

# PRESCHOOLERS' CONCEPTS OF DIGESTION, ABSORPTION AND EGESTION: LINKS WITH BODY MASS INDEX

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*The literature suggests links between people's understandings of nutrition and their actual dietary habits, where knowledge of good practice translates into low body mass index (BMI). In order to investigate a similar effect in preschool children, a sample of 25 four year-olds will take part in structured interviews devised to assess their knowledge of the three processes of digestion, absorption and egestion. Data will be analysed quantitatively to give performance scores, which will be compared with children's body mass index. If links are found there are potential consequences for early years biology education, where the enhancement of nursery children's knowledge of the digestive system could contribute towards positive health outcomes.*

*Key words:* early years; knowledge of nutrition; body mass index.

## INTRODUCTION AND PRIOR RESEARCH

The English primary science national curriculum includes concepts of human nutrition (Department for Education, 2013), firstly because of their relevance to healthy living, aiming to promote normal growth during childhood, as well as addressing the issue of an increasingly overweight population. Secondly, aside from what constitutes nutritious eating in the sense of 'healthy' and 'less-healthy' foods, aspects of the physiology of digestion are introduced. Physiology concepts are typically taught at a basic level, although children are required to grasp a number of abstract ideas in order to conceptualise the digestive system in a holistic, meaningful way. The 'journey of food' through the human body is used to give context to the processes of *digestion* (food is broken down into simpler forms), *absorption* (the body extracts nourishment from food) and *egestion* (once nourishment has been extracted, waste leaves the body).

There has been a limited amount of previous research focused on young children's ideas of these three processes. When Osborne *et al.* (1992) asked English primary children to draw what happens to food inside their bodies, 5-7 y/o tended to depict the interior of the body as a mostly empty vessel storing bits of ingested food – the *hollow bag model* of digestion. Food was not contained in discrete internal organs but instead was distributed within the hollow bag of the body, including arms and legs. When Teixeira's (1998) 4-6 y/o small Brazilian sample drew the journey of a bar of chocolate through the body, some of the older children produced hollow bag models, though others had the food moving from the mouth to a distinct abdominal area (tummy) before being distributed to the legs, which caused stretching of the legs, and an increase in the child's height. When the child bent over at the waist some of the food moved to the arms, which grew in turn.

It has been long established that younger primary children are rarely aware that the body transforms food into simpler forms by the process of digestion (e.g. Gellert, 1962). They understand that food is chewed and divided up into smaller pieces, but have not yet constructed the idea that food is changed chemically, being broken down into smaller components that are capable of being absorbed by the body (Osborne *et al.*, 1992; Teixeira, 1998). They believe instead that food retains its identity within the body, which is compatible with a hollow bag model. Regarding the ultimate fate of food, Teixeira's 4 y/o tended to hold a *fixed container model*, where as well as keeping its original identity all ingested food never leaves the body. Gellert (1962) found that some US primary children thought defecation was

merely a process to stop the body from bursting, and in the same way as Garcia-Barros *et al.*'s (2011) 4-7 y/o Spanish sample, did not relate ingested food to egested faeces. A common idea displayed by learners of a variety of ages is that solid foods and liquid drinks take separate routes through the digestive system, and then exit at different orifices (Giordan & Vecchi, 1988; Garcia-Barros *et al.*, 2011).

Adult obesity is globally on the rise and strongly linked with premature illness and death (De Onis *et al.*, 2010); in addition, being an overweight child is a reliable predictor of adult obesity (Steinberger *et al.*, 2001). Preschool overweight and obesity is dramatically on the increase with an estimated 43 million cases worldwide, with a further 92 million at risk (De Onis *et al.*, 2010). Hypothesised causes of preschool obesity have included diet and a lack of physical exercise, particularly the adoption of sedentary lifestyles, e.g. spending excessive amounts of time watching TV (Han *et al.*, 2010). Governments spend millions *per annum* on health education initiatives aimed at improving nutrition knowledge, although evidence for their effectiveness is equivocal. For example, some researchers have found that nutrition knowledge is indeed linked to good dietary habits (e.g. De Vriendt *et al.*, 2009), while others report no association with obesity (e.g. O'Brien & Davies, 2007). Measures of nutrition knowledge utilised by these studies have usually been limited to aspects such as correctly interpreting food labels, understanding dietary recommendations, or knowing which foods are 'healthy' or otherwise. Participants' knowledge of the physiology of digestion is rarely assessed. The current study aims to explore this knowledge in a sample of preschool children and test for possible associations with body mass index (BMI) in order to assess whether there could be a causative relationship, as argued by authors such as De Vriendt and colleagues.

### **Research Questions**

1. How do preschool children conceptualise digestion, absorption and egestion as processes occurring within their own bodies?
2. Is there a link between these understandings and preschool children's body mass index?

### **METHOD**

A sample of 25 children aged 4.0 years (+/- 2 months) will be accrued on an opportunity basis from a number of local early years settings; this age represents a chronological mid-point in nursery education. Each child will be welcomed singly into a quiet room and take part in a structured interview, the format of which is based on a method that has previously been used effectively by the team with children of the same age group (Allen, 2015). Sat at a table, the child will sort a variety of real foods into a rank order that specifies the degree to which they are 'good for you'. Using the top ranked food as a reference, they will be asked to draw onto an A3-sized body blank what they think happens inside their body once they have eaten this food. This procedure will be repeated using their bottom ranked food. The drawing process will be video recorded and guided by a number of structured questions that enable the child to talk about their ideas of the processes of digestion, absorption and egestion. A researcher will annotate the drawing as the child draws and explains each process. Finally, bioelectrical impedance scales and a stadiometer will be used to measure the child's body mass, height (in order to calculate BMI) and estimate percent body fat content.

### **ANALYSIS**

The drawings and video evidence will be analysed by a method similar to that utilised by Reiss and Tunnicliffe (2000), where the accuracy of children's drawn and verbal data can be numerically assessed with respect to scientific accuracy. This involves first ranking the data, then allocating each child numerical scores for their knowledge and understanding of the three processes of digestion, absorption and egestion, and an overall performance score.

These scores will then be compared statistically using Pearson's correlation coefficient  $r$ , in the search for possible links with BMI.

## RESULTS, DISCUSSION AND CONCLUSIONS

At the time of writing, data collection has not yet taken place therefore no results are presented. Subsequent discussion will involve describing the nature of four year-olds' ideas about how the body deals with food, including whether they believe healthier foods are processed differently, which are aspects of preschool science education that have not been covered in such detail in previous studies. If associations between this knowledge and BMI are discovered then this might have potential consequences for early years biology education. Next steps would involve further investigations on a larger scale, and recommending that improving knowledge of the digestive system in the nursery could have positive health benefits for children.

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