Handwashing Knowledge, Attitudes, and Practices among Students in Eastern Province Schools, Saudi Arabia

Munthir M. Almoslem,1 Talal A. Alshehri,1 Arwa A. Althumairi,2 Mohammed T. Aljassim,1 Mohamed E. Hassan,3 and Mahmoud M. Berekaa1

1Environmental Health Dept., College of Public Health, Imam Abdulrahman Bin Faisal University, P.O. Box 1982, Dammam 31441, Saudi Arabia
2Health Information Management and Technology Dept., College of Public Health, Imam Abdulrahman Bin Faisal University, P.O. Box 1982, Dammam 31441, Saudi Arabia
3Public Health Dept., College of Public Health, Imam Abdulrahman Bin Faisal University, P.O. Box 1982, Dammam 31441, Saudi Arabia

Correspondence should be addressed to Mahmoud M. Berekaa; mberekaa@iau.edu.sa

Received 29 December 2020; Revised 23 April 2021; Accepted 8 September 2021; Published 22 September 2021

Academic Editor: Angel Dzhambov

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Background. Lack of knowledge about appropriate handwashing practices has caused great concerns for human health, especially in the risk of many communicable diseases. The objective of the current study is to determine the level of handwashing knowledge, attitudes, and practices among school students in Eastern Province Schools, Saudi Arabia. A cross-sectional survey was recruited from November 2019 to March 2020 to assess the level of the students’ handwashing knowledge. A reliable questionnaire was prepared (Cronbach’s alpha = 0.608) and conducted using a two-stage sampling technique. A total of 271 students participated in the study from primary, middle, and high schools; 80% were boys, most of whom displayed an acceptable level of knowledge on hand hygiene. Nearly 75% and 74% of boys and girls, respectively, gained knowledge about hand hygiene practices from their parents. Only 46% of the students thought that handwashing is a potential protective measure against diseases, whereas 34% thought it only removes dirt. Prevalence of handwashing with soap after using the toilet was recognized among 52% of the students. Additionally, 93% of the students used water and soap to wash their hands (p value < 0.001) and 97% suggested that soap and water are the best methods to wash their hands (p value < 0.001). There was a positive correlation between the mother’s education and hand hygiene practices (p value = 0.044). Results collectively indicated that handwashing knowledge and practices among school students in the Eastern Province are acceptable interventions in preventing the transmission of infectious diseases such as COVID-19. Indeed, further improvement conducted through specific health education programs to emphasize the role of handwashing in health hygiene is highly recommended.

1. Introduction

Practicing appropriate handwashing with optimum frequency is a fundamental skill for leading a healthy life [1, 2]. Handwashing, especially before eating, is believed to be one of the first techniques to protect children, teens, and adults from many communicable diseases [1, 3]. Generally, there is a progressive increase in risks associated with a wide range of diseases directly correlated with handwashing, for example, water- and foodborne diseases, contagious diseases, severe acute respiratory syndrome (SARS), H1N1 influenza A, norovirus, cholera, malaria, dysentery, meningitis, shigellosis, and multiresistant Staphylococcus aureus [4]. In fact, childhood diarrhoea was found to be significantly correlated with handwashing without soap [5]. Generally, contaminated hands can be a source of infectious diseases, and this happens after picking one’s nose or coughing, using the bathroom, and dealing with garbage [6]. Furthermore, handwashing is an essential cause for healthy growth and development in the community [2, 7, 8]. Unfortunately,
2. Materials and Methods

2.1. Study Location. The study was conducted in selected schools in the major three cities in the Eastern Province (Dammam, Dhahran, and Khobar), Saudi Arabia, between November 2019 and March 2020.

2.2. Sampling Design. A cross-sectional survey was recruited from November 2019 to March 2020 to assess the level of the students’ handwashing knowledge. Data collection was based on a survey questionnaire adapted from Dajaan et al. (2018). The questionnaire was translated to Arabic, and its contents were validated by public health experts. Cronbach’s alpha test was performed using SPSS version 19.0 to check the reliability of the questionnaire and was found to be 0.608.

