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# Awareness of the first aid management of foreign body aspiration among students: A cross-sectional study

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## Abstract:

**BACKGROUND:** Pediatric foreign body aspiration (FBA) is a life-threatening condition responsible for many deaths every year, especially among children younger than 2 years.

**OBJECTIVE:** This study aimed to determine the level of knowledge among students in Jeddah, Saudi Arabia.

**SUBJECTS AND METHODS:** This observational, cross-sectional study was conducted between December and January 2018 at Jeddah, Saudi Arabia via a paper-based questionnaire survey of male and female high school and middle school students. The Chi-square test was used to compare frequencies, and the independent *t*-test was used to compare means.

**RESULTS:** A total of 671 students participated in this survey. The second item, "It is possible for a child to choke on a small toy" had the highest rate of correct responses among both males and females (93.2% vs. 94%, respectively). The eighth item "Sudden cough is a sign of choking among children" had the lowest rate of correct responses among males (40.8%) and females (33%). Most female participants (74.2%) knew that batteries are the most dangerous items a child can swallow, which requires immediate medical attention (item 14), while only 56.2% of male participants knew that ( $P < 0.001$ ). The only significant predictor on linear regression analysis was "Having treated anyone with FBA" (coefficient =  $-0.24$ ,  $P = 0.03$ ).

**CONCLUSIONS:** There is inadequate knowledge regarding FBA among middle and high school students, as is the case among mothers. Moreover, only a small percentage of participants had any first aid training.

## Keywords:

Aspiration, foreign body, high school, middle, pediatric

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## Introduction

Foreign body aspiration (FBA) is defined as the inhalation of foreign bodies/objects into the respiratory tract.<sup>[1]</sup> FBA commonly occurs among pediatric populations,<sup>[2]</sup> most commonly at the age of 6 months to 4 years, when children explore new objects by placing them in their mouths.<sup>[3]</sup> A broad range of foreign bodies have been reported in the literature; the most frequently

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aspirated foreign bodies are toys, sweets, jewels, batteries, rocks, and magnets.<sup>[4]</sup> Pediatric FBA is a life-threatening condition responsible for many deaths every year, especially among children younger than 2 years.<sup>[5]</sup> The obstruction caused by foreign bodies can lead to impaired oxygenation and ventilation, which lead to significant morbidity or mortality. Hypoxic-ischemic brain injury is the leading cause of death followed by pulmonary hemorrhage.<sup>[6,7]</sup> Other complications include neurologic

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disability, recurrent pneumonia, pulmonary abscess, and bronchiectasis.<sup>[8-10]</sup>

According to a large retrospective review published in 2016 in United State, the mortality rate among pediatric patients with FBA was 2.5%.<sup>[8]</sup> The National Safety Council identified the rate of fatal and nonfatal choking among American children in the general population as 0.43 and 20.4/100,000 population, respectively.<sup>[11]</sup>

The rapid diagnosis and proper treatment of FBA has resulted in a significant reduction in the morbidity and mortality rate associated with FBA.<sup>[12-15]</sup> The prevention of FBA is better than early treatment and is the most critical step to avoiding the related mortality and morbidity.<sup>[16]</sup> Public awareness regarding the risk of FBA in children is the best method of prevention and should be increased.<sup>[17]</sup> Previous studies conducted in India, Saudi Arabia, and Japan showed that the awareness levels about FBA were significantly low in the study populations.<sup>[17-19]</sup> However, another study conducted in Turkey in 2015 showed that 50% of mothers, who participated in the study, had adequate information about FBA.<sup>[20]</sup>

As the awareness of FBA is the most important step to preventing this major problem and due to the lack of adequate literature addressing the knowledge regarding FBA, this study aimed to determine the level of knowledge among students in Jeddah, Saudi Arabia.

## Subjects and Methods

This observational cross-sectional study was conducted between December 2018 and March 2019 at Jeddah, Saudi Arabia via a paper-based questionnaire survey of male and female high school and middle school students. All the school students have been included in our study; each student had the opportunity to participate one time only.

The questionnaire used in this study contained 15 questions that were divided into three parts. The first part included questions about demographics such as age, gender, nationality, and level of education, and questions focused on previous first aid training or any experience with FBA. The second part of the questionnaire contained statements focusing on knowledge of the causes of FBA that required true/false responses. This part of the questionnaire was adapted from Higuchi *et al.*<sup>[17]</sup> and was used primarily to evaluate the level of awareness among our sample. The final part contained statements related to the symptoms and signs and the management of FBA. This part of the questionnaire was adopted from two articles published by Singh *et al.*<sup>[18]</sup> and Ozdogan *et al.*<sup>[20]</sup> A pilot study was conducted among 20 randomly selected students; their responses were not shared in

this study and the questionnaire was reviewed by two otolaryngology (head and neck surgery) consultants.

