**Does cardiometabolic health moderate the relationship between dietary patterns and cognitive outcomes in a healthy, community-dwelling group of older Australians?**

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**Abstract**:

**Objectives**: Dietary patterns are associated with cardiovascular risk factors and cardiovascular disease (CVD) endpoints. Vascular risk factors and CVD are increasingly being recognised as having an important role in cognitive decline and dementia risk. Understanding the vascular mechanisms that may link diet and dementia is particularly important in older adulthood given the increased cardiovascular risk associated with that cohort and given that effective dementia treatments are lacking.

**Aim**: This study aims to examine whether cardiometabolic health moderates the relationship between dietary patterns and cognitive performance among healthy older Australian adults

**Design**: A cross-sectional analysis of the baseline phase of the ACTIVate study, which aims to characterise the optimal composition of modifiable lifestyle factors on brain health and cognitive decline.

**Participants**: The study recruited 424 community-dwelling Australians, aged 60-70, without cognitive impairment (screened with the Montreal Cognitive Assessment). Participants were recruited by the University of Newcastle and the University of South Australia.

**Method:** The Australian Eating Survey (AES) Food Frequency Questionnaire was used to collect dietary data, with additional questionnaire including oil consumption. A Principal Component Analysis was applied to the food survey data. Three patterns were identified, related to a healthy plant-rich diet, a Western-Style Diet, and a healthy meat-eating diet. Metabolic risk was assessed using the metabolic syndrome severity score (MetSSS) and inflammation (C-Reactive Protein). The Cambridge Neuropsychological Test Automated Battery (CANTAB) was used to assess cognition, whereby four cognitive domain components were determined.

**Results**:

***Keywords***: Ageing, cardiovascular risk, cardiovascular disease, diet, dietary patterns

**A list of abbreviations**

|  |  |
| --- | --- |
| **AD** | Alzheimer’s Disease |
| **AI** | Augmentation index |
| **AUSNUT** | Australian Food, Supplement and Nutrient (database) |
| **BMI** | Body Mass Index |
| **CANTAB** | Cambridge Neuropsychological Test Automated Batteries |
| **CVD** | Cardiovascular disease |
| **DASH** | Dietary Approaches to Stop Hypertension |
| **FFQ** | Food Frequency Questionnaire |
| **MCI** | Mild cognitive impairment |
| **PSD** | Prudent-style diet |
| **PWV** | Pulse wave analysis |
| **WSD** | Western-style die |

**Background and Rationale**

**Synopsis:**This study is a cross-sectional analysis of the baseline phase of the ACTIVate study, which aims to examine whether cardiometabolic health moderates the relationship between dietary patterns and cognitive performance among healthy older Australian adults.

**Objectives:** This study aims to examine whether cardiometabolic health moderates the relationship between dietary patterns and cognitive performance among healthy older Australian adults

**Primary Research question**

Does cardiometabolic health moderate the relationship between dietary patterns and cognitive outcomes in a healthy, community-dwelling group of older Australians?

**Hypotheses:**

Null:

* Diet does is not associated with cognition.
* There is no moderating effect of cardiometabolic health on the relationship between dietary patterns and cognitive performance among healthy older Australian adults.

Alternative hypotheses:

* Diet is significantly associated with cognition.
* Cardiometabolic health moderates the relationship between dietary patterns and cognitive performance among healthy older Australian adults.

**Explicit:**

* Greater adherence to a plant-based dietary pattern is associated with greater performance in attention.
* Greater adherence to a plant-based dietary pattern is associated with greater performance in processing speed.
* Greater adherence to a plant-based dietary pattern is associated with greater performance in short term memory.
* Greater adherence to a plant-based dietary pattern is associated with greater performance in long term memory.
* Greater adherence to a meat-predominant dietary pattern is associated with greater performance in attention.
* Greater adherence to a meat-predominant dietary pattern is associated with greater performance in processing speed.
* Greater adherence to a meat-predominant dietary pattern is associated with greater performance in short term memory.
* Greater adherence to a meat-predominant dietary pattern is associated with greater performance in long term memory.
* Greater adherence to a Western-style dietary pattern is associated with greater performance in attention.
* Greater adherence to a Western-style dietary pattern is associated with greater performance in processing speed.
* Greater adherence to a Western-style dietary pattern is associated with greater performance in short term memory.
* Greater adherence to a Western-style dietary pattern is associated with greater performance in long term memory

