

## **Abstract**

**Objective:** Children frequently ingest coins (generally with minimal reported side effects) however the ingestion of other items has been subject to less academic study. Parental concern regarding ingestion applies across a range of materials. In this study we aimed to determine typical transit times for another commonly swallowed object; a Lego figurine head.

**Design:** Six paediatric healthcare professionals were recruited to swallow a Lego head. Previous gastrointestinal surgery, inability to ingest foreign objects and aversion to searching through faecal matter were all exclusion criteria. Pre-ingestion bowel habit was standardised by the Stool Hardness and Transit (SHAT) score. Participants ingested a Lego head and the time taken for the object to be found in the participants stool recorded. The primary outcome was the Found and Retrieved Time (FART) score.

**Results:** The FART score averaged 1.71 days. There was some evidence that females may be more accomplished at searching through their stools than males but this could not be statistically validated.

**Conclusion:** A toy object quickly passes through adult subjects with no complications. This will reassure parents, and the authors advocate that no parent should be expected to search through their child's faeces to prove object retrieval.

## Introduction

During the early oral developmental phase (6 months to three years)(1) children learn to explore their environment and may ingest things that offer no nutritional value. Whilst some of these items may be harmful - disc batteries, certain medications - most are inert and offer nothing more than inconvenience. This may explain why in 2002 there were over 128,000 reported incidents of foreign body ingestion or aspiration in the UK.(2) Whilst coins are the most commonly ingested item and a swathe of literature has been devoted to their passing, there has been very little text dedicated to the second most commonly ingested item,(3) nominally categorised as 'toy parts'.

Early work by Spitz(4) suggested that most coins pass within 3.1 to 5.8 days with no adverse effects. The authors wondered if smaller, lighter toy parts might pass more rapidly and with a similar safety profile.

There has been a noble tradition of self-experimentation in the field of medicine - from Werner Forssmann performing his own cardiac catheterisation(5) to Barry Marshall swallowing a flask of *Helicobacter pylori*.(6) With that in mind, the authors felt that they could not ask anything of their test subjects that they would not undertake themselves.

## Methods

Participation was open to healthcare professionals working in the field of paediatric hospital care with exclusion criteria being previous gastrointestinal surgery, inability to ingest foreign objects, or an aversion to searching through faecal matter. Six participants were recruited

from an established discussion forum related to an educational website the authors were involved in or associated with.

Prior to ingestion of the Lego head, each participant kept a three-day stool diary noting volume and Bristol stool chart score for their bowel movements. This was based on ESPGHAN guidance on monitoring stool output. To standardise bowel habit between participants we developed a Stool Hardness and Transit (SHAT) score to look at stool consistency over time. The SHAT score is the sum of Bristol Stool Chart scores over a specific time period divided by that time period in days. A high score indicates more frequent, loose bowel motions (i.e. gastro-intestinal upset may be a factor in transit time) whilst a low score indicates less frequent or more firm motions (i.e. more sluggish bowel habit). The pre-SHAT score was the sum of the Bristol Stool Chart scores divided by three (the number of days of logging prior to ingestion). The SHAT score quotient was the time taken to pass the stool containing the object.

The foreign object (Figure 1) was chosen as it is a standard toy found in most households. It allowed for each participant to ingest an object of the same size and shape. Foreign objects were ingested at the same time of day (between 0700 and 0900) to minimise diurnal variation in bowel habits. No participant was working night shifts during the time of the study.

Post ingestion, stools were monitored and examined in search of the excreted item. The search was conducted on an individual basis and search technique was decided by the participant. The primary outcome was the Found and Retrieved Time (FART) score.

## Results

Six participants were included in the study (Table 1). Half were female. Age of participants ranged from 27-45 years with a mean age of 36.2 years. Five out of six participants were able to locate the Lego head in their stools. The male participant who had not located the Lego head searched stools for a total of two weeks after ingestion.

Of the successfully retrieved Lego heads, the number of bowel motions searched ranged from one to three, with an average of two bowel motions. The females appeared to have faster passage of the foreign body, retrieving the Lego head within two bowel motions whereas the two males who retrieved their Lego heads both did so on their third bowel motion. The principal finding of this study, the FART score (n=5) ranged from 1.14 days (27 hours 20 minutes) to 3.04 days (72 hours 35 minutes) with an average retrieval time of 1.71 days.

