Feasibility of using technology-based dietary assessment with photography in New Zealand adolescents to measure food intake - a pilot study

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Abstract

**Background:** Traditional forms of dietary assessment, including the 24 hour recall, food frequency questionnaire and pen and paper food records tend to underestimate energy intakes in adolescents due to under-reporting and non-compliance. This is in part due to the high respondent burden required to complete them and the difficulty adolescents have in accurately estimating portion size. Preliminary research in the United States of America (USA) has shown that adolescents are more likely to engage in dietary assessment through technology that is relevant to them, and the use of photography can help to reduce the inaccuracy associated with portion size estimation. So far in New Zealand there has been no research using technology based dietary assessment (TBDA) with photography to measure the food intake of adolescents.

**Objective:** The aim of this study is to investigate the feasibility of using an electronic food record with photography to measure food intake in New Zealand adolescents. Feedback from participants regarding the usability of the food record will then be used to improve the future design (interactive design).

**Design:** Five males and five females between the ages of 16 and 19 years were asked to complete an eight day food record with photography on both an Apple iPad® (iPad®) and Apple iPod® (iPod®) touch over eight days (four days using each device). Participants were asked to take photos of the foods they were about to eat, and to fill in a food log underneath each picture. Participants then attended a group interview where they were asked questions in order to gain feedback on the usability of the food record. Feasibility was evaluated by how well participants filled in the food record, clarity/usability of images, a realistic energy intake recorded and feedback given at the group interview.

**Results:** There was relatively high compliance to using the electronic food record with all participants recording at least two meals per day, on six out of the eight days. The majority of
entries could be used (79%) as they contained photographs with excellent image clarity. Overall energy intake measured from both devices was similar to New Zealand Adult Nutrition Survey 2008/09 (NZANS) data (iPad® 8114kJ/day, iPod® 8546kJ/day, ANS 9480kJ/day) from a similar age group. Participant feedback from the focus group gave useful suggestions for improvements to the food record such as the request for a more simple application which required fewer steps to record food intake. Compliance to the devices and participant feedback tended towards preferring the use of the iPod® versus the iPad® to record food intake.

**Conclusion:** The use of TBDA with photography appears to be a feasible way to measure food intake in the adolescent population, as evidenced by the relatively high compliance to using the device, energy intake comparable to the NZANS data and positive feedback from participants using the device.
Preface

This Master of Dietetic thesis is a pilot study of interactive design where the results and participant feedback from this project will be used to improve the next version. The steps involved in the development and implementation of this technology based food record and the contributions of the candidate are as follows:

1. Identification of an electronic device with photographic capabilities which a food record could be kept.
2. Development of a food record template to be used for the study.
3. Recruitment of participants.
4. Meeting with and training participants on the use of the electronic food record.
5. Coordinating and running the data collection period.
6. Planning and running a group interview.
7. Coding and entering of food record data.
8. Data analysis and interpretation.
9. Writing of this thesis.
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List of Abbreviations

USA: United States of America

TBDA: Technology Based Dietary Assessment

iPad®: Apple iPad®

iPod®: Apple iPod®

FFQ: Food Frequency Questionnaire

24hr recall: Twenty four hour recall

EDNP: Energy dense, nutrient poor

iPhone®: Apple iPhone®

PDA: Personal Dietary Assistant

RFPM: Remote Food Photography Method

EMA: Ecological Momentary Assessment

TADA: Technology Assisted Dietary Assessment
1. Introduction

It has been widely documented throughout the literature that adolescents tend to under-report their food intake with traditional dietary assessment methods; including the weighed and estimated food record (1). Adolescents also have a poor ability to estimate portion size compared to adults. This can affect other dietary assessment methods including the food frequency questionnaire (FFQ), estimated food record and 24 hour recall (2, 3). It is thought that a large component of under-reporting may be due to non-compliance; participants not completing the food record because of the high level of motivation required to write down everything that they eat or drink (1).

In recognition of these limitations, there has been some research looking into more novel ways to engage the adolescent population in dietary assessment. These methods include the use of electronic devices and photography (which has been shown to reduce error in portion size estimation) (4). Research has been conducted investigating the use of smartphones and photography in adolescent dietary assessment. This technology based dietary assessment (TBDA) has been found to be a valid way to collect dietary information when compared to a weighed food record alone. Studies which measured adolescent perception using the electronic food record found they enjoyed the electronic version more than pen and paper methods (5-9).

While Technology based dietary assessment has been shown to be a valid and novel way to assess adolescent dietary intake, there has not been any research of this kind in New Zealand. For this reason, the aim of this research thesis is to determine the feasibility of using a technology
based dietary assessment tool with photography to measure food intake in New Zealand adolescents.
2. Literature Review

2.1 Background: Adolescents and eating habits

Adolescence is a time of increased independence and freedom where individuals may begin to express more autonomy over day-to-day decisions such as what they eat (10). Friendships and socialising become important and eating patterns and timing of meals tends to become more disrupted and irregular. Restraints on time from school and sporting commitments may lead to more snacking at the expense of healthier meal options. Unsurprisingly, popular snack choice in adolescents includes foods such as chocolate, sweets, crisps, sugar sweetened beverages and fast foods (11). These types of foods tend to be energy dense and nutrient poor (EDNP) and may lead to weight gain and obesity (12). There is a general consensus that eating EDNP food promotes a positive energy balance and may contribute towards adolescent obesity (12). The 2002 Children’s Nutrition Survey investigating the snacking habits of New Zealand school children found that snack foods such as crisps were consumed by 45% of children during morning tea and lunch (13). Emerging evidence suggests that eating habits developed in youth may be retained in adulthood and the foods consumed during childhood may affect adult health (14, 15).

2.2 Health Outcomes

A poor quality diet of EDNP foods has been linked as a risk factor in the development of chronic diseases such as some cancers, gastro-oesophageal reflux, insulin resistance and type 2 diabetes (16). Being overweight in childhood and adolescence increases the risk developing psychological disorders such as depression as a result from low self-esteem as well as physical health problems such as stroke and coronary heart disease from high blood pressure and arteriosclerosis (17). Overweight children tend to stay overweight and have an increased risk of 1.5 - 2 fold of being overweight as adults (18). Likewise, obese children are likely to become obese adults (19).
Obesity is a rising health problem in many countries including New Zealand and, based on data collected from the NZANS 07/08, among New Zealanders aged 15-18 years of age: 25.0% were classified as overweight (males 23.2%; females 26.9%), and 12.2% were classified as obese (males 10.8%; females 13.6%) (20).

2.3 Measuring food intake in the adolescent population

In order to understand about what sort of foods New Zealanders typically eat, objective and accurate information must be collected. Traditional data collection methods may include; weighed or estimated food records, Food Frequency Questionnaire’s (FFQ), Twenty-four hour recalls (24hr recall) and the diet history. Dietary assessment tools are used to collect information about the health of the nation i.e. the 1997/08 New Zealand Adult Nutrition Survey (24hr recall) (20), and the British National Diet and Nutrition Surveys of adults (weighted diet record) (21).

Dietary assessment is also used to investigate the relationship between nutrition and lifestyle factors and the etiology of chronic disease (22) i.e. the European Prospective Investigation of Cancer (EPIC) study (23). These findings from national surveys and large studies may then be used to inform policy makers in regards to health initiatives. It is therefore imperative that the dietary assessment techniques used are appropriate to the target population in order to obtain realistic and valid results.

2.3.1 Under-reporting

Under-reporting is a universal problem in all age groups but is especially prevalent amongst adolescents (24, 25) and validation with urinary nitrogen and doubly labelled water have shown that all traditional dietary collection methods including twenty-four hour recalls, FFQs and food records are affected (1). There is a range of reasons for this and Livingstone et al suggested that adolescent under-reporting may be influenced by higher calorie requirements and concerns about their self-image (such as what their peers think about them). The busyness of school and other
commitments may also lead to a variation in food intake and eating patterns (1). This busy lifestyle may lead to forgetfulness, and the burden of completing the diary may result in poor compliance. Burrows et al (26) systematically reviewed the literature looking at FFQs, diet recalls and food diary’s. Of the fifteen studies included, six measured the reported food intake of adolescents compared to the method of doubly labelled water. In every study adolescents underreported their food intake. Underreporting has been especially identified in overweight and obese adolescents (1, 25, 27).

2.4 Traditional Dietary Assessment Techniques

2.4.1. Twenty four hour food recalls

Twenty four hour recalls (24hr recall) provide a ‘snapshot’ of what a participant has eaten over the last twenty four hours and relies heavily on memory and self-reported portion size. Portion sizes may be difficult for participants to estimate, and the perception of what a portion size is may vary both intra and interpersonally (1). A review by Cypel et al (28) identified validity of accurate portion sizing estimation was lacking. Since this time, several studies looking at portion size estimates in children and adolescents have sought to bring about validation to the 24hr recall (29).

2.4.2 Portion size estimation

2.4.2.a Portion size estimation using photographic aid

Lillegaard et al (30) looked at whether adolescents and children can estimate portion sizes of specified foods accurately and if age affects judgment. Participants were split into two groups, under 10 years and over 10 years. They were asked to estimate portion sizes of various foods with the aid of a photographic book depicting portion sizes of similar or the same foods. Between children and adolescents, no difference was detected in the ability to estimate portion size. However their ability to estimate correctly decreased with age. Sixty per cent of foods were
identified correctly, but if the food differed from the photograph by thickness or presentation on 
the plate, then it was more difficult for the participants to make correct estimations. These 
findings concur with Baranowski et al (31) who also asked children and adolescents to look at 
photographs with or without size cues such as utensils. The children and adolescents were able to 
make correct classifications up to 60.3% of the time.

2.4.2.b Portion size estimation without photographical aid

The studies by Lillegaard et al and Baranowski et al (3, 31) suggest that the use of photographs 
may be useful to help correctly estimate portion sizes. The 24 hour food recall often occurs in one 
setting and relies on the memory participant to recall what they have eaten and identify portion 
sizes from memory. In this context, there is less evidence to support the accurate recall of portion 
size in children and adolescents (1). Further difficulties arise when the diets of children and 
adolescents are considered. Food intake tends to be irregular and portion sizes are likely to 
change over time. Children and adolescents are also less likely than adults to pay attention to 
what they are eating. This further confuses the accuracy of portion size estimates and therefor 
dietary collection methods such as 24hour recalls (1).

2.4.3 Food Frequency Questionnaires

Food frequency questionnaires (FFQ) are another traditional means to record food intake. A 
recent FFQ validation study in New Zealand looking at adolescent food intake found test-retest 
reliability and validity to be good-excellent (32). The study concluded their FFQ was an 
appropriate tool for measuring food intake in the adolescent age group (ages 14-18 years old). 
The reference of their FFQ validity was measured against an estimated food record which was 
kept by the participants for four-days. Afterwards the food record was checked for completeness. 
It was found that of the small study sample (n=41), 47% of participants did not complete the
study due to low compliance in completing the 4 day diet record. Poor compliance is a typical finding amongst the adolescent population in regards to validation studies for FFQ’s (32, 33). This may partially explain why, in general, most FFQ’s tend to produce inconsistent and low validation of dietary intake (under-reporting) within the adolescent age range (1, 34-36).

2.4.4 Food records

Food records are considered to be the most accurate reflection of an individual’s usual food intake and are usually weighed or estimated using scales or household measurements. Despite being considered the ‘gold standard’ in dietary assessment, (22) food records require literacy and a high level of motivation from the participant for their completion. This may then bias studies towards enrolling participants who are literate, educated and thus decrease the representation of the population (36). A study by Livingstone et al (1) found that within the adolescent population, self-reported food diaries were likely to be biased due to under-reporting. Adolescents have also been known to alter their eating patterns to simplify recording of their food, for example choosing pre-prepared meals versus a recipe to avoid listing all the ingredients found in a mixed dish (37). Other studies using food records have been found to bias towards underreporting by up to 20% in the adolescents and older children population (1).

2.5 The way forward: Using electronic devices to measure food intake

Because of the undesirable effects that under-reporting causes in nutrition, researchers are constantly looking for ways to reduce this. Poor compliance is often targeted as an area for improvement. The use of technology and photographs in the development of electronic food-records (technology-based dietary assessment) seems to be the latest innovation to record food intake in both the adult and adolescent populations (see Table 2). Boushey et al (6) suggested that
the use of technology may be useful to keep adolescents engaged which may help toward gaining a more accurate and reflective picture of what adolescents eat.

2.6 Using technology based dietary assessment to measure food intake

In the last ten years, several new techniques for increasing the accuracy of TBDA have emerged. These include: personal digital assistants, internet based food diaries, smart phone apps, and mobile phones utilising camera capabilities and voice recognition (38). A review of the literature as early as 1998-2005 found digital photography to be a valid and reliable tool within the adult and adolescent population in measuring food intake (4). Long et al (39) investigated dietary assessment methods which were being used effectively. It was found that adolescents had a strong preference to take photos of meals and food in comparison to pen and paper methods, FFQs and recalls. The study recognised that with the increase in popularity of Apple iPhones® (iPhones®) and Smart phones with camera and video capabilities, there was great potential for the advancement in dietary assessment methods.

Further strengthening the argument for TBDA is a pilot study by Boushey et al (6) which looked at the preferences within the adolescent population for reporting dietary intake. Participants completed six different dietary assessment methods including the multiple pass 24hr recall, a pen and paper food record, a Personal Dietary Assistant (PDA) using a hierarchical menu, a PDA using a search menu and a PDA with a camera and a camera with a notebook. A group interview was held asking for opinions regarding the dietary assessment methods. The general consensus was that food diaries and 24hr recall were not enjoyable. However the adolescents did enjoy using photography and there was a much higher adherence to the study when individuals used disposable cameras to record food items.
2.7 Validating technology based dietary assessment

2.7.1 TBDA verses doubly labelled water

Martin et al (40) ran a pilot study in adults to investigate the validity of using food photography in a free living population. It was found that by comparing the method of having food images captured through photography to the gold standard of doubly labelled water, there was only a 3.7% underestimation of energy intake in the photography group compared to 37% underreporting using food records only. While this study was run in adults, it shows that food photography dramatically decreases the incidence of under-reporting. The researchers are currently investigating the validity of this tool in adolescents.

2.8 Advantages of technology based dietary assessment

2.8.1 Validation of portion size estimates – researcher

One of the greatest advantages of TBDA with digital photography is that it removes the need for adolescents to estimate portion size. Instead this burden is placed upon the researcher and so it is important to validate the researcher’s ability to correctly estimate the energy intake of foods from photographs when compared to the actual food weight. Lassen et al (41) sought to validate an electronic food record by asking 19 free-living adults to record their evening meal for five consecutive week days. Participants were asked to weigh and record their meal and separate out the individual components before taking photographs. From these photographs researchers then estimated food weights based on the photographs and compared this to the actual food weights as recorded by participants. They found that the mean weights estimated by the researchers using the photographs were significantly lower than the weighed records (p<.0001). However, when energy density was considered, there was no significant difference between the two groups.
Other studies which have found good to high correlation between food photographs and energy intake estimates include Higgins et al (8) who found no difference between a weighed food record when comparing the amount that participants ate with photographic estimates. Williamson et al (42) also found a high correlation between weighed food with direct and digital estimations.

2.9. Other forms of technology based dietary assessment using photography

2.9.1 SenseCam

Still photography has shown to increase the quality of food record information, but a device called “SenseCam” (which is a device worn around the participants neck and continuously captures video throughout the day) may have the potential to increase the quality of data. This is because all eating occasions are recorded with minimum burden required from the participant. Forty seven participants from three sporting groups were recruited and asked to wear a SenseCam for a day as well as keep a one day weighed food record. When the energy intakes measured from the food log alone were compared to the energy intake measured from the food log plus details from SenseCam images, there was a significant difference in the measured energy intake from the three groups: 10.7% (p<0.001), 17.7% (P<0.001) and 10.1% (p<0.01). These results suggest that SenseCam may be a feasible method to record food images, alongside a food record and increase data collection quality. Limitations of SenseCam included software errors and a lack of flash on the camera. This meant some food images could not be used as poor lighting reduced the image clarity or visibility (43). Ethical issues must also be explored in this type of dietary assessment as a constantly running camera may record undesirable images.

2.10 Challenges and limitations of technology based dietary assessment

While it is useful to know that adolescents enjoy using photography or photo-capable devices over the traditional pen and paper methods of dietary assessment, there are challenges and
limitations in using technology. The challenges include the ability to capture a suitable image that includes all of the meal, as well as actually remembering to photograph ones food (29). Daugherty et al (29) undertook a study to evaluate user skill in both adults and adolescents and compare preferences for using a type of mobile phone record. Skills included the ability to include all of the meal in their photo as well as a fiducial marker (which gives size context to meal) and the number of photos taken which measured precision. It was found that adolescents were more efficient at recording images of their meals and took less photos overall than the adult population (this was statistically significant) and were more confident overall using the technology.

2.11 Current photographic technologies assessing dietary intake

With initial work showing that TBDA can be a valid and effective measure to engage the adolescent population, two larger projects have been developed which incorporate photography and computer software for the use in large scale dietary assessment.

