

## Increased Incidence of Foreign Body Ingestion after Coins Re-exchanged in Saudi Arabia



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**Abstract— Background:** Foreign body ingestion is a common problem among children, with high morbidity and fatality rates. Coin was the most commonly reported kind of foreign body ingestion. Coins were not often used in Saudi Arabia until a new series of coins was produced in 2016. This study was carried out to determine the types, locations, and results of foreign bodies, as well as to analyze the rate of coin ingestion before and after the coins were distributed and utilized in the country. **Methodology:** This study was carried out as a retrospective comparison study at the maternity and children hospital in Dammam, Saudi Arabia, in 2015 and 2021. The patients were divided into two groups: pre-coin exchange 2015 (26 patients) and post-coin exchange 2021 (82 patients). **Results:** The study comprised a total of 108 patients of foreign body ingestion, with a mean age of (4.1 ± 2.4). Significant correlations ( $p < 0.05$ ) were found between the two groups (2015, pre-coin exchange), (2021, post-coin exchange) in the elements of incidence of foreign body ingestion in general, coin ingestion, and rate of admission were considerably higher in year 2021 post-coin exchange. **Conclusion:** The prevalence of foreign body ingestion, particularly coin, has risen in Saudi Arabia after the implementation of the currency exchange initiative. Therefore, early diagnosis and treatment of foreign body ingestion are essential for avoiding adverse outcomes. In addition, increasing parental knowledge on the prevention of foreign body ingestion is an essential step in minimizing its prevalence.

**Keywords:** Foreign Body Ingestion, Children, Coins Re-exchanged, Saudi Arabia.

### Introduction

Foreign Body ingestions (FBI) in children continue to be a persistent and common issue observed in pediatric emergency departments. It often affects children between the ages of 6 months and 3 years. The majority of these FB ingestions are unintentional; nevertheless, incidences of intentional FB ingestion have been observed mostly in adolescents [1]. An estimated 40% of foreign body ingestions in children are unwitnessed, and the majority are

asymptomatic. Since many ingested FBs are safe, may transit through the digestive tract without intervention. However, severe consequences, including as intestinal perforation and obstruction, are possible [2].

Children put in their mouth, a variety of objects and non-food items, such as toy pieces, button batteries, coins, magnets, earrings, rings and whatever triggers their curiosity and whatever they find in their surroundings. Coins remain the most commonly ingested object among children worldwide [3]. They are unlikely to cause any harm, however, there were reported deaths due to coin ingestions. Many factors influence the spontaneous passage of coins in a child's system, which include their position in the esophagus, the age of the child, and the size of the coin [4].

In Saudi Arabia, coins were not routinely used until the new series of coins were issued in 2016 and the one and two Saudi riyal paper notes were replaced with the new Saudi riyal coins (bimetallic), as well as the 50, 20, 10, 5 and 1 halalas. Several studies were conducted worldwide and in Saudi Arabia, which addressed children with foreign body ingestion, as it is one of the most challenging scenarios seen in pediatric emergency departments. To the recent knowledge, there are no descriptive studies on foreign body ingestions in children in Saudi Arabia, focusing on coins ingestion incidence and complications before and after bimetallic Saudi riyals were issued and circulated.

#### **Aim of the Study:**

This study was conducted to identify the distribution of the types and the locations of foreign bodies, to investigate on the FBI occurrence, outcomes, and disposition among Saudi Arabian children, and to assess the ingestion rate of coins in pediatrics before and after their recirculation in the country. Moreover, this assessment also helped in distinguishing the patients who required intervention from the ones who were presented and diagnosed with coins ingestion.

#### **Methodology:**

##### **Patients:**

- A total of 108 foreign body ingestion (FBI) patients were enrolled in the study.

##### **Study design:**

- Retrospective, comparative study

##### **Setting:**

- Maternity and Children Hospital – Dammam (MCH-D).

##### **Target Population:**

- Children with foreign body ingestions visited the Emergency department in MCH-D in the year 2015 prior to the replacement of Riyal notes with the new Riyal coins released in 2016, and in the year 2021 after coins were issued and circulated in Saudi Arabia.

##### **Inclusion Criteria:**

- All the patients less than 15 years of age were diagnosed with foreign body ingestion such as coins, magnets, sharp objects and others.

##### **Exclusion Criteria:**

- Food related foreign body ingestions were excluded.

