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Abstract

Aims: To investigate the diets of women attending the Royal Prince Alfred Hospital allergy unit nutritional adequacy and nut content.

Method: Participants for the study were recruited on a volunteer basis from the Royal Prince Alfred Hospital Allergy Unit Sydney. A total of 25 participants between the ages 19 and 54 were recruited. Based on their questionnaire answers, participants were divided into four groups for nutritional analysis. These four groups were reference subjects from the clinic population on unmodified diets (n=18), pregnant (n=2), breastfeeding (n=3) and elimination diet (n=3). One subject fell into both the breastfeeding and elimination diet groups. The control group was determined as those subjects that were between the ages of 18 and 60 who were not part of any of the other groups. No subjects over the age of 60 were recruited. Subject groups were compared against the control group and the *Dietary Guidelines for Australian Adults* (DGAA) for nutritional adequacy and nut content, with t-tests being used to test for significant differences between the groups.

Results: It was found that the breastfeeding group did not meet the DGAA in regards to consumption of dairy and fruit. It was also found that the breastfeeding group ate significantly less dairy and fruit then the control group, with p values of 0.03 and 0.001 respectively. The elimination diet group was also found to not meet the DGAA in regards to fruit consumption and be significantly less than the control group with a p value of 0.002.

Conclusion: While dietary deficiencies in the breastfeeding and elimination diet groups may be of some concern on face value, more subjects need to be recruited in order to get conclusive results. The real value of these results is that they demonstrate trends, which can be followed up on in the future once more subjects have been recruited and analysed.

Introduction

Adverse reactions to food can cause or worsen a wide variety of conditions, syndromes or symptoms in the average human being. Some of these reactions are quite mild, for example a light rash, while others are quite server, even leading to death. Although there are many different types of adverse reactions to food, they can generally all be classified into one of two groups. These two groups are:

- Food intolerance
- Food allergy

The term 'food allergy' is used to describe any:

Abnormal, reproducible, immunological mediated, adverse reaction to food

While the term food intolerance is used to describe all other abnormal (individual), reproducible adverse reactions to food (Wahlqvist 2002).

Generally food allergy is either classed as Type I or Type IV hypersensitivity. Type IV hypersensitivity reactions are variable and the severity of the symptoms is usually directly related to dose size (Wahlqvist 2002). They are also often delayed reactions, tending to occur between 24 and 48 hours after the allergen is ingested. Due to the nature

of Type I reactions, they are often more serious then Type IV reactions. Type I reactions are not dose related and are often referred to as 'all or nothing' reactions. They generally occur with in 60 minutes of exposure to the allergen. These reactions involve histamine release, which causes the contraction of smooth muscle, stimulates irritant receptors causing itching and increased vascular permeability which, in turn, can lead to a decrease in blood volume and anaphylactic shock (Wahlqvist 2002).

While the symptoms and thus the methods for diagnosing food allergies are understood quite well, there are still gaps in understanding when it comes to the reasons that these food allergies. Particularly, why has there been a sharp rise in the incidence of certain food allergies, such as nut allergies, since the 1980's? This study aims to help establish the idea that changes in eating habits, along with environmental factors have been responsible for this sharp rise in allergies.

There has been a large increase specifically in peanut allergies in recent decades and although family history and the presence of atopy are known as risk factors, the cause of the allergy still remains unknown. A study by Lack et al proposed that peanut allergies can be caused in infancy by the use of peanut based oils on the inflamed skin of babies (Lack et al 2003). Another study found that adults who had had mild allergic to reactions could be desensitized to peanuts, but those who had history of anaphylaxis to peanut had the allergy for life (Spergel et al 2000). This study also had no knowledge of the causes of these life long peanut allergies. Based on studies the UK Department of Health advised that pregnant women 'may wish' to avoid eating peanuts or foods containing peanuts if they or the father or siblings of the unborn child are atopic (Ewan 1998). As can be seen by the use of the term 'may wish' the evidence is strong but not conclusive.

Dietary intervention is seen as a valuable tool to treat food intolerance, but there are fears that it can also affect general health. An elimination diet, as developed by the RPAH allergy unit is used as a method of diagnosing and treating food intolerances, it is also used by some doctors to test for and treat food allergy (Murphy 2003, Butkus and Mahan 1986). This approach proving so successful that it is even used in various forms to treat

animals (White 2001) and has also been used to treat conditions such as obesity (Haas 2000) and arthritis (Dunkin 1999). The elimination diet developed by the RPAH allergy unit works by eliminating all foods high in salicylates, amines and glutamates from the diet and then introducing foods in again to test for intolerance reactions. While this approach has had much success, there have been some studies showing concern over compromised nutrition which may result from removing so much from the diet (Holmberg-Marttila et al 2001). However no proof has been found that those on an elimination diet have compromised nutrition in any way.

