Dietary patterns and practices and leucocyte telomere length: Findings from the UK Biobank

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Research Snapshot

Research Question: Are dietary patterns and practices independently associated with leucocyte telomere length (LTL)?

Key Findings: Analysis of cross-sectional data from the UK Biobank suggests that adherence to “Mediterranean” or “Prudent” dietary patterns and a practice of “Eating 5-a-day” of fruit and vegetables were positively associated with LTL, whilst adherence to a “Meat intake” pattern or “Abstaining from eggs/dairy/wheat/sugar” was negatively associated with LTL, after adjustment for major lifestyle, clinical and social determinants of LTL. However, the magnitude of these associations was small and equivalent to about 1-year of age-related change in LTL.

Abstract

Background: Shorter telomere length (TL) is associated with risk of several age-related diseases and decreased lifespan, but the extent to which dietary patterns and practices associate with TL is uncertain.

Objective: This study aimed to investigate the association of dietary patterns and practices and leucocyte TL (LTL).

Design: This was a cross-sectional study.

Participants/ setting: Data collected voluntarily from up to 422,797 UK Biobank participants, during 2006-2010.

Main outcome measures: LTL was measured as a ratio of the telomere repeat number to a single–copy gene and was $\log_e$-transformed and standardised (z-LTL).

Statistical analysis: *A-priori* adherence to the Mediterranean diet was assessed through the MedDietScore. Principal component analysis was used to *a-posteriori* extract the "Meat" and "Prudent" dietary patterns. Additional dietary practices considered were the self-reported adherence to "Vegetarian" diet, "Eating 5-a-day of fruit and vegetables" and "Abstaining from eggs/dairy/wheat/sugar". Associations between quintiles of dietary patterns or adherence to dietary practices with z-LTL were investigated through multivariable linear regression models (adjusted for demographic, lifestyle and clinical characteristics).

Results: Adherence to the "Mediterranean" and the "Prudent" patterns, was positively associated with LTL, with an effect magnitude in z-LTL of 0.020SD and 0.014SD, respectively, for the highest vs the lowest quintile of adherence to the pattern (both $P<0.05$). Conversely, a reversed association between quintile of the "Meat" pattern and LTL was observed, with z-LTL being on average shorter by 0.025SD ($P=6.12\times10^{-05}$) for participants in the highest quintile of the pattern compared to the lowest quintile. For adherents to "5-a-day" z-LTL was on average longer by 0.027SD ($P=5.36\times10^{-09}$), and for "abstainers", LTL was shorter by 0.016SD ($P=2.51x10^{-04}$). The association of LTL with a vegetarian diet was non-significant after adjustment for demographic, lifestyle and clinical characteristics.

Conclusion: Several dietary patterns and practices, associated with beneficial health effects, are significantly associated with longer LTL. However, the magnitude of the association was small, and any clinical relevance is uncertain.

Keywords: telomere length; dietary patterns; Mediterranean diet; longevity

Introduction

Telomeres are DNA sequences located at the ends of chromosomes that contribute to genome stability. As somatic cells divide, telomeres shorten and cells enter replicative senescence when telomeres shorten to a critical length.[1] Rare syndromes associated with accelerated telomere shortening cause premature ageing phenotypes.[2] At a population level, there is wide inter-individual variation in telomere length, most often measured in leucocytes (leucocyte telomere length, LTL), and shorter LTL has been associated with risk of several age-related diseases[3] as well as a reduced lifespan.[4] This has stimulated an interest in investigating lifestyle and environmental factors[5,6] that could adversely impact an individual's health and lifespan via processes related to telomere attrition, such as oxidative stress, inflammation, telomerase activity, and DNA methylation.[7]

Recent evidence[6] suggests an independent association, on top of other major LTL determinants,[8] between several lifestyle characteristics and LTL with dietary intake being one of them. In particular, several food items were independently associated with LTL,[6] either positively (i.e. muesli, wholemeal bread, cheese, oily fish) or negatively (i.e. salt, margarine, processed meat). Non-refined cereals and fish intake, alongside vegetables and fruit intake, form the basis of the healthy eating pattern known as the Mediterranean diet[9], which is associated with longevity,[10] reduced disease risk[11-13] and inflammation.[14]

Recent systematic reviews and meta-analyses[15, 16] have investigated the association between diet and telomere length. Crous-Bous et al.[15] identified eight observational studies, including approximately 10,500 participants, and three randomized trials, including approximately 700 participants, that studied the association between various dietary patterns (i.e. vegetable rich, traditional, Mediterranean, Prudent, Western) and TL. Findings from the observational studies supported the benefits of adherence to Mediterranean diet on TL, although these results were not consistent between men and women or different ethnic backgrounds or study populations, whilst they showed no association between the Western pattern and TL. Regardless, findings between the Prudent diet and LTL from the randomised trials are conflicting.[15] Pérez et al.[16] systematically reviewed seven randomised trials, including five of them in a meta-analysis covering nine diets and approximately 500 participants. The authors report no effect of diet on telomere length, but also acknowledge the presence of strong heterogeneity in the type and duration of dietary interventions that precludes any final statement. [16] Therefore, the extent to which different diets are associated with telomere length and whether this could explain some of the beneficial effects of certain diets, such as the Mediterranean[17] or vegetarian[18], remains unclear. This study aimed to investigate the extent to which dietary patterns and practices are associated with LTL above and beyond other lifestyle, clinical and social determinants using data from a large contemporary population.

Methods

Study participants

Data from the UK Biobank (UKB, https://www.ukbiobank.ac.uk/), a large prospective study, were used in this study. During 2006-2010 approximately 500,000 men and women from the UK population, aged 40-69 at the date of their baseline assessment visit, consented to participate voluntarily in UKB. Extensive data[19-21] were collected through a touchscreen questionnaire and brief verbal interview at baseline from all participants on their lifestyle, environment, personal and family medical history. Information on sex and date of birth was obtained prior to participants' arrival at the assessment centres through the local National Health Service Primary Care Trust registries. Age was then derived from the date of birth and the date of attending assessment centre and was truncated to whole year part. Participants were able to update their sex or date of birth during recruitment through a touchscreen questionnaire. Ethnic background was obtained through the touchscreen questionnaire at the assessment centre. Participants also underwent a wide range of physical measures, and provided samples of blood, urine and saliva. In addition to information collected at baseline participants have been invited to wear a wrist-worn activity monitor, to record 7-day physical activity, and completed detailed web-based questionnaires on their diet,[22,23] that was used to determine dietary patterns and practices. Utilizing the in-depth genetic and health information[21] leucocyte telomere length (LTL) was measured in 474,074 participants.[8] Baseline data for LTL with no mismatch in self-reported and genetic sex exist for 472,269 UKB participants. For the purposes of the analysis data from 49,472 participants (n=33,728 genetically related data (randomly excluding one from each pair based on a kinship coefficient of K>0.088), n=908 samples who either had no genetic data or failed quality control, and n=14,836 participants who lacked information on ethnicity or white blood cell (WBC) count, both associated with LTL) were additionally excluded.[8] This left a maximum of 422,797 participants available for the analysis (**Figure 1 on-line supplementary material (OLS)**). UK Biobank received approval from the North West Centre for Research Ethics Committee (11/NW/0382) and all participants gave their written informed consent.

Leucocyte telomere length (LTL) measurement

LTL, the outcome of interest, was measured on DNA samples collected at baseline using a validated qPCR method and reported as a ratio of the telomere repeat number (T) to a single-copy gene (S) (T/S ratio). The measurements were $\log_e$-transformed to approximate the normal distribution which were then transformed to z-standardised values (UKB field code “22192”; z-LTL) to facilitate comparison with other datasets. Further details for the quality control of the LTL measurement can be found elsewhere.[8]

Dietary assessment from the short food frequency questionnaire (FFQ)

All UKB participants were asked to complete a short computer touchscreen questionnaire at their initial assessment visit that reliably ranks participants according to intakes of the main food groups.[22] The FFQ included twenty-nine questions about their average diet over the previous 12 months. The selected questions represented six main food groups:[23] (i) meat (processed meat (UKB field code: "1349"), poultry ("1359"), beef ("1369"), lamb ("1379"), pork ("1389")), (ii) cheese ("1408"), (iii) bread (quantity ("1438") and type ("1448")) and breakfast cereals (quantity ("1458") and type ("1468")), (iv) fruit (fresh ("1309") or dried ("1319")), (v) vegetables, excluding potatoes, (raw ("1299") and cooked ("1289")) and (vi) fish (oily ("1329") and non-oily ("1339")). Participants reported frequency of intake (never, less than once per week, once per week, 2-4 times per week, 5-6 times per week, or once or more daily) for most of the groups. For fruit and vegetables, and bread and breakfast cereals, participants entered the average intake of daily and weekly number of standard servings, respectively. For alcohol intake the self-reported weekly and monthly intake, stated in terms of glasses of red wine ("1568" and "4407" respectively), champagne/ white wine ("1578", "4418"), beer/ cider ("1588", "4429"), spirits ("1598", "4440"), fortified wine intake ("1608", "4451"), and other alcoholic drinks ("5364", "4462"), was converted into average daily intake by dividing by 7 or 30 accordingly. Number of drinks per day were quantified as the number of UK units of alcohol intake and then converted to grams of alcohol (one average bottle of wine has 9 units,[24] hence 1 unit (approx. 83mL) is equivalent to 8g of alcohol[25]) and participants were classified as "low" (<5g/day), "moderate" (5-15g/day (or ≤1 small wine glass of 12% alcohol by volume) for women; 5-30g/day (or ≤2 small wine glasses) for men) and "heavy" drinkers (>15g/day (or >1 small wine glass) for women; >30g/day (or >2 small wine glasses) for men).[26]

A-priori defined Mediterranean dietary pattern

The MedDietScore[27] was used to *a-priori* define the adherence to the Mediterranean diet.[9] Compared to scores that are based on median intake, rather than specific guidelines, and incorporate binary components' scoring, the MedDietScore is independent of the consumption of the study population and allows for greater variation in the scoring system. The original MedDietScore[27] was modified to account for food items/ groups collected in UKB, thus utilising data from 8 of the 11 food groups considered in the creation of the MedDietScore: fruit, vegetables, fish, poultry, cheese (representing dairy products), red meat and its products, alcohol intake, and bread and cereal intake, and omitting potatoes, olive oil and legumes that were not included in the FFQ. As consumption of potatoes was not recorded in the UKB, bread and cereal type alongside bread and cereal intake were incorporated to discriminate between non-refined ("brown/ wholemeal/ wholegrain" bread and "bran/ biscuit/ oat/ muesli" cereal) and refined grains ("white" bread and "other (cornflakes/ frosties)" cereal). With the exception of alcohol and meat/ poultry intake, monotonic functions were assigned in order to score the frequency of consumption of the remainder foods. Particularly, scores from "0" to "4" (or on the reverse order) were assigned in each of the food groups according to their position in the Mediterranean diet pyramid.[28] For food groups presumed to be close to this pattern (i.e. fruit, vegetables, non-refined grains, dairy products) a score of "0" or "1" was assigned when participants reported no or rare consumption to a score of "4" for daily consumption. For participants reporting frequent consumption of refined grains the scores were reversed, i.e. a "4" was assigned for no consumption and "0" for daily consumption. For frequency intake of fish, poultry and red meat, that should be consumed on a weekly basis, a non-monotonic scoring system was followed, assigning higher scores for the moderate consumption of fish and poultry and rare consumption of red meat and its products. A non-monotonic function was also used for scoring alcohol intake, with a score of

“5” assigned to participants reporting alcohol intake with a consumption up to 28g of ethanol per day (>0mL and <300mL), scores “4” to “1” to a consumption of 28-37.9, 38-47.9, 48-56.9 and 57-66.9g of ethanol per day respectively, and a score of “0” to no consumption or to 67g or more of ethanol per day (700mL). Thus, the potential range of this modified MedDietScore is 0 to 37, with higher values indicating greater adherence to the Mediterranean diet. The detailed scoring system is shown in **Figure 2**.