## Statistical analysis

Categorical variables are presented as percentages, while continuous variables are presented as means  $\pm$  standard deviation. The Chi-square test was used to compare frequencies, and the independent *t*-test was used to compare means. All statistical analyses were performed using SPSS Statistics version 22 (IBM Corp., Armonk, NY, USA). For all statistical tests,  $P = 0.05$  or lower was considered as statistically significant.

## Confidentiality and ethical approval

The study protocol was approved by the Institutional Review Board of our university hospital (document number: 656-18, December 2018). All identifying information of the participants was removed to ensure privacy and confidentiality, and only the authors had access to the data. The participants were instructed on the purpose of the study, and informed written consent was obtained before filling out the questionnaire.

## Results

### Baseline characteristics

A total of 671 students participated in this study. Among them, 50.4% were males and 49.6% were females with a mean age of  $16.58 \pm 5.57$  years (minimum age was 12 years and maximum age was 18 years); 50.4% of the students were high school students and 47.6% were middle school students. Most of the participants were Saudis (92.1%). Only 23.1% of the participants had previously taken a first aid course, 50.8% had experienced FBA at least once in their life, and 30.1% admitted that they had treated at least one person with FBA. The baseline characteristics of the participants are presented in Table 1.

### Awareness and knowledge

There were 8 statements about FBA requiring true/false responses that are shown in Table 2, and 6 questionnaires comprising multiple choice questions about FBA are shown in Table 3. The second statement "It is possible for a child to choke on a small toy" had the highest rate of correct responses among both males (93.2%) and females (94.0%). The eighth statement: "Sudden cough is a sign of choking among children" had the lowest rate of correct responses among males (40.8%) and females (33.0%). There was a significant difference between the two sexes regarding the responses to statement 6, "It is safe to forcefully take a toy from a child's mouth causing him/her to cry." To this statement, more than half (60.0%) of male participants and 39.9% of female participants gave correct responses ( $P > 0.001$ ). Most female participants (74.2%) and 56.2% of male participants knew that batteries are the most dangerous

**Table 1: Demographic characteristics of the sample (n=671)**

Variables	Values
Age	16.58±5.57
Gender	
Male	338 (50.4)
Female	333 (49.6)
Nationality	
Saudi	618 (92.1)
Non-Saudi	53 (7.9)
Level of education	
High school	338 (50.4)
Middle school	333 (47.6)
Have you taken any first aid course?	
Yes	155 (23.1)
No	516 (76.9)
Have you experienced FBA?	
Yes	341 (50.8)
No	330 (49.2)
Have you treated anyone with FBA?	
Yes	202 (30.1)
No	469 (69.9)

FBA=Foreign body aspiration

objects a child can swallow, which requires immediate medical attention (statement 14) ( $P < 0.001$ ).

The mean rates of correct responses to the true/false questionnaire among the sample showed that male ( $4.62 \pm 1.32$ ) has significantly higher mean than female ( $4.33 \pm 1.17$ ) ( $P = 0.002$ ). Furthermore, students who previously treated anyone with FBA ( $4.67 \pm 1.23$ ) has significantly higher mean than students who did not encounter that ( $4.39 \pm 1.26$ ) ( $P = 0.008$ ). The mean rates of correct responses to the true/false questionnaire are presented in Table 4.

The only significant predictor identified in linear regression analysis was "Having treated anyone with FBA" (coefficient =  $-0.24$ ,  $P = 0.03$ ), as shown in Table 5.

The majority of participants (40.1%) considered "doctors" as the best source of information to raise the awareness about FBA, followed by "health care personnel" (22.9%) and "social media" (18.7%). The worst source of information was "relatives and friends" (6.5%).

## Discussion

The purpose of this study was to determine the level of knowledge about FBA among students in Jeddah, Saudi Arabia, via a validated questionnaire. There was a significant difference in the mean number of correct responses to the true/false questions between males and females ( $4.62 \pm 1.32$  vs.  $4.33 \pm 1.17$  out of 8) ( $P = 0.002$ ).