**Exclusion criteria**

|  |  |
| --- | --- |
| Table 1. |  |
| Inclusion criteria | This project uses a rolling recruitment strategy to enroll Australians living in the greater Hunter Region aged between 60 and 70 years-old. |
| *Exclusion criteria* | Drug and or alcohol dependency.  Claustrophobia.  Pacemaker, metal implants or cochlear implants.  Uncorrected vision problems.  Not fluent in English.  Stroke or transient Ischemic attack.  Dementia.  Physical or intellectual disability.  Cancer treatment in the last 5 years. |

**Measurement and calculation of variables**

**Independent variables**

* IV 1: Principal component 1 “Med / plant diet” (derived by principal component analysis)
* IV 2: Principal component 2 “Western Style-diet” (derived by principal component analysis)
* IV 3: Principal component 3 “Aussie traditional / meat-predominant” (derived by principal component analysis)
* All variables will be treated as continuous, but there is the possibility to partition into tertiles or quartiles to examine descriptive statistics

**Dependent variables**

* Processing Speed
* Attention
* Short term memory
* Long term memory

**Moderators**

* Metabolic syndrome score (composite score involving systolic/diastolic blood pressure, triglycerides (mmol/L), HDL (mmol/L), Waist circumference, blood glucose (mmol/L))
  + I have created a score based on Wiley & Carrington (2016) – may consider other variations.
* C-Reactive protein

**Covariates** includedBMI, education,past education, total energy intake (based on AES), total time spend in physical activity, age, gender, possibly Framingham, also have a series of micronutrients, or core food groups based from the ARFS (could do exploratory post-hoc analysis)

**Statistical Analysis Plan:**

Statistical analyses will be conducted using the latest stable version of R (R Core Team 2021), and the session information will be reported.

**Data cleaning – Dietary patterns**

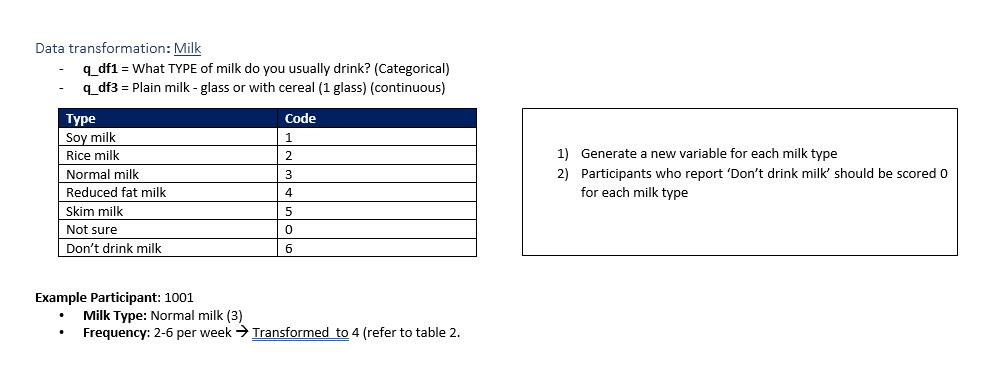
## Australian Eating Survey (AES)

* The AES contains 120-food items questions with 15 supplementary questions regarding age, use of vitamin supplements, food behaviours and sedentary behaviours
* For the purpose of the PCA, only food items will be considered relevant and two categorical variables will (bread type and milk type) will be used to transform corresponding frequency data as follows.
* Refer to Appendix (Table 1) for data dictionary

Data transformation:

* When asked how often a participant consumes a certain food item, Likert responses vary. To ensure that there is a systematic outcome for each food item we need to convert food items to serves per week
* **Table 2. Rules for converting AES codes to serves per week** (see data\_conversion\_rules.xlxs)

|  |  |  |  |
| --- | --- | --- | --- |
| **old\_col\_value** | **new\_col\_value** | **original description** | **notes** |
| 0 | 0 | Never |  |
| 1 | 0.25 | Less than 1 per month |  |
| 2 | 1 | 1 per week or less | Bread only |
| 3 | 7 | Less than 1 per day | Water only |
| 4 | 0.5 | 1-3 per month |  |
| 5 | 1 | 1 per week |  |
| 6 | 3 | 2-4 per week |  |
| 7 | 4 | 2-6 per week |  |
| 8 | 5.5 | 5-6 per week |  |
| 9 | 6 | 5-7 per week |  |
| 10 | 2 | 2 or more per week |  |
| 11 | 5 | 5 or more per week |  |
| 12 | 7 | 1 per day |  |
| 13 | 14 | 1-3 glasses per day | Water only |
| 14 | 17.5 | 2-3 per day |  |
| 15 | 14 | 2 or more per day |  |
| 16 | 28 | 4 or more per day |  |
| 17 | 35 | 4-6 glasses per day | Water only |
| 18 | 49 | 7 or more glasses per day | Water only |



