

# **Does Regular Fish Consumption Reduce the Risk of Childhood Asthma?**

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**Institute of Respiratory Medicine**



**F I S H E R I E S  
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**Project 93/210**

**Does Regular Fish Consumption  
Reduce the Risk of Childhood  
Asthma?**

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**Corporation**

Project No. : 93/210

ISBN No. : 0 646 24793 X

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# 1. SUMMARY

The diets of 468 school children, aged 8 - 11 years, attending nine schools randomly selected from all State and Catholic primary schools within a 10 kilometre radius of Sydney G.P.O. were analysed for 39 nutrients, energy and fibre, and 24 food groups. The population consisted of both asthmatic and non-asthmatic children. Children with airway hyperresponsiveness to exercise (airway abnormality) and wheeze in the past 12 months (asthmatic symptoms) were defined as having current asthma. The major findings of this study were:

1. Consumption of *fresh, oily fish* was associated with a significantly reduced risk of current asthma in 8-11 year old children, after adjustment for other known risk factors for asthma.
2. Consumption of *fresh, non-oily fish* was not associated with any reduction in risk of current asthma, asthmatic symptoms or airway abnormalities.
3. There were no other dietary factors which differed significantly between asthmatic and normal children.
4. Two previous epidemiological studies of children showed an association between the consumption of fish and a reduced risk of asthma. The present study suggests that these findings are valid, since there was moderately good agreement between fish consumption estimated by the standard respiratory questionnaire, used previously, and by the detailed dietary questionnaire.
5. Children who ate fish regularly generally had diets that were higher in all essential nutrients, than did children who were not regular fish eaters.

## 2. BACKGROUND

The prevalence of childhood asthma has been rising steadily since the late 1960's and is now approximately 12% in Australia<sup>1</sup>. This represents a significant problem for both health professionals and the community.

Although the etiology of asthma is still largely unknown, it is well established that the majority of children with asthma are sensitized to various allergens including house dust mites and pollens. These allergies can be responsible for acute asthma attacks but may also be responsible for the chronic symptoms of asthma i.e. inflammation, mucous production and bronchoconstriction. Recent research has shown that fish oils can reduce the production of mediators which are associated with the allergic response<sup>2</sup> and thus, theoretically, may reduce the severity or even occurrence of asthma.

Over the past 10 years we have undertaken epidemiological studies of Australian children in which we have documented asthmatic symptoms (wheeze), allergic sensitization (atopy) and airway hyperresponsiveness. Airway hyperresponsiveness (AHR) is a measure of the sensitivity of airways to a provoking stimulus such as histamine, methacholine or exercise and is closely associated with the occurrence of asthma. Studies of school children living in two areas of N.S.W., Australia, have shown that children who eat fish more than once a week have less AHR to histamine than children who do not eat fish regularly<sup>3,4</sup>. When adjusted for all other risk factors, children who ate a meal containing fish more than once each week had one third the risk of AHR. The question regarding fish intake in the standard respiratory questionnaire used in these studies was not validated against actual fish consumption prior to its use, so it is not certain that fish consumption was the factor responsible for the reduced risk of AHR or whether this was a marker for another dietary characteristic.

The current study was undertaken in order to further explore the findings of these epidemiological studies. In this study, we used a detailed dietary questionnaire to validate the questions of fish intake used in the original standard respiratory questionnaire and to examine the relationship of other dietary factors to asthmatic symptoms and to AHR in children.

### **3. OBJECTIVES**

The objectives of this study were to test the following hypotheses:

1. that the question used to categorise fish consumption in the standard respiratory symptom questionnaire has good construct validity;
2. that regular fish consumption reduces the risk of children having airway abnormality or asthmatic symptoms;
3. that the type or quantity of fish is the important factor associated with a reduced risk of asthma in childhood;
4. that children with abnormal airways or asthmatic symptoms have different dietary characteristics to non-asthmatic children.

## 4. METHODS

### 1. BASELINE STUDY

In May and June, 1993, 812 school children aged 8 - 11 years attending nine schools randomly selected from all State and Catholic primary schools within a 10 kilometre radius of Sydney G.P.O. were assessed for asthmatic symptoms, exercise induced airway hyperresponsiveness (AHR) and allergies. The study was conducted by a research team from the Department of Medicine, University of Sydney and funded by the NH&MRC and the Asthma Foundation of NSW<sup>5</sup>. The aim of this study was to measure the effect of exercise on lung function and validate this as a method of assessing AHR.

All children from grades 3, 4 and 5 were invited to participate in the study but only children with parental consent were tested. Lung function was assessed by measurement of forced vital capacity (FVC) and one second forced expiratory volume (FEV<sub>1</sub>) using a Mijnhardt VRS 2000 dry rolling seal spirometer. Heights and weights were also recorded. Each child underwent an exercise challenge in which lung function measurements were made before and after a 6 minute run and a fall in FEV<sub>1</sub> of 15% or more after exercise was regarded as indicative of AHR. Skin prick tests for dust mite, house dust, rye-grass, plantain, mould, cat dander and cockroach were used to assess the atopic status of each child.

The parents or guardians of the children completed the standard respiratory questionnaire with questions on age, sex, race, history of asthma or asthmatic symptoms, medication use, and also parents' occupation, history of asthma and smoking. The questionnaire included the question used in previous studies about the dietary consumption of fish, i.e. "How often does your child eat a meal that contains fish? (with the options of replying) Rarely; once a week; more than once a week".



## 2. CURRENT STUDY

### SUBJECTS

A stratified case-control design was used. Subjects were selected from the population sample assessed in the baseline study. The study co-ordinator and staff involved in the collection of the data in the current study were blinded to the respiratory or diet history of the children. The children were divided into respiratory groups according to the classification of Toelle et. al.<sup>6</sup> as follows :

Normal	absence of wheeze or AHR
AHR (airway hyperresponsiveness)	15% or greater reduction in FEV <sub>1</sub> (after 6 minutes of exercise)
Wheeze (asthmatic symptoms)	history of wheeze in past 12 months
Current asthma	presence of wheeze <u>and</u> AHR

A total of 584 children were selected using the following criteria :

- All children with AHR
- All children with wheeze
- A 3 in 5 sample of normal children

Ethical approval for the study was obtained from the Ethics Review Committee of the University of Sydney. Permission to approach the schools selected was first obtained from Metropolitan East and North branches of the Department of Education and the Catholic Education Office. Each school principal was then contacted for permission to include their school in the study.

## FOOD FREQUENCY QUESTIONNAIRE

The questionnaire used to assess the diets of the children was adapted from that developed and validated by CSIRO, Division of Human Nutrition, South Australia<sup>7,8,9</sup>. This food frequency questionnaire identifies daily, weekly, monthly, rarely or never consumption patterns of more than two hundred foods which are commonly consumed in Australia. An additional question on the type of fresh fish consumed was included for the purposes of this study.

In October, 1993 all children selected for the study were given a dietary questionnaire to take home, with strict instructions that the parents should complete the questionnaire. A consent form requesting permission for the information to be used for research purposes was also included in the questionnaire booklet.

As incentive for participating in the study, the parents received a summary of the analysis of their child's diet. Marginal or excessive intakes of one or more nutrients were highlighted in the summary with suggestions for implementing improvements and information on where to seek professional help if required.

The school principals were asked to encourage parents to complete and return the questionnaires via notes home and notices in newsletters. Class teachers were also asked to encourage the children to return the questionnaires. If questionnaires were not returned after one month, the parents were contacted by telephone and offers were made to replace the questionnaires if lost, or to provide assistance for those who, for any reason, were unable to complete the questionnaire. In 11 cases, where neither parent spoke fluent English, an interpreter was commissioned to complete the questionnaire with the parents over the telephone.

Each returned questionnaire was checked for missing or obviously erroneous information. In cases where there was an omitted or erroneous reply, parents were contacted by telephone to complete or to clarify the relevant sections.

## ANALYSIS

The questionnaires were analysed by the Division of Human Nutrition, CSIRO, South Australia using Australian Tables of Nutrient Composition for the following nutrients :

kilojoules	saturated fat	thiamin (B1)	calcium
kilocalories	monounsaturated fat	riboflavin (B2)	copper
nitrogen	polyunsaturated fat	pot. nicotinic acid	iron
protein	total fat	total nicotinic acid	magnesium
starch	cholesterol	niacin	manganese
fibre	beta carotene	vitamin B6	phosphorous
refined sugar	retinol	vitamin B12	potassium
natural sugar	vitamin A	free folate	selenium
total sugars	vitamin C	pantothenic acid	sodium
total carbohydrate	vitamin D	biotin	zinc
alcohol	vitamin E		

Each food was allocated to one of 24 different food groups to assess the relative contribution of different foods to the diet. The food groups are as follows :

- |                                  |  |
|----------------------------------|--|
| 1. cereals & farinaceous         | 13. red vegetables                             |
| 2. dairy foods                   | 14. green vegetables                           |
| 3. eggs                          | 15. white vegetables                           |
| 4. red meat                      | 16. legumes                                    |
| 5. white meat                    | 17. other vegetables - e.g. mushrooms, onions  |
| 6. preserved meats               | 18. mixed vegetables - e.g. stir fries, stews  |
| 7. offal meats                   | 19. high vitamin C fruits                      |
| 8. fish coated and fried         | 20. low vitamin C fruits                       |
| 9. fish steamed, grilled, boiled | 21. other fruits - mango, cherries, watermelon |
| 10. canned fish                  | 22. high sugar, high fat treats                |
| 11. fish fingers                 | 23. other foods - coffee, tea, low cal. drinks |
| 12. seafood                      | 24. fat spreads - butter, margarine            |

In order to compare these groups, all answers were converted to a common base of weekly serves.

Fresh fish was categorised as oily - containing greater than 2% fat - or non-oily - containing 2% or less fat. Results of the Analyses of N.S.W Fish and Shellfish by Australian Government Analytical Laboratory, November, 1989 were used to categorise the fish species. The following is the list of oily fish from these analyses :

Blue Eye Cod

Gemfish

Mullet

Pilchards

Yellowtail

Silver bream

Blackfish

Orange roughy

Redfish

For species not available in these analyses, results of the analyses of Victorian fish by Sinclair et. al. were used<sup>10</sup>. The following fish species were included in the list of fish containing greater than 2% fat :

Atlantic Salmon	Southern Bluefin Tuna
Blue Grenadier	Tailor
Blue Mackerel	Tarwhine
Rainbow Trout	

Diet information was merged with data collected in the baseline study and analysed using the statistical package SAS (SAS Institute Inc., Cary, NC). Analysis of variance with a Duncan test post-hoc was used to validate the questions of fish consumption in the respiratory questionnaire. The association between fish intake and respiratory groups or food intake was analysed categorically using Chi-square, and continuously using Students t test and analysis of variance.

Obvious underestimates or overestimates of consumption were corrected prior to data entry. However, there were some values obtained after the nutrient analysis which were clear outliers. Because these values were well outside what could reasonably be expected in children of this age group, these outliers were excluded from the statistical analysis. The number of exclusions never exceeded nine subjects in any analysis and they were not significantly associated with any respiratory group.

Logistic regression was used to assess the impact of confounding factors such as age, sex, race, country of origin, early respiratory infection, parental smoking and parental asthma for the effect of fish consumption on AHR, wheeze and current asthma.

All group data are reported with 95% confidence intervals. Statistical significance was taken at the 5% level.

## 5. RESULTS

Of the 584 children selected from the respiratory survey, ten children had left the schools and were unavailable, giving a total of 574 children who received the questionnaires. From these, 468 completed questionnaires were returned (81.5%). The children who did not respond were not significantly different in their response to the exercise challenge (26.0% of non-responders and 27.1% of responders had AHR.). Non responders were also not significantly different from responders in their fish consumption (46.2% of non-responders and 52.1% of responders were regular fish eaters).

The distribution of responders by respiratory group was as follows :

Normal lung function	263 (56%)
AHR only	55 (12%)
Wheeze only	79 (17%)
Current Asthma	71 (15%)

### VALIDATION OF FISH FREQUENCY QUESTION IN RESPIRATORY QUESTIONNAIRE

The respiratory questionnaire contained a simple multiple choice question regarding the quantity of fish consumed, with the following possible responses : never or rarely; once per week; more than once per week. There was no distinction in this questionnaire between the types of fish consumed and there was no opportunity to state regular fish consumption that was less than once per week but more than would be considered rarely.

The dietary questionnaire contained four questions regarding the quantity of fish consumed which differed according to the processing (fried, steamed/grilled/boiled, canned or fish fingers) with possible responses of never, rarely, times per month, times per week or times per day. From the responses to these four questions, **total fish** consumption was calculated as the number of serves, or fractions of serves, per week. Total fish consumption was further categorised into the following groups: none; one serve or less per week; more than one serve per week so that the results could be compared with the respiratory questionnaire. Personal experience with the recording of dietary histories suggested that, when people are asked about fish consumption, they think mainly of home or restaurant processed fish and not pre-processed fish, such as canned fish and fish fingers. In order to assess the effects of these two categories, repeat analyses were performed excluding them from total fish consumption.

When compared with the responses to the dietary questionnaire, responses to the respiratory questionnaire underestimated the quantity of **total fish** consumed in each category [Figure 1] and the weighted kappa value indicated fair agreement ( $kappa = 0.25$ ;  $95\% \text{ ci} = 0.20, 0.30$ ). When canned fish and fish fingers were removed from the calculation of total fish consumption, the weighted kappa value increased indicating that there was moderate agreement between the two questionnaires ( $kappa = 0.45$ ;  $95\% \text{ ci} = 0.39, 0.52$ ) [Figure 2].

When children were categorised according to **total fish** consumption, there was a highly significant association between the corresponding categories determined by the respiratory questionnaire and the dietary questionnaire ( $\chi^2 = 129.5$   $p=0.0001$ ). However, the sensitivity, specificity, percent in agreement and predictive values for each of the fish consumption categories showed less certain agreement [table 1]. The respiratory questionnaire was able to identify most of the true no-fish eaters correctly, but overestimated the number of children who did not eat fish. The respiratory

questionnaire did not accurately identify subjects belonging to the group of one serve or less per week. This was indicated by the relatively poor values for all measures of agreement compared with the categories of no fish or more than one serve per week. The respiratory questionnaire also underestimated the number of subjects who consumed more than one serve of fish per week. When canned fish and fish fingers were removed from the analysis, the agreement between the questionnaires improved [table 1].

## FISH CONSUMPTION AND RISK OF ASTHMA

**Total fish** intake per week, as the sum of the number of serves of fried, steamed, grilled or boiled fish, with or without canned fish and fish fingers, did not differ significantly between normal children and those with AHR, wheeze or current asthma [figures 3 and 4]. In normal children average total fish consumption was  $1.2 \pm 0.13$  ( $\pm 95\%$  confidence interval) serves/week, including canned fish and fish fingers, and  $0.63 \pm 0.1$  serves/week, without, compared with  $0.99 \pm 0.23$  and  $0.47 \pm 0.14$  serves/week respectively in asthmatic children.

The dietary questionnaire also contained a question about the type, but not the quantity, of **fresh fish** consumed. Fresh fish was eaten by  $71.8 \pm 10.5\%$  children with current asthma and by  $83.7 \pm 4.5\%$  children with normal airways [figure 5]. When types of fresh fish were divided into **oily fresh fish** and **non-oily fresh fish** a significantly lower percentage of children with current asthma ( $15.5 \pm 8.4\%$ ) consumed oily fresh fish than did children with normal airways ( $30.8 \pm 5.6\%$ ) ( $p < 0.05$ ). There was no significant difference between the respiratory groups in the consumption of non-oily fish [figure 6].



The unadjusted risk (odds ratio) for children having current asthma was significantly reduced in those who consumed fresh fish or oily fresh fish [table 2]. When the results were adjusted for the effects of other known risk factors such as atopy, parental asthma, parental smoking, race, country of birth, early respiratory illness and gender, only children who ate oily fresh fish had a significantly reduced risk current asthma. The adjusted odds ratio was 0.26 (95% confidence interval 0.09-0.72), suggesting that the risk of asthma was almost one quarter that of children who did not eat oily fish [table 2, figure 12]. Consumption of fresh fish, oily fish or non-oily fish was not associated with any significant reduction in risk for children having AHR only or wheeze only [table 2, figures 7, 8, 9, 10, 11].

#### **OTHER DIETARY CHARACTERISTICS OF CHILDREN WITH ASTHMA**

Children with **current asthma** did not differ significantly from children with normal airways in the consumption of any nutrient or food group [tables 3 and 4].

Children with **wheeze only** had a significantly higher intake of vitamin B<sub>12</sub> than children with normal airways [table 5]. These children consumed significantly less mixed vegetables such as those in stews, soups and stir fries and significantly more red meat. They also appeared to consume significantly more offal but this may have been a the result of a type I error due to the very small number of children who ate offal [table 6].

Children with **AHR only** had higher intakes of protein (and thus nitrogen), nicotinic acid, vitamin B<sub>12</sub>, calcium, copper and zinc [table 7]. They consumed significantly more cholesterol, refined sugar (and thus total sugar) and significantly more of the high sugar/high fat food group than children with normal airways [table 8]. Offal

consumption was significantly higher in children with AHR, but again this may have been a type I error.

## DIETARY CHARACTERISTICS OF FISH EATERS

As **total fish** consumption increased, so did the intake of all nutrients except refined sugar and, consequently, total sugar [table 9]. Also, as total fish consumption increased, so did the consumption of eggs, red meat, preserved meats, seafood, green vegetables, legumes, other vegetables, mixed vegetables and high vitamin C fruits [table 10]. Because the number of children who ate seafood and legumes was small, the difference between these two groups may be the result of a type 1 error.

Children who consumed **fresh fish** had a significantly higher intake of cholesterol, beta carotene, vitamin A, vitamin B<sub>6</sub>, vitamin B<sub>12</sub>, pantothenic acid, biotin, folic acid, vitamin C, copper and selenium than children who did not consume fresh fish [table 11]. They also consumed significantly more eggs, red meat, seafood, green vegetables, other vegetables and mixed vegetables [table 12].

Children who ate **oily fresh fish** had significantly higher intakes of cholesterol, beta carotene, vitamin A, vitamin B<sub>6</sub>, B<sub>12</sub>, pantothenic acid, biotin, folic acid, copper and selenium than children who ate no fresh fish or children who ate non-oily fresh fish only [table 13]. Children who ate oily fresh fish also consumed significantly more eggs, red meat, white meat, seafood and mixed vegetables but had fewer serves of red vegetables than children who had no fresh fish or children who ate non-oily fresh fish only. Children who ate oily fresh fish consumed significantly more green and other vegetables than children who ate no fresh fish but not more than children who ate non-oily fresh fish [table 14].

## GENERAL ANTHROPOMETRIC FEATURES

The children were categorised according to their percentage ideal body weight (IBW = ideal weight for height and age) as malnourished, underweight, normal weight, overweight and obese. The distribution of ideal body weights was examined in relation to total fish consumption, with and without canned fish and fish fingers, oily and non-oily fresh fish consumption and respiratory group. The percentage of children in each of the IBW categories did not differ significantly between the respiratory groups or the fish consumption groups [table15].

The standard deviations of height and weight from the expected values for age and weight or height respectively, were also calculated. As the consumption of total fish excluding canned fish and fish fingers increased, there was significantly less deviation from expected weight for height and age. Children who ate oily fresh fish also had significantly less deviation of weight from the expected weight for height and age [table 16] than children who did not eat oily fresh fish. All other comparisons were not significant.

## GENERAL DIETARY RESULTS

The mean dietary intake of all nutrients was in excess of the Recommended Daily Intake (RDI) for 8 - 11 year old children in all groups except for biotin, copper and potassium which all fell within the normal range. Vitamin D intake was less than 30% of the American RDI but did not take into account the formation of vitamin D with exposure to sunlight. The mean intake of vitamin C was almost seven times higher than the RDI and the mean intakes of protein, vitamin A, thiamin, riboflavin, vitamin B<sub>6</sub>, vitamin B<sub>12</sub>, iron, magnesium, phosphorous and selenium were two to three times the RDI [table 17].

## 6. DISCUSSION

The most important finding of this study was that consumption of fresh oily fish by 8 - 11 year old children living in the Sydney metropolitan area was associated with a reduced risk of current asthma, defined as the presence of airway hyperresponsiveness to exercise (AHR) and asthmatic symptoms (wheeze). Children with current asthma did not differ from normal children in any other dietary characteristic.

These results are unlikely to be overestimated because of sample bias. The study had an excellent response rate (81.5%) and there were no significant differences between responders and non-responders in respiratory characteristics or fish consumption. However, because this group was selected from a large population sample with a high consent rate, they are likely to be more motivated, and possibly more health conscious.

Many studies of asthmatic subjects have been criticised for failing to take account of documented risk factors. In the present study and previous epidemiological studies on which the present study was based, risk was estimated by odds ratios, adjusted for other known risk factors for asthma, including allergic sensitisation, parental asthma, early respiratory illness and place of birth. Because consumption of oily fish remains a significant protective factor after adjustment for these risk factors, this is a separate effect and is unlikely to be due to an association with other known risk factors.

