaviour. The girls were assured that the

Table 4. *Experiences of hunger among 13–14-year-old schoolgirls in inner-city Kingston, Jamaica**

	<i>n</i> ‡	%
Ever hungry during class (452)†	358	79
Hungry before school begins (430)†		
Day of interview or day before	80	19
Both days	34	8
Have no breakfast (430)†		
1–2 d/school week	83	19
3–5 d/school week	71	17†
No food, or inadequate money for food at school on day of interview (430)†	89	21
Ever go to bed hungry (452)†	181	40
Go to bed hungry (452)†		
1–2 d/week	119	26
3–4 d/week	24	6
5–7 d/week	6	1

* For details of subjects and procedures, see Table 1 and p. 335.

† No. of girls in surveyed group.

‡ No. of girls giving a positive response.

Table 5. *Correlation coefficients for hunger v. nutritional status for 13–14-year-old schoolgirls in inner-city Kingston, Jamaica†*

	Height-for-age	BMI	Triceps skinfold	Subscapular skinfold
Hungry before school‡	0.12**	0.10*	0.10*	0.08*
Ever hungry during class†	0.01	0.12**	0.11*	0.04
Enough food or money for food at school	0.13**	0.11*	0.09*	0.11*
No. of days no breakfast	-0.07	-0.04	-0.08*	-0.05
No. of days go to bed hungry	-0.08*	-0.04	-0.08*	-0.08*
Hunger rating‡	0.14**	0.12**	0.13**	0.11*

* $P < 0.05$, ** $P < 0.01$.

† For details of subjects and procedures, see Table 1 and p. 335.

‡ Comprises hunger before school, food at school and days go to bed hungry, range 0–6; low scores indicate more hunger, maximum scores indicate no hunger.

interview was confidential and every effort was made to create an atmosphere in which they would feel relaxed and able to talk. The interviewers attempted to establish good rapport with the girls and the more sensitive topics, such as sexuality and drugs were placed towards the end of the interview.

Social background

Only 17% of the girls lived with both their parents, 37% lived with their mother only and a further 19% with their mother and stepfather. As many as 20% lived with neither parent. Of the girls, 35% saw their fathers less than once per year.

Two ratings were constructed concerning the children's socio-economic status, one comprising household possessions and the other, quality of housing (water and toilet facilities and crowding). These ratings were correlated with achievement and attendance (r 0.21–0.26, $P < 0.001$) but were not significant in multi-variate analyses and will not be discussed further.

As many as 35% of the girls had no textbooks for their school work, and 25% had no other books at home. The majority of the girls read a newspaper at least once per week but only about one-third used public libraries. Ratings were constructed of school materials (pens and pencils, exercise books, textbooks) and reading stimulation (books at home, newspapers, and use of libraries) for use in the multi-variate analyses of achievement and attendance.

Few girls participated in school or community groups such as sports and drama clubs. Regular attendance at church was 30%, and an index of community participation was devised combining the number of clubs attended and regular church attendance. Many of the girls had household chores to do before going to school including general housework (81%), child care (20%), cooking (36%), collecting water (23%) and washing clothes (53%). The number of household chores was included in the multi-variate analyses.

Sexual experience

At the time of the interview ninety girls (20%) reported having had sexual intercourse and ten girls were, or had been, pregnant. Of the seventeen girls who reported having had sex in the past month only three regularly used contraceptives.

Experiences of violence and aggressive behaviour

During the past year 79% of the girls had witnessed fights involving knives, guns or other weapons in either their home, school or in the community. Of the girls, 30% had been afraid to come to school at least once during the current school year because of violence in their community. Many had been beaten during this school year by either their parents (53%) or teachers (63%).

We asked the girls whether they had been involved in fights at home, school or in the community during the current school year and used this as an index of aggressive behaviour. Of the girls, 37% said they had been involved in fights and girls who were beaten, or who had witnessed violence, were more likely to be involved in fights. This supports the commonly held view that violence leads to violence (Widom, 1989).

SCHOOL PERFORMANCE

The level of school achievement attained by the girls was generally poor. Although they were in grade 8 their mean grade level as measured by the WRAT was 5.1 (SD 2.1). Because the WRAT was developed in the USA we also administered the test to girls attending high schools which were of a better standard than the study schools. In these schools the girls' achievement levels were appropriate for their grade level which suggests that the low scores in the study sample cannot be attributed, to any large extent, to the WRAT being culturally inappropriate.

The girls attended school for an average of 74.2 (SD 17.4) % of the school days while they were in grade 8 and 66.8 (SD 25.0) % of the school days during grade 9. This means that many girls missed at least one in every four school days in grade 8 and one in every three school days in grade 9. Fifty girls dropped out of school by the end of grade 9.

Table 6. *Correlation coefficients for height-for-age, iron status, and hunger rating v. school achievement and attendance for 13–14-year-old schoolgirls in inner-city Kingston, Jamaica†*

	Achievement	Attendance
Height-for-age	0.12**	0.02
Haemoglobin	0.12**	0.15**
Ferritin	0.03	0.19***
Free erythrocyte protoporphyrin	-0.06	-0.10*
Hunger rating‡	0.25***	0.18***

* $P < 0.05$, ** $P < 0.01$, *** $P < 0.001$.

† For details of subjects and procedures, see Table 1 and p. 335.

‡ Comprises hunger before school, food at school and days go to bed hungry, range 0–6; low scores indicate more hunger, maximum scores indicate no hunger.

Associations between nutrition and school achievement

The correlations of height-for-age, Fe status, and hunger with school achievement and attendance are shown in Table 6. Taller girls had better school achievement as did girls with higher haemoglobin levels and who experienced less hunger. Attendance was also related to measures of Fe status and to hunger.