Random sampling was performed using a two-stage sampling technique that involved a fixed number of schools for each stratum in three major cities in Eastern Province, namely Dammam, Khobar, and Dhahran. In the first stage, every 35th school was randomly selected from a list of 1,068 schools in the major three cities in the Eastern Province. In the second stage, every 3rd student was randomly selected from a students’ list of each school. The number of students spread proportionally across the schools, and 271 students were selected from 30 schools. In addition, a checklist was created to inspect the availability of handwashing facilities at schools. Assistance has been provided to respondents to explain the questions as well as to fill out the questionnaires. The questionnaires were collected on the same day of each visited school after assuring that all questions were answered with care and attention.

The questionnaire included questions on students’ parental education and sociodemographic characteristics. In fact, there were 16 questions assessing the perceived levels of knowledge on hand hygiene practices, with a clear response to hand hygiene acquisition and performance. Indeed, the distribution of student responses on their hand hygiene practice was targeted by 11 questions.

2.3. Inclusion and Exclusion Criteria. Primary, intermediate, and secondary school students (male and female) from the selected schools were included in the study. However, students with mental or physical disabilities from the selected schools were excluded.

2.4. Statistical Analysis. The normality of data was tested using a boxplot diagram. A descriptive analysis was the first section presenting the percentage of responses to each domain. The bivariate analysis comprised a Chi-square score analysis for categorical two-group data and ANOVA for categorical data with more than two groups to assess the relationship between student characteristics and the score of hand hygiene practices. All statistical analyses were performed using the SPSS 19.0 program (SPSS Inc., Chicago, IL, USA).

2.5. Ethical Considerations. Ethical permission was obtained from the Institutional Review Board (IRB) of Imam Abdulrahman Bin Faisal University, Dammam, KSA (ethical permission number: IRB-2021-057-CPH).
3. Results

3.1. Students’ Characteristics. Among the 271 students who participated in the study, 80% were boys, and 71% were above 14 years old, that is, mostly from high school (Table 1). There was great variation in terms of parental education, with half of the mothers holding high school and undergraduate degrees (26% and 35%, respectively), while two-thirds of the fathers had gained undergraduate and postgraduate degrees (27% and 28%, respectively).

Seventy-five percent of boys and 74% of girls agreed that they had learnt about hand hygiene practices from their parents (Table 2 and Figure 1). For all age groups, parents had the greatest impact as a means of transmitting handwashing education (Table 2).

As graphically presented in Figure 1, approximately 74–75% of students of all ages gained their knowledge of hand hygiene practices from their parents.

3.2. Perceived Knowledge of Hand Hygiene. Assessing the students’ perceived knowledge on hand hygiene indicated that a majority of participants had a high level of knowledge on hand hygiene (Table 3). Moreover, most students (87%; p value = 0.001) recognized that washing hands with water and soap at schools is significant. Interestingly, 91.1% (p value = 0.001) of students had been educated on how to wash their hands. Unfortunately, only 46% thought that handwashing prevents diseases, and approximately 40% thought it removes dirt, whereas 69% did not believe that handwashing could remove germs. Additionally, 82.7% of students recognized the significant impact of handwashing on personal hygiene (p value = 0.001). Regarding the use of soap in handwashing, 77.5% of students washed their hands before and after eating, whereas 52% washed their hands after using the toilet and 83% while preparing food (p value = 0.001).

Regarding students’ performance, 92% used water and soap to wash their hands (Figure 2), and 97% (p value < 0.001) agreed that using soap and water is the best method to wash their hands (Table 4). Surprisingly, 62% learnt to wash their hands at home and 18% at school (Figure 3).

The students were asked about their perceived hand hygiene practices (Table 5), with the majority of their answers showing evidence of positive practices and with more than 80% agreeing on the best forms of hand hygiene practice (p value < 0.001). However, when they were faced with confirming the statement “I always wash my hands after playing with friends,” only 61% did so.