A-posteriori defined dietary patterns

Principal components analysis (PCA) was used to *a-posteriori* extract dietary patterns, based on the intake of twelve broad food groups (total vegetable intake, total fruit intake, oily fish, non-oily fish, processed meat, poultry, beef, lamb, pork, cheese, bread intake and frequency of alcohol intake (field code: “1558”)). The Kaiser-Mayer-Olkin measure of sample adequacy[29] (0.70) and the Bartlett’s test of sphericity[30] (Chi-square (df)=4.56×10^{5} (66), $P<1.00 \times 10^{-300}$) supported the suitability of the data for PCA. Four dietary patterns were retained with eigenvalues greater than 1 (i.e. the average value of the eigenvalues), that explained in total 51.3% of the variance in food intake. Each derived pattern was named according to the characteristics of food groups whose component loading value was 0.4 or higher. The first pattern (“Meat intake”) was characterised by high intake of red meat and processed meat, the second pattern was characterised by high vegetable, fruit and fish intake (therefore named “Prudent” pattern), the third was characterised by high intake of “cheese and bread” and the fourth by high “alcohol” intake (**Table 1**). For each of the retained components each participant was assigned a score, based on the sum of the component loadings of each food group multiplied with the reported intakes of the specific food group, and they were categorized into quintiles of every derived pattern by their factor score. The two first main patterns that were heavily loaded from multiple food groups and together explain 32.5% of the variation in food intake were used in this analysis.

Other dietary practices

Utilising the self-reported data from the FFQ participants were also classified as i) “vegetarian”, if they reported “never eating” all of the seven food items describing meat, poultry and fish intake,[23] ii) “eating 5-a-day” of fruit and vegetables, with one serving defined as four heaped tablespoons of vegetables or one medium-sized piece of fruit,[31] and iii) “abstainers” if they self-reported abstaining from eggs/ dairy products/ wheat products/ sugar (UKB field code “6144”). Those with missing data in the subgroups of fish/meat intake, fruit/vegetable intake and food abstaining were excluded from the aforementioned classifications.

Statistical analysis

Descriptive statistics are shown as mean (SD) for the continuous variables and frequencies (%) for the categorical. Linear regression models were used to evaluate the association between z-LTL and a) quintiles of dietary patterns (three models assessing: i) *a-priori* defined Mediterranean diet, and *a-posteriori* extracted ii) “Prudent” and iii) “Meat intake” patterns), and b) other dietary practices (three models assessing: i) being vegetarian (yes/ no), ii) eat 5-a-day (yes/ no), and iii) whether an abstainer (yes/ no)). For each case, two linear regression models were examined: i) the base model, adjusted for age, sex (males/ females), ethnic background (defined by UKB as: Asian (2.0% including Asian or Asian British, Indian, Pakistani, Bangladeshi, and any other Asian background), Black (1.6% including Black or Black British, Caribbean, African, and any other Black background), Chinese (0.3%), Mixed (0.6% including White and Black African, White and Black

Caribbean, White and Asian, and any other Mixed background), Other (0.9%) and White (94.5%, including British, Irish, and any other White background)) and white blood cell count (WBC; z-standardised) and ii) the full model, additionally adjusted for smoking (never/ previous/ current; UKB field code "20116"), physical activity group (low/ moderate/ vigorous; "22032"), body mass index classification (derived from field "21001"; under and normal weight <25 kg/m^2, overweight 25-29.9 kg/m^2, and obese ≥30 kg/m^2), and the variables that were previously found to be independently associated with LTL in this population[7] (highest educational level (none; O-levels/ CSE/ GCSE that are equivalent to statutory/ compulsory education; A-levels/ non-vocational qualifications/ other professional educational qualifications that are equivalent to advanced education; degree that is equivalent to college or university degree; "6138"), insomnia (never/ sometimes/ usually; "1200"), fed-up feelings (yes/ no; "1960"), low density lipoprotein cholesterol (LDL; "30780"), C-reactive protein (CRP; "30710"), estimated glomerular filtration rate (CKD-EPI; eGFR; "30700"), and self-reported doctor diagnosed chronic medical conditions (diabetes ("2443"), cancer ("2453"), vascular disease and hypertension (both derived from field "6150")).

Continuous variables were winsorised at the 0.5% and 99.5% percentile values, to exclude extreme outliers, $\log_e$-transformed, where necessary, and scaled to the standardised normal distribution. Results from the regression models are reported as beta coefficients (95% confidence intervals, CI). To aid the interpretation of the observed associations between the dietary patterns and practices and LTL, the association with each pattern/ practice was expressed in terms of number of equivalent years of age-related change in LTL, by dividing the beta coefficients for adherence to the patterns or the practices by the absolute value of the beta coefficient (|-0.023|) for the age-related change in LTL.[8]

To evaluate the generalizability of the results and minimise any impact of missing data, the analysis was repeated using imputed data. Multiple imputations using chained equations[32] were employed to impute 10 datasets in order to generate complete datasets. To ensure convergence, 10 iterations for each imputation was performed. Age, sex, ethnicity and WBC were included as additional covariates in the imputation model to help improve prediction of the missing values. Linear, logistic and multinomial regression models were specified as the imputation models for continuous, binary and categorical variables respectively. The performance of the imputation was evaluated through the comparison of the distribution plots of the continuous variables and the distribution of categorical variables between the available, imputed and complete data.

All data collected at the time of recruitment. All tests were two-sided and statistical significance was set at the 0.05 level. All analyses performed in Stata v17.0.[33]

Results

Study participants

Amongst non-related UKB participants with complete information on LTL and its major determinants (i.e., age, sex, ethnicity and white blood cell count; n=422,797), complete dietary data for the dietary patterns and the dietary practices analyses exist for approximately 80% (n=339,013) and 99.5% (n=420,919) respectively (**Figure 1, OLS**). Participants excluded from the analysis, due to missing information in either food intake (n=83,784) or dietary practices data (n=1,878), were less likely to be of white ethnic background, especially when it comes to dietary practices (i.e., 3.4% (95%CI: -3.6%; -3.2%) fewer participants of white ethnic background when reporting missing data for dietary patterns; 21.6% (95%CI: -23.6%; -19.5%) fewer participants of white ethnic background when reporting missing data for dietary practices). Compared to participants included in the analysis, participants with missing food intake data were more likely to be women (11.3% (95%CI: 10.9%; 11.7%)), whilst those with missing data on diet practices were more likely to be men (6.7% (95%CI:

4.4%; 8.9%)). Differences in the age distribution were not observed for either dietary patterns or practices, whilst participants excluded from the dietary pattern analysis had on average longer LTL (mean difference: 0.022SD (95% CI: 0.014SD; 0.029SD)) (**Table 2, OLS**).

On average, telomere length is longer in participants of younger age, female sex, of non-white ethnic background, with normal BMI and non-smokers (**Table 3**). For the *a-priori* defined Mediterranean dietary pattern, participants' age distribution was relatively constant across the quintiles of the MedDietScore, albeit statistically significant, whilst the proportion of men adhering to that pattern was smaller compared to women and gradually decreased towards the higher adherence to this pattern (P-trend<$1.00x10^{-300}$). In general, the proportion of ethnic minorities adhering to a Mediterranean diet was lower compared with participants of white ethnic background. Several clinical and lifestyle characteristics showed a substantial gradient across the quintiles of the MedDietScore, with participants in the highest quintiles having a more favourable profile (normal weight, non-smokers, physically active, less disease prevalence in general) compared to those in lowest quintile (**Table 4, OLS**).

Participants' lifestyle and social characteristics were similarly distributed when the *a-posteriori* extracted "Prudent" pattern was considered, although ethnic differences were not that apparent. Regardless, the disease prevalence showed a linear association with quintiles of adherence to "Prudent" pattern, compared to the u-shaped association observed with the quintiles of adherence to "Mediterranean" pattern (**Table 5, OLS**).

Conversely, a positive gradient of male sex, unfavourable lifestyle characteristics and disease prevalence, was observed across the quintiles of the "Meat intake" pattern. The distribution of age and ethnicity was similar to the one observed across the quintiles of adherence to the Mediterranean diet, whilst those with higher education qualifications showed a lower adherence to the "Meat intake" pattern (**Table 6, OLS**).

Associations of LTL with dietary patterns

Significant associations with dietary patterns, either *a-priori* or *a-posteriori* extracted, and LTL were observed in the available data. Specifically, after adjustment for age, sex, ethnicity and WBC (base model), there was a positive gradient in the association between quintiles of adherence to the Mediterranean diet or to the *a-posteriori* defined "Prudent" pattern and LTL, whilst the association between quintiles of the "Meat intake" pattern and LTL was reversed (**Figure 3; Table 7, Base model, OLS**). Adjustment for the lifestyle factors and the additional social and clinical characteristics associated with LTL attenuated all the observed associations although the global trends and the differences between the highest and lowest quintiles remained significant (**Figure 3; Table 7, Full model, OLS**). Results derived from the imputed data were concordant with those from the available data (**Figure 3; Table 7, OLS**). Moreover, excluding one marker of inflammation (i.e. CRP) from the fully adjusted model did not substantially alter the results in a meaningful way (**Table 8, OLS**), neither did the inclusion of pack of years of smoking ("20161"), total MET min/week of activity ("22040"), and body mass index (kg/m2, "21001") instead of the respective variables in their categorical form (**Table 9, OLS**). In general, the associations between dietary patterns and LTL did not differ by age, sex, or smoking status (**Figure 5 OLS**). However, the association of the meat intake pattern with LTL was stronger in participants aged 40-49 years than those aged 50-59 and 60-70, and the association of the prudent pattern with LTL was stronger in women (**Figure 5 OLS**).

Associations of LTL with other dietary practices

The distribution of social, lifestyle and clinical characteristics across participants' dietary practices are shown in **Table 10, OLS**. Those following a "vegetarian" diet were on average younger, whilst those eating "5-a-day" and "abstainers" were slightly older. Sex and ethnic differences were observed regarding these dietary practices with men being less and Asian adults being more frequently classified as “vegetarian” and eating “5-a-day”. Higher proportion of “vegetarians”, eating “5-a-day” and “non-abstainers” had in general a favourable lifestyle profile (non-smokers, physically active, normal weight). Whilst the clinical profile was in general better among “vegetarian” participants, the trend was reversed for those eating “5-a-day” and food “abstainers” as suggested by the increased prevalence of the self-reported diagnosed diseases (**Table 10, OLS**).

A “vegetarian” diet and eating “5-a-day” were both associated with longer LTL while abstaining from “eggs/ dairy products/ wheat products/ sugar” was associated with shorter LTL in the base model with adjustment for age, sex, ethnicity and WBC (**Figure 4**), However, after adjustment for other variables associated with LTL, the association with “vegetarian” diet became non-significant, while the associations with eating “5-a-day” and “abstainers” attenuated, but remained significant (**Figure 4**). These findings were concordant in the imputed data (**Figure 4; Table 11, OLS**), whilst no substantial changes in the associations between the dietary behaviours and LTL were observed when CRP was excluded from the analyses (**Table 12, OLS**) or when pack of years of smoking (“20161”), total MET min/week of activity (“22040”), and body mass index (kg/m2, “21001”) were included in the model instead of the respective variables in their categorical form (**Table 13, OLS**). Significant differences by sex were observed for the association between LTL and “being vegetarian”, with the association being stronger for men, and “eating 5-a-day”, with the association being stronger for women (**Figure 6 OLS**).