**Patients' Randomization:**

The 108 foreign body ingested children were classified according to the year 2015 prior to the replacement of Riyal notes with the new Riyal coins into 2 independent groups:

- Pre-coin exchange 2015 group (26 patients)
- Post-coin exchange 2021 group (82 patients)

**Data collection:**

Medical charts of Eligible patients were reviewed, and data was extracted using Standard Data Extraction form.

Data collection excel sheet will consist of:

- Years: 2015, 2021
- Patient identification: Age, Sex.
- Type of FB ingested: Coin, battery, Magnet, Sharp object other/unknown.
- FB location (based on X-rays).
- Disposition.
- Endoscopy (needed or not).

**Primary Objective:**

- The prevalence of coins ingestion before and after the replacement of Riyal notes with the new Riyal coins released in 2016.

**Secondary objective:**

- Incidence of foreign body ingestion was noted to identify the types and locations the of foreign body Outcomes and disposition were also identified.

**Results:**

In the studied population, the mean age of all patients was (4.1 ± 2.4) years. Regarding the gender of the patients, the majority (61.1%) of patients were males, while (38.9%) were females.

(Table 1): revealed the prevalence of FBI out of the total visits to emergency department in 2015 and 2021. During the year 2015, 26 cases of FBI out of 150152 visits to ER compared to 82 out of 83877 in 2021 in which there is significant increased in the rate of FBI during the year 2021 post-coin exchange (p < 0.0001).

Year	Number of Paediatrics ER visits	Number of patients diagnosed with FBI		P value
2015	150152	26	(1.73%)	<b>0.0001**</b>
2021	83877	82	(9.77%)	

Table 1: Prevalence of FBI in 2015 vs 2021.

(Table 2) displayed the type and location of FB. The most often reported form of FB among the first group pre-coin and post-coin was coin at 7.7% and 31.7%, respectively, followed by battery at 7.7% vs. 14.6% and earrings at 11.5% vs. 2.4%. Other metallic FBs and unclassified FBs provided 61.5% compared to 18.3%. The site of the FB as determined by X-ray at the time of emergency presentation. The anatomical location of the FB as determined by a plain X-ray was varied, since patients presented at different periods after ingestion,

allowing the FB to transit through the gastrointestinal tract. The majority of FBs in the first group were found in the stomach (11.5%), followed by the colon (7.7) and the small intestine/oesophagus (3.7%). The site of the FB could not be determined in the remaining 73% of instances. In the second group, however, the bulk of FBs (39%) were found in the colon, followed by the upper oesophagus. The ingestion of coins increased significantly in the second group when the coins were exchanged in the country compared to the first group that pre-coin exchange (7.7% versus 31.7%; P=0.008). Also, the incidence of FB in the intestinesignificantly increased (3.8% vs. 39%) P=0.0004

Variable		Pre-coin exchange 2015 group (26)	Post-coin exchange 2021 group (82)	Chi square test
		P-value		
<b>Type of foreign body ingestion</b>	Battery	2 (7.7%)	12 (14.6%)	= 0.0083**
	Bracelet	0 (0%)	1 (1.2%)	
	Button	0 (0%)	2 (2.4%)	
	<b>Coin</b>	<b>2 (7.7%)</b>	<b>26 (31.7%)</b>	
	Cotton	0 (0%)	1 (1.2%)	
	Earrings	3 (11.5%)	2 (2.4%)	
	Magnet	0 (0%)	5 (6.1%)	
	Metal piece	0 (0%)	5 (6.1%)	
	Nail	1 (3.8%)	5 (6.1%)	
	Plastic piece	1 (3.8%)	5 (6.1%)	
	Sponge foam	0 (0%)	1 (1.2%)	
	Stone	1 (3.8%)	2 (2.4%)	
	Unknown	16 (61.5%)	15 (18.3%)	
	<b>FBlocation</b>	Not detected	19 (73.1%)	
Colon		2 (7.7%)	3 (3.7%)	
<b>Intestine</b>		<b>1 (3.8%)</b>	<b>32 (39%)</b>	
Rectum		0 (0%)	1 (1.2%)	
Stomach		3 (11.5%)	8 (9.8%)	
Under diaphragm		0 (0%)	1 (1.2%)	
Upper esophagus	1 (3.8%)	11 (13.4%)		

Table 2: the types and locations of FB.