A bivariate analysis to assess the relation between student characteristics and scores of hand hygiene practice (score of 12) was conducted. The analysis indicated that the student’s gender and their father’s level of education have no significant impact on perceived practices; however, age had a significant impact on their perceived practice (p value < 0.015), and the older the student, the more aware of hand hygiene practices they were. Additionally, the students’ mothers’ levels of education had a significant relationship to hand hygiene practices (p value = 0.044), as students with a mother who had an elementary or high school education (p value = 0.071 and 0.014, respectively) displayed the highest scores of perceived practices of hand hygiene (Tables 6 and 7).

4. Discussion

The current study was conducted to assess the level of handwashing knowledge and practice among students in the Eastern Province, Saudi Arabia. Consideration was given to the relationship between students’ backgrounds and hand hygiene practices. Results revealed that most of the students (80%) possessed an awareness of hand hygiene. Similar findings were recorded among male primary school students in the city of Abha, Saudi Arabia [30]. In concordance, a study in Abha revealed that 86.6% of the students have acknowledged that respiratory tract infections can be reduced if the proper handwashing practices are maintained [26]. Moreover, Hazazi et al. [30] found that approximately 95% of the students realized the importance of hand hygiene, especially in disease spreading through person-to-person contact. Also, in a study to detect the level of knowledge and practice as a preventive measure to combat COVID-19 disease in Saudi Arabia, Siddiqui et al. [31] revealed that 84% of the population realizes and practices handwashing. On the contrary, Dajaan [15] revealed that only 37.67% of primary school students in Ghana realized the importance of handwashing in disease prevention. Compared to the studies carried out in other Saudi Arabia cities, Ghana, and India, school students in Eastern Province recorded a better awareness towards hand-hygiene-related knowledge and practices [8, 15, 32].

Approximately 75% of the students had learnt hand hygiene practices from their parents; these findings were expected, as the students in the study location generally come from a high socioeconomic status. On the contrary, Al-Hazmi et al. [25] revealed that knowledge of preventive measures against infectious diseases is higher among college students than in schools, and the media is the major source of information on those measures, rather than academic institutions’ programs. Moreover, a study in Al-Ahsa region, Saudi Arabia, explicits that sociodemographic factors and personal hygiene habits are associated with the prevalence of infectious diseases [29]. Most of the students (97%) agreed that soap and water is the best method for washing their hands; this result was consistent with some other previous studies [13, 30, 33–35].

Only 46% of the students thought that handwashing prevents diseases, and 34% of them thought that it removes dirt. Concurrently, Dajaan et al. [15] have found that 100% of Saudi school students recognize the importance of soap and water in handwashing, with their results also showing that 37.67% of the respondents in the study washed their hands to prevent disease, and 21.33% washed their hands to remove germs and dirt [15].

Moreover, 86% and 87% of the students washed their hands before eating and after using the toilet, respectively. In Majma’ah, a study compared food hygiene practices,
Table 1: Distribution of student characteristics.

| Student characteristics | N 271 | Percentage | Chi² (df) | p value |
|-------------------------|-------|------------|-----------|---------|
| Gender                  |       |            |           |         |
| Boy                     | 218   | 80         | 100.5 (1) | <0.001  |
| Girl                    | 53    | 20         |           |         |
| Age                     |       |            |           |         |
| 9–11 years              | 59    | 22         | 180.1 (2) | <0.001  |
| 12–14 years             | 20    | 7          |           |         |
| Above 14 years          | 192   | 71         |           |         |
| Class level             |       |            |           |         |
| Elementary school       | 59    | 22         | 180.1 (2) | <0.001  |
| Secondary school        | 20    | 7          |           |         |
| High school             | 192   | 71         |           |         |
| Maternal education level|       |            |           |         |
| No formal education     | 21    | 8          |           |         |
| Elementary and secondary level | 23 | 9 |           |         |
| High school             | 69    | 26         |           |         |
| Undergraduate level (diploma or bachelor’s) | 95 | 35 |           |         |
| Postgraduate level (master’s, doctoral, or above) | 37 | 14 |           |         |
| I do not know           | 26    | 1          |           |         |
| Paternal education level|       |            |           |         |
| No formal education     | 15    | 6          |           |         |
| Elementary and secondary level | 14 | 5 |           |         |
| High school             | 61    | 23         |           |         |
| Undergraduate level (diploma or bachelor’s) | 74 | 27 |           |         |
| Postgraduate level (master, doctoral, or above) | 76 | 28 |           |         |
| I do not know           | 31    | 1          |           |         |

