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Moving out: The impact of leaving the parental home on diet quality trajectories among Australian adolescents and young adults (14-27 years)

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A B S T R A C T

Background: Adolescence and early adulthood are marked by major life transitions, including leaving the parental home, which may influence dietary behaviours and related health risks. This study examined diet quality trajectories from adolescence into early adulthood and the influence of leaving home.
Methods: Data were drawn from 1135 participants aged 14 to 27 years in the Raine Study (Australia), who completed food frequency questionnaires at five follow-ups. Diet quality was assessed using the Dietary Approaches to Stop Hypertension (DASH) diet score and proportion of energy from discretionary foods and beverages. Multilevel regression models examined diet quality trajectories, investigating interactions with leaving the parental home and subsequent living arrangements (partner, friends or alone).
Results: Diet quality was generally poor and followed a quadratic trajectory. Leaving the parental home was associated with a decline in diet quality, reflected in a lower DASH diet score: $\beta = -1.11$ [95% CI: 1.80, −0.41]; and increased discretionary food intake: $\beta = 1.28$ [95% CI: 0.30, 2.26]. The decline persisted over time for DASH diet score and diminished for discretionary food intake. Moving in with a partner was associated with the greatest decrease in DASH diet score: $\beta = -1.18$ [95% CI: 2.08, −0.28].
Conclusion: Leaving home, particularly to live with a partner, is associated with a small decrease in diet quality in a population with already sub-optimal diets. Public health strategies targeting life transitions may help support healthier dietary behaviours in adolescents and young adults in Australia and other high-income countries.

1. Introduction

Adolescence is a significant developmental life stage and good nutrition during this time is key to establishing dietary habits for adulthood and future health outcomes (Lassi et al., 2017; Norris et al., 2022). A large body of evidence links poor diet with obesity and associated cardiometabolic risk factors (Mozaffarian, 2016a; Lim et al., 2012; Johnson et al., 2008a; Ambrosini et al., 2012; Juonala et al., 2011a; Tirosh et al., 2011; Appannah et al., 2015). Poorer diet quality is associated with higher fat mass (Ambrosini et al., 2012; Johnson et al., 2008b), adiposity (Juonala et al., 2011b), elevated BMI (Tirosh et al., 2011) and cardiometabolic risk factors (Appannah et al., 2015) in adolescents, which often persist into adulthood, posing a continued risk for chronic disease (Joint WHO/FAO Expert Consultation, 2002a). Globally, prevalence of overweight and obesity have recently increased rapidly worldwide (Haththotuwa et al., 2020), particularly among children and adolescents (Ng et al., 2014; Azzopardi et al., 2019; Garnett et al., 2016; Skinner et al., 2018). A 10-year population-based analysis of over 2 million adults in England found that young adults (18 to 24 years) were at 37% greater absolute risk of moving from normal weight to overweight or obesity, and a 42% higher absolute risk of progressing from overweight to obesity, compared to older adults (Katsoulis et al., 2021).

Higher fruit and vegetable intake has been consistently associated with lower cardiometabolic risk (Li et al., 2014; Aune et al., 2017a) and obesity (Panagiotakos et al., 2006; Togo et al., 2004; Wang et al., 2003), while energy-dense nutrient poor foods and beverages have been associated with poorer health outcomes, weight gain and obesity (National Health and Medical Research Council, 2013; Te Morenga et al., 2014; Joint WHO/FAO Expert Consultation, 2002b). Assessing diet holistically provides a clearer and more actionable understanding of dietary behaviours and associated risks (Heidemann et al., 2008; Mozaffarian, 2016b). Ideally, this involves capturing both positive (e.g. fruit, vegetables, whole grains etc.) and negative (e.g. discretionary foods) components to reflect overall diet quality. Several tools have been developed and validated to assess overall diet quality, for example, the Health Eating Index, the Dietary Approaches to Stop Hypertension (DASH) diet score and the Mediterranean Diet Score. The Australian Dietary Guidelines define “discretionary foods and beverages” as those that do not fit

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into the five core food groups (fruit, vegetables, dairy, grain foods, meat, fish and eggs, nuts, seeds and legumes) (National Health and Medical Research Council, 2013; National Health and Medical Research Council; National Health and Medical Research Council, 2011). Despite the known health risks of poor diet quality, research across a range of different countries continues to demonstrate that adolescents fail to meet the World Health Organization (WHO) dietary guidelines for fruit and vegetables, while intake of sugar-sweetened beverages (SSBs) and fast food remains high (Neufeld et al., 2022). Data from the 2011 to 2012 National Nutrition and Physical Activity Survey (NNPAS) in Australia revealed that the proportion of energy from discretionary foods and beverages was highest among 14 to 18 year olds (41%) and remained high (~35%) in 19 to 30 year olds (Australian Bureau of Statistics), highlighting a sustained pattern of consumption across the transitional period from adolescence into early adulthood.

Adolescence and early adulthood remain under-researched life stages, particularly longitudinally, despite being characterised by major social and environmental transitions, which may influence diet (Viner et al., 2015). Several longitudinal studies have shown that leaving the parental home is associated with less healthy dietary patterns (Winpenny et al., 2018, 2020a; Elstgeest et al., 2012). For example, Winpenny et al. (2018) showed that of four life transitions studied (leaving home, leaving education, entering employment, and beginning cohabitation) leaving home had the strongest association with changes in dietary intake in adolescents and young adults (Winpenny et al., 2018). In addition, research suggests that living with a partner also negatively impacts diet. An Australian study of young adults found that living with a partner was associated with weight gain, increased waist circumference and higher cholesterol in women (Burke et al., 2004), and a US-based cohort study reported increased odds of obesity with cohabitation, with risk of obesity and obesity-promoting behaviours increasing the longer couples lived together (The and Gordon-Larsen, 2009). Collectively, these findings indicate that transitions in living arrangements in adolescents are a key period during which dietary behaviours and related health risks are susceptible to change and may be related to destination living arrangements. Understanding the influences that shape diet is crucial for informing effective and targeted interventions for this age group to help reduce the risk of adverse health effects later in life (Pearson et al., 2009).

The present study aimed to investigate diet quality trajectories from adolescence into early adulthood and how a transition out of the parental home and to different living arrangements influences these trajectories. In line with previous evidence, we hypothesise that leaving the parental home is associated with a decrease in diet quality, with transitions to living with a partner, with friends and alone all hypothesised to be associated with a decrease in diet quality.

1.1. Research questions

1. What are the trajectories of overall diet quality in adolescents and young adults aged 14 to 27 years?
2. How does transitioning out of the parental home influence overall diet quality trajectories?
3. How does the influence of transitioning out of the parental home on overall diet quality trajectories differ according to the destination living arrangement (living with partner, friends or alone)?

