Trends of Eating Behaviour in Adult Women - A Cross-Sectional Study.

A major project submitted in partial fulfilment for the award of the degree Bachelor of Nutrition and Dietetics, University of Wollongong

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Trends of Eating Behaviour in Adult Women – a Cross-Sectional Study.

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Food has a role in a number of adverse reactions. Food allergy is an abnormal immunological reaction to food whereas the term food intolerance encompasses all non-allergic adverse responses to foods. There has been a dramatic increase in symptoms associated with allergy in the community and to avoid development, sensitisation must be prevented. Studies suggest exposure to dietary antigens occurs transplacentally during late stage of pregnancy as well as through breast milk which can elicit reactions in infants. It has been shown that infants from mothers who avoid specific food allergens during pregnancy and lactation combined with the avoidance of high allergenic foods in the first years of life experience a significant reduction in allergy and sensitisation, however these results are inconsistent. Dietary behaviour is shown to influence prevalence rates of allergy and this project observed trends in the diets of adult women, particularly those pregnant and/ or lactating, to identify factors contributing to this increased prevalence. A total of 200 women participated by completing a detailed Food Frequency Questionnaire. Significant differences between subgroups of women were determined using ANOVA and *t*-tests. Results showed significant differences between the intakes of nuts between women aged 50-65 and pregnant women ($p=<0.05$), and the intakes of protein containing foods were higher than recommendations set in the *Dietary Guidelines for Australian Adults* for most subgroups of women ($p<0.05$). The real value of these results is that they demonstrate trends which can be followed in the future once more subjects have been recruited.

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Introduction

Food has a role in a number of adverse reactions and medical illnesses. These reactions can cause or aggravate a variety of conditions, syndromes and symptoms and may range from relatively common, mild reactions to those that are both rare and life threatening (FSANZ, 2005; Hedges, 1992; Wahlqvist, 2002). There are two types of adverse food reactions being food allergy and food intolerance.

Food allergy is an abnormal immunological reaction to food, and can be categorised as either Type I or Type IV hypersensitivity. Type I hypersensitivity involves the synthesis of specific antibodies, immunoglobulins type E (IgE) in response to an antigen (allergen) in food. This type of reaction occurs within minutes of consuming the specific protein, involves histamine release and may lead to anaphylactic shock (Schwardtz, 1992). IgE mediated reactions account for less than ten percent of adverse food reactions (Hedges, 1992). Type IV hypersensitivity reactions, however, tend to occur 24-48 hours after exposure to the antigen and symptoms are variable and often dose related (Wahlqvist, 2002). The term food intolerance encompasses all non-allergic adverse responses to foods. They tend to run in families and are related to the amount of food ingested. They are experienced more commonly than IgE reactions (Schiltz, 2003) and symptoms are delayed, appearing hours or days after ingestion of particular foods (Hedges, 1992).

In recent decades there has been a dramatic increase in symptoms associated with allergy in the community (Novak & Leung, 2005; Vieira et al, 2005) and Australia has one of the highest allergy prevalence rates in the world (Prescott, 2005). The large increase in peanut allergies (Lack et al, 2003) are of particular concern because they are often life-long and the most likely cause of fatal food allergy reactions (Hourihane et al, 1996). Special attention has been focused on the role of nuts in the modern diet (DAA, 2005) as they are high in unsaturated fat and other nutrients (La Forge, 2003). Other common foods that cause allergic reactions include milk, eggs, wheat, and fish (Loblay & Swain, 1986).

The expression of allergic phenotype is due to a combination of genetic and environmental factors (Prescott, 2005; Wahlqvist, 2002). Other contributing factors are intestinal permeability and immune responsiveness (Nicholson-Butkus, 1986), but the actual cause of allergy still remains unknown (Wahlqvist, 2002). Children who are born into atopic families are more likely to develop allergic diseases (Bousquet & Michel, 1995; Hill, 1993) when compared to those with no family history and the incidence is higher if both parents are allergic and if the mother, rather than the father, has the allergic disease (Prescott, 2005). Studies show the range of dietary antigens introduced in infancy is an important factor contributing to the development atopic diseases and in genetically susceptible individuals, minute amounts of allergens will lead to a long lasting immune response (Bousquet & Michel, 1995). In order to

avoid development of allergies, it is important to prevent sensitization, the alteration of the responsiveness of the body to the presence of foreign substances (Oxford, 1994), which leads to the formation of potentially harmful IgE antibodies in the blood stream and body tissues (Swain et al, 1996). Prevention can be achieved by avoiding allergens of particular protein foods.

