

Young Children's Understanding of Fluid Intake.

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Abstract

Background

Coppinger and Howells' (2019) previously completed an International comparison between primary schools in Ireland and England focusing on children's understanding of fluid intake. They identified that children under 11 years did not understand the amount of fluid they need each day for good health. Within their sample there was only a limited number of children who were aged 4 – 5 years. This research focuses on this particular age phase and further questions if young children understand fluid intake.

Methods

130 children (63 boys and 67 girls, of which 83 were aged 4 and 47 were aged 5) from 4 elementary schools in the South East of England were questioned between January and April 2019 using an adapted version of Coppinger and Howells' (2019) questionnaire on their understanding of fluid intake and how much they perceived they drank and who supported them in prompting them when to drink. The adaptations were to ensure the questionnaire was age appropriate for younger age range, and included physical visual representations to aid question comprehension.

Results

46.9% of children felt they consumed 500ml or under a day. Only 39.6% responded that they were supported by the teacher, also when children were thirsty, if given the option of playing or stopping rehydration and then playing 33.8% would continue to play without drinking.

Conclusion

Young children in England do not understand fluid recommendations, they were not supported within the school setting by their teacher and more effective resources and strategies are needed to support children's knowledge.

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Introduction

Limited research has explored young children's (those aged 4 – 5 years) knowledge and understanding of the consumption of fluids. Prior research¹ within this area has only had small sample sizes of children in this very young age phase. In England children start school in the September following their fourth birthday, therefore children are aged 4 and 5 when they start school. The young children follow the Early Years Foundation Stage Curriculum² within which the children learn about health and self-care with a focus on the importance of: good health; physical exercise; and a healthy diet, the aim of this area is for children to be able to talk about ways to keep healthy. Therefore, it is hypothesised that as the children are following this curriculum, they should be learning about the consumption of fluids within the school setting and will know and understand fluid intake. As they are being supported as to when to drink by their teacher through the curriculum learning, it is proposed that the teacher will be the main influencer and it is predicted that the young children should be able to articulate their learning of this topic area with the researchers of this study.

Children aged 4 and 5 are recommended to need 1.1 – 1.3 litres of fluid a day to maintain an effective hydration status³. This total amount of 1.1 – 1.3 litres does not include the additional 20 – 30 percent children obtain through food sources, if these are included children require 1.6 – 1.7 litres per day. Most previous research from Europe focuses on 9 – 11 year olds and states that 2 out of 3 children are not drinking enough⁴ and that children are unable to recognise the early stages of thirst⁵, resulting in them not exhibiting a desire to drink, there is a lack of research with younger aged children.

It has been previously reported that children find it difficult to understand when and what to drink, as they have an underdeveloped thirst response⁶, up to potentially there being a 45 minute delay in children showing signs of dehydration and acknowledging the need to consume additional fluids. However, elementary schools and in particular early years' educational settings such as primary schools within England, are particularly important places for developing habits⁷ and teaching children when to drink and how their bodies are

responding to not drinking. There have also been identified cognitive benefits for children who are hydrated, with a 10% improvement in learning potential when hydrated children are compared to dehydrated peers⁸. It also only takes 2 minutes for these cognitive benefits to occur once fluids have been taken⁹. Therefore, it is paramount that teachers encourage children to drink throughout the school day as knowledge of good habits means action into good habits, and will provide young children with lifelong habits¹⁰.

This study aims to investigate what primary / elementary school children (aged 4 and 5 year olds) understand and know about fluid intake, when they drink, how much they perceive they drink and who influences them to drink in terms of who tells them to drink and whether or not variations exist between children from different ages, gender and schools.

Methods

Participants

A total of 130 (63 boys, 67 girls of which 83 were aged 4 and 47 were aged 5) from 4 elementary schools in the South East of England participated in the study between January and April 2019. Prior to study commencement, the lead researcher visited each principal and/or lead teacher at participating schools. The full outline of the study was explained, along with the distribution of information sheets and consent forms were completed by the gatekeepers. Children were read written instructions to ensure they understood they were participating and assent was gained from the children, all were given the option to drop out at any time, without giving reason.

Procedure

Schools were recruited via a geographical cluster sampling method to ensure a representative sample from similar low socioeconomic based schools were encapsulated to allow comparison with similar school settings. The geographical area is one of the most socioeconomically deprived populous in England¹¹. Only children within the age range of 4 – 5 years were included within the sampling. All children within the sample follow the Early Years Foundation Stage Curriculum², and all should be learning about the

importance for good health, physical exercise and healthy diet. The lead researcher spent a day within each school prior to starting the research to ensure familiarity with the children and rapport was developed. Building a rapport with research participants can assist with the undertaking of research¹², particularly important with young age children to allow them to feel more comfortable with the researcher. An opportunistic selection of participants was used, in that, all children who were present at school on the days of the research and wished to participate, completed the research. The lead researcher positioned themselves at child height either on the floor or at a table, to be less threatening within the classroom setting.