This study also showed that the standard respiratory questionnaire, used to estimate the frequency of fish consumption in previous epidemiological studies, distinguishes groups with distinctly different fish consumption habits, and the estimated fish intake is similar to that obtained with the dietary questionnaire. There was fair agreement between the respiratory questionnaire and the dietary questionnaire in categorising subjects according to quantity of fish consumed. This agreement was strengthened when canned fish and fish fingers were removed from the calculation. However,

individual categories of fish consumption classified by the respiratory questionnaire varied widely in sensitivity and specificity. This inconsistency probably resulted from the structure of the question which did not provide any category between "never or rarely" and "once a week" so that the number of no-fish eaters was overestimated and the number of occasional fish eaters was underestimated. The number of children consuming more than one serve per week of fish was also underestimated by the respiratory questionnaire. Taken together these results suggest that the findings of our previous epidemiological studies in NSW children, which have shown an association between fish consumption and reduced risk of asthma, are valid and the previous estimates of the reduced risk are likely to be conservative estimates.

In our previous epidemiological studies, reduced risk of asthma was associated with total fish consumption. In the present study, reduced risk of asthma was associated with consumption of oily fish only and not with total fish consumption. This difference in the findings probably results from the relatively small sample size in the present study - less than half the number of subjects in the previous studies. It is likely that in our previous studies the oily fish component of the total fish consumption was the important factor associated with reduced risk of asthma. However, oily fish makes up only a small proportion of total fish consumption, so large sample sizes are required to detect an effect in total fish consumption. In the present study the use of a detailed dietary questionnaire enabled us to distinguish the contribution of various types of fish in the diet, and to single out the specific protective effect of oily fish.

The risk of current asthma was not significantly reduced in children who ate only fresh, non-oily fish, suggesting that fish oil is the protective factor. This is biologically plausible because of the well documented anti-inflammatory effects of eicosapentanoic acid (EPA) and docosahexanoic acid (DHA), the omega-3 fatty acids found in fish oil. These omega-3 fatty acids are metabolised to produce chemical mediators which are significantly less pro-inflammatory than those derived from arachadonic acid.

Arachadonic acid (AA) is an omega-6 fatty acid, abundant in the food supply and a competitor with the omega-3 fatty acids for enzymes involved in the production of the inflammatory mediators. Short term studies of 6 - 10 weeks in which patients with asthma were given fish oil supplements have shown a substantial replacement of AA with EPA in neutrophil membrane phospholipids<sup>2,11</sup> and a subsequent inhibition of the production of inflammatory mediators and cytokines. Clinically, this has resulted in a significantly reduced allergen-induced late asthmatic response<sup>12</sup>, but there have been no changes in the severity of asthma<sup>11,12,13,14</sup>. More recently, a study in which asthmatic adults were supplemented with fish oil for a substantially longer period (9 months) showed a 25% increase in FEV<sub>1</sub><sup>15</sup>. This evidence suggests that regular consumption of oily fish over a long period of time could reduce the severity of asthma.

If fish oil is the primary factor responsible for the protection of children from having asthma in the current study, then an association between canned, oily fish, such as tuna or salmon, and asthma might be expected but no such association was found. It is possible that the type of oil used in canned fish could offset the effects of the fish oil because it can replace the natural fish oils in the fish meat<sup>16,17</sup>. Most canning oils are derived from vegetable sources which are high in omega-6 fatty acids. The result is a lowering in the ratio of omega-3 to omega-6 fatty acids in the canned fish meat and consequently a reduction in the quantity of omega-3 fatty acids consumed. The dietary questionnaire did not include any questions on the type of canning medium so it was not possible to separate fish canned in oil from fish canned in brine. Alternatively, the heat processing may affect the patency of the fatty acids rendering them less effective.

Children who ate fish generally had a healthier diet, which included a higher consumption of fruits, vegetables, meats, eggs and all essential nutrients. It is therefore possible that a healthier diet is responsible for the reduced risk of asthma.

However, this is unlikely because when the diets were examined on a nutrient by nutrient basis, and in terms of the different food groups, mean intakes in children with current asthma were not significantly different from those of children with normal airways.

Antioxidant vitamins - vitamins A, C and E and mineral cofactors such as selenium and magnesium have been suggested as having a possible protective effect in asthma<sup>18</sup>, but we found no significant differences in these nutrients between the diets of children with asthma or other respiratory symptoms compared to children with normal airways. Increased sodium consumption has also been associated with higher rates of asthma<sup>19,20</sup>, yet we found no differences in the sodium intake between any of the respiratory groups. We also found no significant differences between respiratory groups in the intake of dietary supplements.

The generally healthier diet of children who ate fish was not reflected in any anthropometric differences. However, children who ate fish were significantly more likely to be average weight for height and age than children who did not eat fish. Children with current asthma, wheeze or AHR did not differ from children with normal airways in the distribution of height and weight, or standard deviations from average weight and height for age.

We conclude that consumption of fresh, oily fish is associated with a significantly reduced risk of current asthma in children. Further prospective studies are essential to establish the existence of a causal link between fish consumption and asthma.

## 7. IMPLICATIONS AND RECOMMENDATIONS

- a. We have shown that consumption of fresh, oily fish is associated with a significantly reduced risk of current asthma in children. Omega-3 fatty acids present in fish oil, which have the potential to reduce the production of inflammatory mediators, may have an important role.

However, this study has **not** shown that consumption of fish or fish oil either reduces the severity of existing asthma or prevents the development of the disease. **Further studies are essential** to determine if public health interventions to increase the consumption of oily fish have the potential to reduce either the morbidity or the incidence of asthma in Australian children.

- b. To determine if consumption of fish or fish oil can reduce the clinical severity of asthma, a randomised controlled trial in asthmatic children is required. Such a study is currently being undertaken by researchers at the Institute of Respiratory Medicine, with support from the Fisheries Research and Development Corporation and the Asthma Foundation of NSW.
- c. To determine if consumption of fish or fish oil can prevent the development of asthma, prospective, longitudinal studies of the effects of fish oil in pregnant women and at risk children, during early childhood, are required. Data from the study currently in progress at the Institute of Respiratory Medicine (see above), will be used to develop dietary interventions which are acceptable and effective for use in pregnant women and young children in future studies.
- d. If it can be shown that consumption of fish or fish oil has direct therapeutic or preventative effects on asthma there are significant implications for the fishing industry in the marketing of oily fish, and potentially, in the management of the relevant fisheries.



## 8. REFERENCES

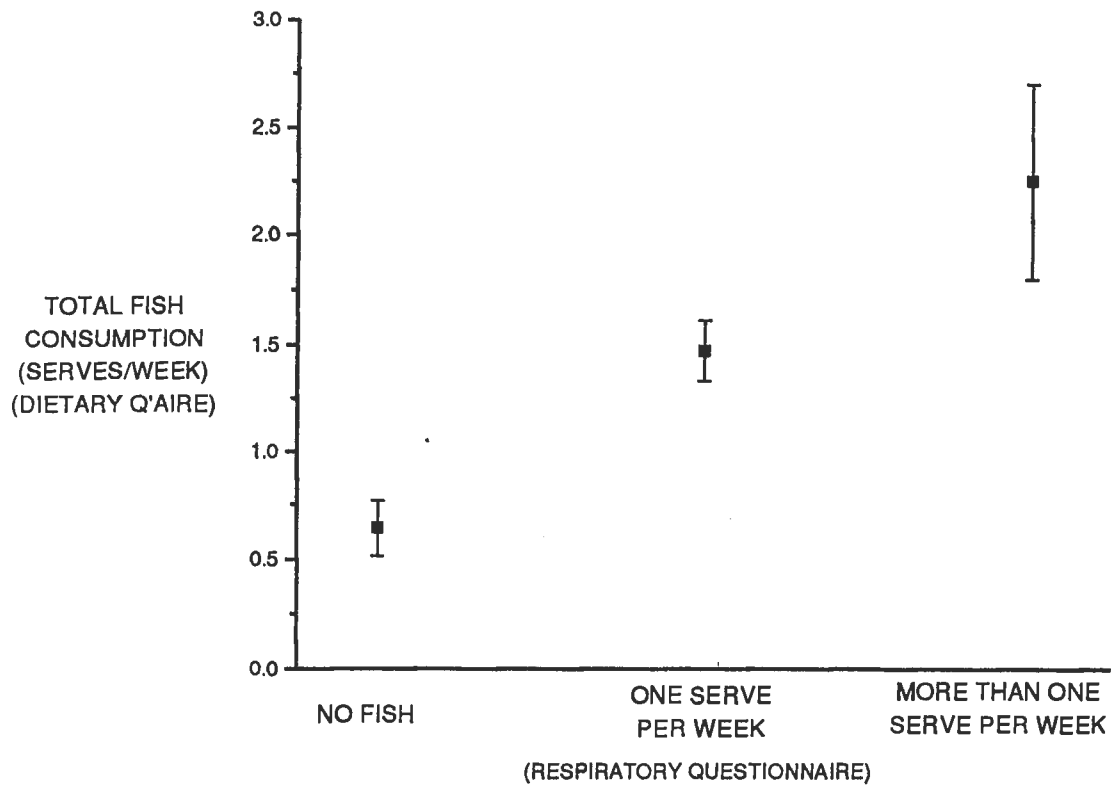
1. Peat JK, Van Den Berg RH, Green WF, Mellis CM, Leeder SR, Woolcock A J. Changing prevalence of asthma in Australian children. *BMJ* 1994;308:1591-6
2. Lee TH, Arm JP. Prospects for modifying the allergic response by fish oil diets. *Clinical Allergy* 1986;16:89-100
3. Peat JK, Tovey E, Gray EJ, Mellis CM, Woolcock AJ. Asthma severity and morbidity in a population sample of Sydney schoolchildren : part II - importance of house dust mite allergens. *Aust N Z J Med.* 1994;24:270-5
4. Peat JK, Salome CM, Woolcock AJ. Factors associated with bronchial hyper-responsiveness in Australian adults and children. *Eur Respir J* 1992;5:921-9
5. Haby MM, Peat JK, Mellis CM, Anderson SD, Woolcock AJ. Validity, repeatability and practicality of exercise challenge for measuring airway responsiveness in epidemiological studies of children. Submitted to *Eur Respir J* 16th June, 1994.
6. Toelle BG, Peat JK, Salome CM, Mellis CM, Woolcock AJ. Toward a definition of asthma for epidemiology. *Am Rev Respir Dis* 1992;146:633-7
7. Baghurst KI, Record SJ. Intake and sources in selected Australian subpopulations of dietary constituents implicated in the etiology of chronic diseases. *J Food Nutr* 1983;40:1-15
8. Rohan TE, Potter JD. Retrospective assessment of dietary intake. *Am J Epidemiol* 1984;120:876-87

9. Rohan TE, Record SJ, Cook MG. Repeatability of estimates of nutrient and energy intake: the quantitative food frequency approach. *Nutr Res* 1987;7:125-137
10. Sinclair A, Dunstan GA, Naughton JM, Sanigorski AJ, O'Dea K. The lipid content and fatty acid composition of commercial marine and freshwater fish and molluscs from temperate Australian waters. *Aust J Nutr Diet* 1992;49:77-83
11. Arm JP, Horton CE, Mencia-Huerta JM, House F, Eiser NM, Clark TJH, Spur BW, Lee TH. Effect of dietary supplementation with fish oil lipids on mild asthma. *Thorax* 1988;43:84-92
12. Arm JP, Horton CE, Spur BW, Mencia-Huerta JM, Lee TH. The effects of dietary supplementation with fish oil lipids on the airways response to inhaled allergen in bronchial asthma. *Am Rev Respir Dis* 1989;139:1395-1400
13. Picado C, Castillo JA, Schinca N, Pujades M, Ordinas A, Coronas A, Agusti-Vidal A. Effects of a fish oil enriched diet on aspirin intolerant asthmatic patients: a pilot study. *Thorax* 1988;43:93-97
14. Kirsch CM, Payan DG, Wong MYS, Dohlman JG, Blake VA, Petri MA, Offenberger J, Goetzl EJ, Gold WM. Effect of eicosapentanoic acid in asthma. *Clinical Allergy* 1988;18:177-87
15. Dry J, Vincent D. Effect of a fish oil diet on asthma : results of a 1-year double-blind study. *Int Arch Allergy Appl Immunol* 1991;95:156-7
16. Vukovic G, Rede R, Manojlovic D, Veresbaranji I. Fatty acid content and composition of sardines. *Hrana-i-Ishrana* 1992;33(1/2):11-13

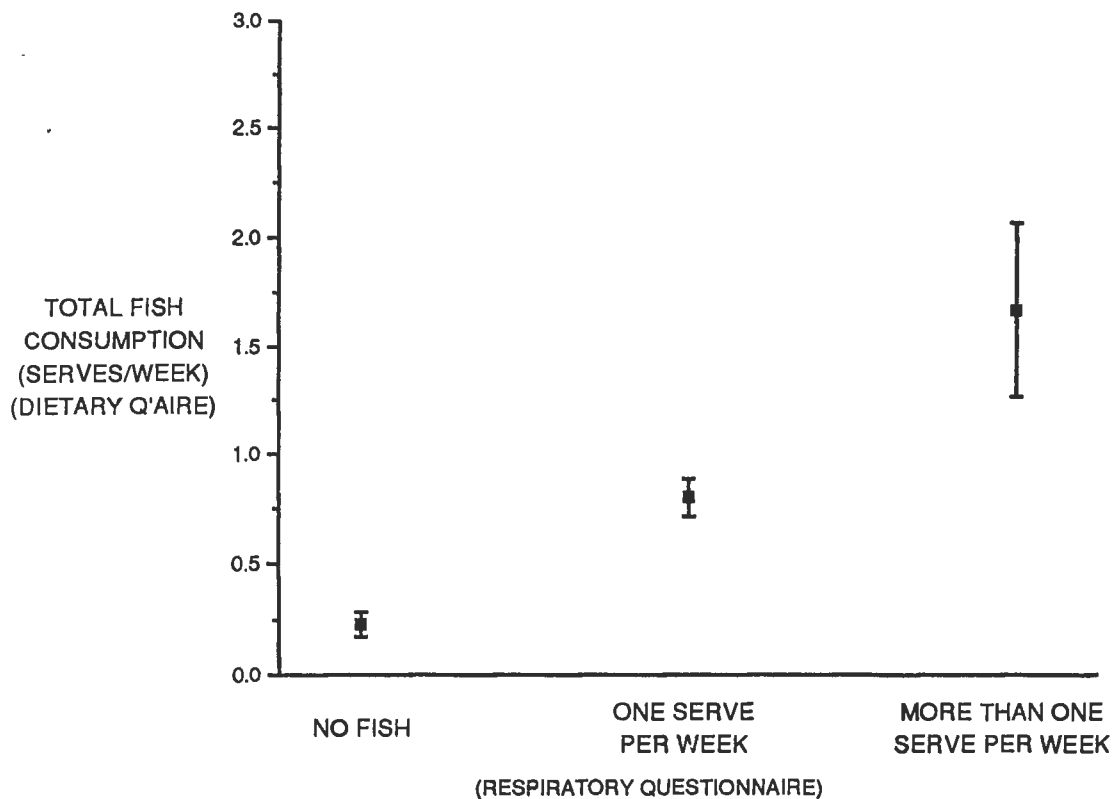
17. Ramel P, Clerc AM le, Dumain J, Fauquembergue D, Sohier Y. Study of the physico-chemical changes in groundnut oil during industrial frying of sardines and the exchange of lipids between fish and oil after canning. *Ann Fals L'Expert Chim* 1971;64(693):14-30
18. Seaton A, Godden DJ, Brown K. Increase in asthma : a more toxic environment or a more susceptible population? *Thorax* 1994;49:171-4
19. Burney P. A diet rich in sodium may potentiate asthma. *Chest* 1987;91:6:143S-148S
20. Pistelli R, Forastiere F, Corbo G M, Dell'Orco V, Brancato G, Agabiti N, Pizzabiocca A, Perucci C A. Respiratory symptoms and bronchial responsiveness are related to dietary salt intake and urinary potassium excretion in male children. *Eur Respir J* 1993;6:517-522.

# FIGURES

# COMPARISON OF TWO QUESTIONNAIRES

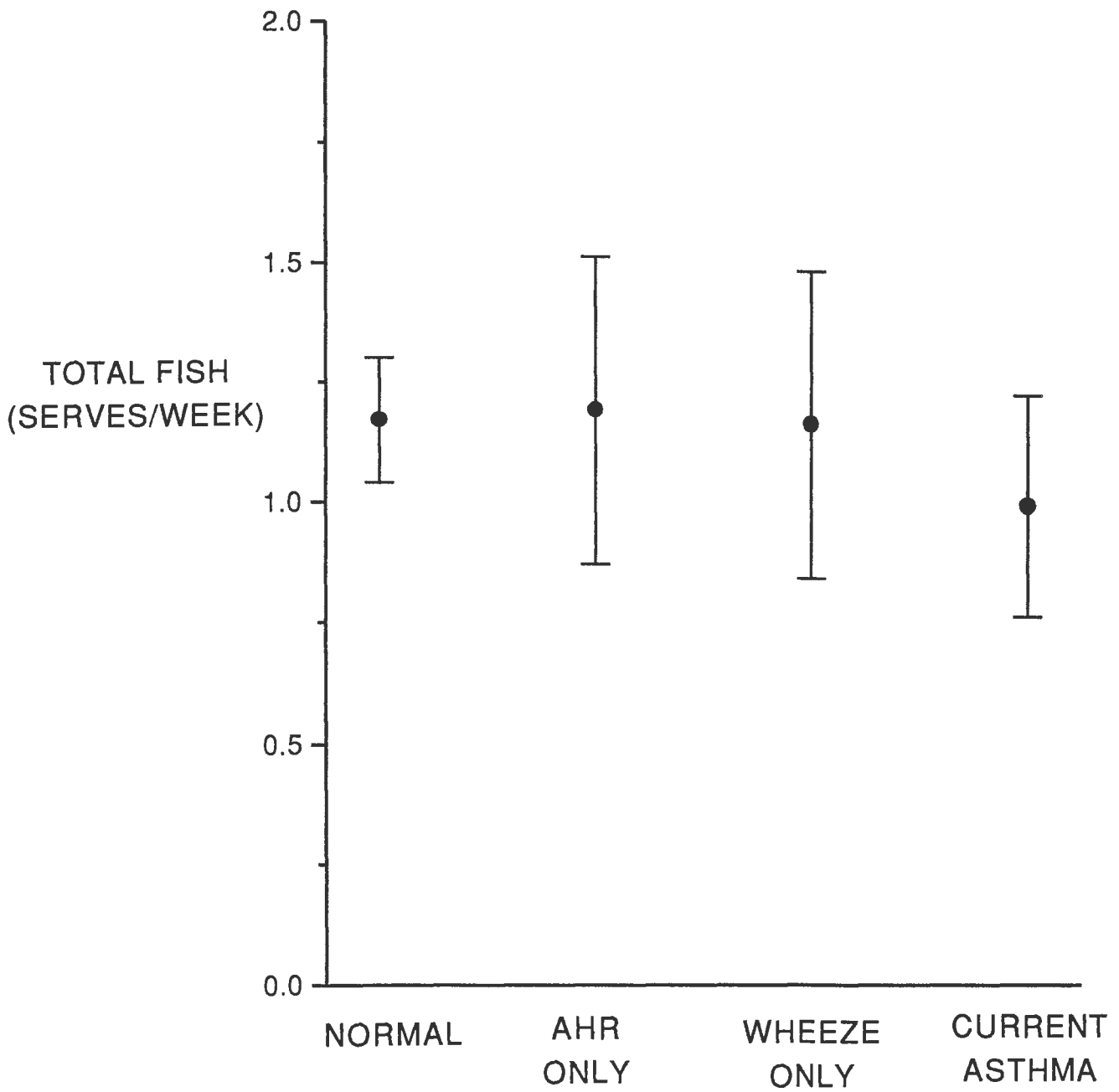


**FIGURE 1.** Mean (95% confidence intervals) of total fish consumption, including canned fish and fish fingers, estimated from the dietary questionnaire in children categorised by the respiratory questionnaire.