The rate of correct responses ranged between 33% and 94%, the highest being associated with the

**Table 2: The percentage of responses to the true/false foreign body aspiration questionnaire among the sample (n=671)**

Question	Male (%)	Female (%)	P
1. It is possible for the child to get choked by a foreign body			
Correct answer	258 (76.3)	245 (73.6)	0.410
Wrong answer	80 (23.7)	88 (26.4)	
2. It is possible for the child to get choked by small toy			
Correct answer	315 (93.2)	313 (94.0)	0.673
Wrong answer	23 (6.8)	20 (6.0)	
3. It is possible for the child to get choked by almond or equivalent			
Correct answer	227 (67.2)	254 (76.3)	0.009
Wrong answer	111 (32.8)	79 (23.7)	
4. You can feed a child under 3 years almond or equivalent			
Correct answer	207 (61.2)	222 (66.7)	0.143
Wrong answer	131 (38.8)	111 (33.3)	
5. Allowing the child to walk and laugh while eating is a safe action			
Correct answer	284 (84.0)	306 (91.9)	0.002
Wrong answer	54 (16.0)	27 (8.1)	
6. Taking a toy from the child mouth forcefully leading him to cry is a safe action			
Correct answer	132 (39.1)	200 (60.1)	0.000
Wrong answer	206 (60.9)	133 (39.9)	
7. Sudden interruption of the breathing is a sign of child choking			
Correct answer	234 (69.2)	248 (74.5)	0.131
Wrong answer	104 (30.8)	85 (25.5)	
8. Sudden cough is a sign of child choking			
Correct answer	138 (40.8)	110 (33.0)	0.036
Wrong answer	200 (59.2)	223 (67.0)	

awareness that small toys can lead to choking and the lowest associated with lack of recognition of sudden cough as a sign of FBA. In the work of Higuchi *et al.* regarding the knowledge of mothers, the highest rate of correct responses also was obtained in knowledge about small toys and the lowest in recognition of sudden cough as a symptom; however, about half of the individuals gave correct responses.<sup>[17]</sup> Such a deficiency in recognizing some of the signs of FBA can contribute to late presentation of the child, especially when the ingestion was not witnessed,<sup>[15]</sup> leading to more complications.<sup>[21]</sup>

Lack of awareness that nuts and similar items can potentially be aspirated among children younger than 3 years is a common problem in our study and other studies,<sup>[17,19]</sup> although it was identified as the most common cause of FBA.<sup>[21]</sup>

**Table 3: The percentage of responses to the multiple choice choices foreign body aspiration questionnaire among the sample (n=671)**

Question	Male (%)	Female (%)	P*
9. How dangerous is swallowing a foreign body by the child?			
Lethal	196 (58.0)	172 (51.7)	0.113
A little danger	65 (19.2)	69 (20.7)	
I don't know	57 (16.9)	78 (23.4)	
Not very dangerous	20 (5.9)	14 (4.2)	
10. At which age the child is more prone to get choked?			
First 2 years	173 (51.2)	176 (52.9)	0.039
From 3 to 5 years	96 (28.4)	113 (33.9)	
I don't know	53 (15.7)	36 (10.8)	
From 6 to 11 years	11 (3.3)	8 (2.4)	
From 12 to 18 years	5 (1.5)	0 (0.0)	
11. Symptoms of FBA			
Vomiting	58 (17.2)	52 (15.6)	0.589
Cough	162 (47.9)	133 (39.9)	0.037
Crying	132 (39.1)	142 (42.6)	0.344
Holding the neck	189 (55.9)	178 (53.5)	0.522
Cyanosis	196 (58.0)	216 (64.9)	0.067
Difficulty of breathing	228 (67.5)	262 (78.7)	0.001
Difficulty of talking	163 (48.2)	190 (57.1)	0.022
Shortness of breath	192 (56.8)	211 (63.4)	0.083
Bloody cough	43 (12.7)	50 (15.0)	0.390
12. What is the best way to prevent a child from swallowing a dangerous body?			
Removing things that can be swallowed out of his reach	178 (52.7)	197 (59.2)	0.166
Continuous observation of the child	60 (17.8)	52 (15.6)	
Educating the child	51 (15.1)	52 (15.6)	
None	49 (14.5)	32 (9.6)	
13. How can you manage a child who swallowed a foreign body?			
I try to remove the foreign body by myself first	206 (60.9)	218 (65.5)	0.92
Taking the child to the hospital immediately	71 (21.0)	75 (22.5)	
I don't know	61 (18.0)	40 (12.0)	
14. What is the most serious body a child can swallow, which requires going to hospital immediately?			
Batteries	190 (56.2)	247 (74.2)	0.000
Toys	100 (29.6)	61 (18.3)	
Food (almonds, nuts, dates .)	48 (14.2)	25 (7.5)	