Comparing the stool diaries pre and post ingestion, there was no significant difference in consistency of stool over time (Figure 2). The pre-SHAT score (n=6) ranged from 3 to 5.67 prior to ingestion, and the Stool Hardness and Transit (SHAT) score (n=5) ranged from 2.96 to 7.76. Comparing these two markers using a Wilcoxon Signed Rank test reveals no significance ( $\alpha_{\text{two-tailed}} \leq 0.1$ ) between Bristol stool scores over time before and after ingestion. This suggests that the ingestion of the Lego heads did not appear to have a significant impact on the consistency of bowel motions in participants.

The SHAT score post ingestion was compared with the FART scores to see if a higher SHAT score (looser stools with greater frequency time) reduced the time of retrieval (Figure 3). There was no significant correlation found ( $r(3) = -0.33$ ,  $p = 0.58$ ).

## **Discussion**

In this novel study it was determined that a pre-defined toy object passed through adult subjects, on average, in one to three days with no complications. It is possible that childhood bowel transit time is fundamentally different from adult but there is little evidence to support this and if anything it is likely that objects would pass faster in a more immature gut. This will be of use to anxious parents who may worry that transit times may be prolonged and potentially painful for their children. Our in-vivo study has also provided some interesting insights for further research. Firstly females (in this study) were more likely to retrieve the foreign body earlier, or indeed at all, compared to males. Sadly this study was not powered to confirm whether this is a true difference. If an experienced clinician with a PhD is unable to adequately find objects in their own stool, it seems clear that we should not be expecting parents to do so - the authors feel that national guidance could include this advice.

Secondly the FART score is shorter than the estimated time for passage of coins by Spitz (reference). The reasons for this are not clear and may only be answered by a factorial design study in which both coins and Lego heads are swallowed (ideally with one study arm including swallowing a Lego figurine holding a coin). We acknowledge different objects may have shorter or longer transit times and it would perhaps be useful to repeat this study with a body or leg part to see if sharp or irregular surfaces to the plastic structure slow gut

passage. We would surmise, in the absence of anecdotal evidence to the contrary, that material that can pass through the pyloric sphincter will pass through the anal sphincter.

There are some limitations to our study. The population studied could not be blinded to the study outcomes as we felt it was unfair on the authors' partners or colleagues to search through their waste products. We also recognise that the stool hardness and transit score is not a perfect surrogate for underlying bowel pattern, but the fact that participants can SHAT themselves without specialist knowledge makes it an inexpensive tool.

## **Conclusion**

This international multicentre trial identified that small objects, such as those swallowed by children, are likely to pass in 1-3 days without complication. This should offer reassurance for parents.

**What is already known on this topic**

- Children frequently ingest foreign objects
- Parents worry about transit times and complications from ingestion

**What this paper adds**

- A pre-defined object passes through adult patients in 1-3 days
- There were no complications in our subjects
- Parents should be counselled not to search for the object in stools as it is difficult to find

## References

1. Hesham A-Kader H. Foreign body ingestion: children like to put objects in their mouth. *World J Pediatr.* Switzerland; 2010 Nov;6(4):301–10.
2. Department of Trade and Industry (2003) 24th (Final) Report of the Home and Leisure Accident Surveillance System. 2000, 2001 and 2002 Data: 2002 Data. [Internet]. 2003. Available from: [www.hassandlass.org.uk/reports/2002data.pdf](http://www.hassandlass.org.uk/reports/2002data.pdf)
3. Arana A, Hauser B, Hachimi-Idrissi S, Vandenplas Y. Management of ingested foreign bodies in childhood and review of the literature. *Eur J Pediatr.* Germany; 2001 Aug;160(8):468–72.
4. Spitz L. Management of ingested foreign bodies in childhood. *Br Med J.* England; 1971 Nov;4(5785):469–72.
5. Meyer JA. Werner Forssmann and catheterization of the heart, 1929. *Ann Thorac Surg.* Netherlands; 1990 Mar;49(3):497–9.
6. Marshall BJ, Warren JR. Unidentified curved bacilli in the stomach of patients with gastritis and peptic ulceration. *Lancet* (London, England). England; 1984 Jun;1(8390):1311–5.