**Sidenote**:

* The original ‘plain milk’ variable (q\_df3) will not be used for the final PCA
* ‘Not sure’ will not be used for the final PCA
* Also multiple participants have reported drinking other milk in the final open-ended question of the AES, however for the sake of keeping things consistent this will not be included in the PCA as well (see responses below for reference)

|  |  |
| --- | --- |
| **Participant** | **Milk** |
| 1030 | Almond milk – (but reported never drinks milk) |
| 1035 | Almond milk |
| 1038 | Almond milk, coconut milk   * had 6 for ‘normal milk’ |
| 1098 | Coconut milk |
| 1149 | Heart smart milk |
| 1184 | Lactose free milk – (but reported never drinks milk) |
| 1188 | Oat Milk |
| 1197 | Oat Milk |
| 1201\* | Skim milk (same as in the survey)\* |
| 2004 | Unsweetened coconut milk |
| 2115 | Almond milk – (but reported never drinks milk) |
| 2117 | Soy milk |
| 2189 | Unhomogenised milk – (but reported never drinks milk) |
| 2190 | Almond milk |
| 2192 | Almond milk / but scored rice milk (but reported never drinks milk) |

A few participants also reported not drinking people but then put a frequency score for ‘plain glasses of milk’. These participants will also receive a ‘0’ score for all milk types

* This includes**: 2115. 2174, 2207, 1030, 1095, 1144, 2107, 2167, 21089, 2118, 1061, 1080, 2181**

### Data transformation**:** Bread

* **q\_b4** = What type of bread do you usually eat? (*bread\_type*)
* **q\_b5** = Bread, pita bread, roll or toast - all types (1 slice) (*bread\_all*)

Bread was coded as the following:

|  |  |
| --- | --- |
| **Type** | **Code** |
| Brown (multigrain, wholemeal) | 1 |
| White | 2 |
| Other | 3 |
| Note sure (N=2) | 4 |

1. Generate a new variable for each bread types: Brown, White, Other

**Sidenote**:

* Not sure will be excluded
* q\_b5 = Bread, pita bread, roll or toast will be excluded
* Participants reported additional bread types (but similar to milk) this will not be considered in the PCA data input (see below for reference)

|  |  |
| --- | --- |
| **Participant** | **Bread** |
| 1016 | Gluten free |
| 1038 | Flat bread (5 flour GF) 7 x a week |
| 1040 | Gluten-free bread (3-4 x a week) |
| 1057 | Low carb grain bread (1 x daily) |
| 1083 | Sourdough bread |
| 1138 | Sourdough bread (home made) |
| 1221 | Sourdough bread |
| 2015 | Sourdough bread |
| 2068 | Sourdough bread (2 serves x week) |
| 2076 | Gluten free keto bread |
| 2172 | Spelt bread |
| 2181 | Gluten free grains-not sure if refers to bread |
| 2190 | Rye sourdough bread ( home made) |
| 2192 | Spelt bread |

## Additional Diet Questionnaire

* For this section, you will use the data from REDcap related to oils.
* Oils will need to be converted from tablespoons per day to serves per week
* See Appendix (Table 2) for key items in questionnaire

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **How much olive oil do you usually use each day?** | **REDCAP** | **Daily serves** | **AGHE** | **New** |
| Less than 1/2 tablespoon | 1 | 0 | 2.628571 | 0 |
| 1/2 tablespoon | 2 | 0.5 | 2.628571 | 1.314286 |
| 1 tablespoon | 3 | 1 | 2.628571 | 2.628571 |
| 2 tablespoons | 4 | 2 | 2.628571 | 5.257143 |
| 3 tablespoons | 5 | 3 | 2.628571 | 7.885714 |
| 4 tablespoons | 6 | 4 | 2.628571 | 10.51429 |
| 5 tablespoons | 7 | 5 | 2.628571 | 13.14286 |
| 6 tablespoons | 8 | 6 | 2.628571 | 15.77143 |
| 7 tablespoons | 9 | 7 | 2.628571 | 18.4 |
| 8 or more tablespoons | 10 | 8 | 2.628571 | 21.02857 |

### Data transformation: olive oil types (extracted from additional diet questionnaire)

* **Categorical variable:** *Which type of olive oil do you usually use? (evoo)*
* **Continuous variable:** How much olive oil do you usually use each day? (oliveoil\_amount)

Coding:

|  |  |
| --- | --- |
| Code | Label |
| 1 | Pure olive oil |
| 2 | Light olive oil |
| 3 | Virgin olive oil |
| 4 | Extra virgin olive oil |

**Determining principal component scores (diet patterns)**

In nutritional epidemiology Principal component analysis (PCA) is a commonly used statistical tool to determine dietary patterns (represented by components) that are specific to the sample being studied. This data driven approach captures the variability of eating patterns through clustering food groups together.

