

Research Topics in Nutrition and Dietetics (BMS304)

“Do children with Autism Spectrum Disorder have a restricted diet? How they compare with the new Dietary Guidelines for Children and Adolescents in Australia.”

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Abstract

Aim: To investigate the dietary variety of children with ASD compared to a control group and the *Dietary Guidelines for Children and Adolescents in Australia (DGCAA)*.

Method: Children diagnosed with Autism Spectrum Disorder (ASD) (n=10) between the ages of three and ten years were investigated against a control sample of children without ASD (n=25). Food intake was measured using a food frequency questionnaire refined for use with a child sample. The influence on food intake was explored using 2 behavioural questionnaires, the Connors Rating Scale and Child Eating Behaviour and Appetite Scale. The groups were compared using averages with a 95% confidence interval to indicate any difference between behavioural influences on food intake and overall food intake. Preferences based on food characteristics such as taste, texture and colour were counted on their frequency in a list of favourite foods.

Results: There were no significant differences between the types of food eaten, flavour or texture. There was a marked difference in the preference for plain coloured foods in the ASD group compared to multicoloured food favourites of the control group. The ASD had a slightly more restricted variety of foods in their diet, which was supported by higher overall scores on the

behaviour questionnaires for preferences for food sameness, and fear of new things. The overall intake based on the 5 major food groups of cereals, vegetables, fruit, dairy and meat (including alternatives) was similarly spread across the two groups. This spread however did not meet the new proportion of daily intake for the five major food groups as recommended by the new DGCAA.

Conclusion: Children with ASD have a slightly more restricted diet than children without ASD, however the balance of the major food groups is similar. However this balance does not meet the recommended daily intake of the DGCAA.

Introduction

Autism is a developmental disorder that affects the central nervous system and the way the individual processes information. (AANSW 03; Knivsberg et al 2000; Williams et al 2001) Leo Kanner first described it in 1943 as early infantile autism by using social and behavioural observations. (Erickson 1992) There is no single known cause of autism, but it is thought to be strongly related to genetic predisposition and it is diagnosed by observing particular patterns of behaviour. (CCCHAP 1997; Volkmar and Pauls 2003)

There are wide variations in characteristics and severity of autism. To encompass them all in 1995 the National Association for Autism (Australia) officially adopted the use of the term Autism Spectrum Disorder (ASD), to include Autism, Asperger Syndrome, and Pervasive Developmental Disorder- Not Otherwise Specified (PDD-NOS). ASD is described through the diagnosis of a “Triad of impairments” with each individual ranking differently on three core features, which include;

- a) Repetitive and restricted patterns of behaviour and interests, including difficulties with change.
- b) Impaired communication skills, including limited language abilities.
- c) Impaired social interaction skills, including a lack of social reciprocity and peer relationships. (Williams et al 2001; AANSW 03; Volkmar and Pauls 2003)

Observational descriptions of children with ASD note that they require order in their lives and are very resistant to change. (Black et al 2002) They are observed to have atypical feeding behaviour

with a strict preference for particular foods and food texture. (Ahearn 2001) The methods of establishing food habits of this group appear to have been very difficult, most of the research has been largely anecdotal with no systematic objective evaluations of the prevalence or nature of their food choices, and have not included a control group of non-ASD children to compare the results against under the same conditions. (Ahearn 2001)

This resistance to change and preference for certain foods could categorise the children as being food neophobic (afraid of new foods). However all children are neophobic to some extent, boys in particular show a significantly higher food and general neophobia than their parents. (Koivisto and Sjoden 1996)

The prevalence of ASD in Australia is not known due to the broad range of mild to severe in each feature. Estimates broadly range from 4 –19 per 10,000, up to 40 per 10,000 when Aspergers is included, (Lotter 1966; Gillberg 1984; Wing 1997) and in the US the figure is estimated to be much higher at 1 in 500 (NCHID 2001) This is an interesting difference because the criteria appears to be the same. There were other discrepancies in the literature on prevalence, and when the numbers were checked on the Australian Bureau of statistics website, there was no breakdown per 10,000 to compare it with. (ABS 2003)

With the relatively high number of children with ASD in Australia it should be considered an important disorder to study. The reported neophobia may restrict the variety and quality of diets, so it is important to see how these children compare with children who do not have the disorder, and with the national dietary guidelines.