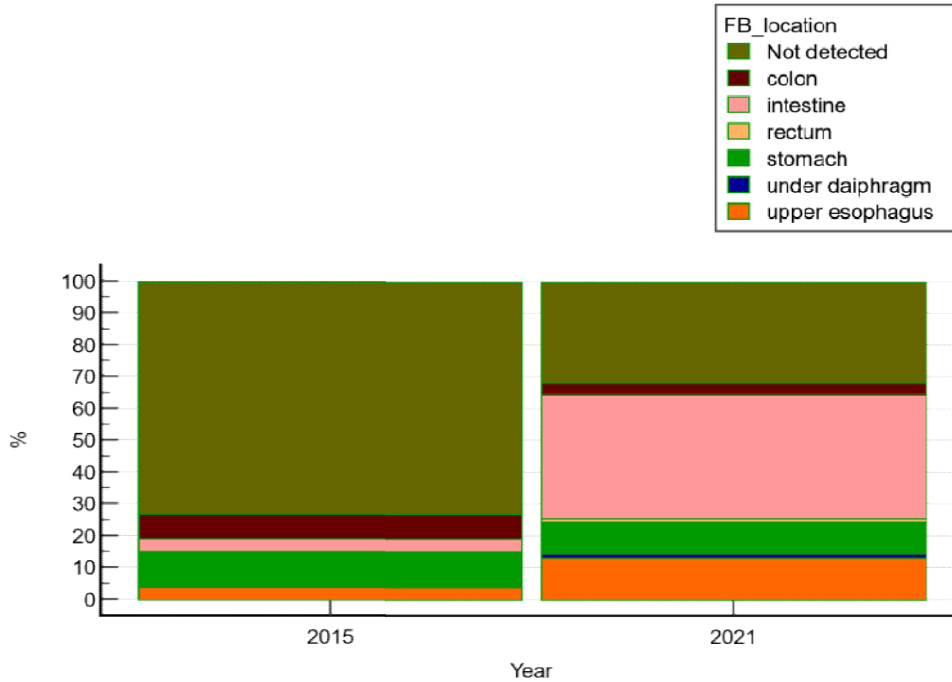


Figure 1: FB location.

Figure 2: showed that the total admission and discharge of cases of FBI were 18.5% and 81.5%, respectively. Only 13% of the case needed endoscopy removal of the FB.

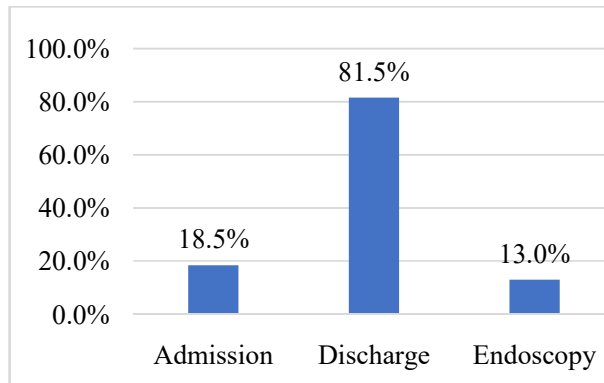


Figure 2: general outcomes of FBI.

(Table 3): demonstrated outcomes of FBI in form of admission and discharge that revealed the rate of admission was significantly increased among post-coin exchange group 32.2% compared to pre-coin exchange group 3.8% ( $p = 0.027$ ). There was no significant relationship between both groups for endoscopy needed.

Variable	Disposition	Pre-coin exchange group (26)	2015	Post-coin exchange group (82)	2021	Chi square test
		P-value		P-value		
<b>Disposition</b>	Admission	1 (3.8%)		19 (23.2%)		= 0.027*

	Discharge	25 (96.2%)	63 (76.8%)	
<b>Endoscopy</b>	Needed	1 (3.8%)	13 (15.9%)	= 0.1139

Table 3: outcomes of FBI in form of admission and discharge among pre and post coin exchange group.

**Discussion:**

This was a retrospective comparative study conducted on 108 foreign body ingestion children, to identify the distribution of types and locations of foreign bodies, to investigate on the FBI occurrences, outcomes, and dispositions among Saudi Arabian children, to assess coins ingestion rate in pediatrics before and after the coins were recirculated in the country. Moreover, this study also helped in distinguishing the patients who required interventions from the children who presented and diagnosed with coins ingestion. This study aimed to identify the distribution of types and locations of the foreign body, to investigate on the FBI occurrences, outcomes, and dispositions among Saudi Arabian children, to assess the coins-ingestion rate in pediatrics before and after the coins were recirculated in the country. Moreover, this study also helped in distinguishing the patients who required interventions from the children who were presented and diagnosed with coins ingestion

The researchers found that the mean age of all patients was (4.1 ± 2.4) years. Regarding gender of the patients, the majority (61.1%) of patients were males; while (38.9%) were females. Which came in agreement with Abualenain et al. (2018), and Chowdhury et al. (2020). Abualenain et al. (2018) reported that, the majority of FB ingestions were found in children aged 0-4 years and occurred more among females (54%), who had a slightly higher FB ingestion rate than males in this age group [5]. Chowdhury et al. (2020) also reported that, a total of 91 children were admitted with ingestion of FB during this period; male 61, female 30 (the male to female ratio being 2:1). The age ranged from 3 months to 12 years (the median being 3.5 ± 3.8 years) [6]. The 108 FBI children were classified according to the outcomes of their distinction into 2 independent groups: pre-coin exchange 2015 group (26 patients) and post-coin exchange 2021 group (82 patients).