There are many gaps in the literature in regards to adult food allergies due to the fact that hypersensitivity reactions to foods are far more prevalent in children then they are in adults (Vaswani et al 1999). Many studies propose treatments for various food allergies, but few can identify the cause of these allergies in the first place (Anon 2004). It is the purpose of this study to assess possible dietary and environmental factors which may lead to these allergies and hopefully shed some light on why they occur.

Aims

1. To identify the intake of allergens – particularly nuts, in the female clinic population.
2. To assess diets using FFQ methodology and BMI to determine if nutrition is compromised with dietary modification, paying particular interest to foods high in folate, iron and calcium in regards to an elimination diet for food intolerance, the diets of pregnant and breastfeeding women and a diet with both food allergen and food chemical intake.

Methods

Subject recruitment and selection

Participants for the study were recruited on a volunteer basis from the Royal Prince Alfred Hospital Allergy Unit Sydney. Participants were approached to take part in the

study in the waiting area of the Allergy Unit, staff of the Allergy Unit were also asked to take part. The participants had to be female and over the age of 18 to take part in the study. Once approached to take part in the study, participants were given a questionnaire to fill out pertaining to various potential allergy causing factors in their day to day lives. Participants could either return the questionnaire the same day or return it at a later date in a reply paid envelope. Due to patients needing a referral in order to attend the allergy clinic it was assumed that subjects were fairly proactive in regards to their personal health. Based on their questionnaire answers, participants were then placed into one of four groups, those groups being elimination diet, pregnant, breastfeeding and a reference group from the clinic population made up of subjects on unmodified diets. A total of 25 subjects were recruited, 18 reference group on unmodified diets, 3 elimination diet, 3 breastfeeding and 2 pregnant, with one subject falling into both the breastfeeding and elimination diet groups. The reference group on unmodified diets was determined as those subjects that were between the ages of 18 and 60 who were not part of any of the other groups and who's diets were not modified in any way. No subjects over the age of 60 have been recruited as of yet. The study is ongoing and continues to recruit participants.

Development of Women's health, allergies, dietary preferences and supplement intake questionnaire

An extensive questionnaire booklet had been developed previously in order to collect data on the subjects. The questionnaire was developed with the aim of exploring the health, allergies, dietary preferences and supplement intake of the participants involved in the study. The questionnaire is comprised of five separate sections, each gathering information on specific aspects of the participant's health and dietary behaviour. The first section of the questionnaire, entitled 'About You' gathers general information on the participants such as height, weight, age, average activity levels and whether they require daily medication for illness. This section of the questionnaire also contains a general health checklist, presenting the participants with 32 statements and asking them if the statement applies to them 'not at all', 'just a little', 'pretty much' or 'very much' in the

past six months. Each answer was assigned a number from 0 to 3 so that the data could be quantitatively analysed.

The second section of the questionnaire, entitled 'About you and known allergies or intolerances' begins by asking question on whether the subject is pregnant or breastfeeding and if they are breastfeeding are they modifying their diet in any way to reduce the risk of their child developing allergies. This section is quite important as it is used to identify participants who are pregnant or breastfeeding, who will be followed yearly for 5 years to determine the outcome of their child's food allergy status. This section also asks the participants if they have any known allergy or intolerance reactions and asks participants who are pregnant or have children whether the father of the child/children has any known allergy or intolerance reactions

The third section of the questionnaire, 'About your environment' asks the participant questions about their home environment and visited environments and possible allergy causes within these environments. This section also asks questions about how often peanuts and other nuts are consumed in the participant's household and where on average the participant eats their meals each week. The fourth section of the questionnaire is only applicable to those participants who have children and asks a number of questions to do with known allergies and allergy causing factors in the child's general environment. This section of the questionnaire can be cross referenced against answers given regarding the child's parents to help ascertain whether there is a family history of allergy, whether the families general environment could be the cause of allergies or whether both could be in effect.

The final section of the questionnaire is a Food Frequency Questionnaire entitled 'Your eating habits'. The FFQ used for this project is a modified version of the FFQ being used in the *Dietary Issues in Children With and Without Autistic Spectrum Disorder* questionnaires currently being used to conduct another research project at the Royal Prince Alfred Hospital Allergy Unit. The questionnaire was originally based on the CSIRO FFQ, which was modified in a number of ways to make it more applicable to the

Dietary Issues in Children With and Without Autistic Spectrum Disorder study. This modified questionnaire was then further altered in order to make it more extensive for use on an adult subject group. The list of foods used in the survey was developed using the Woolworths and Coles online shopping lists, with a section for alcoholic beverages being added to make the questionnaire more applicable to participants over the age of 18. At the end of each section of foods there was also an "other" space provided for participants to add any foods, which were not included in the list given. Participants were asked to answer whether they didn't like, rarely or never at a food or how many times a month, week or day they ate each food on the list. The participant is then asked to indicate the amount eaten of each food, with a standard serve amount for each food being given as a reference point. Some of the standard serve amounts for certain foods in the FFQ were modified from previous versions to make them more practical once results from the previous study using this FFQ were reviewed. The final column in the FFQ table asks participants for further details on the specific food consumed e.g. brand, name, type. This project is part of ongoing research using this questionnaire, this project only made use of food frequency questionnaire data for analysis, other sections of the questionnaire will be analysed in the future. A copy of the questionnaire can be found in the appendix.