Data Analysis

All children were read the questionnaire by the lead researcher to ensure the young children understood the questions. The same questionnaire and types of questions were used as in previous research¹. The language of the questions was supported through showing visual representations and physical aids were used to help question comprehension, to ensure that this young age group were able to access the questions effectively. All children's responses were anonymised via an identification number and their subsequent results inputted into SPSS statistical package 24.0 for analysis. Rating scale questions were used to understand children's frequency of thirst and visual methodologies¹³ using pictures of water bottles were used to ask children about the total amount they perceived they

drank. Five questions within the questionnaire were multiple choice in order for direct comparisons to be made between age and gender. Six open-ended questions were also included within the questionnaire to ascertain children's understanding of why drinking is important, identify who tells them when to drink, what opportunities they had to drink within the school day and what barriers they faced to not being allowed to drink at school. This open-ended style was chosen in order to obtain more in depth answers from participants. The final question asked participants to identify their favourite drink. MANOVA statistical analysis was undertaken on all quantitative data and coding analysis completed on all qualitative responses to also allow for comparison across location, gender and age, respectively. Ethical approval was received from the ethics committees Canterbury Christ Church University in December 2018.

Results

The results presented within this paper are quantitative data and reported with a focus on gender and on specific questions from the questionnaire and focus on similar questions to previous research¹.

How Much do Children Perceive they Drink?

The data concluded that children did not understand or know how much should be drinking a day, as there were great contrasts that were reported. This indicated that the children were very much confused as to what they should be drinking. Fig 1

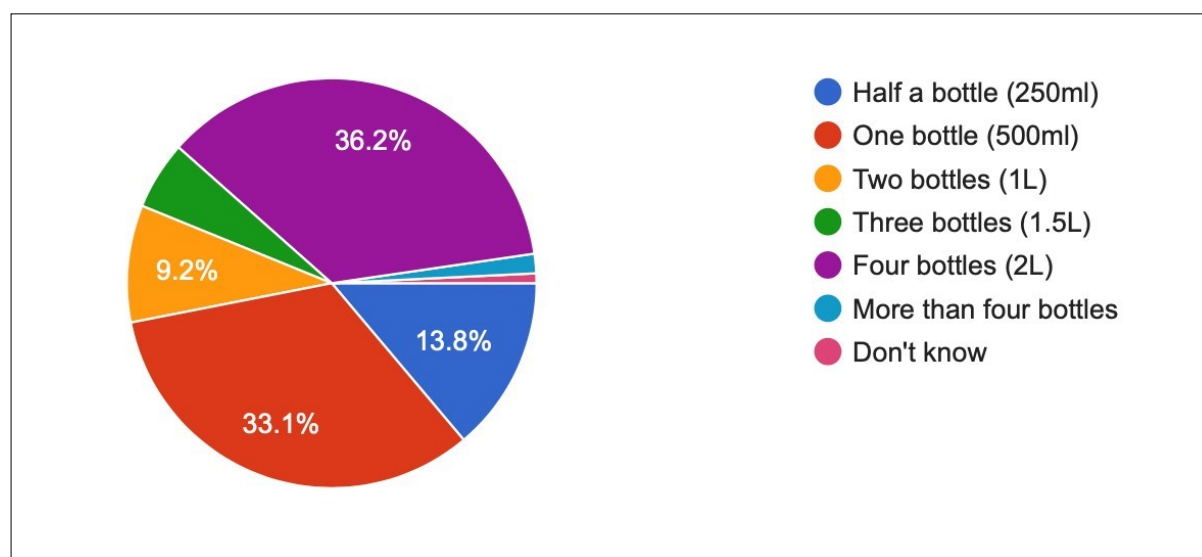


Figure 1. One Illustrates young children's reported consumption of fluids per day.

Overall there were no statistical main effects or interactions ($p > 0.05$), figure one shows that 36.2% of children reporting they drank 2 litres, whilst on average 46.9% of the children believed they drank between 250ml (13.8%) and 500ml (33.1%). These are between 600 and 850ml under the recommended guidelines³ and this response is also below the EFSA's¹⁴ guidelines. These results clearly indicate a serious weakness in the children's understanding of their own biological requirements, and an area of children's knowledge with regard diet and health within the curriculum that is not currently being addressed by the teachers².