Discussion

To the best of our knowledge this is the first large scale contemporary study to investigate the association between dietary patterns and practices and telomere length at a population level. The findings suggest that amongst dietary patterns, higher adherence to the Mediterranean diet and a prudent diet are significantly associated with longer LTL whilst higher adherence to a “Meat intake” pattern is associated with shorter LTL. Adjustment for social, lifestyle and clinical characteristics associated with LTL attenuated the associations with either pattern although they remained significant. Amongst dietary practices, an “eat-5-a-day” of fruit and vegetables was associated with longer LTL while abstinence from “eggs/ dairy products/ wheat products/ sugar” was associated with shorter LTL. Notably, a self-reported “vegetarian” diet *per se* was not significantly associated with LTL after adjustment for other lifestyle, social and clinical characteristics.

The design and scale of the UK Biobank afforded the opportunity to identify dietary patterns and practices in a contemporary population, across a wide age range, and further explore the association between diet and telomere length. Dietary data were retrospectively collected and as such are prone to recall bias. However, data collected using a touchscreen, short, reproducible FFQ that successfully discriminates participants between low and high intakes of main food groups[22,23] in the presence of Biobank staff members who helped to reduce participants’ burden and bias. Moreover, dietary patterns were extracted using established methods[27,34] and the ones identified here were also reported in other settings.[35] Olive oil (rich in mono-unsaturated fatty acids and antioxidants, and a usual component of the Mediterranean diet[28]) intake was not recorded in the UKB. However, small associations between olive-oil based spread and LTL were previously demonstrated,[6] hence it is anticipated that the inclusion of olive oil in the MedDietScore would have, if anything, strengthened the observed associations. The MedDietScore employed in this analysis was also limited by the lack of information regarding legumes intake (rich in plant protein). However, legumes intake has been captured, by definition, under the “vegetarian” diet, where association with LTL was fully explained by the additional lifestyle, social and clinical characteristics. Within this context significant changes in the association between the Mediterranean diet and LTL should legumes be included in the MedDietScore, re-created for the purposes of this analysis, are not anticipated. Moreover, previous interrogations of telomere length determinants[3,6,8] enabled accounting for all known potential confounders to date providing a comprehensive analysis for potential confounders. In addition, results utilising the imputed data showed that the conclusions were unlikely to be affected by missing data. Risk factor associations in UK Biobank are accepted to be generalizable,[36] even though there is evidence of "healthy volunteers" bias.[37] However, this is a cross-sectional study and as such the possibility of residual confounding exists, so associations reported here do not imply causality.

Dietary pattern analysis allows for any interactive, additive, synergistic, or attenuating effect that occurs when foods are consumed in combination, and captures the cumulative effect of the overall diet, which is ignored when food items are examined in isolation.[38] Recent evidence suggests that greater adherence to a "healthy dietary pattern", such as the Mediterranean or the "Prudent" diet, reduces the risk of chronic diseases and overall mortality[39] and increases lifespan.[10] Rich in antioxidants, unrefined cereals and mono-unsaturated fats, the Mediterranean diet may help to counteract telomere attrition via a series of potential mechanisms such as oxidative stress and inflammation.[7] Consistent with other studies,[16] a positive gradient in the association between greater adherence to Mediterranean diet and LTL was observed, even after adjustment for several potential confounding factors.

As *a-priori* defined Mediterranean diet may not be relevant to the UK population or neglect important dietary components that could affect LTL, results from the data-driven dietary pattern analyses are also reported. The observed associations of the "Prudent" pattern with LTL were consistent to the findings regarding the Mediterranean diet. Conversely, an inverse association between higher adherence to "Meat intake" and LTL was observed that retained at some extent the effect magnitude in the full model suggesting that the association is only partly mediated through lifestyle, social and clinical factors. These findings were directionally concordant with other studies,[40, 41] with differences in the point estimates attributed to differences to populations studied (e.g. differences in race, socio-demographic factors, clinical profile), the way diet and LTL were measured and the covariates included in the models.

Interestingly, results from the full model indicate a null association between being a vegetarian and LTL. Being a vegetarian covers a wide spectrum of dietary habits and practices, from the unhealthy plant-based food intake, such as the intake of refined grains (pasta, white rice, processed breads and cereals), potatoes (French fries and potato chips), or juices and sugar-sweetened beverages, to the healthy one, such as the intake of whole grains, fruits, vegetables, nuts, legumes, and healthy oils. Therefore, the lack of association could have been anticipated. It was not possible to delineate which end of the spectrum "vegetarians" of this study represented, but results suggest that being vegetarian is a behaviour associated with cultural, social (including lifestyle) and health influences and any association with LTL is mediated by other factors. Moreover, some vegetarians still consume animal products (e.g. lacto-ovo vegetarians[42]); it could thus be possible that their intake hinders the true association between pure plant origin intake (e.g. vegans[42]) and LTL. This hypothesis can be supported by the findings regarding adherence to the public health guidance of daily consumption of at least five portions of fruit and vegetables, with similar results reported elsewhere.[43]

Abstaining from "eggs/ dairy products/ wheat/ sugar" was associated with shorter LTL, albeit of a small magnitude. Although the individual effect of these items cannot be unravelled with the current data, results are contradictory to previous studies.[44-46] Food avoidance could be related to undesirable and aversive past experiences of consuming certain food items, and as such is quite prevalent in people with chronic gastrointestinal diseases,[47] or food allergies or intolerances,[48] or to the global interest in dieting leading to dietary trends mainly focused on fast weight loss or how to improve appearence.[49] As the reason for food abstaining was not recorded in UKB, we cannot unravel whether avoiding eggs, milk, wheat, and sugar are linked to food allergy,[50] increased obesity prevalence,[51] or fad diets.[52] Therefore, the observed negative association between "abstainers" and LTL could also suggest either an underlying association with a health condition or current dieting trends, rather than with the avoidance of specific food items *per se*.

Telomere length is a highly heritable[53] diverse trait that is affected by a combination of genetic and environmental determinants, but the range of factors and the way they influence telomere dynamics is not fully understood. Research suggests that telomere attrition is due to oxidative stress[54] and inflammation.[55] Whilst fruit and vegetables have significant antioxidant and anti-inflammatory properties,[56] and therefore could delay biological ageing by maintaining telomere length, meat intake has antagonistic action. Processed meat, in particular, consists of saturated fat, sodium, nitrates and glycotoxins that were found to promote oxidative stress and inflammation.[57,58] Regardless, excluding one inflammation marker from the fully adjusted model did not substantially change the association between the dietary patterns and practices with LTL, which suggests that CRP is an unlikely biological pathway of diet's influence on telomere length.

Conclusion

Data from a large-scale study that offer the ability to account for several determinants of LTL and other confounders were used in this study. Although the observed associations between several dietary patterns and practices and LTL were significant, the magnitude of the associations were small and equivalent in most cases (after adjustment for confounding factors) to 1 year or less of age-related change in LTL (**Tables 7 and 10, OLS**). As such, the clinical importance of the associations and any relevance to the effects of healthy diets towards chronic disease prevention remains uncertain.

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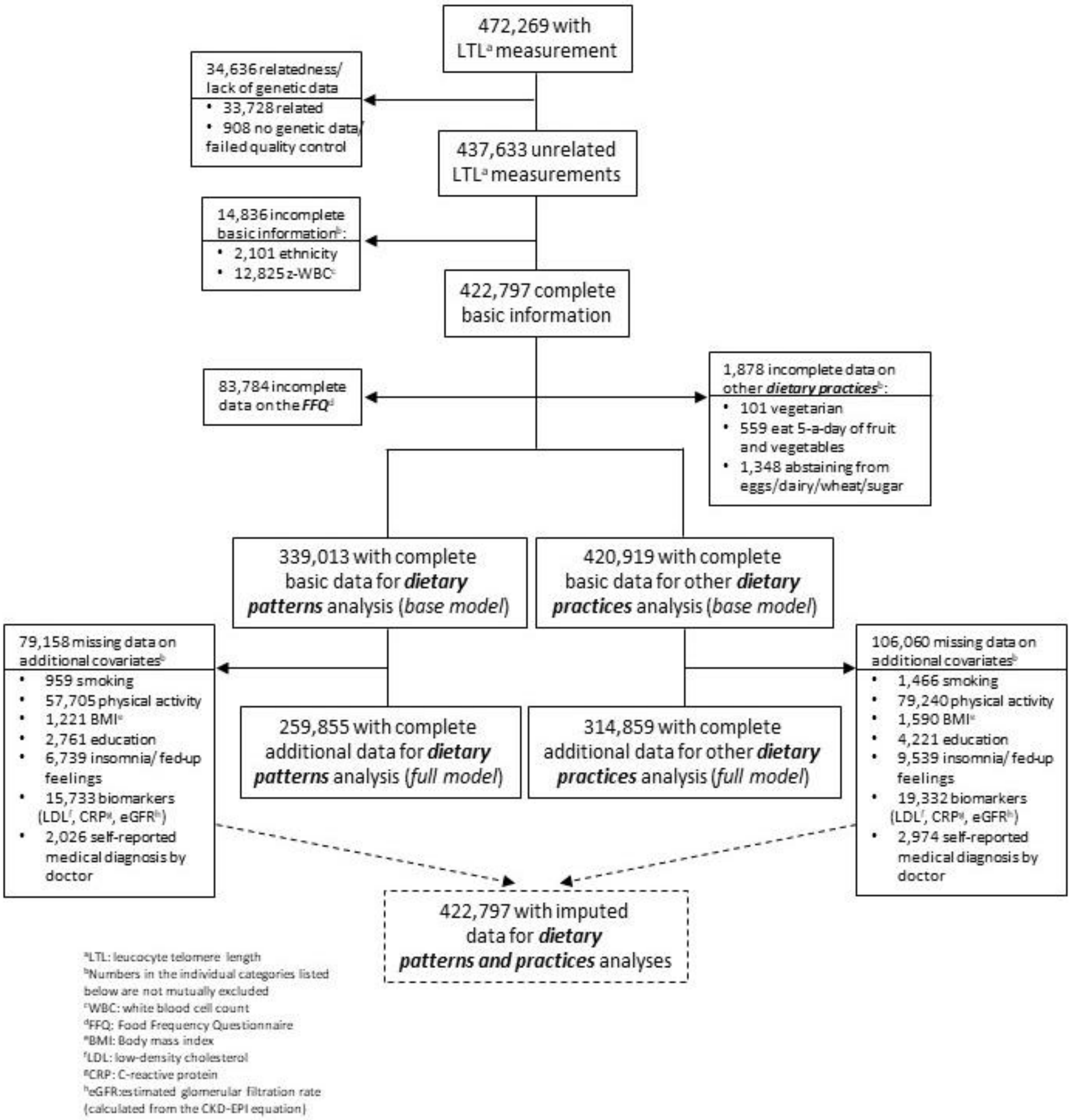

Figure 1 Supplement. Flowchart of data collected during 2006-10 from UK Biobank participants that were used in the current study.

Food groups	Scoring system					
Vegetables, servings/day	<1	≥1 to <2	≥2 to <3	≥3 to <4	≥4	
score	0	1	2	3	4	
Fruit, piece/day	<1	1	2	3	≥4	
score	0	1	2	3	4	
Grains, servings/day		<2	≥2 to <4	≥4 to <6	≥6	
Non-refined, score		1	2	3	4	
Refined, score		4	3	2	1	
Cheese, frequency		Never/rarely	Monthly	Weekly	Daily	
score		1	2	3	4	
Fish, frequency		Never/rarely	Monthly	Weekly	Daily	
score		1	2	4	3	
Poultry, frequency		Never/rarely	Monthly	Weekly	Daily	
score		1	3	4	2	
Red meat, frequency	Never	Rarely	Monthly	Weekly	Daily	
score	2	3	4	1	0	
Alcohol, g of ethanol/day (mL/ day)	0 or 67+ (0 or ≥700)	>0 to <28 (>0 to <300)	28 to 37.9 (≥300 to <400)	38 to 47.9 (≥400 to <500)	48 to 56.9 (≥500 to <600)	57 to 66.9 (≥600 to <700)
score	0	5	4	3	2	1

Figure 2. Scoring system for the a-priori defined adherence to Mediterranean Diet.