Table 2: The relationship between gender, age distributions, and the teaching means.

| Student characteristics | Teacher | Health officer | Parent | Missing | Chi² (df) | p value |
|-------------------------|---------|----------------|--------|---------|-----------|---------|
|                         | n       | %              | n     | %       | n        | %       | p value |
| Gender                  |         |                |       |         |           |         |         |
| Boys                    | 18      | 9              | 34    | 17      | 152      | 75      | 14      | 6       | 0.671 (2) | 0.715   |
| Girls                   | 3       | 6              | 10    | 20      | 36       | 74      | 4       | 8       |           |         |
| Total                   | 21      | 8              | 44    | 17      | 188      | 74      | 18      | 7       |           |         |
| Age                     |         |                |       |         |           |         |         |         |
| 9–11 years              | 10      | 17             | 8     | 63      | 37       | 7       | 4       | 7       | 12.171 (4) | 0.016   |
| 12–14 years             | 2       | 10             | 6     | 30      | 12       | 60      | 0       | 0       |           |         |
| Above 14 years          | 9       | 5              | 30    | 16      | 139      | 72      | 14      | 7       |           |         |
| Total                   | 21      | 8              | 44    | 16      | 188      | 69      | 18      | 7       |           |         |

Figure 1: Major sources of knowledge about hand hygiene among school students between 9 and 14 years old.
including handwashing, between primary, intermediate, and secondary school students and found that the students demonstrated good levels of practice, even though attitudes and levels of knowledge were considerably reasonable [28]. Hazazi et al. [30] revealed that more than 90% of primary year school students use soap in handwashing especially before and after eating and also after using the toilet. Unfortunately, only 39.88% of primary school students in Ghana use soap in handwashing after visiting the toilet [15]. Remarkably, UNICEF [36] declares that the two most vital moments of handwashing happen before eating and after using the toilet, supporting the findings of the current study.

Also, the results remarkably revealed that approximately 86% and 87% of the students washed their hands before eating and after using the toilet. The role of handwashing as an efficient preventative technique against many infectious diseases, for example, impetigo, diarrhoea, HFMD, and the novel COVID-19 has been reported by many scientists [4, 10, 35, 37, 38]. Recently, the role of hand hygiene behaviour in COVID-19 prevention among primary school students has been studied in China [39]. Approximately, 42.05% of the students showed good behaviour and were significantly affected by many factors including mother’s educational background. In a study to detect the level of knowledge and practices during the COVID-19 pandemic among the Saudi population, it was found that most of the participants preferred handwashing to alcohol disinfection [40].

Indeed, the use of soap in handwashing by approximately 86.5% of the students is greater in comparison with other countries (42% to 49%) [4]. Also, handwashing with soap plays a crucial role in the prevention of water- and foodborne diseases by 50% to 70%, and pneumonia, impetigo, and diarrhoeal diseases by 40% to 50% [4]. Also, in Riyadh, a study revealed that handwashing with soap is