Methods

Subject recruitment and selection

Participants for the study were recruited on a volunteer basis from the Royal Prince Alfred Hospital (RPAH) Allergy Unit Sydney, the Autism Association of NSW, schools for children with ASD in Sydney and local child care centres in the central Sydney area. Participants from the Allergy Clinic were contacted directly, while participants from the schools and child care centres were contacted through the school or centre. The children had to be between the ages of 3 and 10 years of age, because ASD is officially diagnosed at 3 years of age (Williams et al 2001) and

parents would still have a good indication of what their child is eating up until about 10 years of age, because they would not be buying any of their own food. The mean age of the ASD group was 6.32 +- 2.23 (min 3.42 - max 11.00 years) and the control group's ages were 5.41 +- 1.76 (min 3.67 - max 10.83 years). The parents filled out a self-administered questionnaire on behalf of their child, and to be included had to spend the equivalent of 4 whole days a week with the child to ensure that they had an adequate knowledge of the child's actual behaviours and eating patterns. The total number of respondents to the whole study was 73; this was a response rate of 34% from the 214 questionnaires that the survey team posted. In order to reduce food variety bias by dietary interventions from the clinic such as the elimination diet, participants who had attended the clinic as patients were excluded. This exclusion reduced the sample to two groups ASD (n=10) and Control (n=26), the age range and gender mix were not significantly affected.

The Central Sydney Area Health Service Ethics Committee approved the research protocol.

Development of Survey booklet

An extensive questionnaire booklet was developed to collect data on the subjects. The booklet was developed by the research team to explore "dietary beliefs, practices and problems in the management of diet modification in children with ASD." The questionnaires reported the parent's observations of their child's current and historical health, behaviour and feeding status. The parents were also asked about their own mental health status using depression, anxiety and stress scales, impact on family as well as reporting on their own health during the early part of their child's life. This background information created a context to look for confounding factors, and trends that may affect their child's health status and behaviours. A copy of the full questionnaire is in the appendix. The assessment of eating behaviours and variety was examined using the Food Frequency Questionnaire (FFQ), the Child Eating Behaviour and Appetite Scale (CEBAS), and the Conner's Ranking Scale (Conner's).

The FFQ was based on the CSIRO FFQ and was rearranged and modified in a number of ways to make it more applicable to the study population. The format was matched to the other surveys in the booklet and the timeframe was reduced from 6 months to 3 months. It was accepted that this would not account for different seasons such as Easter (for chocolate consumption) and summer (change in type of fruits consumed), but because all the participants were measured over the same timeframe it would not affect the comparison. The foods were updated to reflect currently available food; the CSIRO version was last updated in 1998. The list was developed

using the Coles and Woolworth's online shopping lists and a final list of 508 specific foods, drinks and meals were listed. In addition there were "other – please specify" options at the end of each section, so the number of foods answered by parents varied from 508 to 514. The parents were asked to place an answer for each food on the list as either "Never tried", "Didn't like", "Rarely" consumes or times a month, week or day it is usually consumed. They then needed to indicate the usual serving size, which was assisted by a usual serving size for a child as indicated in the Dietary Guidelines for Children and Adolescents in Australia (DGCAA). The representative serving sizes were written as "Standard serve, amount", and the column for them to fill out had "amount eaten" to simplify the language, and the sizes were represented using straightforward house hold measures such as cups, tablespoons, pieces, slices and packets.

The National Health and Medical Research Council (NHMRC) and the Commonwealth Department of Health and Ageing (CDHA) publicly released the revised Dietary Guidelines for Australian Adults (DGAA) and DGCAA on 19 June 2003. The guidelines highlighted the amount and types of foods that are recommended for good nutrition at each stage of life. A diet with plenty of fruit, vegetables, and cereals was recommended, and consumption of meat, dairy, and their alternatives was encouraged. They recognised that many people have problems getting this balance right, so to assist them they recommended a range of servings per day of the major food groups and extras based on each age group. (NHMRC 2003)

The Conners behaviour rating system for children aged 3 to 17 years is an evaluation tool that is used to assist in the diagnosis and treatment of behavioural problems. It is fully validated, and can be self administered by parents reporting on their child. (Conners 1997) The parent is instructed to answer "how much you think your child has been bothered by the problem in the past month", with 4 possible answers ranging from 0-3, "not at all" giving a score of zero, to "very much" with a score of three. Two questions from this questionnaire were used in the comparison of participant's food and ASD related behaviour, question 12. "Fearful (of new situations, new people or places, going to school)" and question 40. "Problems with eating (poor appetite, up between bites)".