##### Assumptions of the PCA that must be met include:

* + 1. Input variables should be continuous
    2. There should be a linear relationship between all variables
    3. You should have sampling adequacy
    4. Data should be suitable for data reduction
    5. No significant outliers

###### Input variables should be continuous

Various sources can be used to determine food items to be put into a PCA and some studies also use nutrient values as well. Food frequency questionnaires are the most commonly used when using PCA to determine diet or nutrient patterns. However, as food frequency questionnaires (FFQ) capture diet consumption through using Likert scale responses, they must be transformed from ordinal to continuous variables to meet the assumptions of the PCA. What’s more, if the Likert scale varies across different food items, all variables must be standardised prior to being entered into the PCA. For instance, all responses may be standardised to grams per day or serves per week.

Grouping food items

Usually surveys with anywhere between 60 – 140 food items will be condensed into broader categories informed by nutritional composition, culinary use, and previous research. For instance, bacon, salami, and sausage may be grouped into one food group known as processed meats; although some food items may standalone (e.g., eggs, tea, avocado).

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Whole grains** | **Refined grains** | **Other grains** | **Savoury snacks** | **Sweet desserts** |
| Cooked porridge  Brown bread | White bread  English muffin  Dry or savoury biscuits  Pasta  Noodles | Rice  Muesli  Other grains (e.g. cous cous)  Bread (other) | Chips  Potato chips  Dry or savoury biscuits  Snack noodles  Savoury combinations  Savoury pastries | Cakes  Sweet pies  Pudding  Cream or chocolate biscuits  Plain sweet biscuits |
| **Spreads** | **Sweet snack bars** | **Processed meat** | **Meat without veg** | **Meat vegetables** |
| Jam & honey  Nut spread | Fruit bars  Sweet combination  Snack bars Muesli bars | Bacon / ham  Sausage  Salami / Devon | Beef or lamb pieces & sauce  Plain meat  Pork pieces  Plain pork | Beef or lamb pieces & sauce  Plain meat  Pork pieces  Plain pork |
| **Chicken with veg** | **Chicken without veg** | **Seafood** | **Fried protein** | **Yellow veg** |
| Plain chicken  Chicken pieces | Plain chicken  Chicken pieces | Fresh fish  Canned tuna  Other seafood | Fried / Crumbed fish  Crumbed chicken | Pumpkins  Carrot  Sweet potato |
| **Fresh fruit** | **Other vegetables** | **Green leafy veg** | **Cruciferous vegetables** | **Legumes** |
| Fruit salad  Apple/pear  Banana  Peach  Mango  Pineapple  Grapes  Melon | Zucchini  Capsicum  Mushrooms  Celery  Corn  Onion | Spinach  Lettuce | Broccoli  Cauliflower  Cabbage | Green beans  Peas  Soybeans  Baked beans  Other beans |
| **Dairy (normal)** | **Dairy (discretionary)** | **Fast fried food** | **Other oils** | **Condiments** |
| Cottage cheese  Cheese  Yoghurt  Full fat milk  Low fat milk  Skim milk | Cream or sour cream  Flavoured milk  Ice cream  Frozen yoghurt  Ice block (creamy)  Cheese spread | Hamburger  Hot dog  Pizza  Pie / Sausage roll  Hot chips  Hash brown  Tacos | Vegetable  Canola  Sunflower  Peanut  Coconut oil | Salad dressing  Low fat salad dressing  Vegemite  Tomato sauce |
| **Sugary beverages** | **Other milk** | **Soup** | **Margarine** | **Butter** |
| Soft drink  Fruit juice  Cordial | Rice milk  Soy milk | Creamy soup  Other soup | Margarine  Margarine blend | Butter  Butter blend |
| **Canned fruit** | **Dried fruit** | **Nuts** | **Avocado** | **Tomato** |
| **Mince meat dishes** | **Eggs** | **Liver** (chicken or red meat) | **Tea /coffee** | **Cereal** |
|  | **Chocolate** | **Diet soft drink** | **Lollies** | **Ice block** |
| **Potato group** | **wine** | **spirits** | **beer** |  |

**Sampling adequacy**

A common criticism within the PCA field is how replicable the components are. One way to ensure that the PCA is producing a reliable result is to ensure your sample size is large enough and different rules of thumb are often referred to when determining this. Generally speaking, a minimum of 150 cases is considered acceptable OR 5-10 cases per variable. This is another reason why using food groups (e.g. 30-40) instead of an entire FFQ dataset that contains over 100 food items, may be more desirable. To test for sampling adequacy you can also use the:

Kaiser-Meyer Olkin (KMO) Measure of Sampling Adequacy on the entire dataset. This should be a value greater than .6. Anything less will indicate power of the PCA

KMO measure for each individual variable (consider anything below .5)

**Truncating variables**

To meet assumptions of PCA, removing uncommon variables and truncating extreme variables has been done in the past.

