



RESEARCH ARTICLE

Personal hygiene in schools: retrospective survey in the northern part of Côte d'Ivoire

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Keywords

Personal hygiene • Primary school students • North Côte D'Ivoire

Summary

Introduction. *Students' personal hygiene helps maintain health and promote good academic performance. When health facilities are insufficient, this hygiene can be difficult to achieve. We wanted to analyse the determinants of personal hygiene in schools in the northern region of Côte d'Ivoire.*

Methods. *The retrospective cross-sectional study brings together data on 2,035 schoolchildren recruited from thirty schools in northern Côte d'Ivoire. Indexes on personal hygiene were constructed and analysed in comparison to the socio-demographic characteristics of students, homes and schools. They were analysed with R Software version 1.1.463, the χ^2 test and a logistic regression model.*

Results. *Overall, the majority of students had good personal hygiene (82.75%) with an average personal hygiene score of 4.74 ± 1.36 . The predictors of good personal hygiene among schoolchildren were female gender (OR = 1.5; 95% CI = 4.31-16.37), father's primary education level (OR = 1.55; 95% CI = 1.07-2.29), the father's income level above 60,000 FCFA (90 Euros) and modern housing (OR = 1.45; 95% CI = 1.05-2.03). However, the poor level of home sanitation resulted in poor personal hygiene among the students (OR = 0.34; 95% CI = 0.23-0.5).*

Conclusions. *Measures to raise the standard of living of families and the provision of sanitary facilities in homes becomes necessary in order to improve students personal hygiene.*

Introduction

Personal hygiene refers to the set of practices that help maintain good health and prevent the spread of diseases. This involves regular washing of the body, hands, trimming of the nails, washing clothes, washing the hair and brushing the teeth [1]. In schools, students spend most of their time closer to each other, resulting in rapid transmission of infections, due to their naturally weak immune system and lack of knowledge of basic hygiene practices [2, 3]. Hygiene therefore plays an essential role in the prevention of communicable diseases [4]. These pathologies are the cause of absenteeism (75% in Malaysia in 2019), resulting in working time loss for parents, significant medical expenses due to medical visits and antibiotic prescriptions [5]. More than 1.9 billion school days could be gained if the supply of drinking water, sanitation were achieved and the incidence of diarrhoeal diseases would be reduced [3, 6]. The provision of drinking water and sanitary facilities at schools contribute to improved personal hygiene with a positive impact on the health of students [7]. In Kenya, for example, diarrhoea cases were reduced by half in 2004 [8]. In Burkina Faso, in the study conducted by Erismann et al., the prevalence of helminthiasis was decreased in schools, from 11.4% in 2015 to 8.0% in 2016 [9]. The provision of facilities also encourages the improvement of good hygiene practices as noted

in the study by Chard et al. in 2014 in Laos, where we observed an increase in the number of students who used the toilet and washed their hands with soap after using the toilet [10]. However, these facilities are not always available at schools, especially in the underdeveloped countries. In 2018, only 51% of schools in these countries have access to adequate water supply and 45% had adequate sanitation [7]. However, the origins of many adult diseases have their roots from childhood health behaviour. School-aged children can learn specific health-promoting behaviours, even if they do not always understand the links between illness and behaviour [11]. Therefore, hygiene education in schools can promote behaviour that will improve students' academic performance by reducing the rate of morbidity and absenteeism [1, 4, 12]. Instilling good hygiene practices at a younger age could have a lasting impact on the health of schoolchildren [2, 13]. The factors associated with the personal hygiene of pupils are well elucidated in the literature [14-17], namely the inadequate and insufficient sanitation facilities in schools, the level of education of the father, the level of income of the father, access to drinking water, gender and class of students, cleanliness of toilets, lack of separated toilets only for girls and lack of soap and water in handwashing device.

Meanwhile in Côte d'Ivoire, these factors are little studied. It is with this in mind that we analysed the determinants of personal hygiene in the school

environment in the northern region of Côte d’Ivoire, based on a database on intestinal helminthiasis carried out in 2016 which made it possible to highlight the personal hygiene index [18, 19].

Material and methods

TYPE OF STUDY AND POPULATION

Between October 2016 and January 2017, a cross-sectional study was carried out in 4 departments in the northern area of Côte d’Ivoire, namely the departments of Tengrela, Boundiali, Ferkéssedougou, Dabakala. The study examined elementary school children aged 5 to 15. All schoolchildren present during the survey period and who had lived in the north for more than 3 months were included. However, schoolchildren who had been dewormed 3 weeks before the start of the study were excluded.

