

# Statistical Analysis Plan

## Diet and Psychological Distress in NZ Adults

### Study aims and hypotheses

The aim of this study is to explore patterns in lifestyle, diet, and psychological distress in physically healthy adult New Zealanders aged between 18-45 years. The study will provide baseline information from which more targeted research can be developed. The proposed hypotheses are:

1. There is a relationship between diet and psychological distress in the NZ population, with poorer quality diet associated with higher levels of psychological distress.
2. Lower intakes of micronutrients will be associated with increased psychological distress
3. An inflammatory diet (lower anti-inflammatory diet index score) will be associated with increased psychological distress.
4. Environmental stressors will moderate the relationship between diet and psychological distress, with a poor quality diet being more strongly related to psychological distress when an individual is experiencing high levels of stressful life events.
5. Gender will moderate the relationship between diet and psychological distress, with the relationship being stronger in females than in males.
6. Stress-resilience will be associated with a higher quality diet.
7. Relationships between diet and psychological distress will still be significant after controlling for confounding variables.

### Method

#### Power analysis

Sample size was estimated using G\*Power software version 3.1.9.7. For multiple regression, with six covariates and assuming an identification of four dietary patterns, 172 participants are required for an effect size of 0.1, 80% power and an alpha of 5% for the f-test. For MANOVA, 180 participants are required for an effect size (f) of 0.25, 80% power, and an alpha of 5%.

#### Measurements

##### ***Assessment of dietary intake***

Participants will record their dietary intake using a 70-item food frequency questionnaire. The FFQ has previously been validated in NZ adults (Sam et al., 2020). Individual dietary components will be quantified (see Table A2, Appendix A), and dietary patterns will be identified using multivariate analysis using the 70 food items measured in the FFQ. Diet quality will be assessed using the 2015 version of the Healthy Eating Index (HEI-2015). The HEI-205 scores diet on quality, independently from energy intake. It comprises two sub-scores, diet adequacy with nine components, and diet moderation, with four components. A total score out of 100 is obtained, with a higher score indicating a better quality diet (Guenther et al., 2008; Krebs-Smith et al., 2018).

##### ***Assessment of psychological distress***

The short form 12-item version of the General Health Questionnaire (GHQ-12) will be used (Goldberg, 1972; Goldberg & Williams, 1988). The GHQ-12 contains two factors: Anxiety and Depression and Social Dysfunction (Kalliath et al., 2004). There are 12 statements to which participants indicate agreement based on the previous seven days on a four-point scale (0 = *Not at all*; 3 = *More than usual*). Scores are summed, and a lower overall score indicates less psychological distress.

### **Measurements of life stressors**

Recent Life Changes Questionnaire (RLCQ), also known as the Holmes-Rahe stress inventory, is a questionnaire with a list of 74 life events (Miller & Rahe, 1997). Participants select all which they have experienced over the past 6 months. The occurrence of a high number of these life events was found to be associated with increased risk of the onset of mental distress (Holmes & Rahe, 1967). Each life event is assigned a Life Change Unit (LCU) value and the LCUs are summed to provide a total score. A score of 300 LCU or higher is considered as high life stress (Miller & Rahe, 1997).

### **Stress resilience**

Cluster analysis will be used to determine if groups categorised as stress-resilient and stress-sensitive can be determined. Possible groups are shown in Table 1. If cluster analysis does not adequately split the groups, participants will be grouped according to whether they have experienced a high number of life stressors, and whether they have high or low psychological distress scores. Those with high life stressors will be classed as stress-sensitive or stress-resilient depending on their distress scores. High and low scores will be determined using a median split.

Table 1 – Possible categories of stress resilience (life stress)

		Life Stress	
		Low/moderate	High
GHQ-12 score	Low	Low stress & low psych distress	Stress-sensitive
	High	Low stress, high psych distress	Stress-resilient

### **Physical Activity**

The New Zealand Physical Activity Questionnaire - short form (NZPAQ-SF) will be used to collect physical activity data. This is a self-report questionnaire which asked participants to report the number of days and hours/minutes they have spent walking and undertaking moderate and/or vigorous physical activity over the previous week (Boon et al., 2010; Moy et al., 2008). Total physical activity will be quantified using the scoring protocol of the international physical activity questionnaire (Craig et al., 2003). Total physical activity will be expressed as metabolic equivalent minutes per week (METs/wk) (Boon et al., 2010; Moy et al., 2008).