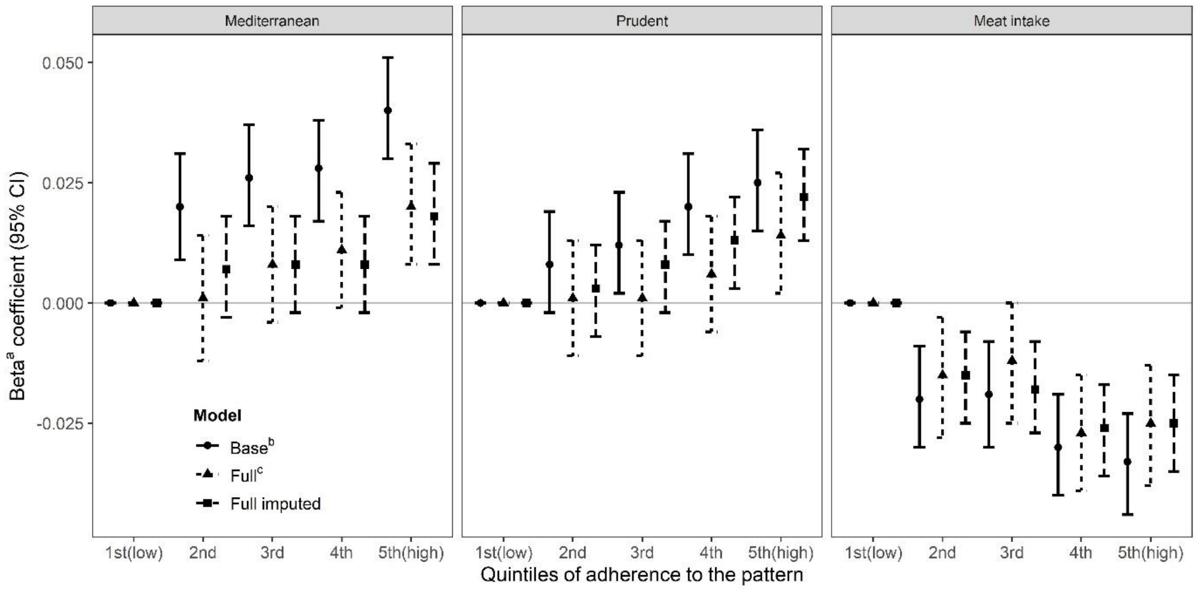

Figure 3. Association of UK Biobank participants' adherence to a dietary pattern with leucocyte telomere length using data collected during 2006-10.

[a]Point estimates are beta coefficients for z-standardised LTL. Error bars represent 95% confidence intervals (CI). [b]The base model includes the quintiles of adherence to the specific pattern and is adjusted for age, sex, ethnic background and white blood cell. [c]The full model is additionally adjusted for smoking habits, physical activity, body mass index classification, highest educational qualification, experiencing insomnia, fed-up feelings, low-density lipoprotein, C-reactive protein, estimated glomerular filtration rate (CKD-EPI) and self-reported diseases diagnosed by doctor (diabetes, cancer, hypertension and vascular diseases).

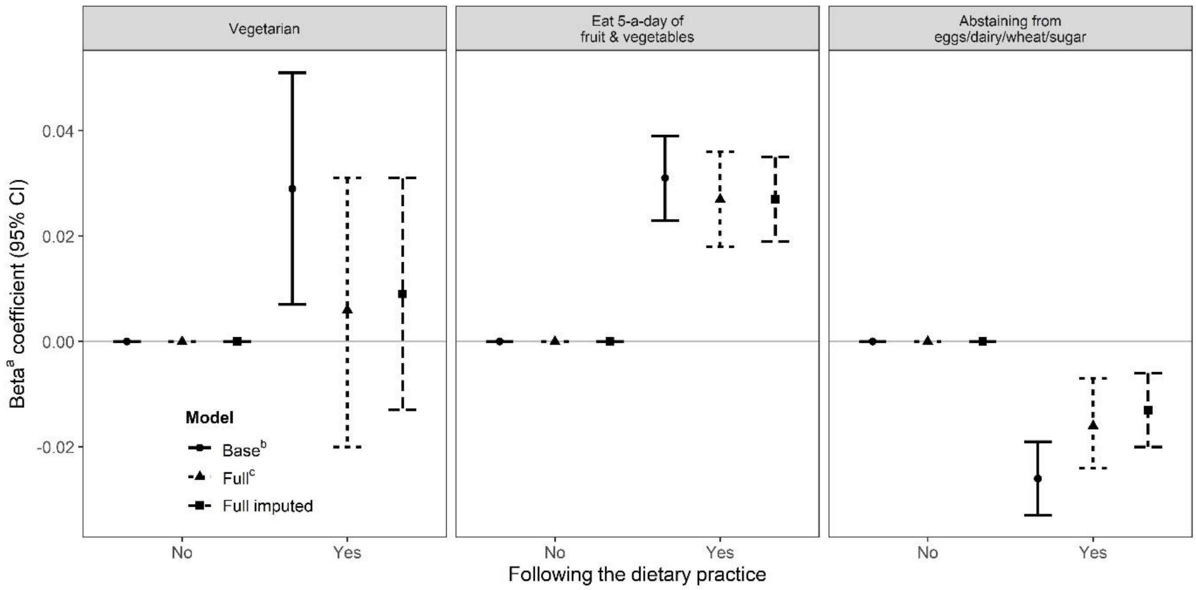

Figure 4. Association of UK Biobank participants' adherence to dietary practices with leucocyte telomere length using data collected during 2006-10.

[a]Point estimates are beta coefficients for z-standardised LTL. Error bars represent 95% confidence intervals (CI). [b]The base model includes the quintiles of adherence to the specific pattern and is adjusted for age, sex, ethnic background and white blood cell. [c]The full model is additionally adjusted for smoking habits, physical activity, body mass index classification, highest educational qualification, experiencing insomnia, fed-up feelings, low-density lipoprotein, C-reactive protein, estimated glomerular filtration rate (CKD-EPI) and self-reported diseases diagnosed by doctor (diabetes, cancer, hypertension and vascular diseases).

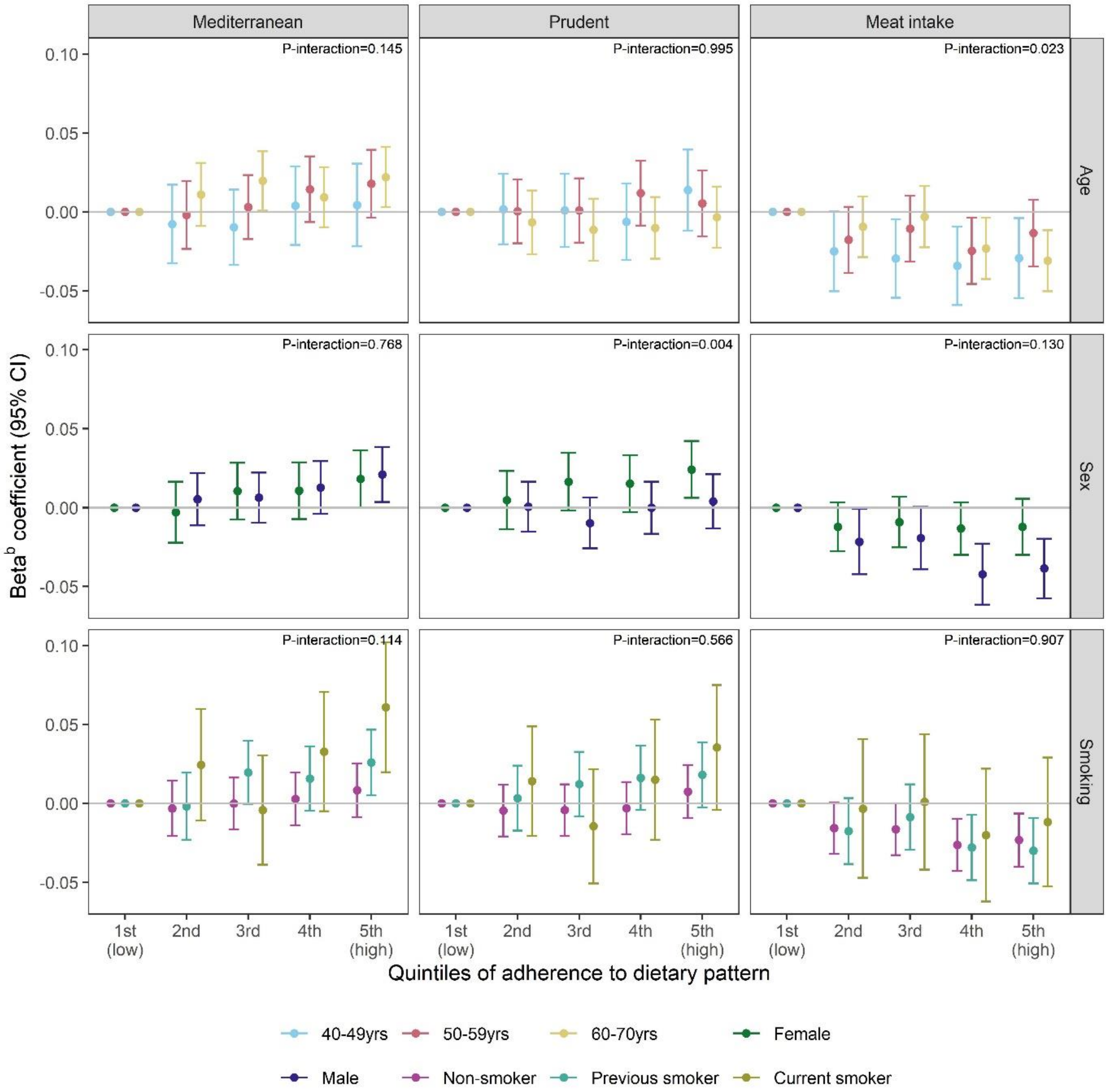

Figure 5 Supplement. Age, sex and smoking stratified analyses of the associations of adherence to a dietary pattern with leucocyte telomere length, in the fully adjusted[a] model using data from the UK Biobank collected during 2006-10.

[a]Each model is adjusted for age, sex, ethnic background, white blood cell, smoking habits, physical activity, body mass index classification, highest educational qualification, experiencing insomnia, fed-up feelings, low-density lipoprotein, C-reactive protein, estimated glomerular filtration rate (CKD-EPI) and self-reported diseases diagnosed by doctor (diabetes, cancer, hypertension and vascular diseases). Variables considered in the stratification are excluded from the modelling. [b]Point estimates are beta coefficients for z-standardised LTL. Error bars represent 95% confidence intervals (CI).