Studies suggest that exposure to dietary antigens occurs transplacentally in the late stage of pregnancy (Hill, 1993) and through the breast milk of lactating mothers (Coulston, 2003; Falth-Magnusson, 1995), and this exposure can elicit allergic reactions infants (Ring, 1988). It is for these reasons that there is special interest regarding what influence the maternal diet during pregnancy and lactation has on the manifestations of atopic diseases in offspring (Falth-Magnusson, 1995). Studies show that infants from mothers who avoid specific food allergens during pregnancy and lactation combined with avoidance of high allergenic foods in the first years of life experience a significant reduction in allergy and sensitization (Hill, 1993; Zeiger & Heller, 1995). Results from studies, however, are inconsistent and dietary restrictions are not currently recommended during pregnancy and lactation in Australia (Prescott, 2005). Various concerns that dietary modifications are unlikely to be of value, too hard to adhere to and they increase the risk of inadequate nutrition currently prevent health messages directed at this strategy.

There have been significant changes in dietary behaviour in recent decades (ABS, 2005). People are consuming more fat and added sugars than recommended (Enns et al, 2003), an intake that correlates with the obesity epidemic (Ello-Martin, 2005) and its various associated conditions (WHO, 2004). Life stage has also been shown to influence individual concerns relating to personal nutrition (Devine & Olson, 1991). As dietary changes and modification of consumer habits have been shown to influence the prevalence rates of various allergic conditions (Devereux & Seaton, 2005; Ellwood et al, 2001; Kompauer et al, 2005; Novak & Leung; 2005; Weiland et al, 1999), the Royal Prince Alfred Hospital (RPAH) Allergy Unit has been exploring dietary trends in women to identify contributing factors to this increasing incidence. This project is both a continuation and extension of Simon Bardon's major project in 2004 which investigated the diets of 25 women attending the RPAH Allergy Unit for nutritional adequacy and nut content by use of a Food Frequency Questionnaire (FFQ), a common method used to assess dietary intake (Potosky, 1990; Schaefer et al, 2003).

Aims

There were two primary aims of this project:

1. To determine the intake of high allergen foods in women, particularly those pregnant and/ or lactating, and to compare actual intake of nuts and foods that may contain trace nuts (MCTN) with avoidance claims;
2. To observe trends in the diets of adult women and compare intake of food groups with those outlined in the *Dietary Guidelines for Australian Adults* (*DGAA) (NHMRC, 2005*).

Methods

This project was of cross sectional study design and aimed to recruit as many women as possible over the age of 18 years. Participation was voluntary and women were recruited from the RPAH Allergy Unit that were either patients, past patients or mothers of children attending the clinic. Women were also recruited from Central Sydney Early Child Care Centres (CCECC), University Nutrition classes and from the General Public. All women were provided with an information sheet (Appendix 1) and were asked to complete a FFQ (Appendix 2) which they could do on the same day or return in a reply paid envelope. All women who completed the FFQ were included in the study and exclusion only occurred for incomplete questionnaires.

A total of 1300 FFQ were distributed between July 2004 - September 2005 comprising of 1100 Allergy Unit population, 130 CCECC, 50 University Students and 20 General Public. Data from 100 women who had attended the Allergy Unit during the period July 2004 and June 2005 will also be used in this analysis. Based on questionnaire answers, participants were categorized into various groups for analysis.

Food Frequency Questionnaire:

'women's health, allergies, dietary preferences and supplement intake'

An extensive questionnaire booklet (Version: 1, Adult 06/04) was developed by the RPAH Allergy Unit in June, 2004 with the intention to collect data about women's health, allergies, dietary preferences and supplement intake. It gathers specific information about the participant and is comprised of five separate sections. As this is the first major study using this FFQ, it is still in the process of being validated.

The first section 'About You' asks for information regarding height, weight, age, current work, travelling time, levels of activity, illnesses and medication. There is a general health checklist for symptoms of allergy or intolerance and asks the participant to indicate how much each of 32 statements has applied to them in the previous six months. The second section 'About You and Known Allergies or Intolerances'

asks about children and pregnancy and/ or breastfeeding status of the participant. If the woman answers 'yes' to either pregnant or breastfeeding it then asks whether they are modifying their diet in any way to reduce the risk of their child developing allergies. Women who have modified their diet will be followed up yearly for five years to determine the outcome of their child's allergy status. This section also contains questions regarding known allergies and intolerance reactions for both the woman and the father of the child to answer if applicable. The third section 'About your Environment' gathers information about home and visited environments to determine possible causes of symptoms within these environments. The fourth section 'About your Children' collects information about children (if applicable) and causative factors in the child's general environment. Future studies will cross-reference these responses against previous answers regarding the parent's allergy or intolerance status. The fifth and final section is a FFQ titled 'Your Eating Habits' and gathers a detailed record of eating habits over the last three months.

In 2003, The RPAH Allergy Unit modified a CSIRO FFQ and developed a FFQ *Dietary Issues in Children with and without Autistic Spectrum Disorder* which has been used over the past three years to conduct research. This was further modified in 2004 to make it more extensive for use on an adult subject group. The list of foods used in the survey was developed using Woolworths and Coles online shopping lists, with a section for alcoholic beverages added to be more applicable to participants over the age of 18. At the end of each food section there is a space labelled 'other' for the participant to add any foods not included on the list given. The participant is asked to answer the question "How often did you eat these foods in the past three months?" and columns allow the woman to indicate whether they didn't like, rarely or never ate 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. The final column in the FFQ table asks for further details on the food consumed such as brand, name and type.