The CEBAS was developed by the RPAH Allergy Unit to pilot for this study, and was based on the Children's Eating Behaviour Questionnaire that had been preliminarily validated to assess dimensions of eating style. The CEBAS was designed to have the same rating scale as the Conners to allow for comparison. It had 50 questions in total and in addition the parent was asked to list their child's five most liked and five most disliked foods. Twelve questions were

assessed in addition to the two from the Conners, they were chosen based on the literature discussing typical ASD related eating difficulties. (Ahearn et al 2001) The questions chosen were 1. Has poor appetite, 2. Diet lacks good nutrition, 8. Lacks variety in food choices, 9. Prefers bland foods 10. Makes repetitive food choices, 11. Craves some types of foods, 12. Is obsessed with sameness of foods, 13. Is fussy about food temperature, 14 Will only accept food or drink with certain plates or cups, 15. Is fussy about food texture, 16. Is fussy about food colour, 17. Is afraid of trying new foods, see the survey booklet in the appendix for the whole survey.

Data analysis

Microsoft Excel 2002 (Microsoft Corp., USA), was used in all the data calculations. The groups were compared using averages with a 95% confidence interval (CI) to indicate any difference between behavioural influences on food intake and overall food intake.

The scores from the FFQ were obtained by establishing an average daily intake of each food listed on the FFQ by calculating the rarely eaten as eaten once over the three month period, and multiplying the weekly number by four and the daily number 30, then dividing the total monthly frequency by 30. This was then adjusted to the serving size recorded by the parent to indicate the actual amount eaten in a usual daily consumption of each of the major food groups as indicated by the DGCAA. The “Extra Foods” recommendations from the DGCAA were not included in these calculations from the FFQ. Counting the number of foods never tried and inverting the percentage of the total foods on the list calculated the number of foods tried. Any foods that were not answered by the parents were presumed to be “never tried” because there was no way to estimate the amount of the food eaten if it was a part of the child’s diet. The percentage of foods that were not liked by the child was counted against the total number of foods on the list.

The five most liked and disliked foods were categorised by colour, texture, type and flavour, and then counted for the frequency of each characteristic within the category. For example the number of white, brown, green, yellow, pink, orange, red and multicoloured foods was counted for the total ASD and Control group, and converted to a percentage for comparison of each colour between groups, the same was done for each of the other categories.

The Conners and the CEBAS were scored from 0-3, the average at 95%CI was measured and graphed for the ASD and the control group to establish any similarities in the behavioural trait indicated by the questions.

Results

Food Frequency Questionnaire

The FFQ was a very extensive listing of foods, some participants left blanks, which may indicate that the length was prohibitive for them to go back and check that they had filled out for each for the foods. The FFQ probably had too many foods for this survey, however the clinic may use it for future analysis of food chemicals, and the difference between individual vegetables and fruits warrant the inclusion of the vast variety. There were some questions on more adult type beverages, such as tea, coffee and alcohol, which led some parents to comment that this was a survey on their child's eating habits, so having alcohol was not appropriate. However some parents indicated that their child in fact has a sip of wine every now and again at meals, and they drink tea, so it may be a valid food listing in a child focused FFQ.

There were no significant differences in the percentage of foods tried or the percentage of foods not liked between the ASD and the Control groups. Figure 1 describes how many different foods were in the diet based on the percentage of foods that the child had never tried. The average percentage of foods tried by the control sample was 44% (95%CI 37-52) and was more evenly spread with the lower limit being higher than the ASD average 33% (95%CI 18-53). This would indicate that generally the control group had a higher variety of foods in their diet. The much broader spectrum of variety in the ASD group, follows along the differences in each component of the spectrum overall between individuals. (Williams et al 2001) Perhaps these children don't score as high on the repetitive behaviour and afraid of new things scale, as some of the others in the sample.