Data Analysis

Microsoft Excel 2002 (Microsoft Corp, USA) was used for all data calculations and figures. When group data was compared with the reference group using *t* tests a P value of less then 0.05 was used to indicate a significant difference between the groups.

Results

Food Frequency Questionnaire

The Dietary Guidelines for Australian Adults were used to assess all the groups for nutritional adequacy. The serves per day averages for each food group were taken and compared against the dietary guidelines in order to give a representation of the nutritional adequacy of the achieved by each subject group. Each groups serves per day were also compared against the reference group using *t* tests, the breast feeding group were found to eat significantly less serves per day of dairy and fruit then the reference group with p values of 0.03 and 0.001 respectively ($p<0.05$). The elimination diet group were also found to be eating significantly less fruit then the reference group, with $p=0.002$ ($p<0.05$). No other statistically significant results were found.

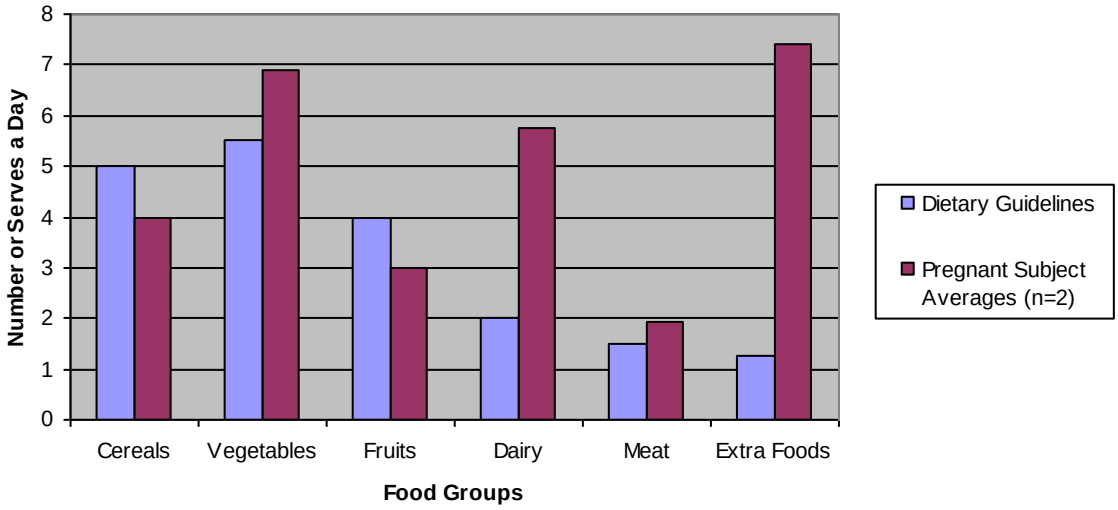

Figure 1: Dietary Guidelines for Australian Adults for pregnant women compared against pregnant subject averages.