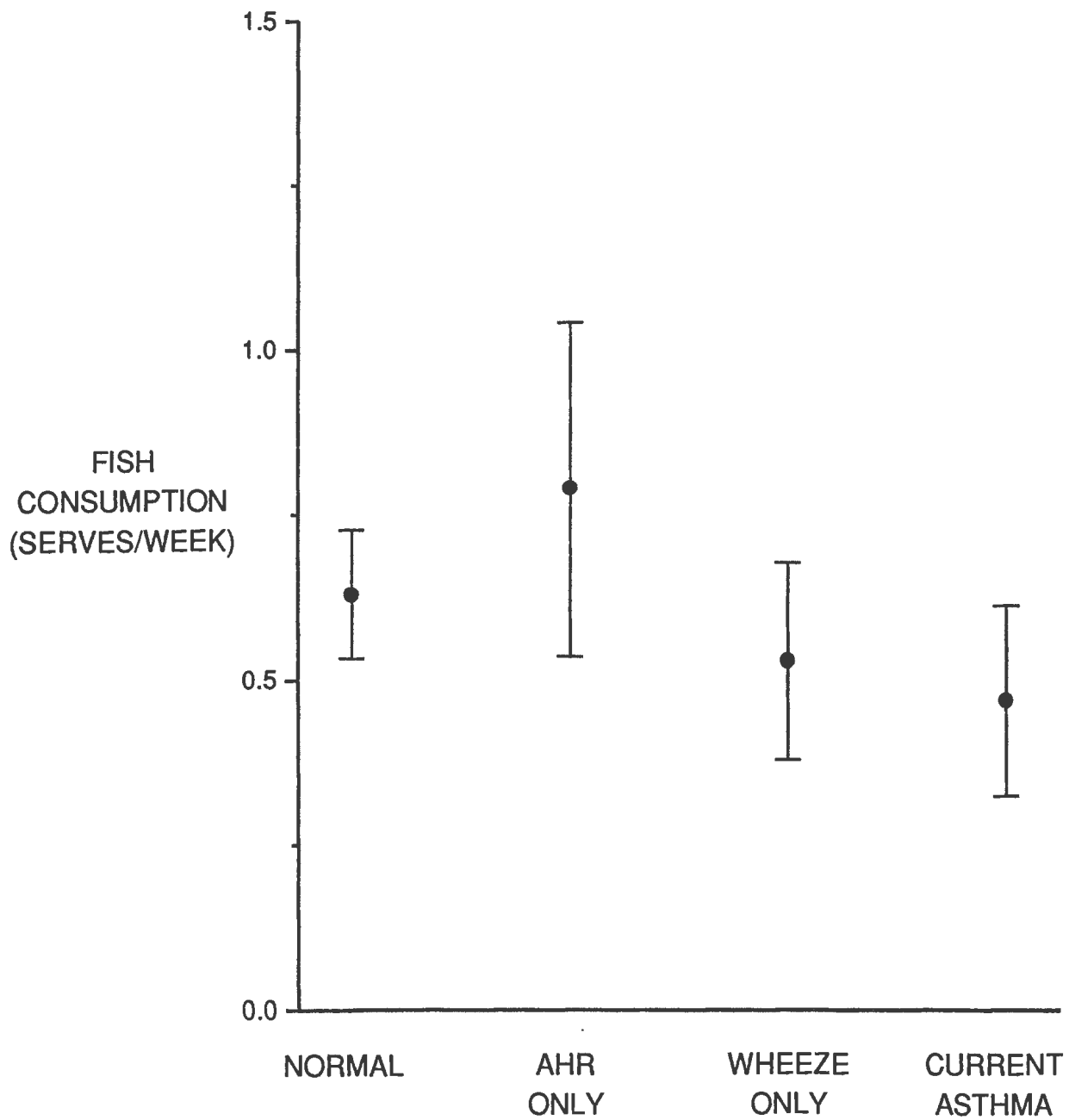


**FIGURE 2.** Mean (95% confidence interval) fish consumption excluding canned fish and fish fingers estimated from the dietary questionnaire in children categorised by the respiratory questionnaire.

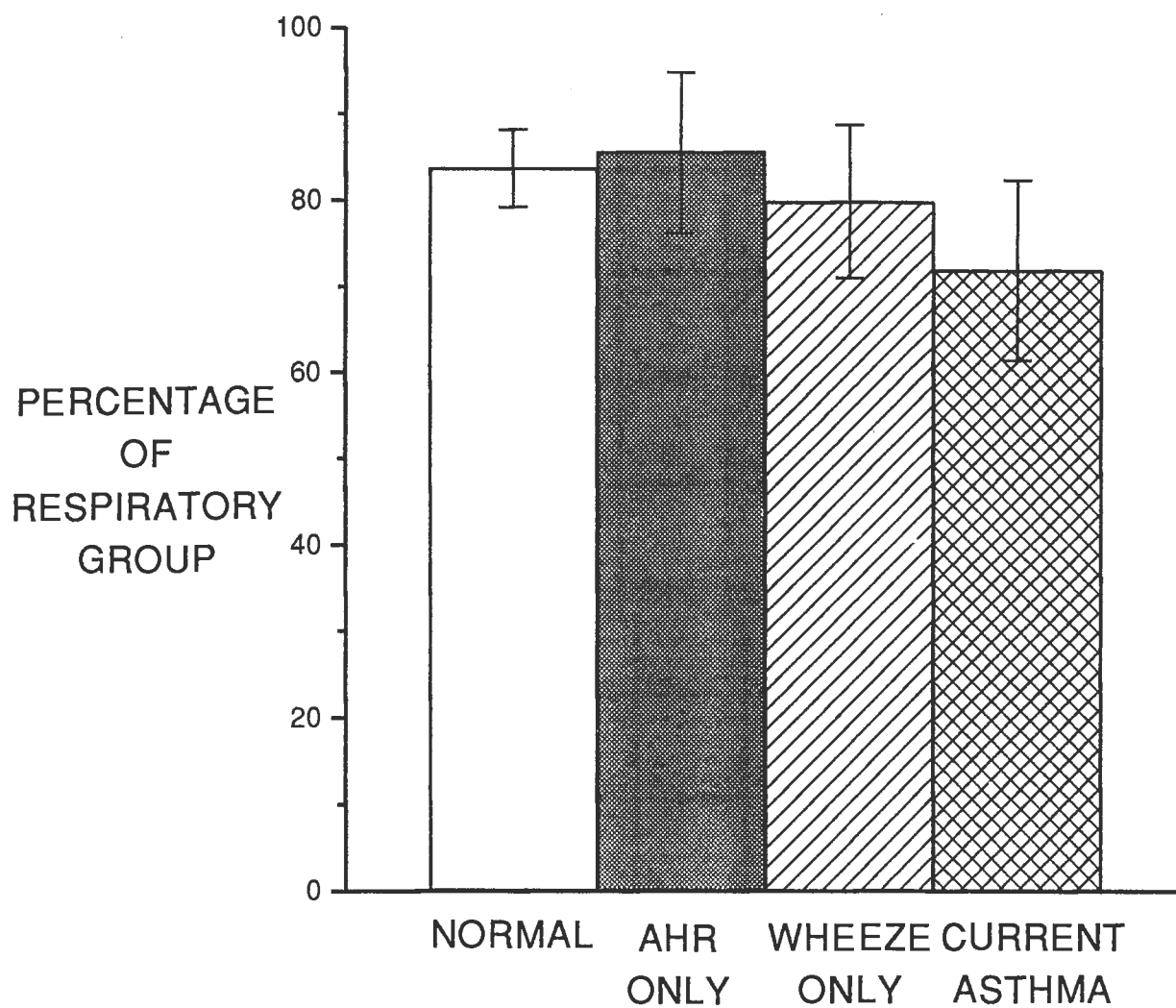
**FIGURE 3.** Mean (95% confidence interval) total fish consumption according to respiratory group



**FIGURE 4.** Mean (95% confidence interval) fish consumption, excluding canned fish and fish fingers, according to respiratory group.

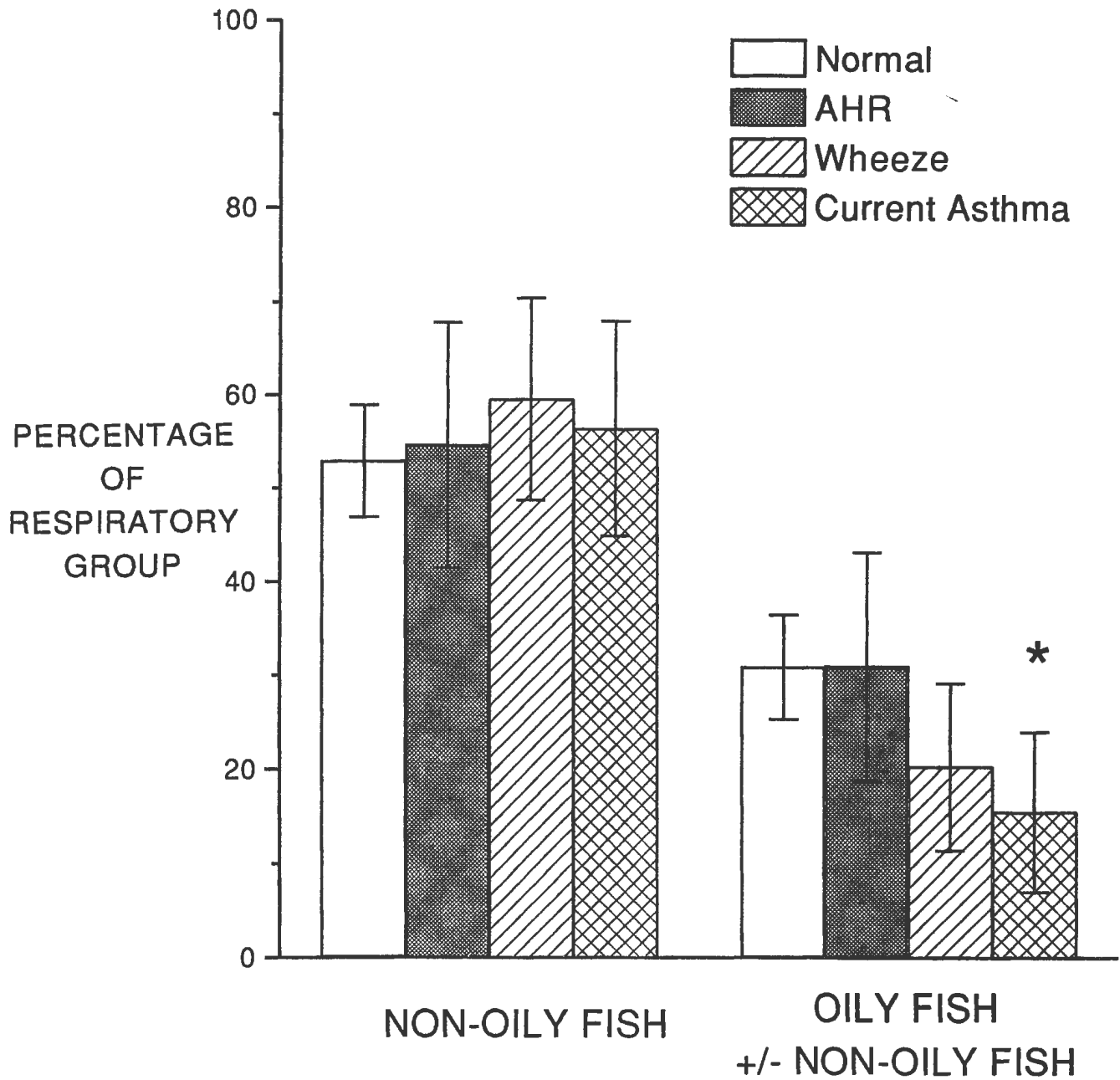


**FIGURE 5.** Percentage of children in each respiratory group consuming fresh fish



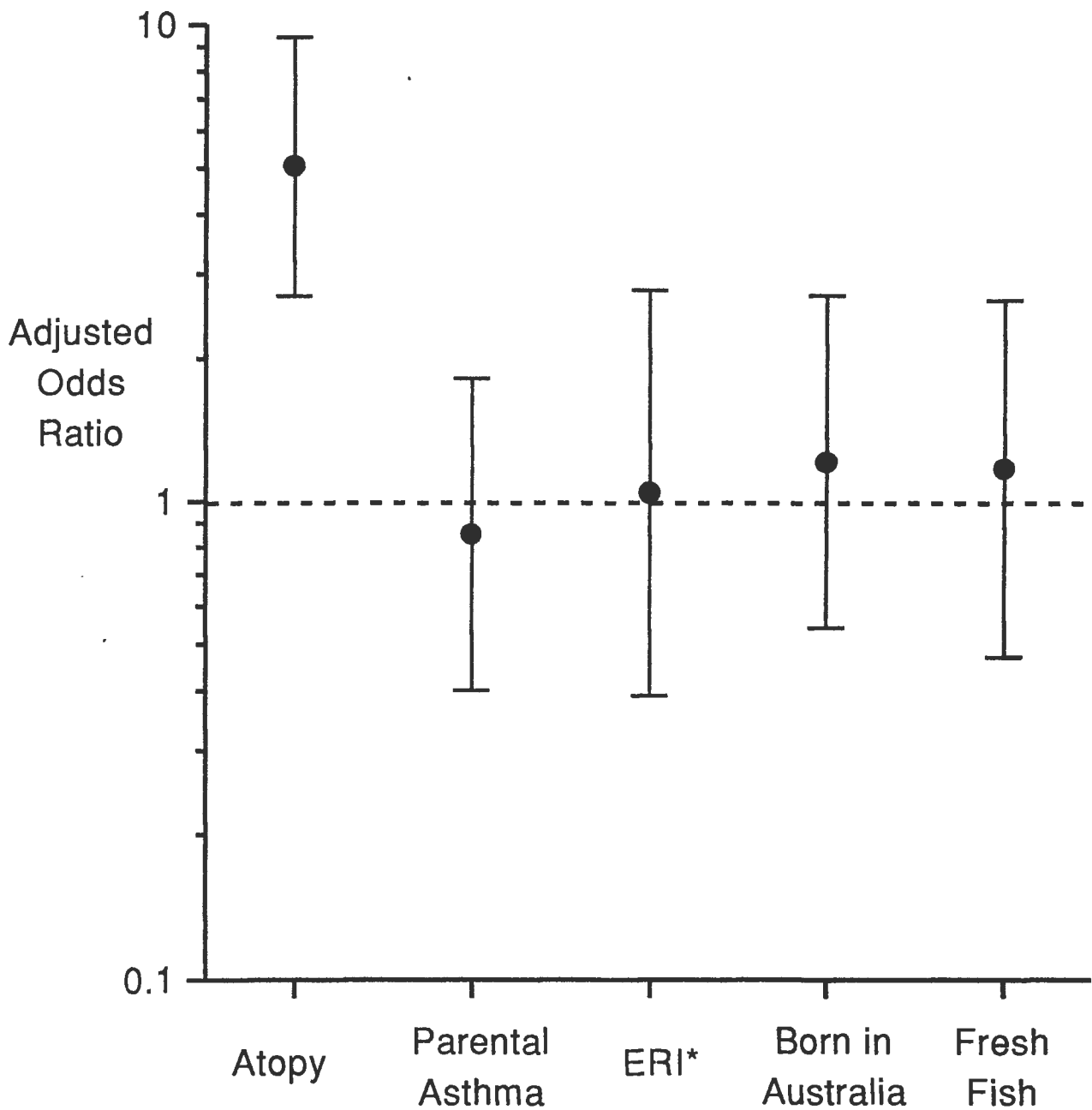


**FIGURE 6.** Percentage of children in each respiratory group consuming fresh, non-oily fish or fresh oily fish with or without non-oily fish.



\* p < 0.05

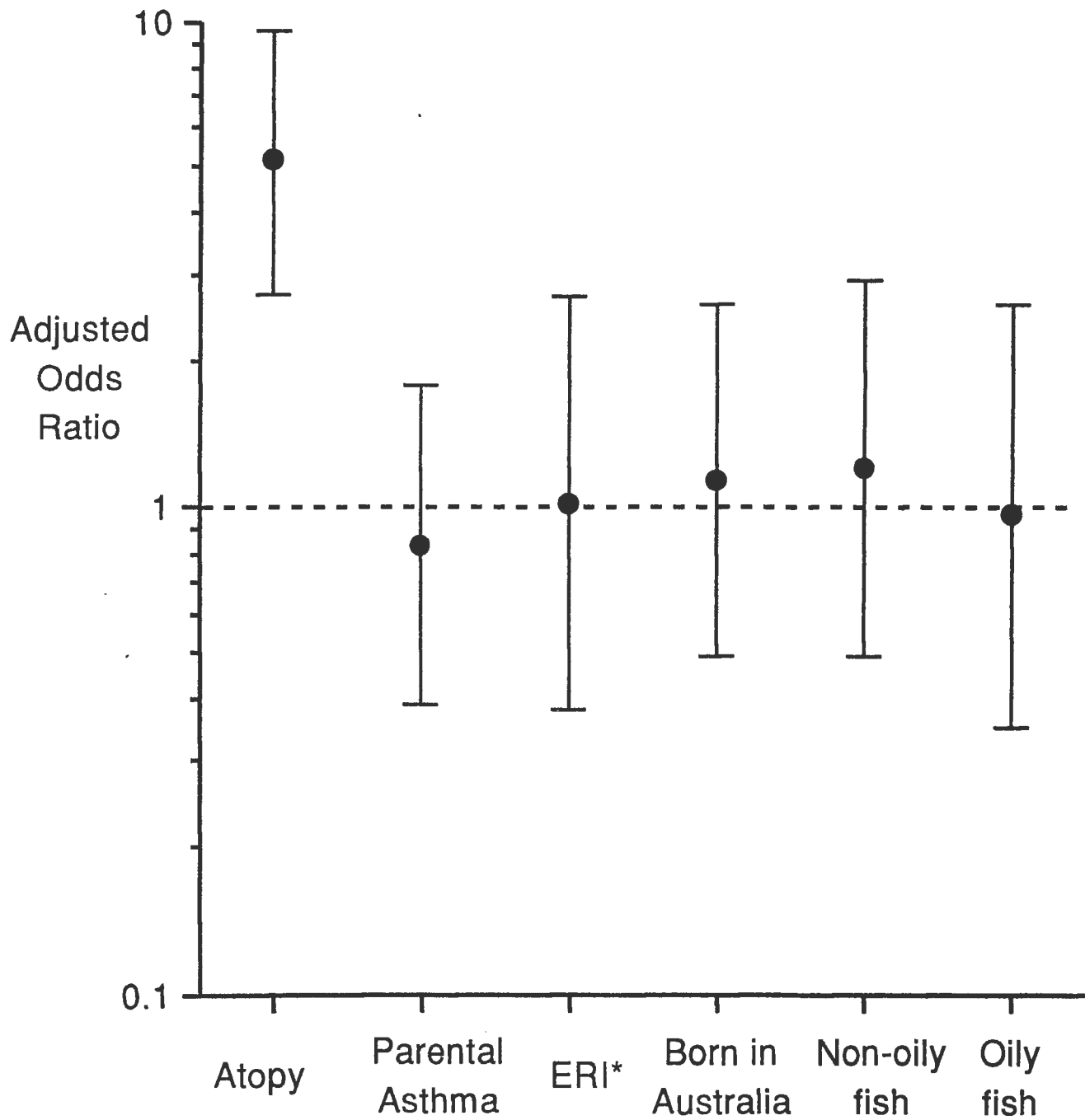
**FIGURE 7.** Adjusted odds ratio for AHR and fresh fish



\*early respiratory infection

Odds ratios which differ significantly from one (ie the confidence interval does not include one) indicate altered risk. Values greater than one indicate increased risk, values lower than one indicate reduced risk.