When are Children Most Thirsty?

Children reported that they were most thirsty at different times during the school day. There were no significant main effects or interactions for a particular time of day that the children are most thirsty. The majority of children reported that they were most thirsty at the beginning of the school day (27.7%), this is the opposite end of the school day compared to previous research¹, who found that children were most thirsty at the end of the school day. This may be to the low socioeconomic status of children within the sample and their lack of eating breakfast prior to attending school, and the high proportion of children within this research, eating breakfast at school as part of the free breakfast club provided by all of the four schools.

What Makes You Thirsty?

Children were able to identify running as the

main reason for causing them to be thirsty and making them want to get a drink. The children also named ball games, and other forms of physical activity, such as play time (recess) games activities and other forms of non-physical activity also made them thirsty. For this result there was a significant main effect for school location ($F = 2.085$, $p < 0.05$) in which school 4, the children only gave had 2 reasons for getting thirsty which were either running (72.7%) or they did not know why they were thirsty (27.3%). Indicating these children in this particular school needed further guidance from their teachers (in particular) in understanding their biological responses that were occurring to be thirsty, to understand how the body reacts and what it means in terms of them needing to drink. There were no significant differences for gender, both boys and girls were unsure as to what made them thirsty and found it difficult to explain reasons why they were thirsty.

Why is Drinking Important?

The question of why is drinking important was a question that this age group overall struggled to be able to a respond, (see Table 1) with on average 24.6% of all children not knowing why drinking was important, or only being able to give vague reasons such as 'because it is', highlighting they did not fully understand the reasons behind why it was important.

If children do not know why it is important to take in fluids, then habits will not be, formed at this important age phase of the children's lives. More strategies and support are recommended from this

Table 1. Illustrates reported examples of why drinking is important.

'don't know'
'something to do with being healthy'
'like the flavour'
'helps me think'
'helps me go for a wee'
'if you don't drink you die'
'helps stops headaches'
'helps cool you down'
'not sure'
'because it is'

result in particular during class time. It is proposed that more learning time is spent on drinking habit development and education of the importance of fluid intake, especially in terms of when to drink, how often to drink and what to drink. It is also recommended that community packs are used to help support understanding and knowledge within the family and home environment.

For this question, the results did indicate there was a significant main effect ($F = 5.704, p < 0.05$) for age, with a difference of opinion occurring for 4 and 5 year olds, for why children thought drinking was important. 58.3% of 5 year old children reporting that drinking was important as it assisted them in being healthy, whilst 4 years olds (16.1%) reported more focused elements of the importance of drinking such as stopping headaches and to cool the body. Although not a significant finding it is important to note that 4.8% of the children reported a lack of drinking fluids would lead to death. It is important to note this finding especially when considering barriers to drinking and if children perceive themselves to not be allowed to drink, and these young children believe that they are going to die if they do not drink this has potential implications for mental health, which is beyond the remit of this research, but important to acknowledge from a policy and practice viewpoint for future research. Also this particular result indicates the importance of ensuring that young children fully understand the reasons and have not just 'half' learnt / remembered the reasons. The children in this class within their curriculum learning had learnt about being hydrated and the importance of hydration with staying alive, it is clear that some children have then interpreted this and remembered this as they are going to die if they do not drink.

What are the Barriers to Drinking?

Children were asked if there was ever a time within school that they were not allowed to drink to understand if the children felt there were any barriers to being able to drink. There were no statistical main effects or interactions, however great contrasts were shown in the responses, showing again a lack of understanding of school rituals and practices in the classroom. Children indicated that they were always allowed to drink (43.8%), or they responded by saying

they did not know when they were allowed or not allowed to drink (33.8%). There is a potential need for more set times throughout and across the school day for young children to regularly drink, to enable them to develop habits as to when to drink regularly.

Who Tells you to Drink?

Only 39.6% of all children felt that someone within the school setting (such as school teacher) told them when to consume fluids. 14% reported that 'no one' or 'myself' told me when to drink, this response is much lower than the 24% reported previously¹ for this same age range. The stronger influencer were family members (44.2%), which a variety of members were reported, siblings, grandparents as well as parents. This result highlights that teachers may not be ensuring adequately that children are hydrated within the school day, this may be due to the notion previously proposed¹⁵ that teachers are not keen on their pupils drinking in lesson time due to distractions caused by taking time to consume, not then partaking in learning activities because of frequent visits to the toilets. This could indicate that teachers need further professional development to fully understand the benefits and also the limitations of effective hydration and the impact that this can have on their class of young children. Also for the teachers to understand that they can be one of the key influencers due to teaching the children about healthy drinking within the curriculum, and the need to help children develop habits for drinking from an early age.