### Table 3: Students’ responses to perceived levels of knowledge on hand hygiene practices.

| Students’ perceived knowledge | Yes | %     | No | %     | p value |
|------------------------------|-----|-------|----|-------|---------|
| 1.01. Is it important to wash your hands with soap when in school? | 236 | 87.1  | 33 | 12.2  | <0.001  |
| 1.02. Is it important to wash your hands with water to prevent diseases? | 121 | 44.6  | 141| 52.0  | 0.217   |
| 1.03. Is it important to wash your hands with soap to prevent diseases? | 124 | 45.8  | 138| 50.9  | 0.217   |
| 1.04. Is it important to wash your hands to remove germs? | 74  | 27.3  | 187| 69.0  | 0.387   |
| 1.05. Is it important to wash your hands to remove dirt? | 108 | 39.9  | 153| 56.5  | <0.001  |
| 1.06. Is it important to wash your hands for personal hygiene? | 224 | 82.7  | 37 | 13.7  | <0.001  |
| 1.07. Have you ever been educated on how to wash your hands? | 247 | 91.1  | 23 | 8.5   | <0.001  |
| 1.08. Do you wash your hands before and after eating? | 210 | 77.5  | 60 | 22.1  | <0.001  |
| 1.09. Do you wash your hands after handling rubbish/garbage? | 174 | 64.2  | 96 | 35.4  | <0.001  |
| 1.10. Do you wash your hands before preparing food? | 226 | 83.4  | 43 | 15.9  | <0.001  |
| 1.11. Do you wash your hands after using the toilet? | 141 | 52.0  | 128| 47.2  | <0.001  |
| 1.12. Do you wash your hands after playing with friends? | 185 | 68.3  | 85 | 31.4  | 0.428   |
| 1.13. Do you wash your hands after coughing or blowing your nose? | 185 | 68.3  | 85 | 31.4  | <0.001  |
| 1.14. Did you wash your hands in school? | 230 | 84.9  | 40 | 14.8  | <0.001  |
| 1.15. Did you wash your hands in school with soap? | 143 | 52.8  | 127| 46.9  | 0.330   |
| 1.16. Is it necessary to dry your hands after washing? | 207 | 76.4  | 63 | 23.2  | <0.001  |

### Figure 2: Student responses on their hand hygiene methods.

- **Wash hand with water**
- **Wash hand with water and Soap**
- **Missing**

- 92% Wash hand with water
- 7% Wash hand with water and Soap
- 1% Missing
negatively correlated with students' absence in school [27]. Interestingly, the prevalent use of soap with handwashing is recorded as an efficient measure for reducing contamination of the hands due to the potentially lethal effects of microbial contaminants [41, 42].

Finally, in concordance with previous studies, maternal education levels and student age are significantly correlated with good hand hygiene practices among school students. However, the gender of school students was not correlated with the level of handwashing. On the contrary, Alshammary et al. [43] revealed that Saudi females are equipped with a higher level of knowledge and practice on hand hygiene than males during the COVID-19 pandemic (86% and 80%, respectively). Moreover, Dajaan et al. [15] identified that female students have higher handwashing practices than males.

| Student performance | N   | Percent | p value |
|---------------------|-----|---------|---------|
| How do you wash your hands? |     |         | <0.001 |
| Wash hands with water | 18  | 7       |         |
| Wash hands with water and soap | 251 | 93      |         |
| Missing              | 2   | 1       |         |
| Total                | 271 | 100     |         |
| Where have you ever been educated on how to wash your hands? |     | <0.001 |
| School               | 50  | 18      |         |
| Home                 | 167 | 62      |         |
| Media                | 20  | 7       |         |
| Community            | 20  | 7       |         |
| Missing              | 14  | 5       |         |
| Total                | 271 | 100     |         |
| What is the best to use when washing your hands? |     | <0.001 |
| Water only           | 7   | 3       |         |
| Water and soap       | 263 | 97      |         |
| Missing              | 1   | 0       |         |
| Total                | 271 | 100     |         |
| Which soap type is best to use in handwashing? |     | <0.001 |
| Liquid soap          | 185 | 68      |         |
| Bar soap             | 46  | 17      |         |
| Powder detergent     | 5   | 2       |         |
| Do not know          | 32  | 12      |         |
| Missing              | 3   | 1       |         |
| Total                | 271 | 100     |         |

Figure 3: Student responses on their hand hygiene performance.
Table 5: Distribution of student responses on their hand hygiene practice.