This project is part of an ongoing project conducted at the RPAH Allergy Unit and all information gathered will be used for future analysis. Subjects will continue to be recruited for several years and FFQ are currently being distributed to women at the Allergy Unit and Maternity Wards. My student colleague Tomoko Yokoyama (University of Wollongong, 2005) has also used this FFQ for her project titled 'Food Allergy in Siblings of a Child with Food Allergy: Influence of Heredity and Maternal Dietary Modification Program Aimed at Modifying Risk of Food Allergy'. Her project has mostly relied on information supplied in sections one to four of the questionnaire whereas this project was based on the information provided in sections two and five.

Ethics approval and funding:

Ethics approval for researching women's health using FFQ's was submitted to the Central Sydney Area Health Service (CSAHS) on 27th July, 2004 and was approved shortly thereafter. This approval is valid for four years and the Committee requires it to be furnished with annual reports on the study's progress beginning in August 2005. Amendments were conducted on 27th May, 2005 for the continuation of study into women's health for the period July to November 2005 (Appendix 3). Funding was provided by the RPAH Allergy Unit.

Data analysis:

Information provided in the sections one to four of the questionnaire was entered into a database developed and provided by the RPAH Allergy Unit. Data provided in section five was entered into Microsoft Excel 2002 (Microsoft Corp, USA) and was used for all data calculations and figures.
The following will be explored:

(1) Intake of nuts across subgroups of age, pregnant and/ or lactating;
(2) Claims of food avoidance in pregnant and/ or lactating women;
(3) Statements about avoidance of nuts and foods that may contain trace nuts (MCTN) (Appendix 4) by pregnant and/ or lactating women compared with actual intake;
(4) Diets across subgroups of age, pregnant and/ or lactating compared with the number of serves of food groups recommended in DGAA;
(5) Relationship between Body Mass Index (BMI) and Extra Foods consumption.

When group data was compared with each other, One Way Analysis of Variance ANOVA tests were used using Statistical Package for the Social Sciences (SPSS Version 13.0 for Windows), and group data was compared with the reference group using SPSS One Sample *t*-tests. For all statistical tests a P value of <0.05 indicated a significant difference between groups.

Results

Response:

Of the 1300 FFQ distributed, 233 (17.9% of total distributed) were returned by 19th October, 2005 and 207 were entered into the database before date for final data entry (23rd September, 2005). This project is based on data supplied by 200 women (15.4% of total distributed). This comprised 175 from the Allergy Unit population (15.9 % return), 6 CCECCC (4.6% return), 13 University Students (26.0% return) and 6 from the General Public (30.0% return). Seven of the returned FFQ were incomplete and excluded from the study.

The mean age of participants was 37 years with the youngest at 19 and oldest 65 years. The mean BMI of participants was 24.0, the lowest was 16.3 and the highest 57.6. The women were divided into subgroups as follows: pregnant (n=14), lactating (n=29), neither pregnant nor lactating (n=157).

Nut consumption:

Figure 1

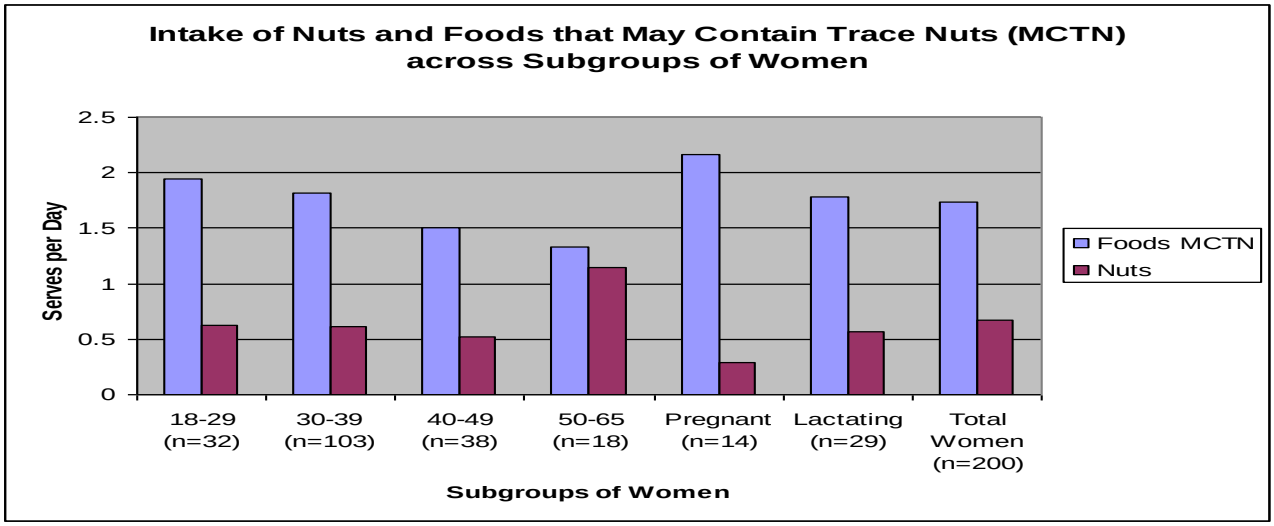


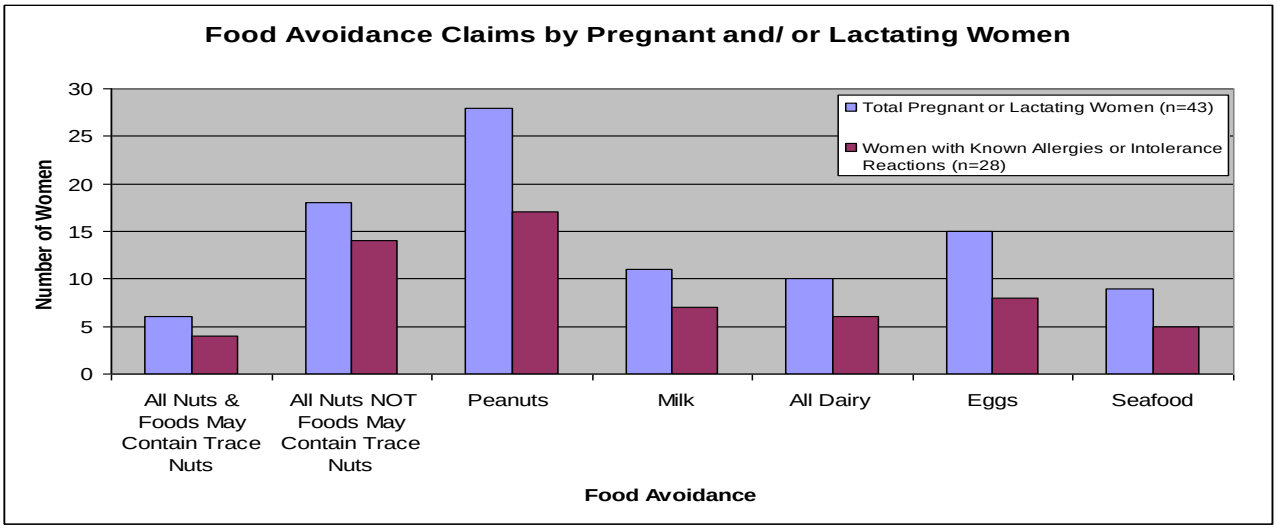
Table 1

Comparisons between Subgroups of Women and Intake of Nuts and Foods that May Contain Trace Nuts			
	All Nuts	Foods MCTN	All Nuts and Foods MCTN
ANOVA P value	0.034	0.386	0.728
Bonferroni test P value	n/a	**0.025**	n/a

Age was provided for 191 women. A significant difference was found between nut intake for women aged 50-65 and pregnant women (p = 0.025). No other significant differences were found. The highest intake of nuts was in women aged 50-65 (mean intake 1.15 serves per day) and pregnant women consumed the most foods MCTN (mean intake 2.17 serves per day).

Dietary Modifications:

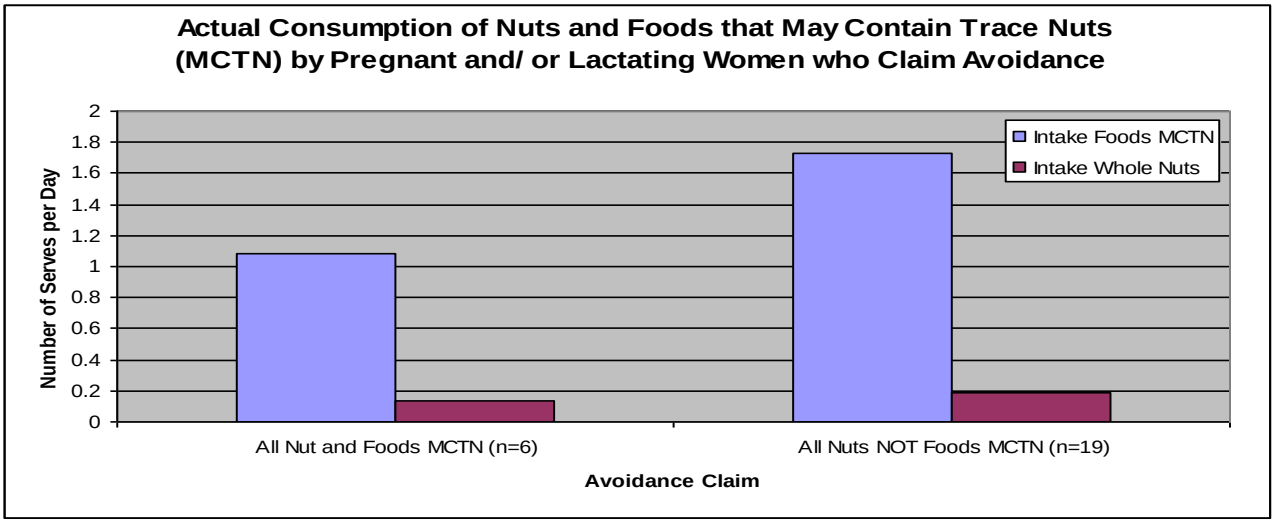
Figure 2



The majority of women either pregnant and/ or lactating (n=43) were recruited from the Allergy Unit {38 (88%)} and most {37 (86%)} claimed taking part in some kind of food avoidance. Of these women, over half {24 (65%)} answered affirmatively to the question 'do you have any known allergies or intolerance reactions'. The main food avoided was peanuts {28 (76%)}, followed by all nuts not foods MCTN {18 (49%)} and eggs {15 (41%)}.

Of the total pregnant and/ or lactating women who had known allergies or intolerance reactions (n=28), most {17 (61%)} claimed to be avoiding peanuts and half {14 (50%)} all nuts not foods MCTN.

Figure 3



Six women either pregnant and/ or lactating claimed avoiding all nuts and foods MCTN. Dietary analysis revealed their mean intake of nuts/ foods MCTN to be 0.14 and 1.08 serves per day respectively. Two

women achieved a nut intake of zero and the minimum intake of foods MCTN for this group was 0.04 serves per day.

Nineteen women who were either pregnant and/ or lactating claimed to be avoiding peanuts and all nuts but not avoiding foods MCTN. These women had a mean intake of 0.19 serves of nuts per day. Five women achieved a nut intake of zero and thirteen women achieved an intake of <0.1 serves per day.

Adherence to Dietary Guidelines:

Two values are provided in DGAA for the various food groups to allow for different eating patterns (Appendix 5). The mean of these values was used for graphical representation and statistical analysis.

Figure 4

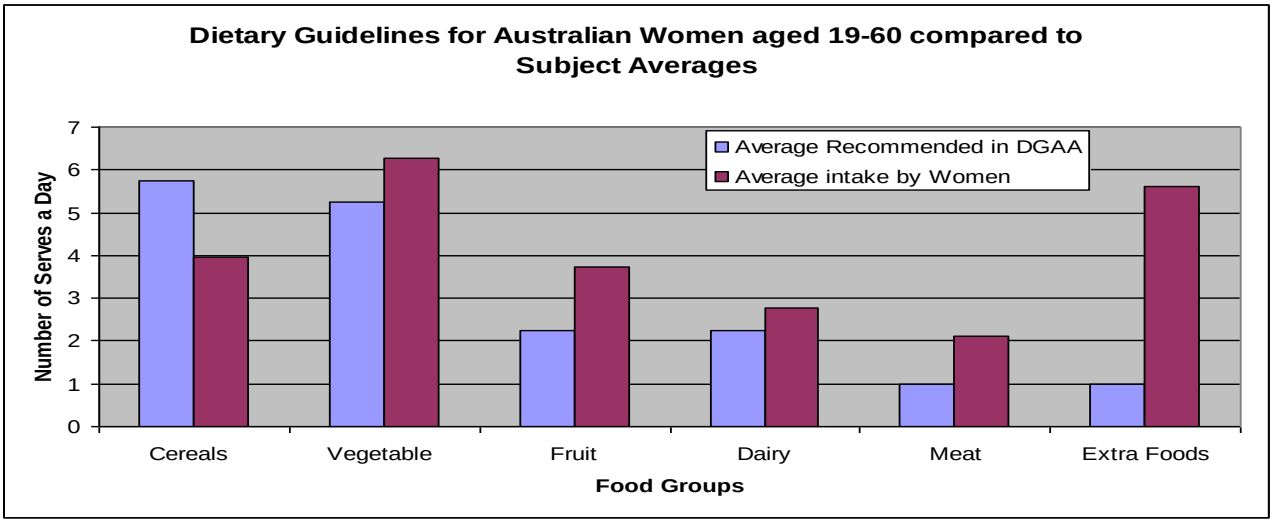


Table 2 Adherence to DGAA in Women aged 19-60

Food Group	cereals	vegetables	fruit	dairy	meat	extra foods
One Sample Test P value	p=<0.001	p=<0.001	p=<0.001	p=0.002	p=<0.001	p=<0.001

156 participants neither pregnant nor lactating were between ages 19-60. Significant differences were found between the mean number of serves in DGAA and the mean intake for all food groups, however the intake of cereals, vegetables and dairy were within the ranges set out in DGAA.