To Drink and then Play or Just Play Without Drinking?

When children were given the choice of either drinking and then playing or just playing without drinking 33.8% of them chose to play right away with toys and not to drink. These results concur with previous results¹⁶, supporting that children and in particular young children, do not have an effective thirst response to be able to independently recognise when they are thirsty and how to achieve effective hydration and the understanding that they are allowed to stop playing and to go and retrieve their water bottle to rehydrate. Also the lure of playing and the excitement of playing can act as an inhibitor to recognising these physiological responses as thirst responses and the need to drink. If set drink times are integrated within the play and child

initiated play times, this could help support the children to recognise their thirst reflexes.

Children's Favourite Drink

There were no significant main effects of interactions linked to the final; question of what is your favourite drink? Compared to previous research¹ there were overall lower numbers of children who preferred water (30.8%) as their favourite drink. There were similar numbers who stated that they preferred milk as their favourite drink, the reason for this preference, may be due to the children within England, receiving free milk every day until the age of 5, within their school settings, which may not be as readily accessible within the home environment due to the low socioeconomic area of the research sample and milk costing more than free water from the tap.

Discussion

This study aimed to investigate the knowledge and perceived fluid intakes of primary school children aged 4 and 5 within the South East of England, in particular their understanding of fluid intake and how much they perceived they drank and who supported them in prompting them when to drink. Whether or not children from all four schools possess similar patterns in these behaviours was also explored as well as age and gender differences.

Do Children know and Meet Fluid Intake Recommendations?

The data concluded that children did not understand or know how much they should be drinking a day, this could be due to the children not yet having been taught about fluid intake within the curriculum, or them poorly comprehending what they have been taught. From the vast contrasts of the perceived intake it is possible that the children could have just guessed an answer rather than drawing upon prior knowledge and understanding. Due to these wide disparities, further research to record the children's actual fluid intake throughout the day is needed for this particular age group to ascertain a more accurate picture of young children's daily fluid intake when compared to the recommendations^{3,14}. These results that children find it difficult to know and to meet the fluid intake recommendations and are similar to previously reported¹

findings, that children under nine years of age often under evaluate their consumption amounts due to their lack of understanding, this research continues to contribute to the call for the need for more support from the teachers and developing this area of the curriculum within their teaching to help the children's learning².

Who Supported them in Drinking?

It was expected that teachers would have been greater influences within the study as to the key people who supported the children in drinking and prompting the young children to drink. Yet family members were reported to be the key influencers. This result indicates that there may be a call for further resources and guidance for teachers to help support children's learning further in drinking and to make more links within the curriculum to ensure all children fully understand the reasons behind the need to drink. Also the results highlighted that it is important not to assume that children can recognise their thirst response, especially with this age bracket of 4 – 5 year olds when children are still learning about their bodies and understanding their biological / physiological responses. Within this age phase, young children still need to be taught when to drink, how often to drink and also the benefits of ensuring that they stay rehydrated. The data has indicated the importance of children understanding the positive benefits of fluid intake such as cognitive benefits⁹, rather than focusing on the negative extreme elements such as some children reported as dying. Teachers need to understand the importance of encouraging their pupils to drink during school hours, which will enable them to be key influencers in supporting children in their learning of how, why and when to drink. The researchers of this study propose the development of focused *hydration community packs* to support the understanding of fluid intake to help understanding for families, teachers and children, similar to such initiatives implemented by Public Health England (2019)¹⁷ as the 'Change4Life' programme. The Change4Life programme is a resource that has helped to combat the rise of obesity within the UK through practical resources and software applications created, through this programme there has been a seismic shift in the wider public knowledge relating to the risks associated with being overweight. It is proposed that

these new hydration community packs which are currently under development by the researchers and their effectiveness will be assessed within future research, in terms of how they have supported teachers, families as well as children in continuing to enhance children's understanding of how, why and when to drink.

Limitations

Response Rates

A total of 217 children could have been questioned within the four elementary schools (the entire size of the four settings), but due to the time constraints of the schools allowing the researchers into the settings, only 130 children were accessed via an opportunistic sampling technique. This is 59.9% of the overall total potential sample within the settings. However, the total sample size was regarded as a medium sample size, as previous research on fluid intake has varied from a small sample size of 58⁸ to a large sample size of 529¹⁸. It is recognised that if more time was allowed within each of the settings a larger sample size could be obtained. The schools were also all from the same low socioeconomic status, so more research is needed in wider range of socioeconomic status to investigate if there is a correlation between socioeconomic status and drinking habit.