Two food items were removed, liver and Othermilk.

Over 85% of participants reported never consuming these items.

**Retaining principal components**

Traditionally, when determining the number of factors to retain, researchers will evaluate the amount of eigenvalues with a cutoff above one and inspect the screeplot. Components are then commonly rotated using a varimax rotation (i.e., an orthogonal rotation) to maximise the item variance and simplify interpretability of latent factors. The rotated components will then be labelled depending on what dietary pattern they represent. Researchers typically retain 2 – 6 principal components and then each participant will be given a score for each component.

Chart, line chart

Description automatically generated

**Determining principal component scores**

The score represents the level of adherence to the respective dietary pattern and is determined by multiplying each factor loading by food group value for the participant and then summing across food groups to determine the dietary pattern adherence score.

1. **Descriptive statistics:** Describe the characteristics of the study population including demographics, dietary patterns, cardiometabolic health, and cognitive outcomes using means, standard deviations, frequencies, and percentages as appropriate. We may wish to consider breaking down adherence groups, and describing desriptive stats as per quartile/tertile – see Table 3 for example.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Table 4.** | | | |  |
| **Diet adherence group** | **1** | **2** | **3** | **4** |
| Mean diet score |  |  |  |  |
| Age |  |  |  |  |
| ACE-III Scores |  |  |  |  |
| BMI |  |  |  |  |
| Systolic BP |  |  |  |  |
| Diastolic BP |  |  |  |  |
| Heart Rate |  |  |  |  |
| Education |  |  |  |  |
| Total cholesterol |  |  |  |  |
| LDL |  |  |  |  |
| HDL  Resting glucose  C-reactive protein  MetSSS |  |  |  |  |

1. **Bivariate analyses**: Use Pearson's correlation coefficient to examine the associations between the dietary patterns, cardiometabolic health, and cognitive outcomes. Additionally, perform t-tests or ANOVA to compare cognitive outcomes between groups of participants with different dietary patterns or cardiometabolic health status.
2. **Multiple regression analysis:** 
   1. Note variables that are significantly correlated with outcome variables (retain in next step)
   2. Build a series of multiple regression models to examine the association between dietary patterns and cognitive outcomes, adjusting for significant potential confounding factors such as age, sex, education, and physical activity.
   3. Then, add cardiometabolic health variables (MetSSS and C-Reactive Protein) as moderators to assess their interaction with the dietary patterns on cognitive outcomes.
3. **Sensitivity analyses:** Conduct sensitivity analyses to examine the robustness of the findings, such as excluding participants with medication use or chronic diseases that may affect cognitive function.

E**.**g. note 2142 is an extreme outlier case

1. **Stratified analyses:** Conduct stratified analyses to examine whether the associations between dietary patterns and cognitive outcomes differ by subgroups, such as sex, age, education, and physical activity level.
2. **Subgroup analyses**: Conduct subgroup analyses to examine whether the associations between dietary patterns and cognitive outcomes differ by different levels of cardiometabolic health, such as high vs. low MetSSS or high vs. low C-Reactive Protein.
3. **Mediation analyses:** Conduct mediation analyses to explore the potential mediating pathways between dietary patterns, cardiometabolic health, and cognitive outcomes, such as whether inflammation mediates the association between dietary patterns and cognitive outcomes.

Diagram

Description automatically generated

Diagram

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1. **Sensitivity analyses for mediation models**: Conduct sensitivity analyses for mediation models to examine the robustness of the findings, such as excluding participants with medication use or chronic diseases that may affect inflammation.
2. **Model fit**: Evaluate the overall model fit and goodness of fit for each model using appropriate measures, such as R-squared, adjusted R-squared, Akaike information criterion (AIC), and Bayesian information criterion (BIC).
3. **Reporting**: Report the results in a clear and concise manner, including tables and figures as appropriate, and discuss the implications of the findings for future research and public health interventions.