2. Methods

2.1. Study population

The Raine Study is a longitudinal cohort established to investigate the complex interplay between genetic, environmental, behavioural and developmental factors in shaping health and wellbeing. It follows individuals born in Perth, Western Australia, between 1989 and 1992. Pregnant women (Generation 1, Gen1) were recruited from clinics in and around King Edward Memorial Hospital (KEMH), with eligibility criteria including English language proficiency, planned delivery at KEMH and intention to remain in Western Australia (Straker et al., 2017). The children born to these women comprise the Generation 2 (Gen2) cohort. Detailed data has been collected, starting from 18 weeks' gestation and is still ongoing, with new recruitment efforts to include children of Gen2 (Generation 3) (The Raine Study). The most recent data available was collected when Gen2 were, on average, 28 years old. For this analysis, we included adolescents and young adults from Gen2 across five follow-ups where diet data was collected: 14, 17, 20, 22 and 27 year follow-ups. The Raine Study received approval from the University of Western Australia's Human Research Ethics Committee and was conducted in accordance with their ethical standards. Parents of the Gen2 cohort (Gen1) provided informed consent until their child turned 18 years old, after which consent was obtained directly from Gen2 participants.

2.2. Survey measures

2.2.1. Outcomes: diet quality

There is increasing recognition that assessing diet holistically, rather than focussing solely on individual nutrients, provides a clearer and more actionable understanding of dietary behaviours and associated risks (Mozaffarian, 2016a). Ideally, this involves capturing both positive (e.g. fruit, vegetables, whole grains etc.) and negative (e.g. discretionary foods) components to reflect overall diet quality. Therefore, diet quality was assessed using two measures: the Dietary Approaches to Stop Hypertension (DASH) score and proportion of energy from discretionary foods and beverages.

Diet data was collected through self-reported semi-quantitative food frequency questionnaires (FFQs) (Straker et al., 2015). For Gen2-14 and 17 year follow-ups, the Commonwealth Scientific and Industrial Research Organisation (CSIRO) FFQ (Baghurst and Record, 1984) was used. For the Gen2-20 year follow-up onwards, the Dietary Questionnaire for Epidemiological Studies (DQESV2) FFQ from the Cancer Council of Victoria (Hebden et al., 2013) was used as the CSIRO was no longer available. Despite this change, the CSIRO and DVESV2 have been shown to be comparable for assessing diet at the group level (Gardener et al., 2015; Keogh et al., 2010) and have been used longitudinally previously (Appannah et al., 2021; Marchese et al., 2025; Rousham et al., 2025).

The CSIRO and Cancer Council of Victoria converted FFQ data to grams per day, for their respective FFQs, taking into consideration any seasonal variations. As there were some differences in items included across the two FFQs, we harmonised each measured food group intake data across the follow-ups for consistency (Supplementary File 1). This was required to calculate diet quality scores consistently across follow-ups and reduce the impact of bias from additional foods included in the DQESV2 FFQ that may be affecting diet quality calculations purely due to a wider range of foods being reported. As an additional check, a sensitivity analysis was conducted adjusting for the change in FFQ as a covariate. This did not strongly affect the results and therefore, was not included in the final models (for results see Supplementary File 2).

2.2.1.1. Dietary Approaches to Stop Hypertension (DASH) diet score. A widely applied tool to assess overall diet quality is the Dietary Approaches to Stop Hypertension (DASH) diet score (Appel et al., 1997; Steinberg et al., 2017), originally developed and validated in the DASH clinical trial for its blood pressure-lowering effects (Appel et al., 1997). This measure was selected as it allows for overall diet quality assessment and is directly linked to cardiometabolic outcomes in adolescents, including lowered odds of developing metabolic syndrome (Asghari et al., 2016), lower blood pressure (Moore et al., 2012) and reduced cardiometabolic risk score (Loizou et al., 2024). In the present study each individual's DASH diet score at each time point was calculated

according to the absolute scoring system set out by Günther et al. (2009) for daily energy intake of 2000 kcal per day (outlined in Supplementary File 3). It is based on the intake of eight key dietary components: 1) fruit, 2) vegetables, 3) grains, 4) dairy, 5) meat, fish and eggs, 6) nuts, seeds and legumes, 7) fats, and 8) sweets (Günther et al., 2009). It is scored proportionally out of 80 points, and a higher score indicates a higher diet quality. Intakes above a set threshold of fats, sweets, meat, fish and eggs result in a lower score and intakes above a set threshold of fruit, vegetables, dairy, and nuts, seeds and legumes result in a higher score. Energy intake was converted from kilojoules per day to kilocalorie (kcal) per day by dividing by 4.184.

Diet data was energy adjusted using the residuals method (Willett et al., 1997), based on a daily energy intake of 2000 kcal across all individuals (Rousham et al., 2025) to provide a relative measure of diet quality for each individual, independent of the quantity of food consumed. The energy adjusted grams per day for each food was converted to servings per day using the 2021-2023 Food and Nutrient Database for Dietary Studies (FNDDS) (U.S. Department of Agriculture and Agricultural Research Service, 2024) (see Supplementary File 4).

2.2.1.2. Proportion of energy from discretionary foods & beverages (discretionary food intake). We also calculated the proportion of total energy derived from discretionary foods and beverages to provide a complementary perspective on dietary patterns. Discretionary foods and beverages were identified from the FFQs across the five follow-ups based on their alignment with the Australian Guidelines definition for discretionary foods and beverages (National Health and Medical Research Council) (see Supplementary File 1 for included items). Reported intakes, given in grams per day, for each discretionary item were converted to kcal using estimated energy content (kcal per 100g) from the 2021-2023 FNDDS (U.S. Department of Agriculture and Agricultural Research Service, 2024) (see Supplementary File 5). The kcal from all discretionary foods and beverages were then summed to calculate total energy derived from discretionary items and expressed as a proportion using each individual's total energy intake. This measure is referred to throughout as "discretionary food intake".

2.2.2. Exposure: living arrangement

For Gen2-14 and 17 year follow-ups, the participant's primary caregiver reported on all adults and children living in the home. Living arrangement was self-reported from a list of options by participants at Gen2-20, 22 and 27 year follow-ups (detailed in Supplementary File 6).

In the context of living arrangement for the present analysis, "parent (s)" are considered to include mother, father, stepmother/adoptive/fathers defacto, stepfather/adoptive/mothers defacto, foster mother and/or foster father. Therefore, acknowledging non-normative parental compositions. Moving forward, references to "living with parent(s)" or "the parental home" encompass the above categories.

For comparability across follow-ups, living arrangements were collapsed into four possible categories: 1) parent(s) and other relative(s) ("the parental home"), 2) partner, 3) friends or shared accommodation, and 4) alone (categorisation is detailed in Supplementary File 7). Further details on the distribution of participants across categories has been included in Supplementary File 6. Parents and other relatives were combined under a single "parents and other relatives" category, due to the small sample size of participants living with other relatives (14y n = 0, 17y n = 13 (1%), 20y n = 35 (4%), 22y n = 33 (3%), 27y n = 69 (6%)). Living arrangements which did not fit into one of the four categories and those categorised as "other" were dropped from the analysis (14y n = 0; 17y n = 0; 20y n = 24 (3%); 22y n = 52 (5%); 27y n = 12 (1%)).