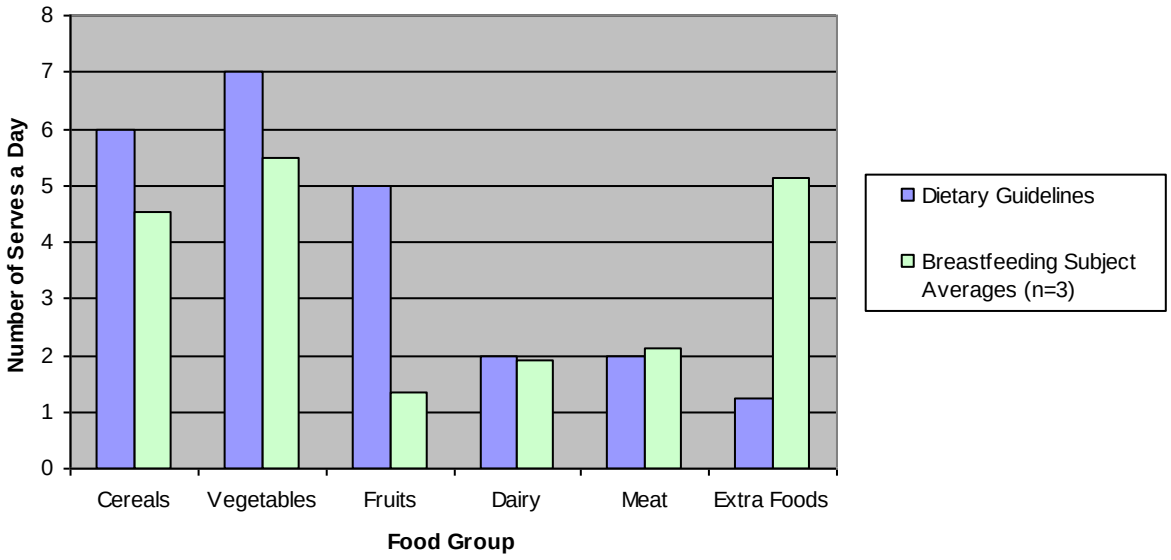

Figure 2: Dietary Guidelines for Australian Adults for women breastfeeding compared against breastfeeding subject averages.

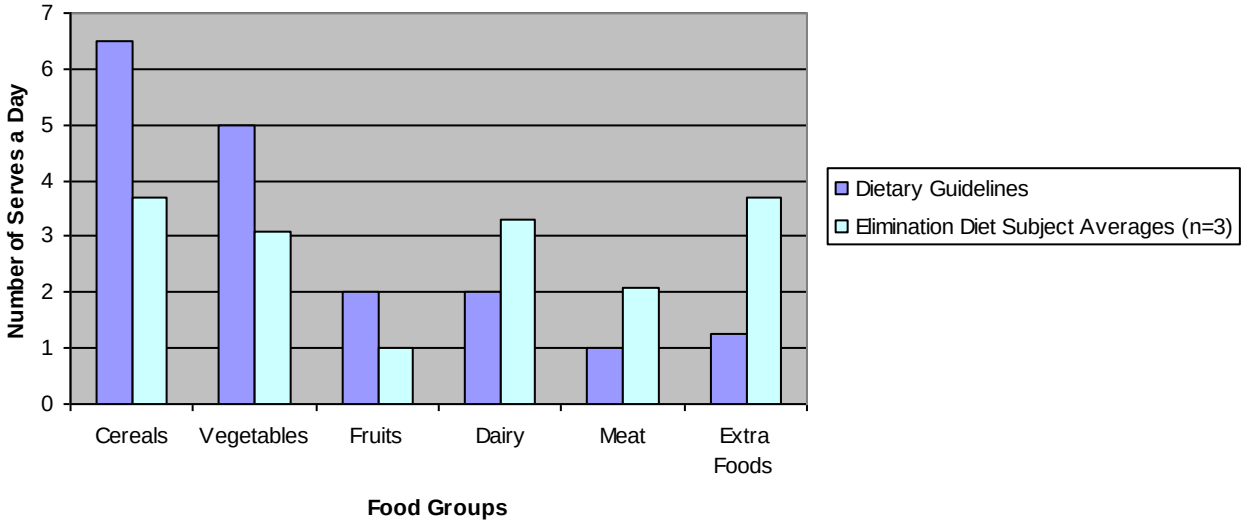

Figure 3: Dietary Guidelines for Australian Adults for women aged 19-60 compared against elimination diet subject averages.