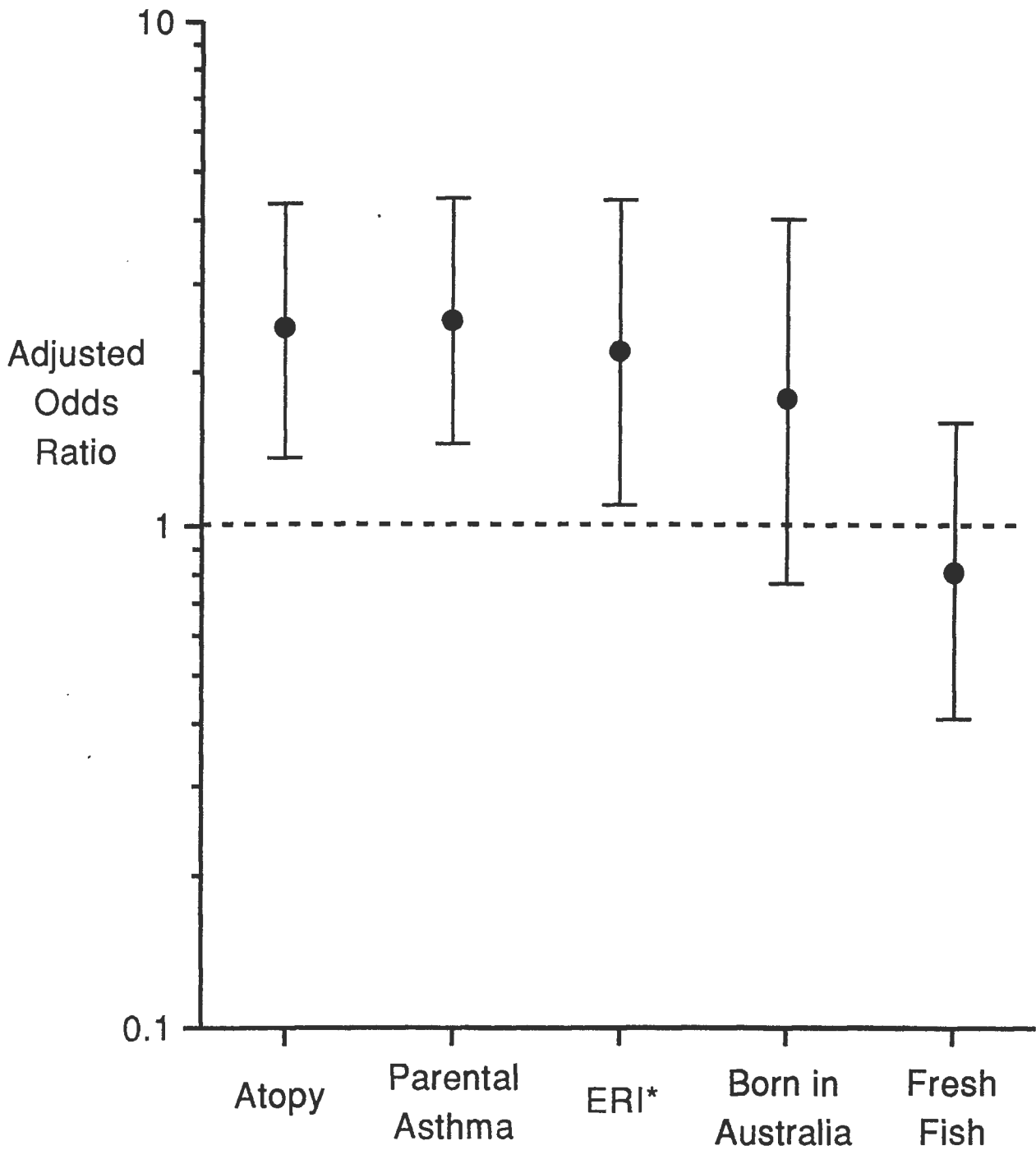
**FIGURE 8.** Adjusted odds ratio for AHR and oily/non oily fish



\*early respiratory infection

Odds ratios which differ significantly from one (ie the confidence interval does not include one) indicate altered risk. Values greater than one indicate increased risk, values lower than one indicate reduced risk.

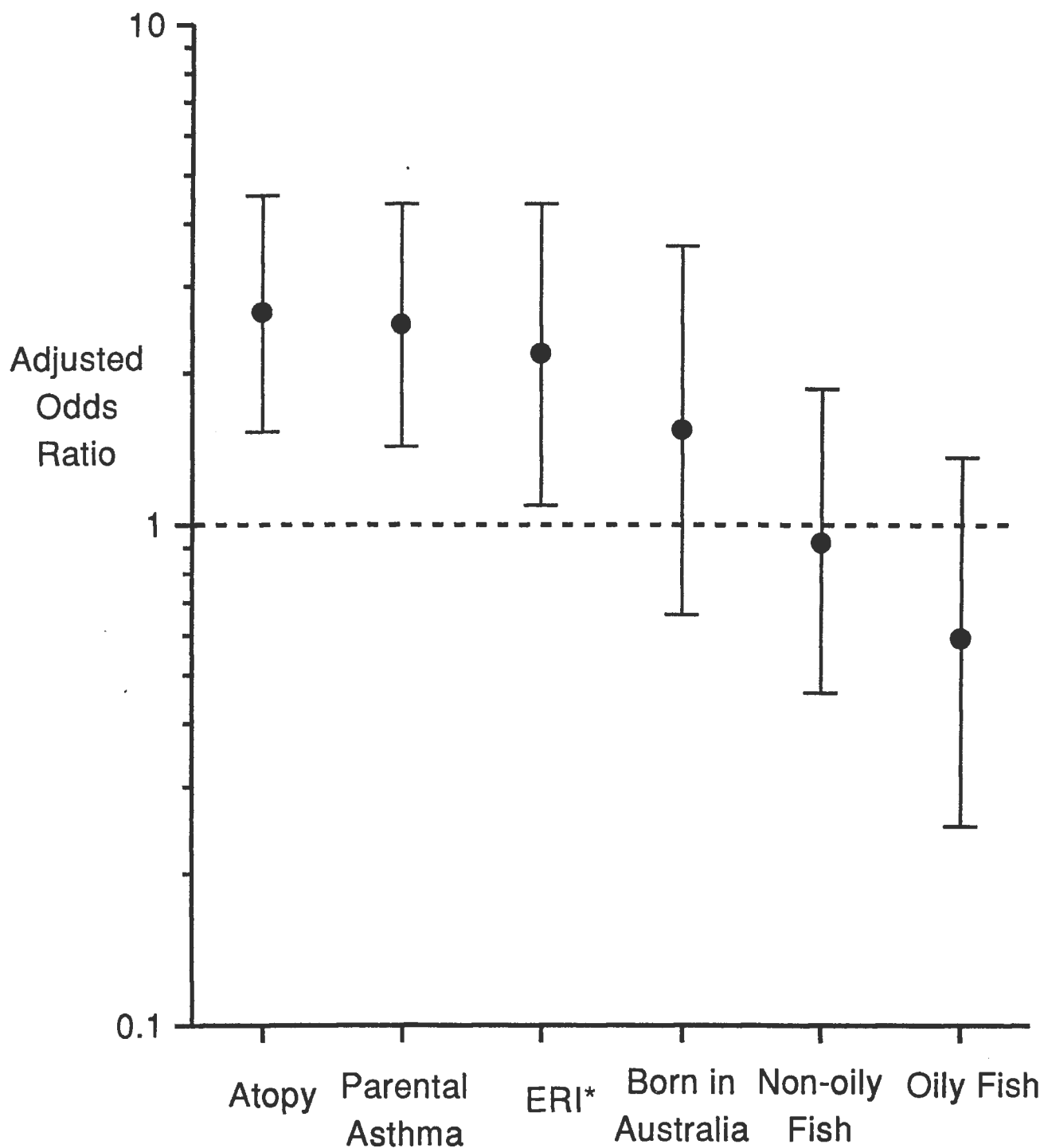
**FIGURE 9.** Adjusted odds ratio for wheeze and fresh fish



\*early respiratory infection

Odds ratios which differ significantly from one (ie the confidence interval does not include one) indicate altered risk. Values greater than one indicate increased risk, values lower than one indicate reduced risk.

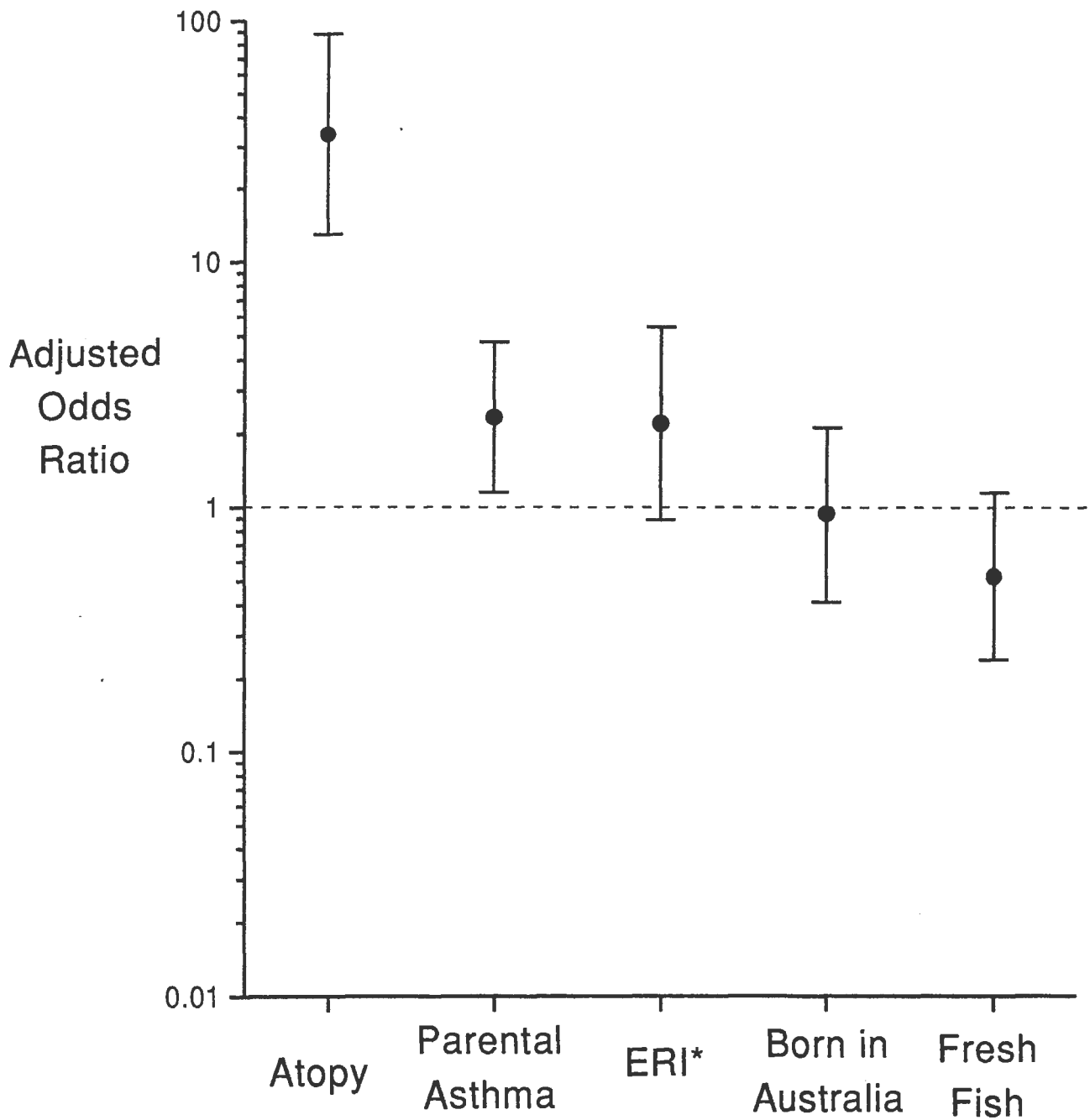
**FIGURE 10.** Adjusted odds ratio for wheeze and oily/non-oily fish.



\*early respiratory infection

Odds ratios which differ significantly from one (ie the confidence interval does not include one) indicate altered risk. Values greater than one indicate increased risk, values lower than one indicate reduced risk.

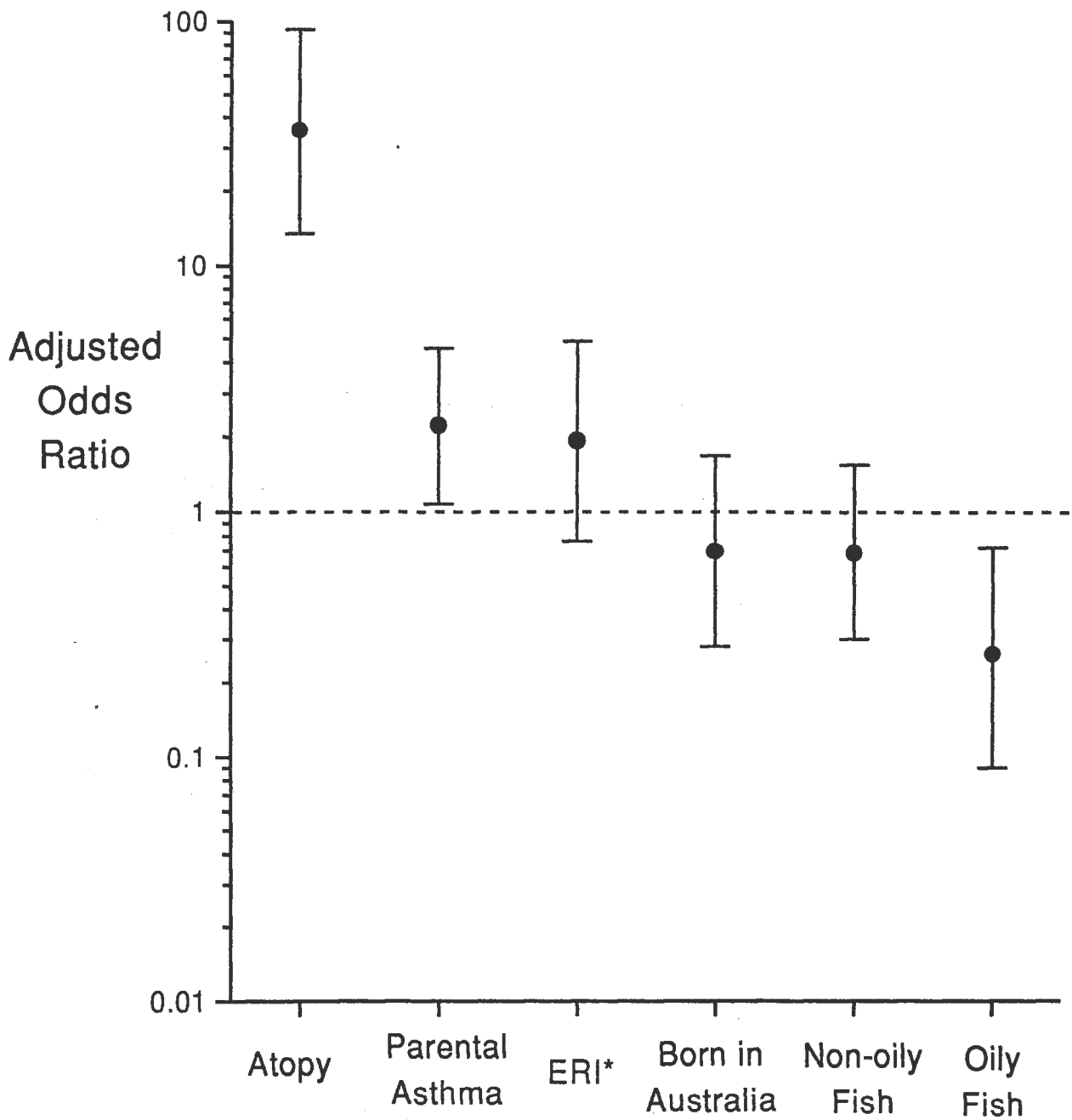
**FIGURE 11.** Adjusted odds ratio for current asthma and fresh fish



\* early respiratory infection

Odds ratios which differ significantly from one (ie the confidence interval does not include one) indicate altered risk. Values greater than one indicate increased risk, values lower than one indicate reduced risk.

**FIGURE 12.** Adjusted odds ratio for current asthma and oily/non-oily fish



\* early respiratory infection

Odds ratios which differ significantly from one (ie the confidence interval does not include one) indicate altered risk. Values greater than one indicate increased risk, values lower than one indicate reduced risk.

# TABLES



# TABLE 1

## COMPARISON OF TWO QUESTIONNAIRES

	NO FISH		ONE OR LESS SERVES/WEEK		MORE THAN ONE SERVE/WEEK	
	WITH CF & FF %	W'OUT CF & FF %	WITH CF & FF %	W'OUT CF & FF %	WITH CF & FF %	W'OUT CF & FF %
SENSITIVITY	91	84	44	58	16	33
SPECIFICITY	63	71	58	72	96	96
% IN AGREEMENT	69	76	53	65	62	85
PRED. VALUE	38	60	37	66	77	60

TABLE 1. Comparison of total weekly fish serves according to the dietary questionnaire, with and without canned fish (CF) and Fish Fingers (FF), with responses to the respiratory questionnaire.

**RISK FACTORS FOR AHR,  
WHEEZE AND CURRENT ASTHMA WITH FISH CONSUMPTION**

	AHR			WHEEZE			AHR AND WHEEZE		
	odds ratio	confidence interval	p value	odds ratio	confidence interval	p value	odds ratio	confidence interval	p value
<b>FRESH FISH :</b>									
<b>Unadjusted</b>	1.15	0.51-2.60	0.740	0.77	0.41-1.46	0.422	<b>0.50</b>	<b>0.27-0.92</b>	<b>0.026</b>
Adjusted	1.17	0.47-2.65	0.804	0.81	0.41-1.60	0.543	0.52	0.24-1.15	0.110
Atopy	5.04	2.70-9.40	0.000	2.60	1.51-4.46	0.001	33.71	12.90-88.07	0.000
Parental asthma	0.85	0.40-1.82	0.673	2.53	1.45-4.42	0.001	2.33	1.15-4.74	0.019
Early respiratory infection	1.04	0.39-2.77	0.937	2.20	1.10-4.39	0.025	2.20	0.89-5.46	0.089
Born in Australia	1.21	0.54-2.71	0.639	1.77	0.77-4.03	0.176	0.94	0.41-2.13	0.873
<b>NON-OILY FISH :</b>									
<b>Unadjusted</b>	1.16	0.50-2.72	0.733	0.91	0.47-1.76	0.777	0.62	0.33-1.17	0.140
Adjusted	1.20	0.49-2.93	0.692	0.92	0.46-1.86	0.820	0.68	0.30-1.54	0.356
<b>OILY FISH :</b>									
<b>Unadjusted</b>	1.13	0.45-2.83	0.797	0.53	0.24-1.17	0.114	<b>0.29</b>	<b>0.13-0.67</b>	<b>0.003</b>
Adjusted	0.96	0.35-2.61	0.936	0.59	0.25-1.36	0.213	<b>0.26</b>	<b>0.09-0.72</b>	<b>0.010</b>
Atopy	5.13	2.74-9.61	0.000	2.64	1.53-4.54	0.001	35.13	13.39-92.18	0.000
Parental Asthma	0.83	0.39-1.78	0.632	2.50	1.43-4.38	0.001	2.21	1.07-4.54	0.031
Early Respiratory Infection	1.01	0.38-2.71	0.983	2.18	1.09-4.37	0.027	1.92	0.76-4.85	0.170
Born in Australia	1.13	0.49-2.61	0.773	1.54	0.66-3.60	0.323	0.69	0.28-1.67	0.408

Odds ratios which differ significantly from one (ie the confidence interval does not include one) indicate altered risk. Values greater than one indicate increased risk, values lower than one indicate reduced risk.