\*P values were derived via Chi-square test. FBA=Foreign body aspiration

Moreover, the lack of knowledge among males and to a lesser extent, females about the risk of making a child cry in the attempt to extract the aspirated object was more pronounced than in the study conducted by Higuchi *et al.*<sup>[17]</sup> However, Al-Qudehy *et al.* reported a more severe lack of knowledge in this aspect even among well-educated mothers in western Saudi Arabia.<sup>[19]</sup>

Responses to the last section of the questionnaire on symptoms and management were more prevalently correct than in a previous study conducted among mothers,<sup>[18]</sup> 46% of whom could not state any symptom of FBA. Most participants also stated they would manage FBA by trying to remove the foreign body themselves. However, only 58% of males and 51.7% of females in our study recognized FBA as a potentially lethal problem as compared to 81% in another study.<sup>[20]</sup>

Studies on the awareness of FBA among children are scanty. One study<sup>[22]</sup> assessed the knowledge of schoolchildren aged  $17.01 \pm 0.73$  years before and after a training program using a visual presentation followed by application on models of different ages that included first aid. A significant proportion (43.0%–92.0%) lacked knowledge regarding the symptoms of FBA, the importance of the nature of the aspirated object, and the need to consult a physician after extracting a foreign body. The training program resulted in significant increases in knowledge about these aspects. Similar to our study, most of the participants (76.9% in our study and 99% in the previous study) did not have any training concerning FBA.

This population is unique in that older siblings could potentially prevent or treat FBA in the absence of parental supervision.



**Table 4: The mean of correct responses to the true/false questionnaire among the sample (n=671)**

Variables	Responses	P*
Gender		
Male	4.62±1.32	0.002
Female	4.33±1.17	
Nationality		
Saudi	4.48±1.26	0.884
Non-Saudi	4.45±1.23	
Level of education		
High school	4.32±1.17	0.002
Middle school	4.62±1.32	
Have you taken any first aid course?		
Yes	4.47±1.14	0.947
No	4.48±1.28	
Have you experienced FBA?		
Yes	4.55±1.19	0.134
No	4.40±1.32	
Have you treated anyone with FBA?		
Yes	4.67±1.23	0.008
No	4.39±1.26	

Values are presented as mean±SD. \*P values were derived via independent t-test. SD=Standard deviation, FBA=Foreign body aspiration

**Table 5: Results of the true/false questionnaire score, based on multivariate analyses**

Variables	R	Confidence interval	P
Gender	-0.197	-0.48-0.09	0.178
Nationality	-0.108	-0.46-0.24	0.544
Age	0.034	-0.04-0.11	0.402
Have you taken any first aid	0.006	-0.22-0.23	0.06
Have you experienced FBA?	-0.079	-0.27-0.11	0.430
Have you treated anyone with FBA?	-0.239	-0.45--0.02	0.030
Cons	4.251	2.84-5.65	0.000

FBA=Foreign body aspiration

We surveyed our participants on the best possible source of information to enhance the knowledge of FBA. Doctors have been the top suggestion (40.1%) followed by other healthcare personnel (22.9%). This reinforces the need for counseling regarding FBA, particularly from pediatricians, since only 1.6%–3.2% of knowledge is currently obtained from healthcare workers including physicians.<sup>[18]</sup>

Other methods that have been suggested for the prevention of FBA include labeling foods that could result in choking, public awareness campaigns targeting children, and regular training and counseling of parents during regular child checkups.<sup>[6,17]</sup> Some international tools have been developed to address the risk of aspiration of small toys such as the small parts test fixture<sup>[23]</sup> by the Consumer Product Safety Commission of the United States in addition to the European regulations.<sup>[24]</sup>

A limitation of this study is the absence of information on the number of siblings in the house, which could influence

the awareness of FBA prevention and treatment. Another is the inability to assess the socioeconomic status and income level of participants.

## Conclusions

Summarily, there is inadequate knowledge regarding FBA among middle school and high school students, as is the case among mothers. The greatest deficiency in knowledge was found regarding the risk of ingesting nuts below the age of three, which is the most common cause of FBA, and the symptoms of FBA, which is one of the main factors for delayed diagnosis and increased complications. Moreover, only a small proportion of participants had had any first aid training. Methods recommended to enhance the prevention and treatment of FBA mainly include continuous campaigns and simulation sessions targeting mothers and children, counseling from pediatricians during regular visits, as well as the use of clear warning labels on toys and food products that could cause choking for children below the age of 3 years. Furthermore, taking of information about the number of siblings in the house and socioeconomic status and income level of participants would enhance the result of the future studies.

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## Conflicts of interest

There are no conflicts of interest.

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