2.11.a Remote Food Photography Method

Remote Food Photography Method (RFPM) is a method that was developed to measure the energy and nutrients from foods eaten by people in their normal environment. The remote food photography method involves taking pictures with a photo-capable device or a smartphone before and after eating to encompass plate waste. These images are then sent through a wireless network to a server which uses a programme called “Food Photography Application”. This compares the food images to known portion sizes and estimates the calorie and nutrient content of the foods based on the USDA nutrient database. The image analysis is known as ‘semi-automated’ as it relies on both human users as well as computer automation. Ecological momentary assessment (EMA) methods are usually used alongside the RFPM to increase data quality. This works by
identifying behaviours such as binge eating or meal skipping which may confound results. EMA then sends notifications to the participants to remind them to take photos of their food or ask questions regarding intake. Martin et al (28) tested RFPM in controlled conditions and found RFPMs to be very effective and the underestimation of calories from food intake was thought to have decreased to 6.6% (44). It must be noted that these results were obtained under controlled conditions and not measured in a free living population. RFPM was then validated in conjunction with EMA this time in a free-living population. Customised prompts (personalised to individuals eating patterns) were used this time to remind participants to take photos (40). RFPM underestimated calories by only 8.8% compared to doubly labelled water. It is important to note that while these results are impressive and promising, they were not statistically significant. The researchers acknowledge this may have been due to the small sample size and reduced statistical power as this was a pilot study. The findings show RFPM combined with EMA has potential as a feasible method to assess dietary intake and shows promise for the future.

2.11.b Technology Assisted Dietary Assessment (TADA)

Technology assisted dietary assessment or TADA is very similar to RFPM as it also incorporates photography and computer software programs in dietary assessment. TADA was designed at Purdue University, West Lafayette, Indiana. Again the user takes a photo of their meal before eating and of plate waste with a fiducial marker. The photograph is sent to a server where the food is identified electronically, labelled and volume estimated using 3D density technologies. This information is then sent back to the user to confirm or correct information. The nutrient profile of the food is then analysed using a large database. This information is sent to the researcher or dietitan. Schap et al (45) describes the process in more detail. TADA has been through initial phases of pilot testing in an adolescent population. It was found that with training and use, the adolescents using the programme increased their proficiency and reported the
software easy to use (5). A 2012 study examined the accuracy of the TADA automated portion size estimation by comparing known portion weights to those automatically determined by the TADA computer program. In a controlled environment, fifteen adolescents took photos of their food over twenty-four hours. Of the nineteen foods eaten by participants that were deemed to be “commonly consumed”, only 50% could be estimated by the computer program within an acceptable range. Some foods such as lettuce were overestimated by as much as 400%. Other foods such as sausages, scrambled eggs, and toast, the participants estimated portion size more accurately than the computer (46).

2.11.1 Benefits of RFPM/TADA systems

The participant benefits of both TADA and RFPM are proposed to reduce participant burden as there is less training required in taking photos of food. Just taking photos is thought to reduce the amount of work the participant is required to do and this will hopefully increase compliance. The researcher’s burden may also be reduced though the semi-automated computer programs which automatically calculate nutrient data. This means the researcher spends less time reviewing the diet record for inaccuracies, manually coding and entering the diet information into the nutrient database. Automated notifications mean the researcher should no longer be required to call and remind participants to use the food record.

2.11.2 Limitations of RFPM/TADA systems

Remote food photography method and TADA both rely heavily on their software programs, computer estimates and analysis. These are expensive to set up and costs for development and maintenance can run into the millions of dollars. The databases used are validated only for the country they are used in and licensing (if possible to purchase) would probably be very expensive. Also, a country compatible nutrient database would need to be designed. The programs require
extensive expertise and skills in program software as well as researchers to oversee the ‘human input’ aspect of the data entry. Despite the ‘computer recognition software’, human researchers are often required for quality checks such as to ensure that similar coloured foods are not miscoded e.g. scrambled eggs is not entered as margarine. The user must take both before and after photos as well as correct misinformation such as the misclassification of food items or quantities. Furthermore, these programs are not protected from human error limitations such as non-compliance by participants and the loss/breakage of expensive equipment.

2.12 Implications for research

While the benefits of systems such as RFPM and TADA remove some of the barriers in dietary assessment including the reliance on the participant to estimate portion size and incorporate a technology that is relevant to adolescent’s, the cost of setting up a similar system in New Zealand may cost many millions of dollars and is not feasible.

Nevertheless in 2013 current technology is affordable and multifunctional. The iPod® originally designed for listening to music now come with touch screens and have internet capabilities, and can take photos and videos. The memory capacity of smart phones such as the iPhone®, Windows phone, Blackberry and Android now hold many mega-bites of data and have higher resolution and imaging capabilities. The device’s processors are much faster and, combined with improved memory capacity and network connectivity, have become the ideal tool for data collection. At the same time, iPad®s and tablets are becoming cheaper and with their lightweight and slim-line design are much more portable and user-friendly. Utilising this technology in dietary assessment is now less about the ability to do so, rather, the quality of that information
collected and achieving this in a way that is feasible and relevant to the target population and affordable for the research institute.

“Evidence based development” is an important part of the design process and incorporates the concept of interaction design. Interaction design in the context of an electronic food record is where the user tests the product and gives feedback to improve the next version which is then tested again. This process results in a more user-friendly product which will hopefully lead to a more positive and relevant experience for the person using it (5).

2.13 New Zealand context

An extensive literature search has found no published research where an electronic food record with photography has been used to measure food intake in either an adult or adolescent population within New Zealand. As the literature shows support towards this type of dietary assessment, it is the purpose of this thesis to pilot test a technology based food record with photography to determine if this is a feasible way to collect dietary information from New Zealand adolescents.
<table>
<thead>
<tr>
<th>Reference</th>
<th>Electronic Food record</th>
<th>Participants</th>
<th>Study Objective</th>
<th>Study design</th>
<th>Relevant Outcome/Conclusions</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Author: Six et al (5)</strong>&lt;br&gt;<strong>Country:</strong> US&lt;br&gt;<strong>Date:</strong> 2010</td>
<td>Mobile phone food record (MPFR)</td>
<td>N=78&lt;br&gt;Age: 11-18</td>
<td>To determine if training increase accuracy of the use of a mobile phone food record (MFPR) and to gather feedback on perceptions and use after training.</td>
<td>Participants used the MFPR for one-two meals and proficiency was measured by the ability of participants to capture an image of high enough quality for analysing. Perception measured from self-reported ease of use.</td>
<td>79% of participants agreed that using the MPFR was easy and 11% thought that taking photos of their snacks would be easy. After training this number had increased significantly to 32% (p&lt;0.0001). There was also improvements for those taking photos of plate waste (21% before training to 43% after training (p&lt;0.0001)</td>
</tr>
<tr>
<td><strong>Author: Boushey et al (6)</strong>&lt;br&gt;<strong>Country:</strong> US&lt;br&gt;<strong>Date:</strong> 2009</td>
<td>Personal Digital Assistant (PDA)</td>
<td>N=31&lt;br&gt;Age: 11-16</td>
<td>The use of both quantitative and qualitative measures to assess dietary assessment preference in adolescents</td>
<td>Participants used three different versions of PDA to record food intake for two three week periods. Participants also partook in other forms of dietary records including multi-pass 24hr recall. At the end of the research period focus groups were held to evaluate and gather feedback about using the different forms of food records.</td>
<td>Participants preferred using dietary assessment methods which incorporated technologies i.e. taking photos of their food.</td>
</tr>
<tr>
<td><strong>Author: Higgins et al (8)</strong>&lt;br&gt;<strong>Country:</strong> US&lt;br&gt;<strong>Date:</strong> 2009</td>
<td>Photographic food records</td>
<td>N=28&lt;br&gt;Age: 10-16</td>
<td>To determine if photographic food records used in dietary assessment are as accurate as weighed diet records and will decrease respondent burden.</td>
<td>Participants were given food items and asked to keep a weighed food record for three days returning uneaten foods. They were also asked to take photos of their meals before and after eating. Experts analysed photos to estimate serving size. This was compared to actual amounts consumed. Participants were asked for feedback on how they found using the two methods.</td>
<td>There was no difference found between the two diet record methods for total energy or macronutrients. Participants reported preference for the photographic method.</td>
</tr>
<tr>
<td>Author: Daugherty et al (29)</td>
<td>Mobile telephone food record</td>
<td>N=135</td>
<td>Age:78 adolescents, 57 adults</td>
<td>To evaluate a two groups, adults and adolescents using a mobile phone food record (MPFR) and to compare preferences and perceptions of use between the two groups.</td>
<td>Participants took photos before and after eating and gave feedback on how they found doing this. Skills, preferences and perceptions between the two groups were measured.</td>
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<tr>
<td>Author: Long et al (39)</td>
<td>Variety of technology based dietary assessment</td>
<td>15 different studies included of all ages</td>
<td>A review of the evidence on how effective technology-based dietary assessment is when measuring fruit and vegetable consumption.</td>
<td>Using the Stetler Strength of Evidence Scale, 15 articles from 187 were included and evaluated by an interdisciplinary team.</td>
<td>Six different types of technology based dietary assessment methods were identified and conclusions were that validity of these methods are promising but more research in this area in a wider range of populations is required.</td>
</tr>
<tr>
<td>Country: USA</td>
<td>Date:2012</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Author: Corby et al (40)</td>
<td>Remote Food Photograp hy Method</td>
<td>N=40</td>
<td>Age:18-65</td>
<td>To test the effect of two variations of Ecological Momentary Assessment (EMA) on estimating energy intake in conjunction with Remote Food Photography Method (RFPM) over 6 days in free-living conditions and to compare estimated energy Intakes with Doubly labelled water method.</td>
<td>Participants used the RFPM to estimate their energy intake and wore accelerometers to measure physical activity. Participants were randomised to two groups; one group received standard EMA prompts while the other received custom EMA prompts. Energy intakes as estimated from the RFPM would be compared to doubly labelled water.</td>
</tr>
<tr>
<td>Country: USA</td>
<td>Date:2012</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Author: Lassen et al (41) Country: Denmark Date: 2010</td>
<td>Photograp hy</td>
<td>Main Study: N=19 Mean age: 37 Validation study: N=28 Mean age: 40</td>
<td>To validate a digital method compared to a weighed diet record in an adult population.</td>
<td>Main study: Participants took photos of their evening meal for five weekdays and weigh/record individual meal components. Photos analysed and food amounts estimated and compared to actual food weights. Feasibility study: Feasibility was then measured by asking different participants to take photos of meals on weekdays for three weeks and feedback was sought from semi structured interviews.</td>
<td>Both Studies: There was a high correlation for the weights of food record and the digital method. Participant feedback indicated overall satisfaction with the digital method.</td>
</tr>
<tr>
<td>Author: Williamson et al (42) Country: USA Date: 2003</td>
<td>Photograp hy</td>
<td>N=6,</td>
<td>Validity testing of a digital photography method. Comparing portion sizes of a known weight to estimations from direct viewing and food photographs.</td>
<td>Trained researcher associates used digital photography or direct visual estimates to estimate the portion sizes of foods including leftovers.</td>
<td>Visual estimation between digital photography and direct visual estimations correlated highly for food selection, plate waste and food intake when compared with the weighed food diary. Both methods yielded small over and underestimations.</td>
</tr>
<tr>
<td>Author: O’Loughlin et al (43)</td>
<td>Microsoft SenseCam</td>
<td>N=47 Mean ages:</td>
<td>Using Microsoft SenseCam to determine the accuracy of self-reported energy intake.</td>
<td>Participants were recruited from various elite sporting teams and asked to wear the SenseCam for a day while keeping a one day written food record. Comparisons between the food record and food record in conjunction with SenseCam data were analysed.</td>
<td>Significant differences in energy intake were recorded between the two methods of 10.7% (P=0.001), 17.7% (P=0.001) and 10.1% (P=0.01) for the three groups. The SenseCam method provides more accurate total calorie estimation of food intake when combined with a food record.</td>
</tr>
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<td>-------------------------------</td>
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<td>--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------</td>
</tr>
<tr>
<td>Author: Lee et al (46)</td>
<td></td>
<td>N=15 ages 11-18</td>
<td>To compare the difference in weight generated by automated computer for a known portion size and then compare this to the error between human and automation.</td>
<td>Participants were given food items and asked to take photos of all of their eating occasions over twenty-four hours and to record their portion size for one meal. These foods were weighed and automatically analysed.</td>
<td>The Automated system was only able to estimate foods within an acceptable range about 50% of the time and the 95% confidence intervals were lower than for human (participant) estimates.</td>
</tr>
<tr>
<td>Author Corby et al (47)</td>
<td>Pilot Study 1: No participants. Pilot Study 2: 41 participants, mean age of 33.9. Main Study: 52 Adults, mean age of 32.4.</td>
<td>To report reliability and validity of using the Remote Food Photography Method (RFPM) via two pilot studies, and to run the main study which would obtain reliability and validity data using RFPM in free-living conditions.</td>
<td>Pilot study 1: Tested Registered dietitians ability to correctly estimate Calories from food images. Pilot study 2: Free-living individuals to take images of their food and plate waste for four days and give brief descriptions of the foods. Main study: Participants trained take photos their food and plate waste on mobile phone. Participants were asked to give feedback based on their experience using the RFPM.</td>
<td>Pilot study 1: The RDS were able to reliably and accurately estimate (difference of only 0.2%) energy intake with standard portion photographs. Pilot Study 2: Issues that arose included: participants forgot to take photos of their food, researchers could not monitor progress and so systematic errors in photo taking by participants could not be corrected. Main Study: Weighed EI correlated well with both estimated EI and RFPM in the free living and the laboratory conditions (p&lt;.0001). Conclusions: RFPM is a promising method for assessing the Energy intake of free-living people.</td>
<td></td>
</tr>
</tbody>
</table>
3.0 Objective Statement

Dietary assessment is important for informing policy makers about the health of the nation. Despite this, within the adolescent population it is difficult to get an accurate picture of what they are eating. This is because traditional dietary assessment methods including FFQs, 24hr recalls and food records are limited by poor compliance, under-reporting and inaccuracy in portion size estimation. A review of the literature has found technology based dietary assessment to be a novel and validated approach to collecting this dietary information with users reporting positive feedback from their experiences. The use of photography in TBDA has been shown to reduce error in portion size estimation. Currently, much of the published research involving TBDA has been either in a laboratory setting or using expensive computer software in other parts of the world. There has been little research to determine the feasibility of utilising commercially available (and less expensive) technology such as the iPad® and iPod® in a free-living adolescent population in dietary assessment. Therefore this thesis will aim to pilot test an technology based dietary assessment tool utilising photography on commercially available device (iPads® and iPods®). The purpose is to measure food intake in a free-living New Zealand adolescent population. Feedback will be acquired from participants so that perceptions, preferences, usability and acceptability can be used to further augment the design. Feasibility in regards to compliance and the safe return of the devise will also be observed.

**Research Aim:** The purpose of this pilot study was to research the feasibility of an inexpensive technology-based dietary assessment tool utilising photography, to measure food intake amongst New Zealand adolescents.
Stages involved in food record development and implementation

1. Identification of an electronic device which can take photos, connect to the internet and host a program to record food intake (an electronic food record).

2. Development of a programme that can be used to record food intake and store photos of food (on the device identified in stage one).

3. Recruitment of an adolescent population to pilot test the electronic food record.

4. Explore compliance in both the food log and photography aspects of the electronic food record.

5. Feedback from participants regarding usability and strengths and weaknesses to determine feasibility.

6. Feedback from participants regarding usability.

7. Explore the limitations of the electronic food record.

8. Final directions/improvements to the electronic food record.
4. Subjects and Methods

4.1 Study Design

This is a cross-sectional study. Both qualitative and quantitative methods were used to undertake a pilot test of a technology based food record with photography in a New Zealand adolescent population.

4.2 Participants

We aimed to recruit participants between the ages of 16 and 19 who were able to give their own consent for participation. Ten participants (five females and five males) were required so that there would be sufficient numbers for participation in a group interview.

4.3 Recruitment

A convenience sample was recruited through a local youth group and by word of mouth from within the Otago region. The researcher visited the youth group during a Sunday afternoon social event and the study was explained to eligible adolescents in attendance. Those who were interested and met the inclusion criteria (aged 16-19) had their names and contact details recorded and were phoned at a later stage. Eligible adolescents who were not in attendance were contacted at a later date and asked to participate. Other participants were enrolled though the snowball technique via friendships through the youth group, the youth leaders and researcher.

4.4 Food Record; Hardware and Software

4.4.1 Hardware

An electronic device was required for this study. The requirements for the device were:

- The capacity to connect to the internet: so that data could be transmitted from the participants to the researcher throughout the progression of the study, and;
- Photo capable to allow food images to be taken.

Smart phones were excluded as only 30 percent of participants had a smart phone which varied in model, photo-capabilities and screen size. For standardisation purposes, iPads® and iPods® were selected for data collection as between these two types of devices, modem speed, wireless connections and camera features (including number of megapixels and flash) were consistent.