Figure 5

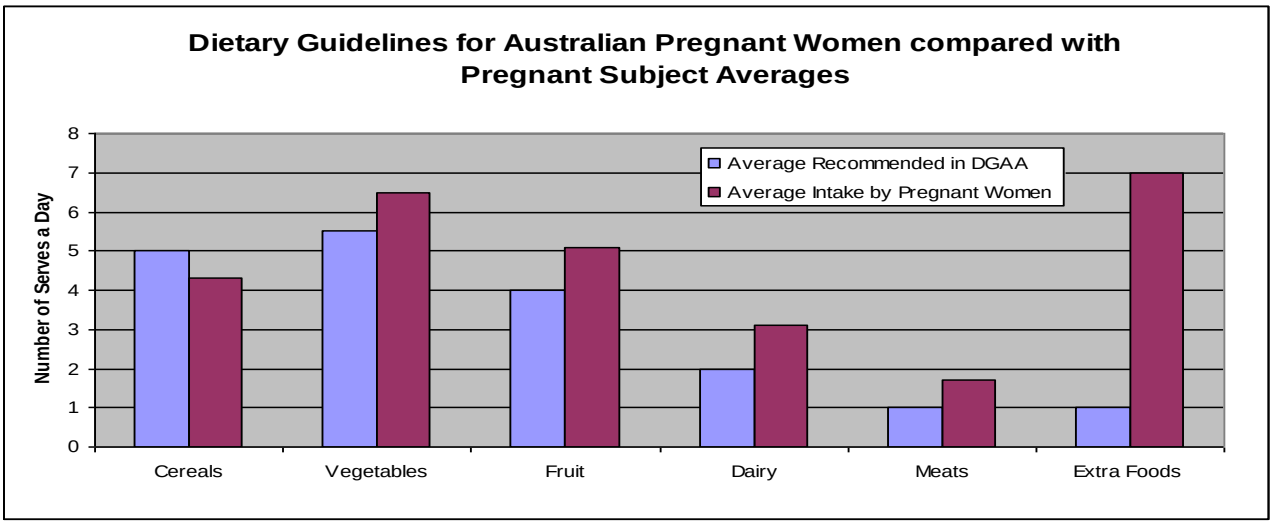


Table 3 Adherence to DGAA in Pregnant Women

Food Group	cereals	vegetables	fruit	dairy	meat	extra foods
One Sample Test P value	0.108	0.260	0.201	0.009	0.001	0.004

Pregnant women (n=14) achieved requirements for all food groups although the intakes of dairy, meat and extra foods were significantly higher than the DGAA recommendations.

Figure 6

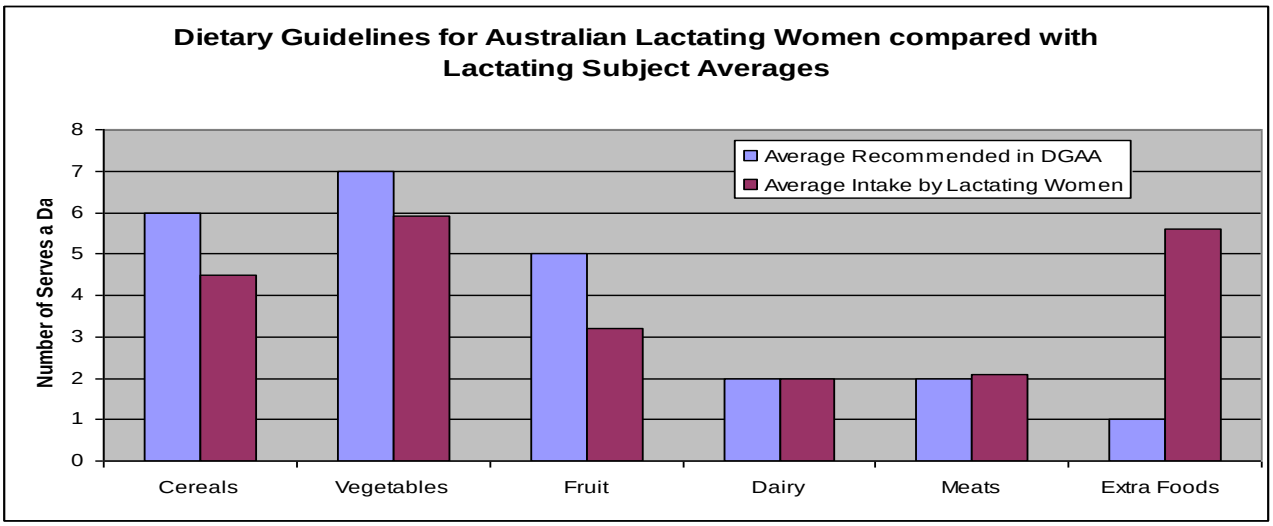
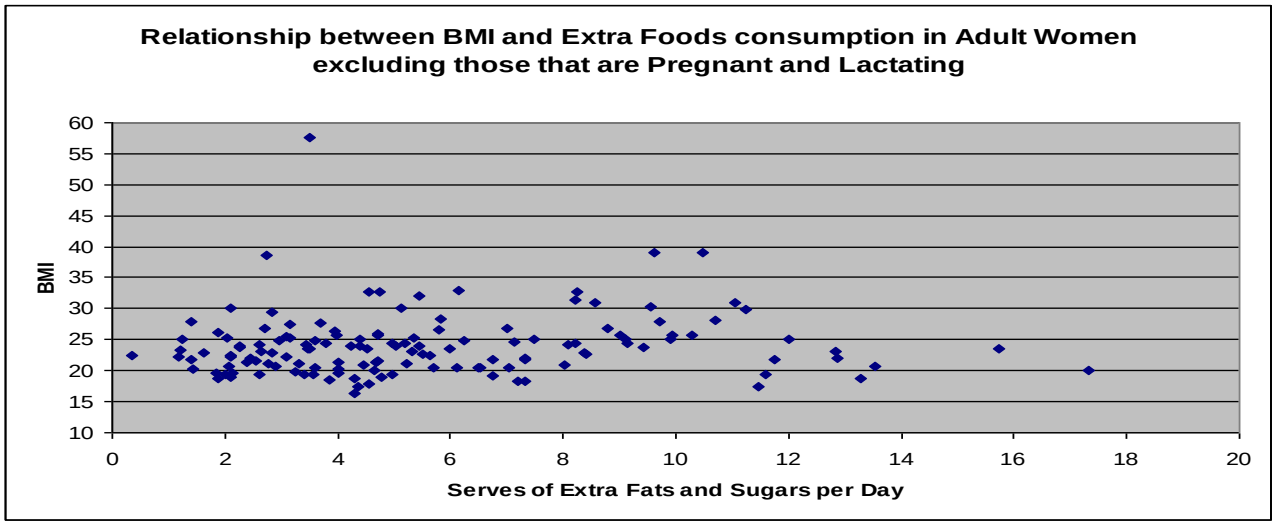


