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Knowledge, attitudes, and practices regarding hand hygiene among students in a public primary school in Cotonou, southern Benin

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Abstract

Promotion of improved hand hygiene has been recognised as an important public health measure. The objective of this study was to assess the handwashing knowledge and practices among school students, with a specific focus on identifying their primary sources of knowledge regarding hand hygiene. A survey was conducted to assess the level of handwashing knowledge of students in a selected public primary school in Cotonou. The main variables studied were the age and sex of the respondents, their level of education, their knowledge, attitudes, and practices regarding handwashing, as well as the materials available in the school for handwashing. Students' hands were swabbed before hand washing and after hand washing to assess hand contamination. The samples Chapman and EMB were used for bacterial isolation and strain identification was done based on biochemical tests. Results showed that most (67.57%) participants had a good level of knowledge on hand hygiene but highlight a need of training in handwashing practicing. The assessment of hand contamination before and after handwashing showed significant reduction in hand contamination with Gram-negative bacilli. The presence of bacteria, including SCN (38%), *Staphylococcus aureus* (32%), *Escherichia coli* (10%), *Enterobacter cloacae*, and *Klebsiella pneumoniae* (6%), poses a significant risk of infections that can be challenging to treat among students. In conclusion, it is crucial to prioritize sustainable health education within schools to provide children with the necessary knowledge and foster positive attitudes towards hand hygiene.

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Introduction

Hygiene is the right attitude to keep your living and working space as clean as possible to avoid illness (Parker *et al.*, 2021). Hand hygiene is even more important because we are quicker to use our hands to perform our tasks and especially to eat (Hirose *et al.*, 2021). Hand hygiene is nothing more than washing hands with soap and water in order to eliminate microorganisms (Jing *et al.*, 2020). Hand washing is a personal hygiene practice that dates back thousands of years. But, it was through the work of pioneers such as Ignaz Semmelweis and Louis Pasteur that hand washing became standard practice in hospitals and other health care facilities (Vermeil *et al.*, 2019).

The importance of hands in all activities of life allow for frequent contact with them. The use of contaminated hands for cooking and eating is responsible for the transmission of many pathogens into the body (Vermeil *et al.*, 2019). This state of affairs causes many parasitic, viral, bacterial and fungal diseases (Alharbi *et al.*, 2019). It is therefore necessary to better educate the youngest about this practice. Effective and appropriate hand hygiene for school children is crucial to prevent infectious diseases such as diarrhoea, which is the second leading cause of death among children in sub-Saharan Africa (Demissie *et al.*, 2021). As lifestyle and behavioural choices are made during childhood, it is crucial that health education on the importance of hand hygiene is initiated as early as possible to have an effect on healthy habits. This is possible in children because their poor hygiene habits are less developed, unlike adults, whose habits are more developed and therefore more difficult or impossible to change (Mbakaya *et al.*, 2017). Effective and consistent handwashing technique can have a significant impact on the prevention of gastrointestinal and respiratory tract infections (Guo *et al.*, 2018).

So handwashing can improve education and health at the same time. Unfortunately, there is a lack of reliable scientific research such as randomized controlled trials in developing countries, where the

incidence of infectious diseases among school-aged children is very high.

Benin, like many developing countries, regularly experiences strong episodes of child diarrhoea. This is due to a lack of soap and adequate infrastructure for handwashing and hygiene in primary schools. As schools are places where there is daily interaction between pupils, teachers, maintenance staff and shop assistants, there is an urgent need to educate children about good handwashing practices. This is what justifies the interest of this study which aims to evaluate the level of knowledge and infectious risks, in an urban school environment, the conditions and practice of handwashing among schoolchildren in a public school in Benin.

Materials and methods

Study design

This study is an evaluative mixed-methods (both qualitative and quantitative) descriptive study, inspired by the KAP (Knowledge, Attitudes, and Practices) inquiry paradigm (Essi and Njoya, 2013). A survey was conducted between May and June 2022 to assess the level of handwashing knowledge of students in a selected public primary school in Cotonou, one of Benin's fast-growing southern cities (Villeret, 2017). The data collection tools were designed and tested among the different study groups, followed by the collection of empirical data within the school. The target population of the survey was made up of second-year elementary school students and first and second-year middle school students at the school. This choice was made because these students have a certain level of maturity in understanding the importance of good hand hygiene practices. Students from other classes or schools were excluded from the study.