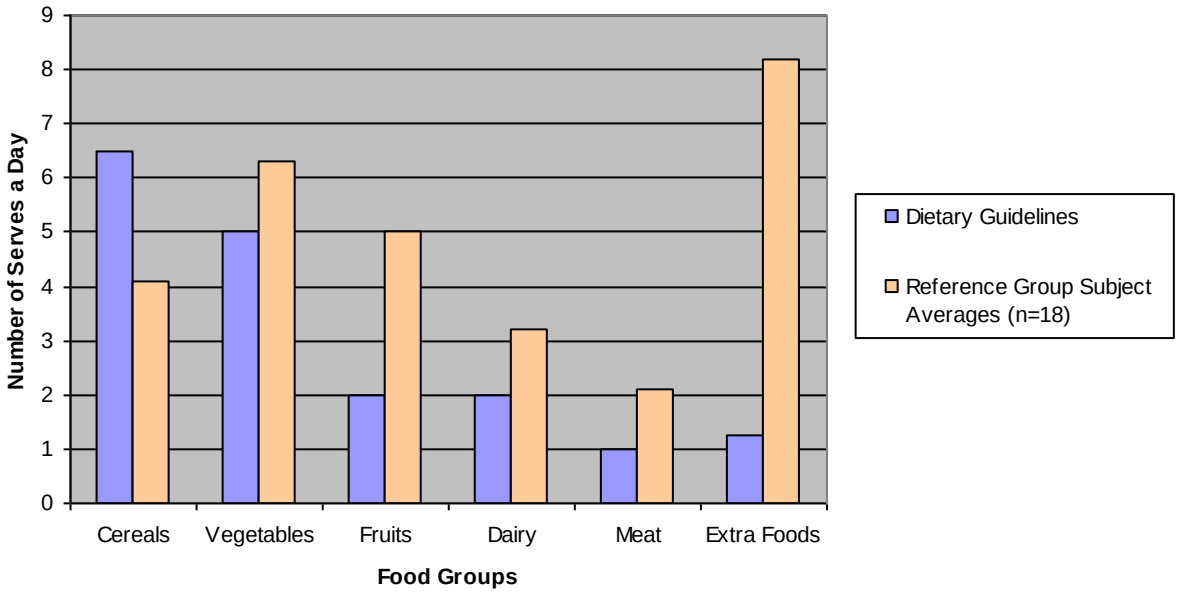

Figure 4: Dietary Guidelines for Australian Adults for women aged 19-60 compared against the clinic environment reference group on unmodified diets subject averages.

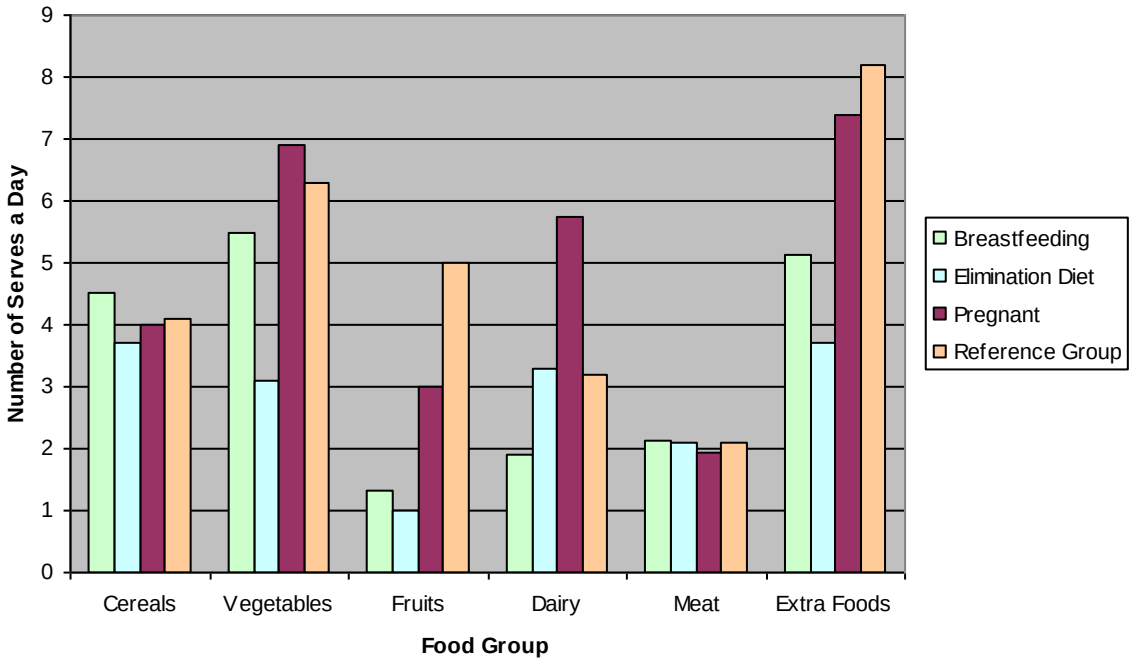

Figure 5: Averages serves per day of food groups for subject groups compared against the clinic environment reference group on unmodified diets subject averages.