2.2.2.1. Defining the "leaving the parental home" transition. The age that Gen2 participants first reported any living arrangement other than living in the parental home was considered the point at which they left the parental home. The transition point for "left the parental home" was a binary variable derived from their living category described above. Once a participant had reported leaving the parental home for the first time, they were considered to have left the parental home for all subsequent follow-ups. For analytical purposes, leaving the parental home was treated as a one-way transition. This approach was justified by the fact that 95% of participants did not return to the parental home after their initial departure, and by the analytical focus being on the first transition out of the parental home during this life stage. Given the population-level focus of the analysis and limited extent of return transitions, modelling the transition as one-way was considered methodologically appropriate.

The four living arrangement categories listed above were used to identify whether there were differences between continuing to live in the parental home and other living arrangements. We allowed for changes at each follow-up between non-parental home categories. A small number of individuals in the sample (n = 57, 5%) returned to living in the parental home at some point after reporting they had moved out of the parental home. For these individuals, we assumed that they were influenced by living in the parental home in the same way before they had ever left the parental home and after they return home.

2.2.3. Potential confounders

Sociodemographic characteristics and their influence on health throughout the life course is complex, spanning across many factors and including intergenerational effects. For the present analysis, we mapped the potential confounders in the relationship between leaving the parental home and diet quality (DASH diet score or discretionary food intake), and our directed acyclic graph (DAG) is displayed in Fig. 1. Confounders adjusted for during the final analysis included parental race, sex, parental education, family income, starting further or higher education and starting work. These variables are discussed in detail subsequently.

2.2.3.1. Childhood sociodemographic confounders and time-varying confounders. Biological sex was reported by the primary caregiver at birth. Parental race was self-reported at birth by mothers and fathers (Table 1). The participant's race was derived by assigning the same race category if mother's race was the same as father's race. Otherwise, the participant's race was classified as "Mixed".

Due to several race categories having very small counts (Tables 1 and 2), producing unstable estimates in multilevel models, we used a binary indicator (Caucasian vs non-Caucasian) only as an adjustment variable to control for broad social patterning in the outcome. We explored models using the original race categories in sensitivity analyses and substantive conclusions did not change (reported in Supplemental File 10). We recognize that collapsing race categories masks heterogeneity and may obscure distinct lived experiences, we therefore make no substantive inferences about the aggregated non-Caucasian group.

Parental education and equivalised family income were used as measures of childhood socioeconomic position (SEP). Parental education was derived from self-reported mother's and father's highest education attainment at Gen2-8 year follow-up, retaining only the highest value. Parental education is a key indicator of family socioeconomic status. Education from both parents was included, where available, to capture the family's socioeconomic context since adolescents and young adults may be influenced by both parents. The categories used were 1) no qualification, 2) Tertiary Entrance Exam (TEE) or equivalent, 3) trade or apprenticeship, 4) college diploma or degree, and 5) university degree.

Equivalised family income was included at Gen2-8 year follow-up, before the start of the trajectory and at Gen2-14 year follow-up, at the start of the trajectory. These follow-ups were both included to acknowledge the changing nature of family income as a measure of childhood SEP. To account for further variation in family income, an

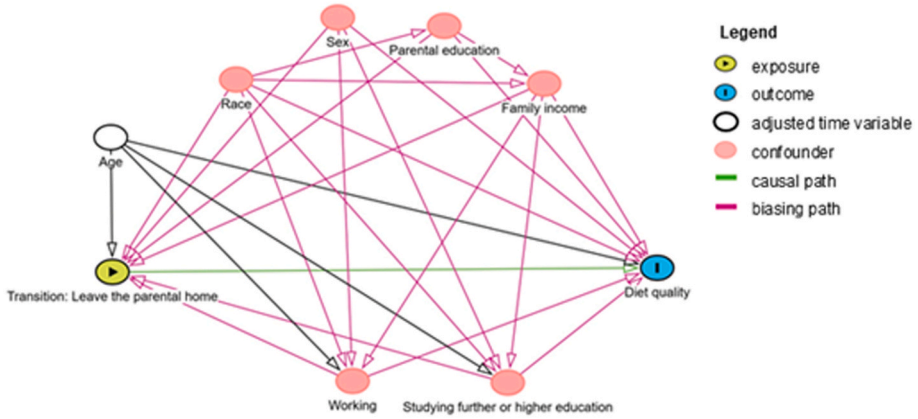


Fig. 1. DAG mapping the hypothesised confounders in the association between leaving the parental home and diet quality in adolescents and young adults. Footnote: SEP = Socioeconomic position; created in http://www.dagitty.net.

Table 1
Self-reported parental race at Gen2 birth.

Race category	Mother, n (%)	Father, n (%)
Caucasian (European descent)	1029 (91)	1025 (91)
Aboriginal	4 (<1)	7 (<1)
Polynesian	9 (1)	8 (<1)
Vietnamese	4 (<1)	5 (<1)
Chinese	53 (5)	37 (3)
Indian	30 (3)	32 (3)
Other	0	10 (1)

additional sensitivity analysis was conducted to include family income at Gen2-17 year follow-up, however, these did not substantively change the conclusions drawn from the analysis (see Supplementary File 12). Therefore, family income at Gen2-17 year follow-up was not included to avoid adjusting DASH diet score at earlier follow-ups for future variables, maintaining the statistical soundness of the analysis. For each included follow-up, family income and number of adults and children that the income supported were reported by the Gen2 participant's primary caregiver. Equivalised income was calculated using the OECD-modified equivalence scale (Eurostat), based on the midpoint of each reported income band. Finally, the income variables were standardised for use in the analysis for model stability. Family income at Gen2-14 year follow-up was collapsed into three categories to provide the descriptive statistics in Table 2.

Participants reported whether they had a job at Gen2-17, 20, 22 and 27 year follow-ups. This was coded as a time-varying binary variable: 1) not working or 2) working (including full-time, part-time, paid, unpaid and voluntary work). For the 14 year follow-up, we assumed that participants were not working based on legal restrictions in place in Western Australia on working for children aged 13 and 14 years (Government of Western Australia).

In this analysis, studying in further or higher education referred to pursuing education beyond secondary school. Participants were asked at what level they are currently studying at Gen2-20, 22 and 27 year follow-ups: 1) university, 2) Technical and Further Education (TAFE)/ college, 3) other, and 4) vocational training. They were considered to be studying if they were at university, college or vocational training and not studying if they selected not studying or "other", as there were no details on what this entailed. We assumed that none of the participants were studying in further or higher education at Gen2-14 and 17 year follow-ups.

2.2.4. Missing data & outliers

Of the 2968 Gen2 participants born into the Raine Study, there were 1207 respondents with diet data collected via FFQs at any of the follow-ups of interest. Participants with less than two follow-ups available for their living arrangement were excluded. Based on dietary data, observations from follow-ups were excluded if daily energy intake was below 500 kcal per day or over 3500 kcal per day for female participants and below 800 kcal per day or above 4800 kcal per day for male participants (Willett and Willett, 2012), accounting for the increased requirements during adolescence (Scientific Advisory Committee on Nutrition, 2011). In addition, observations above 100% for discretionary food intake were excluded. Subsequently, participants were excluded from the analysis if they had less than two follow-ups available for the either of dietary outcomes (DASH score and discretionary food intake). Multilevel models are well suited for unbalanced data and allow for inclusion of available data without introducing bias when follow-ups are missing at random (Singer et al., 2003). Within the analytical sample, almost 90% of participants had three or more follow-ups of data available. After applying the inclusion criteria, the final analysis sample comprised of 1135 participants (Fig. 2).