Table 4 Adherence to DGAA in Lactating Women

Food Group	cereals	vegetables	fruit	dairy	meat	extra foods
One Sample Test P value	0.039	0.005	<0.001	0.910	0.486	<0.001

Significant findings in lactating women (n=29) were low intakes of cereals, vegetables, fruit and high intake of extra foods when compared to DGAA.

Figure 7



Data regarding both BMI and consumption of 'Extra Foods' (Appendix 4) was provided for 138 women that were neither pregnant nor lactating. The vertical axis clusters between 17-25 and an outlier exists at 58. The mean BMI for this group was 24.09. On the horizontal axis there is cluster between 1 and 6 and the mean intake of extra foods per day was 5.57.

Table 5

Comparisons between Subgroups of Women and each Food Group						
Food Group	Cereals	Vegetable	Fruit	Dairy	Meat	Extra Foods
ANOVA P value	0.440	0.440	0.507	0.210	0.629	0.082

No significant differences were found between the intakes of each food group and the subgroups of women.

Discussion

The rise in nut consumption over the past several decades corresponds with an increased amount of nutrition information published about the healthful nature of nuts. Studies have shown nuts to have numerous health benefits including decreasing the risk of cardiovascular disease (Coulston, 2003) and having an inverse relationship with risk of Type 2 diabetes (La Forge, R. 2003). Health messages directed at increasing the consumption of nuts are due to their unsaturated fatty acid profile, plant protein, fibre, antioxidant and nutrient quality and bioactive compounds (Coulston, 2003). Older women who participated in this study, aged 50-65, consumed the highest proportion of nuts (Figure 1) which supports findings that concern for personal health and the influence of public information regarding health increases after age 40, possibly due to being more aware of physical body changes and the illness of their parents (Devine & Olson, 1991).

Food avoidances were common in women either pregnant and/ or lactating (Figure 2), and the recruitment from the Allergy Unit was a likely predictor to this result. It can be assumed that this subgroup had an increased awareness about allergy when compared to the general less informed population. Peanuts by large was the main food avoided followed by all nuts but not foods MCTN (Figure 2), indicating the health message encouraged by clinicians at the RPAH Allergy Unit to avoid their consumption during these life stages is being adhered to. The reasoning behind this health message is that sensitization may occur in offspring if this food is consumed (Coulston, 2003; Hill, 1993; Magnusson, 1995; Ring, 1988; Zeiger & Heller, 1995), and because the increased consumption of nuts may have contributed to the heightened number of children having peanut allergies in the past several decades (Lack et al, 2003).

Difficulties were experienced with avoiding nuts and foods MCTN, even by those who claimed total avoidance (Figure 3). One standard serve of nuts is equivalent to one third of a standard cup (83grams) and the reported mean intake of 0.19 serves (15.8 grams) by women claiming to be avoiding all nuts not foods MCTN (Figure 3) was high. The mean intake of nuts in America is less than this result and is between 8.8 - 11.2 grams per day (Coulston, 2003). This gives rise to questions regarding the validity of this FFQ for measuring the quantity of nuts consumed by this population. Currently there are no values set regarding appropriate intake of nuts and recommendations are in the form of simple statements such as ‘eat in moderation’ and ‘replace snack foods with nuts’ (DAA, 2005), and the DGAA includes nuts in a food group alongside lean meat, fish, poultry and legumes (NHMRC, 2003). Trace nuts may be present in a variety of foods and their widespread presence in the modern food supply stresses the problems that allergic individuals experience, and highlights how the presence and use of food labels are essential to help manage allergies (FSANZ, 2005).

