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Can a school-based intervention increase fruit and vegetable consumption for children with Autism?

Autism Spectrum Disorder (ASD) is a neuro-developmental disorder, typically characterised by difficulties in social interaction, communication and imagination (Wing, 1996). However, children with ASD are also likely to experience problems in processing sensory-perceptual information, including taste, smell and touch (Boucher, 2009; Nadon et al., 2011). Indeed, research has shown that children with ASD often exhibit several difficulties in feeding and mealtime behaviours including food selectivity, based on texture and taste (Johnson et al., 2008; Nadon et al., 2011), food refusal and disruptive mealtime behaviours (Nadon et al., 2010). However, behavioural differences in children with ASD do not always translate to differences in nutritional intake when compared to their typically-developing peers (Johnson, Handen, Mayer-Costa & Sacco, 2008). In addition to feeding difficulties, research has also identified that children with developmental disorders such as ASD are more likely to be overweight or obese compared to typically-developing children (De, Small & Baur, 2008). In light of this, interventions that aim to improve eating behaviours may be beneficial for these children. As children spend a large proportion of their time in school, the school environment is recognised as a logical setting for implementing healthy eating interventions.

Interventions to promote fruit and vegetable consumption in the school environment are varied in their theoretical approach, however three strategies that have been shown to have a reliable effect on children's fruit and vegetable consumption are taste exposure, peer modelling and rewards (Horne, Lowe, Fleming & Dowey, 1995; Lowe et al., 1998), principles on which the *Food Dudes* programme are based. Research has suggested that the *Food Dudes* programme is effective in producing increases in children's lunchtime fruit and vegetable consumption (Horne et al., 2004, 2009; Lowe et al., 2004); however no published evidence, to date, has reviewed the impact of the programme for children with additional learning needs such as ASD. Research that evaluates the effectiveness of programme with this group of children is important, as evidence suggests that children with developmental disabilities such as ASD often exhibit food selectivity and limited exposure to novel tastes and textures.

This preliminary study evaluated the short and long-term effectiveness of the *Food Dudes* intervention on lunchtime fruit and vegetable consumption for children with ASD.

Methods

Design

A cohort study consisting of children who received the *Food Dudes* intervention during the autumn term of 2010. The programme was evaluated at baseline (prior to the intervention), 3 month follow-up (post intervention) 1 and 2 year follow-up.

Participants

The programme was evaluated in a school for children with ASD located on the outskirts of a West Midlands city. The sample consisted of 12 children (9 boys and 3 girls) from two classes aged between 8-10 years. The percentage of pupils in the school known to be eligible for and claiming free school meals was 53.5%, above the national average of 37.5% for children attending special schools. The majority of pupils (96.5%) spoke English as their first language, above the national average of 87.7% (Department for Education, 2012). The school was selected to participate in the intervention by the local health authority as part of a large-scale evaluation study involving a number of primary schools within the area (see Upton, Upton

& Taylor, 2012 for further information).

Procedure

Measures were recorded across five consecutive days and the same procedure employed at each study phase. In line with guidelines developed by the Health Promotion Agency (HPA, 2009), a child's portion of fruit or vegetables was defined as 80g.

Consumption at lunchtime was assessed using the weighed intake method, the 'gold standard' method for measuring dietary intake (Wrieden & Pearce, 2003). Prior to lunchtime, each child was given a label with their ID number, name and class. Due to the time frame of lunchtime service, mean portion size was obtained to provide an accurate measure of dietary intake. Average portions of all fruit and vegetables on the school menu were taken and five weights of each food recorded to obtain a mean weight. At the beginning of the lunchtime period, children's food choices were recorded on a spreadsheet and, once they had finished their lunch, the children brought their lunch trays to a member of the research team and the weight of any food waste for each child was recorded. All rubbish bins were located next to the weighing area to ensure that children did not throw away any uneaten food. Salter digital scales were used accurate to 1 gram. The amount of fruit and vegetables consumed was calculated by subtracting the leftover weight from the average portion weight recorded. In cases where a negative value was obtained, it was assumed that the child did not consume that particular food item and a value of zero was reported.