### 4.4.2 Software

Several applications, including My Fitness Pal (48), Odish (49) and Instagram (50) were reviewed during the software selection process. The selected application needed to be able to take photos and have the ability to record dietary information without counting calories as this may have influenced participant’s food intake. The selected application also needed to be secure and the ownership of the food images to remain with the user and not the application. The program used needed to transmit data through the internet to allow the researcher to monitor the progress of the participant and enter data as it was recorded. It was decided to utilise an existing program to record food intake. The program “Evernote®” (51) was selected as it met the selection criteria and allowed the researcher to design a food record template within the Evernote® program which photos could be captured and incorporated into.

Each participant was provided with an Evernote® account with a username and password which was linked to the researcher’s university email. A food record was designed by the researcher and shared with the participant Evernote® accounts so they could record food and drinks consumed (Appendix A). Participants were asked to sync their Evernote® account daily so the researcher could observe progress and save data to minimise data loss.
4.5 Study Protocol and Instructions

4.5.1 Protocol
Once recruited, the researcher met with each participant individually or in pairs. The purpose of the meeting was to obtain consent and to explain how to use the food record, including a demonstration. Participants were asked to read and sign a consent form (Appendix B). The study’s purpose and what would be required of each participant was explained verbally. For participants who lived at home and/or attended school, a parental and/or school information form outlining the participant’s involvement was provided and the school principal was phoned and spoken to regarding the participant’s involvement. The conversation was followed up with the information form being posted to their school principal and dean (See Appendix C for letter).

4.5.2 Using the food record; verbal instructions and demonstration
Participants were asked to complete an electronic food record where they recorded and took photos of everything they ate and drank for eight days. Four days were recorded using an iPad® and four days were recorded using an iPod®. Participants were given specific instructions about how to take the photos, for example to show the cut part of the sandwich in the photograph or lift the top slice of bread to show sandwich contents. A table of specific instructions are included below.

Table 2; List of instructions participants were given regarding how to take photos.

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Ensure the entirety of the meal or snack is visible in the photograph.</td>
</tr>
<tr>
<td>2</td>
<td>Please take a photograph of leftovers.</td>
</tr>
<tr>
<td>3</td>
<td>Where possible please include a teaspoon or utensil in the photograph to give size context to plates or bowls.</td>
</tr>
<tr>
<td>4</td>
<td>Where possible include packaging in photograph to give researcher more information about brand and portion size.</td>
</tr>
<tr>
<td>5</td>
<td>Where possible include condiments in photograph.</td>
</tr>
<tr>
<td>6</td>
<td>For sandwiches and burgers where filling is not immediately visible, please lift top slice of bread or hold cut part of sandwich toward the camera.</td>
</tr>
</tbody>
</table>
4.5.3 Written aspect of the food record

Participants were instructed to fill out a simple food log to help identify the foods in the images which was to help the researchers with coding and data entry (Appendix A). Participants were instructed to use one device to record their intake for four days, and then switch to the other device for four days. They were asked to include four non-consecutive days, one of which should be a weekend. Participants were asked to complete the diary within a two week period. Written instructions for using both the iPad® and iPod® were given as well as verbal instructions about how to connect the device to their home wireless internet network. This was required to synchronise the device each evening which would allow data transfer from the participant’s food record to the researcher. Participants were asked questions regarding their usual schedule in order to identify times where safe storage of the device may be required to reduce the likelihood of theft or damage, i.e. during sport practice or situations where their bag would be unattended. This was important as the return of the undamaged devices was a measure of the feasibility for this project.

After the food record was demonstrated to the participants, to help reinforce the instructions, participants were asked to demonstrate back to the researcher how to record a snack using a chocolate bar as an example. Written instructions for using the electronic food record and taking photos on both the iPad® and the iPod® were given to the participants to refer to (Appendix D). Participants were also given a contact phone number and email address of the researcher which they could use at any time to ask questions.
4.6 Data Collection Time Period

The food record template asked participants to record the date they were entering the food log and meal times were broken down into seven occasions which were designed to encompass usual meal patterns (Table 3).

Table 3: Data collection time periods for food record:

<table>
<thead>
<tr>
<th>Occasion</th>
<th>Time Frame</th>
<th>Usual Meal Patterns</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>6am-10am</td>
<td>Breakfast</td>
</tr>
<tr>
<td>2</td>
<td>10am-12pm</td>
<td>Morning tea</td>
</tr>
<tr>
<td>3</td>
<td>12pm-2pm</td>
<td>Lunch</td>
</tr>
<tr>
<td>4</td>
<td>2pm-5pm</td>
<td>Afternoon tea</td>
</tr>
<tr>
<td>5</td>
<td>5pm-8pm</td>
<td>Dinner</td>
</tr>
<tr>
<td>6</td>
<td>8pm-12am</td>
<td>Evening/Late night snack</td>
</tr>
<tr>
<td>7</td>
<td>12am-6am</td>
<td>Midnight snack/Early morning meal.</td>
</tr>
</tbody>
</table>

Under each occasion participants were asked to record their food and were asked questions about the food/meal they consumed during this time frame. They were also asked to insert the photos of their food within these occasions if possible (Appendix A). Questions asked included the time the food was eaten, where they ate it, which they were with at the time, what the food was the size/portion or weight. There were three boxes per occasion where a participant could record information about what they ate and participants were instructed to write outside of the box if they ate more than three times in one occasion.

4.7 Compliance measures

After the food records were completed, participants were given forms to fill out which asked questions about the type of milk and bread typically eaten as well as other questions around condiment use and fluid consumption (Appendix F). This information was then used to crosscheck the information in the diary to ensure data was entered correctly when no specifics
were given and when food items were not obvious from the images (i.e. whole milk v trim milk). This form also asked participants about their meal patterns. As adolescents tend to have irregular eating patterns, meal frequency information was gathered to compare against reported intake (from the food record) to help determine compliance. All participants stated eating at least two main meals daily and so a minimum of two meals per day will be the primary measure of compliance used for this food record.

4.8 Food record coding

Data from the food record were identified and coded using information from both the photographs and the written information accompanying these. This was then entered into Kai-calculator (v1.08d), the dietary assessment software developed in the Department of Human Nutrition, University of Otago. The food composition database includes current and previous versions of FOOD files from Plant and Food Research Ltd (52) and selected recipes calculated for the 2008/09 New Zealand Adult Nutrition Survey (20). For foods which were not in included in Kai-calculator, these were researched on the internet and a similar product was entered into Kai-calculator based on the ingredient list. For example “chicken chips” contained 55% chicken. The closest match in Kai-Culator was "Chicken patty, crumbed", which contains 57% chicken.

For food items where there was potential for energy or macronutrient variation between brands such as bread, assumptions were made and then entered in a standardised way. For example, bread was coded as either whole-grain, wheat-meal, white or ‘Vogels’ based on food record description and what the photo depicted. These were then entered in the same way across all participants’ food records unless brand names were specified. The table below shows a list of main assumptions made for all participants when specific data was unavailable.
### Table 4 Global coding decisions

<table>
<thead>
<tr>
<th>Item from Food log</th>
<th>Entered as</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Liquid Breakfast of varying brands</strong></td>
<td>“Up and Go” Sanitarium</td>
</tr>
<tr>
<td><strong>Orange Juice, no visible bottle or brand given</strong></td>
<td>“Just Juice – Orange and Mango”</td>
</tr>
</tbody>
</table>
| **Pizza – if topping was not specified**                | Homemade: “Pizza, homemade, regular base, ham and pineapple”  
                            | Dominos: “pizza, dominos, beef’n ‘BBQ swirl, classic crust”  
                            | Pizza Hut: “Pizza hut, meat lovers, thick base”               |
| **Rice Balls**                                          | Assumed rice balls to contain: 1 cup cooked with a small amount of chicken and avocado. Assumed soy sauce was used if visible in photo. |
| **Visible Drinks in photograph**                        | Assumed participant consumed the entire drink. |
| **Bowls of cereal where milk was visible but not recorded in food log.** | Assumed ½ cup of milk to every 1 cup of cereal and entered milk type as per participant feedback/extra information form. |
| **Butter or margarine/table spread visible in photo but not recorded in diary.** | Type of spread (Butter or Margarine/table spread) was established by refereeing to extra information form and was assumed as 1 tsp per slice of bread or 1.5 tsp per slice of toast to account for melting. “Butter, salted” or “Margarine Meadowlea original” This spread was selected as it contains 70% fat which is a typical amount of fat to be found in a table spread in New Zealand. Meadowlea was selected as it is a common household brand. |
| **A ‘handful’ or ‘scoop’ of hot chips.**                | Quantity estimated if image available or one ‘handful or scoop’ was assumed to equal one tub which was a measure in Kai-calculator of 144g. |
| **Sugar sweetened beverages:**                          | Unless specified that the diet version was consumed, the full sugar version was assumed. |
| **Yeast Spread**                                        | If not specified, yeast spread was entered as “Marmite” |
Fish and Chips – if fish type not specified
Shark, battered and deep fried
(Typical to most New Zealand fish and chip shops).

Hot Chocolate or Milo
Was assumed to be made up of 1Tbsp of either Hot Chocolate or Milo, plus 30ml of milk and 1 cup of water. This amount was selected based on the feedback of how one participant typically made her Milos.

Milk in hot drinks
This was entered as 30ml unless stated otherwise.

Vegetables with meal
Vegetables were estimated based on visual appraisal from photographs if participant did not give quantity. Nearby utensils or glasses were used to estimate portion size.

Mince
“Mince recipe for shepherd’s pie” (as this contained stock and vegetables – typical to most mince dishes).

Foods not in Kai-cultator
These were Googled and ingredients lists scrutinised, and then similar products in Kai-culator were entered in place.

Slices/cakes which were unbranded or homemade
Participant was asked to identify the food item, if this was not in Kai-culator a similar food was entered in its place.

4.9 Measures of feasibility and compliance for both the food log and photography aspects of the food record.

4.9.1 Feasibility and Measuring compliance
As stated previously, compliance to the food log was measured by participants recording at least two meals each day for eight days. Other measures to determine feasibility in this study included:

- The return of the devices undamaged.
- Realistic energy intakes as compared to the data from the New Zealand Adult Nutrition Survey data for adolescents aged 15-18 over the recording period. These results broken down into device use by sex.
- Attendance to the group interview and feedback regarding the usability/strengths and weaknesses of the device.
Feasibility was also evaluated based upon how well the participants follow instructions for taking food images (i.e. clarity of image).

4.9.2 Feedback from participants regarding usability and strengths and weaknesses to determine feasibility.

After data collection was complete, a group interview was held to discuss the strengths and weaknesses of each device and to determine which device the participants prefer using and why. Participants were contacted by phone or text messaging and asked to attend on a prearranged date. A meal was provided for participants who attended as well as an entry into a draw to win an iPod touch. Participants were asked to give feedback on how they found using the device and ways to improve the program to make it more user-friendly and to increase user compliance (interactive design). Feedback was recorded electronically and transcribed (Appendix G). Any participants who could not attend the group interview were met on an individual basis to obtain feedback.
5. Results

5.1 Measured compliance from both the food log and food imaging aspects of the food record.

5.1.1 Energy intakes from iPad® and iPod® devices

Table 5: Energy Summary from iPad® and iPod® devices as compared to New Zealand Adult Nutrition Survey (males and females aged 15-18 years)

<table>
<thead>
<tr>
<th></th>
<th>iPod®</th>
<th>iPad®</th>
<th>iPad® &amp; iPod®</th>
<th>NZANS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Average</td>
<td>8,546</td>
<td>8,004</td>
<td>8,114</td>
<td>9,480</td>
</tr>
<tr>
<td>Males</td>
<td>10,089</td>
<td>8,292</td>
<td>9,111</td>
<td>11,121</td>
</tr>
<tr>
<td>Females</td>
<td>7,003</td>
<td>7,715</td>
<td>7,117</td>
<td>7,839</td>
</tr>
</tbody>
</table>

Ten participants with a mean age of 17.5 years were recruited to the study. Energy intakes were similar between both devices with the iPod® averaging a higher overall energy intake compared to the iPad®. Males recorded the highest average daily energy intake at 10.1MJ, as would be expected given their higher metabolic requirements (53). When compared to the NZANS data, male iPod® users recorded similar energy intakes (iPod®; 10,089kJ versus NZANS; 11.121kJ), while female iPad® results were very similar (iPad®; 7715kJ versus NZANS; 7839kJ). Overall, the average energy intake from the iPad® and iPod® food records were broadly comparable to the NZANS data from a similar age group, although it must be acknowledged that our sample size is small and data collection methods differed between studies. While the iPad® and iPod® data appears to be realistic for the females, for males, energy intake measured on the iPad® is much lower than the NZANS data.

5.1.2 Meals

Out of the total 80 days participants were asked to record their meals, five days were excluded due to data loss. A further 16 days were excluded due to low compliance (participants reporting
less than two meals per day). Results from table 5 and table 7 are calculated based upon 59 days of diet records. Of the 59 days used in the data analysis, 26 days of data (44%) was collected using the iPad® and 33 days (56%) was collected using the iPod®.

Table 6: Days of data exclusion by sex and devices

<table>
<thead>
<tr>
<th></th>
<th>iPad®</th>
<th>iPod®</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Males</td>
<td>7</td>
<td>3</td>
<td>10</td>
</tr>
<tr>
<td>Females</td>
<td>5</td>
<td>1</td>
<td>6</td>
</tr>
<tr>
<td>Data loss</td>
<td>2</td>
<td>3</td>
<td>5</td>
</tr>
<tr>
<td>Total</td>
<td>14</td>
<td>7</td>
<td>21</td>
</tr>
</tbody>
</table>

5.1.3 Compliance between the devices

Thirty percent of participants completed all 8 days over both devices. With regards to the iPod®, there was enough data from all participants to be included in the analysis, with 50% of participants completing all four days. With more days of data recorded on the iPod® than the iPad®, it is suggestive that overall, the iPod® had the better compliance between the two devices. Forty percent of iPad® users completed all four days but two participants had to be excluded from the analysis due to non-compliance and data loss. Of the 16 days excluded from non-compliance, 12 days were from male users and four from female users. Because some participants accidentally deleted data, these days also had to be excluded alongside days of non-compliance.

5.1.4 Macronutrients

Table 7 gives a comprehensive breakdown of macro and micronutrients as calculated from the both devices and sexes over the collection period. Due to the small sample size it is difficult to make comparisons to the general population; although it would appear that calcium levels are
similar to the values estimated from the NZANS data (Males 980mg/day, Females 682mg/day). However both this study and the NZANS estimated calcium values less than the Ministry of Health’s daily recommendations for calcium in adolescents aged 14-18 (RDI: Males and females 1300mg/day). Other micronutrients calculated from this dietary analysis were also similar to those found in the NZANS.
Table 7: Nutrient intakes calculated from data per device

<table>
<thead>
<tr>
<th></th>
<th>iPad® &amp; iPod®</th>
<th>iPod®</th>
<th>iPad®</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Average</td>
<td>Males</td>
<td>Females</td>
</tr>
<tr>
<td>Energy (kJ)</td>
<td>8,114</td>
<td>9,111</td>
<td>7,117</td>
</tr>
<tr>
<td>Protein (g)</td>
<td>80</td>
<td>91</td>
<td>69</td>
</tr>
<tr>
<td>Total fat (g)</td>
<td>90</td>
<td>94</td>
<td>87</td>
</tr>
<tr>
<td>Carbohydrate (g)</td>
<td>204</td>
<td>245</td>
<td>163</td>
</tr>
<tr>
<td>Sodium (mg)</td>
<td>2,844</td>
<td>3,189</td>
<td>2,498</td>
</tr>
<tr>
<td>Fiber (g)</td>
<td>19</td>
<td>20</td>
<td>18</td>
</tr>
<tr>
<td>Saturated Fat (g)</td>
<td>37</td>
<td>38</td>
<td>35</td>
</tr>
<tr>
<td>Sugar (g)</td>
<td>75</td>
<td>81</td>
<td>69</td>
</tr>
<tr>
<td>Calcium (mg)</td>
<td>849</td>
<td>877</td>
<td>822</td>
</tr>
<tr>
<td>Iron (mg)</td>
<td>10</td>
<td>12</td>
<td>8</td>
</tr>
<tr>
<td>Potassium (mg)</td>
<td>2,391</td>
<td>2,697</td>
<td>2,086</td>
</tr>
<tr>
<td>Vitamin A (µg)</td>
<td>679</td>
<td>616</td>
<td>741</td>
</tr>
<tr>
<td>Vitamin B12 (µg)</td>
<td>4</td>
<td>6</td>
<td>2</td>
</tr>
<tr>
<td>Vitamin D (µg)</td>
<td>3</td>
<td>2</td>
<td>4</td>
</tr>
<tr>
<td>Vitamin E (mg)</td>
<td>9</td>
<td>9</td>
<td>9</td>
</tr>
</tbody>
</table>
5.1.5 Return of devices

A measure of compliance in this pilot study was the safe return of the iPad®/iPod® devices. This is an important measure of feasibility as if the iPads® or iPods® were broken or stolen it would compromise the future financial viability of the study. All devices were returned undamaged and in good working condition.

5.2 Food Record Images

5.2.1 Image recording

Seventy eight point five percent of all food logs recorded contained images. Seven of the ten participants recorded images every day, with the remaining three participants recording images over 50% of the time. On days where photos were omitted from the food record, text was very useful to determine what the participant ate.