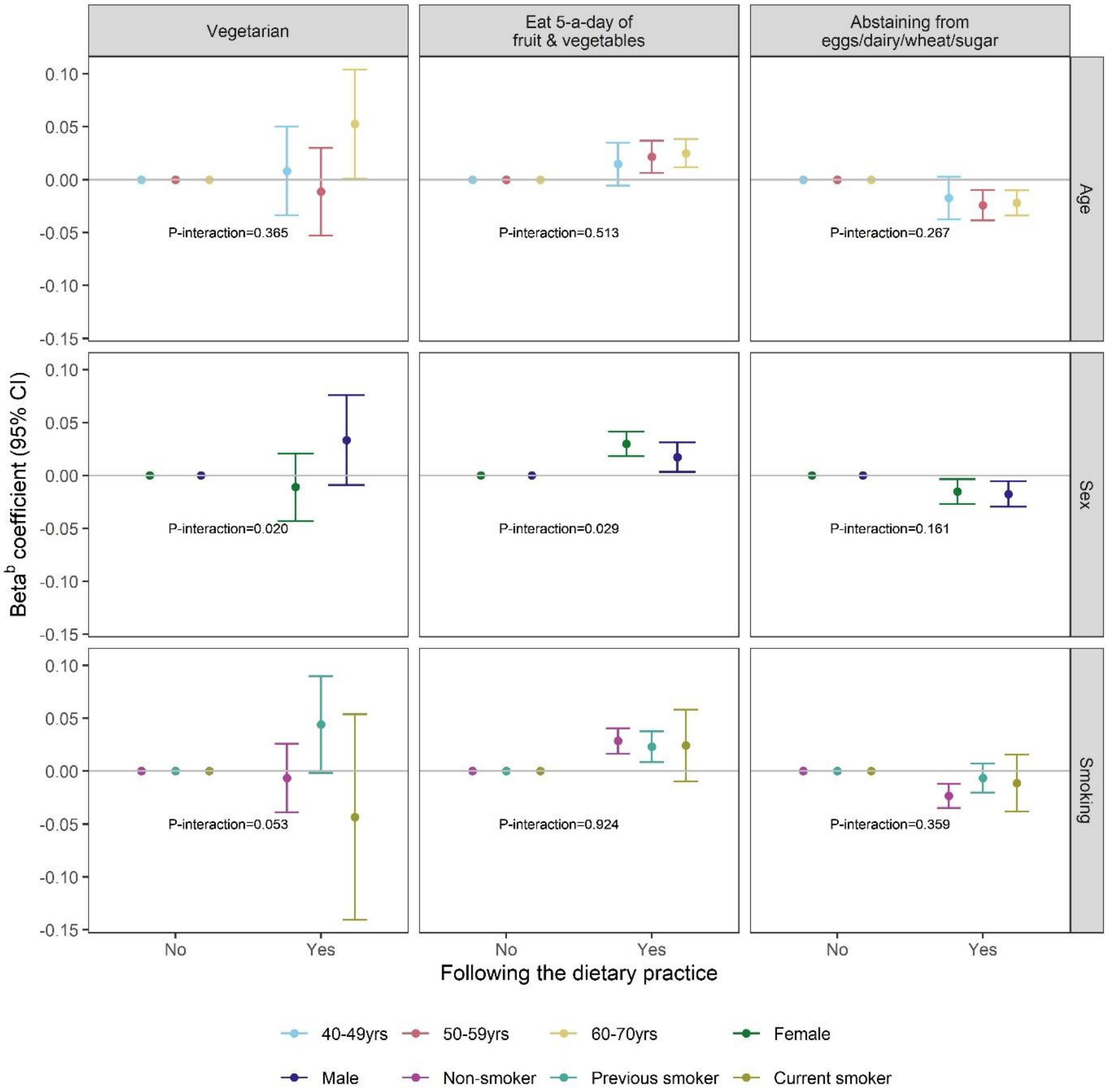

Figure 6 Supplement. Age, sex and smoking stratified analyses of the associations of adherence to a dietary practice with leucocyte telomere length, in the fully adjusted[a] model using data from the UK Biobank collected during 2006-10.

[a]Each model is adjusted for age, sex, ethnic background, white blood cell, smoking habits, physical activity, body mass index classification, highest educational qualification, experiencing insomnia, fed-up feelings, low-density lipoprotein, C-reactive protein, estimated glomerular filtration rate (CKD-EPI) and self-reported diseases diagnosed by doctor (diabetes, cancer, hypertension and vascular diseases). Variables considered in the stratification are excluded from the modelling. [b]Point estimates are beta coefficients for z-standardised LTL. Error bars represent 95% confidence intervals (CI).

Table 1. Component loadings for the four major dietary patterns *a-posteriori* extracted, using dietary data from 339,013 UK Biobank participants collected during 2006-10.

	Meat intake	Prudent pattern	Cheese and bread	Alcohol intake
Food item/ group				
Vegetables	-0.11	**0.43**[a]	0.02	-0.34
Fruit	-0.18	**0.42**	-0.09	-0.18
Oily fish	-0.05	**0.53**	0.25	0.15
Non-oily fish	0.03	**0.46**	0.32	0.38
Poultry	0.28	0.22	-0.16	0.33
Cheese	0.10	-0.12	**0.56**	-0.37
Bread	0.13	-0.18	**0.48**	0.32
Processed meat	**0.44**	-0.11	0.16	0.24
Beef	**0.47**	0.07	-0.16	-0.11
Lamb	**0.43**	0.16	-0.20	-0.20
Pork	**0.46**	0.10	-0.13	-0.13
Alcohol	-0.19	-0.02	-0.38	**0.46**
Variation explained	18.8%	13.7%	10.3%	8.5%

[a]**Bold** fonts highlight values greater than the threshold (>0.4) used to characterise the dietary patterns.

Table 2 Supplement. Distribution of basic demographic and clinical characteristics, collected during 2006-10, between UK Biobank participants with complete and missing data[a].

	Complete basic information	Dietary patterns		Mean difference	Dietary behaviours		Mean difference
		complete data	missing data	missing-complete	complete data	missing data	missing-complete
	n=422,797	n=339,013	n=83,784	(95% CI[b])	n=420,919	n=1,878	(95% CI)
z-LTL[c], SD	0.000 (1.000)	-0.005 (0.998)	0.017 (1.009)	0.022 (0.014; 0.029)	0.000 (1.000)	-0.009 (1.016)	-0.009 (-0.054; 0.036)
Age, year	56.6 (8.0)	56.6 (8.0)	56.4 (8.2)	-0.20 (-0.26; -0.14)	56.6 (8.0)	56.2 (8.6)	-0.40 (-0.76; -0.04)
Male sex, n (%)	195,177 (46.2)	164,087 (48.4)	31,090 (37.1)	-11.3 (-11.7; -10.9)	194,186 (46.1)	991 (52.8)	6.7 (4.4; 8.9)
Ethnic background[d], n (%)							
White	400,036 (94.6)	323,084 (95.3)	76,952 (91.9)	-3.4 (-3.6; -3.2)	398,663 (94.7)	1,373 (73.1)	-21.6 (-23.6; -19.5)
Black	6,587 (1.6)	4,332 (1.3)	2,255 (2.7)	-	6,455 (1.5)	132 (7.0)	-
Asian	8,355 (2.0)	6,224 (1.8)	2,131 (2.5)	-	8,113 (1.9)	242 (12.9)	-
Mixed	2,518 (0.60)	1,892 (0.56)	626 (0.75)	-	2,497 (0.59)	21 (1.1)	-
Chinese	1,373 (0.32)	840 (0.25)	533 (0.64)	-	1,356 (0.32)	17 (0.91)	-
Other	3,928 (0.93)	2,641 (0.78)	1,287 (1.5)	-	3,835 (0.91)	93 (5.0)	-
White blood cell[e], cells/mm^3	6,869 (1,737)	6,840 (1,714)	6,987 (1,820)	147 (134; 160)	6,868 (1,736)	7,089 (1,861)	221 (142; 300)

[a]Data are shown as mean (SD), unless otherwise indicated; [b]CI: Confidence interval; [c]z-LTL: z-standardised leucocyte loge telomere length; [d]Ethnic background is presented as reported through UK Biobank data collection. White ethnic background also includes British, Irish, and any other White background; Asian ethnic background also includes Asian or Asian British, Indian, Pakistani, Bangladeshi, and any other Asian background); Black ethnic background also includes Black or Black British, Caribbean, African, and any other Black background); Mixed ethnic background also includes White and Black African, White and Black Caribbean, White and Asian, and any other Mixed background);
[e]Conversion factor from cells/mm^3 to 10^9 cells/Litre: divide with 0.001.

Table 3. Distribution of leucocyte telomere length by the levels of selective characteristics in UK Biobank participants with complete basic information (n=422,797) collected during 2006-10.

	n (%)	mean (SD) z-LTL[a]	P[b]
Age group			$<1.00\times10^{-300}$
40-49 years	97,837 (23.1)	0.273 (0.984)	
50-59 years	141,874 (33.6)	0.057 (0.979)	
60-70 years	183,086 (43.3)	-0.191 (0.985)	
Sex			$<1.00\times10^{-300}$
Females	227,620 (53.8)	0.086 (0.996)	
Males	195,177 (46.2)	-0.101 (0.995)	
Ethnic background as reported through UK Biobank data collection			4.86×10^{-232}
White (including British, Irish and any other white background)	400,036 (94.6)	-0.016 (0.996)	
Asian (incl. Asian British, Indian, Pakistani, Bangladeshi, and any other Asian background)	6,587 (1.6)	0.518 (1.049)	
Black (incl. Black British, Caribbean, African, and any other Black background)	8,355 (2)	0.068 (1.002)	
Mixed (incl. White and Black African, White and Black Caribbean, White and Asian, and any other Mixed background)	2,518 (0.6)	0.234 (1.005)	
Chinese	1,373 (0.32)	0.484 (0.976)	
Other	3,928 (0.93)	0.267 (1.034)	

Body mass index classification				4.60×10^{-253}
	Normal weight[c]	139,365 (33)	0.068 (1.003)	
	Overweight	179,429 (42.4)	-0.024 (0.998)	
	Obese	102,371 (24.2)	-0.052 (0.995)	
	Missing[d]	*1,632 (0.39)*	-	
Smoking status				2.34×10^{-223}
	Never	230,529 (54.5)	0.048 (0.997)	
	Previous	146,351 (34.6)	-0.058 (0.998)	
	Current	44,343 (10.5)	-0.059 (1.012)	
	Missing	*1,574 (0.37)*	-	

[a]zLTL, z-standardised leucocyte $\log_e$ telomere length; [b]P values were obtained from the independent t-test for the comparison between female and male sex or oneway ANOVA for all other comparisons; [c]Normal weight category also includes 2,155 participants with BMI<18.5kg/m^2; [d]Missing data were excluded from the comparisons.

Table 4 Supplement. UK Biobank participants' demographic, lifestyle and clinical characteristics[a], collected during 2006-10, by quintiles of adherence to the *a-priori* defined Mediterranean diet pattern.