Ethical approval

Ethical approval was granted by the Institute ethics committee. Consent was sought from headteachers acting *in loco parentis*, supplemented by parental "opt-out" consent whereby the child is included in the study unless their parents withdraw them (Severson & Biglan, 1989).

Data analysis

Mean values were computed for each child to provide an indication of average daily consumption of fruit and vegetables. Data were analysed using the Statistical Package for Social Science version 19.0 (IBM, USA) and differences in consumption tested using the Friedman Test. Wilcoxon Signed-Rank Tests determined the source of any variance and effect sizes were calculated to measure the practical significance of any changes in fruit, and vegetable consumption. An alpha level of 0.05 was used in all statistical analyses unless otherwise stated.

Results

Table 1 (below) shows the mean consumption of fruit and vegetables at baseline (pre-intervention), 3 month follow-up (post-intervention) 1 year and 2 year follow-up. As shown in Table 1, baseline vegetable consumption was higher than consumption of fruit. Mean fruit consumption increased between baseline and 3 month follow-up (+19.73g) however decreased at 1 year follow-up (-10.17g) and 2 year follow-up (-14.28g) from baseline. In contrast, mean vegetable consumption decreased between baseline and 3 month follow-up (-3.31g); however, increased at 1 year follow-up (+10.57g) from baseline.

Results indicated a statistically significant difference in fruit consumption across study phases $\chi 2$ (3, 12) = 12.65, $p<0.05$. Wilcoxon signed-rank tests (alpha level adjusted to 0.016) suggested that fruit consumption did not increase significantly between baseline and 3 month follow-up (z= -1.94, p=0.05, r=-0.40), baseline and 1 year (z=-1.24, p=0.21, r=-0.25), or 2 year follow-up (z=-1.48, p=0.14, r=-0.30). In contrast, mean vegetable consumption did not change significantly across the study phases, $\chi 2$ (3, 12) = 5.40, $p>0.05$.

Discussion

Findings from this study showed that the *Food Dudes* intervention had a minimal impact on children's fruit consumption in the short- or long-term. While mean consumption of fruit increased at 3 month follow-up, these changes

Table 1. Mean consumption of fruit and vegetables in grams at baseline and follow-up (standard deviation in parentheses, N = 12).

	Baseline	3 month Follow-up	1 year follow-up	2 year follow-up
Fruit	24.42 (31.32)	44.15 (35.34)	14.25 (24.87)	10.14 (23.36)
Vegetables	43.11 (19.96)	39.80 (13.65)	53.68 (19.57)	39.58 (20.92)

in children's eating behaviour were not statistically significant or maintained at 1 or 2 year follow-up. Similarly, despite an increase in mean vegetable consumption between baseline and 1 year follow-up, these increases were also not statistically significant and decreased at 2 year follow-up. However, it should be noted that as children consumed relatively high levels of vegetables at baseline (approximately one portion), the potential of the programme to increase vegetable consumption would be difficult due to ceiling effects reached at baseline. Research has shown that children with developmental disabilities such as ASD may exhibit food selectivity (Johnson et al., 2008) however it is possible that this may vary depending upon the severity of ASD, e.g. some children will have greater difficulties in sensory perception than others which may impact upon their willingness to taste and consume novel fruits and vegetables or even those that they are familiar with. The extent of ASD for children in this study was not known therefore it is difficult to establish the potential impact of this on the study findings.

This study has clear limitations. The overall sample size was small, resulting in low statistical power and children were from an area of high deprivation thus making generalisation limited. Future studies would benefit from larger numbers of children from more diverse socio-economic areas. A particular strength of this study is the use of validated measures of dietary intake. As noted by Klepp, Pérez-Rodrigo & De Bourdeauhuij (2005) evaluations of such interventions should be based upon robust measures of dietary intake. Many evaluations of interventions designed to increase children's fruit and vegetable consumption rely on self-report measures, which are clearly limited by the ability of respondents (in this case children) to accurately recall and record consumption. In contrast, the present study used weighed intake of foods, the 'gold standard' assessment tool to measure consumption of school provided meals.

In conclusion, the present study showed little evidence that the *Food Dudes* programme produced either short- or long-term changes in children's lunchtime consumption of fruit or vegetables for children with ASD. Further development of the programme could explore how the intervention could be tailored to children with developmental disabilities such as Autism.

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