Figure 1: Average Percentage of foods tried and not liked

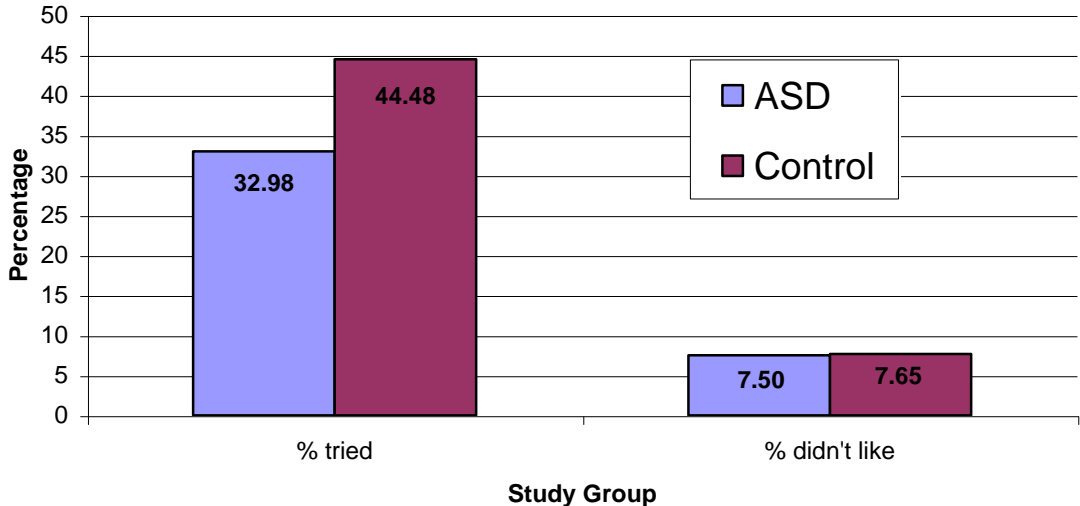


Figure 2: Average serve per day of 5 major food groups of ASD and control

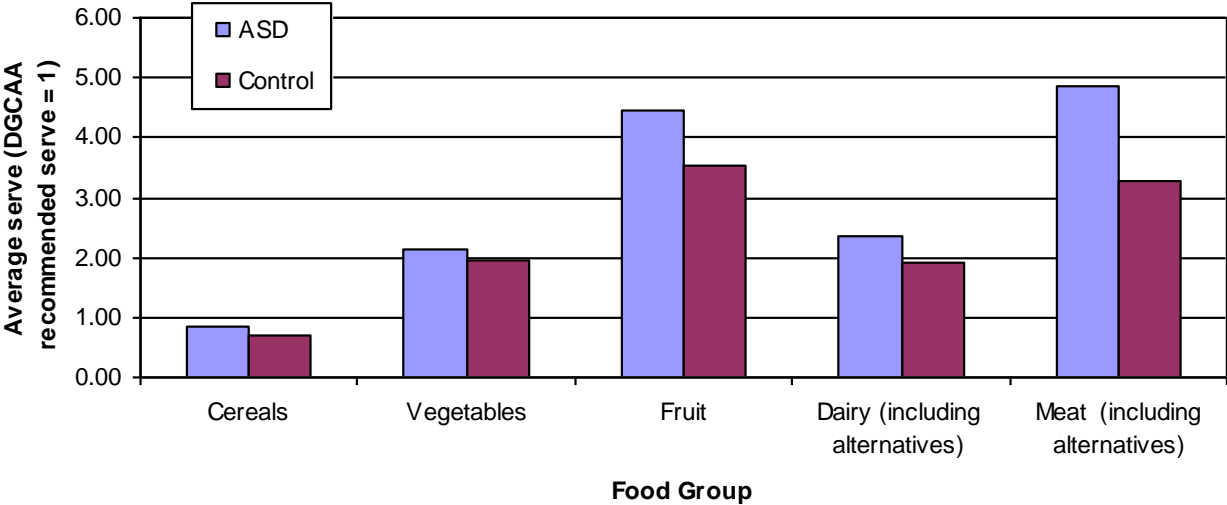
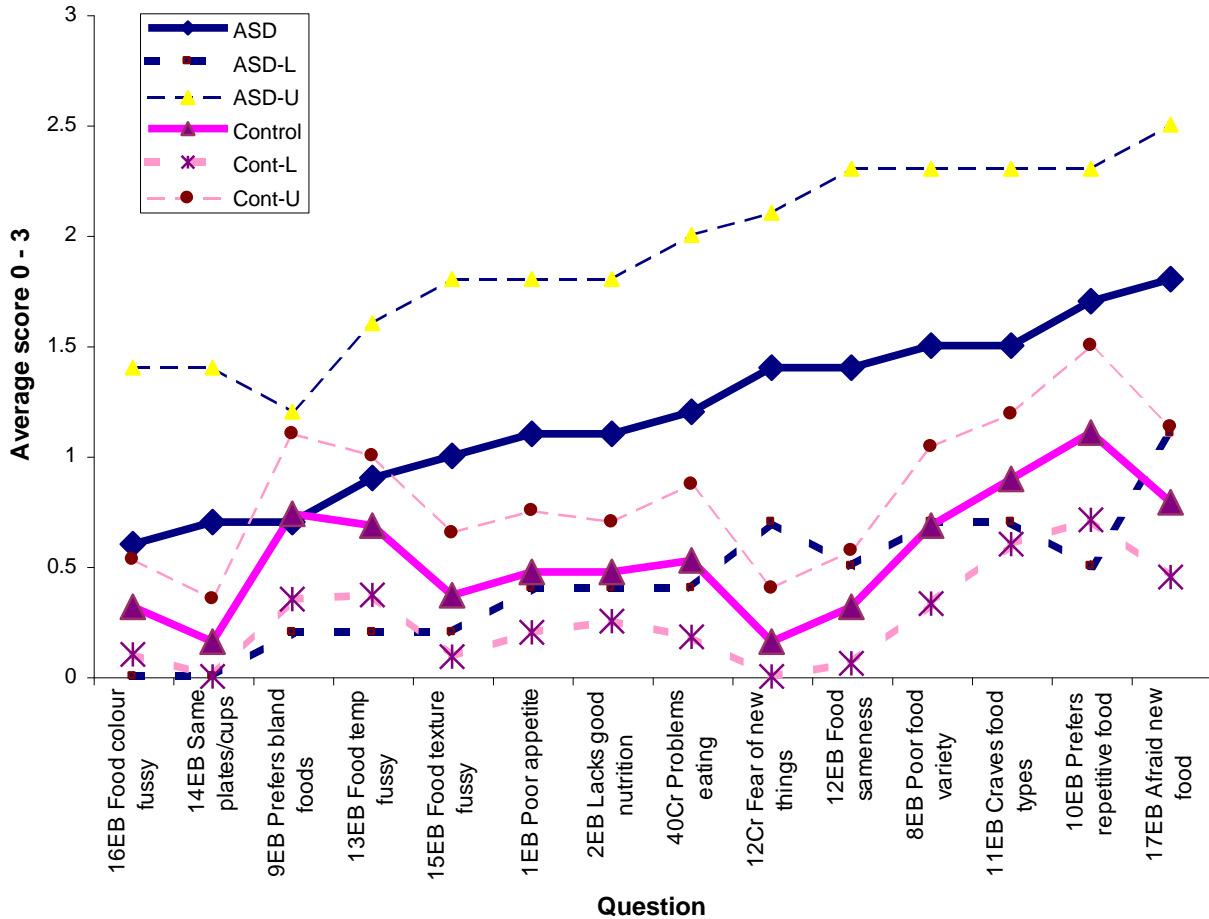


Figure 3: Food related behaviours from Connors & CEBAS with 95% limits



The FFQ compared with the DGCAA

There was no significant difference between the ASD and control group for average daily servings of the main five food groups. Figure 2 shows a marked difference between the children’s consumption and the recommended number or serves for their age in the DGCAA. The DGCAA recommends between 5-7 and 6-9 servings of cereal-based foods for 4-7 and 8-11 year old children respectively. The ASD had a higher overall consumption than the controls with some respondents meeting the recommendations, but most did not, with the average number in the