Sampling

The educational departments of northern Côte d’Ivoire comprised 536 primary schools, with 81,041 schoolchildren enrolled in the period for the 2014-2015 school year [Department of Strategies, Planning and Statistics (DSPS, 2014-2015)]. To calculate the minimum number of schools and children to be included, the sample size was determined using Schwartz’s formula with a theoretical prevalence of 50%, accuracy of 5%. The calculated sample was 384 students extrapolated to 510 students per region. The total enrollment was 2,040 schoolchildren.

In each region we have made the reasoned choice to take 60 classes, which brings us to an enrollment of 8.5 students per class, rounded off to 10 students per class. Each school has 6 classes, we have selected 10 schools per region.

Selection

Once in the classroom, the schoolchildren were randomly selected until they reached ten pupils.

COLLECTION OF DATA

Data were collected using a standardized questionnaire forms. These data related to age, sex, class, taking dewormer, the student housing environment (rural or urban), certain behaviors (for example, defecating habits, visiting rivers) and status. socio-economic status of the mother. The investigation included the functional signs related to various stages of schistosomiasis, such as itching, headache, stomach upset or diarrhea.

SAMPLE COLLECTION AND LABORATORY PROCEDURES

Faecal samples were taken from schoolchildren directly using the plastic pots and analyzed using the Kato-Katz method. A stool sample was taken for each child. This technique has been used to identify *S. mansoni* eggs and the presence of other helminths, including roundworms, whipworms, hookworms and *Taenia* sp. Thus a database on hookworms in schools conducted in the north of Côte d’Ivoire was set up. Our study was based on this database, which also contained variables on the personal hygiene of the student, the socio-demographic and environmental characteristics of the student, his family and the variables related to sanitation at school. Schools in the northern region of Côte d’Ivoire face a double challenge : insufficient access to drinking water and poor hygiene and sanitary conditions. Indeed, the average performance in mathematics and reading (-53.8 points and -34.9 points) in the Northern region are lower than the national averages in both subjects and irrespective of the level [20].

The data was exported to an Excel table for the construction of new variables.

VARIABLES

Dependent variable

The personal hygiene variable was constructed by referring to the personal hygiene index developed by Jeyakumar et al. [21]. The personal hygiene items (explained variable) consisted of four domains including hand hygiene, nail hygiene, wearing shoes, school excreta disposal. For hand hygiene, 3 criteria were retained, for nail hygiene and the wearing of shoes, these criteria were two in number and one criterion was retained for the elimination of excreta. The personal hygiene variable therefore included a total of 8 criteria (Tab. I). Hand hygiene was said to be good if the student always washed his hands before eating and after bowel movements, using soap and water. Nail hygiene was good if the student did not bite his or her nails and had clean nails. Foot hygiene was correct if the student had shoes that he always put on. Excreta disposal was correct if the student used the toilet. Each observation could get a score of 0 or 1. When the observed practice was positive, a score of 1 was assigned. The level of personal hygiene was therefore calculated by adding the scores. Thus, the total personal hygiene score was between 0 and 8. A poor personal hygiene practice corresponded to a score less than or equal to 3, a good personal hygiene practice to a score between 4 and 5 and a very good personal hygiene practice corresponded to a score between 6 and 8.

Tab. I. Indexes to assess personal hygiene.

Hand hygiene	Nail hygiene	Foot hygiene	Excreta elimination
Hand washing Always wash hands before eating and after toilet Use soap and water to wash hands	Have nails trimmed Have clean nails	Have shoes Wear shoes always	Use toilets
Possible score 0-3	Possible score 0-2	Possible score 0-2	Possible score 0-1

EXPLANATORY VARIABLES

The explanatory variables were the socio-demographic characteristics of the students, the area of residence, sanitation at school, the socio-economic characteristics of families and access to water and sanitation in households. The student's socio-demographic variables included age, gender, and educational attainment. The school sanitation was assessed on the basis of the answers to the existence of toilets in the school and the state of cleanliness of these toilets. The school sanitation was assessed on the basis of the answers to the existence of toilets in the school and the state of cleanliness of these toilets. Thus, the level of hygiene in the school was good when there was at least one toilet and when the facilities were clean.

The socio-demographic variables of the family consisted of the level of education of the father and the mother, the monthly income of the parents recoded into 2 salary levels with reference to the guaranteed minimum inter-professional wage (SMIG) in force in Côte d'Ivoire < 60,000 FCFA and \geq 60,000 FCFA or 90 Euros. The habitat type has been dichotomized into the modern type habitat and rural type habitat.