Appendix:

**Table 1. Original AES items and descriptions**

|  |  |
| --- | --- |
| **Item** | **Description** |
| record\_id | Record ID |
| Age | 1. How old are you? |
| bddate | 2. When is your birthday? (D-M-Y) |
| Gender | Are you? |
| Vitamins | Do you take vitamins? |
| vitamin\_ frequency | How many vitamin tablets do you take each week? |
| vitamin\_duration | How many years have you been taking them? |
| breakfast\_days | How many days per week do you usually have something to eat for breakfast? |
| q\_b | Where do you usually eat breakfast? |
| fruit\_pieces | How many pieces of fruit do you eat? (include all types) |
| q\_d | How many times a week do you eat vegetables with your meal at night? (not including hot chips) |
| q\_e | How often do you eat takeaway foods? eg. Chinese, fish and chips, hamburger and chips/fries, pizza |
| q\_f | How many times a week do you eat your meal at night in front of the television (TV)? |
| q\_g | How much time each day do you spend watching television? |
| q\_h | How much time each day do you spend on the computer or playing video games? |
| q\_i | How much money do you usually spend each week on buying lunches, snacks and drinks (eg. coffee)? |
| q\_j | How many times a day do you eat snacks? |
| q\_k | Add up how many times a day you have a glass of milk, a tub of yoghurt or a slice of cheese. |
| q\_l | Add up how many glasses of softdrink or cordial you have each day? (all types) |

