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Risk factors for failure to thrive: a population-based survey

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Summary

Aim **To identify whether differences exist between failure to thrive children and controls in either demographic characteristics or parental rating of their eating and other behaviour.**

Methods **As part of an intervention study, 97 children with failure to thrive were identified by population screening and received a standardized assessment by their health visitor at a median age of 15.1 months. This included standard questions to parents concerning their perception of their child's feeding history and behaviour. Their responses were compared with the parents of 28 normally growing children aged 16–18 months, systematically sampled from the same district.**

Results **Cases had fallen through a mean of 1.69 weight standard deviation score and were markedly underweight for height. The case families had similar levels of deprivation, both to controls and city norms, and only four showed evidence of major neglect. Failure to thrive children had significantly more infancy feeding problems and were introduced to solids and finger foods later than controls; they were significantly more often described as variable eaters, undemanding and shy and less often as hungry. Cases liked most foods, but significantly less so than controls.**

Conclusions **This suggests that the role of deprivation and neglect has been overstated and that undemanding behaviour, low appetite and poor feeding skills may contribute to the onset and persistence of failure to thrive.**

Keywords: behaviour, failure to thrive, feeding, infant, temperament

Child: Care, Health and Development

VOLUME 26
NUMBER 1

2000

PAGES 5–16

Background

Failure to thrive (FTT) is a common problem of early childhood that continues to elude easy explanation. Although it is generally agreed that undernutrition is the usual underlying cause, the risk factors that lead to it are less clear. Many authors over the years have suggested that FTT children and their mothers manifest a disorder of attachment (Drotar & Eckerle 1989; Singer *et al.* 1990), while others have suggested that temperamental features in the child are an important risk factor (Kotelchuck & Newberger 1983). However, most studies of the risk factors associated with FTT have been of referred cases (Boddy & Skuse 1994), often without a control group and in many cases using subjective or unreproduceable case definitions (Wilcox, Nieburg & Miller 1989). In these cases prior beliefs about FTT will almost inevitably lead to bias either at the point of referral or at the point of inclusion into the study, making the interpretation of any observed difference impossible. For example, the high levels of feeding problems found in one clinical series were unsurprising since they were recruited from a 'failure to thrive and feeding disorders' clinic (Ramsay, Gisel & Boutry 1993).

Therefore, if risk factors for FTT are to be explored without bias, the subjects must constitute all the cases identified in a population using a valid and consistent definition of FTT and should be compared with normal controls from the same population. Only four published studies appear to meet these basic criteria. Sherrod and colleagues (1985) conducted the earliest, prospective, whole-population study of infants showing subnormal weight gain, which found no differences in the mothers of cases and controls but did find cases to be significantly more 'difficult' using the Carey temperament scale. However, in this study the initially praiseworthy design was flawed by the prior exclusion of a quarter of eligible cases on the ground that they were judged to be 'short normal but healthy' on apparently subjective grounds. There have been two British population-based studies (Heptinstall *et al.* 1987; Puckering *et al.* 1995). The first found some differences in feeding and interactive behaviour between stunted underweight 4 year olds and matched controls. However, this study was seriously under-powered with only 23 cases. A subsequent study by the same group (Skuse, Wolke & Reilly 1992) found significant interactional differences between cases and controls, but these have since been ascribed to differences in maternal or child IQ (Wolke, Skuse & Reilly 1996). In another study (Black *et al.* 1994) 102 FTT children and their parents, recruited from community clinics, apparently without a formal screening process, were significantly more likely to have a 'neglecting' parenting style compared with local

Child: Care, Health and Development

VOLUME 26
NUMBER 1

2000

PAGES 5–16

controls. A significant association was then found between 'neglecting' parenting style and the child showing poor interactive competence, but no independent association with FTT.

The role of poverty and social problems has been particularly hard to evaluate as most studies are directed at highly vulnerable groups and usually matched on some measure of deprivation, implying that it is assumed that poverty plays a major role. However, our own earlier population survey (Wright, Waterson & Aynsley-Green 1994a) found that while children from the most deprived areas were twice as likely to show subnormal weight gain, nonetheless the majority of cases came from less deprived areas and that there was even a moderate excess of cases from the most affluent areas. Batchelor and Kerslake (1990) found that children from deprived homes were more likely to be labelled as FTT than children from affluent homes despite showing identical weight patterns.

Thus, of the large number of previous publications seeking to examine the antecedents and risk factors associated with FTT, only a few are truly free of referral or selection bias and of these, all but one studied fewer than 50 cases. The result is that there have been few unequivocal findings to guide clinicians.