2.2.4.1. Multiple imputation of confounders. About 12% of observations were missing for parental education, family income, working and studying across all follow-ups. Investigation of missingness through Little's missing completely at random (MCAR) test (Little, 1988) suggested that these were not missing completely at random. Therefore, we followed the recommendation to conduct multiple imputation (Heymans and Twisk, 2022). The wide range of sociodemographic covariates included in our model supports our missing at random assumption. As the analysis includes both time-invariant and time-varying covariates, the method for multiple imputation of longitudinal data was used as described by Wijesuriya et al. (2025) and conducted in R for the linear mixed model-based fully conditional specification (LMM-FCS-2L) method (detailed in the Supplementary File 8).

2.3. Statistical analysis

Analyses were performed using R statistical software (R Core Team, 2021) (Version 4.5.0 2025-04-1) in R-studio (Posit team, 2025) (Version, 2025.05.0 + 496) and data pre-processing was conducted in Python 3 (Van Rossum and Drake, 2009) in Jupypter Notebooks (Kluyver et al., 2016). Descriptive statistics were computed for covariates using counts and percentages or means and standard deviations, as appropriate (Table 2).

2.3.1. Multilevel models

Multilevel regression models were fitted for both outcomes with random intercepts and random slopes for age to allow individuals to have different trajectories, allowing for correlation between random

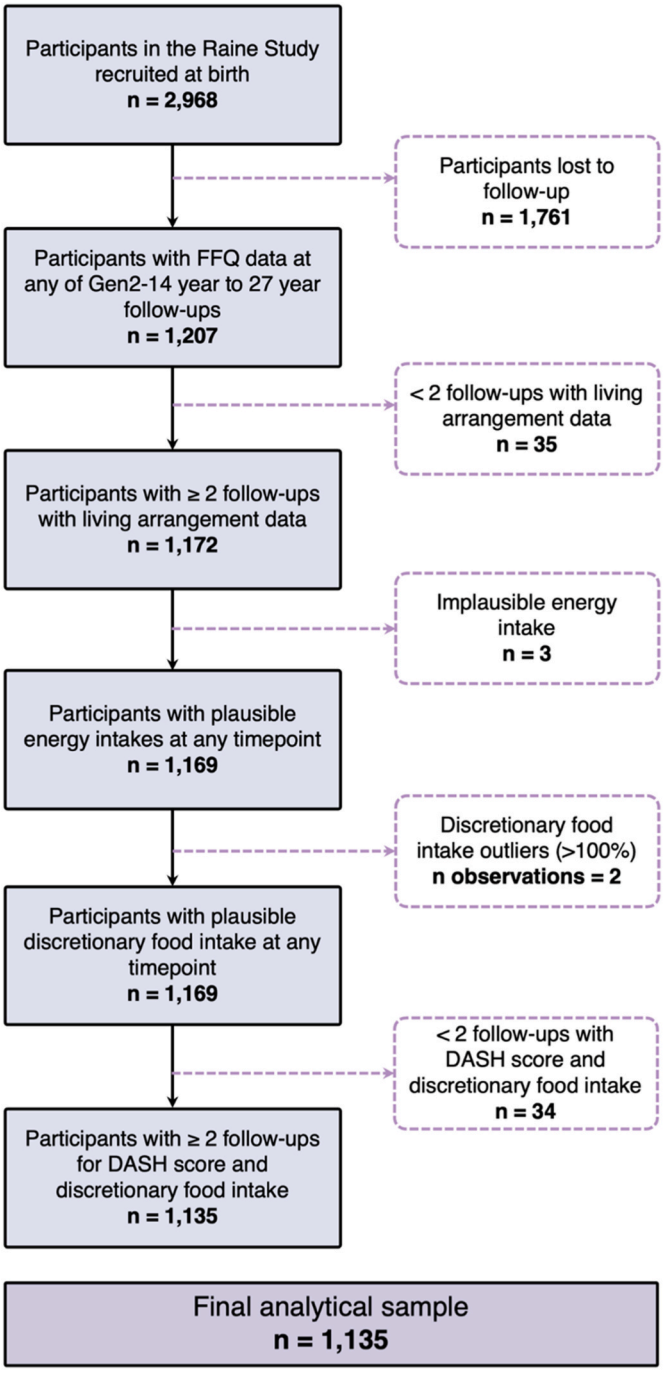


Fig. 2. The Raine Study diet trajectory analysis sample size flow chart.

intercepts and random slopes. The underlying growth model (Model 0) was fitted to include the effect of age (centred at age 14 years for interpretability) on the outcomes with follow-ups nested within participants, to provide the two-level structure. Building on Model 0, the quadratic term for age was included as a fixed effect and was shown to improve model fit for both outcomes through likelihood ratio testing. Therefore, the linear and quadratic terms for centred age were included in the subsequent models.

Model 1 addressed the first research question and included the binary living arrangement variable indicating whether participants were living in the parental home or had left the parental home, as well as its interaction with time passed since they left the parental home. A sensitivity analysis for both models was conducted including the quadratic term for "time since left home" (derived from age). However, likelihood ratio testing showed that this did not improve model fit and results and conclusions were not different from the main model. This term was therefore dropped from the final analysis for model simplification and ease of interpretation of results. Model 2 addressed the second research question by including the categorical living arrangement variable, which determined whether participants continued living in the parental home or whether they lived with friends, a partner or alone after leaving the parental home.

In R, all models were fitted to the imputed datasets using the *lme4* package (Bates et al., 2023). Pooled estimates and 95% CIs were generated using *testEstimates* and *confint* within the *mitml* package (Grund et al., 2015).

3. Results

3.1. Sample characteristics & descriptive statistics

Table 2 provides details of sociodemographic characteristics and diet quality for the total analytical sample and stratified by whether

Table 2
Descriptive statistics of outcomes (DASH diet score and discretionary food intake) and time-fixed variables, stratified by living arrangement.

	n (%)/mean ± standard deviation		
	Did not leave the parental home at any follow-up (n = 422, 37%)	Left the parental home at any follow-up (n = 713, 63%)	Total (n = 1135)
Sex – Female	195 (46)	404 (57)	599 (53)
Parental race			
Caucasian (European descent)	343 (81)	600 (84)	943 (83)
Aboriginal	0 (0)	1 (<1)	1 (<1)
Polynesian	1 (<1)	0 (0)	1 (<1)
Vietnamese	2 (<1)	0 (0)	2 (<1)
Chinese	16 (4)	12 (2)	28 (2)
Indian	7 (2)	8 (1)	15 (1)
Mixed	53 (13)	91 (13)	144 (13)
Other	0 (0)	1 (<1)	0 (0)
Annual family income at Gen2-14 year follow-up			
A$1 to 25,000	45 (13)	48 (9)	93 (10)
A$25,001 to 50,000	87 (26)	129 (23)	216 (24)
A$50,001 or more	208 (61)	377 (68)	585 (65)
Missing	82	159	241
Parental Education at Gen2-8 year follow-up			
No qualification	33 (8)	70 (11)	103 (10)
TEE or equivalent	46 (12)	56 (9)	102 (10)
Trade or apprenticeship	39 (10)	87 (13)	126 (12)
College diploma or degree	124 (32)	205 (31)	329 (31)
University degree	148 (38)	238 (36)	386 (37)
Missing	32	57	89
Highest education achieved at Gen2-27 year follow-up			
Primary school	0	0	0
Secondary school	35 (10)	115 (17)	150 (19)
University	83 (23)	217 (32)	300 (38)
Other educational institute (TAFE, college)	57 (16)	182 (27)	239 (31)
Postgraduate	22 (6)	71 (11)	93 (12)
Missing	60	37	97
DASH diet score, 0–80	53.36 ± 9.21	53.59 ± 8.57	53.50 ± 8.81
Discretionary food intake, % total energy	25.01 ± 10.17	25.17 ± 9.08	25.11 ± 9.49