Multi-variate analyses of school achievement

Step-wise multiple-regression analyses of school achievement were conducted offering those nutritional, social and behavioural variables which were related to achievement in uni-variate analyses. Anaemia was the only nutritional variable which made a unique contribution to the variance in achievement (Table 7).

Better school achievement was associated with school materials, the index of reading stimulation and participation in community activities. Girls who had more household chores to do before school, who were already sexually active or who were more aggressive had poorer levels of school achievement.

In multiple-regression analyses school materials, stimulation, having had sex, and chores before school were significant independent predictors of attendance during grade 8. We repeated the analyses of achievement including school attendance as an additional independent variable to determine whether some of the effects of the other variables were due to their effects on attendance. When attendance was included in the model, having had sex, community participation, and chores before school were no longer related to achievement and the effect of school materials was reduced (Table 7).

Table 7. *Multiple regression of school achievement on nutritional, social and behavioural variables (standardized regression coefficients) for 13–14-year-old schoolgirls in inner-city Kingston, Jamaica†*

	Model without attendance	Model including attendance
Anaemia‡	0.11*	0.11*
Reading stimulation	0.16**	0.16***
School materials	0.16***	0.10*
Community participation	0.09*	0.08
Aggression rating	-0.15**	-0.16***
Has had sex	-0.12**	-0.07
No. of chores before school	-0.10*	-0.09
Attendance	—	0.18***
R ²	0.18	0.21

* $P < 0.05$, ** $P < 0.01$, *** $P < 0.001$.

† For details of subjects and procedures, see Table 1 and p. 335.

‡ Haemoglobin (Hb) < 115 g/l = 0, Hb ≥ 115 g/l = 1.

Table 8. Risk factors for school drop-out (unadjusted odds ratios) for 13–14-year-old schoolgirls in inner-city Kingston, Jamaica*

Risk factor†	Odds ratio	95% CI
Involved in fights	1.98	1.10– 3.58
Has had sex	3.86	2.08– 7.47
No community participation	2.51	1.38– 4.56
Beaten by parents	2.04	1.09– 3.82
Skips school or ever suspended	2.26	1.05– 4.87
Not living with both parents	3.53	1.07–11.67
Girl works	2.14	1.18– 3.87
≥Two chores before school	2.76	1.14– 6.65
Inadequate school materials	3.54	1.47– 8.53
Achievement		
<Grade 7	3.07	1.08– 8.77
<Grade 5	2.63	1.36– 5.09
Attendance		
<90%	3.41	1.19– 9.73
<60%	7.51	3.99–14.14

* For details of subjects and procedures, see Table 1 and p. 335.

† Risk factor present 1, absent 0.

Predictors of school drop-out

Logistic regression analyses were used to determine which variables were risk factors for school drop-out. Those variables which predicted drop-out in uni-variate analyses are shown in Table 8. These variables were entered in a multiple logistic regression model to obtain odds ratios adjusted for the other variables. Poor attendance while in grade 8, having had sex, and not living with both parents remained significant risk factors for drop-out.

CONCLUSIONS

Anaemia was the principal nutritional problem identified in this population. Of the girls, 16% were anaemic and the associations with menstrual history suggest that the Fe status of the girls will become worse with increasing age. Anaemia was associated with poor school performance and this association remained after controlling for social background and attendance. Studies in younger children have shown that Fe supplementation of anaemic infants and school-aged children can lead to improvements in cognition and educational achievement (Soemantri *et al.* 1985; Seshradi & Gopaldas, 1989; Idjradinata & Pollitt, 1993). Adolescent girls were included in one study (Seshradi & Gopaldas, 1989) and anaemic girls' scores increased on two tests of cognitive function with Fe supplementation. Evaluation of strategies to reduce the levels of anaemia in this population is needed since this may have long-term benefits for future work productivity and well-being, as well as future pregnancies.

Undernutrition as measured by weight and height was not a significant problem in the

study population; however, experiences of hunger were not uncommon. The girls reported coming to school hungry, not having enough to eat at school, and going to bed hungry. In Jamaica school failure in primary-school children was associated with poor breakfasts even after controlling for a wide range of socio-economic variables (Clarke *et al.* 1991) and in the Philippines missing breakfast and feeling hungry were associated with poor school performance (Popkin & Lim-Ybanez, 1982; Florencio, 1988). In the present study, hunger was associated also with poor school achievement, but this was primarily because both were associated with lower socio-economic status.

The school achievement of the girls in the Kingston study was generally poor, with most of them performing at levels that would be expected after 4 or 5 years of primary school. Although a number of factors were identified which contributed to this, the poor quality of the schools was undoubtedly also important. The measures of social background which were most strongly related to achievement were possession of school materials and the availability of reading material in the home. These reflect socio-economic status, but also the priority that the family gives to spending on education, which in turn may be affected by the child's school performance. Having many household chores to do before going to school affected the girls' school attendance and, through this, their achievement. This finding provides evidence that the extent to which girls in developing countries are expected to work in the home can have a negative impact on their educational attainment.

The girls' behaviour had significant effects on their school achievement. This shows a different pattern from that seen with younger children in whom biological and social variables are more important (Powell & Grantham-McGregor, 1985; Clarke *et al.* 1991). In particular, aggressive behaviour and early sexual activity were negatively associated with achievement. Early sexual activity predicted school drop-out, which was also more common in girls who had a less-stable family structure. These findings have implications for health and education policy such as the need to improve sex education and reduce the levels of physical punishment in both homes and schools.

In conclusion, anaemia was a significant problem among adolescent girls in Kingston and contributed to their poor school performance. However, social and behavioural factors may be more important determinants of school achievement in adolescence.

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