We have studied a group of children with FTT, identified by population screening and assessed by field staff as part of a previously reported randomized trial of community intervention (Wright *et al.* 1998). While not primarily recruited for this purpose, this group provided an unusual opportunity to investigate possible correlates of FTT in an exceptionally large, unselected population-based cohort. The limitations to this study were, however, that primary data collection was to be done by field staff and there was no funding to recruit matched normally grown controls. Nonetheless a range of simple questions about demographic variables, eating and other behaviour were routinely recorded. It was therefore decided to compare these responses, where possible, with routine national and local statistics and to obtain comparison data from a representative group of normally growing toddlers.

Child: Care, Health and Development

VOLUME 26
NUMBER 1

2000

PAGES 5–16

Patients and methods

Cases

Children were identified via a screening programme for all children resident in Newcastle, UK. This required that for each infant in the district a minimum

of two weights be entered on the child health computer: a base-line weight at the 6–8 week check and a later weight, usually between 9 and 18 months. Children were then identified as failing to thrive if the weight standard deviation score (SDS) had fallen between the baseline weight (SDS_1) at 6 weeks and the subsequent weight (SDS_2) after adjustment for regression to the mean, using the 'thrive index' (TI) method ($TI = SDS_2 — SDS_1 \times 0.65$) (Wright *et al*. 1994b). The screening threshold used was a fall (thrive index) of 1.26 SDS, equivalent to a centile shift from the 50th to between the 10th and 3rd centile, which identifies the slowest gaining 5% of children (Wright *et al*. 1994b).

Twenty of the 38 primary care teams in the city, each with one to three health visitors, were randomly allocated by toss of coin to take part in the intervention arm of the study run by a community-based multidisciplinary team, the Parkin Service. It is the children identified in these practices, representing approximately 1800 births per year, who are the subject of this paper.

Recruitment began in October 1991 and continued for 2 years. There were no exclusions, except second twin sibs, where both screened in, and children who had already recovered to above the screening threshold by the time of identification. All screening data were checked by project staff before cases were included. Compliance with the screening programme by health visitors was not universal, but during the study period 60% of the expected number of FTT cases were identified.

As the programme was designed to reflect everyday service conditions, all the case data were collected by field health visitors. This had the considerable advantage of easy access to families, but it meant that the information they were asked to collect had to be relatively brief and unintrusive. After introductory training sessions, the health visitors in the intervention practices were sent a proforma for each new case, which they usually completed at a home visit. This documented family information, the child's medical and dietary history and incorporated a number of structured questions about the child's eating behaviour, food preferences and personality, using adjective check-lists and Likert scales. A medical examination was then performed by a community paediatrician and, where relevant, screening blood and urine tests were performed, except where the child was already under hospital management.

Controls

The control group were identified from three Newcastle general practices, chosen because they were generally representative of the city. All children in

Child: Care, Health and Development

VOLUME 26
NUMBER 1

2000

PAGES 5–16

those practices aged 16–18 months were identified from the child health computer and invited to participate. Those parents who agreed were interviewed at home by EB, using the same assessment proforma as that used for the cases.

Results

Subjects

One hundred and twenty cases were identified in intervention practices, but 23 had no additional input, having recovered to above the screening threshold before identification. This left 97 eligible children of whom 95 (98%) received at least part of the standardized health visitor assessment. There were 40 eligible control children in the target age range in the three practices and the mothers of 28 (70%) of them agreed to be interviewed.

All the control children were aged between 16 and 18 months when their parents were interviewed, compared with the cases who were aged a median of 15.1 months at health visitor assessment, with a wider spread of ages (range = 7–28 months).

The demographic features of the cases were similar to both controls and to census data for Newcastle (Table 1). Over the period of follow-up, 21 (22%) case families received some social work input, five prior to Parkin Service involvement and 16 following it. This resulted in four children being registered as being at risk of abuse or neglect, of whom three spent time in care.

Table 1 Demographic features of cases compared with controls

	Cases		Controls		Newcastle City families with children (OPCS 1992)
	n	%	*n*	%	
Male	52	53.6	17	60.7	
Firstborn	37	38.1	10	35.7	
No employed parent	39	41.5	13	46.4	29.4*
Not home owners	52	54.7	15	53.6	53.5
Not car owners	43	48.3	14	50	49.0
Non-Caucasian	9	9.4	0	0	9.35
Total	97		28		

*Families with children < 15

Child: Care, Health and Development

VOLUME 26
NUMBER 1

2000

PAGES 5–16

Seventeen (17.5%) case children had relevant organic conditions, but in only four could these be said to be the main explanation for their failure to thrive and all but two of these conditions were already recognized. Although blood was taken in 46 (61%) of the children with no other indicators of organic disease, no unexpected pathology was revealed. None of the control children had either significant organic disease or social work input.