Self Reporting

Coppinger and Howells (2019) aired caution in the fact that there may be limitations in the accuracy of children's, particularly young children, such as the sample age in this research as to cognitive ability to recall when they consume fluids within the school day. This may explain the great discrepancies in the results that were obtained. It is recommended that in future research to include observations within the classroom and school setting to compare actual to perceived fluid intake in school children and therefore observe and measure fluid intake behaviour.

Conclusion

This study has extended previous international comparison¹ to examine and focus on very young children's understanding and knowledge and found that 4 and 5 year olds, indicate from their responses that they seem confused and do not understand fluid recommendations, particularly when they are allowed to

drink within a school day and why drinking fluids is important. Further interventions such as the recommended hydration community packs are needed to help children understand as well as education for parents and teachers to help support this young age group recognise their thirst responses is recommended through the development of community hydration resources packs and continuous professional development is warranted.

References

1. Coppinger, T. and Howells, K. (2019). International Comparison of Children's Knowledge, Barriers and Reported Fluid Intake Across the School Day. *International Journal of Nutrition*, 4(1).
2. Department for Education. (2017). Statutory framework for the early years foundation stage. Setting the standards for learning, development and care for children from birth to five. Crown: London.
3. World Health Organization. (2004). Guidelines for drinking-water quality: recommendations (Vol. 1). World Health Organization.
4. National Hydration Council (2017) Hydration for Children. British Dietetic Association <https://www.naturalhydrationcouncil.org.uk/wp-content/uploads/2017/05/NHC-Children-Hydration-Factsheet-FINAL.pdf> (accessed August 2019).
5. Kenney WL & Chiu P (2001) Influence of age on thirst and fluid intake. *Med Sci Sports Exerc* 33 (9): 1524-32.
6. Shaw, V. (2010). Hydration in infants and children. Available at: https://www.nutrition.org.uk/attachments/442_Shaw.pdf. (Accessed: 9th November 2018).
7. Howells, K. (2012). Chapter 13 Placing an importance on health and physical activity. In Griggs, G. *An introduction to primary physical education*. (pp.207 – 220). Routledge: Oxen.
8. Edmonds, C. J., & Burford, D. (2009). Should children drink more water? The effects of drinking water on cognition in children. *Appetite*, 52(3).
9. Adan, A. (2012). Cognitive performance and dehydration. *Journal of the American College of Nutrition*, 31(2).

10. Cloutier, M. M., Wiley, J. F., Trapp, C., Haile, J., & Gorin, A. A. (2018). The Childcare Center: an Untapped Opportunity to Engage and Educate Families in Healthy Behaviors. *Journal of Racial and Ethnic Health Disparities*, 5(2).
11. Kent Public Health Observatory. (2016). Analysis of Deprived Areas. Available at: https://www.kpho.org.uk/__data/assets/pdf_file/0010/58834/Thanet-Profile.pdf (Accessed: 20th December 2018).
12. Colonnese, C., Nikolić, M., de Vente, W., & Bögels, S. M. (2017). Social anxiety symptoms in young children: investigating the interplay of theory of mind and expressions of shyness. *Journal of Abnormal Child Psychology*, 45(5).
13. Procter L & Hatton A (2015) Chapter 4 Producing Visual Research with Children: Exploring Power and Meaning Making in Stirling, E. and Yamada-Rice, D. (eds) *Visual Methods with Children and Young People: Academics and Visual Industries in Dialogue (Studies in Childhood and Youth)*. London: Palgrave Macmillan.
14. European Food Safety Authority (2010) Scientific Opinion on Dietary Reference Values for Water. EFSA Panel on Dietetic Products, Nutrition and Allergies (NDA), *European Food Safety Authority Journal*, 8 (3): 1459-1507
15. Johnston-Molloy, C., Gandy, J., Cunningham, C., & Glennon Slattery, C. (2008). An exploration of factors that influence the regular consumption of water by Irish primary school children. *Journal of Human Nutrition and Dietetics*, 21(5).
16. Benelam, B., & Wyness, L. (2010). Hydration and health: a review. *Nutrition Bulletin*, 35(1).
17. Public Health England. (2019). Change4Life Resource Overview. Available at: <https://campaignresources.phe.gov.uk/resources/campaigns/84-2019-change4life-nutrition-campaign>. (Accessed: 3rd May 2019).
18. Bonnet, F., Lepicard, E. M., Cathrin, L., Letellier, C., Constant, F., Hawili, N., & Friedlander, G. (2012). French children start their school day with a hydration deficit. *Annals of Nutrition and Metabolism*, 60(4).