5.2.2 Photo Clarity

Participants complied with the instruction to include the entire meal in the photos and images were clear enough to identify the food with the accompanying description in the written part of the food record. See figure 1 for an example diary entry. Most participants held the cut part of their sandwich towards the camera or removed the top layer of bread to reveal the inside which allowed for the estimation of amounts. Participants also included utensils alongside main meals to give size context to the dish 59% of the time.
5.2.3. Details observed from photos

Photos with accompanying text provided the most information to allow coding. For example; if a participant entered ‘meat sandwich’. The photo could then be used to identify bread type (white, wholegrain or wheat meal), thickness of bread and how many sandwiches the participant ate. If the sandwich was cut, this meant that the filling was visible and this information could be recorded without contacting the participant to obtain further information (Figure 2). Food images were also used to identify extra food items which the participant consumed but may not have entered as text i.e. a glass of water. For example in (Figure 3) a participant wrote “pie” in the food log part of the food record yet the information given was ‘Big Ben’. So it was possible to establish from the written information it was an individual sized pie. The photo showed the participant had added half a cup of grated cheese and approximately two teaspoons of tomato sauce on the pie.
<table>
<thead>
<tr>
<th>Time</th>
<th>11:05</th>
</tr>
</thead>
<tbody>
<tr>
<td>Where I ate it</td>
<td>school</td>
</tr>
<tr>
<td>Who I was with</td>
<td>friends</td>
</tr>
<tr>
<td>What the food was</td>
<td>Chicken pastrami, cheese, lettuce and mayosandwich. Pains salt and vinegar chips. Vanilla up and go.</td>
</tr>
<tr>
<td>Size/portion/weight</td>
<td>home</td>
</tr>
<tr>
<td>Did you buy this food yourself?</td>
<td>no</td>
</tr>
</tbody>
</table>

**Figure 2:**
<table>
<thead>
<tr>
<th>Time</th>
<th>3:00</th>
</tr>
</thead>
<tbody>
<tr>
<td>Where I ate it</td>
<td>home before work</td>
</tr>
<tr>
<td>Who I was with</td>
<td>alone</td>
</tr>
<tr>
<td>What the food was</td>
<td>pie</td>
</tr>
<tr>
<td>Size/portion/weight</td>
<td></td>
</tr>
<tr>
<td>Where was the food from?</td>
<td>freezer</td>
</tr>
<tr>
<td>Extra info (i.e brand)</td>
<td>Big Ben</td>
</tr>
</tbody>
</table>

**Figure 3**
5.3. Food Diary

5.3.1 Portion Size

When comparing photos with the participant’s estimation of portion size, several discrepancies were observed. Despite participants being asked to estimate portion size based on household measurements or to give weights from packets, some foods appeared to be estimated incorrectly or ambiguously i.e. a ‘handful’ of cheese. Portion size estimates for items like vegetables or potatoes were often unclearly defined as ‘some vegetables’ or ‘3 potatoes’ without specifying size. In these situations, photos (when taken) proved very useful in giving size context. Figure four shows an example where a participant stated that they had ‘5 potatoes with butter and cheese’. The photograph with utensils allows the researcher to estimate the potato size and the amount of cheese added.
<table>
<thead>
<tr>
<th>Time</th>
<th>7:30</th>
</tr>
</thead>
<tbody>
<tr>
<td>Where I ate it</td>
<td>home</td>
</tr>
<tr>
<td>Who I was with</td>
<td>family</td>
</tr>
<tr>
<td>What the food was</td>
<td>5 potatoes with butter and cheese</td>
</tr>
<tr>
<td>Where was the food from?</td>
<td>home</td>
</tr>
<tr>
<td>Did you buy this food yourself?</td>
<td>no</td>
</tr>
<tr>
<td>Extra info (i.e brand)</td>
<td></td>
</tr>
</tbody>
</table>

Figure 4.
5.3.2 Common food omissions

The information collected from the extra information sheets was used to correct and amend data from the food record. For example, participants rarely took photos of their drinks and did not record them in their food record and the extra information form was able to pick this up. Foods which participants commonly omitted from the food log part of the food record included milk and sugar in cereal and hot-drinks, and condiments such as tomato sauce on pies/chips. Margarine and butter were only occasionally mentioned when consumed with toast. The type of milk and bread eaten was rarely mentioned (i.e. trim milk versus whole milk). Participants also consistently forgot to record cold drinks including water, sugar sweetened beverages and milk drinks.

5.4 Group interview feedback from participants regarding usability and strengths and weaknesses to determine feasibility

5.4.1. Food record feedback

All participants found the presentation of the food record easy to understand and the layout of the food record to be “good” and ‘straightforward’ in regards to filling it in. All participants were able to easily log onto and navigate the Evernote® program and after using the program for one day became proficient. Participants unanimously agreed that they liked having the instructions verbalised and demonstrated to them “I prefer to be told than read”. There were no problems connecting to wireless networks and all participants reported the battery power of the devices to be sufficient.
5.4.2 Memory/remembering to use food record

Most participants reported remembering to record food items difficult. Almost all agreed that it was easier to remember at school/work/university compared to at home. One participant cited that it was more difficult to remember at home because at school her friends would remind her, and also she was carrying the device around in her school bag. At home she would sometimes forget to take it out of her bag: *at home I might sit down for dinner and halfway through I might sort of remember*. Participants sometimes forgot about recording until after they had eaten: “*you can quickly make a sandwich and you can’t be bothered doing it – and you eat it and then you remember*”. This was observed in the food diaries with entries without photos “*yeah I would come off the farm and can’t be bothered doing anything so I would cook up a feed – have it and be like ... forgot*”. When participants were asked about what they did when they forgot to record meals, some would restart their record the next day, others would enter the food without the picture, and one participant would fill in the gaps the following day “*yeah if I left stuff I would continue it – fill in that gap with what I had the next day*”. Participants were asked how long they could continuously remember to use the device for. This varied between participants with some forgetting more in the first couple of days and others three or four days in:

“I would probably forget more in the first couple of days”... “That’s the same as me”... “The first couple days I would forget to do it then get into that routine”...

“I’m the opposite – first couple of days I’m sweet as and then once I miss a day I’m......”.

Participants reported the most difficulty remembering to record when they switched between devices “*you sort of got into a bit of routine, I found when I used the iPod that was fine but it was having to switch and I would be like “Oh I can’t take it there” or it was harder to use so I would forget*”. This was reflected by gaps in the food record of up to a week between using the iPod®
and the iPad®: “Like the first, I tried to do it within the first three or four days – and then when I went to the iPad I forgot more. So – ended up doing over a week or a couple of weeks.”

5.4.3 Retrospective entry

Participants found the photos to be a useful visual reminder to fill in the food diary retrospectively.

“Sometimes I just took a photo of it and I filled the rest of it out when I got home. So if I was going out for lunch I would just take a photo of my lunch and put it back away and go fill it out when I got home because I knew what I had and I knew I finished it. So then I didn’t have to worry about sitting there taking up half my lunchtime filling it in. I would be like ‘Ok – I have time later I will worry about that later’ but I knew what I had”.

Participants who did not include photos in their food record reported that they forgot to take photos on these days and ‘could not be bothered’ doing the food record again and so wrote down what they remembered eating. Participants also stated that if they had not taken a photo then it was harder to remember to fill in the record later on “I usually forgot if I didn’t take a photo of it”.

5.4.4 Pen and paper records

When asked how they would find using a pen and paper record instead, the general consensus from those who had used pen and paper record before was they preferred the electronic version. Participants admitted they may not fill in a written food record properly.

“Yeah I have done it once before and it was harder to remember with pen and paper and I tried doing it once and I kept forgetting. It was harder to remember (to do the pen and paper record) over the ipad or the ipod”. And: “I did it once, we were meant to do it for PE and I forgot the whole time so I just made it up”.

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5.4.5 Incentives to remembering to use the food record in general

For one participant having an electronic device at school caught the attention of her friends and they remind the participants to record in her food record “I had some friends that were like “have you written down your food diary today?” And I was like “oh no I haven’t”. For others, the visual reminder of having the device where they could see it helped some participants with their recording “I sat mine in the kitchen while I was in the kitchen, or if I knew I was going to be in the kitchen the next time I ate – I left it on the kitchen like next to the fridge or next to the jug”. Another participant found that “The bright blue cover (on the iPad) was better as it stood out. I would see it and go ahhh – photo”. Other participants had so much trouble remembering to use the food record that they consistently forgot to take photos and recorded all meals retrospectively and this was reflected in the food record where several days contained no photos and generalised entries.

5.4.6 Meal times

There was not a specific meal time that participants reported being easier to remember. In the weekends participants reported being less likely to eat breakfast as they slept in. Some participants had “no technology” rules at dinner time which was an unanticipated barrier to using the food record and would need to be considered in future.

5.4.7 Time frames

Participants found that the timeframes in the food log part of the food record template were not useful and would rather have just put in the time of day themselves “I think I would rather just put in the time because those time frames some of them were completely like, I might have been in-between two times”. “Or right on the line of two
times”. “Sometimes I just put it in wherever I thought – just putting in the time rather than just having time frames would be easier”.

5.4.8 Duration of food record

Participants were asked how long they would be happy to complete the food record for and all agreed that two weeks would be fine as long as they had a month to complete it within and could use only one device. “I would be fine if it wasn’t longer than two weeks – no longer than two weeks”

5.5 Feedback on devices used

5.5.1 iPad®

Participants reported to enjoy using the iPad® for their personal use (i.e. to browse the internet/Facebook®) however the size of the iPad® was an issue for some participants to use it or take it places. “Well if we were going out to dinner I didn’t actually want to take the iPad to a restaurant or whatever but with the iPod it was fine. Three participants reported size as a barrier to removing it from their school/uni bags “at school, having to take the iPad out of my bag was – doesn’t take much effort but I really couldn’t be bothered”. Another mentioned the feasibility of carrying it around: “The iPad was a little bit more hard. I forgot more with the iPad. It was too big to constantly carry around with you”. Females did not have trouble transporting the devices as they could put them in their school/uni/work bag or into their handbag. Participants reported it was more difficult to take pictures with the iPad®. There was a range of reasons for this including that it was more obvious taking photos with the iPad® in class and this may lead to embarrassment; “I got some funny looks from people”. Other participants found that the lack of zoom on the iPad® made it difficult to take photos “yeah like the iPad had no zoom – so you had
to hold it like that (demonstrates holding it above plate) and you only get part of the food and you end up holding it like that (holds iPad way above head)”

5.5.2. iPod®

Participants reported that the iPod® was more convenient for taking places and found that “The iPod is a lot more portable”. For many participants – especially the males, they could put it in their pocket and for this reason participants were more likely to take the iPod® with them. The negative aspect of using the iPod® was reportedly because of the iPods® small size. The screen and therefor the display of the food-record template was much smaller than the iPad® and this made it more difficult for participants to fill in the food-log aspect of it.

“The hardest thing with the (iPod) pictures was pressing the little space to get it (the cursor) in the right spot otherwise it would all go to the bottom”. . . “I found it was so much harder on the iPod to put the stuff in and keep the pictures”. . . “And sometimes it just deleted half of my stuff and I was like “where has it gone?!”

5.6. Reported Issues using the food record

5.6.1 Main issues

The main issues participants found using the food record were; remembering to use it, recording drinks and estimating portion size. An unexpected finding that contributed to significant data loss was that four participants deleted a day’s food diary due to selecting the “trash” option when trying to remove an unwanted photo. “I didn’t do backspace I just clicked on the rubbish bin on the top and it deleted the whole thing” The deleted days and photos were unable to be recovered and may have resulted in an underestimation of nutrient intake.
5.6.2. Recording drinks and estimating portion size

Because the food record entries highlighted a knowledge deficit in the area of portion size, as part of the group interview, participants were asked for feedback on how they found estimating portion size of the foods they ate. All participants agreed finding portion size estimating difficult. “Size and portion was probably the worse – like – how do you make a cup full? Like I have a plate of chips, which could be three or four scoops”. Similarly, participants were asked why they did not record drinks. All unanimously agreed “that was hard”. One participant said “I completely forgot about drinks” . . . “You just automatically would just go and get a drink and then have it and go ‘ohh, opps’ but with food you sort of – I remembered”.

5.7. Suggestions for dealing with these issues

5.7.1 Notifications/prompting

As well as the visual reminders of placement and bright device covers, one participant suggested that a notification on the application might be useful to remind them to fill in their food record. “yeah or even if the app had a notification because there are apps which have notifications and it tells you to remind you that you’ve got to do it”. After further discussion the participants specified a notification might only be useful if it was sent to their phone as they tended only to use the iPad®/iPod® when using the device to record their food intake. Most participants specified they carry around their mobile phone and that it might be useful to receive a text message to remind them to complete their food record. “I guess after the first few days if we saw your name at certain times it would be a reminder. You wouldn’t actually need to say anything in the text, like if we saw that it was from you we would remember”. Participants gave mixed responses in regards to timing of text messages but general consensus was that they were tailored to the individual. Text messages would need to be earlier rather than later in the day “(A text message
would be helpful) depending on if I took the photo or not. If I took the photo I would fill it out but if I didn’t take the photo I wouldn’t bother”. The general consensus was that email notifications would not be suitable for this age group as only one participant checked her email daily but all participants thought a Facebook notification may work.

5.8. Potential Improvements/suggestions

5.8.1 Preventing data loss

As some participants ended up deleting an entire day’s food record, it was suggested that it would be useful to have instructions on how to avoid this from happening in the future. Participants asked for a template which could not be deleted. “A big blue print thing” “It’s like you have a form that’s already filled out but you can’t rub out anything else so if you backspace too far then you can’t delete what you have written”. Photos did not always save (backup) to the device so if day’s food record was deleted these photos could not be retrieved, which makes it difficult to establish which device (if any) was affected by this the most. In the future instructions to save all photos to the device (this involves ticking a ‘save to device’ option after taking photo) may reduce data loss from occurring.

5.8.2 Suggestions to improve recording of drinks ad estimating of portion size.

Participants suggested that to help them remember to record drinks it might be useful to have a visual reminder on their cup cupboard or fridge such as a sticker, or a sticker on the device itself reminding them to record drinks.

“Have a sticker on your glass. One of those wee sticky poster thingies”. . . . “I think a sticker would be good”. . . . “yeah just on the back of the iPod. On the screen just the top corner”. . . . “A poster on the cupboards with the glasses in it maybe”, “or on your fridge”.

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With regards to portion size, participants also reported that it would be useful to have a reference on the device that they use which gave examples of key food items. These would include: breakfast cereals, mixed vegetables, potato, pasta, rice and hot-chips in either cup sized serves on a plate/bowl or in small, medium or large servings. The references could then be compared to the foods they were eating in order to estimate portion size. “Yeah (have the portion size examples) just in one of the folders in Evernote® and you quickly go out and check the folder, or just in the notification itself”.

5.8.3. Suggestions to improve the food record

Participants stated they would only use their own phone to record a food record if they had a Smartphone as the screens are larger than traditional flip-top phones. Participants also stated they would use an iPod instead of a Smartphone if the design of the diary was improved so they could easily record data – or if they could fill out the food log aspect on something the program was linked to i.e. a website at a later time.

5.9. Summary

Based on participant feedback and results from the food record, participants would prefer to use either their own Smartphone or an iPod® with a simplified version of the food record where they could take pictures and have access to a type of reference to help them estimate portion size. They would prefer to enter in the time and details into a form which could not be easily deleted and would need notifications or promptings to their phone or Facebook to remind them to use the food record. Participants would be happy to complete the food record for two weeks if they had a month to complete the record in, and they would like some sort of visual reminder that they could put in their kitchen or regular eating space to remind them to record their food and drink. Overall
participants were very confident in using the technology and preferred the technology based record with photography to writing down on pen and paper what they ate. They found taking photos easy and might be more inclined to record meals and snacks if there was less information to fill in on the food record and if they could do this online or at a later time.
6. Discussion

The findings of this pilot study support the use of the method described previously and confirm alongside other research the feasibility of TBDA with photography as an effective way to record food intake in the adolescent population (6). Reasonable measures of food and energy intake were observed when compared to the NZANS (20), and group interview feedback was positive with most participants finding the food record easy to use and an enjoyable experience. Barriers were around participant forgetfulness in using the devices and human error which lead to data loss. Final suggestions will be made toward improvements of the electronic food diary at the end of this discussion.

6.1. Overall compliance

After accounting for data loss; compliance rates (as measured by recording two or more meals per day) was found to be 80%. This is a high rate of compliance when compared to a NZ study by Wong et al (32), where compliance from adolescents was just 47%. The higher compliance in this pilot study may have been due to peer encouragement as this was a youth group who saw each other on a frequent basis. The small sample size and peer encouragement may have also contributed toward no one dropping out of this study (32).