|  |  |
| --- | --- |
| **Item** | **Description** |
| q\_d1 | DIET softdrink eg. Diet coke |
| q\_d2 | Softdrink (NOT DIET) including flavoured mineral water eg. lemonade, coke, fanta, flavoured mineral water |
| q\_d3 | Water - including bottled water, unflavoured mineral water, tap water (1 glass) |
| q\_d4 | Fruit juice-based drinks eg. orange juice or Popper (1 serving) |
| q\_d5 | Cordial or 'make up' eg. Cottee's crush, raspberry (1 glass) |
| q\_d6 | Tea or coffee (1 cup or mug) |
| q\_d7 | Beer (1 can, bottle or glass) |
| q\_d8 | Wine or wine coolers eg. West Coast cooler (1 can, bottle or glass) |
| q\_d9 | Spirits eg. vodka, bourbon (1 drink or shot) |
| **q\_df1** | **What TYPE of milk do you usually drink?** |
| q\_df2 | Flavoured milk eg. Moove, Oak, hot chocolate, milkshake, thickshake, smoothie (1 glass) |
| q\_df3 | Plain milk - glass or with cereal (1 glass) |
| q\_df4 | Cream or sour cream |
| q\_df5 | Ice cream - vanilla, chocolate, strawberry, sundaes, cones |
| q\_df6 | Frozen yoghurt (1 serving) |
| q\_df7 | Yoghurt (not frozen) plain or flavoured eg. Ski, Yoplait, Vaalia (1 serving) |
| q\_df8 | Cottage cheese or ricotta (1 serving) |
| q\_df9 | Cheese - including cheese on sandwiches, biscuits or on toast (1 slice) |
| q\_df10 | Cheese spread, cream cheese (1 serving) |
| q\_b1 | Muesli (1 bowl) |
| q\_b2 | Cooked porridge (1 bowl) |
| q\_b3 | Breakfast cereal eg. Weet-bix, Nutri-grain, Cornflakes, Sultana Bran (1 bowl) |
| q\_b4 | What type of bread do you usually eat? |
| q\_b5 | Bread, pita bread, roll or toast - all types (1 slice) |
| q\_b6 | English muffin, bagel or crumpet (1) |
| q\_b7 | Rice (1 serving) |
| q\_b8 | Other grains eg. cous cous, burghul (1 serving) |
| q\_b9 | Noodles eg. egg noodles (yellow), rice noodles (white) (1 serving) |
| q\_b10 | Pasta eg. spaghetti, lasagne, pasta bake (1 serving) |
| q\_s1 | Cakes, sweet muffins, scones, pikelets, pancakes, hot cakes eg. apple muffin, chocolate cake, lamington (1 serving) |
| q\_s2 | Sweet pies or sweet pastries eg. apple pie, danish (1 serving |
| q\_s3 | Other puddings or desserts (not ice cream) eg. chocolate mousse, sticky date pudding (1 serving) |
| q\_s4 | Plain sweet biscuits eg. Arrowroot, Morning Coffee, Tiny Teddies (1 serving) |
| q\_s5 | Cream or chocolate biscuits eg. Tim Tams, shortbread creams (1 serving) |
| q\_s6 | Dry or savoury biscuits, crispbread, crackers eg. Saos, Vita Weats, Jatz, Shapes, rice crackers, Cruskits (1 serving) |
| q\_s7 | Savoury combination snacks - biscuits and cheese eg. Le Snak, Snack abouts (1 serving) |
| q\_s8 | Sweet combination snacks eg. Dunkaroos (1 serving) |
| q\_s9 | Snack noodles eg. 2 minute noodles, Monster noodles (1 serving) |
| q\_s10 | Fruit bars eg. Roll ups (1 bar) |
| q\_s11 | Snack bars eg. K-Time twist bar (1 bar) |
| q\_s12 | Muesli bars eg. Yoghurt tops (1 bar) |
| q\_m1 | Mince dish eg. spaghetti bolognese, rissoles, shepherd's pie, lasagne (1 serving) |
| q\_m2 | Beef or lamb pieces and sauce WITHOUT vegetables eg. beef stroganoff (1 serving) |
| q\_m3 | Beef or lamb pieces and sauce WITH vegetables eg. stir fry (1 serving) |
| q\_m4 | Plain meat (beef or lamb) (eg. roast, chops, steak) WITHOUT vegetables or salad (1 serving) |
| q\_m5 | Plain meat (beef or lamb) (eg. roast, chops, steak) WITH vegetables or salad (1 serving) |
| q\_m6 | Chicken pieces and sauce WITHOUT vegetables eg. satay chicken (1 serving) |
| q\_m7 | Chicken pieces and sauce WITH vegetables eg. stir fry |
| q\_m8 | Chicken crumbed eg. Chicken nuggets, KFC pieces, schnitzel (1 serving) |
| q\_m9 | Plain chicken (eg. roast or BBQ) WITHOUT vegetables (1 serving) |
| q\_m10 | Plain chicken (eg. roast or BBQ) WITH vegetables (1 serving) |
| q\_m11 | Pork pieces and sauce WITHOUT vegetables eg. sweet and sour pork |
| q\_m12 | Pork pieces and sauce WITH vegetables eg. stir fry |
| q\_m13 | Plain pork (eg. roast or chops) WITHOUT vegetables (1 serving) |
| q\_m14 | Plain pork (eg. roast or chops) WITH vegetables |
| q\_m15 | Liver - beef, calf, chicken (including pat?) (1 serving) |
| q\_m16 | Fish crumbed or battered eg. fish & chips, fish fingers (1 serving) |
| q\_m17 | Fresh fish, not crumbed or battered (1 serving) |
| q\_m18 | Canned tuna, salmon, sardines, including patties (1 serving) |
| q\_m19 | Other seafood eg. prawns, lobster (1 serving) |
| q\_m20 | Creamy soup (1 serving) |
| q\_m21 | Clear soup with rice or noodles (1 serving) |
| q\_m22 | Tacos, burritos, enchiladas (1 serving) |
| q\_m23 | Sausages, frankfurts, Pluto Pup (1 serving) |
| q\_m24 | Hamburger - all types (1 serving) |
| q\_m25 | Pizza (1 serving) |
| q\_m26 | Pie, sausage roll, chiko roll (1 serving) |
| q\_m27 | Hot dog (1 serving) |
| q\_m28 | Savoury pastries e.g. spinach and cheese triangles (1 serving) |
| q\_m29 | Hash browns, potato scallops (1 serving) |
| q\_o1 | Chips (not potato) e.g. Twisties, corn chips, burger rings (1 packet) |
| q\_o2 | Potato chips or crisps e.g. plain, salt and vinegar (1 packet) |
| q\_o3 | Ice block - creamy e.g. Paddle Pop, Magnum, Cornetto (1 ice block) |
| q\_o4 | Ice block - water e.g. Frosty Fruit, lemonade (1 ice block) |
| q\_o5 | Chocolate eg. plain chocolate, Mars Bar, Snickers, Milky Way (1 serving) |
| q\_o6 | Lollies without chocolate e.g. lollipops, snakes, Skittles, Starburst (1 serving) |
| q\_o7 | Low fat salad dressing or mayonnaise (1 serving) |
| q\_o8 | Salad dressing or mayonnaise - not low fat (1 serving) |
| q\_o9 | Nuts eg. peanuts, almonds (1 serving) |
| q\_o10 | Jam, honey, golden syrup, marmalade (1 serving) |
| q\_o11 | Peanut butter, Nutella (1 serving) |
| q\_o12 | Vegemite, Mighty Mite, Promite, Marmite (1 serving) |
| q\_o13 | Tomato sauce, barbecue sauce (1 serving) |
| q\_o14 | Devon, salami (1 serving) |
| q\_o15 | Bacon, ham (1 serving) |
| q\_o16 | Eggs e.g. boiled, scrambled (1 serving) |
| q\_o17 | Jelly (1 serving) |
| q\_f1 | Hot chips bought from a shop e.g. McDonald's fries (1 serving) |
| q\_f2 | Hot chips cooked at home e.g. oven fries, wedges (1 serving) |
| q\_f3 | Potato - boiled, mashed, baked (1 serving) |
| q\_f4 | Pumpkin (1 serving) |
| q\_f5 | Sweet Potato (1 serving) |
| q\_f6 | Cauliflower (1 serving) |
| q\_f7 | Green beans (1 serving) |
| q\_f8 | Spinach (1 serving) |
| q\_f9 | Cabbage or brussel sprouts (1 serving) |
| q\_f10 | Peas (1 serving) |
| q\_f11 | Broccoli (1 serving) |
| q\_f12 | Carrots (1 serving) |
| q\_f13 | Zucchini, eggplant, squash (1 serving) |
| q\_f14 | Capsicum (1 serving) |
| q\_f15 | Corn, sweetcorn, corn on the cob (1 serving) |
| q\_f16 | Mushrooms (1 serving) |
| q\_f17 | Tomatoes (1 serving) |
| q\_f18 | Lettuce (1 serving) |
| q\_f19 | Celery, cucumber (1 serving) |
| q\_f20 | Avocado (1 serving) |
| q\_f21 | Onion, spring onion, leek (1 serving) |
| q\_f22 | Soybeans, tofu (1 serving) |
| q\_f23 | Baked beans (1 serving) |
| q\_f24 | Other beans, lentils eg. chickpeas, split peas (1 serving) |
| q\_f25 | Canned fruit eg. peaches, Two fruits (1 serving) |
| q\_f26 | Fruit salad (1 serving) |
| q\_f27 | Dried fruit eg. sultanas, dried apricots |
| q\_f28 | Apple or pear (1 serving) |
| q\_f29 | Orange, mandarin, grapefruit (1 serving) |
| q\_f30 | Banana (1 serving) |
| q\_fs1 | Peach, nectarine, plum or apricot (1) |
| q\_fs2 | Mango or paw-paw (1 serving) |
| q\_fs3 | Pineapple (1 serving) |
| q\_fs4 | Grapes, strawberries, blueberries |
| q\_fs5 | Melon eg. watermelon, rockmelon, honeydew melon (1 serving) |
| q\_other\_foods | Please list any foods that you regularly eat that you have not been asked about: - Open-Ended Response |