Participants in this study were typical to those from economically developed countries who have been shown to consume relatively low amounts of calories from cereals, tubers and other starchy foods. The low intake of calories from cereals was evident as the mean intake of this food group was either near or below the lowest value suggested in the guidelines (Figure 4, 5 and 6/ Appendix 5). This trend may well be associated with the incidence of allergy as a world wide analysis has shown a consistent inverse relationship between the prevalence rates of allergic conditions and the intake of starch, cereals and vegetables. It is speculated that if the daily consumption of these foods is increased, an important decrease in symptom prevalence may be achieved (Ellwood et al, 2001). The reported consumption of fruit and vegetables by participants (Figure 4) is an improvement from the results of the 1995 National Nutrition Survey which found women aged 19-64 consumed an average of only 44% and 46% of the suggested intake of fruit and vegetables per day respectively (ABS, 2005). The high intake of vegetables in women, when compared to fruit, is possibly due to seasonal variances of foods, as majority of the data was collected during winter months.

A trend that showed high intakes of protein from foods of animal origin, meat, and dairy, was present in all women surveyed (Figure 4, 5 and 6), a finding characteristic of the modern western diet (Ellwood et al, 2001). All subgroups of women consumed 'extra foods' in excessive quantities, a result that coincides with the increased prevalence of obesity in society today. It has been shown that increasing the intake of energy dense snack foods does not always correspond with increased levels of fullness (Ello-Martin et al, 2005), and people often consume foods when it is unwarranted and ignore or override hunger and satiety signals. The lack of correlation between the consumption of extra foods and BMI (Figure 7), suggests the calories consumed from 'extra foods' replaced those of other food groups, such as cereals, rather than having been consumed in addition with other food groups. The mean BMI was within the 'healthy range' (WHO, 2004) and although some outliers were present, the results are consistent with findings typical to dietary surveys that show underreporting is common among overweight respondents (Enns et al, 2003). The mean intake of dairy foods was found to be adequate in all subgroups of women (Figures 4, 5 and 6), even though ten women, either pregnant and/ or lactating, claimed to be avoiding these products (Figure 2). Further analysis of this data may alleviate some of the expressed concerns regarding inadequate nutrition in people who undergo dietary modifications.

Dietary lipids exert numerous complex effects on pro-inflammatory and immunologic pathways (Devereux & Seaton, 2004) and participants in this study consumed an excess of the various food groups that have high fat contents (Figure 4, 5 and 6). *Trans* fatty acids are present in hydrogenated vegetable oils and dairy fats (Kompauer et al, 2005), and the intake of these products has risen in the past few decades. A positive correlation is recognized between the intake of these *trans* fatty acids and the frequency of allergic symptoms (Weiland et al, 1999). It has also been suggested that the altered

consumption of long chain poly-unsaturated fatty acids (PUFA's) over the past few decades is linked with the rising prevalence of allergic disease, as the modern diet consists of high intakes of omega-6 fatty acids and a relatively low intake of omega-3 fatty acids (Devereux & Seaton, 2004; Kompauer et al, 2005).

Of the various approaches to collecting information regarding dietary intake, FFQ are quicker and easier than diet records, but are also considered to be less accurate (Potosky et al, 1990). The FFQ used in this project was developed to provide information regarding the types of foods consumed, with particular attention directed on allergenic foods. The 'other' foods that were manually listed in the FFQ by participants were not calculated into spreadsheet totals (Appendix 2 and 6) due to time constraints and it is possible that not all results were reliable estimates of actual quantities consumed. Minor alterations to the format of this FFQ would decrease chances of misinterpretation, and hence increase its validity (Appendix 7).

Recommendations:

For results to be able to be generalised to the greater population, recruitment of subjects need be less bias toward those attending the Allergy Unit. Alterations to the format of the FFQ would assist increasing its validity as would comparing the results to those of diet records collected after several days (Potosky et al, 1990).

Conclusions

This project has shown trends in the types of foods eaten in women aged 19-65 in society today, including those that are pregnant and/ or lactating. The intake of nuts and trace nuts in women was observed and statements regarding avoidance compared with actual intake. Women aged 50-65 consumed a significantly higher amount of nuts when compared to pregnant women. Trends in the diets of adult women were observed and the intake of various food groups compared to DGAA. Significant findings were high intakes of fruit and meat in women aged 19-60, high intakes of dairy and meat in pregnant women and low intakes of cereals, vegetables and fruit in lactating women. The intake of 'extra foods' was significantly high in all subgroups of women. Dietary habits were typical of those from economically developed countries and the observed trend of replacing calories from cereals with those from other food groups has potential implications on the prevalence of allergy in society. Various limitations to this study need to be addressed before results are able to be generalised to the greater population. The real value of these results is that they demonstrate trends which can be followed in the future once more subjects have been recruited.

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