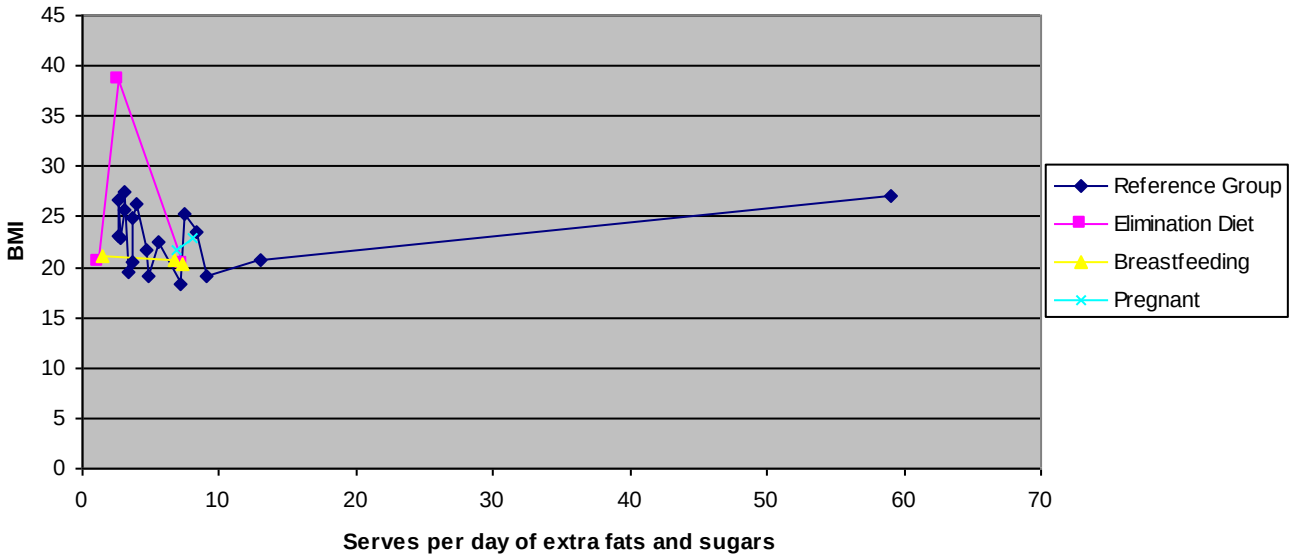

Figure 6: Extra foods consumption Vs body mass index for all subject groups.

Nut Consumption

The average number of whole nuts and traces of nuts consumed by each subject group was determined using the FFQ. T tests were performed on each group against the control to see if there were any significant differences in nut consumption between the groups.

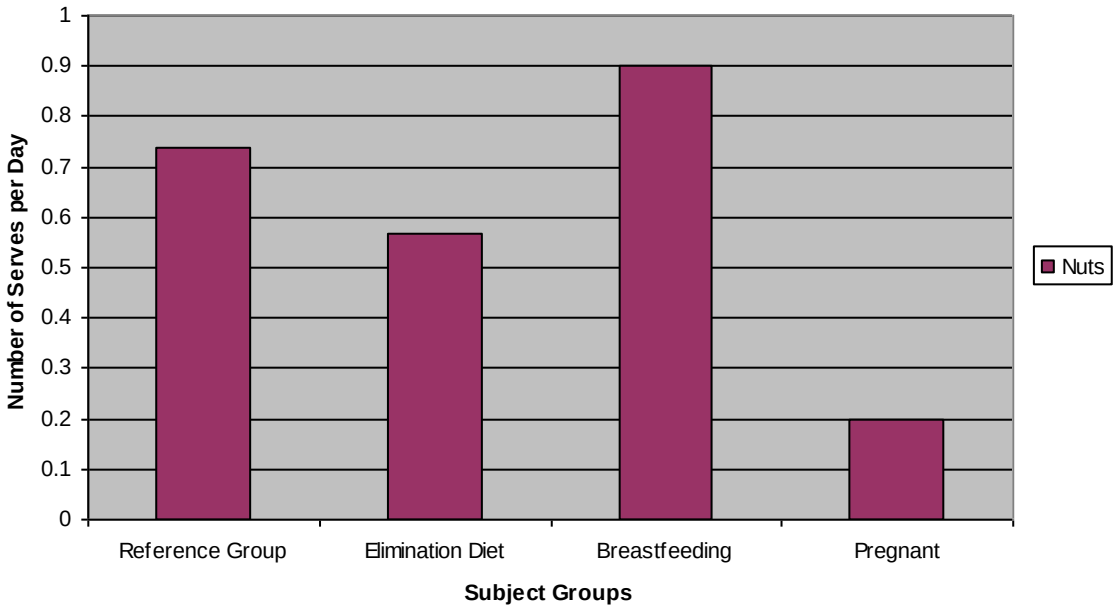

Figure 7: Average number of serves per day of nuts eaten by each subject group.