The selection of students included in the study was carried out using the systematic random probability sampling method (Etikan and Bala, 2017). Based on the alphanumeric lists of each of the three selected classes in the school for the study, a random drawing of 15 students per class was conducted for interviews

and observation of hand washing practices. However, at the end of the survey, 40 students were included in the study (n=40). The gender approach was respected.

Survey

The study was conducted through three main surveys. The first survey was based on an individual interview with the selected schoolchildren and focused on the main terms of the schoolchildren's knowledge of handwashing, their attitudes towards handwashing and their wishes to promote handwashing in their school. The second survey was based on individual observation of handwashing practices by the schoolchildren included in the study. The third and final survey was an assessment of the conditions and resources available at school level for handwashing promotion (Almoslem *et al.*, 2021). The main variables studied were the age and sex of the respondents, their level of education, their knowledge, attitudes, and practices regarding handwashing, as well as the materials available in the school for handwashing.

Respondents were given assistance in understanding the questions and completing the questionnaires. The questionnaires were collected on the same day as the school visits after ensuring that all questions were answered carefully and attentively.

Sampling and microbiological analysis

Students' hands were swabbed before hand washing and after hand washing. The swabs were labelled, placed in tubes containing peptone water and transported to the laboratory of the Research Unit in Applied Microbiology and Pharmacology of Natural Substances (URMAPha) in suitable containers with cold accumulators. The samples were plated on Chapman for the isolation of Staphylococci and EMB for Enterobacteriaceae after microscopic examination. The reading of the different colonies observed on the culture media was carried out after 18 hours of incubation, followed by a Gram control. Isolation was done to obtain a pure culture. Strain identification was done based on biochemical tests.

The API 20E gallery was used for the identification of Enterobacteriaceae and the classical diagnostic biochemical tests (catalase, oxidase, free staphylocoagulase and DNase) for Cocci.

Ethical permit

Ethical permission was obtained from the the National Health Research Ethics Committee of Benin under the number N°67/MS/DC/SGM/DRFMT/CNERS/SA of 20/04/2021.

Data analysis

The initial part of the study involved a descriptive analysis where the percentage of responses for each domain was presented. The data collected was entered and analysed using Excel software according to the content analysis approach for qualitative data in accordance with the principles of the application of the conceptual reference framework of the study KAP (Knowledge, Attitudes and Practices) survey approach.

Results

Student's characteristics

A total of 40 school children were observed washing their hands with soap and water, 23 of whom were girls (57.5%) and 17 boys (42.5%). Their average age was 11 years, with extremes ranging from 7 to 13 years. Many of the schoolchildren surveyed (70%) were in the first and second year of intermediate class (Fig. 1).

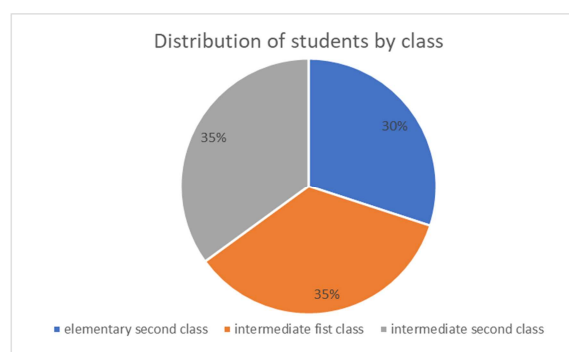


Fig. 1. Distribution of students by class

Hand contamination

From the analysis of the results obtained, it appears that 50% of the hands were contaminated before

washing and 13% of the hands remained contaminated after hand washing. Several bacterial species were isolated before hand washing including SCN (38%), *Staphylococcus aureus* (32%), *Escherichia coli* (10%), *Enterobacter cloacae* and *Klebsiella pneumoniae* (6%). After hand washing, only *Staphylococcus aureus* strains were found with an isolation frequency of 5%. These results are presented in Fig. 2.