The household's water supply source was informed through the availability or not of drinking water at home. Access to good sanitation at home was treated like the disposal of excreta at school.

STATISTICAL ANALYSIS

The analysis of the data thus generated was carried out with R Software version 1.1.463.

Each variable was subjected to descriptive analysis. Associations between levels of personal hygiene and the variables studied were explored using the χ^2 test in univariate analyzes. A p value < 0.05 was considered indicative of a statistically significant association. Individuals with missing data for dependent variables were not retained for analysis. For multivariate analyzes, the analysis strategy was to include in the model all variables that had a p-value of less than 20% in univariate. This threshold has been favored so as not to immediately eliminate the important variables. Then, the variable which, at each step, provided the least information was removed from the model while checking that it was not a confounding factor (percentage of variation in odds ratio greater than 20-25%). This progressive elimination procedure was carried out until a model was obtained which consisted only of significant variables (p-values < 5%). Once the reduced model was obtained, relevant interaction terms were introduced and a top-down procedure was performed again to find out whether any interaction terms were significant (significance level set at 5%). The variables involved in a significant interaction were maintained in the model.

MISSING DATA

Pre-treatment

The pre-processing of the data consisted in listing the number of non-response by variable.

Data cleaning and missing data management. The non-response rates were estimated and were relatively low because only 5 (0.24%) children were concerned, which allowed us not to take them into account in our study and to have a correct database.

ETHICAL CONSIDERATIONS

The agreement of the head of the parasitology-mycology department of the Faculty of Pharmacy and Biological Sciences has been obtained for the use of the database. The original file was anonymous.

Results

SOCIODEMOGRAPHIC CHARACTERISTICS

Table II shows the socio-demographic characteristics of students, parents and households. There were 2,035 students with a sex ratio (M/F) of 1.24. There were practically the same number of pupils in the 3 levels CP, CE and CM (33%). The mean age was 9.2 (\pm 2.33) years. Most students attended schools with toilets (71.9%), however, 84% had poor sanitation in the schools. Most of the students had parents who were not educated, respectively 46% for fathers and 58% for mothers. More than half of the parents had a monthly income greater than or equal to the minimum wage (61% of fathers and 62% of mothers). Almost all of the students came from households where the parents lived as a couple (96.71%). Their housing was 68.55% rural. They had access to drinking water (97%) and a good level of sanitation (75%).

COMPONENTS OF PERSONAL HYGIENE

Analysis of personal hygiene in Table III shows that the components "hand hygiene", "foot hygiene" and "nail hygiene" were poor in 91, 72 and 67% of students, respectively. The most correct hygienic practice was the disposal of excreta (about 2 out of 3 students). Overall personal hygiene was good with an average score of 4.74 \pm 1.36. Thus, 8 out of 10 students had good personal hygiene.

UNIVARIATE ANALYSIS

The univariate analysis presented in Table IV revealed that personal hygiene was better in girls (p = 0.002), in students over 10 years old (p = 0.031) and when school sanitation was good (p < 0.001). Family characteristics related to personal hygiene were parents education level, level of their income above the minimum wage, modern housing and adequate sanitation (p < 0.001). When the household had access to good drinking water, the personal hygiene of the students was also better (p = 0.008).

MULTIVARIATE ANALYSIS

In the final logistic regression model, student sex, school and home sanitation, father's income and education level,

Tab. II. Socio-demographic characteristics of students in the north of Côte d'Ivoire (n = 2,035).

Socio-demographic characteristics	Frequency	Percentage
Students' characteristic		
Sex		
Male	1,128	55.43
Female	907	44.57
Age group (Years)		
< 10	1,094	53.76
≥ 10	941	46.24
Class		
CP	679	33.37
CE	679	33.37
CM	677	33.26
Schools characteristic		
Sanitation at school		
Poor	1,719	84.62
Good	313	15.38
Family characteristic		
Father's education level		
Illiterate	939	46.14
Primary school		21.28
Secondary school	382	18.77
Higher education	281	13.81
Mother's education level		
Illiterate	1,198	58.87
Primary school	439	21.57
Secondary school	319	15.68
Higher Education	79	3.88
Father's monthly income (FCFA)		
< 60 000	787	38.67
≥ 60 000	1,248	61.33
Mother's monthly income (FCFA)		
< 60 000	766	37.64
≥ 60 000	1,269	62.36
Matrimonial status		
Couple	1,968	96.71
Single parent	67	3.29
Portable water		
Yes	1975	97.05
No	60	2.95
Type of habitation		
Modern	640	31.45
Rural	1,395	68.55
Sanitation at home		
Yes	1,538	75.58
No	497	24.42

family home type were the predictors of good personal hygiene for students (Tab. V). Compared to boys, female students and those whose fathers received an elementary or secondary school education were 1.5 times more likely to have good personal hygiene. The same was true for modern-type housing compared to rural-type housing. The father's income level above the minimum wage doubled the student's probability of having good personal hygiene. Adequate sanitation at school was strongly associated with good student personal hygiene (8 times). Poor sanitation at home reduced by a third the probability of the student having good personal hygiene.