6.1.1 iPad® versus iPod®

Overall, participants recorded a higher energy intake on the iPod® compared to the iPad®. For males when energy intakes were compared to the NZANS data, the data appeared to be more reasonable in comparison to the iPod® versus the iPad®. Interestingly, in the group interview the males stated that they had trouble transporting the iPad® whereas they put the iPod® in their pocket and always had it with them. But the females (whose energy intake measured higher on the iPad®) would put both the iPad® and iPod® in their handbag. Transportation of the device
was not actually considered beforehand and because this is the first study comparing the use of a tablet to something the size of a smart phone, it is not possible to determine if the transportability of the device affected usability and therefore compliance. However both the data and feedback from the group interview indicated that overall the participants preferred using the iPod®.

6.1.2 Photos

Participants followed instructions for taking photos of their food and managed to capture food images in their food logs 78.5% of the time. All food images could be clearly deciphered when considered in conjunction with the accompanying description. This is an impressive finding when considering participants were recording what they usually eat in a free-living setting compared to a laboratory setting in which other feasibility studies have taken place (47). This provides evidence towards this studies application in real-world situations. Clear images are especially important in larger studies which rely on computer automation to identify the food (45, 47).

Previous studies have had difficulties with unclear food images when participants have taken photos in a darkened room or the device used had a poor quality camera or flash (47, 54). In this study, despite participant training, it is possible the high degree of clear and usable food images may have been due to the standardising of devices given to participants. The iPad® and iPods® both had high quality cameras and LED flashes. The standardisation of hardware in TBDA is supported in a review by (39) who suggested that to standardise research outcomes across populations there should be a standardisation of specific devices and training specific to these devices.
6.2 Extra information

An important finding from this pilot study was that the photographs themselves provided the opportunity to observe extra details in the participant’s diet that they had not written down in the food log aspect of the food record which affects the ability of the research to accurately access energy intake. For example:

- Additional details about a food eaten i.e “cereal” written in the food log, but the picture depicts the type of cereal (eg. Sultana bran or Milo cereal)
- Complete food omissions where the participant has forgotten or neglected to mention the addition of a food i.e milk in cereal, margarine or butter on toast or tomato sauce on chips/pie.

Studies by Long et al and O’Loughlin et al (43, 55) have also observed that food images, when analysed and entered in conjunction with information from a written food record can lead to significant differences between measured energy intakes (43, 55). The implications of this extra information show that technology based food records with photography have the potential to:

a. increase accuracy and validity of the dietary assessment method as small omissions can add up to significant measured differences in energy intake and;

b. reduce the researcher burden as the researcher is no longer is required to contact the participant to find out specifics of food if not written down i.e. type of cereal

Feedback from the group interviews and evidence from the food logs indicated that participants were less likely to retrospectively record food items. If participants only had time to take a photograph when consuming food items then it may be that under-reporting is minimised compared to the paper diaries because details including portion size and food eaten could be
established from the visible information. However, this was unable to be measured in the current study design and further research is required to corroborate these findings.

6.3 Portion sizes

At the onset of this study it was recognised that participants would unlikely be able to estimate portion size correctly as the literature agrees that children and adolescents find portion size estimation difficult and burdensome (6, 45, 56) and one of the largest confounders in dietary assessment research is that adolescents tend to underestimate portion size (56). Studies have even shown that even after extensive participant training, improvements in portion size estimation may only improve slightly (57). It was for this reason a decision was made to incorporate a photography component into the food record. Despite this it was still important to ask participants to estimate portion size in case of the situation where they forgot to take a food image and needed to enter data retrospectively. As expected, the portion size estimates that participants entered into their food log tended to be vague or ambiguous (i.e. 2 potatoes or ‘some chips’). As with food omissions, small discrepancies in portion size may impact total energy intake over the course of the data collection period. For this reason, where possible, the researcher used the food images to amend food that had been incorrectly estimated by the participant to reduce miss-reporting.

6.4 Feedback from participants regarding usability and incentives to remembering to use the food record

Feedback from the group and individual interviews was positive. Participants expressed satisfaction with the method and for those who had previously completed a pen and paper food diary, they preferred the digital method. These findings agree with previous research (6, 8, 9, 47) which supports the novel approach of using the technology in dietary assessment in its appeal to adolescents. Important findings to come out of the group interview centered on the participant’s ability to remember to take photos and fill in the food record. Participants gave good feedback
and suggestions toward helping them remember such as visual reminders, notifications and social motivations.

6.4.1 Visual Reminders

For some participants, visually seeing the iPad® or iPod® reminded them to record. One participant stated that the cover of the iPad® caught her eye because it stood out. There has been little research into visual reminders for participants to remind them to record food and drink and so it is not known whether providing visual reminders would actually increase compliance. However participants stated that they may have been more inclined to record drinks and their food if they had visual reminders to put on their fridge or cupboard or even upon the device itself reminding them to record when they ate.

6.4.2 Notifications

A clear message that came out of the group interview was that; participants recognised they forgot to record meals and snacks. Forgetting to fill in a food record is also a barrier in the traditional pen and paper food logs, but the potential with an electronic version is the ability to set automated reminders on the device. Interestingly, the participants actually requested a notification to remind them to record. In general the participants preferred a text message or Facebook message notification. This was because they did not use the device apart from recording in their food record and taking photographs but they always had their mobile phones with them The use of text message notifications in a study by Corby et al (47) has been shown to be an appropriate tool to remind participants to use their food record and increased compliance.

6.4.3 Social Motivations
For several participants, it was their friends who reminded them to use their food record. Social support groups have been identified as important in the area of weight loss interventions (58) but remains an unexplored area of research within dietary assessment. Previous group interviews exploring the limitations often highlight adolescents’ embarrassment to fill them in in front of their peers as a reason for non-compliance. However a study by Boushey et al (6) asked participants if there were situations where they felt embarrassed and most of the participants said no. With social networking becoming an important influence on this current generation and the concept of sharing one’s life online “normal”, there is potential that involving a participant’s peers or family members may help to increase compliance. For example there are actually mobile applications which encourage participants to take photos of their food and post online and share this with their friends (49). Utilising a familiar application such as Instagram (50) for participants to upload their food images onto and share with both the researcher and selective peers may be an area for future exploration.

### 6.5 Limitations

The first and greatest limitation of this study is the small sample size which is not representative of the entire New Zealand adolescent population. For this reason it is not possible to determine feasibility from energy intake alone. It is important to note that this was a feasibility study of interactive design which meant that the limitations of the food diary would be addressed in future work. Other limitations seen in this pilot study tend to be similar to those found in other forms of dietary assessment which rely on memory to record meals, snacks and drinks; retrospective entry of food items (without images) and human error which may led to data loss.

#### 6.5.1 Memory
Many participants simply forget to record meals or snacks or ate before remembering they needed to take photos. When this happened some participants recorded these food items without the photos later on (retrospectively), others did not. Participants did not record drinks well with several participants admitting they did not record drinks at all. The exclusion of most drinks probably resulted in an underestimation of total energy intake. Some studies have actually excluded drinks from their data collection (59) and (41) believing they should be treated separately due to their effect on energy intake. Overall omitted meals, snacks and drinks lead to an under-reporting of the day’s food intake. This phenomenon is not uncommon and is seen throughout the literature. While this data can be somewhat made up for when participants enter food items retrospectively, it is likely the quality of the data is reduced. An unexpected finding from this study was the use of retrospective entry with photography. One participant who had a busy job would take food images, note down the time in the food record and later return to fill in the details later. This type of diet assessment has not before been researched but a study by Berry et al (60) found that seeing images of food prompted the brain to recall memory more so than seeing a written record of food items alone.

6.5.2 Human Error

While photographs provided visual information which helped with the estimation of portion size, human error led to data being deleted from the device eight times. And while some of this data could be retrieved, it is an indication of the impossibility of eliminating all forms of error from dietary assessment regardless of how ‘technical’ it becomes. It is also impossible to eliminate other self-report limitations such as participants with a higher BMI tending to under-report (25).

6.6 Final directions/Improvements to technology

The Evernote® program was useful and met the needs of a pilot study but essentially the participants from this pilot study requested that in future they would prefer an application which
required as few steps as possible. The iPod® size was appropriate and useful for participants to carry around and had a high quality inbuilt camera with LED flash which was important for image clarity. Participants requested they would like to receive notifications as well as have visual reminders they could put around their house to remind them to record. It is possible that a future design would incorporate a social media component where the participant could choose to have their friends ‘support’ them while completing the food record. In consideration of participant feedback and supporting literature, the next version of this food record will be completed on a standardised device. Users will be set up on an application similar to Evernote® in which a food image could be uploaded securely and participants can write a caption describing the food. The application will be web based allowing the research to receive data immediately and to save the image to prevent data loss. The research could monitor the participant’s progress in real-time and send prompts or notifications through the application account or via a text message to the participant to remind them to record. The application would have to allow for participants anonymity, however there could be an option for participants to add their friends for peer support. Finally, to improve memory, as well as prompting, participants could also receive stickers to place on their cupboards and fridge to remind them to record their meals and drinks.

6.7. Conclusion

Digital photography allows for the possibility of collecting dietary information from a large group quickly with minimal disruptions to their usual eating behaviours. Food images eliminate the need for adolescents to estimate portion size and may increase accuracy as the photo often depicts more information than is written in the food record. After the initial purchase for the iPod® touches, the total study cost may decrease as the information provided from the food images should reduce the follow-up burden for researchers. A strong preference to use technology verses pen and paper methods by adolescents may also improve co-operation and
compliance. By incorporating the suggested changes, limitations around data losses and literacy requirements may be reduced. This would allow for the potential for dietary assessment across a more diverse population while decreasing subject burden. It is important to note that TBDA with photography is still in the early stages of development and will continue to be tested and refined. This study has shown that this form of dietary assessment can estimate as reasonable energy intake compared to the NZANS data and adds to the body of evidence that digital photography is a more convenient way to collect dietary information which appeals to the adolescent age group.
7. Application to Practice

Dietetics is an evidenced based practice which is patient centered. In the same way dietary assessment needs to be patient centered with evidenced based improvements made upon the traditional methods. Improvements which will reduce participant burden and are appropriate to the target group. This thesis has sought to achieve this outcome and to show TBDA with photography has the potential improve dietary assessment in the adolescent age group. Firstly, TBDA with photography has shown to be a valid way to estimate energy intake in the adolescent population in regards to acceptability and compliance. In a research context, this is important because taking photo images of food does not require high levels of education or literacy and therefore opens doors to collect dietary information across a more diverse population range. Food images also reduce reliance upon the adolescents’ ability to estimate portion size. Food images give more information than a written food record and therefore allow the trained researcher to ask more in-depth questions i.e. around cooking methods which would improve the quality of dietary information. In a more general sense and across both private and clinic settings, photographic food records would allow the dietitian to view images from the clients usual diet, compare this to nutritional guidelines and help the client adjust their intake to meet specific dietary requirements i.e. weight loss/identifying food allergens. If the food record is associated with an online or mobile application, this would allow the client to transmit dietary information to the dietitian who can then monitor and evaluate the client’s progress outside of clinic setting. In respects to dietetic food service; there is the potential to incorporate this technology in all areas of the systems model. For example, participants in a hostel or hall of residence could capture food images of their meals which could be used by the food service manager to determine quality control in regards to portion size and food acceptability (by measurement of plate waste).
A limitation of TBDA which has been of concern in other countries is the expense of the devices required to capture images (i.e. smart phone). However in New Zealand, the use of smart phones are rapidly becoming the norm and the use of smartphones and similar technologies appear to be ambiguous across all socio-economic status with as many as three in five New Zealanders owning a smartphone (61, 62). In conclusion, as technology progresses and the availability of smart phone use increases, dietitians have the opportunity to apply this evidence based advancement in dietary assessment to their practice to improve their quality of service in all areas of dietetics.
8. References


9. Appendix

9.1 Appendix A – Food Record Template

<table>
<thead>
<tr>
<th>Day: Mon</th>
<th>Tue</th>
<th>Wed</th>
<th>Thur</th>
<th>Fri</th>
<th>Sat</th>
<th>Sun</th>
<th>Date:</th>
</tr>
</thead>
</table>

**Time: 6am-10am**

- Before pics

<table>
<thead>
<tr>
<th>Time</th>
<th>Where I ate it</th>
<th>Who I was with</th>
<th>What the food was</th>
<th>Size/portion/weight</th>
<th>Where was the food from?</th>
<th>Did you buy this food yourself?</th>
<th>Extra info (i.e brand)</th>
</tr>
</thead>
</table>

**Time: 10am-12pm**

- Before pic

<table>
<thead>
<tr>
<th>Time</th>
<th>Where I ate it</th>
<th>Who I was with</th>
<th>What the food was</th>
<th>Size/portion/weight</th>
<th>Where was the food from?</th>
<th>Did you buy this food yourself?</th>
</tr>
</thead>
<tbody>
<tr>
<td>Extra info (i.e brand)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>-----------------------</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### After pic

**Time:** 12pm-2pm

### Before pic

<table>
<thead>
<tr>
<th>Time</th>
<th>Where I ate it</th>
<th>Who I was with</th>
<th>What the food was</th>
<th>Size/portion/weight</th>
<th>Where was the food from?</th>
<th>Did you buy this food yourself?</th>
<th>Extra info (i.e brand)</th>
</tr>
</thead>
</table>

### After pic

**Time:** 2pm-5pm

### Before pic

<table>
<thead>
<tr>
<th>Time</th>
<th>Where I ate it</th>
<th>Who I was with</th>
<th>What the food was</th>
<th>Size/portion/weight</th>
<th>Where was the food from?</th>
<th>Did you buy this food yourself?</th>
<th>Extra info (i.e brand)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Time</td>
<td>Where I ate it</td>
<td>Who I was with</td>
<td>What the food was</td>
<td>Size/portion/weight</td>
<td>Where was the food from?</td>
<td>Did you buy this food yourself?</td>
<td>Extra info (i.e brand)</td>
</tr>
<tr>
<td>------</td>
<td>----------------</td>
<td>----------------</td>
<td>-------------------</td>
<td>---------------------</td>
<td>---------------------------</td>
<td>-----------------------------</td>
<td>----------------------------</td>
</tr>
<tr>
<td><strong>5pm-8pm</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>8pm-12pm</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Time: 12pm-6am</td>
<td></td>
<td></td>
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<td></td>
<td></td>
</tr>
<tr>
<td>----------------</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Before pic</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Time</td>
<td>Where I ate it</td>
<td>Who I was with</td>
<td>What the food was</td>
<td>Size/portion/weight</td>
<td>Where was the food from?</td>
<td>Did you buy this food yourself?</td>
<td>Extra info (i.e. brand)</td>
</tr>
<tr>
<td>After pic</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
9.1.1 Example of the Evernote® food record 6am-10am meal period before participant has filled it in

<table>
<thead>
<tr>
<th>Time</th>
<th>1:39</th>
</tr>
</thead>
<tbody>
<tr>
<td>Where I ate</td>
<td>home</td>
</tr>
<tr>
<td>Who I was with</td>
<td></td>
</tr>
<tr>
<td>What the food was</td>
<td>one mocha and a cream corn toasted sandwich</td>
</tr>
<tr>
<td>Size/Portion/weight</td>
<td>one cup. And one standard sandwich size</td>
</tr>
<tr>
<td>Where was the food from</td>
<td>supermarket</td>
</tr>
</tbody>
</table>

**After pic**
Pilot Testing of an Electronic Food Diary

Parent/Guardian Information sheet for Testing Food Diary and Group Discussion

We have written to your child and other students in your child’s youth group to invite them to take part in an important study to investigate adolescents’ food habits and where they buy their own food. You are receiving this information sheet because your child has agreed to take part in this study. This sheet gives you some information about this study.

What is this study about?
We are interested in the foods that adolescents eat, where they buy their food and who they are with when they do this. In order to do this we usually give people paper food diaries to complete. It can be difficult to remember to take these with you everywhere you go and to remember to accurately record all food and drinks. Because of this we have developed an electronic food diary that can be completed on either iPads or iPods, which allows people to take pictures of everything that they eat and drink, which should make recording easier. We need to understand whether the iPad and iPod versions of the diary are easy for secondary school students to fill in and to keep with them every day before we use these diaries in a much bigger study. We hope that these studies will help to make students in New Zealand healthier.

Why my child?
We are inviting ten Year 11 to 13 students, who are aged 16 to 19, from secondary schools or youth groups in Dunedin to participate in this pilot
study. Your child’s youth group has decided to take part in this study and have allowed us to invite students from your child’s year to participate. Every student can individually decide whether or not they would like to take part in the study and your child has decided that they would like to take part.

**What will the study involve for your child?**

Our trained researcher will meet individually with your child to explain the study further. Your child will be asked to fill in the electronic food diaries. Four days of information will be collected using the iPad diary and four days using the iPod diary. After completing the diaries Victoria Wood (Vikki), who is the researcher running this project, will ask your child some questions about what they thought of the questionnaires. We are interested in whether your child thought that the diaries were easy to complete. Your child would also take part in a group discussion about the questionnaires with 7-9 other students.

This discussion will be led by Vikki. She will use the feedback given by your child and the other students who have filled in the diaries to discuss possible changes that could be made to the diaries to make them better. With your child’s permission, Vikki will record the group discussion using a tape recorder. Everything that is discussed will remain confidential. The group interview will last for about an hour. Participation in this study is voluntary, which means that your child does not have to take part if they do not want to.