A comparative study between the 2 groups revealed a highly significant increase in Coin FBI, in the post-coin exchange 2021 group (31.7%) as compared to the pre-coin exchange 2015 group (7.7%) (p = 0.0083). This came in agreement with Gurevich et al. (2018), Orsagh-Yentis et al. (2019), Binshaiq et al. (2021), and Ibrahim et al. (2021). Gurevich et al. (2018) reported that, coins were the most commonly ingested foreign body in pediatrics. Radiographic imaging should be obtained in these diagnoses. An esophageal coin should be removed within 24 hours of its ingestion. Objects wider than 2.5 centimeters or longer than 6 centimeters are at a higher risk of retention [7]. Orsagh-Yentis et al. (2019) also reported that, coins accounted for 67.0% of all FBIs in 1995 and 58.5% of ingestions in 2015. Of all patients who were hospitalized over the study period, 79.7% ingested coins. When compared with children who ingested all the other products, those who ingested coins were 2.43 times as likely to be hospitalized (95% CI: 2.14–2.75). Of the case narratives in which the type of coin could be determined, pennies (65.9%) and quarters (16.0%) were the most common. Quarter ingestions increased with age, from 4.4% of one-year-old children to 21.9% of five-year-old children.. The children who were ingested with quarters were almost twice as likely

to be hospitalized when compared with those who ingested other coins (RR: 1.87 [95% CI: 1.62–2.12]), and the children who ingested pennies were less likely to be hospitalized (RR: 0.52 [95% CI: 0.45–0.59]) [8].

Binshaiq et al. (2021) also reported that, along the target years and depending on the type of the FBs, in 2015, there were 25 cases (15.63%) and the most common FBs were coins ( $n = 6$ ; 24%). The year 2016 had the highest record; there were 50 cases (31.25%) and the most common FBs were metallic FBs ( $n = 9$ ; 18%). In 2017, the reports observed 31 cases (19%) and the most common FBs were metallic FBs ( $n = 5$ ; 16.3%). In 2018, there were 25 cases (15.63%) and the most common FBs were coins ( $n = 6$ ; 24%). In 2019, the analysis observed 29 cases (18.13%) and the most common FBs were coins ( $n = 13$ ; 44.8%). The number of cases that needed medical investigations or interventions was 26 (16.25%). The number of cases that developed complications was 29 (18.13%) [9]. Ibrahim et al. (2021) also reported that, a coin was the most commonly ingested FB (22.9%) followed by buttons and batteries (19.5%). Most of the ingested FBs passed spontaneously without any intervention (69%). An upper endoscopy was performed in 121 cases (27.7%) [10]. A comparative study between the 2 groups revealed a highly significant increase in admission rates, in the post-coin exchange 2021 group as compared to the pre-coin exchange 2015 group ( $p = 0.027$ ). This was in agreement with Lee (2018), Shatani et al. (2021), and Conners (2022). Lee (2018) concluded that, coins, magnets, or sharp FBs in the esophagus should be removed within 2 hours in symptomatic and within 24 hours in asymptomatic children. Among those presenting with a single or multiple magnets and a metallic FB that have advanced beyond the stomach, the symptomatic children need a consultation with a pediatric surgeon for surgery, and the asymptomatic children may be followed with serial X-rays to assess progression. Sharp or pointed, and long or large and wide FBs located in the esophagus or stomach require endoscopic removal [11]. Shatani et al. (2021) also concluded that, coins were identified on radiographic surveys in 109 of 134 patients; 25 of 134 patients had no coins. Of those with coins, none of 109 had coin(s) in the airway, 42 of 109 had coin(s) in the esophagus, and 67 of 109 had coin(s) distal to the esophagus. Of those with esophageal coins, 35 of 42 reported symptoms, 7 of 42 were asymptomatic, 40 of 42 underwent endoscopic coin removal, and 2 of 42 had no intervention [12]. Conners (2022) also concluded that, while foreign body ingestion is common in children, the large majority of swallowed foreign bodies will pass through the GI tract without complication. A recognition of those patients and foreign bodies that are most highly associated with complications is important. These include patients with histories of medical or surgical abnormalities of the GI tract, those with symptoms, and those with previous complications of foreign body ingestion. Button batteries, magnets, long objects, or those that are sharply pointed or with a sharp edge, are most prone to complication [13].