TEE = Tertiary Entrance Exam; TAFE = Technical and Further Education; DASH = Dietary Approaches to Stop Hypertension.

participants had left the parental home (63%) or not (37%) by 27 year follow-up.

Almost all participants were living in their parental home at Gen2-14 and −17 year follow-ups. By Gen2-27 year follow-up, 29% of participants were still living in their parental home and 46% of the total sample were living with a partner, which is 65% of the sample that had left the parental home (Table 3).

In addition, we explored how living arrangements covaried with employment and education across waves. At Gen2-20 and 22 year follow-ups, the majority of individuals continued living in the parental home after starting employment and about half of individuals were in further or higher education, the majority of which were living in the parental home (shown in heat maps in Supplementary File 11).

3.2. Dietary trajectories: model 1 – leaving the parental home

Trajectories of DASH diet score and discretionary food intake with age, depending on whether individuals were living in the parental home or not are displayed in Fig. 3. Although participants could transition from living in the parental home to other living arrangements between any study follow-ups, in Fig. 3 we plot an example trajectory for those leaving the parental home at age 20, based on model parameters.

For DASH diet score, there was a U-shaped trajectory with the lowest score seen around age 20 years. After leaving the parental home, DASH diet score dropped by about one point (out of a total of 80 points) compared to those who continued living in the parental home ($\beta = -1.11$ [95% CI: 1.80, −0.41]). After the initial drop, DASH diet score remained lower over time for individuals that had left the parental home, in comparison to those that had not left home. In contrast, discretionary food intake followed the opposite trajectory (inverted U-shape), increasing by about 1% after leaving the parental home ($\beta = 1.28$ [95% CI: 0.30, 2.26]). However, the difference between individuals that did not leave the parental home and those that did narrowed the longer time passed since they had left the parental home ($\beta = -0.41$ [95% CI: 0.69, −0.14]). Final pooled model estimates across imputations for all models are presented in Supplementary File 13.

3.3. Dietary trajectories: model 2 – different living arrangements (with a partner, friends or alone)

Compared to those who continued to live in the parental home, individuals who lived alone, with friends or with a partner had an initial drop in DASH diet score, illustrated for an individual who left the parental home at age 20 in Fig. 4. The largest change was seen for individuals who moved in with a partner ($\beta = -1.18$ [95% CI: 2.08, −0.28]). Leaving the parental home and moving in with a partner or friends increased discretionary food intake by about 1% in comparison to not leaving the parental home. Moving out of the parental home to live alone appeared to lead to an initial decrease in discretionary food intake by 0.65%. The interaction effects of time since leaving the parental home did not significantly differ by living arrangement.

Table 3
Overall categorised living arrangement at each follow-up.

Living Arrangement	**14y (%)**	**17y (%)**	**20y (%)**	**22y (%)**	**27y (%)**
Parents and other relatives	908 (100)	636 (99)	612 (81)	621 (67)	226 (29)
Partner	0	4 (<1)	74 (10)	165 (18)	357 (46)
Friends or shared accommodation	0	2 (<1)	62 (8)	119 (13)	124 (16)
Alone	0	0	12 (2)	20 (2)	65 (8)
Total	**908**	**642**	**760**	**925**	**772**
Missing (not included above)	*2*	*19*	*120*	*138*	*107*

4. Discussion

4.1. Principal findings

This study is the first Australia-based diet trajectory analysis investigating changes in diet quality associated with transitioning out of the parental home. A U-shaped trajectory for DASH diet score was observed, with the lowest diet quality seen around age 20 years. Leaving the parental home was associated with a one point drop in DASH diet score (out of a total of 80 points). At the transition point of leaving the parental home, discretionary food intake increased by approximately 1%.

When investigating different living arrangements, individuals who moved in with a partner experienced an approximate one point decreased DASH in comparison to those who remained living in the parental home. A smaller decline was seen for those living with friends or alone. These differences in dietary trajectories persisted over time, suggesting that diet quality does not revert to levels seen while living in the parental home up to age 27 years. Following the transition out of the parental home, there was an observed increase in discretionary food intake among those living with a partner or with friends and a slight decrease for those who began living alone.

Furthermore, the results suggest that the initial drop in diet quality does not worsen over time but is sustained for DASH diet score in any living arrangement. On the other hand, for discretionary food intake, the negative interaction effect in all the living arrangements showed a narrowing over time, suggesting a potential improvement in diet quality for individuals who left the parental home back to discretionary food intake levels seen before leaving the parental home.

4.2. Strengths & limitations of the study

Relative to other longitudinal studies, this analysis utilised a large dataset with repeated measures spanning across adolescence and early adulthood, allowing for the investigation of dietary trajectories and associations with transitions in living arrangements. Few longitudinal studies have examined diet during this life stage, particularly across life transitions making this study a useful contribution to the evidence base.

The inclusion of living arrangement details allowed us to explore how different living contexts may influence diet quality. One limitation was that the exact date of leaving parental home was not available and leaving age was inferred based on first report, which introduced uncertainty around the exact transition point. The absence of a follow-up between 22 and 27 years limited our ability to capture more precise transitions, particularly since 40% of participants left the parental home between these two follow-ups. Nevertheless, the available data allowed for meaningful comparison between individuals who continued to live in the parental home and those in other living arrangements, capturing differences in dietary influences. However, some of the living arrangement subgroups (e.g. living alone), were very small, potentially limiting the statistical power and generalisability. As a result, we could not examine sex-specific differences that could potentially exist in this cohort, which may also have influenced the observed relationships. The effects of transitioning out of the parental home may have also differed between individuals who underwent the transition earlier versus later in life, due to differences in income, work demands, life experience and attitudes toward healthy eating (Harker et al., 2009). These highlight the need for further research to disentangle influences by capturing more precise timing of transitions, examining potential sex-based and age-related interactions and motivations behind dietary behaviours in more detail. In addition, we have acknowledged the influence of sociodemographic factors, where possible and available, through covariate adjustment. We deliberately do not make any inferences on the association between the sociodemographic covariates and diet quality to avoid overinterpreting findings from an analysis that is not intended to, and does not, do justice to this complex interplay of factors.