**What will the research team do with the things your child tells them?**

Each student’s personal information (name and age) will be collected on a separate form which will be kept separate from the results from the diaries. The researcher (Vikki) will make notes from the tape recorded sessions and then the tapes will be erased. We will not use your child’s real name in the notes so that no-one knows who made comments on any question. All information collected will be securely stored in such a way that only researchers actively involved in the project will be able to gain access to it. At the end of the project any personal information will be destroyed immediately except that, as required by the University's research policy, any raw data on which the results of the project depend will be retained in secure storage for five years, after which it will be destroyed.
This project has been approved by the University of Otago Human Ethics Committee. Because the questions that we ask in the group interview will be based on feedback from your child and other students we do not know exactly what questions we will ask. Although the Ethics Committee knows the general questions that will be explored in the interview, the Committee has not been able to review the exact questions to be used. If your child feels uncomfortable answering any of the questions your child has a right not to answer them.

The data collected will be summarised and written up by Vikki for her University work. The results of the project may also be published in journals and presented at conferences but all results will be anonymous. No personal information about individual children will be reported. If you would like a copy of the results of the project then let Vikki know.

**What happens after the study?**
After the interview is completed your child will receive a $10 iTunes voucher as a token of appreciation for taking part and will go into a 1 in 10 draw to win the iPod touch that was used by the students. Vikki will also be happy to provide a reference for each student for future use in their CV or employment applications.

**What do I do now?**
If you want any further information about the study then contact us (our details are below). Your child can withdraw from this study at any time without affecting their future education or care in any way. Thank you for reading this information.

Vikki Wood
woovi104@student.otago.ac.nz or 0272383969

Principal investigator
Thank you for taking the time to read this information sheet

This study has been approved by the University of Otago Human Ethics Committee. If you have any concerns about the ethical conduct of the research you may contact the Committee through the Human Ethics Committee Administrator (ph 03 479 8256). Any issues you raise will be treated in confidence and investigated and you will be informed of the outcome.

**Pilot Testing of an Electronic Food Diary**

**Information sheet for Testing Food Diary and Group Discussion**

We are writing to ask you and other students at your school or youth group to help us with an important study. This sheet gives you some information about this study.

**Why are we doing this study?**
We are interested in the foods that adolescents eat, where they buy their food and who they are with when they do this. In order to do this we usually give people paper food diaries to complete. It can be difficult to remember to take these with you everywhere you go and to remember to accurately record all food and drinks. Because of this we have developed an electronic food diary that can be completed on either iPads or iPods, which also allows people to take pictures of everything that they eat and drink, which should make recording easier. We need to understand whether the iPad and iPod versions of the diary are easy for secondary school students to fill in and to keep with them every day before we use these diaries in a much bigger study. We hope that you will help us with this important study, which we hope will help to make students in New Zealand healthier.

**Who can take part?**
We are asking Year 11 to 13 students in your school or youth group, who are aged 16 to 19, to take part.

**What would I have to do?**
If you do decide to take part, we will come to your youth group or arrange to meet with you. You will be asked to fill in the electronic food diaries. We will ask you to record everything that you eat and drink for four days using an iPad diary and four days using the iPod diary.

After completing the diaries, Victoria Wood (Vikki) who is the researcher running this project, will ask you some questions about what you thought of the diaries. We are interested in whether you thought that the diaries are easy to complete and if you took them with you every day. You would also take part in a group discussion about the questionnaires with 7-9 other students. This discussion will be led by Vikki. They will use the feedback given by you and the other students who have filled in the diaries to discuss possible changes that could be made to the diaries to make them better. With your permission, Vikki will record the group discussion using a tape recorder. Everything that is discussed will remain confidential.

The group interview will last for about an hour. Participation in this study is voluntary, which means that you do not have to take part if you do not want to.

**What if I change my mind and decide not to take part?**
You can stop taking part at any time and don’t have to give a reason. Also, If you feel uncomfortable answering any of the questions you have a right not to answer them.

**What will happen to the results?**
We will ask you your name and age but this will not be linked to any of your answers. In addition the results from the diary will be collected. The researcher (Vikki) will make notes from the tape recorded sessions and then the tapes will be erased. We will not use your real name in the notes so that no-one knows who made the comments on any question. All information collected will be locked away and only researchers involved in the project will be able to gain access to it.

Vikki will write up the results from this study for her University work. The results may also be written up in journals and talked about at conferences. Your name will not be on anything that Vikki writes up about this study.

**What happens after the study?**
After the interview is completed you will receive a $10 itunes voucher as a token of appreciation for taking part and will go into a 1 in 10 draw to win the iPod touch that was used when you completed your food diaries. The iPad will be presented to the youth group and Vikki will also be happy to provide a reference for your CV or employment applications.
What do I do now?
Thank you for reading this information. We hope you will be able to take part in our study. Please fill in the reply form and bring it back to your youth group. If you have any questions you can contact us by e-mail:

Vikki Wood
(woovi104@student.otago.ac.nz)

This study has been approved by the University of Otago Human Ethics Committee. If you have any concerns about the ethical conduct of the research you may contact the Committee through the Human Ethics Committee Administrator (ph 03 479 8256). Any issues you raise will be treated in confidence and investigated and you will be informed of the outcome.

Pilot Testing of an Electronic Food Diary

Consent form for participants

Thank you for reading the attached information sheet for this study. Please ask us if there is anything that is not clear or if you would like more information.

I understand what this study is about. All my questions have been answered in a way that makes sense.

I know that:

1. Participation in this study is voluntary, which means that I do not have to take part if I don’t want to and nothing will happen to me. I can also stop taking part at any time and don’t have to give a reason;

2. Anytime I want to stop, that’s okay.

3. If I don’t want to answer some of the questions, that’s fine.
4. If I have any worries or if I have any other questions, then I can talk about these with Vikki.

5. As soon as Vikki has made notes from the tape recording of the group discussion the tapes will be erased.

6. The computer file with my answers will only be seen by Vikki and the people they are working with. They will keep whatever I say private.

7. Vikki will write up the results from this study for her University work. The results may also be written up in journals and talked about at conferences. My name will not be on anything Vikki writes up about this study.

8. As a token of appreciation, I will be given a $10 movie voucher at the end of the group discussion and will go into a 1 in 10 chance draw to win the iPod used for the food diaries. I may also have a reference letter provided by Vikki for employment purposes if I request it.

I agree to take part in the study.

......................................................... ....................................................
Signed Date

.........................................................
9.3 Appendix C: Permission form for School Principal/Dean

School Information sheet for Testing of Electronic Food Diary

To Whom it may concern.

_________ has been invited to take part in an important study to investigate adolescents’ food habits and where they buy their own food. You are receiving this letter ______________ has agreed to take part in this study and will require the school’s permission to use an iPad and iPod during school hours for the purpose of this research. __________ may also require the safe keeping of the ipad/ipod device at certain times of the day (i.e during sports periods) and we would appreciate your assistance in this if required.

What is this study about?
We are interested in the foods that adolescents eat, where they buy their food and who they are with when they do this. In order to do this we usually give people paper food diaries to complete. It can be difficult to remember to take these with you everywhere you go and to remember to accurately record all food and drinks. Because of this we have developed an electronic food diary that can be completed on either iPads or iPods, which allows people to take pictures of everything that they eat and drink, which should make recording easier. We need to understand whether the iPad and iPod versions of the diary are easy for secondary school students to fill in and to keep with them every day before we use these diaries in a much bigger study. We hope that these studies will help to make students in New Zealand healthier.

This project has been approved by the University of Otago Human Ethics Committee. If you want any further questions or would like more information
about the study then contact us (our details are below). Thank you for your co-operation.

Vikki Wood

woovi104@student.otago.ac.nz

Principal investigator

Dr Paula Skidmore  Department of Human Nutrition
9.4 Appendix D – iPad®/iPod® instructions

9.4.1 iPad instructions

Push down black button on back of iPad to turn on (hold for about 5 secs)

Click on the green Evernote button

Click “sign in” on the screen
Enter the Evernote user name and password you have been given.
Select Notebooks

Select the day that you need
Open the day

Tick the day and write in the date
To insert a photo

Tap your finger just below where the "Before pics" box is.

This will put the cursor in the right place.
Take as many pictures as you need. When finished, tap the tick on the left bottom corner and you will return to Evernote.

You may need to scroll past the pictures to find the table to fill in.

Filling In the Table:

<table>
<thead>
<tr>
<th>Time</th>
<th>A/I</th>
</tr>
</thead>
<tbody>
<tr>
<td>What I ate</td>
<td>On the way to school</td>
</tr>
<tr>
<td>What I was with</td>
<td>Friends</td>
</tr>
<tr>
<td>What the food was</td>
<td>Apple</td>
</tr>
<tr>
<td>Where was the food from?</td>
<td>Supermarket - pack and save</td>
</tr>
<tr>
<td>Notes</td>
<td></td>
</tr>
</tbody>
</table>

After pic:

Before pic:

Place cursor in the box by tapping (the box will get bigger as you start to write)

Enter as much detail as you can about what you are eating including brand, where you got the food from, i.e name of supermarket if your mum got it in the shops, and try to give an amount such as "a cup of milk" or a "bowl of cornflakes"
If you eat more than one item within the time period, use the second column to record and just record pictures with others in time period

---

If you run out of time to record information, you can use the voice recorder (microphone button near camera button) and read out what you are eating and describe the food. If you use this function PLEASE take a picture of the food you are eating.

To use the microphone, tap somewhere within the table to insert the cursor then tap on the microphone (near camera).

Speak aloud describing what you are eating and when you stop a box will pop into the table.

Don’t forget to connect to WIFI at the end of each day and sync your booklet!

If you have any problems you could:
- write a note in the “enquiries” notebook and sync (this can only be used when connected to WIFI)
- Text Vikki on 0272383569
- Email (from your own account) the email user name you have been given i.e.
  lopddiaryX@student.etagco.ac.nz
9.4.2 iPod instructions:

1. Open up Evernote

2. Click "sign in"

3. Sign in using the username and password you have been given
4. Click on Notebooks

5. Click on the day you wish to open

6. Tap on notebook to open and sync
7. Tick today's day and enter day and date.

8. Find the correct time frame.
   - Tap cursor so it is below "Before picture box" and take photo of food before you eat it.
9. Fill in the Tables - giving as much detail as you can i.e. name of the shop the food came from, brand details etc.

10. Tap below the “after photo” box and take picture of whatever is left or write “at it all”.

Filling in the Tables:

<table>
<thead>
<tr>
<th>Time</th>
<th>8:52</th>
</tr>
</thead>
<tbody>
<tr>
<td>Where I ate it</td>
<td>school</td>
</tr>
<tr>
<td>With I was with</td>
<td>friends</td>
</tr>
<tr>
<td>What the food was</td>
<td>Freddie</td>
</tr>
<tr>
<td>Size/portion</td>
<td>1 serve</td>
</tr>
<tr>
<td>Where was food from?</td>
<td>dairy by school</td>
</tr>
</tbody>
</table>

After pic

Before pic

Time: 9am-12pm
11. If your in a big hurry and don’t have time to fill in the boxes, tap on the Dictaphone function and speak into the iPod to record as much detail as you can about what you have just eaten.

12. This should insert a file into the diary which Vikki can listen to later.
If you run into any trouble;

Text Vikki on 0272383969 or

Email: your username ie. fooddiary@student.otago.ac.nz or

Write a note in the “enquiries” notebook (don’t forget to sync afterwards!)

Thankyou!!!
9.5 Extra Information Form

1. Please Circle or enter Yes/No to each of the questions.

2. Please fill out the box with how often you buy food, who’s money you spend and where you usually buy it from:

How many times each week do **YOU** usually?

<table>
<thead>
<tr>
<th></th>
<th>Number of times per week</th>
<th>Do you use your money or your parent’s money?</th>
<th>Name of shop if known: (i.e school canteen)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Buy Breakfast</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>Buy lunch</td>
<td></td>
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<td></td>
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<tr>
<td>Buy Dinner</td>
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<tr>
<td>Buy Snacks (i.e chocolate bars, hot chips, ice creams, coffees etc)</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>Get take-outs (i.e McDonalds, KFC, Pizza)</td>
<td></td>
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<td></td>
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</tbody>
</table>

3. Please write yes or no depending if you usually eat these meals or snacks. *(For example on Sat & Sun you may mark “no” for breakfast because you sleep in)*

Do you usually: (Write yes or no)

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<tr>
<th></th>
<th>Mon-Fri</th>
<th>Sat &amp; Sun</th>
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<tbody>
<tr>
<td>Eat Breakfast?</td>
<td></td>
<td></td>
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<tr>
<td>Eat Morning tea?</td>
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<tr>
<td>Eat Lunch?</td>
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<tr>
<td>Eat Afternoon Tea</td>
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<tr>
<td>Eat Dinner</td>
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<td>------------</td>
<td>---</td>
<td></td>
</tr>
<tr>
<td>Have an evening snack</td>
<td></td>
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</tbody>
</table>

**4: Do you own a smart phone?** i.e Android or IPhone

- If not - Does your phone have a photo taking function? Yes/No

**5. Do you use:**

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<tr>
<th>Platform</th>
<th>Tick for Yes</th>
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<td>Pinterest</td>
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<tr>
<td>Any others: (please name)</td>
<td></td>
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9.8 Appendix G: Transcript of Group Interview

Transcription of Group Interview 24 June 2013

F – The questions I ask are for everyone to, jump in and answer, to give your own opinion and agree or disagree with what other people have to say. It’s all pretty much to do with the food diary that you used and comparing from one device to the other, so when you answer, bear in mind each device as a separate item so – if I ask a certain question “was it difficult” you can compare one to the other, the iPad to the iPod. Does that make sense? Hopefully it will become clearer as we go through. So starting off:

F: How did everyone find using the food diary? So that is the actual food diary that is in the Evernote programme.

Ppt8: Easy

F: Easy?

Chorus of yes, yup

Ppt8: You explained very well

F: So what made it easy to use?

Ppt8: It was really straight forward – all the information was pretty straight forward, didn’t need to go into too much detail.

F: So when you talk about – are you talking about the instructions?

Ppt8: I mean what the food was – how much was it, size/portion/weight blab la bla.

F: Ok – so everyone agree that it was pretty straight forward?

(Nods)

F: Ok, what was your initial reaction then, when you first saw the food diary, what did you think when you first looked at it and got to have a little play with it?

Ppt4: I was kind of confused a bit

F: Confused initially?

Ppt4 – “Yup, I was just ‘will see how this goes’ but it was fine.

F – So you wernt sure maybe at the start?

Ppt4 – I had never used the programme and was just like ‘yeah we will see how this goes’, me and technology sometimes don’t mix.
F – Ok so that was maybe more of a personal reaction to the technology?

Ppt4- Mmm

Ppt9 – So the fact that I cancelled the first day . . . it took me a little bit

Ppt10 – you weren’t the only one

F – Yes I had that problem a few times, that’s something I will be looking at improving

Ppt9 – But apart from that it was easy. Apart from deleting that first day I got the hang of it because I learnt what not to do.

F – Ok so you learnt what not to do, learnt from mistakes – good.

F – Was it easy to understand? The actual format of the food diary?

P- Chorus of yes, mm hums, and yips

F – And I have sort of asked in what way, and it was mentioned that it was quite straight forward, and laid out.

F – Now how about remembering to use the food diary?

Chorus of ‘yeah that was hard’

Ppt4 – It was hard for it at home rather than at school because I was carrying it around with me most of the time. And I sort of, I had some friends that were like “have written down your food diary today?” And I was like “oh no I haven’t” but at home I might sit down for dinner and halfway through I might sort of remember.

F – So your friends reminded you?

Ppt4- Yeah, They sort of asked me what I was doing and I explained tell me – remind me cause I will probably forget.

Ppt10 (something I couldn’t pick up)

F – And so, going back to the home situation, what was it - was it just that you weren’t carrying it around with you so you didn’t have that visual reminder?

Ppt4 – Yeah it was probably in my bag or in my room, and just sitting there right beside me.

F - How did everyone else find it? Did you agree with Ppt4 in regards to school – or did some of you find it harder to remember at school?

Ppt5 - Well at home it’s the same thing – You can quickly make a sandwich and you cant be bothered doing it”
F – Ok yup

Ppt5- And you eat it and then you realise

Ppt2: Yeah I always forgot until I had finished eating and so there was no picture.

(Laughs of agreeing)

Ppt8 – yeah I would come off the farm and can’t be bothered doing anything so I would cook up a feed – have it and be like ‘oh crap’ forget.

Ppt8 -Like the first, I tried to do it within the first three or four days – and then when I went to the iPad I forgot more. So – ended up doing over a week or a couple of weeks.

F: So did anyone else find that, they would start one day and then forget halfway through and do that day again? Or would you leave it as it was? Leave the day half done.

Ppt10 – Yeah if I left stuff then I would continue it - fill in that gap with what I had the next day.

F – Ok right –

Ppt10 – If it was similar

F - Did anyone else do the same thing?

Ppt4 – If I forgot half the day I would start that day the next day.