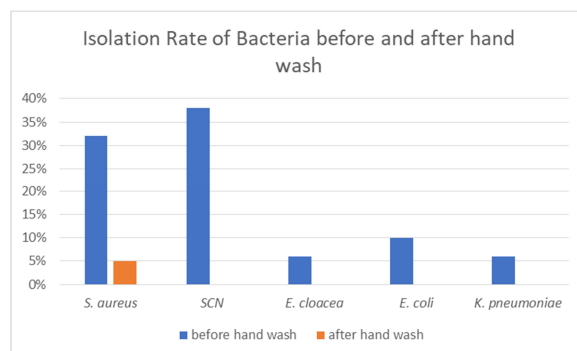


Fig. 2. Isolation rate of bacteria before and after hand wash

Knowledge and attitude on hand washing

The analysis of the data shows us that the least washed parts of the hands by the observed schoolchildren are: the thumbs (50% of schoolchildren), the fingertips (57.50% of schoolchildren), and the nails (52.50% of schoolchildren). Almost all of the observed schoolchildren (92.50%) did not dry their hands after washing, which could logically explain the absence of waste to dispose of (100% of observed schoolchildren). Furthermore, none of the observed schoolchildren stored the materials used after handwashing.

All 37 interviewed schoolchildren (100%) claimed to know the definition of handwashing, but on the other hand, 12 of them (35.13%) were unable to provide a definition of handwashing. The most mentioned advantages of handwashing by the interviewed schoolchildren are: to stay healthy (94.59%) and to reduce the risk of disease transmission (86.48%). Generally, most interviewed schoolchildren know several benefits of handwashing. The entirety (100%)

of the interviewed schoolchildren affirmed that they know the disadvantages of not regularly washing their hands. The most cited disadvantage of not regularly washing hands according to the interviewed schoolchildren is getting sick (39%). It is important to note that 21% of schoolchildren know that the absence of regular handwashing with soap and water could be a risk factor for COVID-19. The entirety (100%) of the interviewed schoolchildren affirmed that they know the diseases caused by dirty hands. The most mentioned diseases caused by dirty hands according to the interviewed schoolchildren are: stomachaches (83.73%), vomiting (10.81%), and diarrhea (45.94%). The most cited sources of information on handwashing according to the interviewed schoolchildren are television (81.08%), school (78.37%), and radio (56.75%). The most mentioned materials necessary for handwashing are a clean water source (or a handwashing device) (97.29%) and soap (94.59%). Most of the interviewed students (43.25%) claimed that they do not know the recommended approximate time for handwashing.

All 37 interviewed schoolchildren (100%) affirmed that they practice handwashing with soap and water. 45.95% of the interviewed schoolchildren claimed that they wash their hands at least three times a day, while others stated that they practice handwashing even more than three times a day (21.62%). The circumstances in which the interviewed schoolchildren claim to practice handwashing the most are: "Before eating": 37 schoolchildren; "After eating": 33 schoolchildren; "After using the toilet (WC)": 27 schoolchildren.

According to the data, more than half (52.50%) of the observed schoolchildren practiced handwashing after recess. Almost all the observed schoolchildren (90%) did not wet their hands with water before applying soap. Furthermore, half of the observed schoolchildren (50%) did not rub their hands together after soaping them. Out of the 37 interviewed schoolchildren, 67.57% provided a good definition of handwashing, but on the other hand, 12 of them (32.43%) were unable to give a definition of

handwashing. The most mentioned advantages of handwashing by the interviewed schoolchildren are to stay healthy (94.59%) and to reduce the risk of

disease transmission (86.48%). Generally, many interviewed schoolchildren are aware of several benefits of handwashing (Table 1).