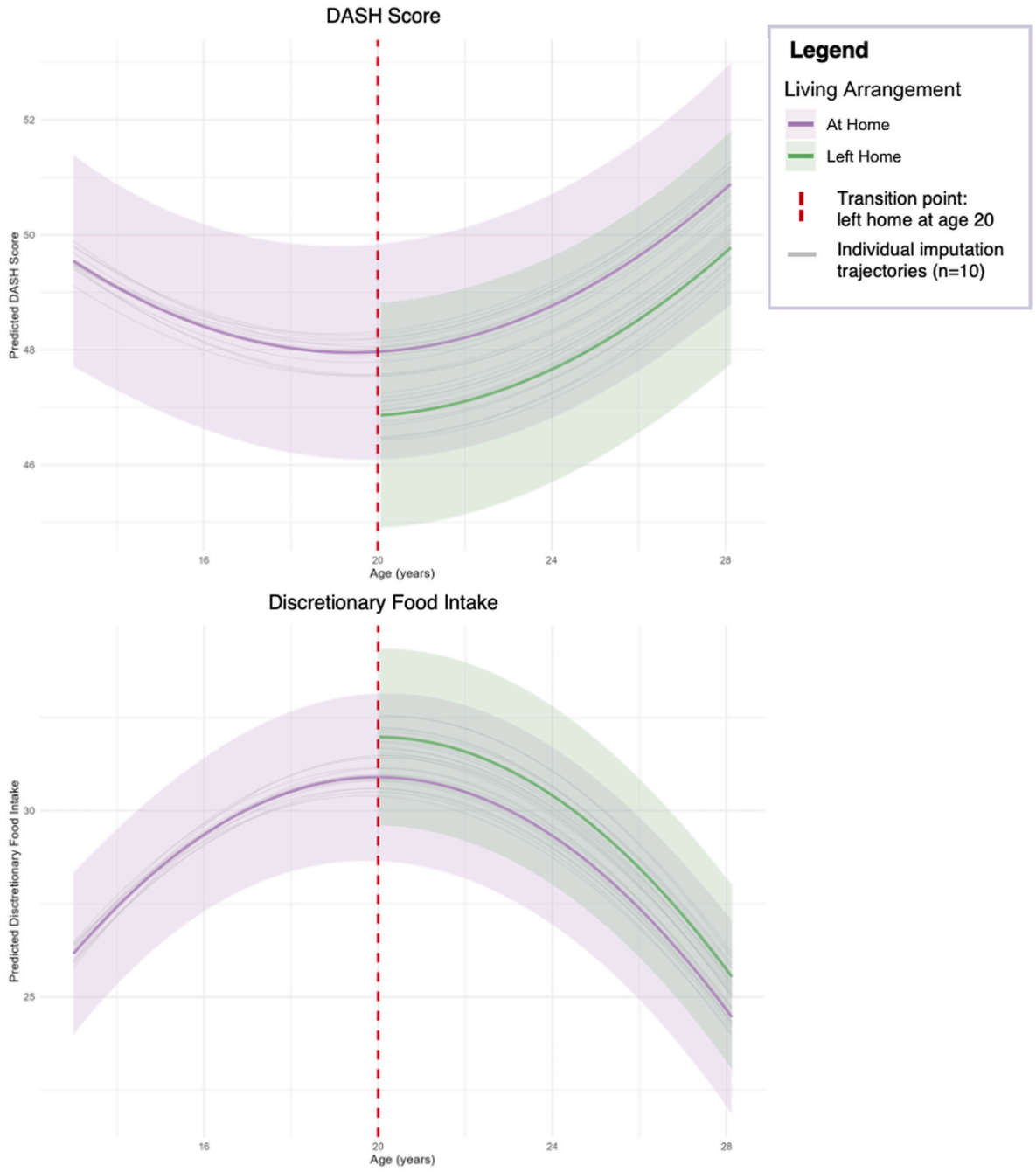


Fig. 3. Predicted dietary trajectories for DASH diet score and discretionary food intake from age 14 to 27 years, comparing leaving the parental home at age 20 to not leaving the parental home at this age, showing the individual imputed trajectories and the mean of imputed trajectories with 95% confidence bands.

The DASH diet score is well-established measure supported by evidence linking it to positive health outcomes, enhancing comparability with other studies and facilitating cross-contextual analyses within Australia and internationally. Including discretionary food intake as a second outcome allowed for a more comprehensive assessment of diet quality and to distinguish between healthier and less healthy dietary behaviours. However, inherent to most diet research, self-reported intakes are subject to limitations such as recall bias, reporting bias, social desirability bias or social approval leading to under- or over-reporting certain foods. This was addressed to some extent by excluding participants with implausible energy intakes and conducting energy adjustment, which will have likely reduced the impact of misreporting. In addition, the change in dietary data collection tool between Gen2-17 and 20 year follow-ups (from CSIRO FFQ to DQESV2 FFQ) represents a potential source of bias in describing the overall trajectory of diet quality with age. However, prior research has demonstrated that these FFQs are comparable for assessing diet at the group level, supporting the suitability of this approach for the present analysis (Gardener et al., 2015; Keogh et al., 2010; Appannah et al., 2021; Marchese et al., 2025; Rousham et al., 2025). Harmonisation of the food items included across the two instruments was used to reduce potential bias.

As with much longitudinal data, the issue of missing data required a thoughtful approach. We used multiple imputation for both time-fixed and time-varying confounders, allowing for a more complete analysis and reduced bias in results and underestimation of standard errors that would have been seen if single imputation methods had been used (Li et al., 2015). The analysis sample was confined to those that were still responding at the 14 year follow-up and therefore, affected by attrition