F – Ok so you would restart the entire day? (at Ppt4)

Ppt4 – Yup

F – And you would fill the gaps in? (at Ppt10)

Ppt4 – that only happened once

(General agreeing)

Ppt4 I just forgot to take photos a lot of the time.

Ppt2 – I would just forget to fill it in

F – I’m not making any judgements because I have seen everyone’s food diary’s and I know how they were filled in so

Ppt5: It was harder to eat in class especially with the iPad

Ppt4 – I got some funny looks from people – I was like “Don’t judge me!”

98
Ppt5 – And then if you were watching a movie or something quickly on You tube when you’ve been at home then the sound is till up and you would hear that “Chook” and you would sort of wait there and the teacher would turn around

P: Laughs

Ppt5 – and there was and iPad and some chips . .

F – Was it helpful having those letters for your schools so that they knew what was happening?

Ppt5 – I didn’t really need it

(chorus of no – neither did I )

Ppt4 – I just sort of took the picture and then just put it away and no one sort of noticed and the teacher didn’t ask me

F – Do most of you carry your phone around with you?

Chorus of yes

F – So if I was to send you text messages to remind you to take a picture at say breakfast lunch and dinner would that be helpful?

Ppt8- Sort of, not for me really – because I am out most of the day and when I come in its only for lunch, breakfast or dinner.

F –Ok

Ppt8 - so you could text me during the day and I might get it but then completely forget for the rest of the day but you could text me around 3am in the morning . . .

*Laughs*

Ppt8 – or 6pm at night...

F – How about everyone else?

Ppt4 – Sometimes I just ignore my phone and look and go – oh that was a bit too late

F – Ok

Ppt4 – but that might help because I usually just have my phone sitting around.

F – Just going back to the instructions: Would it be useful to have something in the instructions to stop those days being deleted?

*Chorus of adamant “yes”*

Ppt10 – like how to add in one if you did delete

99
Ppt9 – How to cancel a photo

Ppt8 – yeah cause I didn’t do backspace I just clicked on the rubbish bin on the top and it deleted the whole thing.

Ppt5 – I think I did that as well, but I think I just left it so I had 10 pictures for one initial thing and it was trying to delete the pictures so it had 10 pictures

F – So maybe even an instruction to say ‘don’t delete’ those photos – just leave them Ok because that was sort of a surprise for me, that was something I didn’t expect to happen – but that’s fine – that’s what this is about – it’s a pilot test.

F – So what helped you remember to use your food diary? We have talked about remembering to bring it with you –

Ppt9 – I sat mine in the kitchen while I was in the kitchen or if I knew I was going to be in the kitchen the next time I ate – I left it on the kitchen like next to the fridge or next to the jug.

Ppt8 – I left mine in the lounge because we usually eat there

F – So somewhere you could see it

chorus of yes

Ppt8 The bright blue cover was better as it stood out. I would see it and go ahh – photo. But I always kept forgetting to take photos after I finished but we didn’t actually have to take photos of the empty plate. Or my empty hand.

Ppt5 – The iPad was a little bit more hard. I forgot more with the iPad. It was too big to constantly carry around with you.

Ppt10 – Yeah with the iPod I just constantly had it in my pocket. So it was so much easier

F – So for transport

F – How useful did you find the demonstration of the using the food diary when we first started when I sat down with you and went through how to use it. Was that useful?

Ppt10, Ppt5, Ppt4 Yeah

F – Or could I have been more clear?

Chorus of “I think it was clear, pretty straight forward, was good”

Ppt4 – If I was on my own I probably would have been like “ohh”

Ppt5 – But if it was a little bit more confusing app it would have been a lot more necessary – but it was pretty straight forward.
F – so you found that app pretty easy to use then?

Ppt4- And the pictures

Ppt7– The hardest thing with the pictures was pressing the little space to get it in the right spot otherwise it would all go to the bottom.

Ppt4 – I found it was so much harder on the iPod to put the stuff in and keep the pictures

Ppt7: Fill in the box it didn’t go the whole way

Ppt4: And sometimes it just deleted half of my stuff and I was like “where has it gone?!?” And I got frustrated but the iPad was more bulky but easier to use

Ppt2: Yeah it was way easier to use

Ppt4: The iPod was smaller and easier to cart around but trying to get the pictures on the iPod was a bit of a mission.

F: If you were to take a pen and paper diary into class with you how would you find that compared to using the iPad or iPod?

Ppt9: I’m used to doing that anyway.

Ppt8: Half and half really.

F: Would you actually do it?

Ppt8: I would write down in my diary what happens during the day, when I get up and whatever – I’m kind of used to writing things down. So I would probably remember more than the iPod.

Ppt4: I reckon even though I do have pen and paper in the class, when you have the iPod or the iPad it sort of reminds me but pen and paper its sort of like

Ppt8 – you have to cart it around. You can’t really cart an iPad around town.

F – Was it good having the photos – being able to take photos?

*Chorus of yes*

F – Did you like that aspect of it?

*Chorus of yes*

Ppt9 – Sometimes I just took a photo of it and I filled the rest of it out when I got home. So if I was going out for lunch I would just take a photo of my lunch and put it back away and go fill it out when I got home because I knew what I had and if I knew I finished it

F – So a visual reminder made it easier to sort of fill it in retrospectively?
Chorus of yes

Ppt9 – SO then I didn’t have to worry about sitting there taking up half my lunch time filling it in. I would be like “ok I have time later I will worry about that later but I knew what I had.

F – And if you didn’t take a photo was it easy to remember later on?

Ppt9 – I usually forgot if I didn’t take a photo of it.

F – if you forgot to record something would at text later on remind you to do it? Would you go back and record it retrospectively? Or would you just no worry about it?

Ppt9 – probably depends how far back it was. Like if it was breakfast and you got a text at tea time or something, probably would be like .

Ppt8 – Depending on if I took the photo or not. If I took the photo I would fill it out but if I didn’t take the photo I wouldn’t bother.

F – What made it fun to use?

Ppt8 – Got to go on the internet. The iPad was probably the best because I have an iPhone so didn’t really bother with the iPod but the iPad was easier to just go onto face-book or whatever.

F - So you liked that you were able to use the iPad and use it in your own time.

Ppt5 – The fun game with the iPod was to see how many taps it takes you to actually get it in the little writing box.

Ppt2 Oh my gosh (in agreeing)

F – What were you saying Ppt4?

Ppt4 - I didn’t really use it, I just used it for the food diary because I have my laptop with me most of the time. But I think if I was wanting to muck around it was easier and kind of fun to use.

Ppt8 – Made me want to buy one

Ppt4 – I encouraged Dad to buy one – because of his work – I sort of showed him it when I had it.

F – So it’s good to encourage your parents to buy something. Was there anything that stopped you from using the food diary? A few of you mentioned at home if you didn’t see it around it might have prevented you from using it. But what about at school, or if you were going out to dinner or sports practice.

Ppt10- well if we were going out to dinner I didn’t actually want to take the iPad to a restaurant or whatever but with the iPod it was fine. And also at school, having to take the iPad out of my bag was – doesn’t take much effort but I really couldn’t be bothered. So I just used the iPod.
F – so maybe the physical size of the iPad was a barrier to removing it (from the bag) and using it.

Ppt5 – and also most lunch times and tea times your with the family – “no technology at the table”

F – Ok so some family rules around technology. So that would have put a damper on things!

(laughs)

F – How about battery life? Did anyone have any issues with the batteries?

Chorus of “no’s”

Ppt8 – didn’t need to use it that much

F – did you charge it?

Ppt8- I charged it once and that was it.

Ppt5 – I charge everything every night so just added it to the collection of things to charge

Ppt2 – yeah me too

Ppt10 yeah

F – If you are to think about how long you might like to do a food diary for how long would be a good length of time?

Ppt9 – At least a week – Gives you a good idea, then you have the weekend and your usual week.

Ppt8 – Depending on how many days we get to do it for.

F – Maybe what would be the longest time you would want to do a food diary for?

Ppt5 – Two weeks?

Chorus of agreeing

Ppt5- You get at least two days of everything so it’s a lot easier to work out

Ppt8 – Once you got into a rhythm you would probably be alright

Ppt2 – yeah

Ppt8 – but the thing is its only 8 days, four days on one and 4 days on another

F – so you found that swapping over was that a bit of a pain?

Ppt5 – yeah
Ppt8 – yeah if it was all on one then it would be sweet as. It’s just the fact that one was bigger you couldn’t take it certain places. And the other was so small you couldn’t remember it or whatever.

Ppt4 – you sort of got into a bit of routine, I found when I used the iPod that was fine but it was having to switch and I would be like “Oh I can’t take it there” or it was harder to use so I would forget

F – So you think two weeks might be ok, how would you feel if you were to do it for two weeks

Ppt9 – I would be fine if it wasn’t longer than two weeks – no longer than two weeks

F – Is that a general consensus? Can you put your hands up if you would do it for two weeks? If you would be happy to do it for two weeks. Ok so its unanimous

Ppt8 – As long as we had like a months period

F – ok so you would want a month to do it in

Ppt8 – Yeah a month to do two weeks of information

F – And if we were just talking about remembering to use the food diary – what would be a good length of time to do a food diary for. If you were to do it every day, do it straight – how many days would you remember to do it for straight before you forgot?

Ppt8- I don’t know, although I guess I did experience it . .

Ppt5 – I would be safe and say four

Ppt9 – I would probably forget more in the first couple of days

Ppt4 – That’s the same as me

Ppt9 – the first couple days I would forget to do it then get into that routine.

Ppt8 – I’m the opposite – first couple of days I’m sweet as and then once I miss a day I’m screwed.

F – so maybe in terms of prompting, if I was to send messages to contact you a couple of days in - how would that, when would be the best time for me to step in and say “hey guys remember”

Ppt9 – Maybe three or four days

Ppt8 – Well I could just set an alarm on my phone

Ppt5 – Or even with me even every three days

Ppt7 – yeah or even if the app had a notification because there are apps which have notifications and it tells you to remind you that you’ve got to do it.
F – That’s a really good point – ok – so it had a little alarm or a notification or which sent an email to remind you

Ppt7 – yeah so when you check it its going to be there still

Ppt4 – I would probably do it on my phone too. Because like I wouldn’t necessarily see that until I opened it.

Ppt9 – But you would see it if you looked at your phone

Ppt4- Yeah so if you like had it set in a few places.

F – So if you could sync it to your phone so you go the notification on your phone as well or via email - how many of you regularly check your email?

Ppt4 – every day, three times a day

Chorus of – every few weeks, once a month, once a week

F – So the guys, not very often

Ppt8 – I’m not very often and I’m not a guy

Ppt2 – I don’t check my

F – So email maybe for some people, but phone may be the better option for some people.

Ppt5 – If you could send the notifications to you tube I would probably remember to use it.

F – What about if you got a notification on face-book?

Choruses of yes

F – If I sent you a face-book message

Choruses of “yes that would work”

F – ok.

RA: what about an automatic one? Like in the calendar set up on the iPod – like one came up at say 9oclock “hello, what have you had for breakfast” kind of thing. And another one at 12

Ppt8 – If it came to my phone yeah but not on the iPad or iPod because I wouldn’t check it.

F – so it would need to come to something you would look at every day. Where if you had it on the iPad you only going to open the iPad to use the diary anyway – so – ok.

F – Any other comments around notifications?

F – What meal times were the best to remember?
Ppt5 – Dinner

Ppt4 – Lunch and morning tea – because I have it and its right there but dinner it (iPad/pod) might still be with my school work so I don’t really think about taking it out of my bag.

Ppt2: Dinner

Ppt5 – Afternoon tea and tea because I generally keep my technology with me in the afternoon

F – ok yup

Ppt9 – I would be more likely to forget breakfast as I’m not awake

Ppt4 – Breakfast was alright for me because I kept it beside my bed ad decided to have it in bed and I kept it beside my bed and decided to have my breakfast at the same time. Like it’s a reminder to get breakfast then take it back up rather than go downstairs and forget to take the iPad.

Ppt3 – I would like forget breakfast because I would be in a rush and so I would forget to take a picture of it.

F – Would the weekends be different from the weekdays – being at school or work?

Ppt8 – I don’t get weekends

F – Well for those of you who have a different schedule in the weekend to the week

Ppt7 – Yeah it was for me because in the weekends I just woke up at lunch time anyway - so there was no breakfast.

Chorus of agreeing

F – And how did you find recording drinks?

Ppt8 – yeah no that was the worst for me.

Chorus of ‘that was hard’

Ppt5 – I completely forgot about drinks

Ppt4 – You just automatically would just go and get a drink and then have it and go ‘ohh, opps’ but with food you sort of – I remembered.

F – So what could we do about drinks? Would there be any way of helping you remember to record drinks?
Ppt8 – Have a sticker on your glass. One of those wee sticky poster thingies but will have to be written down or whatever,

F – so would you like a poster or a sticker to put somewhere?

Ppt8 – I think a sticker would be good

F – a sticker on your phone?

Ppt10 – yeah just on the back of the iPod. On the screen just the top corner

F - ok like the “property of the University of Otago” have one that says “Have you remembered to record your drinks?”

Ppt8- A poster on the cupboards with the glasses in it maybe

Ppt4 – or on your fridge

Ppt5 – everywhere around the house

*laughs*

F – was it useful for me to show you how to use the food diary?

*Chorus of yes*

F – Do you think any of you could have gone on the instructions given?

*Chorus of No*

Ppt8 – I don’t like reading

Ppt4 – No

F – So you prefer to be told them? (the instructions)

Ppt4 – Yeah prefer to be told them than read

F- so the demonstration was useful

Ppt4 – Yeah I think it was good because if I was trying and then might not be sure about something I could sort of ask you right then and if you were doing it by yourself and you get a problem you would probably have to contact you or someone else. And it might be frustrating.

F – And we sort of talked about txt messages so do you think – if I sent you a text everyday would that be useful?

Ppt7 – Would be for me
Ppt5 – I guess after the first few days if we saw your name at certain times it would be a reminder you wouldn’t actually need to say anything in the text, like if we saw that it was from you we would remember.

F – ok so like if I sent a blank text?

*laughs*

F – or something like “food diary”

Ppt5 – It would work for me.

Ppt8 – I could put a picture of you on my wall

F – So maybe my photo could be on the stickers?

*Laughs*

Ppt8 – It wouldn’t be creepy in my household but . . .

*Laughs*

F – So how did you find the questions on the food diary? Could you write down all the information that you wanted to?

Ppt7: Yup they were pretty basic.

Ppt4  Which was good.

Ppt8 – Size and portion was probably the worse – like – how do you make a cup full? Like I have a plate of chips, which could be three or four scoops

Ppt9 – Yeah but if you do the teaspoon thing and put a teaspoon next to it she can see how much you have got.

Ppt8- I didn’t do the teaspoon thing.

*Laughs*

F – So might it be useful if there was an instruction to put your teaspoon next to your plate?

Ppt8 – yup

F – instead of giving me cup sizes or portion sizes?
Ppt9: Yeah because some bowls are like that (gestures with hands) and some bowls are Massive. Depending on where you go.

F – Did anyone else find that quite hard? Working out portions?

Ppt4 – Yeah

Chorus of yes

Ppt2: A little

Ppt5 – but I don’t think I really bothered with that unless it actually said it on the packet of whatever I was eaten – then I put it in – but otherwise no.

Ppt8 – Grams and stuff were all right if it was on a packet of chips. Or a tin of something. That’s alright, but everything else was just.

F – so you feel there might have been a bit of guess work with the portion sizes. And in that sense the photo might have been quite . . .

Ppt8 – Quite useful for you if you didn’t know

F – Well they were useful for me, if I had say, portion sized pictures on the iPad, so for example .

Ppt10 – like a reference?

F – yes – a reference. Would this be useful? So I could have a plate with a cup of pasta and you could look – would anyone actually use it?

_Chorus of I would, yes, probably_

Ppt5 – Yeah if it was in a separate area

F – Just in a folder?

Ppt5 – Yeah just in one of the folders in ever-note and you quickly go out and check the folder

F – ok so if that was on the desktop of the iPad? And you can just open it quickly.

Ppt5 – Or just in the notification itself – you know how you have separate folders with the days, have a separate folder with the portion sizes so you don’t have to keep exiting out of stuff.

F – Yeah that’s a really good point. What does everyone else think about that? Would that be something . . .

_Chorus of yes, mmhum, yup._

F – Ppt7 would you use something like that?

Ppt7 – Could be helpful
You can say yes or no just getting some ideas. And what do you suggest I would put in those portions? What would be the foods you would probably want to see to get idea of how big a cup would be?

Cereal
Pasta
Potato’s and pasta and stuff
Chips, hot chips
Rice
Rice?
Cereal, like mixed vegetables – they are quite hard to judge
Ok. And what about small medium and large, if I had a plate of pasta – if it was divided into small medium and large and you could just look at the picture and just go ‘oh mine looks like a large and just write large in there – would that be helpful?

Chorus of yes – mmhum
Ok and just relating it back ok. Where there too many questions to answer?