Table 1. Knowledge and attitude of students on handwashing

Characteristics	Category	Frequency	
		Number	%
Correct definition of handwashing	Yes	25	67.57
	No	12	32.43
Benefits of hand washing	Remove soils from hand	22	59.45
	Remove microbes from hand	23	62.16
	Decrease disease transmission risk	32	86.48
	Be healthy	35	94.59
	Be pure	16	43.24
Disadvantages of not washing hands	Not be sick	14	37.84
	Not be pure	8	21.62
	Increase disease transmission risk	7	18.91
	Increase COVID 19 transmission risk	8	21.62
Illnesses due to poor hand washing	Cough	1	2.70
	Ebola	1	2.70
	Cholera	1	2.70
	Dental carries	1	2.70
	Kwashiokor	1	2.70
	Infection	3	8.10
	Cephalgia	4	10.81
	Malaria	5	13.51
	AIDS	5	13.51
	Intestinal Parasitose	6	16.21
	COVID-19	8	21.62
	Diarrhea	17	45.94
	Vomit	22	59.45
Source of information about hand washing	Stomach	31	83.78
	In street	1	2.70
	In taxi	1	2.70
	Social Network	1	2.70
	Church	1	2.70
	Hospital	2	5.40
	Newspaper	8	21.62
	House	10	27.02
	Radio	21	56.75
Materials for hand washing	School	29	78.37
	Television	30	81.08
	Pure water	36	97.29
	Soap	35	94.59
	Soap distributor	11	29.72
	Individual towel	16	43.24
	Hydroalcoholic gel	2	5.40
	Toilet paper	1	2.70
Time for handwashing	Sponge	1	2.70
	Less than 30 seconds	1	2.70
	30 seconds	5	13.51
	30 < T < 1min	9	24.33
	2 min	3	8.11
	4 min	1	2.70
Reasons for drying hands	Don't know	16	43.25
	Remove germs	21	57.69
	Growing of germs on humid hands	14	38.46
	Remove reset water	3	7.69
	Avoid soil to fall in food	3	7.69
Daily frequency of hand washing	Avoid water entry wound	2	5.40
	One per day	2	5.40

	Two per day	10	27.02
	Three per day	17	45.94
	More than three per day	8	21.62
Circumstances in which hand washing is practiced	After sweep	1	2.70
	Before entry in classroom	1	2.70
	Before entry in official	1	2.70
	After trim or have sneezed	14	37.83
	After touch unpure object	18	48.64
	After find unclean hand	19	51.35
	After the toilet	27	72.97
	After eat	33	89.18
	Before eat	37	100
	Moment of hand washing	Food	1
Comeback toilet		4	10.81
During recreation		13	35.13
After recreation		20	54.05
First four stages of handwashing practice	Checking the presence of washing hand materials	3	8.10
	Wet hands with water	4	10.81
	Soaps hands	35	94.59
	Hand rub together during 20 s	19	51.35

Discussion

Handwashing is considered the most effective method for preventing the transmission of infectious organisms between individuals (Eshetu *et al.*, 2020). The objective of this study was to evaluate the knowledge and attitude of handwashing among students in a public primary school in Cotonou, southern Benin. The study aimed to examine the possible connection between students' backgrounds and their hand hygiene practices.

Results from microbiological analysis revealed that 50% of the hands were contaminated before washing and 13% of the hands remained contaminated after hand washing. Several studies have also demonstrated a substantial decrease in the number of contaminated hands following handwashing (Burton *et al.*, 2011; Hoque *et al.*, 1995a; Lucet *et al.*, 2002). Unlike the study conducted by Hoque and colleagues, the bacteriological methods employed in this study do not offer a quantification of bacterial load (Hoque *et al.*, 1995a). The quantification of the impact of various handwashing procedures on bacterial load can be especially valuable for research conducted in impoverished areas with inadequate sanitation facilities, where environmental contamination with fecal organisms is more prevalent (Hoque *et al.*, 1995b; Kaltenthaler *et al.*, 1996; Pinfold and Horan, 1996).

Several bacterial species were isolated before hand washing including SCN (38%), *Staphylococcus aureus* (32%), *Escherichia coli* (10%), *Enterobacter cloacae* and *Klebsiella pneumoniae* (6%). Similar organisms have also been found on hand and reported in several studies (Allam *et al.*, 2016; Shojaei *et al.*, 2006). The isolation of these organisms, including the spread from feces to hands, indicates poor hygiene practices among the food handlers (Shojaei *et al.*, 2006). After hand washing, only *Staphylococcus aureus* strains were found with an isolation frequency of 5%. The significant reduction in hand contamination with Gram-negative bacilli, in the current study, demonstrates that these organisms can be effectively eliminated through handwashing (Shojaei *et al.*, 2006). *Staphylococcus aureus* is known to spread through close contact and is commonly found on the skin as a commensal bacterium.