| Students’ perceived practice | Yes | %  | No | %  | p value |
|------------------------------|-----|----|----|----|---------|
| 2.01. I always wash my hands before and after eating | 238 | 88 | 28 | 10 | <0.001 |
| 2.02. I always wash my hands with soap before and after eating | 235 | 87 | 35 | 13 | <0.001 |
| 2.03. I always wash my hands after visiting the toilet | 232 | 86 | 31 | 11 | <0.001 |
| 2.04. I always wash my hands with soap after handling garbage | 239 | 88 | 31 | 11 | <0.001 |
| 2.05. I always wash my hands after playing with friends | 165 | 61 | 100 | 37 | <0.001 |
| 2.06. I always wash my hands with soap after playing with friends | 171 | 63 | 97 | 36 | <0.001 |
| 2.07. I always wash my hands after blowing my nose or coughing | 219 | 81 | 46 | 17 | <0.001 |
| 2.08. I always wash my hands with water after blowing my nose or coughing | 223 | 82 | 45 | 17 | <0.001 |
| 2.09. I always wash my hands with soap after blowing my nose or coughing | 223 | 82 | 45 | 17 | <0.001 |
| 2.10. I always wash my hands when they are visibly dirty | 235 | 87 | 28 | 10 | <0.001 |
| 2.11. I always wash my hands with soap when they are visibly dirty | 261 | 96 | 9 | 3 | <0.001 |

Table 6: Bivariate analysis of students’ means scores of hygiene practices according to their background.

| Student background | N* | Mean | SD | Std. error mean | T-test5 | p value |
|--------------------|----|------|----|-----------------|---------|---------|
| Gender             |     |      |    |                 |         |         |
| Boy                | 218 | 10.05| 2.333| 0.158           | 1.510   | 0.132   |
| Girl               | 53  | 9.51 | 2.259|                 |         |         |
| Age                |     |      |    |                 |         |         |
| 9–11 years         | 59  | 10.59| 2.102| 0.310           | 4.247   | 0.015   |
| 12–14 years        | 20  | 9.00 | 2.362|                 |         |         |
| Above 14 years     | 192 | 9.84 | 2.347|                 |         |         |
| Class level        |     |      |    |                 |         |         |
| Elementary school  | 59  | 10.59| 2.102| 4.247           | 2       | 0.015   |
| Secondary school   | 20  | 9.00 | 2.362|                 |         |         |
| High school        | 192 | 9.84 | 2.347|                 |         |         |
| Maternal education level | | | | | | |
| No formal education| 21  | 9.71 | 2.148| 2.325           | 5       | 0.044   |
| Elementary and secondary level | 23  | 10.39| 2.061|                 |         |         |
| High school        | 69  | 10.35| 1.984|                 |         |         |
| Undergraduate level| 95  | 9.85 | 2.445|                 |         |         |
| Postgraduate level | 37  | 8.89 | 2.706|                 |         |         |
| I do not know      | 7   | 10.57| 1.512|                 |         |         |
| Paternal education level | | | | | | |
| No formal education| 15  | 10.87| 1.407| 1.214           | 5       | 0.303   |
| Elementary and secondary level | 14  | 10.14| 2.070|                 |         |         |
| High school        | 61  | 9.92 | 2.193|                 |         |         |
| Undergraduate level| 74  | 9.66 | 2.495|                 |         |         |
| Postgraduate level | 76  | 9.76 | 2.487|                 |         |         |
| I do not know      | 10  | 11.00| 1.414|                 |         |         |

*The total number of complete cases is 271. 5F-score for more than two groups.
5. Conclusions

The purpose of the current study was to determine the level of school students' handwashing knowledge and practices, with a special emphasis on their source of knowledge about hand hygiene. Additionally, the correlation between students' backgrounds and hand hygiene practices was clearly discussed. Interestingly, more than 80% of the students have high levels of hand hygiene awareness, especially learnt at home. Unlike the students' fathers' education levels, their mothers' education levels, and the age of the students have been found to have a significant impact on hand hygiene practices and behaviour. The work presented in this study can serve as a basis for the construction of awareness programs to promote hand hygiene education and practices against infectious diseases, for example, COVID-19 and similar pandemics. Further studies are needed to understand how hand hygiene is practiced at home and in school while relating this practice to infectious disease transmission and risk factors.

Data Availability

Raw data are available from the corresponding author upon reasonable request.

Conflicts of Interest

The authors declare that there are no conflicts of interest regarding the publication of this paper.
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