**TABLE 3**

**CURRENT ASTHMA BY NUTRIENT**

<b>NUTRIENT</b>	<b>NORMAL AIRWAYS</b>			<b>WITH CURRENT ASTHMA</b>			<b>p VALUE</b>
	<b>n</b>	<b>Mean Daily Intake</b>	<b>Std Dev</b>	<b>n</b>	<b>Mean Daily Intake</b>	<b>Std Dev</b>	
<i>KILOJOULES</i>	258	10,565	2,859	69	10,646	2,835	0.8342
<i>NITROGEN (gm)</i>	258	15.2	4.3	69	15.1	4.3	0.9779
<i>PROTEIN (gm)</i>	258	93.4	27.0	69	93.5	26.5	0.9761
<i>STARCH (gm)</i>	258	149.8	41.4	69	150.3	39.6	0.9347
<i>FIBRE (gm)</i>	258	27.3	8.4	69	25.9	9.4	0.2363
<i>REFINED SUGAR (gm)</i>	258	84.1	40.9	69	91.5	46.0	0.1939
<i>NATURAL SUGAR (gm)</i>	258	96.5	38.0	69	90.6	37.1	0.2501
<i>TOTAL SUGAR (gm)</i>	258	180.7	63.0	69	182.2	64.9	0.8609
<i>TOTAL CARBOHYDRATE (gm)</i>	258	330.7	88.6	69	332.7	90.8	0.8681
<i>SATURATED FAT (gm)</i>	258	39.4	15.1	69	40.0	13.5	0.7831
<i>MONOUNSAT. FAT (gm)</i>	258	34.8	12.2	69	35.4	11.6	0.6925
<i>POLYUNSAT. FAT (gm)</i>	258	17.1	6.9	69	17.2	7.4	0.9134
<i>TOTAL FAT (gm)</i>	258	98.9	33.1	69	100.5	31.1	0.7345
<i>CHOLESTEROL (mg)</i>	258	300.8	148.3	69	286.4	115.9	0.4557
<i>CAROTENE (mcg)</i>	262	5,528	2,903	71	5,004	2,769	0.1737
<i>RETINOL (mcg)</i>	260	491.0	278.5	71	557.5	367.6	0.0989
<i>VITAMIN A (mcg)</i>	260	1,418	630	71	1,391	641	0.7511
<i>THIAMIN (mg)</i>	263	1.8	0.6	70	1.8	0.6	0.7935
<i>RIBOFLAVIN (mg)</i>	258	2.6	1.0	69	2.6	0.9	0.9679
<i>POT. NICOT. ACID (mg)</i>	258	18.9	5.7	69	18.9	5.6	0.9693
<i>TOTAL NICOT. ACID (mg)</i>	258	40.3	10.6	69	41.0	11.7	0.6136
<i>NIACIN (mg)</i>	258	21.4	5.7	69	22.1	7.3	0.3828
<i>VITAMIN B6 (mg)</i>	258	2.0	0.6	69	1.9	0.6	0.3157
<i>VITAMIN B12 (mcg)</i>	262	4.5	2.3	71	4.6	2.2	0.6484
<i>PANTOTHENIC ACID (mg)</i>	262	6.1	2.1	71	6.1	2.2	0.9997
<i>BIOTIN (mcg)</i>	262	28.1	11.5	71	26.9	10.2	0.4141
<i>FREE FOLATE (mcg)</i>	258	153.4	51.6	69	146.1	47.4	0.2901
<i>TOTAL FOLATE (mcg)</i>	258	256.4	78.9	69	246.1	72.5	0.3311
<i>VITAMIN C (mg)</i>	261	201.4	85.3	71	203.6	94.6	0.8510
<i>VITAMIN D (mcg)</i>	261	2.4	1.3	70	2.3	1.3	0.6991
<i>VITAMIN E (mg)</i>	258	10.2	4.4	69	10.4	4.5	0.8070
<i>CALCIUM (mg)</i>	258	1,320	535	69	1,293	501	0.6994
<i>COPPER (mg)</i>	258	1.9	0.6	69	1.9	0.6	0.8624
<i>IRON (mg)</i>	258	15.4	4.0	69	15.4	4.1	0.9274
<i>MAGNESIUM (mg)</i>	258	376.2	110.0	69	365.9	110.1	0.4903
<i>MANGANESE (mg)</i>	258	3.9	1.4	69	3.7	1.3	0.3146
<i>PHOSPHOROUS (mg)</i>	258	1684.7	539	69	1,673	510	0.8690
<i>POTASSIUM (mg)</i>	258	4226.0	1,193	69	4,095	1,198	0.4206
<i>SELENIUM (mcg)</i>	258	136.0	38.8	69	134.9	38.0	0.8318
<i>SODIUM (mg)</i>	258	2972.7	936	69	3,085	1,078	0.3944
<i>ZINC (mg)</i>	258	12.9	3.7	69	13.0	3.7	0.8347

**TABLE 4**

**CURRENT ASTHMA BY FOOD GROUP**

<u>GROUP</u>	<u>NORMAL AIRWAYS</u>			<u>WITH CURRENT ASTHMA</u>			<u>p VALUE</u>
	<u>n</u>	<u>Mean</u> <u>(Serves/Wk)</u>	<u>Std Dev</u>	<u>n</u>	<u>Mean</u> <u>(Serves/Wk)</u>	<u>Std Dev</u>	
<i>CEREALS</i>	260	40.6	14.6	70	40.3	14.2	0.8903
<i>DAIRY</i>	260	12.9	9.0	70	12.8	8.7	0.9045
<i>EGGS</i>	260	1.9	2.2	70	1.5	1.4	0.1555
<i>RED MEAT</i>	260	5.4	2.8	70	5.6	2.8	0.6325
<i>WHITE MEAT</i>	260	1.3	0.9	70	1.3	1.3	0.6915
<i>PRES.MEATS</i>	260	3.1	2.5	70	3.1	2.4	0.8105
<i>OFFAL</i>	260	0.1	0.2	70	0.1	0.3	0.4572
<i>SEAFOOD</i>	260	0.2	0.4	70	0.1	0.2	0.2515
<i>RED VEG</i>	260	4.3	3.3	70	3.9	2.9	0.4367
<i>GREEN VEG</i>	260	9.5	6.2	70	10.0	7.8	0.5580
<i>WHITE VEG</i>	260	3.8	2.6	70	3.9	2.5	0.7211
<i>LEGUMES</i>	260	0.6	1.0	70	0.7	1.1	0.6252
<i>OTHER VEG</i>	260	5.3	5.4	70	4.8	4.6	0.5259
<i>MIXED VEG</i>	260	3.3	4.4	70	3.4	5.6	0.8397
<i>HIGH C FRUIT</i>	260	17.4	11.1	70	16.2	8.1	0.3915
<i>LOW C FRUIT</i>	260	12.8	7.7	70	11.3	8.6	0.1645
<i>OTHER FRUIT</i>	260	1.0	1.9	70	1.7	5.0	0.0532
<i>HIGH SUG/FAT</i>	260	18.5	8.7	70	19.9	11.6	0.2678
<i>OTHER</i>	260	13.4	12.6	70	11.6	13.9	0.3216

# TABLE 5

## WHEEZE BY NUTRIENT

NUTRIENT	NORMAL AIRWAYS			WITH WHEEZE ONLY			p VALUE
	n	Mean Daily Intake	Std Dev	n	Mean Daily Intake	Std Dev	
KILOJOULES	258	10,535	2,859	78	10,680	2,793	0.7540
NITROGEN (gm)	258	15.2	4.3	78	15.8	4.8	0.2388
PROTEIN (gm)	258	93.4	27.0	78	97.5	30.0	0.2431
STARCH (gm)	258	149.8	41.4	78	151.7	37.8	0.7264
FIBRE (gm)	258	27.3	8.4	78	27.1	7.9	0.8719
REFINED SUGAR (gm)	258	84.1	40.9	78	87.1	40.8	0.5797
NATURAL SUGAR (gm)	258	96.5	38.0	78	90.1	33.5	0.1823
TOTAL SUGAR (gm)	258	180.7	63.0	78	177.2	61.3	0.6688
TOTAL CARBOHYDRATE (gm)	258	330.7	88.6	78	329.1	85.1	0.8893
SATURATED FAT (gm)	258	39.4	15.1	78	39.4	14.3	0.9942
MONOUNSAT. FAT (gm)	258	34.8	12.2	78	35.7	11.4	0.5486
POLYUNSAT. FAT (gm)	258	17.1	6.9	78	17.7	7.0	0.5079
TOTAL FAT (gm)	258	98.9	33.1	78	101.0	31.7	0.6347
CHOLESTEROL (mg)	258	300.8	148.3	78	293.3	129.0	0.6875
CAROTENE (mcg)	262	5,528	2,903	79	5,025	1,973	0.1499
RETINOL (mcg)	261	491.0	278.5	77	559.4	445.6	0.1048
VITAMIN A (mcg)	261	1,418	630	79	1,471	725	0.5336
THIAMIN (mg)	263	1.8	0.6	79	1.8	0.5	0.9045
RIBOFLAVIN (mg)	258	2.6	1.0	78	2.6	1.0	0.6955
POT. NICOT. ACID (mg)	258	18.9	5.7	78	19.8	6.3	0.2408
TOTAL NICOT. ACID (mg)	258	40.3	10.6	78	42.5	11.9	0.1072
NIACIN (mg)	258	21.4	5.7	78	22.8	6.3	0.0643
VITAMIN B6 (mg)	258	2.0	0.6	78	2.0	0.6	0.7531
<b>VITAMIN B12 (mcg)</b>	<b>262</b>	<b>4.5</b>	<b>2.3</b>	<b>79</b>	<b>5.2</b>	<b>3.3</b>	<b>0.0278</b>
PANTOTHENIC ACID (mg)	262	6.1	2.1	79	6.1	1.9	0.9130
BIOTIN (mcg)	262	28.1	11.5	79	26.9	9.8	0.3785
FREE FOLATE (mcg)	258	153.4	51.6	78	148.0	41.8	0.4040
TOTAL FOLATE (mcg)	258	256.4	78.9	78	253.4	69.2	0.7675
VITAMIN C (mg)	261	201.4	85.3	79	196.5	84.7	0.6538
VITAMIN D (mcg)	261	2.4	1.3	78	2.5	1.4	0.6326
VITAMIN E (mg)	258	10.2	4.4	78	10.5	4.2	0.6362
CALCIUM (mg)	258	1,320	535	78	1,326	538	0.9365
COPPER (mg)	258	1.9	0.6	78	2.0	0.6	0.5421
IRON (mg)	258	15.4	4.0	78	15.8	4.4	0.4534
MAGNESIUM (mg)	258	376.2	110.0	78	378.1	102.6	0.8892
MANGANESE (mg)	258	3.9	1.4	78	3.9	1.2	0.9673
PHOSPHOROUS (mg)	258	1,685	539	78	1,713	535	0.6810
POTASSIUM (mg)	258	4,226	1,193	78	4,218	1,180	0.9522
SELENIUM (mcg)	258	136.0	38.8	78	140.8	37.8	0.3358
SODIUM (mg)	258	2,973	936	78	3,094	943	0.3191
ZINC (mg)	258	12.9	3.7	78	13.8	4.3	0.0591

# TABLE 6

## WHEEZE BY FOOD GROUP

GROUP	NORMAL AIRWAYS			WITH WHEEZE ONLY			p VALUE
	n	Mean (Serves/Wk)	Std Dev	n	Mean (Serves/Wk)	Std Dev	
CEREALS	260	40.6	14.6	78	42.2	15.3	0.3910
DAIRY	260	12.9	9.0	78	14.1	11.2	0.3148
EGGS	260	1.9	2.2	78	1.4	1.8	0.1049
<b>RED MEAT</b>	<b>260</b>	<b>5.4</b>	<b>2.8</b>	<b>78</b>	<b>6.2</b>	<b>3.5</b>	<b>0.0411</b>
WHITE MEAT	260	1.3	0.9	78	1.4	1.0	0.2855
PRES.MEATS	260	3.1	2.5	78	3.2	2.4	0.6833
<b>OFFAL</b>	<b>260</b>	<b>0.1</b>	<b>0.2</b>	<b>78</b>	<b>0.3</b>	<b>1.0</b>	<b>0.0008</b>
SEAFOOD	260	0.2	0.4	78	0.2	0.3	0.8315
RED VEG	260	4.3	3.3	78	4.1	2.6	0.7238
GREEN VEG	260	9.5	6.2	78	10.4	7.2	0.2894
WHITE VEG	260	3.8	2.6	78	4.3	3.8	0.1292
LEGUMES	260	0.6	1.0	78	0.5	0.8	0.2985
OTHER VEG	260	5.3	5.4	78	4.3	4.3	0.1200
<b>MIXED VEG</b>	<b>260</b>	<b>3.3</b>	<b>4.4</b>	<b>78</b>	<b>2.3</b>	<b>2.1</b>	<b>0.0486</b>
HIGH C FRUIT	260	17.4	11.1	78	15.9	9.1	0.2928
LOW C FRUIT	260	12.8	7.7	78	11.3	6.7	0.1261
OTHER FRUIT	260	1.0	1.9	78	1.2	2.0	0.3037
HIGH SUG/FAT	260	18.5	8.7	78	20.3	12.0	0.1454
OTHER	260	13.4	12.6	78	13.1	10.7	0.8622

# TABLE 7

## AIRWAY RESPONSIVENESS BY NUTRIENT

NUTRIENT	NORMAL AIRWAYS			HYPERRESPONSIVE AIRWAYS ONLY			p VALUE
	n	Mean Daily Intake	Std Dev	n	Mean Daily Intake	Std Dev	
<i>KILOJOULES</i>	258	10,565	2,859	54	11,417	3,448	0.0560
<b>NITROGEN (gm)</b>	<b>258</b>	<b>15.2</b>	<b>4.3</b>	<b>54</b>	<b>16.6</b>	<b>5.2</b>	<b>0.0385</b>
<b>PROTEIN (gm)</b>	<b>258</b>	<b>93.4</b>	<b>27.0</b>	<b>54</b>	<b>102.1</b>	<b>32.4</b>	<b>0.0375</b>
<i>STARCH (gm)</i>	258	149.8	41.4	54	152.2	40.0	0.7032
<i>FIBRE (gm)</i>	258	27.3	8.4	54	27.4	9.1	0.9277
<b>REFINED SUGAR (gm)</b>	<b>258</b>	<b>84.1</b>	<b>40.9</b>	<b>54</b>	<b>102.4</b>	<b>45.2</b>	<b>0.0036</b>
<i>NATURAL SUGAR (gm)</i>	258	96.5	38.0	54	99.3	39.6	0.6285
<b>TOTAL SUGAR (gm)</b>	<b>258</b>	<b>180.7</b>	<b>63.0</b>	<b>54</b>	<b>201.7</b>	<b>72.5</b>	<b>0.0306</b>
<i>TOTAL CARBOHYDRATE (gm)</i>	258	330.7	88.6	54	354.3	97.2	0.0821
<i>SATURATED FAT (gm)</i>	258	39.4	15.1	54	43.3	19.0	0.1046
<i>MONOUNSAT. FAT (gm)</i>	258	34.8	12.1	54	37.7	15.6	0.1266
<i>POLYUNSAT. FAT (gm)</i>	258	17.1	6.9	54	17.6	7.7	0.6168
<i>TOTAL FAT (gm)</i>	258	98.9	33.1	54	107.8	42.7	0.0932
<b>CHOLESTEROL (mg)</b>	<b>258</b>	<b>300.8</b>	<b>148.3</b>	<b>54</b>	<b>347.6</b>	<b>181.5</b>	<b>0.0437</b>
<i>CAROTENE (mcg)</i>	262	5,528	2,903	55	6,032	3,683	0.2667
<i>RETINOL (mcg)</i>	260	491.0	278.5	52	540.1	385.7	0.2808
<i>VITAMIN A (mcg)</i>	260	1,418	630	53	1,583	876	0.1087
<i>THIAMIN (mg)</i>	263	1.8	0.6	55	1.9	0.6	0.4207
<i>RIBOFLAVIN (mg)</i>	258	2.6	1.0	54	2.8	1.0	0.0796
<b>POT. NICOT. ACID (mg)</b>	<b>258</b>	<b>18.9</b>	<b>5.7</b>	<b>54</b>	<b>20.6</b>	<b>6.8</b>	<b>0.0460</b>
<b>TOTAL NICOT. ACID (mg)</b>	<b>258</b>	<b>40.3</b>	<b>10.6</b>	<b>54</b>	<b>43.5</b>	<b>12.3</b>	<b>0.0479</b>
<i>NIACIN (mg)</i>	258	21.4	5.7	54	22.9	6.3	0.0870
<i>VITAMIN B6 (mg)</i>	258	2.0	0.6	54	2.1	0.7	0.1165
<b>VITAMIN B12 (mcg)</b>	<b>262</b>	<b>4.5</b>	<b>2.3</b>	<b>54</b>	<b>5.2</b>	<b>3.0</b>	<b>0.0439</b>
<i>PANTOTHENIC ACID (mg)</i>	262	6.1	2.1	53	6.5	2.4	0.2501
<i>BIOTIN (mcg)</i>	262	28.2	11.5	53	28.7	10.9	0.7670
<i>FREE FOLATE (mcg)</i>	258	153.3	51.6	54	159.5	52.3	0.4302
<i>TOTAL FOLATE (mcg)</i>	258	256.4	78.9	54	270.6	88.8	0.2400
<i>VITAMIN C (mg)</i>	261	201.4	85.4	55	211.7	92.2	0.4262
<i>VITAMIN D (mcg)</i>	261	2.4	1.3	54	2.3	1.5	0.5246
<i>VITAMIN E (mg)</i>	258	10.2	4.4	54	10.5	5.5	0.7005
<b>CALCIUM (mg)</b>	<b>258</b>	<b>1,320</b>	<b>535</b>	<b>54</b>	<b>1,488</b>	<b>668</b>	<b>0.0466</b>
<b>COPPER (mg)</b>	<b>258</b>	<b>1.9</b>	<b>0.6</b>	<b>54</b>	<b>2.1</b>	<b>0.8</b>	<b>0.0365</b>
<i>IRON (mg)</i>	258	15.4	4.0	54	16.5	4.1	0.0565
<i>MAGNESIUM (mg)</i>	258	376.2	110.0	54	394.9	126.9	0.2695
<i>MANGANESE (mg)</i>	258	3.9	1.4	54	3.9	1.4	0.8178
<i>PHOSPHOROUS (mg)</i>	258	1,685	539	54	1,833	631	0.0753
<i>POTASSIUM (mg)</i>	258	4,227	1,210	54	4,508	1,428	0.1343
<i>SELENIUM (mcg)</i>	258	136.0	38.8	54	141.9	41.1	0.3187
<i>SODIUM (mg)</i>	258	2,973	936	54	3,254	1,183	0.0563
<b>ZINC (mg)</b>	<b>258</b>	<b>12.9</b>	<b>3.7</b>	<b>54</b>	<b>14.0</b>	<b>4.3</b>	<b>0.0467</b>

# TABLE 8

## AIRWAY RESPONSIVENESS BY FOOD GROUP

GROUP	NORMAL AIRWAYS			HYPERRESPONSIVE AIRWAYS ONLY			p VALUE
	n	Mean (Serves/Wk)	Std Dev	n	Mean (Serves/Wk)	Std Dev	
CEREALS	260	40.6	14.6	55	37.5	10.4	0.1387
DAIRY	260	12.9	9.0	55	14.8	12.0	0.1875
EGGS	260	1.9	2.2	55	2.5	3.6	0.0978
RED MEAT	260	5.4	2.8	55	6.1	3.0	0.1071
WHITE MEAT	260	1.3	0.9	55	1.3	1.0	0.9212
PRES.MEATS	260	3.1	2.5	55	3.1	2.4	0.8284
<b>OFFAL</b>	260	<b>0.1</b>	<b>0.2</b>	55	<b>0.3</b>	<b>1.1</b>	<b>0.0010</b>
SEAFOOD	260	0.2	0.4	55	0.2	0.4	0.1896
RED VEG	260	4.3	3.3	55	4.5	3.8	0.6756
GREEN VEG	260	9.5	6.2	55	9.4	6.0	0.9008
WHITE VEG	260	3.8	2.6	55	3.3	2.6	0.1928
LEGUMES	260	0.6	1.0	55	0.6	0.8	0.7271
OTHER VEG	260	5.3	5.4	55	5.9	8.4	0.5168
MIXED VEG	260	3.3	4.4	55	4.5	6.4	0.1013
HIGH C FRUIT	260	17.4	11.1	55	17.6	9.8	0.9114
LOW C FRUIT	260	12.8	7.7	55	12.0	6.5	0.4891
OTHER FRUIT	260	1.0	1.9	55	1.4	3.9	0.2774
<b>HIGH SUG/FAT</b>	260	<b>18.5</b>	<b>8.7</b>	55	<b>24.4</b>	<b>15.8</b>	<b>0.0001</b>
OTHER	260	13.4	12.6	55	14.5	14.0	0.5563



**TABLE 9**

**TOTAL FISH SERVES BY NUTRIENT**

NUTRIENT	NO FISH			ONE SERVE OR LESS			MORE THAN ONE SERVE			p VALUE
	n	Mean Daily Intake	Std Dev	n	Mean Daily Intake	Std Dev	n	Mean Daily Intake	Std Dev	
KILOJOULES	93	9,941	2,718	167	10,207	2,617	199	11,462	3,086	0.0001
NITROGEN (gm)	93	1370.0	425.7	167	1442.4	380.8	199	1708.7	469.8	0.0001
PROTEIN (gm)	93	84.5	26.4	167	88.8	23.7	199	105.3	29.2	0.0001
STARCH (gm)	93	143.7	40.6	167	143.6	36.2	199	159.4	41.7	0.0002
FIBRE (gm)	93	24.2	8.1	167	26.7	7.9	199	28.7	8.9	0.0001
REFINED SUGAR (gm)	93	86.7	43.1	167	85.2	39.8	199	90.7	44.4	0.4447
NATURAL SUGAR (gm)	93	83.7	35.1	167	96.3	36.8	199	98.9	38.0	0.0042
TOTAL SUGAR (gm)	93	170.5	59.6	167	181.5	62.0	199	189.6	67.8	0.0570
TOTAL CARBOHYDRATE (gm)	93	314.5	85.0	167	325.3	84.4	199	349.3	93.3	0.0026
SATURATED FAT (gm)	93	36.9	13.7	167	37.2	13.3	199	43.7	16.7	0.0001
MONOUNSAT. FAT (gm)	93	32.8	11.5	167	32.7	10.7	199	38.8	13.4	0.0001
POLYUNSAT. FAT (gm)	93	16.1	7.6	167	16.2	6.8	199	18.7	6.8	0.0005
TOTAL FAT (gm)	93	93.1	31.4	167	93.6	29.7	199	109.8	36.1	0.0001
CHOLESTEROL (mg)	93	235.9	104.8	167	271.6	124.6	199	360.4	157.4	0.0001
CAROTENE (mcg)	95	4,459	2,498	171	5,253	2,664	201	6,023	3,052	0.0001
RETINOL (mcg)	95	428.1	213.9	170	501.4	302.5	195	576.9	402.5	0.0014
VITAMIN A (mcg)	95	1,171	522	171	1,392	594	197	1,616	766	0.0001
THIAMIN (mg)	95	1.7	0.5	171	1.8	0.6	201	1.9	0.6	0.0049
RIBOFLAVIN (mg)	93	2.4	1.0	167	2.6	0.9	199	2.8	1.0	0.0019
POT. NICOT. ACID (mg)	93	17.0	5.5	167	17.9	5.0	199	21.3	6.1	0.0001
TOTAL NICOT. ACID (mg)	93	37.0	10.9	167	38.6	9.5	199	45.1	11.5	0.0001
NIACIN (mg)	93	20.0	5.9	167	20.7	5.4	199	23.8	6.3	0.0001
VITAMIN B6 (mg)	93	1.7	0.5	167	1.9	0.5	199	2.2	0.6	0.0001
VITAMIN B12 (mcg)	95	3.6	1.8	171	4.2	2.1	200	5.7	2.9	0.0001
PANTOTHENIC ACID (mg)	95	5.4	1.9	170	6.0	2.0	200	6.7	2.2	0.0001
BIOTIN (mcg)	95	23.0	9.2	170	27.2	10.7	200	30.7	11.1	0.0001
FREE FOLATE (mcg)	93	128.7	41.7	167	148.1	44.5	199	166.3	52.3	0.0001
TOTAL FOLATE (mcg)	93	220.6	68.5	167	244.8	64.3	199	282.0	83.3	0.0001
VITAMIN C (mg)	95	175.8	75.9	170	201.2	89.9	201	215.4	87.7	0.0012
VITAMIN D (mcg)	95	2.0	1.2	169	2.2	1.3	199	2.7	1.4	0.0001
VITAMIN E (mg)	93	9.7	4.9	167	9.8	4.3	199	11.1	4.5	0.0105
CALCIUM (mg)	93	1,215	505	167	1,300	514	199	1,425	584	0.0050
COPPER (mg)	93	1.7	0.5	167	1.8	0.5	199	2.2	0.7	0.0001
IRON (mg)	93	14.3	4.0	167	14.8	3.5	199	16.9	4.2	0.0001
MAGNESIUM (mg)	93	336.0	102.0	167	367.0	103.0	199	404.7	114.1	0.0001
MANGANESE (mg)	93	3.4	1.3	167	3.8	1.3	199	4.2	1.3	0.0001
PHOSPHOROUS (mg)	93	1,513	506	167	1,633	488	199	1,856	571	0.0001
POTASSIUM (mg)	93	3,814	1,060	167	4,079	1,110	199	4,572	1,317	0.0001
SELENIUM (mcg)	93	117.5	34.8	167	126.3	29.7	199	156.0	39.1	0.0001
SODIUM (mg)	93	2,756	924	167	2,791	797	199	3,390	1,065	0.0001
ZINC (mg)	93	11.9	3.6	167	12.5	3.4	199	14.4	4.1	0.0001