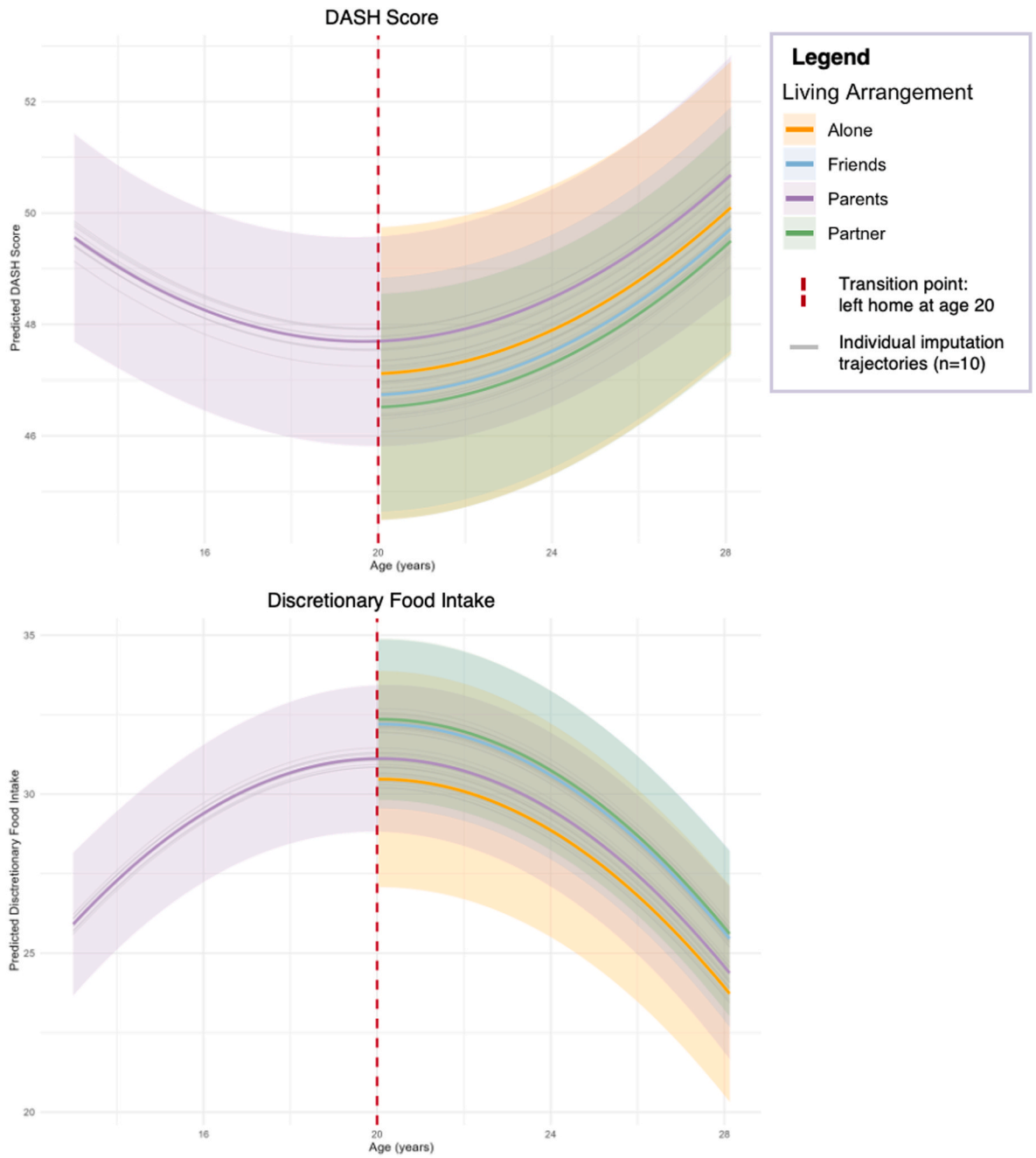


Fig. 4. Predicted dietary trajectories for DASH diet score and discretionary food intake from age 14 to 27 years, by different living arrangements, comparing leaving the parental home at age 20 to not leaving the parental home at this age, showing the individual imputed trajectories and the mean of imputed trajectories with 95% confidence bands.

from the original birth sample. The Raine Study cohort has been shown to be broadly comparable to the Western Australian population based on census data from corresponding follow-up years (Gen2-8, 14, 17, 20 and 22 year follow-ups) (Straker et al., 2017). The main differences observed were that, at the Gen2-17 year follow-up, participants tended to have slightly different work related characteristics and a higher proportion of participants reported higher income (Straker et al., 2017). Comparisons between participants and non-participants at each follow-up indicated that the distribution of most sociodemographic characteristics remained relatively stable over time, with the exception of a gradual decline in the proportion of participants identifying as Aboriginal or Torres Strait Islander (Straker et al., 2017) and participants who remained engaged with the study tended to be from higher SEPs (White et al., 2017). Consequently, the findings may be less generalisable to non-Caucasian populations and individuals from lower SEP.

Beyond Australia, results may not be transferable to low- or middle-income countries, where food environments, life transitions and social norms differ substantially. Even within countries, significant intra-national variations exist in food availability and consumption patterns by geography or socioeconomic position (Imamura et al., 2015). Generalisability of dietary behaviours is challenging given country-specific guidelines, food access, affordability, availability and cultural preferences. Life transitions also differ contextually. Country-level factors including youth unemployment, economic conditions, gross domestic product (GDP), and institutional support systems all shape the timing and nature of these transitions. Additionally, individual-level factors such as religious beliefs and family values may influence whether a young person remains in the parental home (van den Berg et al., 2021).

Nevertheless, findings from the present analysis add to the existing evidence base, which allows for comparisons across a new context (Australia), beyond those already studied (e.g. USA).

4.3. Comparison with previous evidence

The mean DASH diet score in our analysis (~50/80) was relatively low, which is consistent with national data indicating poor adherence to dietary guidelines among Australian adolescents and young adults. The Australian Health Survey (AHS, 2011-12) and the National Health Survey (NHS, 2022) similarly report suboptimal intakes across core food groups and high consumption of discretionary foods (>30% proportion energy), with less than 3% of adolescents and young adults meeting fruit and vegetable recommendations (Australian Institute Of and Health and Welfare, 2018; Australian Bureau of Statistics, 2022).

The U-shaped trajectories seen in our study align with international findings. A Norwegian study (ages 14 to 30) reported a decrease in fruit and vegetable intake until early 20s, followed by an increase, with sugar-sweetened beverage and confectionary intake peaking at 18 years, after which it declined (Winpenny et al., 2018). A key transition identified was leaving the parental home, which was associated with a notable decline in fruit and vegetable consumption (Winpenny et al., 2018), mirroring the patterns seen in our study. Similarly, a USA-based study found that fast food intake peaked around age 19, though it declined after leaving home (Winpenny et al., 2020a), contrasting with our findings on discretionary intake. In addition, some research from university campus-based settings in the USA and the UK found that living away from parents was associated with better diet quality or reduced discretionary food intake (Laska et al., 2009; Beasley et al., 2004). These discrepancies could be due to financial resources or where the participants are moving to. For example, university campuses may have structured food provision, through meal plans, which differ significantly from the broader living arrangements studied here, making direct comparisons difficult. Another USA-based study also showed a similar diet quality trajectory, with a decrease in DASH diet score from 15 to 20 years, followed by an increased score to age 30 years. This study found that cohabiting with a partner was associated with a decrease in DASH diet score for female participants only (Tao et al., 2024).

Consistent with cross-sectional research, our study found that continuing to live in the parental home was associated with better diet quality. Studies from Germany (Sharma et al., 2009), Greece (Papadaki et al., 2007) and Spain (Sandri et al., 2023) have similarly reported higher intake of core food groups and better overall diet quality among adolescents and young adults living in the parental home. Qualitative studies from Australia suggest that moving out of the parental home can negatively impact diet due to limited financial resources, routine, skills, motivation and shared housing challenges (Grunseit et al., 2019; Oftedal et al., 2024). They highlighted that living outside of the parental home provided more opportunities to consume takeaway food, as opposed to home cooked foods participants associated with living with their parents (Grunseit et al., 2019). These findings are consistently demonstrating that leaving home could be associated with poorer diet quality, highlighting the importance of context. Most comparable studies in this age group are conducted on university campuses (Braune et al., 2025), and this study demonstrates that consistent impacts of leaving the parental home on diet quality can be observed among those not in university education, and moving to different living environments.