Growth patterns

At assessment the cases had mean (SD) standard deviation scores for weight of – 2.00 (0.93) and for height of – 1.06 (0.96) and had made a mean fall (thrive index) of 1.69 (0.68). The onset of their FTT had been surprisingly early, with 50% crossing the screening threshold by the age of 6.2 months. During follow up 96 (99%) children showed catch-up weight gain at some point and 85 (88%) showed sustained improvement. None of the control children has at any time met screening criteria for FTT.

Feeding history

Initial breast feeding rates were similar between cases (47%) and controls (50%) and were comparable with national survey data (Foster, Laider & Cheesbroughs 1997). The case parents reported commencing supplementary solids at a mean (SD) age of 3.89 (1.29) months, later than controls at 3.04 (1.11) months (P, *t*-test = 0.003). This is comparable with the median national figure of just under 3 months (Foster *et al*. 1997). Cases were similarly late-starting finger foods (cases 7.15 [1.9] months; controls 6.14 [1.5] months; *P*-value, *t*-test = 0.005). Parents were asked if their child had any sort of feeding problem in infancy; 27 (28%) case parents described their child as having some sort of problem compared with only 2 (7%) controls (*P*-value, $\chi^2 = 0.022$) (Table 2). Despite the high levels of recalled early feeding problems, no association was found within the case group between the reporting of early feeding problems and the age of introduction of solids.

Parental perceptions of their child's feeding and other behaviour

When offered a check-list of five adjectives to describe eating style, case parents were significantly more likely to describe their child as a variable eater, while controls were more likely to describe their child as hungry (Table 2).

Parents were also asked to rate their child's liking for different food groups

Child: Care, Health and Development

VOLUME 26
NUMBER 1

2000

PAGES 5–16

Table 2 Parental description of feeding history and eating style

	Cases ($N = 95$)		Controls ($N = 28$)		
Total	***n***	**%**	***n***	**%**	***P*-value†**
Problems in infancy					
Sucking	14	14.7	0	0	0.02
Swallowing	10	10.5	0	0	0.07
Chewing	15	15.8	2	7.1	0.19
Any of the above	27	28.4	2	7.1	0.02
*Children described as**					
Hungry	10	13	11	39.3	
Average	26	33.8	9	32.1	
Variable eater	27	35.1	5	17.9	
Uninterested in food	9	11.7	2	7.1	
Poor eater	5	6.5	1	3.6	0.003**

*20 cases excluded as more than one adjective chosen. **χ^2 for trend 'hungry' *vs* 'average' *vs* 'variable'/'uninterested'/'poor'. †*P*-value calculated using Fisher's exact test.

Table 3 Food preference scores
1 = dislikes to 5 = likes a lot

	Cases			Controls		
	N*	**Mean**	**SE**	**Mean**	**SE**	***P*-value**
Food groups scored						
Energy score**	91	4.11	0.04	4.5	0.04	0.001
Fibre score***	89	3.95	0.05	4.54	0.06	< 0.0001
Total score****	91	3.96	0.04	4.41	0.04	< 0.0001

*Number of controls always = 28. **(Starch + milk + crisps + sweets + cakes/biscuits)/5. ***(fruit + Vegetables)/2. ****(sum of eight individual food scores)/8. †*P*-value calculated using *t*-test to compare means.

on a five-point scale. Controls were rated as liking most foods more than case children, with no difference in preferences for high or low energy foods. This difference was highly significant when aggregated as a score for all foods, for energy and for fibre-rich foods (Table 3).

Parents were also asked to describe their child in four different modalities, each on a three-point Likert scale: happy/miserable, good behaviour/poor behaviour, demanding/undemanding and sociable/shy. Most parents in both groups described their child as happy, but case parents were slightly less likely

Child: Care, Health and Development

VOLUME 26
NUMBER 1

2000

PAGES 5–16

Table 4 Parental rating of child's behaviour and temperament

	n	%	*n*	%	*n*	%	*P*-value
	Happy		**Average**		**Miserable**		
Cases (*N* = 93)	75	80.6	16	17.2	2	2.2	
Controls (*N* = 28)	25	89.3	3	10.7	0	0.0	0.25
	Good behaviour		**Average**		**Poor**		
Cases (*N* = 92)	61	66.3	30	32.6	1	1.1	
Controls (*N* = 28)	23	82.1	5	17.9	0	0.0	0.10
	Sociable		**Average**		**Shy**		
Cases (*N* = 76)	47	61.8	17	22.4	12	15.8	
Controls (*N* = 28)	26	92.9	2	7.1	0	0.0	0.002
	Demanding		**Average**		**Undemanding**		
Cases (*N* = 77)	18	23.4	48	62.3	11	14.3	
Controls (*N* = 28)	13	46.4	15	53.6	0	0.0	0.005

†*P*-value calculated using χ^2 test.

to describe their child as well behaved and significantly more likely to describe them as undemanding and shy (Table 4).