**TABLE 10**

**TOTAL FISH SERVES BY FOOD GROUP**

<u>GROUP</u>	<u>NO FISH</u>			<u>ONE SERVE OR LESS</u>			<u>MORE THAN ONE SERVE</u>			<u>p VALUE</u>
	<u>n</u>	<u>Mean Daily Intake</u>	<u>Std Dev</u>	<u>n</u>	<u>Mean Daily Intake</u>	<u>Std Dev</u>	<u>n</u>	<u>Mean Daily Intake</u>	<u>Std Dev</u>	
<i>CEREALS</i>	94	39.3	16.4	169	40.7	14.0	200	40.8	13.3	0.6784
DAIRY	94	11.2	8.1	169	13.7	10.0	200	14.0	10.1	0.0621
<b>EGGS</b>	<b>94</b>	<b>1.1</b>	<b>1.7</b>	<b>169</b>	<b>1.7</b>	<b>2.5</b>	<b>200</b>	<b>2.3</b>	<b>2.3</b>	<b>0.0002</b>
<b>RED MEAT</b>	<b>94</b>	<b>5.1</b>	<b>3.2</b>	<b>169</b>	<b>5.0</b>	<b>2.3</b>	<b>200</b>	<b>6.4</b>	<b>3.2</b>	<b>0.0001</b>
WHITE MEAT	94	1.3	1.1	169	1.2	1.1	200	1.4	1.0	0.1611
<b>PRES.MEATS</b>	<b>94</b>	<b>2.8</b>	<b>2.1</b>	<b>169</b>	<b>2.7</b>	<b>2.3</b>	<b>200</b>	<b>3.6</b>	<b>2.6</b>	<b>0.0004</b>
<i>OFFAL</i>	94	0.1	0.3	169	0.2	0.7	200	0.2	0.6	0.3246
<b>SEAFOOD</b>	<b>94</b>	<b>0.0</b>	<b>0.1</b>	<b>169</b>	<b>0.1</b>	<b>0.3</b>	<b>200</b>	<b>0.3</b>	<b>0.4</b>	<b>0.0001</b>
<i>RED VEG</i>	94	3.9	2.9	169	4.1	3.2	200	4.5	3.2	0.2947
<b>GREEN VEG</b>	<b>94</b>	<b>7.1</b>	<b>5.4</b>	<b>169</b>	<b>9.8</b>	<b>6.3</b>	<b>200</b>	<b>10.9</b>	<b>7.0</b>	<b>0.0001</b>
<i>WHITE VEG</i>	94	4.0	3.3	169	3.5	2.8	200	4.0	2.6	0.1312
<b>LEGUMES</b>	<b>94</b>	<b>0.3</b>	<b>0.6</b>	<b>169</b>	<b>0.6</b>	<b>0.9</b>	<b>200</b>	<b>0.7</b>	<b>1.1</b>	<b>0.0040</b>
<b>OTHER VEG</b>	<b>94</b>	<b>3.2</b>	<b>3.8</b>	<b>169</b>	<b>4.9</b>	<b>6.0</b>	<b>200</b>	<b>6.2</b>	<b>5.7</b>	<b>0.0001</b>
<b>MIXED VEG</b>	<b>94</b>	<b>2.2</b>	<b>2.6</b>	<b>169</b>	<b>2.2</b>	<b>3.2</b>	<b>200</b>	<b>4.7</b>	<b>5.9</b>	<b>0.0001</b>
<b>HIGH C FRUIT</b>	<b>94</b>	<b>14.3</b>	<b>8.4</b>	<b>169</b>	<b>17.3</b>	<b>10.6</b>	<b>200</b>	<b>17.9</b>	<b>10.4</b>	<b>0.0157</b>
<i>LOW C FRUIT</i>	94	10.7	7.5	169	12.7	7.7	200	12.5	7.4	0.0949
<i>OTHER FRUIT</i>	94	0.8	1.2	169	1.4	3.6	200	1.2	2.8	0.2871
<i>HIGH SUG/FAT</i>	94	20.0	9.4	169	19.0	11.0	200	20.2	11.6	0.5255
OTHER	94	10.7	11.4	169	12.9	11.6	200	14.5	13.9	0.0534

# TABLE 11

## FRESH FISH CONSUMERS BY NUTRIENT

NUTRIENT	NO FRESH FISH			SOME FRESH FISH			p VALUE
	n	Mean Daily Intake	Std Dev	n	Mean Daily Intake	Std Dev	
KILOJOULES	85	10,568	2,597	374	10,726	2,994	0.6534
NITROGEN (gm)	85	14.7	4.2	374	15.6	4.6	0.0811
PROTEIN (gm)	85	90.4	25.9	374	96.2	28.6	0.0880
STARCH (gm)	85	151.4	37.5	374	150.3	40.9	0.8200
FIBRE (gm)	85	25.5	8.6	374	27.4	8.5	0.0670
REFINED SUGAR (gm)	85	91.1	41.9	374	87.1	42.6	0.4331
NATURAL SUGAR (gm)	85	91.0	34.7	374	95.8	37.9	0.2825
TOTAL SUGAR (gm)	85	182.1	59.5	374	182.9	65.5	0.9154
TOTAL CARBOHYDRATE (gm)	85	333.8	84.6	374	333.5	90.6	0.9744
SATURATED FAT (gm)	85	38.8	13.8	374	40.2	15.6	0.4432
MONOUNSAT. FAT (gm)	85	35.0	11.7	374	35.4	12.6	0.7873
POLYUNSAT. FAT (gm)	85	17.8	7.4	374	17.2	7.0	0.4287
TOTAL FAT (gm)	85	99.0	31.0	374	101.0	34.5	0.6334
CHOLESTEROL (mg)	85	257.3	108.6	374	313.2	151.2	0.0013
CAROTENE (mcg)	87	4,553	2,461	380	5,622	2,915	0.0016
RETINOL (mcg)	87	473.2	226.3	373	528.8	359.4	0.1682
VITAMIN A (mcg)	87	1,232	484	376	1,490	710	0.0014
THIAMIN (mg)	87	1.8	0.6	380	1.8	0.6	0.5988
RIBOFLAVIN (mg)	85	25.7	9.4	374	26.3	9.7	0.5680
POT. NICOT. ACID (mg)	85	18.3	5.5	374	19.4	6.0	0.1047
TOTAL NICOT. ACID (mg)	85	39.4	10.3	374	41.5	11.4	0.1232
NIACIN (mg)	85	21.1	5.5	374	22.1	6.2	0.2070
VITAMIN B6 (mg)	85	18.2	5.3	374	20.2	6.2	0.0060
VITAMIN B12 (mcg)	87	4.0	1.9	379	4.9	2.7	0.0064
PANTOTHENIC ACID (mg)	87	5.8	1.9	378	6.3	2.2	0.0443
BIOTIN (mcg)	87	25.5	9.1	378	28.4	11.3	0.0268
FREE FOLATE (mcg)	85	134.9	41.9	374	156.0	50.4	0.0004
TOTAL FOLATE (mcg)	85	229.1	63.5	374	262.1	79.4	0.0004
VITAMIN C (mg)	87	184.9	88.6	379	206.1	86.7	0.0414
VITAMIN D (mcg)	86	2.5	1.4	377	2.4	1.4	0.4681
VITAMIN E (mg)	85	10.4	4.7	374	10.3	4.5	0.8050
CALCIUM (mg)	85	1,324	490	374	1,340	562	0.8180
COPPER (mg)	85	1.7	0.4	374	2.0	0.6	0.0004
IRON (mg)	85	15.1	4.1	374	15.7	4.1	0.2708
MAGNESIUM (mg)	85	357.7	97.3	374	381.6	113.3	0.0731
MANGANESE (mg)	85	3.6	1.3	374	3.9	1.3	0.0685
PHOSPHOROUS (mg)	85	1,633	481	374	1,722	559	0.1752
POTASSIUM (mg)	85	4,018	1,081	374	4,289	1,259	0.0666
SELENIUM (mcg)	85	128.9	35.1	374	139.3	39.3	0.0247
SODIUM (mg)	85	2,960	828	374	3,062	1,026	0.3913
ZINC (mg)	85	12.5	3.7	374	13.4	3.9	0.0824

# TABLE 12

## FRESH FISH CONSUMERS BY FOOD GROUP

GROUP	NO FRESH FISH			SOME FRESH FISH			p VALUE
	n	Mean (Serves/Wk)	Std Dev	n	Mean (Serves/Wk)	Std Dev	
CEREALS	86	42.7	15.2	377	39.9	14.0	0.1069
DAIRY	86	12.8	9.3	377	13.4	9.9	0.5579
EGGS	86	1.2	1.4	377	2.0	2.4	0.0044
RED MEAT	86	5.0	3.0	377	5.8	2.9	0.0265
WHITE MEAT	86	1.3	1.1	377	1.3	1.0	0.9242
PRES MEATS	86	3.0	2.2	377	3.1	2.5	0.5205
OFFAL	86	0.1	0.2	377	0.2	0.6	0.1420
SEAFOOD	86	0.0	0.1	377	0.2	0.4	0.0001
RED VEG	86	4.0	3.0	377	4.3	3.2	0.5014
GREEN VEG	86	7.7	5.7	377	10.1	6.7	0.0018
WHITE VEG	86	4.1	2.9	377	3.8	2.8	0.2660
LEGUMES	86	0.5	1.0	377	0.6	0.9	0.2185
OTHER VEG	86	3.4	4.0	377	5.5	5.8	0.0014
MIXED VEG	86	1.7	1.9	377	3.7	5.0	0.0004
HIGH C FRUIT	86	15.4	9.4	377	17.3	10.3	0.1150
LOW C FRUIT	86	11.8	8.8	377	12.3	7.3	0.5730
OTHER FRUIT	86	1.0	2.0	377	1.2	3.1	0.4842
HIGH SUG/FAT	86	20.9	10.7	377	19.5	11.0	0.2646
OTHER	86	12.0	12.2	377	13.5	12.8	0.3249

**TABLE 13**

**FISH TYPE BY NUTRIENT**

NUTRIENT	NO FRESH FISH			FRESH WHITE FISH ONLY			FRESH OILY +/- WHITE FISH			p VALUE
	n	Mean Daily Intake	Std Dev	n	Mean Daily Intake	Std Dev	n	Mean Daily Intake	Std Dev	
KILOJOULES	85	10,568	2,597	252	10,687	3,039	122	10,807	2,908	0.8440
NITROGEN (gm)	85	14.7	4.2	252	15.5	4.6	122	15.9	4.6	0.1479
PROTEIN (gm)	85	90.4	25.9	252	95.2	28.6	122	98.0	28.7	0.1572
STARCH (gm)	85	151.4	37.5	252	146.9	38.1	122	157.3	45.5	0.0631
FIBRE (gm)	85	25.5	8.6	252	27.5	8.7	122	27.1	8.0	0.1717
REFINED SUGAR (gm)	85	91.1	41.9	252	87.9	42.2	122	85.7	43.5	0.6585
NATURAL SUGAR (gm)	85	91.0	34.7	252	96.3	39.9	122	94.7	33.6	0.5205
TOTAL SUGAR (gm)	85	182.1	59.5	252	184.2	67.4	122	180.4	61.7	0.8610
TOTAL CARBOHYDRATE (gm)	85	333.8	84.6	252	331.3	92.1	122	337.8	87.8	0.8046
SATURATED FAT (gm)	85	38.8	13.8	252	40.1	15.8	122	40.3	15.1	0.7406
MONOUNSAT. FAT (gm)	85	35.0	11.7	252	35.6	12.7	122	35.0	12.5	0.8817
POLYUNSAT. FAT (gm)	85	17.8	7.4	252	17.4	7.4	122	16.7	6.2	0.4971
TOTAL FAT (gm)	85	99.0	31.0	252	101.2	35.0	122	100.4	33.6	0.8725
CHOLESTEROL (mg)	85	257.3	108.6	252	303.6	139.4	122	333.2	171.9	0.0010
CAROTENE (mcg)	87	4,553	2,461	255	5,534	2,875	125	5,802	2,998	0.0048
RETINOL (mcg)	87	473.2	226.3	252	524.7	358.4	121	537.4	362.9	0.3657
VITAMIN A (mcg)	87	1,232	484	254	1,475	715	122	1,523	700	0.0048
THIAMIN (mg)	87	1.8	0.6	255	1.8	0.6	125	1.9	0.7	0.5428
RIBOFLAVIN (mg)	85	2.6	0.9	252	2.6	1.0	122	2.6	0.9	0.8271
POT. NICOT. ACID (mg)	85	18.3	5.5	252	19.3	6.0	122	19.7	6.0	0.2192
TOTAL NICOT. ACID (mg)	85	39.4	10.3	252	41.3	11.4	122	41.9	11.4	0.2686
NIACIN (mg)	85	21.1	5.5	252	22.0	6.2	122	22.2	6.4	0.4298
VITAMIN B6 (mg)	85	1.8	0.5	252	2.0	0.6	122	2.1	0.6	0.0175
VITAMIN B12 (mcg)	87	4.0	1.9	255	4.7	2.6	124	5.2	2.9	0.0069
PANTOTHENIC ACID (mg)	87	5.8	1.9	253	6.2	2.1	125	6.5	2.2	0.0448
BIOTIN (mcg)	87	25.5	9.1	253	27.3	10.6	125	30.5	12.4	0.0025
FREE FOLATE (mcg)	85	134.9	41.9	252	155.0	51.8	122	158.1	47.4	0.0015
TOTAL FOLATE (mcg)	85	229.1	63.5	252	259.7	80.7	122	267.1	76.6	0.0013
VITAMIN C (mg)	87	184.9	88.6	255	207.6	88.3	124	203.1	83.6	0.1121
VITAMIN D (mcg)	86	2.5	1.4	254	2.4	1.3	123	2.4	1.4	0.7439
VITAMIN E (mg)	85	10.4	4.7	252	10.5	4.7	122	9.9	4.0	0.4468
CALCIUM (mg)	85	1,324	490	252	1,351	587	122	1,317	509	0.8386
COPPER (mg)	85	1.7	0.4	252	2.0	0.6	122	2.1	0.6	0.0005
IRON (mg)	85	15.1	4.1	252	15.6	4.1	122	15.7	4.1	0.5323
MAGNESIUM (mg)	85	357.7	97.3	252	381.8	117.6	122	381.0	104.4	0.2007
MANGANESE (mg)	85	3.6	1.3	252	3.9	1.3	122	4.0	1.3	0.1857
PHOSPHOROUS (mg)	85	1,633	481	252	1,718	581	122	1,729	511	0.3928
POTASSIUM (mg)	85	4,018	1,081	252	4,296	1,316	122	4,276	1,138	0.1843
SELENIUM (mcg)	85	128.9	35.1	252	136.8	37.9	122	144.5	41.7	0.0157
SODIUM (mg)	85	2,960	828	252	3,035	1,011	122	3,117	1,057	0.5239
ZINC (mg)	85	12.5	3.7	252	13.3	4.0	122	13.5	3.9	0.1863

**TABLE 14**

**FISH TYPE BY FOOD GROUP**

<u>GROUP</u>	<u>NO FISH</u>			<u>NON-OILY FISH ONLY</u>			<u>OILY FISH WITH/WITHOUT NON-OILY FISH</u>			<u>p VALUE</u>
	<u>n</u>	<u>Mean Serves/week</u>	<u>Std Dev</u>	<u>n</u>	<u>Mean Serves/week</u>	<u>Std Dev</u>	<u>n</u>	<u>Mean Serves/week</u>	<u>Std Dev</u>	
<i>CEREALS</i>	86	42.7	15.2	255	40.2	14.2	122	39.5	13.6	0.2452
<i>DAIRY</i>	86	12.8	9.3	255	14.1	10.6	122	12.0	7.9	0.1240
<i>EGGS</i>	86	1.2	1.4	255	1.8	2.3	122	2.3	2.6	0.0032
<i>RED MEAT</i>	86	5.0	3.0	255	5.6	2.8	122	6.0	3.1	0.0419
<i>WHITE MEAT</i>	86	1.3	1.1	255	1.2	0.9	122	1.5	1.2	0.0444
<i>PRESMEATS</i>	86	3.0	2.2	255	3.1	2.4	122	3.3	2.7	0.5748
<i>OFFAL</i>	86	0.1	0.2	255	0.2	0.8	122	0.1	0.3	0.2191
<i>SEAFOOD</i>	86	0.0	0.1	255	0.2	0.3	122	0.3	0.4	0.0001
<i>RED VEG</i>	86	4.0	3.0	255	4.6	3.4	122	3.5	2.6	0.0051
<i>GREEN VEG</i>	86	7.7	5.7	255	10.6	7.1	122	9.3	5.8	0.0016
<i>WHITE VEG</i>	86	4.1	2.9	255	3.9	2.9	122	3.4	2.6	0.0968
<i>LEGUMES</i>	86	0.5	1.0	255	0.6	0.9	122	0.7	1.0	0.3479
<i>OTHER VEG</i>	86	3.4	4.0	255	5.7	6.4	122	5.0	4.3	0.0030
<i>MIXED VEG</i>	86	1.7	1.9	255	2.9	3.5	122	5.3	6.8	0.0001
<i>HIGH C FRUIT</i>	86	15.4	9.4	255	17.6	10.1	122	16.9	10.8	0.2442
<i>LOW C FRUIT</i>	86	11.8	8.8	255	12.3	7.2	122	12.4	7.4	0.8434
<i>OTHER FRUIT</i>	86	1.0	2.0	255	1.5	3.6	122	0.7	1.2	0.0511
<i>HIGH SUG/FAT</i>	86	20.9	10.7	255	19.6	11.1	122	19.1	10.9	0.4873
<i>OTHER</i>	86	12.0	12.2	255	14.1	13.4	122	12.2	11.3	0.2478

# TABLE 15

## PERCENTAGE IDEAL BODY WEIGHT (IBW) BY TOTAL FISH, FRESH FISH/TYPE AND RESPIRATORY GROUP

	n	MALNOURISHED (<80% IBW) %	UNDERWEIGHT (80-89% IBW) %	NORMAL WEIGHT (90-109% IBW) %	OVERWEIGHT (110-120% IBW) %	OBESE (>120% IBW) %
<b>SAMPLE POPULATION</b>	468	3.6	19.7	47.9	16.0	12.8
<b>TOTAL FISH SERVES</b>						
NO FISH	95	3.2	22.1	43.2	16.8	14.7
ONE SERVEWEEK OR LESS	171	5.3	18.7	48.5	14.0	13.5
MORE THAN ONE SERVEWEEK	202	2.5	19.3	49.5	17.3	11.4
<b>TOTAL FISH EXCLUDING CANNED FISH &amp; FISH FINGERS</b>						
NO FISH	160	2.5	20.0	45.0	16.9	15.6
ONE SERVEWEEK OR LESS	228	4.4	19.7	48.7	14.5	12.7
MORE THAN ONE SERVEWEEK	80	3.8	18.8	51.3	18.8	7.5
<b>FRESH FISH TYPE</b>						
NO FRESH FISH	87	1.2	14.9	55.2	16.1	12.6
NON-OILY FR. FISH	256	4.7	18.0	43.0	18.8	15.6
OILY FRESH FISH	125	3.2	26.4	52.8	10.4	7.2
ANY FRESH FISH	381	4.2	20.7	46.2	16.0	12.9
<b>RESPIRATORY GROUP</b>						
NORMAL	263	3.8	20.5	51.0	12.6	12.2
HYPERRESPONSIVE	55	3.6	12.7	43.6	25.5	14.6
WHEEZE	79	2.5	24.1	36.7	24.1	12.7
CURRENT ASTHMA	71	4.2	16.9	52.1	12.7	14.1