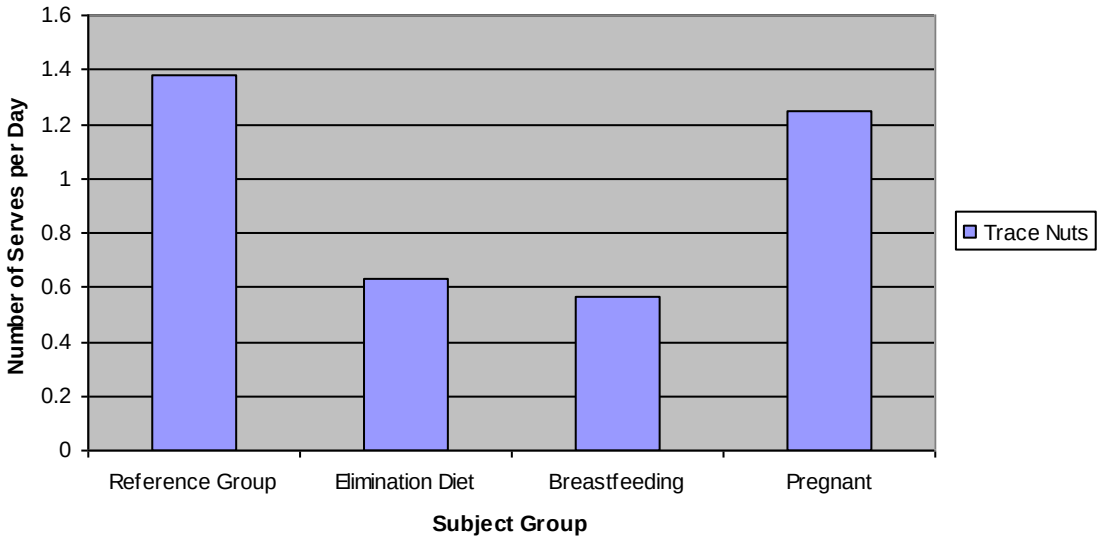

Figure 8: Average number of serves per day of trace nuts eaten by each subject group

Discussion

It is important to note that the results analysed in this research were done so with relatively small sample numbers due to the project only just moving from its planning stages into full operation. The subjects analysed were the very first respondents to have completed their questionnaire, further questionnaires were received, but could not be data entered and analysed in time to be included in this report. While subject numbers were fairly low (there were as little as 2 subjects in one of the groups) and the obvious problem of results being heavily influenced by one or two subjects did present itself, the results did show trends in certain areas, which will be followed up on once more subjects, have been recruited.

It can be seen through figure 1 that the pregnant subjects are eating a nutritionally adequate diet when compared with the Dietary Guidelines for Australian Adults for this group. The only area in need of improvement is a slight increase in the intake of fruit, cereals may look slightly low but just makes into the bottom of the range outlined (4 – 7 serves), the middle of the range provided by the Dietary Guidelines for Australian Adults was used for graphing all groups against recommended cereal intake. It is important to note that the average dairy intake for the pregnant subjects was well above the Dietary Guidelines for Australian Adults and also the highest out of all of the subject groups.

There is some concern over the dairy intake of the breastfeeding group. As can be seen in figure 2 the dairy intake of the breastfeeding group is slightly below the 2 serves a day recommended in the Dietary Guidelines for Australian Adults and it was also found that the breastfeeding group were consuming significantly less serves of dairy per day when compared to the reference subjects on unmodified diets group, with a p value of 0.03 ($P<0.05$). However it must be noted that the group comprised of only 3 subjects, two of whom were consciously avoiding all dairy products, one was also avoiding all soy based products. When this is taken into consideration it can be seen as an encouraging result that the average dairy intake was only slightly below the Dietary Guidelines for Australian Adults (with the group average being 1.9 serves per day of dairy). It must also

be noted that the breastfeeding group ate significantly less fruit per day when compared with the control ($p=0.001$) and also ate less on average then the Dietary Guidelines for Australian Adults. While these results are of some concern, with the sample size being so small it is impossible to say that these results represent a broad cross section of breastfeeding mothers.

Results regarding the elimination diet group are a perfect example of individual subjects heavily influencing results in small subject groups. The elimination diet group only contained 3 subjects, one of which, according to their completed FFQ, consumed no fruits or vegetables. This goes to explaining why it was found that the elimination diet group was found to be eating significantly less fruit then the reference subjects on unmodified diets group, with a p value of 0.002 ($P<0.05$). This heavily influenced the averages for the elimination diet group and as such it is unfair to try and judge the nutritional adequacy of the elimination diet on these results. The results when compared to the Dietary Guidelines for Australian Adults would suggest some form of malnutrition, yet none of the subjects BMI's confer with this suggestion. From this it can be seen that subjects in the elimination diet group are far to small and varied to gain definitive results from as of yet. One positive trend to come out of the elimination group results is that those on the elimination diet ate the least amount of extra foods (eg. Cakes, pies, soft drinks, lollies, etc) (figure's 3 and 5).

The reference subjects on unmodified diets group of the study clearly appear to have the most nutritionally adequate diet of all the groups when compared to the corresponding Dietary Guidelines for Australian Adults. The reference subjects on unmodified diets group meets all of the suggested serves for per day for all of the different food groups including cereals, coming in at the lower end of the suggested 4 –9 serve range. The only concern in regards to the reference subjects on unmodified diets group was the high average intake of extra foods (figure 4), indicating a high consumption of fats and sugars, the highest of all the groups in the study as can be seen in figure 5. While this high intake of sugar and fat might be of some concern, the average BMI of the reference subjects on unmodified diets group was 23.00, a figure that falls comfortably within the

normal weight range of 20 – 24.9 (Wahlqvist 2002). It is also important to point out that the highest BMI in the reference subjects on unmodified diets group was 27.48 indicating that none of the subjects within the reference subjects on unmodified diets group appeared to be obese.