ASD group being 0.86 (95%CI 0.63-1.39) per recommended daily serves. In the control group the upper 95% CI limit did not meet the RDI, scoring 0.70 (95%CI 0.54-0.85) times the recommended number of servings. For the other food groups all of the children exceeded the recommended number of daily serves, with fruit and meat being the highest. The DGCAA recommends only 1 serve of fruit a day across the two age group brackets, yet the children consumed almost 4 times that amount with the ASD scoring 4.45 (95%CI 2.37-7.2) and the controls 3.52 (95%CI 2.61-4.43). The children also ate almost four times the recommended 0.5-1 serving of meat and meat alternatives with the ASD group averaging 4.87 (95%CI 2.67-7.88) and the controls 3.26 (95%CI 2.69-3.83). The servings for the milk and vegetables were between 2 and 3 serves per day, which would indicate that the children probably have an equal proportion of servings across all the food groups, rather than a focus on cereals, vegetables and dairy.

Comparisons of Behaviour Scores

The behaviour patterns of the children in each group show some significant differences, but with only slightly augmented overall behaviours in the ASD group. The questions that related to fear and sameness, indicative of a main character trait for ASD, that the child shows repetitive patterns of behaviour including difficulties with change are the most significantly different. The maximum score was three for “very much so” and zero for “not at all”. Question 12 from the Conners was significantly different with the ASD group scoring on average 1.4 (95%CI 0.73-2.27) and the controls having a much lower average score of 0.32 (95%CI 0.07-0.57), indicating that children with ASD are more likely to be afraid of new things. Other scores that were close to being significantly different and show quite a difference on the graph of averages are questions 12 and 17 from the CEBAS with 1.4 (95%CI 0.51-2.27), 0.4 (95%CI 0.15-0.65) and 1.8 (95%CI 1.10-2.92), 0.92 (95%CI 0.58-1.26) for the ASD and the control groups respectively. The one question that showed an agreement across both groups was question 9 from the CEBAS related to the preference for bland foods. The ASD group scored an average of 0.7 (95%CI 0.19-1.13) and the controls scored similar ratings with 0.92 (95%CI 0.53-1.31), this one is less behaviour based and more so related to taste, and general food preference, which may account for this similarity.

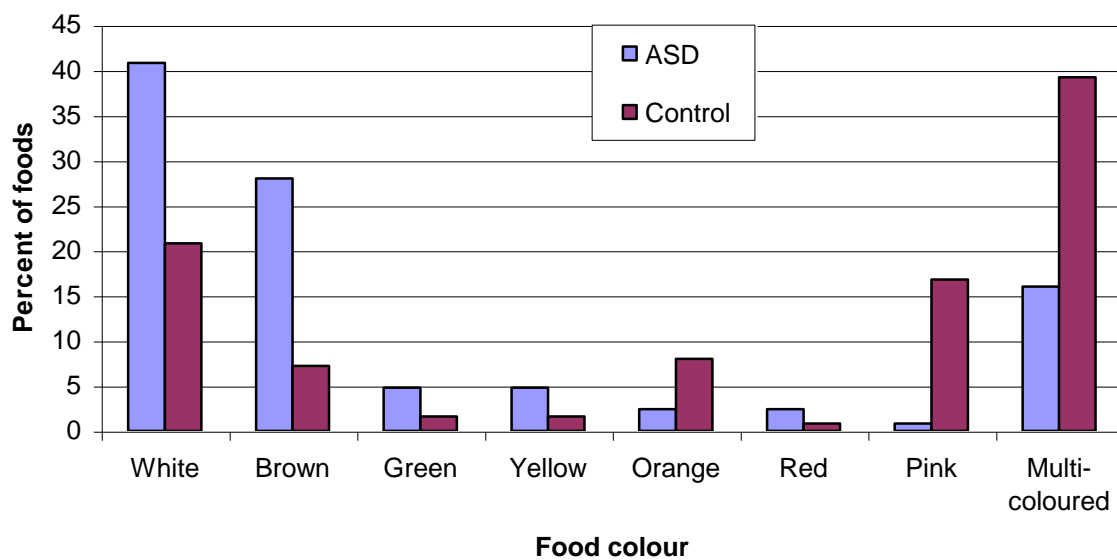
Of the “five favourite foods” list for each group there were not many differences between the ASD and control samples in regard to the most preferred food characteristics of food type, texture and flavour with the highest scoring preferences listed in table 1.