# TABLE 16

## COMPARISON OF STANDARD DEVIATIONS (SD) FOR HEIGHT AND WEIGHT WITH TOTAL FISH, FRESH FISH/TYPE AND RESPIRATORY GROUP

	n	MEAN SD HEIGHT	MEAN SD WEIGHT
<b>FISH QUANTITY</b>			
<b>TOTAL FISH</b>			
No fish	95	0.33	0.38
One or less serves/week	171	0.39	0.49
More than one serve/week	202	0.22	0.27
p value		0.22	0.17
<b>EXCL. CANNED FISH &amp; FISH FINGERS</b>			
No fish	160	0.33	0.47
One or less serves/week	228	0.36	0.41
More than one serve/week	80	0.12	0.06
p value		0.15	<b>0.02</b>
<b>FISH TYPE</b>			
No fresh fish	87	0.37	0.50
Any Fresh fish	381	0.29	0.34
p value		0.49	0.24
No fresh fish	87	0.37	0.50
Non-oily fresh fish only	256	0.31	0.47
Oily fresh fish	125	0.25	0.09
p value		0.68	<b>0.00</b>
<b>RESPIRATORY GROUP</b>			
NORMAL	263	0.30	0.32
AHR	55	0.34	0.49
p value		0.81	0.29
Wheeze	79	0.28	0.39
p value		0.86	0.62
Current Asthma	71	0.32	0.44
p value		0.87	0.42



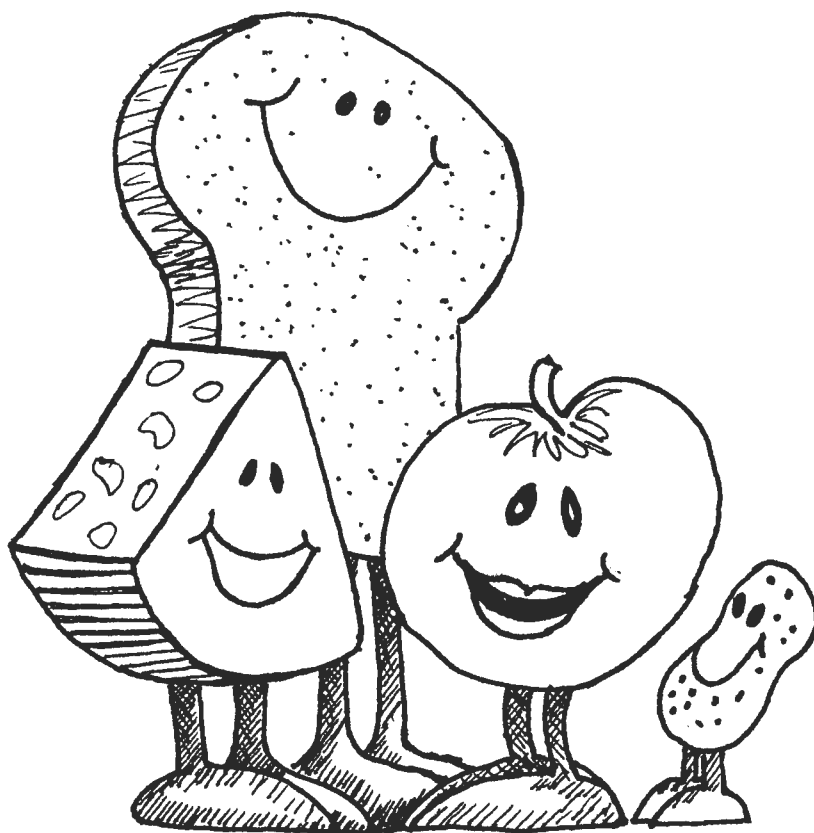
# TABLE 17

## NUTRIENT INTAKE OF SAMPLE POPULATION AND RECOMMENDED DIETARY INTAKES

NUTRIENT	RECOMMENDED DIETARY INTAKES FOR 8-11 YEAR OLD CHILDREN	POPULATION MEAN
KILOJOULES	8,800 - 9,200	10,700
PROTEIN (gm)	27 - 39	95
VITAMIN A (mcg)	500	1,400
THIAMIN (mg)	0.8 - 0.9	1.8
RIBOFLAVIN (mg)	1.3 - 1.4	2.6
NIACIN (mg)	14 - 16	22
VITAMIN B6 (mg)	1.0 - 1.6	2.0
VITAMIN B12 (mcg)	1.5	4.7
PANTOTHENIC ACID (mg) (USA)	4.0 - 5.0	6.2
BIOTIN (mcg) (USA)	30	28
TOTAL FOLATE (mcg)	150	260
VITAMIN C (mg)	30	200
VITAMIN D (mcg) (USA)	10	2.4
VITAMIN E (mg)	8	10
CALCIUM (mg)	800 - 900	1,300
COPPER (mg) (USA)	1 - 2	1.9
IRON (mg)	6 - 8	16
MAGNESIUM (mg)	160 - 180	380
MANGANESE (mg) (USA)	2 - 3	3.9
PHOSPHOROUS (mg)	800	1,700
POTASSIUM (mg)	1,950 - 5,460	4,200
SELENIUM (mcg)	50	140
SODIUM (mg)	600 - 2,300	3,000
ZINC (mg)	9	13

# APPENDIX

# ***CHILDREN'S DIETARY BOOKLET***



Dear Parent

Thank you for agreeing to take part in this study. We are asking you to complete a food questionnaire for your child (with his or her help) to help us answer important questions about how the things children eat affect their health.

We realise that children's eating habits can be extremely variable, but we would like you, as far as possible, to fill out the booklet as it relates to your child's usual eating patterns over the past year. If your child has made any major changes in the past two months, disregard these.

Please look at the examples over the page before filling out the rest of the questionnaire.

When you have completed the questionnaire, please have your child return it to his or her teacher at school. As soon as the results are available we will mail you a free assessment of your child's diet.

If you have any problems with the booklet, please ring Linda Hodge on 516 8583.

Thanks once again for your help!

## PLEASE SIGN HERE :

I give my consent for this information about my child's diet to be used in a research study of diet and asthma. I understand that the information is confidential and that I can withdraw my consent at any time.

Signature : ..... Date : .....  
(Parent or guardian)

## YOUR CHILD'S EATING HABITS

This section is about the kinds of foods your child usually eats. On the next few pages you will find lists of foods, separated by questions about your child's eating habits.

Read through each list of foods and record about how often your child usually eats these foods. We realise that your child's food intake may vary from time to time, so just try to give us the best overall picture of what your child eats that you can.

We are interested in **YOUR CHILD'S** eating habits, not that of someone else in your household.

### THIS IS HOW TO ANSWER

We are going to ask you "About how often does your child usually eat these foods?" Use the following simple code to write your answer in the space next to each food.

If your child **NEVER** has a food ..... write **N**  
If your child **RARELY** has a food (less than once a month) ..... write **R**

If your child usually eats a food

About **once** a **MONTH** ..... write **1M**  
About **twice** a **MONTH** ..... write **2M**  
About **three** times a **MONTH** ..... write **3M**

About **once** a **WEEK** ..... write **1W**  
About **twice** a **WEEK** ..... write **2W**  
About **three** times a **WEEK** ..... write **3W**  
and so on ..... (**4W, 5W, 6W**)

About **once** a **DAY** ..... write **1D**  
About **twice** a **DAY** ..... write **2D**  
and so on ..... (**3D, 4D, 5D, etc**)

### Standard Serves

Alongside each food there is a "standard serve" size. The "standard" serve is not necessarily a "normal" serve, it is simply there to help us measure food intake. If your child usually eats more or less than the standard serve size for a particular food, please indicate on the **COMMENTS** line what amount is usually eaten.

For example, if when your child eats icecream he/she has one "scoop" instead of our "standard" serve of two "scoops", indicate how often icecream is eaten, and then write "one scoop only" on the comments line.

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On the opposite page you will see some examples of how to fill out the questionnaire. Please read these carefully before you start to fill out the answers for your child's diet.

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## HOW TO ANSWER

NEVER <b>N</b>	RARELY <b>R</b>	Times a MONTH <sup>1</sup> / <sub>2</sub> / <sub>3</sub> <b>M</b>	Times a WEEK <sup>1</sup> / <sub>2</sub> / <sub>3</sub> <b>W</b> and so on	Times a DAY <sup>1</sup> / <sub>2</sub> / <sub>3</sub> <b>D</b> and so on
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### HERE ARE SOME EXAMPLES

	<u>STANDARD SERVE</u>	<u>COMMENTS</u>
Custard	1/2 cup	..... _____
Boiled egg	1 egg	..... _____
Cucumber	3 slices (each 0.5 cm thick)	..... _____
Tea	1 cup	..... _____
Beetroot - canned	2 slices	..... _____

The child above has, on average :-

- A standard serve of custard **three times a week**
- Two boiled eggs **three times a month**
- Rarely eats cucumber
- Four cups of tea **every day**
- Half a standard serve (1 slice) of beetroot - canned,  
twice a month

---

We realise that some parents have an exact idea of how often their child eats particular foods, whilst others only have an approximate idea. Be as accurate as you can but do not spend too much time choosing your answers.

---

**PLEASE GIVE AN ANSWER FOR EVERY FOOD**

## HOW TO ANSWER

NEVER <b>N</b>	RARELY <b>R</b>	Times a MONTH <sup>1</sup> / <sub>2</sub> / <sub>3</sub> <b>M</b>	Times a WEEK <sup>1</sup> / <sub>2</sub> / <sub>3</sub> <b>W</b> and so on	Times a DAY <sup>1</sup> / <sub>2</sub> / <sub>3</sub> <b>D</b> and so on
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### ABOUT HOW OFTEN DOES YOUR CHILD USUALLY EAT THESE FOODS?

<u>CEREALS</u>			<u>COMMENTS</u>
Porridge/Oatmeal	1 cup (cooked)	.....	_____
Muesli	1/2 cup	.....	_____
Other breakfast cereal	1 cup	.....	_____
Plain bran (raw)	1 tablespoon	.....	_____
Wheatgerm	1 tablespoon	.....	_____
Bread roll (NOT hamburger buns)	1 roll	.....	_____
Fried rice	1 cup (cooked)	.....	_____
Boiled rice	1 cup (cooked)	.....	_____
Instant noodles (Maggi etc.)	1 cup (cooked)	.....	_____
Other pasta (spaghetti, macaroni etc.)	1 cup (cooked)	.....	_____

**Q-1** How many slices of bread does your child usually eat? **Remember the bread in toast and sandwiches.** If bread is not eaten at all, write 'none'.

\_\_\_\_\_ slices/day OR \_\_\_\_\_ slices/week ...

**Q-2** What type of bread does your child usually eat? (Circle the number beside one answer)

- 1 Wholemeal or mixed grain
- 2 White
- 3 About half the time wholemeal and half white
- 4 Other breads (e.g. rye, Hi-Fibe)  
(please specify type) .....
- 5 My child does not eat bread

**Q-3** Does your child eat low-salt types of bread? (Circle one answer)

ALL or MOST OF THE TIME OCCASIONALLY RARELY/NEVER

**Q-4** Which of the following does your child usually spread on bread or crackers? (Circle **one** answer)

- 1 Butter
- 2 Polyunsaturated margarine
- 3 Table or cooking margarine
- 4 Reduced-fat margarine (e.g. Era, Becel Light)
- 5 Dripping/Lard
- 6 My child does not use anything
- 7 My child does not eat bread or crackers
- 8 Something else : please name .....

**Q-5** For whatever spread your child has, is it usually the regular variety or reduced salt? (Circle **one** answer)

- 1 Usually has the regular variety
- 2 Usually has the reduced-salt variety

**Q-6** What types of breakfast cereals does your child most commonly eat?

Please name : .....

**Q-7** If your child eats muesli is it : (Circle **one** answer)

- 1 Home made muesli
- 2 Pre-packaged muesli

**Q-8** How many cups of milk does your child usually add to breakfast cereal, porridge or muesli ? (Circle the number closest to the amount he/she has)

- 1 None
- 2 About a half a cup
- 3 About one cup
- 4 About one and a half cups
- 5 About two cups or more (please state how much .....

**Q-9** What type of milk does your child usually add to cereals, porridge or muesli? (e.g. whole milk, Hi-Lo, Lite, skim, powdered skim, Shape, Farmers Best, goat's milk, condensed/evaporated milk etc.)?

Type of milk added : .....

**Q-10** How many teaspoons of sugar or honey does your child usually add to cereal, porridge or muesli. (Note : 1 level dessertspoon = 2 level teaspoons)

Write the number of level teaspoons your child has here : .....

**Q-11** Does your child add salt to porridge? (Circle **one** number)

- 1 Yes
- 2 No
- 3 He/she doesn't eat porridge



## HOW TO ANSWER

NEVER <b>N</b>	RARELY <b>R</b>	Times a MONTH <sup>1</sup> <sub>2</sub> <sup>3</sup> <b>M</b>	Times a WEEK <sup>1</sup> <sub>2</sub> <sup>3</sup> <b>W</b> and so on	Times a DAY <sup>1</sup> <sub>2</sub> <sup>3</sup> <b>D</b> and so on
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ABOUT HOW OFTEN DOES YOUR CHILD USUALLY EAT THESE FOODS?

<u>CEREAL FOODS</u>					<u>COMMENTS</u>
Crumpet or Muffin	1	.....	.....	.....	
Croissant	1	.....	.....	.....	
Fruit Loaf/Currant bread	1 slice	.....	.....	.....	
Sweet bun/doughnut	1	.....	.....	.....	
Crispbread/Cracker	2	.....	.....	.....	
Salted biscuits	3	.....	.....	.....	
Plain sweet biscuits	2	.....	.....	.....	
Fancy biscuits (eg choc-coated)	2	.....	.....	.....	
Cake	1 small cake or 1 slice large cake	.....	.....	.....	
Milk pudding (eg rice, sago)	1/2 cup	.....	.....	.....	
Steamed sponge - suet	1/4 small pudding	.....	.....	.....	

**Q-1** Does your child have milk :

(Circle one for each)

in tea?	YES	NO	DOES NOT DRINK TEA
in coffee?	YES	NO	DOES NOT DRINK COFFEE
in coffee substitute?	YES	NO	DOES NOT DRINK COFFEE SUBSTITUTE

## HOW TO ANSWER

NEVER  
**N**

RARELY  
**R**

Times a  
MONTH  
<sup>1</sup>/<sub>2</sub>/<sub>3</sub> **M**

Times a  
WEEK  
<sup>1</sup>/<sub>2</sub>/<sub>3</sub> **W**  
and so on

Times a  
DAY  
<sup>1</sup>/<sub>2</sub>/<sub>3</sub> **D**  
and so on

ABOUT HOW OFTEN DOES YOUR CHILD USUALLY HAVE THESE DRINKS?

<u>BEVERAGES</u>			<u>COMMENTS</u>
Sustagen (made with powder)	1 cup	.....	_____
Sustagen Gold	small carton (300 ml)	.....	_____
Carton of other flavoured milk (eg chocolate, strawberry etc)	small carton (300 ml)	.....	_____
Cocoa	1 cup	.....	_____
Drinking Chocolate/Milo/ Quik etc.	1 cup	.....	_____
Akta-Vite	1 cup	.....	_____
Glass of milk (as such)	1 glass	.....	_____
Milk shake/Thick shake	regular size	.....	_____
Tea	1 cup	.....	_____
Herbal tea	1 cup	.....	_____
Instant coffee	1 cup	.....	_____
Ground coffee (eg filter/drip)	1 cup	.....	_____
Decaffeinated coffee	1 cup	.....	_____
Coffee substitute (eg Caro)	1 cup	.....	_____

**Q-2** Does your child have cocoa/chocolate/Milo/Akta-Vite with : (Circle **one** number)

- 1 Mostly milk?
- 2 Mostly water?
- 3 About half and half?
- 4 He/she does not drink these drinks.

**Q-3** What type of milk does your child usually add to tea/coffee/cocoa/chocolate etc?  
(Please state the type of milk used eg whole milk, Lite, Hi-Lo, skim, powdered skim, Shape, Farmers Best, goats milk, condensed milk, evaporated milk etc.)

Type of milk added .....

**Q-4** How many **teaspoons** of sugar/honey does your child usually have in each cup of :

(Circle **one** number for each drink)

Tea?	0	1	2	3	4	5	6
Coffee?	0	1	2	3	4	5	6
Coffee substitute?	0	1	2	3	4	5	6
Cocoa?	0	1	2	3	4	5	6
Milo/Quik/Chocolate?	0	1	2	3	4	5	6

## HOW TO ANSWER

NEVER <b>N</b>	RARELY <b>R</b>	Times a MONTH <sup>1</sup> / <sub>2</sub> / <sub>3</sub> <b>M</b>	Times a WEEK <sup>1</sup> / <sub>2</sub> / <sub>3</sub> <b>W</b> and so on	Times a DAY <sup>1</sup> / <sub>2</sub> / <sub>3</sub> <b>D</b> and so on
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### ABOUT HOW OFTEN DOES YOUR CHILD USUALLY EAT THESE FOODS?

<u>DAIRY PRODUCTS and EGGS</u>				<u>COMMENTS</u>
Cheese	30 grams (1 slice)		.....	_____
Low-fat cottage cheese	100 gm (1/2 carton)		.....	_____
Cream	1 tablespoon		.....	_____
Yoghurt	200 gm (1 carton)		.....	_____
Icecream (from a tub)	2 scoops	SUMMER	.....	_____
		WINTER	.....	_____
Icecream desserts (eg Symphony, Vienetta)	1 serving	SUMMER	.....	_____
		WINTER	.....	_____
Icecream (on a stick/cone)	1 icecream	SUMMER	.....	_____
		WINTER	.....	_____
Vitari	1 cone	SUMMER	.....	_____
		WINTER	.....	_____
Ice block/Icy Pole	1	SUMMER	.....	_____
		WINTER	.....	_____
Custard	1/2 cup		.....	_____
Fried egg	1 egg		.....	_____
Boiled egg	1 egg		.....	_____
Omelette/Scrambled eggs	2 eggs		.....	_____

**Q-1** When your child eats cheese, does he/she have the **reduced-salt** varieties (Circle **one** number)

- 1 Always or nearly always
- 2 Sometimes
- 3 Rarely or never
- 4 He/she does not eat cheese

**Q-2** When your child eats cheese, does he/she have the **reduced-fat** varieties (Circle **one** number)

- 1 Always or nearly always
- 2 Sometimes
- 3 Rarely or never
- 4 He/she does not eat cheese

**Q-3** When your child eats yoghurt which type is it? (Circle **one** number)

- 1 Plain (eg not fat-reduced)
- 2 Plain, low fat
- 3 Fruit flavoured (not fat-reduced)
- 4 Fruit flavoured, low-fat
- 5 Frozen yoghurt
- 6 He/she does not eat yoghurt

**Q-4** When your child eats ice-cream, diet-ice or similar is it **usually**? (Circle **one** number)

- 1 Low calorie
- 2 Regular icecream
- 3 Other (please state .....)

## HOW TO ANSWER

**NEVER**  
**N**

**RARELY**  
**R**

**Times a**  
**MONTH**  
 $\frac{1}{2}$  **M**

**Times a**  
**WEEK**  
 $\frac{1}{2}$  **W**  
and so on

**Times a**  
**DAY**  
 $\frac{1}{2}$  **D**  
and so on

### ABOUT HOW OFTEN DOES YOUR CHILD USUALLY EAT THESE FOODS?

<u>MEATS</u>		<u>COMMENTS</u>	
Steak (eaten as such)	1 medium (100g) ..... (approximately size of fillet)		_____
Pork chop	1 medium chop .....		_____
Lamb chop (loin chop size)	2 chops .....		_____
Roast pork/pork fillet	2 slices .....		_____
Roast beef/veal	2 slices .....		_____
Roast lamb	2 slices .....		_____
Sausages	2 thick or 3 thin .....		_____
Frankfurters/Saveloys	2 thick or 3 thin .....		_____
Bacon	2 rashers .....		_____
Ham	3 thin or 2 thick slices .....		_____
Luncheon meat/Fritz/ Devon/Windsor etc.	3 slices ..... (1 cm thick if small nob)		_____
Continental Sausage (salami/Mettwurst etc)	3 slices .....		_____
Pate/liver paste	1 tablespoon .....		_____
Liver	1/2 liver (150 gm) .....		_____
Kidney	2 kidneys .....		_____
Brains	1/2 cup .....		_____
Pureed meat dishes (canned/bottled)	1/2 cup .....		_____

## HOW TO ANSWER

NEVER  
**N**

RARELY  
**R**

Times a  
MONTH  
<sup>1</sup><sub>2</sub><sup>3</sup>**M**

Times a  
WEEK  
<sup>1</sup><sub>2</sub><sup>3</sup>**W**  
and so on

Times a  
DAY  
<sup>1</sup><sub>2</sub><sup>3</sup>**D**  
and so on

ABOUT HOW OFTEN DOES YOUR CHILD USUALLY EAT THESE FOODS?