It can be seen through figure 6 that there appears to be no correlation between the amount of extra fats and sugars consumed in the diet and body mass index. A perfect example of this can be seen in the reference subjects on unmodified diets group, one subject in the reference subjects on unmodified diets group consumed 59 serves of extra fats and sugars per day and had a BMI of 27.1, the second highest of the group. However, the subject with the highest BMI of the group, 27.48 only consumed 3.1 serves per day of extra fats and sugars, the equal fourth lowest consumption of the group. The only group, which showed a positive relationship between, increased extra fat and sugar intake and BMI was the pregnant subject group, but with only two subjects in the group the results garnered are far from proving anything at this point in time.

Figure 7 shows the average whole nut consumption of each of the 4 groups represented as serves per day, with one serve of whole nuts being 1/3 cup or approximately 25g. Given that both subjects who make up the pregnant group indicated in their questionnaires that they were both actively avoiding all whole nuts and foods containing nuts, it is not surprising to find that it was this group who consumed the least amount of whole nuts per day. What is surprising is that Figure 8 shows that the pregnant subject group comes a close second to the reference subjects on unmodified diets group in regards to consumption of traces of nuts, 1 serving of trace nuts being defined as 1 serving of a food containing traces of nuts (eg. Biscuits or muesli bars). It was also found that the breastfeeding subject group were consuming the least amounts of nut traces, even though all subjects in this group indicated that they were not avoiding and continued to consume foods which they believed to contain traces of nuts. This may suggest that some subjects had trouble identifying which foods may or may not contain traces of nuts.

Conclusions / Recommendations

It is important to note that this project has only recently moved from its planning stages into the process of collecting and analyzing data. Current results are not and were not expected to be conclusive with such small sample numbers. What these results do achieve is to point out trends and issues, such as the seemingly poor quality of the diet of breastfeeding mothers, which can be followed and further analysed once more data has been collected. This report has met the aims of the project using early data and gives an insight into issues, which may continue to appear as further data is collected and analysed.

Reference List

Anon. 2004. Association of Operating Room Nurses. AORN Journal: New research on peanut allergies, Volume 79, Issue 2, page 328, February 2004. Association of Operating Room Nurses, Inc.

Butkus, M.N. Mahan, L.K. 1986. Journal of the American Dietetic Association: Food allergies: immunological reactions to food, Volume 86, Issue 5, page 601, May 1986.

Dunkin, N.A. 1999. Arthritis Today: Elimination Diets, Volume 13, Issue 5, page 54, September 1999.

Ewan, P. W. 1998. The Lancet: Prevention of peanut allergy, Volume 352, Issue 9121, page 4, July 1998. Lancet Ltd.

Haas, E.M. 2000. Total Health: The false fat diet, Volume 22, Issue 3, page 52, May/June 2000.

Holmberg-Marttila, D. et al. 2001. Clinical and Experimental Allergy: Do combined elimination diet and prolonged breastfeeding of an atopic infant jeopardise maternal bone health?, Volume 31, Issue 1, page 88, January 2001.

Lack, G. et al. 2003. The New England Journal of Medicine: Factors associated with the development of peanut allergy in childhood, Volume 348, Issue 11, page 977, March 2003**.** Massachusetts Medical Society, Publishing Division

Murphy, L. 2003. Chatelaine: The elimination game, Volume 76, Issue 4, page 74, April 2003.

NHMRC (2003) "Dietary Guidelines for Adult Australians"

http://www.nhmrc.gov.au/publications/pdf/n33.pdf

Last accessed 27/09/2004

Spergel, J.M. et al. 2000. Annals of Allergy, Asthma, and Immunology: Resolution of childhood peanut allergy, Volume 85, Issue 6, page 473, December 2000**.** American College of Allergy and Immunology

Vaswani, K. S. et al. 1999. Annals of Allergy, Asthma, and Immunology: Adult onset grape hypersensitivity causing life threatening anaphylaxis Volume 83, Issue 1, page 25, July 1999**.** American College of Allergy and Immunology

Wahlqvist, M.L. 2002. Australia and new zealand food and nutrition 2nd edition. Allen and Unwin Pty Ltd., Crows Nest, Australia

White, P. 2001. DVM: Limited diets gnaw away at food allergy, page 32, June 2001.

Appendix

Complete “women’s health, allergies, dietary preferences and supplement intake” food frequency questionnaire.