A comparative study between the 2 groups revealed a highly significant increase in the prevalence of FBI, in the post-coin exchange 2021 year (9.77%) as compared to the pre-coin exchange 2015 year (1.73%) ( $p < 0.0001$ ). This agreed with Orsagh-Yentis et al. (2019), Chowdhury et al. (2020), Speidel et al. (2020), and Binshaiq et al. (2021). Orsagh-Yentis et al. (2019) reported that, the annual rate of FBI per 10,000 children increased by 91.5%, from 9.5 in 1995 to 18 in 2015. Overall, boys more frequently ingested foreign bodies (52.9%), as

did children 1 year of age (21.3%). Most children were able to be discharged after their suspected ingestion (89.7%). Among the types of objects ingested, coins were the most frequent (61.7%). Toys (10.3%), jewelry (7.0%), and batteries (6.8%) followed thereafter. The rates of ingestions of those products also increased significantly over the 21-year period. Across all age groups, the most frequently ingested coin was a penny (65.9%). Button batteries were the most common batteries ingested (85.9%) [8].

Chowdhury et al. (2020) also reported that, children ingested 21 different types of FB; however, ingestion of coins was the most common (24 patients, 26.37%) followed by different types of pins (19 patients, 20.88%), nails (6 patients, 6.59%), batteries (5 patients, 5.49%), screws (5 patients, 5.49%), needles (4 patients, 4.40%), rings (4 patients, 4.40%) and others (18 patients). Ingestion of sharp objects was more common in the older (>5 year) age group [6]. Speidel et al. (2020) also reported that, in total, 1199 patients were analyzed; the mean age was 3.3 years (SD 3.12; range 7 days to 16 years), the male to female ratio was 1.15:1, and 194 (16.2%) were hospitalized. The number of patients, seen annually, increased from 66 in 2005 to 119 in 2017, with a rise in percentage of all emergency patients from 0.82% in 2010 to 1.34% in 2017. The majority of patients (n = 619) had no symptoms, and 244 out of 580 symptomatic patients complained of retching or vomiting. Most frequently ingested objects were coins (18.8%). Radiopaque objects accounted for 47.6%, and sharp objects accounted for 10.5% of the ingested foreign bodies, both of which were significantly more often ingested by girls ( $p < 0.001$  for both). Button battery ingestion was recorded for 63 patients with a significant annual increase ( $R^2 = 0.57$ ;  $\beta = 0.753$ ;  $p = 0.003$ ). The annual rate of complications also increased significantly ( $R^2 = 0.42$ ;  $\beta = 0.647$ ;  $p = 0.017$ ) [14]. Binshaiq et al. (2021) also reported that, coins were the most common foreign body ingested in pediatric population attended in King Abdullah Specialized Children's Hospital and the Primary healthcare center for both genders. No significant difference in the pattern of foreign body ingestion was noticed while comparing males and females. However, a spike of coins ingestion incidences was noticed in 2019, which could be due to the introduction of metallic currencies in that year [9].

**Conclusion:**

To conclude, in Saudi Arabia, children with foreign body ingestions increased especially after the coin exchange program in the year 2015 after the replacement of the Riyal notes with the new Riyal coins released in 2016, and the rate of coin ingestion was markedly increased among children in the year 2021 after coins were issued and circulated in Saudi Arabia. The results from this study shed light on a vital aspect of foreign body ingestion. The findings from this study call for future studies with substantially larger sample sizes of foreign body ingestion to assess the prevalence of the coins ingestion in the subsequent years after coins re-exchanged in Saudi Arabia and family awareness.

**Conflict of interest:**

There is no conflict of interest.

**Funding:**

None.

**Ethical approval:**

Ethics committee approval was received for this study from the ethics committee of maternity and children hospital in Dammam.

**Informed consent:**

Written informed consent was waived by the ethical committee because the publication of the result was without any identification of the participants and the data were collected and utilized in one device and only authorized personnel had an access to it.

**Authorship**

All the listed authors contributed significantly to the conception and the design of the study, its acquisition, analysis, and the interpretation of data and drafting of the manuscript, to justify authorship.

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