Chorus of no
I recon there was a good amount
You could put down the details you wanted to?
Chorus of yup
I didn’t quite understand the whole ‘who you were with’
Where you with friends, where you with your parents
Most of the time I was by myself – yeah it was quite an interesting question – but mostly it was with friends I was at home with my parents and that was about it.
I just didn’t understand the point of the question.
I wasn’t sure if imaginary friends counted

Laughs
F – would it be useful – just going back to the portion size thing if you had on the iPad – like the stickers, a sticker ruler – so you could hold your pizza next to it and go – oh looks like about 7cm – would that be useful?

Chorus of yes, yup, that would be actually

Ppt8 – You could just put it up then take a photo of it and so scale/ruler

Ppt5 – Or just have it in the picture piece so you didn’t even need to worry about having it before you took the picture – just having it in a side frame.

F – ok

Ppt5 – so just have it in a boarder so you don’t need to worry about lining it up – possibly getting it dirty or possibly not or dropping it.

F – Did anyone have trouble logging into ever note?

Chorus of No’s/nope

Ppt8 – I was logged in the whole time

Ppt2 – Once or twice – or maybe that was in the pre-test.

F – Did anyone have trouble using the food diary programme? So ever note itself? Apart from deleting the whole day.

*Chorus of no’s*

Ppt5 – I didn’t realise that it was all written out so when I put it beside the time to take the picture and accidently hit the backspace, it got rid of the colon or semicolon and yeah you accidently delete one work.

F – Ok so that was a pain. And was it relatively easy to take the photos? You mentioned it was easier to take them on the iPod? (at Ppt10)

Ppt10 – yup

F – What did everyone else think?

Ppt9 – Well it was just easier to carry around and just take a photo and you’re not having to try a

F – so this size made it easier . .

Ppt9 – yeah it was more convenience

Ppt5 – yeah like the iPad had no zoom – so you had to hold it like that (demonstrates holding it above plate) and you only get part of the food and you end up holding it like that (holds iPad way above head)
F – Ok so it makes it more difficult in regards to contents. Alright and how could this be improved? Any suggestions?

Ppt8 - Just one machine

*Chorus of murmured agreeing*

Ppt9 – But they both have their advantages

Ppt10 – I suppose you could always just take the pictures with the iPod then fill it out at home with the iPad.

Ppt9- yeah,

F – Would you find that difficult to do? Would you be happy to do that?

Ppt10 – That would be easier as the iPod is a lot more portable.

F – ok

Ppt9 – it is so much easier to fill out on the iPad

*Chorus of agreeing*

Ppt5 – one thing was defiantly the iPad boxes to put the text in was a lot more easier to get in.

Ppt7 – And the words all stayed in the box instead of bunching up

Ppt5 - instead of the iPod where you would tap numerous times and never could (get the cursor in ) no matter how hard you tried. Unless you held it there and waited until the little magnifying glass appeared.

*Laughs*

F – What would you think about having a programme – similar to ever-note, maybe changing the design a little bit so you could get your curser in the right spot for writing – having that on your phone? Instead of an iPad or iPod?

*Chorus of yes –*

Ppt8 – yes defiantly

Ppt5 – yeah that’s way better

Ppt9 – yeah cause you know how to use your own phone

Ppt4 – Found with both of them they rotated around and I was trying to do it and it just rotates. It got really annoying but after a-while it was alright.
F – what do you guys think? (to Ppt2 & Ppt3) I know your phones out of order at the movement (to Ppt2) which makes it a little difficult but what would everyone else think?

Ppt5 – If you had it on your phone you could have wouldn’t have to have who knows how many separate devices to carry around and you have only two or three pockets so . .

Ppt4 – Also depends on what sort of phone – like a touch screen phone your right

Ppt8 – and camera quality as well.

Ppt4 – iPhones would be the best, I find androids are not the best – like my screen is tiny.

Ppt9- it would still be pretty handy if we could do it on the iPod – with the photo on the iPod and the photo went back to the iPad which you could fill out at night – you just took the photos.

Ppt2 – so it goes onto your other device automatically like an icloud. It would be convenient

F – I didn’t tell you guys this but you could actually log into ever-note from the internet from your computer. But that’s alright these comments are useful.

Ppt7 – Just on your computer?

Ppt10 – I probably wouldn’t have anyway

Ppt7 – If you could do it on the app though maybe.

Short break for dessert.

F – The concept of using your phone or an iPod again but being able to link it to another device like your laptop or

Ppt9 – something bigger to fill it out on

F – something bigger to fill it out on – so maybe the actual form of the Evernote, maybe I could redesign that a little bit and make it more user friendly in terms of putting information into.

Ppt10 - If you made it so that whole layout you couldn’t change any of that

F – Ok

Ppt10 – and you could only press buttons in the boxes where the times and stuff are – like it’s a big blue print thing.

F: Ok – so the blue print is there, and it’s almost like you are just tapping something to allow you to enter data?

Ppt9 – It’s like you have a form that’s already filled out but you can’t rub out anything else

F – So you can’t delete it
Ppt8 – Yeah so if you backspace too far then you can’t delete what you have written

F – and if it was on your phone, would you still like to link it back to - say to access it online?

Ppt8 – yeah because if you erase it on your phone or if your phone broke. So backup

F – And so if I was to do that, would you be happy about me access the photos that you have taken on your phone?

Ppt8 – as long as you didn’t have access to everything it would be sweet.

F – because for that to work I would need to maybe plug into your phone and download your photos off your phone and you would need to be happy with me

Ppt8 – accessing our photos

F – Yeah – I guess that’s what I’m saying

Ppt5 – uh-oh

F-yeah you might want to selectively go through them before hand – not sure how you would want to do that.

Ppt9 – you could always have a certain folder – if they all went into a certain folder you could access that folder.

Ppt8 – yeah you could screen photos

F – I guess it would depend on how fancy your phone is but even if you were able to take the photos on your phone and then chuck them onto this online programme afterwards

Ppt10 – well if you have a computer you could just take the photos and then just plug them into that and chuck them all through there

F- And then give me the folder

Ppt10 – yup

Ppt8 – maybe if we plugged the iPhone into the iPad and it syncs through that and goes directly to whatever you had it under

F - so maybe at the end of the study instead of you each having iPad’s  I could give you an iPad to put the photos on – or a USB or whatever else.

F – So if you were to choose – what did you prefer, the iPad or the pod?

Ppt8 – iPod
Ppt5- iPad

Ppt4 – half and half really – there are things I like about the iPad but there are things I don’t like about the iPod.

Ppt10 – Because if you could access it online you could use your computer and you wouldn’t need the iPad.

Ppt4 – I think the iPod would be easier if you could use something else at home. To sort of fill everything else and just use the iPod for pictures.

F – ok, so

Ppt5 – you look fancier with an iPad

F – you look fancier with and iPad?

Laughs

F – so you like the prestige that comes with the iPad?

(laughs)

Ppt4 – but the iPad minis are quite cool – the are more like

Ppt5 – They are almost like a galaxy note - that size but a little bit bigger (indicates to his phone)

Ppt4 – Yeah so they are a good size as they but the iPods would still be a good size to cart around – defiantly smaller than the iPads.

F – Would you be able to fit it into your pocket which is something . . .

Chorus of no’s

F - That would have liked – to fit it in your pocket.

(some discussion about carrying around iPads/iPods/iPad minis in jacket pockets, trench coats, handbags and Man-bags)

F – I know Ppt9 you have used a pen and paper diary before has anyone else? Ppt10 you might have?

Ppt10 – yeah probably.

F – Does anyone else?

Ppt8 – what do you mean?

F – Pen and paper diaries instead of doing it on an iPad or iPod you are just writing everything down.
Ppt8 – is it like a diary of times?

Ppt9 – Its like a graph where you already have everything like date time etc mapped out and you write it down instead of typing it into.

Ppt2 – Yeah I have done one before and it was harder to remember with pen and paper and I tried doing it once and I kept forgetting it was harder to remember than the iPad or pod

Ppt3 – I did it once, we were meant to do it for PE and I forgot the whole time so I just made it up

*Laughs*

F – so if you were to choose – what would you prefer to do? On an iPad/pod or pen and paper?

Ppt2 – iPad or iPod

Murmurs of agreement

Ppt8 – Either phone or pen and paper

F – And if you could change anything about the food diary – what would it be?

Ppt8 – Just having a solid graph and not being able to backspace that away questions.

Ppt5 – Having the questions and the boxes smaller and so having a larger box tap and if its on a smaller device.

F – How did you find the time frames? Were they useful or would you rather just put in the time?

Ppt4 – I think I would rather just put in the time because

Murmurs of agreement

Ppt4 – those time frames – some of them were completely like, I might have been in-between two times.

F – Or right on the line of two times

Ppt4 – Sometimes I just put it in wherever I thought – just putting in the time rather than just having time frames would be easier.

F – Did you feel that you had enough support while using the food diary?

Yups

Ppt9 – And you were only a text or a phone call away anyway.

F – Was that text communication good or would you prefer me calling . . .

Ppt10 – no it was good because you text me in the middle of an assessment so .
F – oh sorry !!!

*laughs*

Ppt10 – so it was better than getting called

F – Ok, I will take note of school hours next time. Would you do this completely voluntary? If there was no iPod to win?

Ppt8- As long as there is a feed involved!

(murmurs of agreements about food.)

F- Is that a consensus? Just be honest – put your hand up if you would – no peer pressure here (all put hand up) – ok that’s cool.

F - I think that’s all I have to ask.

F: Thank you very much for coming along.
9.9 Ethical Approval

HUMAN ETHICS APPLICATION: CATEGORY A

PLEASE read carefully the instructions “Filling out your Human Ethics Application” and important notes on the last page of this form. Provide a response to each question; failure to do so may delay the consideration of your application.

1. University of Otago staff member responsible for project:

   (surname)  (first name)  (title)
   Skidmore  Paula  Dr

2. Department: Human Nutrition

3. Contact details of staff member responsible: paula.skidmore@otago.ac.nz

4. Title of project: Pilot testing of an electronic food diary for use in adolescents

5. Indicate type of project and names of other investigators and students:

   Staff Research  x  Names  Dr Paula Skidmore, Dr Robin Quigg

   Student Research  x  Names  Vikki Wood, Sarah Philipsen

   Level of Study (e.g. PhD, Masters, Hons)  Masters (Vikki), PGDipSci (Sarah)

   Office Use Only  x

1. Please provide the level of study for each investigator.
External Research/
Collaboration

6. Is this a repeated class teaching activity?
   NO

7. Fast-Track procedure
   Do you request fast-track consideration?
   NO

8. When will recruitment and data collection commence?
   February 2013

   When will data collection be completed?
   July 2013. The entire project will be completed by December 2013.

9. Funding of project.
   Is the project to be funded by an external grant?
   NO

   If commercial use will be made of the data, will potential participants be made aware of this before they agree to participate? If not, please explain: N/A

10. Brief description in lay terms of the purpose of the project (approx. 75 words):
    We have developed an iPod/iPad based food diary for recording food and drink intake in adolescents and we wish to test whether the iPod (smaller so more easily transported) or the iPad (larger so easier to fill in) version is more user friendly for adolescents.

11. Aim of project, including the research questions the project is intended to answer:
Previous research suggests that compliance rates for paper-based methods of dietary assessment in adolescents can be as low as 50%. More recent pilot research in other countries suggests that using electronic measures to capture food intake in this age group may result in higher compliance (around 75%). Therefore we have developed an electronic food diary that can be used on iPads and iPods and the aim of this study is to pilot test this in ten adolescents from school years 11 to 13 from Dunedin schools or youth groups. We would like to find out which of the two formats (iPad or iPod) of the diary is the most user friendly in this age group.

12. Researcher or instructor experience and qualifications in this research area:

Dr Paula Skidmore has over ten years of experience in dietary assessment methodology in all age groups and both Dr Skidmore and Dr Quigg have previous experience carrying out school and youth group based research in Otago. Dr Skidmore also has extensive experience in supervising PGDipSci and Masters students.

13. Participants

13(a) Population from which participants are drawn:

Participants will be minors: Adolescents from school years 11 to 13 who attend school or youth groups in Dunedin.

13(b) Specify inclusion and exclusion criteria:

Inclusion criteria

Boys and girls attending secondary schools or youth groups in the Dunedin area;

Aged between 15 to 18 years old and in school years 11 to 13

Exclusion criteria

Boys and girls under the age of 15;
Students whose parent/guardian who has stated on the reply slip that they do not wish their child to take part;

Students who do not give informed consent;

Students will be given an information sheet and consent form for themselves and also an information sheet and consent form for their parent/guardian; Students who sign the consent form but who change their mind about participating will not be allowed to participate.

13(c) Estimated number of participants:

Ten

13(d) Age range of participants:

15 to 18 years of age

13(e) Method of recruitment:

Through local schools and youth groups. See 14 for more details.

13(f) Please specify any payment or reward to be offered:

A fifty dollar movie voucher will be given to everyone who participates in the study as a thank you for participating.

14. Methods and Procedures:

Participants will be recruited through local schools and youth groups. Researchers will visit schools/youth groups to talk to principals/leaders and if a school/youth group agrees to take part we will visit these to talk to students. Interested students will be provided with information sheets and consent forms for both themselves and their parents. Once these are completed they will be returned to the school/youth group and a visit by the research team to the school/youth group will be arranged. At this visit participants will be provided with an iPad or iPod by a research assistant and will be shown how to complete this. Each participant will be asked to complete their diary over four days in the following week and a second visit at the school/youth group will be arranged. At the second visit the research assistant will check over the food diary with the participant and obtain any
extra information needed. All checking of food diaries will take place in private to avoid any discomfort to participants. Participants who first completed the food diary on the iPad will then be given an iPod (and vice versa) and asked to collect another four days of record in the following week, which will be checked for completeness by a research assistant. All participants will also complete a demographics questionnaire that will collect information on age, sex and home address. Once all ten participants have completed both versions of the food diary a group interview will be organised to discuss whether the diaries were easy to use and to discuss any possible improvements that could be made, either to the diary itself or the accompanying instructions. This group interview will be held at either a local school or youth group (depending on where the majority of participants are recruited from). This group interview will last approximately one hour.

The group interview will be recorded using a digital recorder and notes will be taken. Responses made during the group interview will be anonymous. Participants who are not comfortable with the session being recorded will have the right to withdraw from participating. The session is voluntary and participants may withdraw from the session at any time without any disadvantage. Responses during the session are also voluntary and no participants will be forced to answer any questions if they do not want to. No personal information will be collected from participants during the group interview.

15. Compliance with The Privacy Act 1993 and the Health Information Privacy Code 1994 imposes strict requirements concerning the collection, use and disclosure of personal information. These questions allow the Committee to assess compliance.

15(a) Are you collecting and storing personal information directly from the individual concerned that could identify the individual?

YES

15(b) Are you collecting information about individuals from another source? Please explain:

No

15(c) Collecting Personal Information:

• Will you be collecting personal information?

YES
• Will you be informing participants of the purpose for which you are collecting the information and the uses you propose to make of it?

YES

• Will you be informing participants who will receive the information?

YES

• Will you inform participants of the consequences, if any, of not supplying the information?

YES

• Will you inform the participants of their rights of access to and correction of personal information?

YES

15(d) Please outline your data storage and security procedures.

The hard copies of data collected during the study will be securely stored in a locked filing drawer in locked offices of Dr. Skidmore in Department of Human Nutrition. The list connecting the ID numbers present on the raw data to the names of individual participants will also be stored securely in Dr Skidmore’s office. Electronic responses will be stored on study staff computers and these responses will be identifiable by ID number only. Digital recordings of the group interview will be destroyed once these are transcribed. Upon completion of the study, as required by the University’s research policy, data will be stored in a locked room and on a departmental computer for five years. Dr Paula Skidmore or the relevant Head of Department will destroy the original data.

15(e) Who will have access to personal information, under what conditions, and subject to what safeguards?

Dr Paula Skidmore will have access to the personal information collected from the participants. The information will be securely stored and disposed as mentioned above in 15(d) to prevent any unauthorized disclosure. Participants’ data will be entered in a research database using a unique participant identifier (study ID). Upon request, participants and their parents/guardians will have an access to their own data in its raw format.
Will participants have access to the information they have provided?

The results of the research will be made available to participants and their parents/guardians if they wish, when the project is completed.

15(f) Do you intend to publish any personal information they have provided?

No. The results will be submitted for publication in a peer-reviewed journal. The results will be presented and published as either a mean value or collectively summarised statement and therefore data will not be able to be traced to any participant in the study.

15(g) Do you propose to collect demographic information to describe your sample? For example: gender, age, ethnicity, education level, etc.

Yes, we will collect information on age and gender.

15 (h) Have you, or do you propose to undertake Māori consultation? Please choose one of the options below, and delete the options that do not apply:

YES Consultation is underway but not yet completed

16. Does the research or teaching project involve any form of deception?

NO

17. Please disclose and discuss any potential problems:

None expected

18. Applicant's Signature: ..............................................................

[Principal Applicant: as specified in Question 1]

Date: .........................
19. **Departmental approval:** I have read this application and believe it to be scientifically and ethically sound. I approve the research design. The Research proposed in this application is compatible with the University of Otago policies and I give my consent for the application to be forwarded to the University of Otago Human Ethics Committee with my recommendation that it be approved.

**Signature of *Head of Department:** .................................................................

**Name of Signatory (please print):** ...............................................................  

**Date:** .................................................................