Table 1: Most common characteristics of five favourite foods

Category	Most favoured	ASD group	Control group
Food type	Grains and starches	26%	21%
	Vegetables and nuts	21%	20%
	Meat	16%	21%
Texture	Soft	53%	54%
Flavour	Savoury/bland	44%	64%
	Sweet	35%	21%

There was however a quite a difference in the favourite foods based on their colour, with figure 4 showing the ASD groups high preference for plain coloured foods with white (41%) and brown (28) foods been mentioned the most often. The control group on the other hand had a much higher preference for more complex colours with the multicoloured foods scoring in 39% of the most favoured foods.

Figure 4: Most liked foods by colour



Discussion

The dietary variety of children with ASD was not significantly different to the children without ASD. Both groups had a similar proportion of the five major food groups in their diets, and none of these food groups met the new DGCAA.

The anecdotal reporting of limited food intake from the focus group study (Andonopoulos 2003) and the diagnosis criteria of repetitive and restricted patterns of behaviour and interests, including difficulties with change was only hinted to by the FFQ. Children with ASD had a slightly more limited range of total foods in their diet when compared with the control sample, however the difference was not significant, and there was no difference between the numbers of foods that the children disliked from the FFQ list. None of the previous studies had actually tested their ASD samples against a control of a non-ASD sample, so perhaps more comparative studies need to be done.

There was not much difference between the texture and preferred flavours in the children's most favoured foods. This is comparative to the findings of the Ahearn (2001) study, however the research settings were different. Where Ahearn attempted to test out the preference for texture and taste in a laboratory environment, this study looked retrospectively at the foods usually eaten by that child. The resistance to change in a child with ASD would indicate that they would be even less likely to eat the different foods in a laboratory environment, so this retrospective may be a better indication of food preference.

The neophobic tendencies of children in general (Koivisto and Sjoden 1996) were supported across the whole sample. The answers from the CEBAS and the Conners supported the notion that the ASD would be slightly more neophobic than the non-ASD children. However there were no significant differences between the foods tried and food not liked as reported in the FFQ. The scores from the FFQ were not compared to the child's parent's scores, or compared with older children in the same family, so it is unclear if the percentage of foods not tried is specific to that child, or if the foods on the list are not usual for that family, so the child would not be introduced to the food.

The indication of colour in the five most liked and disliked foods somewhat validates the need for sameness. Children with ASD like things to not be too busy (AANSW 03), which would indicate why white foods are the most preferred. There has been no validation however of how many

white foods would be present in a general diet, so it is difficult to relate this only to autism, when there may be more white foods consumed in the general diet. The difference in the most liked foods being multicoloured for the control group indicates that there is a trend in the ASD groups preference for plain coloured food.

The FFQ and the CEBAS are still in a developmental stage and require further validation, which may be a limiting factor to the accuracy of the reporting. The FFQ for example could be made more accurate if the researcher followed-up any ambiguities, such as serve sizes and missing data. This would also be true for many other answers in the total questionnaire booklet, a general limitation in self-administered questionnaires. I am uncertain as to how this may impact on the confidentiality of the surveys, so it would have to depend on the context that the survey is used.

A larger sample size may improve the power of the results. The continuation of the larger study by the RPAH allergy Unit will increase the sample size. The survey booklet is very comprehensive and long. The benefits of a comprehensive survey like this are that it collects a broad variety of information, which may increase the chance of discovering various trends that may affect the diet of a child with ASD. However the length of the survey may cause a bias in the sample type to only include parents who are willing to take the time out to complete such a lengthy survey. This is a difficult problem to overcome, as the study continues the booklet will need to be further refined, and the researchers will need to continue to recruit as a broad sample of subjects reduce the bias.

Conclusions/recommendations

The questionnaire booklet will require further refinement, and the study sample size will need to increase to improve the power of the analysis of the data. This study has found that children with ASD have a similar overall dietary intake to children without ASD over the five major food groups, with a limit in variety within the food groups. However none of the children in this sample were meeting the dietary guidelines for their age group, which may be of relevance to future dietetic advice to children in this age group.

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Appendix

Total set of Questionnaires