Discussion

This study took place in primary schools in northern Côte d'Ivoire with a sample of 2,035 students. Overall, in our study the majority of students had good personal hygiene (82%), as in the study conducted by Baba et al. in Nigeria, where 74% of school children had good personal hygiene [16]. This personal hygiene was associated with gender ($p = 0.002$) with girls being 1.5 times cleaner than boys. This trend has also been reported in studies by Motakpalli et al. and Sakar in India [4, 11]. Among the socio-demographic variables of the parents, the primary

Tab. III. Distribution of students according to the components of personal hygiene (n = 2,035).

Personal hygiene components	Frequency	Percentage
Hands hygiene		
Poor	1,856	91.2
Good	179	8.8
Nails hygiene		
Poor	1,363	66.98
Good	672	33.02
Foot hygiene		
Poor	1,468	72.14
Good	567	27.86
Excreta elimination		
Poor	673	33.07
Good	1,362	66.93
Global personal hygiene		
Poor	351	17.25
Good	1,091	53.61
Very good	593	29.14

and secondary education level of the father encouraged more than once a good personal hygiene in the pupils and personal hygiene improved with the advancement in the education level of the pupil and father. Rather, Lopez in 2007 noted that handwashing among students increased with mother's level of education [17]. Pupils whose fathers had a monthly income greater than or equal to 60,000 FCFA (90 Euros) were 2.36 times cleaner than those whose fathers earn a lower income ($p < 0.001$). This result could be explained by the fact that the father's income below the minimum wage is low, however several charges in the household fall on the father, namely sanitary products and sanitary facilities as well as access to potable drinking water which incur costs making this income very insufficient for household needs. These results are similar to those of Oga in 2004 in Agboville where the prevalence of intestinal helminthiasis decreased when the father's income increased [22].

In terms of the household and school environment, our study showed that children who lived in modern-type houses were 1.45 times cleaner than those in rural-type houses ($p < 0.001$). According to Bewa et al. (2016), in Benin, the type of housing was an indirect reflection of the economic level of the household [23]. In fact, in these households, children do not benefit from amenities such as drinking water supply and excreta disposal and may have difficulty practicing hygiene measures [24]. When schools had good sanitation, students were almost 8 times cleaner than those in schools with poor sanitation ($p < 0.001$). According to Koné in 2012, in Mali, such unsanitary conditions favour student absenteeism and the spread of diseases linked to faecal peril, in particular diarrheal diseases, typhoid fever and polio [25].

Among students aged 10 and above with poor home sanitation, personal hygiene was still 3.38 times more important. This could be related to the adaptability of children's development as they grow older. It has been reported that the ability to understand and apply basic personal hygiene advice would be improved in older

Tab. IV. Univariate analysis of factors associated with student personal hygiene.

Personal Hygiene	Bad	Good	P
Sex			
Female	130 (14.3)	777 (85.7)	0.002
Male	221 (19.6)	907 (80.4)	
Class			
CP	125 (18.4)	554 (81.6)	0.531
CE	117 (17.2)	562 (82.8)	
CM	109 (16.1)	568 (83.9)	
Age group (years)			
< 10	207 (18.9)	887 (81.1)	0.031
≥ 10	144 (15.3)	797 (84.7)	
Sanitation at school			
Good	10 (3.2)	304 (96.8)	< 0.001
Poor	341 (19.8)	1380 (80.2)	
Father's education level			
Illiterate	231 (24.6)	708 (75.4)	< 0.001
Primary school	75 (17.3)	358 (82.7)	
Secondary school	32 (8.4)	350 (91.6)	
Higher education	13 (4.6)	268 (95.4)	
Mother's education level			
Illiterate	272 (22.7)	926 (77.3)	< 0.001
Primary school	59 (13.4)	380 (86.6)	
Secondary school	18 (5.6)	301 (94.4)	
Higher education	2 (2.5)	77 (97.5)	
Father's income (FCFA)			
< 60,000	232 (29.5)	555 (70.5)	< 0.001
≥ 60,000	119 (9.5)	1,129 (90.5)	
Mother's income (FCFA)			
< 60,000	273 (21.5)	996 (78.5)	< 0.001
≥ 60,000	78 (10.2)	688 (89.8)	
Marital status			
Couple	335 (17.0)	1,633 (83.0)	0.144
Single parent	16 (23.9)	51 (76.1)	
Portable water			
No	18 (30)	42 (70)	0.008
Yes	333 (16.9)	1,642 (83.1)	
Type of home			
Modern	58 (9.1)	582 (90.9)	< 0.001
Rural	293 (21.0)	1,102 (79.0)	
Sanitation at school			
No	158 (31.8)	339 (68.2)	< 0.001
Yes	193 (12.5)	1,345 (87.5)	