		Total	Quintiles of MedDietScore (0-37)					P[b]
			1st (≤16)	2nd (17-18)	3rd (19-20)	4th (21-22)	5th (≥23)	
n (%)		339,013	62,470 (18.4)	60,184 (17.8)	78,298 (23.1)	71,551 (21.1)	66,510 (19.6)	
z-LTL[c], SD		-0.005 (0.998)	-0.030 (1.009)	-0.006 (0.995)	0.001 (0.997)	0.001 (0.993)	0.008 (0.995)	$8.35x10^{-11}$
Age, year		56.6 (8.0)	56.2 (8.1)	56.1 (8.1)	56.4 (8.0)	56.8 (7.9)	57.4 (7.8)	$1.90x10^{-229}$
Male sex, n (%)		164,087 (48.4)	35,108 (56.2)	31,997 (53.2)	38,357 (49.0)	31,524 (44.1)	27,101 (40.8)	$<1.00x10^{-300}$
Ethnic background[d], n (%)								$<1.00x10^{-300}$
	White	323,084 (95.3)	56,742 (90.8)	57,467 (95.5)	75,432 (96.3)	69,252 (96.8)	64,191 (96.5)	
	Black	4,332 (1.3)	1,255 (2.0)	757 (1.3)	810 (1.0)	705 (1.0)	805 (1.2)	
	Asian	6,224 (1.8)	2,923 (4.7)	1,026 (1.7)	1,004 (1.3)	697 (1.0)	574 (0.9)	
	Mixed	1,892 (0.6)	469 (0.8)	341 (0.6)	418 (0.5)	343 (0.5)	321 (0.5)	
	Chinese	840 (0.3)	319 (0.5)	141 (0.2)	180 (0.2)	120 (0.2)	80 (0.1)	
	Other	2,641 (0.8)	762 (1.2)	452 (0.8)	454 (0.6)	434 (0.6)	539 (0.8)	
White blood cell[e], cells/mm^3		6,840 (1,714)	7,044 (1,820)	6,880 (1,724)	6,809 (1,692)	6,768 (1,671)	6,725 (1,656)	$5.30x10^{-225}$
Smoking status, n (%)								$3.35x10^{-263}$
	Never	182,281 (53.8)	31,500 (50.4)	31,711 (52.7)	42,371 (54.1)	39,618 (55.4)	37,081 (55.8)	
	Previous	121,702 (35.9)	20,755 (33.2)	21,532 (35.8)	28,373 (36.2)	26,157 (36.6)	24,885 (37.4)	
	Current	34,071 (10.1)	10,021 (16.0)	6,795 (11.3)	7,327 (9.4)	5,591 (7.8)	4,337 (6.5)	
	Missing	*959 (0.3)*						
Physical activity, n (%)								$<1.00x10^{-300}$
	Low	51,457 (15.2)	11,918 (19.1)	10,119 (16.8)	12,145 (15.5)	9,740 (13.6)	7,535 (11.3)	
	Moderate	115,358 (34.0)	20,475 (32.8)	21,039 (35.0)	27,250 (34.8)	24,833 (34.7)	21,761 (32.7)	
	Vigorous	114,493 (33.8)	17,904 (28.7)	18,690 (31.1)	25,944 (33.1)	25,347 (35.4)	26,608 (40.0)	
	Missing	*57,705 (17.0)*						

Body mass index classification, n (%)							$2.21x10^{-150}$
Normal weight[f]	114,151 (33.7)	18,978 (30.4)	19,660 (32.7)	26,859 (34.3)	25,237 (35.3)	23,417 (35.2)	
Overweight	146,442 (43.2)	26,413 (42.3)	26,264 (43.6)	34,227 (43.7)	30,998 (43.3)	28,540 (42.9)	
Obesity	77,199 (22.8)	16,737 (26.8)	14,020 (23.3)	16,969 (21.7)	15,120 (21.1)	14,353 (21.6)	
Missing	*1,221 (0.4)*						
Highest education[g], n (%)							$3.95x10^{-199}$
None	51,138 (15.1)	12,394 (19.8)	9,010 (15.0)	10,781 (13.8)	9,725 (13.6)	9,228 (13.9)	
Statutory/ compulsory education	55,637 (16.4)	10,794 (17.3)	9,744 (16.2)	12,671 (16.2)	11,512 (16.1)	10,916 (16.4)	
Advanced education	111,709 (33.0)	20,032 (32.1)	19,924 (33.1)	26,049 (33.3)	23,773 (33.2)	21,931 (33.0)	
University/ College degree	117,768 (34.7)	18,591 (29.8)	21,021 (34.9)	28,203 (36.0)	26,026 (36.4)	23,927 (36.0)	
Missing	*2,761 (0.8)*						
Insomnia, n (%)							$8.79x10^{-14}$
Never/rarely	83,859 (24.7)	15,259 (24.4)	14,971 (24.9)	19,548 (25.0)	17,610 (24.6)	16,471 (24.8)	
Sometimes	161,832 (47.7)	28,507 (45.6)	28,677 (47.7)	37,771 (48.2)	34,851 (48.7)	32,026 (48.2)	
Usually	93,123 (27.5)	18,649 (29.9)	16,504 (27.4)	20,946 (26.8)	19,049 (26.6)	17,975 (27.0)	
Missing	*199 (0.1)*						
Fed-up feelings, n (%)							$5.24x10^{-269}$
No	202,445 (59.7)	33,757 (54.0)	35,205 (58.5)	47,074 (60.1)	44,354 (62.0)	42,055 (63.2)	
Yes	130,006 (38.4)	27,284 (43.7)	23,797 (39.5)	29,795 (38.1)	25,895 (36.2)	23,235 (34.9)	
Missing	*6,562 (1.9)*						
LDL[h] cholesterol, mg/dL	137.5 (33.0)	136.6 (33.6)	137.4 (32.9)	137.9 (32.8)	138.0 (32.8)	137.5 (32.8)	$1.48x10^{-07}$
Missing, n (%)	14,821 (4.4)						
CRP[i], µg/mL	2.426 (3.597)	2.797 (3.968)	2.492 (3.649)	2.364 (3.523)	2.273 (3.415)	2.257 (3.430)	$1.00x10^{-300}$
Missing, n (%)	14,872 (4.4)						
eGFR[j], umol/L	0.84 (0.85)	0.70 (0.84)	0.76 (0.84)	0.83 (0.85)	0.91 (0.84)	0.96 (0.84)	$<1.00x10^{-300}$
Missing, n (%)	14,404 (4.2)						
Diabetes[k], n (%)							$4.50x10^{-72}$
No	322,058 (95.0)	58,202 (93.2)	57,092 (94.9)	74,799 (95.5)	68,475 (95.7)	63,490 (95.5)	

	Yes	16,144 (4.8)	4,010 (6.4)	2,929 (4.9)	3,351 (4.3)	2,957 (4.1)	2,897 (4.4)	
	Missing	*811 (0.2)*						
Cancer[k], n (%)								1.10×10^{-21}
	No	312,760 (92.3)	57,828 (92.6)	55,747 (92.6)	72,520 (92.6)	65,780 (91.9)	60,885 (91.5)	
	Yes	25,349 (7.5)	4,407 (7.1)	4,268 (7.1)	5,593 (7.1)	5,613 (7.8)	5,468 (8.2)	
	Missing	*904 (0.3)*						
Hypertension[k], n (%)								5.91×10^{-24}
	No	248,215 (73.2)	44,109 (70.6)	44,033 (73.2)	58,327 (74.5)	53,166 (74.3)	48,580 (73.0)	
	Yes	90,258 (26.6)	18,209 (29.2)	16,044 (26.7)	19,874 (25.4)	18,305 (25.6)	17,826 (26.8)	
	Missing	*540 (0.2)*						
Vascular disease[k], n (%)								1.50×10^{-26}
	No	319,831 (94.3)	58,097 (93.0)	56,821 (94.4)	74,186 (94.8)	67,934 (94.9)	62,793 (94.4)	
	Yes	18,642 (5.5)	4,221 (6.8)	3,256 (5.4)	4,015 (5.1)	3,537 (4.9)	3,613 (5.4)	
	Missing	*540 (0.2)*						

[a]Data are shown as mean (SD) unless otherwise indicated; [b]P values are estimated using the Jonckheere-Terpstra test for trend for both continuous and categorical variables; [c]zLTL, Z-standardised leucocyte $\log_e$ telomere length; [d]Ethnic background is presented as reported through UK Biobank data collection. White ethnic background also includes British, Irish, and any other White background. Asian ethnic background also includes Asian or Asian British, Indian, Pakistani, Bangladeshi, and any other Asian background. Black ethnic background also includes Black or Black British, Caribbean, African, and any other Black background. Mixed ethnic background also includes White and Black African, White and Black Caribbean, White and Asian, and any other Mixed background; [e]Conversion factor from cells/mm^3 to 10^9 cells/Litre: divide with 0.001; [f]Normal weight category also includes 2,155 participants with BMI<18.5kg/m^2; [g]Statutory/ compulsory education is equivalent to “O-levels/CSE/GCSE” of the UK educational system, Advanced education is equivalent to the “A-levels/Non-vocational qualifications/ Other

professional educational qualifications” of the UK educational system; [h]LDL, low-density lipoproteins (conversion factor from mg/dL to mmol/L: divide with 0.0259); [i]CRP, C-reactive protein (conversion factor from μg/mL to mg/L: multiply by 1); [j]eGFR, estimated glomerular filtration rate (CKD-EPI) (conversion factor from mg/dL to umol/L: multiply by 88.496); [k]diseases are self-reported as diagnosed by doctor.

Table 5 Supplement. UK Biobank participants' demographic, lifestyle and clinical characteristics[a], collected during 2006-10, by quintiles of adherence to the *a-posteriori* defined 'Prudent' pattern.

		Total	Quintiles of adherence to Prudent pattern					P[b]
			1st (low)	2nd	3rd	4th	5th (high)	
n (%)		339,013	66,184 (19.5)	67,746 (20.0)	68,439 (20.2)	68,677 (20.3)	67,967 (20.1)	
z-LTL[c], SD		-0.005 (0.998)	0.001 (1.000)	-0.002 (0.997)	-0.009 (0.992)	-0.007 (0.997)	-0.006 (1.004)	0.054
Age, year		56.6 (8.0)	54.8 (8.2)	55.9 (8.1)	56.7 (7.9)	57.4 (7.8)	58.1 (7.6)	$<1.00\times10^{-300}$
Male sex, n (%)		164,087 (48.4)	38,931 (58.8)	35,350 (52.2)	32,854 (48.0)	29,937 (43.6)	27,015 (39.8)	$<1.00\times10^{-300}$
Ethnic background[d], n (%)								1.38×10^{-32}
	White	323,084 (95.3)	63,123 (95.4)	64,839 (95.7)	65,616 (95.9)	65,706 (95.7)	63,800 (93.9)	
	Black	4,332 (1.3)	587 (0.9)	647 (1.0)	728 (1.1)	861 (1.3)	1,509 (2.2)	
	Asian	6,224 (1.8)	1,640 (2.5)	1,338 (2.0)	1,131 (1.7)	989 (1.4)	1,126 (1.7)	
	Mixed	1,892 (0.6)	386 (0.6)	358 (0.5)	350 (0.5)	367 (0.5)	431 (0.6)	
	Chinese	840 (0.3)	97 (0.2)	137 (0.2)	155 (0.2)	199 (0.3)	252 (0.4)	
	Other	2,641 (0.8)	351 (0.5)	427 (0.6)	459 (0.7)	555 (0.8)	849 (1.3)	
White blood cell[e], cells/mm^3		6,840 (1,714)	6,991 (1,792)	6,870 (1,719)	6,832 (1,697)	6,782 (1,676)	6,729 (1,675)	8.03×10^{-169}
Smoking status, n (%)								6.61×10^{-78}
	Never	182,281 (53.8)	34,366 (51.9)	36,723 (54.2)	37,377 (54.6)	37,256 (54.3)	36,559 (53.8)	
	Previous	121,702 (35.9)	21,633 (32.7)	23,621 (34.9)	24,547 (35.9)	25,741 (37.5)	26,160 (38.5)	
	Current	34,071 (10.1)	10,003 (15.1)	7,237 (10.7)	6,352 (9.3)	5,463 (8.0)	5,016 (7.4)	
	Missing	*959 (0.3)*						
Physical activity, n (%)								$<1.00\times10^{-300}$
	Low	51,457 (15.2)	13,388 (20.2)	11,610 (17.1)	10,380 (15.2)	8,915 (13.0)	7,164 (10.5)	
	Moderate	115,358 (34.0)	22,304 (33.7)	23,915 (35.3)	24,067 (35.2)	23,729 (34.6)	21,343 (31.4)	
	Vigorous	114,493 (33.8)	18,146 (27.4)	20,367 (30.1)	22,435 (32.8)	24,798 (36.1)	28,747 (42.3)	
	Missing	*57,705 (17.0)*						