Eliminating it can be challenging due to its persistent nature (Rashid *et al.*, 2013). In general, the impact of soap seemed to be unrelated to the specific type of bacteria, and our study had limited sensitivity to detect variations between bacterial species. While we cannot be certain about the duration and technique used by individuals who used soap to wash their hands, it is plausible that their hands could have become contaminated by touching surfaces such as the tap after washing their hands (De Alwis *et al.*, 2012).

Assessing the students' perceived knowledge on hand hygiene indicated that most (67.57%) participants had a good level of knowledge on hand hygiene. Similar findings were reported among male primary school students in the city of Abha, Saudi Arabia (Hazazi *et al.*, 2018). A study conducted in Abha also found that 86.6% of students recognized that respiratory tract infections can be reduced by practicing proper handwashing (Saleh, 2013). Furthermore, Hazazi *et al.* (2018) discovered that approximately 95% of students understood the importance of hand hygiene, particularly in preventing disease transmission through person-to-person contact. In a study assessing the level of knowledge and practice as a preventive measure against COVID-19 in Saudi Arabia, Siddiqui *et al.* (2020) revealed that 84% of the population recognized and practiced handwashing. Conversely, Dajaan *et al.* (2018) found that only 37.67% of primary school students in Ghana understood the significance of handwashing in disease prevention. Compared to studies conducted in other cities in Saudi Arabia, Ghana, and India, school students in the Eastern Province demonstrated a higher level of awareness regarding hand hygiene-related knowledge and practices (Dajaan *et al.*, 2018; Garbutt *et al.*, 2007; Gawai *et al.*, 2016).

The entirety (100%) of the interviewed schoolchildren in this study affirmed that they know the diseases caused by dirty hands. In the study conducted by Gawai *et al.* (2016), it was found that only 46% of the students held the belief that handwashing plays a role in preventing diseases, with 34% of them considering it primarily as a means of removing dirt. In contrast, Dajaan *et al.* (2018) observed that all Saudi school students recognized the importance of soap and water in handwashing. Their study revealed that 37.67% of the participants washed their hands to prevent disease, while 21.33% washed their hands to eliminate germs and dirt.

The most mentioned materials necessary for handwashing are a clean water source (or a handwashing device) (97.29%) and soap (94.59%).

According to the data, more than half (52.50%) of the observed schoolchildren practiced handwashing after recess and the most mentioned materials necessary for handwashing are a clean water source (or a handwashing device) (97.29%) and soap (94.59%). The duration of handwashing and the proper technique were considered in this study since both factors are crucial for effectively disinfecting all areas of the hand. Most of the interviewed students (43.25%) claimed that they do not know the recommended approximate time for handwashing. In the study conducted by Hazazi *et al.* (2018), it was revealed that more than 90% of primary school students, as reported by the participants, used soap during handwashing. This practice was especially prevalent before and after meals, as well as after using the toilet. However, in a different study involving primary school students in Ghana, only 39.88% were found to use soap during handwashing after using the toilet (Dajaan *et al.*, 2018). It is noteworthy that UNICEF highlights the significance of handwashing before eating and after using the toilet, which aligns with the findings of the current study (UNICEF, 2020).

Conclusion

The objective of this study was to assess the handwashing knowledge and practices among school students, with a specific focus on identifying their primary sources of knowledge regarding hand hygiene. Results showed that most (67.57%) participants had a good level of knowledge on hand hygiene but highlight a need of training in handwashing practicing. The assessment of hand contamination before and after handwashing showed significant reduction in hand contamination with Gram-negative bacilli. The presence of bacteria, including SCN (38%), *Staphylococcus aureus* (32%), *Escherichia coli* (10%), *Enterobacter cloacae*, and *Klebsiella pneumoniae* (6%), poses a significant risk of infections that can be challenging to treat among students. Hence, it is crucial to prioritize sustainable health education within schools to provide children with the necessary knowledge and foster positive attitudes towards hand hygiene. Additionally, ensuring the presence of standardized latrines,

adequate water supply systems, and the availability of antimicrobial soap in schools are essential factors that contribute to promoting proper handwashing practices.

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