Because of the discrepancy in age between the two groups, where variables showed a significant difference between cases and controls, the possibility of a confounding association with age at assessment was explored within the case group, using linear regression and χ^2 analysis for trend. However, only one variable, recall of feeding problems in early infancy, showed a significant association with age, with parents of younger children (< 14 months) being most likely to report problems. However, in the age group nearest to the controls (14–20 months) six (26%) case parents still recalled problems, and this was nearly four times the rate in the control group.

Discussion

The strength of this study is that information has been collected from an unusually large, unselected population cohort of children with FTT, identified using a standardized velocity-based definition, with a high level of participation. In view of the apparent heterogeneity and selective nature of many previous case series, this study presents the opportunity to examine which behavioural characteristics are actually associated with FTT as opposed to those factors that may lead a child to be identified and referred.

The study does have obvious limitations. It was possible to recruit only

Child: Care, Health and Development

VOLUME 26
NUMBER 1

2000

PAGES 5–16

a small control group from a limited age range. However, the characteristics examined proved remarkably stable with age, making this less of a problem than might have been expected. The control group were also collected from only three general practices. However, these were chosen because they were felt to be generally representative of the city and this proved to be the case when compared with national survey data. A 70% response rate from the control families is respectable for a study of this nature. However, the absent 30% will inevitably have introduced some bias as non-responders are usually more disadvantaged than responders. However, as above, the comparability with city norms offers reassurance that this effect cannot have been great.

For both groups the data were collected unblinded, by a range of staff and the potential differences in interview techniques, particularly between cases and controls could also have introduced bias. However, the survey instrument used was standardized although necessarily brief in order to be acceptable in a busy field setting. It was not feasible to use the few relevant standardized scales that are available, due to staff and time limitations. However, the measures used did reveal interesting differences, and their simplicity made it possible to study a large group with high levels of compliance, due to the involvement of families' own health visitors. More exhaustive studies performed by research staff tend to encounter substantial rates of non-consent, with a consequent risk of unrepresentativeness.

Thus these results must be viewed with caution, to generate new hypotheses for future examination rather than establish new certainties. However, as they stand they do supply a useful supplement to previously published work and do suggest interesting new lines of enquiry.

As suggested by our earlier work, the great majority of cases arose in unremarkable homes with little to suggest an increased risk among the poorest families. The rates of proven neglect and abuse were higher than expected in the general population, but still constituted only 5% of all cases, suggesting that both the role of poverty and of neglect and abuse has been overemphasized in the past. This finding is consistent with previous published studies (Sherrod *et al*. 1985; Skuse *et al*. 1992) where similarly low rates of abuse were found.

The differences in parental reports on feeding and behaviour are plainly more subjective, but interesting nonetheless. The FTT children were generally positively described by their parents, but they were seen as relatively shy and undemanding. Their feeding was more likely to have presented early problems and solids were introduced later than for controls. They were described as liking

Child: Care, Health and Development

VOLUME 26
NUMBER 1

2000

PAGES 5–16

most foods, but significantly less so than controls, and over half were described as being uninterested in food, poor or variable eaters. This study also reveals some interesting things about normal growing toddlers for paediatricians accustomed to parents' worries and complaints; the controls were predominantly described as happy, well-behaved and sociable children who enjoyed most foods.

The question is whether the FTT children had an inherently undemanding temperament, low appetite and a lack of interest in food, resulting in low intake and late weaning, or alternatively whether this behaviour was itself a manifestation of low-grade under-nutrition. Other studies have shown that malnourished children are apathetic (Grantham-McGregor, Stewart & Powell 1991a) and that, where malnourished children receive food supplements, they are both developmentally more mature and more pro-active in soliciting food from their carers (Chavez & Martinez 1979; Grantham-McGregor *et al*. 1991b). One must also consider the possibility that it is the parents' perceptions that differ rather than the children themselves. Two studies have found that mothers consulting for feeding problems in their children, themselves had more disordered attitudes to food (McCann *et al*. 1994; Stein *et al*. 1995). Unfortunately it has not been possible to compare maternal perceptions to objective observations of behaviour in this or, to our knowledge, any other study.

In conclusion, these results suggest that children with FTT largely come from unremarkable households, but have significantly different behaviours in relation to food from the earliest age and tend to be relatively shy and undemanding. While the individual differences are not extreme, it seems plausible that the combination of low interest in food, poor feeding skills and a retiring personality could lead to low intake, at a time when energy needs are exceptionally high. This could explain why simple interventions, such as our own (Wright *et al*. 1998) can make significant differences in weight gain, since dietary assessment and advice can serve to concentrate parents' attention on the feeding of an otherwise undemanding child.

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Child: Care, Health and Development

VOLUME 26
NUMBER 1

2000

PAGES 5–16

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Child: Care, Health
and Development

VOLUME 26
NUMBER 1

2000

PAGES 5–16