Body mass index classification, n (%)							$1.15x10^{-09}$
Normal weight[f]	114,151 (33.7)	22,587 (34.1)	23,163 (34.2)	23,221 (33.9)	23,104 (33.6)	22,076 (32.5)	
Overweight	146,442 (43.2)	28,003 (42.3)	29,342 (43.3)	29,695 (43.4)	29,863 (43.5)	29,539 (43.5)	
Obesity	77,199 (22.8)	15,313 (23.1)	15,017 (22.2)	15,305 (22.4)	15,465 (22.5)	16,099 (23.7)	
Missing	*1,221 (0.4)*						
Highest education[g], n (%)							$2.78x10^{-19}$
None	51,138 (15.1)	10,965 (16.6)	9,834 (14.5)	9,761 (14.3)	9,964 (14.5)	10,614 (15.6)	
Statutory/ compulsory education	55,637 (16.4)	11,586 (17.5)	11,022 (16.3)	11,022 (16.1)	10,984 (16.0)	11,023 (16.2)	
Advanced education	111,709 (33.0)	21,713 (32.8)	22,530 (33.3)	22,700 (33.2)	22,488 (32.7)	22,278 (32.8)	
University/ College degree	117,768 (34.7)	21,413 (32.4)	23,888 (35.3)	24,474 (35.8)	24,659 (35.9)	23,334 (34.3)	
Missing	*2,761 (0.8)*						
Insomnia, n (%)							$1.32x10^{-06}$
Never/rarely	83,859 (24.7)	16,903 (25.5)	17,139 (25.3)	16,848 (24.6)	16,455 (24.0)	16,514 (24.3)	
Sometimes	161,832 (47.7)	30,811 (46.6)	32,182 (47.5)	33,096 (48.4)	33,265 (48.4)	32,478 (47.8)	
Usually	93,123 (27.5)	18,420 (27.8)	18,387 (27.1)	18,462 (27.0)	18,925 (27.6)	18,929 (27.9)	
Missing	*199 (0.1)*						
Fed-up feelings, n (%)							$<1.00x10^{-300}$
No	202,445 (59.7)	35,110 (53.1)	39,354 (58.1)	41,690 (60.9)	42,812 (62.3)	43,479 (64.0)	
Yes	130,006 (38.4)	29,740 (44.9)	27,052 (39.9)	25,459 (37.2)	24,581 (35.8)	23,174 (34.1)	
Missing	*6,562 (1.9)*						
LDL[h] cholesterol, mg/dL	137.5 (33.0)	136.8 (32.5)	137.7 (32.7)	137.7 (32.9)	138.0 (33.2)	137.2 (33.5)	0.039
Missing, n (%)	*14,821 (4.4)*						
CRP[i], µg/mL	2.426 (3.597)	2.578 (3.749)	2.448 (3.602)	2.434 (3.613)	2.362 (3.538)	2.313 (3.476)	$9.38x10^{-83}$
Missing, n (%)	*14,872 (4.4)*						
eGFR[j], mg/dL	0.84 (0.85)	0.67 (0.83)	0.78 (0.85)	0.85 (0.85)	0.92 (0.85)	0.97 (0.83)	$<1.00x10^{-300}$
Missing, n (%)	*14,404 (4.2)*						
Diabetes[k] GP, n (%)							$6.89x10^{-17}$
No	322,058 (95.0)	62,974 (95.2)	64,566 (95.3)	65,201 (95.3)	65,239 (95.0)	64,078 (94.3)	

Yes	16,144 (4.8)	3,016 (4.6)	3,018 (4.5)	3,102 (4.5)	3,294 (4.8)	3,714 (5.5)	
Missing	*811 (0.2)*						
Cancer[k] GP, n (%)							$3.17x10^{-73}$
No	312,760 (92.3)	61,837 (93.4)	62,901 (92.9)	63,111 (92.2)	62,963 (91.7)	61,948 (91.1)	
Yes	25,349 (7.5)	4,154 (6.3)	4,665 (6.9)	5,143 (7.5)	5,556 (8.1)	5,831 (8.6)	
Missing	*904 (0.3)*						
Hypertension[k] GP, n (%)							$2.80x10^{-138}$
No	248,215 (73.2)	50,065 (75.7)	50,662 (74.8)	50,269 (73.5)	49,483 (72.1)	47,736 (70.2)	
Yes	90,258 (26.6)	16,024 (24.2)	16,989 (25.1)	18,066 (26.4)	19,077 (27.8)	20,102 (29.6)	
Missing	*540 (0.2)*						
Vascular disease[k] GP, n (%)							$3.47x10^{-34}$
No	319,831 (94.3)	62,749 (94.8)	64,241 (94.8)	64,700 (94.5)	64,655 (94.1)	63,486 (93.4)	
Yes	18,642 (5.5)	3,340 (5.1)	3,410 (5.0)	3,635 (5.3)	3,905 (5.7)	4,352 (6.4)	
Missing	*540 (0.2)*						

[a]Data are shown as mean (SD) unless otherwise indicated; [b]P values are estimated using the Jonckheere-Terpstra test for trend for both continuous and categorical variables; [c]zLTL, Z-standardised leucocyte $\log_e$ telomere length; [d]Ethnic background is presented as reported through UK Biobank data collection. White ethnic background also includes British, Irish, and any other White background. Asian ethnic background also includes Asian or Asian British, Indian, Pakistani, Bangladeshi, and any other Asian background. Black ethnic background also includes Black or Black British, Caribbean, African, and any other Black background. Mixed ethnic background also includes White and Black African, White and Black Caribbean, White and Asian, and any other Mixed background; [e]Conversion factor from cells/mm^3 to 10^9 cells/Litre: divide with 0.001; [f]Normal weight category also includes 2,155 participants with BMI<18.5kg/m^2; [g]Statutory/ compulsory education is equivalent to “O-levels/CSE/GCSE” of the UK educational system, Advanced education is equivalent to the “A-levels/Non-vocational qualifications/ Other

professional educational qualifications" of the UK educational system; [h]LDL, low-density lipoproteins (conversion factor from mg/dL to mmol/L: divide with 0.0259); [i]CRP, C-reactive protein (conversion factor from μg/mL to mg/L: multiply by 1); [j]eGFR, estimated glomerular filtration rate (CKD-EPI) (conversion factor from mg/dL to umol/L: multiply by 88.496); [k]diseases are self-reported as diagnosed by doctor.

Table 6 Supplement. UK Biobank participants' demographic, lifestyle and clinical characteristics[a], collected during 2006-10, by quintiles of adherence to the *a-posteriori* defined 'Meat intake' pattern.

		Total	Quintiles of adherence to Meat intake dietary pattern					P[b]
			1st (low)	2nd	3rd	4th	5th (high)	
n (%)		339,013	62,380 (18.4)	65,563 (19.3)	68,169 (20.1)	70,341 (20.8)	72,560 (21.4)	
z-LTL[c], SD		-0.005 (0.998)	0.068 (0.997)	0.005 (0.998)	-0.005 (0.992)	-0.027 (1.002)	-0.054 (0.997)	$1.27x10^{-109}$
Age, year		56.6 (8.0)	56.1 (8.1)	56.9 (7.9)	56.6 (8.0)	56.6 (8.0)	56.8 (8.0)	$2.76x10^{-26}$
Male sex, n (%)		164,087 (48.4)	18,874 (30.3)	25,944 (39.6)	33,268 (48.8)	38,900 (55.3)	47,101 (64.9)	$<1.00x10^{-300}$
Ethnic background[d], n (%)								$<1.00x10^{-300}$
	White	323,084 (95.3)	55,781 (89.4)	62,585 (95.5)	65,932 (96.7)	68,350 (97.2)	70,436 (97.1)	
	Black	4,332 (1.3)	1,328 (2.1)	863 (1.3)	667 (1.0)	681 (1.0)	793 (1.1)	
	Asian	6,224 (1.8)	3,696 (5.9)	1,045 (1.6)	656 (1.0)	447 (0.6)	380 (0.5)	
	Mixed	1,892 (0.6)	474 (0.8)	351 (0.5)	351 (0.5)	332 (0.5)	384 (0.5)	
	Chinese	840 (0.3)	168 (0.3)	168 (0.3)	139 (0.2)	180 (0.3)	185 (0.3)	
	Other	2,641 (0.8)	933 (1.5)	551 (0.8)	424 (0.6)	351 (0.5)	382 (0.5)	
White blood cell[e], cells/mm^3		6,840 (1,714)	6,700 (1,690)	6,792 (1,702)	6,832 (1,702)	6,881 (1,719)	6,970 (1,741)	$3.11x10^{-202}$
Smoking status, n (%)								$<1.00x10^{-300}$
	Never	182,281 (53.8)	36,575 (58.6)	36,492 (55.7)	36,897 (54.1)	36,927 (52.5)	35,390 (48.8)	
	Previous	121,702 (35.9)	20,706 (33.2)	23,245 (35.5)	24,619 (36.1)	25,763 (36.6)	27,369 (37.7)	
	Current	34,071 (10.1)	4,894 (7.9)	5,642 (8.6)	6,469 (9.5)	7,446 (10.6)	9,620 (13.3)	
	Missing	*959 (0.3)*						
Physical activity, n (%)								$7.19x10^{-95}$
	Low	51,457 (15.2)	8,175 (13.1)	9,572 (14.6)	10,574 (15.5)	11,317 (16.1)	11,819 (16.3)	
	Moderate	115,358 (34.0)	20,270 (32.5)	22,133 (33.8)	23,609 (34.6)	24,520 (34.9)	24,826 (34.2)	
	Vigorous	114,493 (33.8)	23,089 (37.0)	22,231 (33.9)	22,274 (32.7)	22,732 (32.3)	24,167 (33.3)	
	Missing	*57,705 (17.0)*						

Body mass index classification, n (%)							$<1.00 \times 10^{-300}$
Normal weight[f]	114,151 (33.7)	27,041 (43.4)	23,556 (35.9)	22,465 (33.0)	21,503 (30.6)	19,586 (27.0)	
Overweight	146,442 (43.2)	23,794 (38.1)	27,999 (42.7)	30,052 (44.1)	31,625 (45.0)	32,972 (45.4)	
Obesity	77,199 (22.8)	11,181 (17.9)	13,793 (21.0)	15,442 (22.7)	17,010 (24.2)	19,773 (27.3)	
Missing	*1,221 (0.4)*						
Highest education[g], n (%)							2.76×10^{-21}
None	51,138 (15.1)	9,304 (14.9)	10,151 (15.5)	10,155 (14.9)	10,354 (14.7)	11,174 (15.4)	
Statutory/ compulsory education	55,637 (16.4)	9,679 (15.5)	11,481 (17.5)	11,619 (17.0)	11,639 (16.6)	11,219 (15.5)	
Advanced education	111,709 (33.0)	18,410 (29.5)	21,143 (32.3)	22,918 (33.6)	24,130 (34.3)	25,108 (34.6)	
University/ College degree	117,768 (34.7)	24,327 (39.0)	22,254 (33.9)	22,967 (33.7)	23,723 (33.7)	24,497 (33.8)	
Missing	*2,761 (0.8)*						
Insomnia, n (%)							1.05×10^{-14}
Never/rarely	83,859 (24.7)	15,257 (24.5)	15,614 (23.8)	16,802 (24.7)	17,519 (24.9)	18,667 (25.7)	
Sometimes	161,832 (47.7)	29,374 (47.1)	31,785 (48.5)	32,708 (48.0)	33,832 (48.1)	34,133 (47.0)	
Usually	93,123 (27.5)	17,712 (28.4)	18,137 (27.7)	18,606 (27.3)	18,947 (26.9)	19,721 (27.2)	
Missing	*199 (0.1)*						
Fed-up feelings, n (%)							0.995
No	202,445 (59.7)	36,910 (59.2)	39,539 (60.3)	40,634 (59.6)	42,242 (60.1)	43,120 (59.4)	
Yes	130,006 (38.4)	24,125 (38.7)	24,849 (37.9)	26,249 (38.5)	26,789 (38.1)	27,994 (38.6)	
Missing	*6,562 (1.9)*						
LDL[h] cholesterol, mg/dL	137.5 (33.0)	135.2 (32.7)	137.6 (33.0)	138.1 (33.0)	138.1 (32.9)	138.3 (33.2)	5.07×10^{-61}
Missing, n (%)	*14,821 (4.4)*						
CRP[i], µg/mL	2.426 (3.597)	2.213 (3.468)	2.361 (3.552)	2.427 (3.591)	2.480 (3.612)	2.615 (3.723)	$<1.00 \times 10^{-300}$
Missing, n (%)	*14,872 (4.4)*						
eGFR[j], mg/dL	0.84 (0.85)	1.11 (0.79)	0.99 (0.84)	0.84 (0.85)	0.74 (0.85)	0.58 (0.81)	$<1.00 \times 10^{-300}$
Missing, n (%)	*14,404 (4.2)*						
Diabetes[k] GP, n (%)							4.97×10^{-22}
No	322,058 (95.0)	59,406 (95.2)	62,518 (95.4)	64,966 (95.3)	66,820 (95.0)	68,348 (94.2)	