<u>MIXED DISHES</u>				<u>COMMENTS</u>
Hamburger WITH bun	1 medium	.....	_____	
Hamburger patty WITHOUT bun	1 medium	.....	_____	
Pizza (frozen)	1 mini or 1/4 large	.....	_____	
Pizza (homemade or take-away)	1/2 small or 1/4 large	.....	_____	
Sausage roll	1 large or 2 small	.....	_____	
Meat pie	1 individual	.....	_____	
Meat pie (homemade)	1 individual or 1 slice of large pie	.....	_____	
Pastie	1 individual	.....	_____	
Crumbed veal (schnitzel)	1 large piece	.....	_____	
Stew/casserole/curry/goulash (with meat or chicken)	1 cup	.....	_____	
Stew/casserole/curry/goulash (without meat or chicken)	1 cup	.....	_____	
Chinese meat and veg dish	1 cup	.....	_____	
Savoury pies/pastries (eg quiche)	1 individual OR 1 slice of large pie	.....	_____	
Mince meat (eaten as such)	1 cup	.....	_____	
Mince meat dishes (eg Shepherds' pie)	1 piece (8x8x4cm)	.....	_____	
Spicy mince added to pastas (eg spag. sauce)	1/2 cup mince	.....	_____	

## HOW TO ANSWER

<b>NEVER</b>	<b>RARELY</b>	<b>Times a MONTH</b>	<b>Times a WEEK</b>	<b>Times a DAY</b>
<b>N</b>	<b>R</b>	<sup>1</sup> / <sub>2</sub> / <sub>3</sub> <b>M</b>	<sup>1</sup> / <sub>2</sub> / <sub>3</sub> <b>W</b>	<sup>1</sup> / <sub>2</sub> / <sub>3</sub> <b>D</b>
			and so on	and so on

**ABOUT HOW OFTEN DOES YOUR CHILD USUALLY EAT THESE FOODS?**

<u>CHICKEN, FISH AND SEAFOOD</u>			<u>COMMENTS</u>
Roast/Barbecue chicken	2 slices of breast or 1 drumstick or 2 wings	.....	_____
Boiled chicken	as above	.....	_____
Crumbed, fried chicken	4 small pieces	.....	_____
Chicken nuggets	6 nuggets	.....	_____
Fish - fried	1 piece or 6 nuggets	.....	_____
Fish without batter (steamed, grilled/boiled)	1 piece	.....	_____
Canned fish (tuna, salmon etc)	1/3 cup	.....	_____
Fish Fingers	3 - 4 fingers	.....	_____
Seafood (prawns, crab, lobster etc)	1/2 cup	.....	_____
Mornay dishes	1 cup	.....	_____

**Q-1** If your child eats the following meats, how are they usually cooked? (Circle **one** for each food)

Steak	FRIED	GRILLED/BAKED	MICROWAVED	DON'T EAT
Chops	FRIED	GRILLED/BAKED	MICROWAVED	DON'T EAT
Sausages	FRIED	GRILLED/BAKED	MICROWAVED	DON'T EAT
Bacon	FRIED	GRILLED/BAKED	MICROWAVED	DON'T EAT

**Q-2** When your child eats meat with fat on it, does he/she eat : (Circle **one** number)

- 1 All of the fat
- 2 Most of the fat
- 3 About half of the fat
- 4 Little or none of the fat
- 5 He/she does not eat meat



**Q-3** Does your child have the skin removed from their chicken? (Circle **one** number)

- 1 Always or nearly always
- 2 Sometimes (about half the time or less)
- 3 Rarely (less than a quarter of the time)
- 4 Never
- 5 He/she does not eat chicken

**Q-4** If your child eats fried fish, in which of the following is it usually coated? (Circle **one** number)

- 1 Batter
- 2 Breadcrumbs
- 3 Flour
- 4 Other coating; please name.....
- 5 Fried without coating

**Q-5** When your child eats fish coated in batter, crumbs etc how often is it: (Circle **one for each**)

Coated at home	ALWAYS	SOMETIMES	RARELY	NEVER
Pre-packed, frozen cooked at home	ALWAYS	SOMETIMES	RARELY	NEVER
Bought ready cooked from fish shop	ALWAYS	SOMETIMES	RARELY	NEVER

**Q-6** If you buy fresh fish for your child, what variety is it usually? .....

## HOW TO ANSWER

NEVER  
**N**

RARELY  
**R**

Times a  
MONTH  
<sup>1</sup>/<sub>2</sub><sup>3</sup> **M**

Times a  
WEEK  
<sup>1</sup>/<sub>2</sub><sup>3</sup> **W**  
and so on

Times a  
DAY  
<sup>1</sup>/<sub>2</sub><sup>3</sup> **D**  
and so on

ABOUT HOW OFTEN DOES YOUR CHILD USUALLY EAT THESE FOODS?

CANNED and DRIED VEGETABLES

COMMENTS

Potato - canned	2-3 small	.....	
Potato - packet (powdered)	1/3 cup (cooked)	.....	
Potato salad	1/3 cup	.....	
Carrots - canned	1/3 cup	.....	
Beetroot - canned	2 slices	.....	
Green beans - canned	1/3 cup	.....	
Haricot, Lima beans - canned	1/3 cup	.....	
Baked beans in tomato sauce	1/3 cup	.....	
Green peas - canned	1/3 cup	.....	
Lentils - dried/canned	1/3 cup	.....	
Zucchini salad	1/3 cup	.....	
Sweetcorn - canned (including creamed corn)	1/3 cup	.....	
Mushrooms - canned	6-7 small ones	.....	
Mushrooms - canned in sauce	1/3 cup	.....	
Olives	3 medium	.....	
Gherkins/Pickled onions	3 pieces	.....	
Pureed vegetables (canned/bottled)	1/3 cup	.....	

## HOW TO ANSWER

**NEVER**  
**N**

**RARELY**  
**R**

Times a  
MONTH  
<sup>1</sup>/<sub>2</sub>/<sub>3</sub> **M**

Times a  
WEEK  
<sup>1</sup>/<sub>2</sub>/<sub>3</sub> **W**  
and so on

Times a  
DAY  
<sup>1</sup>/<sub>2</sub>/<sub>3</sub> **D**  
and so on

The following list of foods contains some vegetables that may be eaten much more frequently at some times of the year than others (eg in the warmer or cooler weather). Please fill in how often each food is eaten in **BOTH** the warmer months of the year (**SUMMER**) and the cooler months (**WINTER**).

**For example :-** If your child usually has :

A standard serve of peas about twice a week during the warmer months of the year and about every day during the cooler months :

and:

Two medium potatoes (roasted) a week throughout the year :

You would write :

		<u>Summer</u>	<u>Winter</u>	
Green peas	1 cup	.....	.....	
Potato - roasted	1 medium	.....	.....	

### ABOUT HOW OFTEN DOES YOUR CHILD USUALLY EAT THESE FOODS?

#### SEASONAL VEGETABLES

		<u>Summer</u>	<u>Winter</u>	
Potato - fresh & mashed (with milk)	1/3 cup	.....	.....	
Potato - fresh, boiled	1 medium	.....	.....	
Potato - roasted	1 medium	.....	.....	
French fries/hot chips	17-18 chips	.....	.....	
Potato Gems/ Pommes Noisettes	about 5	.....	.....	
Carrots (fresh/frozen)	1/3 cup	.....	.....	
Turnip/Swede (fresh/frozen)	1/3 cup	.....	.....	
Broad beans (fresh/frozen)	1/2 cup	.....	.....	
Green beans (fresh/frozen)	1/3 cup	.....	.....	

**SEASONAL VEGETABLES (continued)**Summer   Winter

<b>Green peas (fresh/frozen)</b>	1/3 cup	.....	.....	_____
<b>Cabbage</b>	1/3 cup	.....	.....	_____
<b>Brussels sprouts (fresh/frozen)</b>	5 - 6	.....	.....	_____
<b>Silver beet/spinach (fresh/frozen)</b>	1/3 cup	.....	.....	_____
<b>Broccoli (fresh/frozen)</b>	1/3 cup	.....	.....	_____
<b>Cauliflower (fresh/frozen)</b>	1/2 cup	.....	.....	_____
<b>Pumpkin</b>	1/3 cup	.....	.....	_____
<b>Sweetcorn (fresh/frozen)</b>	1 small cob	.....	.....	_____
<b>Zucchini (courgettes)</b>	1 medium sized	.....	.....	_____
<b>Onion - fried</b>	1/4 cup	.....	.....	_____
<b>Onion (raw, baked, boiled) (fresh/frozen)</b>	1 medium	.....	.....	_____
<b>Tomato - fresh</b>	1 medium	.....	.....	_____
<b>Tomato - grilled/fried</b>	1/2 medium	.....	.....	_____
<b>Lettuce</b>	2 small leaves	.....	.....	_____
<b>Cucumber</b>	3 slices (each 0.5 cm thick)	.....	.....	_____
<b>Coleslaw</b>	1/2 cup	.....	.....	_____
<b>Celery (fresh/frozen)</b>	1 x 15cm stick	.....	.....	_____
<b>Capsicum (Green pepper) (fresh/frozen)</b>	2 strips (each 0.5 cm thick)	.....	.....	_____
<b>Mushrooms - fresh</b>	6-7 small ones	.....	.....	_____
<b>Sprouted bean shoots</b>	1/3 cup	.....	.....	_____
<b>Fried mixed vegetables (eg stir fried)</b>	1/2 cup	.....	.....	_____

**Q-1** When you use canned vegetables, are they reduced-salt varieties? (Circle one number)

- 1 Always or nearly always
- 2 Sometimes
- 3 Never or rarely
- 4 Only for some vegetables (please state which.....)

**Q-2** Is salt added to the cooking water when boiling the following foods? ( Circle one for each food)

Vegetables	USUALLY	SOMETIMES	NEVER
Pasta and rice	USUALLY	SOMETIMES	NEVER

**Q-3** If salt is added to the cooking water when boiling foods, is the water : (Circle one number)

- 1 Lightly salted
- 2 Medium salted
- 3 Heavily salted
- 4 Salting is highly varied
- 5 Salt is not added to cooking water

**Q-4** How often do you add salt to your child's meals after they are cooked? (Circle one number)

- 1 Rarely or never
- 2 Sometimes
- 3 Always or nearly always

**Q-5** When you add salt at the table to your child's meals, how much is usually added?  
(Circle one number)

- 1 A light sprinkle
- 2 A medium sprinkle
- 3 A heavy sprinkle
- 4 Salting is highly varied
- 5 Salt is not added at the table

**Q-6** When you cook vegetables for your child which of the following methods is the one most commonly used? (Circle one number)

- 1 Boiled in a little water
- 2 Boiled in a lot of water
- 3 Steamed
- 4 Cooked in a pressure cooker
- 5 Microwaved
- 6 Stir-fried

- |            |          |  |          |                           |
|------------|----------|--|----------|---------------------------|
| <b>Q-7</b> | <b>1</b> | Vegetable oils (olive, sunflower etc.) | <b>4</b> | Dripping/lard/meat juices |
|            | <b>2</b> | Cooking or table margarine             | <b>5</b> | Polyunsaturated margarine |
|            | <b>3</b> | Butter                                 | <b>6</b> | Nothing                   |

From the list above write which type of fat/oil is most commonly used :

- (a) When roasting/frying meats/fish.....
- (b) When roasting/frying vegetables.....
- (c) On vegetables when served (eg butter on peas).....

**Q-8** Is butter or margarine added to your child's potatoes when they are mashed?

(Circle one number)

- 1 Yes, always
- 2 Yes, occasionally
- 3 Never

## HOW TO ANSWER

<b>NEVER</b>	<b>RARELY</b>	<b>Times a MONTH</b>	<b>Times a WEEK</b>	<b>Times a DAY</b>
<b>N</b>	<b>R</b>	<sup>1</sup> / <sub>2,3</sub> <b>M</b>	<sup>1</sup> / <sub>2,3</sub> <b>W</b>	<sup>1</sup> / <sub>2,3</sub> <b>D</b>
			and so on	and so on

**ABOUT HOW OFTEN DOES YOUR CHILD USUALLY EAT THESE FOODS?**

<u>FRUIT</u>				<u>COMMENTS</u>
Orange, Mandarin, Grapefruit	1 medium	.....		_____
Apple, Pear - fresh/baked	1 medium	.....		_____
Banana	1 medium	.....		_____
Fresh fruit salad	1 cup	.....		_____
Dried fruit (apple/apricot etc)	4-5 pieces	.....		_____
Raisins, sultanas or currants	1/3 cup	.....		_____
Fruit in syrup or stewed (including fruit salads)	1/2 cup	.....		_____
Fruit canned in water (low-cal) (including fruit salads)	1/2 cup	.....		_____
Fruit pie or pastry or fritters	1 small pie or 1 slice large	.....		_____

## HOW TO ANSWER

<b>NEVER</b>	<b>RARELY</b>	<b>Times a</b>	<b>Times a</b>	<b>Times a</b>
<b>N</b>	<b>R</b>	<b>MONTH</b>	<b>WEEK</b>	<b>DAY</b>
		<sup>1</sup> / <sub>2</sub> / <sub>3</sub> <b>M</b>	<sup>1</sup> / <sub>2</sub> / <sub>3</sub> <b>W</b>	<sup>1</sup> / <sub>2</sub> / <sub>3</sub> <b>D</b>
			and so on	and so on

The fruits listed below are only available for a short time during the year. Therefore we only want you to record how often your child has them when they are IN SEASON.

### HOW OFTEN DOES YOUR CHILD EAT THESE FOODS WHEN THEY ARE IN SEASON?

#### SEASONAL FRUITS

#### COMMENTS

Berries - fresh/frozen	3/4 cup	.....	
Melon (not watermelon)	1 large slice	.....	
Peach - fresh	1 medium	.....	
Plum - fresh	3-4 plums	.....	
Nectarine - fresh	1 medium	.....	
Apricot - fresh	3 apricots	.....	
Grapes - fresh	about 20	.....	
Pineapple - fresh	1 slice	.....	
Avocado	1/2 a medium	.....	

Please list here, along with your child's standard serve size, any other fruit that your child eats (eg mango; pureed, canned/bottled fruits)

		.....	
		.....	

### HOW OFTEN DOES YOUR CHILD USUALLY EAT THESE FOODS?

#### NUTS and SNACKS

#### COMMENTS

Potato crisps, Twisties etc	1 small bag or	.....	
	14 - 15 pieces		
Peanuts (fresh)	9 - 10 nuts	.....	
Nuts - salted & cooked	9 - 10 nuts	.....	
Other unsalted nuts (fresh walnuts/almonds etc)	5 - 6 nuts	.....	

## HOW TO ANSWER

NEVER  
**N**

RARELY  
**R**

Times a  
MONTH  
<sup>1</sup>/<sub>2</sub> **M**

Times a  
WEEK  
<sup>1</sup>/<sub>2</sub> **W**  
and so on

Times a  
DAY  
<sup>1</sup>/<sub>2</sub> **D**  
and so on

**ABOUT HOW OFTEN DOES YOUR CHILD USUALLY EAT THESE FOODS?**

**SOUPS**

**COMMENTS**

<b>Canned soup (eaten as such)</b>	1 cup	WINTER .....	_____
		SUMMER .....	_____
<b>Packet soup (eaten as such)</b>	1 cup	WINTER .....	_____
		SUMMER .....	_____
<b>Homemade soup (eaten as such)</b>	1 cup	WINTER .....	_____
		SUMMER .....	_____

**Write an example of the type of soup your child most often eats (eg canned tomato; homemade pea and ham)**

.....



## HOW TO ANSWER

NEVER  
**N**

RARELY  
**R**

Times a  
MONTH  
<sup>1</sup>/<sub>2</sub> **M**

Times a  
WEEK  
<sup>1</sup>/<sub>2</sub>/<sub>3</sub> **W**  
and so on

Times a  
DAY  
<sup>1</sup>/<sub>2</sub>/<sub>3</sub> **D**  
and so on

**ABOUT HOW OFTEN DOES YOUR CHILD USUALLY EAT THESE FOODS?**

CONFECTIONERY, JAMS AND SAUCES

COMMENTS

Chocolate	1 small bar (50 grams)	.....	_____
Chocolate covered bar (eg Mars/Bounty)	1 bar	.....	_____
Individually wrapped lollies, eg toffees	4 - 5 lollies	.....	_____
Packet lollies (eg Lifesavers/Polos)	1 small packet	.....	_____
Muesli bar/Health bar	1 bar	.....	_____
Honey, jam, marmalade	1 tablespoon	.....	_____
Vegemite, marmite etc	1/2 teaspoon	.....	_____
Thick sauces (tomato/HP etc)	1 tablespoon	.....	_____
Polyunsaturated Mayonnaise/ Salad cream	1 tablespoon	.....	_____
Regular Mayonnaise/ Salad cream	1 tablespoon	.....	_____
Low calorie salad dressings	1 tablespoon	.....	_____
Polyunsaturated salad dressings	1 tablespoon	.....	_____

## HOW TO ANSWER

NEVER  
**N**

RARELY  
**R**

Times a  
MONTH  
<sup>1</sup>/<sub>2</sub>/<sub>3</sub> **M**

Times a  
WEEK  
<sup>1</sup>/<sub>2</sub>/<sub>3</sub> **W**  
and so on

Times a  
DAY  
<sup>1</sup>/<sub>2</sub>/<sub>3</sub> **D**  
and so on

ABOUT HOW OFTEN DOES YOUR CHILD USUALLY HAVE THESE FOODS?

<u>BEVERAGES</u>		<u>COMMENTS</u>	
Glass of cordial	medium glass .....		_____
Glass of cola (eg Coca Cola)	medium glass .....		_____
Glass of fizzy drink Includes mineral water with juice	medium glass .....		_____
Glass of low-calorie fizzy drink	medium glass .....		_____
Fruit drink (eg Fruit Box)	250 ml carton .....		_____
Pure fruit juice	medium glass .....		_____
Vegetable juice	small glass .....		_____
Water/Spring water	medium glass .....		_____
Mineral Water	medium glass .....		_____
Low-alcohol beer	medium glass .....		_____
	230 mls		
Beer	medium glass .....		_____
	230 mls		
Alcoholic cider	medium glass .....		_____
	230 mls		
Wine	1 wine glass .....		_____
Wine Cooler	1 wine glass .....		_____

If your child has any other foods or drinks that we have not mentioned, at least once a month, please write them down here and tell us how often he/she has them, using the same response scale as before (eg 1D, 3M etc).

## HOW TO ANSWER

<b>NEVER</b>	<b>RARELY</b>	<b>Times a MONTH</b>	<b>Times a WEEK</b>	<b>Times a DAY</b>
<b>N</b>	<b>R</b>	<b><sup>1</sup><sub>2</sub><sup>3</sup> M</b>	<b><sup>1</sup><sub>2</sub><sup>3</sup> W</b>	<b><sup>1</sup><sub>2</sub><sup>3</sup> D</b>
			and so on	and so on

### FOODS AND DRINKS MY CHILD CONSUMES THAT HAVE NOT BEEN MENTIONED :

Name of Food	His/her usual serve size	How often is it eaten?
_____	_____	.....
_____	_____	.....
_____	_____	.....
_____	_____	.....
_____	_____	.....

142EOB

### VITAMIN AND MINERAL SUPPLEMENTS

If your child takes any vitamins or minerals, or any other dietary supplements, such as fibre tablets, lecithin, kelp, yeast etc, please fill in the table below. (Check the label on the box or bottle if you are unsure of some of the answers).

BRAND (eg Nyal)	NAME OF PRODUCT (eg vitamin C pill)	SIZE OF DOSE (eg 250 mg)	NUMBER OF DOSES (eg 2 per day)
_____	_____	_____	_____
_____	_____	_____	_____

WHAT WAS YOUR CHILD'S WEIGHT AND LENGTH AT BIRTH .....

WAS YOUR CHILD BREAST FED? (Please circle answer)                      YES                      NO

IF SO, FOR HOW LONG WAS YOUR CHILD BREAST FED? .....

HAS YOUR CHILD CHANGED HIS/HER DIET IN THE PAST 2 - 3 MONTHS?                      YES                      NO

IF SO, WHAT ARE THESE CHANGES? .....