**Table 2. Original Additional Diet Questionnaire Items and Descriptions**

|  |  |  |
| --- | --- | --- |
| **Item** | **Description** | |
| additional\_diet\_id | | Researcher ID |
| add\_diet\_notes | | Notes |
| Butter | | Do you use butter? |
| butter\_amount | | How much butter do you usually use each day? |
| Butterblend | | Do you use a butter blend (i.e. Devondale Dairy Soft, Western Star Spreadable)? |
| butterblend\_amount | | How much butter blend do you usually use each day? |
| Margarine | | Do you use margarine? |
| marg\_amount | | How much margarine do you usually use each day? |
| Margblend | | Do you use a margarine blend (i.e. Nuttelex, olive oil spread)? |
| margblend\_amount | | How much margarine blend do you usually use each day? |
| Lard | | Do you use lard? |
| lard\_amount | | How much lard do you usually use each day? |
| veg\_oil | | Do you use vegetable oil? |
| veg\_oil\_amount | | How much vegetable oil do you usually use each day? |
| Canola | | Do you use canola oil? |
| canola\_amount | | How much canola oil do you usually use each day? |
| sunflower\_oil | | Do you use sunflower oil? |
| sunflower\_amount | | How much sunflower oil do you usually use each day? |
| peanut\_oil | | Do you use peanut oil? |
| peanutoil\_amount | | How much peanut oil do you usually use each day? |
| coconut\_oil | | Do you use coconut oil? |
| coconutoil\_amount | | How much coconut oil do you usually use each day? |
| olive\_oil | | Do you use olive oil? |
| Evoo | | Which type of olive oil do you usually use? |
| oliveoil\_amount | | How much olive oil do you usually use each day? |
| other\_oils | | Do you use any other cooking oils or fats (i.e. rice bran, avocado)? |
| otheroils\_type | | Which other oils do you use? |
| otheroils\_amount | | How much do you usually use each day? |
| other\_oils\_2 | | Do you use any other cooking oils or fats? |
| otheroils\_type\_2 | | Which other oils do you use? |
| otheroils\_amount\_2 | | How much do you usually use each day? |
| other\_oils\_3 | | Do you use any other cooking oils or fats? |
| otheroils\_type\_3 | | Which other oils do you use? |
| otheroils\_amount\_3 | | How much do you usually use each day? |
| additional\_diet\_questions\_complete | | Complete? |