children compared to younger children even if home sanitation was not adequate [16].

STUDY LIMITATIONS

This study highlights the level of hygiene of school children in the North as well as the risk factors. Outcomes should be considered cautiously as behaviours are self-reported. However, any bias in the responses can overestimate or underestimate the behaviours. The results of this study cannot be generalized to other hygiene practices in the country since the sampling is not representative of the country and it is a retrospective study.

Tab. V. Personal hygiene and predictive factors among students in the north of Côte d'Ivoire.

Variables	Personal hygiene		Adjusted OR (95% CI)	P-value
	Bad n (%)	Good n (%)		
Students' characteristic				
Sex				
Female	130 (14.3)	777 (85.7)	1.5 (1.16-1.94)	0.001
Male	221 (19.6)	907 (80.4)	1	-
Age group (years)				
< 10	207 (18.9)	887 (81.1)	1	-
≥ 10	144 (15.3)	797 (84.7)	0.79 (0.57-1.08)	0.152
School characteristic				
Sanitation at school				
Good	10 (3.2)	304 (96.8)	7.93 (4.31-16.37)	< 0.001
Poor	341 (19.8)	1380 (80.2)	1	-
Family characteristic				
Father's education level				
illiterate	231 (24.6)	708 (75.4)	1	-
Primary school	75 (17.3)	358 (82.7)	1.55(1.07-2.29)	0.021
Secondary school	32 (8.4)	350 (91.6)	1.84(1.02-3.38)	0.042
Higher education	13 (4.6)	268 (95.4)	1.95 (0.92-4.36)	0.089
Mother's education level				
illiterate	272 (22.7)	926 (77.3)	1	-
Primary school	59 (13.4)	380 (86.6)	0.96 (0.60-1.53)	0.877
Secondary school	18 (5.6)	301 (94.4)	1.90 (0.92-4)	0.085
Higher education	2 (2.5)	77 (97.5)	3.90 (0.99-26.08)	0.086
Father's income (FCFA)				
< 60,000	232 (29.5)	555 (70.5)	1	-
≥ 60,000	119 (9.5)	1129 (90.5)	2.36 (1.59-3.54)	< 0.001
Mother's income (FCFA)				
< 60,000	273 (21.5)	996 (78.5)	1.37 (0.91-2.09)	0.129
≥ 60,000	78 (10.2)	688 (89.8)	1	-
Type of home				
Modern	58 (9.1)	582 (90.9)	1.45 (1.05-2.03)	0.025
Rural	293 (21.0)	1102 (79.0)	1	-
Sanitation at home				
No	158 (31.8)	339 (68.2)	0.34 (0.23-0.50)	< 0.001
Yes	193 (12.5)	1345 (87.5)	1	-
Age ≥ 10 years * Poor sanitation at home	-	-	3.38 (2-5.76)	< 0.001

Conclusions

The personal hygiene of pupils in northern Côte d'Ivoire was good. Thus girls had better hygiene than boys, children aged 10 and above were cleaner, the more higher the father's education level was, and the pupil's personal hygiene increased. Modern housing and sanitation at home and at school promoted good hygiene. Personal hygiene in students therefore requires the provision of health infrastructure both at home and at school, not to mention the training of students. This suggests an effective involvement of education authorities, the economy, without forgetting the participation of teachers, parents and students.

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Conflicts of interest statement

The authors declare no conflict of interest.

Authors' contributions

SKJ: conception, design, data collection, supervision and writeup of the manuscript.

DAA: writing original draft.

KBP: data collection.

KJ : data analysis and interpretation.

TML, GBM[†], KKL: review.

All authors have read and agreed to the published version of the manuscript.

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