The formula for calculating the METs/wk is as follows:

- Walking MET-minutes/week at work = 3.3 \* walking minutes \* days walking.
- Moderate MET-minutes/week at work = 4.0 \* moderate-intensity activity minutes \* number moderate intensity days
- Vigorous MET-minutes/week at work = 8.0 \* vigorous-intensity activity minutes \* number vigorous intensity days

Total PA MET-minutes/week = sum of walking + moderate + vigorous MET-minutes/week scores.

### **Sleep**

The single-item sleep quality scale (SQS) will be used. The SQS comprises one question which asks the participant to rate their sleep quality over the last 7 days on a scale from 0 (terrible) – 10 (Excellent) (Snyder et al., 2018).

### **Body Mass Index**

Body Mass Index will be calculated using self-reported height and weight using the formula  $BMI = \text{kg/m}^2$ .

### **Social support**

Perceived social support will be measured using the Multidimensional Scale of Perceived Social Support (Zimet et al., 1988). Lower social support measured using this scale has been found to be associated with higher depression scores (Trivedi et al., 2009). The scale has 12 items which are rated on a scale from 0 (very strongly disagree) to 7 (very strongly agree). Scores are summed for a total score, and there are three subscales, significant other, family, and friends.

### **Coping style**

Approach (task-focussed or problem solving) coping is associated with better psychological outcomes compared with avoidance (escapism or emotion-focused) coping (Beasley et al., 2003). Due to limitations to the length of the survey only approach coping will be measured. The Brief Resilient Coping Scale (BRCS) will be used in this study. It is a 4-item measure which measures tendencies to cope with stress in an active problem-solving manner (Sinclair & Wallston, 2004). The scale asks participants to rate statements on a scale from 0 (does not describe me at all) – 5 (describes me very well). Scores are summed for a total BRCS score.

### **Socioeconomic status**

To minimise the number of questions asked to the participants, the direct socioeconomic status of the participants will not be calculated, but the socioeconomic status of their neighbourhood will be recorded using the 2018 New Zealand Index of Multiple Deprivation (Exeter et al., 2017). Participants will enter the address of their usual residence which will be automatically converted to an IMD score. The address itself is not recorded.

### **Procedure**

Questionnaires will be administered via the online survey program *Qualtrics*. To reduce participant bias, the study will be described in generic terms as collecting data on lifestyle factors and wellbeing.

### **Statistical Analysis**

Dietary patterns will be identified using principal component analysis combined with cluster analysis. This combination reduces the influence of minor foods or outliers, but still allows diet to be attributed to individuals (Ocké, 2013).

To investigate associations between diet quality and psychological distress (hypotheses 1 and 2), dietary patterns, diet quality, and individual dietary components will be (separately) assessed against psychological distress (GHQ-12 scores) along with the covariates BMI, sleep quality, physical activity, IMD, social support and coping style using multiple linear regression.

To assess if relationships between diet and psychological distress are stronger under higher environmental stressors (hypothesis 3), or differ by gender (hypothesis 4), moderator analysis using linear regression will be undertaken.

To determine any unique contribution of diet to psychological distress (hypothesis 6), these analyses will be repeated with stepwise multiple regression, controlling for the covariates.

To investigate whether stress resilience is associated with differences in diet quality (hypotheses 5), participants will be grouped according to stress-resilience (see Table 1), and diet quality and individual dietary components will be compared between groups using MANOVA.

## Appendix A

Table A2. Food types and dietary components which will be identified using the FFQ data.

Food type	
Fruit & Vegetable intake	(serving)
Dairy intake	(serving)
Eggs, meat etc (animal derived protein)	(serving)
Breads, Cereals, Starches	(serving)
Fast Foods	(serving)
Sweets, baked goods, miscellaneous	(serving)

  

Dietary component	
Energy	(MJ)
Protein	(g)
Total fat	(g)
Saturated fat	(g)
Monounsaturated fat	(g)
Polyunsaturated fat	(g)
Cholesterol	(mg)
Carbohydrate	(g)
Sucrose	(g)
Fructose	(g)
Fibre	(g)
Alcohol	(g)
Total vitamin A	(µg)
β-carotene	(µg)
Thiamin	(mg)
Riboflavin	(mg)
Niacin equivalents	(mg)
Vitamin B6	(mg)
Folate	(µg)
Vitamin B12	(µg)
Vitamin C	(mg)
Vitamin E	(mg)
Calcium	(mg)
Potassium	(mg)
Iron	(mg)
Selenium	(µg)
Sodium	(mg)
Magnesium	(mg)
Zinc	(mg)

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