Living with a partner was associated with a decline in diet quality compared to staying in the parental home. A systematic review found mixed evidence on cohabitation, with some studies linking marriage to increased BMI but limited information on associations with dietary changes (Werneck et al., 2020). An Australian longitudinal study found that living with a partner was associated with weight gain, increased waist circumference and higher cholesterol levels (Burke et al., 2004). Similarly, findings from a prospective cohort study of young couples in the USA indicated that the transition to cohabitation or marriage was associated with increased odds of obesity, with risk of obesity and obesity-promoting behaviours increasing the longer the couples lived together (The and Gordon-Larsen, 2009). This aligns with the results from Model 2, which showed a decrease in diet quality when cohabiting with a partner, persisted over time. A qualitative study in 20 newlywed couples found that most couples experienced gradual convergence in their diets, with an initial period of dietary change and experimentation (Bove et al., 2003), which could explain the temporary drop in diet quality through an increase in discretionary food intake in the present study, which subsequently improves the longer they are living with a partner, if they are converging back to an improved diet. Contrastingly, a study in 1402 Australian young adults found no relationship between marital status transitions and diet quality score and takeaway food consumption after a five year follow-up (Smith et al., 2017). The mixed evidence highlights the need for further investigation of the dynamics of partner influences on diet, particularly in the young adult population.

Overall, despite the differences in cultural and geographical contexts across these studies, the findings suggest a degree of consistency in dietary trajectories from adolescence into young adulthood across economically comparable countries, reinforcing the relevance and potential generalisability of these findings.

4.4. Implication of findings

The effect sizes observed in the present study were modest. In the context of DASH diet score, a one-point difference can correspond to a reduction in fruit or vegetable intake of approximately three portions per week (0.4 portions per day), depending on baseline intake. A comprehensive systematic review of observational studies demonstrated an inverse, dose-response association between fruit and vegetable intake and the risk of cardiovascular disease-related mortality and morbidity, which is particularly meaningful for low consumers (Aune et al., 2017b). Importantly, the associations were shown to be non-linear, demonstrating that the relative benefit of increasing fruit and vegetable intake is greatest among those with the lowest consumption, indicating that small increases are likely to have potentially significant health benefits in people with poorer diet quality (Aune et al., 2017b; Wang et al., 2021). Therefore, even small changes in diet quality could have the potential to have long-term health implications, particularly when scaled up to a population level.

In relation to discretionary foods, a 1% increase in energy from these foods translates to approximately 20 kcal per day, or 140 kcal per week (equivalent to a 25-g bag of crisps or a 330 mL can of Coca Cola), for an individual consuming 2000 kcal per day. Although this increase appears minor at an individual level, it is concerning within a population already consuming close to 30% of their total energy from discretionary foods, as they are adding to an already poor dietary pattern. The effect of leaving the parental home observed in the present study on discretionary food intake (i.e. a 1% increase) is of a similar magnitude to the decrease reported in a systematic review of school meal interventions. In the review, school meal policies (investigated in five studies) were associated with a decrease in total fat and saturated fat intake by about 1.5% and 1% energy, respectively (Micha et al., 2018).

The observed U-shaped trajectories for diet quality through adolescence to early adulthood, particularly during the transition out of the parental home, emphasises that this is a period of dietary vulnerability. Leaving the parental home is observed to be associated with a drop in diet quality that is not fully recovered with age, which is consistent with findings from other countries (Winpenny et al., 2018; Tao et al., 2024). Young adults living with a partner or in shared accommodation have exhibited poorer diet quality, likely influenced by shifts in routines, shared decision-making around food and fluctuating financial resources with newfound independence.

Changes in living arrangements during adolescence and early adulthood may be associated with a host of new social and physical environments. Additional factors such as starting work or further or

higher education may be contributing to the new environments that adolescents and young adults are being exposed to. These factors, treated as time-varying confounders in this analysis, have been shown to influence diet (Tao et al., 2024; Winpenny et al., 2020b). Heat maps presented in Supplementary File 11 demonstrate that around age 20 years, when diet is at the lowest point in the trajectory, many individuals are in further or higher education and/or employed, yet still living with their parents. The Household, Income and Labour Dynamics in Australia survey found that since the early 2000s, young people have increasingly chosen to live with their parents for longer into early adulthood, driven by housing costs, reduced availability of full-time employment, and an increased number of people attending higher education (More Australian adult children are). In addition, the competing demands of education and work, as well as time constraints, individual income, and peer influence may all be contributing to the observed decline in diet quality and the mediating mechanisms of these factors should be considered in future analyses.

If the findings from our study were confirmed as causal, they imply that interventions targeting young adults should consider both life stage and living context, with an emphasis on support and providing resources needed for healthy eating outside of the parental home, using life transitions as opportunities for dietary interventions. Evidence reviewing interventions among university students indicates some improvements in dietary behaviours but overall impact has been modest, with most studies being short-term (Belogianni and Baldwin, 2019), demonstrating the need for improved multi-component approaches in university settings. In addition, strategies should ensure they are reaching young adults transitioning into other non-university pathways e.g. directly into the workforce, to avoid generating new or widening existing inequalities. Public health interventions may be more effective if designed at the household unit level by engaging parents, partners and peers to foster social learning as well as autonomy to enhance effectiveness of health promoting efforts in this population, especially for those moving into independent living arrangements away from the parental home (Yeager et al., 2018).

Future research should investigate additional factors during this life stage such as the timing and context of transitions, motivations for food choices, sex-differences, interactions with age, as well as mediating factors such as changes in income and time constraints.

5. Conclusion

This study found that diet quality, measured using the DASH diet score, followed a U-shaped trajectory from adolescence through early adulthood, while the proportion of energy intake from discretionary foods and beverages showed the inverse pattern. Moving out of the parental home, especially to live with a partner, was observed to be associated with poorer diet quality.

These findings provide valuable insights into the factors contributing to changes in diet quality in adolescents and young adults, demonstrating the importance of key life transitions as critical windows for interventions. A better understanding of the factors that shape dietary behaviours, including living arrangement, could lead to more effective public health strategies when considering the additive effect that a combination of approaches could have on diet quality, highlighting that even modest, incremental changes should not be underestimated in their potential to reduce diet-related disease risk when properly targeted.

Ethical approval & consent to participate

This study conformed to the Declaration of Helsinki and was approved by The University of Western Australia Human Research Ethics Committee. Raine Study participants have provided fully informed consent during data collection and have explicitly consented to the use of their deidentified data for future research projects.

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CRediT authorship contribution statement

Tanya Braune: Conceptualization, Data curation, Formal analysis, Methodology, Visualization, Writing – original draft, Writing – review & editing. **Jessica K. Barrett:** Methodology, Writing – review & editing. **Jean Adams:** Conceptualization, Supervision, Writing – review & editing. **Eleanor M. Winpenny:** Conceptualization, Methodology, Supervision, Writing – review & editing.

Declaration of interest statement

The authors declare no competing interests.

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Appendix A. Supplementary data

Supplementary data to this article can be found online at https://doi.org/10.1016/j.healthplace.2026.103651.

Data availability

The individual-level data from the Raine Study cannot be made available or stored on another, non-Raine Study, public repository due to legal and ethical constraints. The Raine Study is a publicly available data provider, and data can be accessed by interested researchers upon reasonable request. To request access, please contact the Raine Study team at rainestudyscience@uwa.edu.au.

The analysis code has been made available on OSF at the following

link:
https://osf.io/hruqv/?view_only=198d4b95a89141f3a1d846b28b655d2c.

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