	Yes	16,144 (4.8)	2,812 (4.5)	2,902 (4.4)	3,056 (4.5)	3,363 (4.8)	4,011 (5.5)	
	Missing	*811 (0.2)*						
Cancer[k] GP, n (%)								0.005
	No	312,760 (92.3)	57,415 (92.0)	60,367 (92.1)	62,889 (92.3)	65,020 (92.4)	67,069 (92.4)	
	Yes	25,349 (7.5)	4,757 (7.6)	5,013 (7.7)	5,096 (7.5)	5,156 (7.3)	5,327 (7.3)	
	Missing	*904 (0.3)*						
Hypertension[k] GP, n (%)								3.93x10^{-127}
	No	248,215 (73.2)	47,694 (76.5)	48,433 (73.9)	49,759 (73.0)	51,108 (72.7)	51,221 (70.6)	
	Yes	90,258 (26.6)	14,552 (23.3)	17,042 (26.0)	18,316 (26.9)	19,118 (27.2)	21,230 (29.3)	
	Missing	*540 (0.2)*						
Vascular disease[k] GP, n (%)								5.35x10^{-20}
	No	319,831 (94.3)	59,178 (94.9)	61,879 (94.4)	64,448 (94.5)	66,349 (94.3)	67,977 (93.7)	
	Yes	18,642 (5.5)	3,068 (4.9)	3,596 (5.5)	3,627 (5.3)	3,877 (5.5)	4,474 (6.2)	
	Missing	*540 (0.2)*						

[a]Data are shown as mean (SD) unless otherwise indicated; [b]P values are estimated using the Jonckheere-Terpstra test for trend for both continuous and categorical variables; [c]zLTL, Z-standardised leucocyte $\log_e$ telomere length; [d]Ethnic background is presented as reported through UK Biobank data collection. White ethnic background also includes British, Irish, and any other White background; Asian ethnic background also includes Asian or Asian British, Indian, Pakistani, Bangladeshi, and any other Asian background. Black ethnic background also includes Black or Black British, Caribbean, African, and any other Black background. Mixed ethnic background also includes White and Black African, White and Black Caribbean, White and Asian, and any other Mixed background; [e]Conversion factor from cells/mm^3 to 10^9 cells/Litre: divide with 0.001; [f]Normal weight category also includes 2,155 participants with BMI<18.5kg/m^2; [g]Statutory/ compulsory education is equivalent to "O-levels/CSE/GCSE" of the UK educational system, Advanced education is equivalent to the "A-levels/Non-vocational qualifications/ Other

professional educational qualifications” of the UK educational system; [h]LDL, low-density lipoproteins (conversion factor from mg/dL to mmol/L: divide with 0.0259); [i]CRP, C-reactive protein (conversion factor from μg/mL to mg/L: multiply by 1); [j]eGFR, estimated glomerular filtration rate (CKD-EPI) (conversion factor from mg/dL to umol/L: multiply by 88.496); [k]diseases are self-reported as diagnosed by doctor.

Table 7 Supplement. Association of the dietary patterns with leucocyte telomere length, in the UK Biobank using data collected during 2006-10.

	Base model[a]					
	Available data (N=339,013)[b]			*Imputed data (N=422,797)*		
	Beta[c] (95% CI)	P	Equivalent years of age-related change in LTL[d]	Beta (95% CI)	P	Equivalent years of age-related change in LTL
Quintiles of Mediterranean pattern, vs 1st (lowest)	*Global P[e]:*	$9.03x10^{-12}$		*Global P:*	$8.41x10^{-08}$	
2nd	0.020 (0.009; 0.031)	$2.95x10^{-04}$	0.87	0.015 (0.005; 0.026)	0.004	0.65
3rd	0.026 (0.016; 0.037)	$4.88x10^{-07}$	**1.13**[f]	0.019 (0.009; 0.029)	$2.28x10^{-04}$	0.83
4th	0.028 (0.017; 0.038)	$2.05x10^{-07}$	**1.22**	0.021 (0.011; 0.031)	$2.05x10^{-05}$	0.91
5th (highest)	0.040 (0.030; 0.051)	$1.93x10^{-13}$	**1.74**	0.032 (0.022; 0.042)	$1.31x10^{-09}$	**1.39**
Quintiles of Prudent pattern, vs 1st (lowest)	*Global P:*	$1.87x10^{-05}$		*Global P:*	$2.53x10^{-11}$	
2nd	0.008 (-0.002; 0.019)	0.123	0.35	0.010 (0.001; 0.020)	0.032	0.43
3rd	0.012 (0.002; 0.023)	0.024	0.52	0.018 (0.009; 0.028)	$1.61x10^{-04}$	0.78
4th	0.020 (0.010; 0.031)	$1.55x10^{-04}$	0.87	0.025 (0.015; 0.034)	$2.84x10^{-07}$	**1.09**
5th (highest)	0.025 (0.015; 0.036)	$2.72x10^{-06}$	**1.09**	0.034 (0.024; 0.043)	$7.36x10^{-12}$	**1.48**

	Beta (95% CI)	P	Equivalent years of age-related change in LTL	Beta (95% CI)	P	Equivalent years of age-related change in LTL
Quintiles of Meat intake pattern, vs 1st (lowest)						
	Global P:	8.84×10^{-09}		*Global P:*	1.51×10^{-10}	
2nd	-0.020 (-0.030; -0.009)	3.33×10^{-04}	-0.87	-0.019 (-0.028; -0.009)	1.15×10^{-04}	-0.83
3rd	-0.019 (-0.030; -0.008)	5.90×10^{-04}	-0.83	-0.022 (-0.031; -0.012)	8.80×10^{-06}	-0.96
4th	-0.030 (-0.040; -0.019)	6.89×10^{-08}	**-1.30**	-0.031 (-0.040; -0.021)	3.34×10^{-10}	**-1.35**
5th (highest)	-0.033 (-0.044; -0.023)	1.23×10^{-09}	**-1.43**	-0.032 (-0.041; -0.022)	1.90×10^{-10}	**-1.39**

Full model[g]

	Available data (N=259,855)			*Imputed data (N=422,797)*		
	Beta (95% CI)	P	Equivalent years of age-related change in LTL	Beta (95% CI)	P	Equivalent years of age-related change in LTL
Quintiles of Mediterranean pattern, vs 1st (lowest)	*Global P:*	0.009		*Global P:*	0.015	
2nd	0.001 (-0.012; 0.014)	0.870	0.04	0.007 (-0.003; 0.018)	0.172	0.30
3rd	0.008 (-0.004; 0.020)	0.199	0.35	0.008 (-0.002; 0.018)	0.119	0.35
4th	0.011 (-0.001; 0.023)	0.071	0.48	0.008 (-0.002; 0.018)	0.110	0.35
5th (highest)	0.020 (0.008; 0.033)	0.002	0.87	0.018 (0.008; 0.029)	4.59×10^{-04}	0.78
Quintiles of Prudent pattern, vs 1st (lowest)	*Global P:*	0.103		*Global P:*	3.03×10^{-05}	
2nd	0.001	0.917	0.04	0.003	0.602	0.13

	(-0.011; 0.013)			(-0.007; 0.012)		
3rd	0.001	0.839	0.04	0.008	0.121	0.35
	(-0.011; 0.013)			(-0.002; 0.017)		
4th	0.006	0.308	0.26	0.013	0.009	0.57
	(-0.006; 0.018)			(0.003; 0.022)		
5th (highest)	0.014	0.021	0.61	0.022	6.86x10^{-06}	0.96
	(0.002; 0.027)			(0.013; 0.032)		
Quintiles of Meat intake pattern, vs 1st (lowest)						
	Global P:	1.03x10^{-04}		*Global P:*	5.29x10^{-07}	
2nd	-0.015	0.014	-0.65	-0.015	0.002	-0.65
	(-0.028; -0.003)			(-0.025; -0.006)		
3rd	-0.012	0.047	-0.52	-0.018	2.89x10^{-04}	-0.78
	(-0.025; 0.000)			(-0.027; -0.008)		
4th	-0.027	1.87x10^{-05}	**-1.17**	-0.026	1.04x10^{-07}	**-1.13**
	(-0.039; -0.015)			(-0.036; -0.017)		
5th (highest)	-0.025	6.12x10^{-05}	**-1.09**	-0.025	5.14x10^{-07}	**-1.09**
	(-0.038; -0.013)			(-0.035; -0.015)		

[a]The base model includes the quintiles of adherence to the specific pattern, and is adjusted for age, sex, ethnic background and white blood cell. [b]Findings are shown for the subset of participants with available data to extract the patterns (white columns) and for the imputed data in the full cohort (blue shaded columns). [c]All beta coefficients are for z-standardised leucocyte telomere length (z-LTL) with the comparator groups specified in the table. [d]Equivalent years of age-related change in LTL is the ratio of the quintiles of adherence beta and the absolute value of age beta (|-0.023|). For example, in the fully adjusted model of the available data, z-LTL is shorter by 0.027SD in participants classified at the 4th quintile of the meat intake pattern, compared to the 1st quintile. This means that LTL is shorter by approximately 1.17 years (-0.027/0.023) for participants in the 4th quintile of the meat intake pattern compared to those in the 1st quintile. [e]A Global Pvalue has been estimated using a likelihood ratio test. [f]Bold fonts are used to highlight results with effect ≥ 1 year (in absolute value) age-related change in LTL. [g]The full model is additionally adjusted for smoking habits, physical activity, body mass index classification, highest educational qualification, experiencing

insomnia, fed-up feelings, low-density lipoprotein, C-reactive protein, estimated glomerular filtration rate (CKD-EPI) and self-reported diseases diagnosed by doctor (diabetes, cancer, hypertension and vascular diseases).

Table 8 Supplement. Association of the dietary patterns with leucocyte telomere length, after excluding C-reactive protein from the fully adjusted model, in the UK Biobank using data collected during 2006-10.

	Full model[a]					
	Available data[b] (N=259,855)			*Imputed data (N=422,797)*		
	Beta[c] (95% CI)	P	Equivalent years of age-related change in LTL[d]	Beta (95% CI)	P	Equivalent years of age-related change in LTL
Quintiles of Mediterranean pattern, vs 1st (lowest)	*Global P[e]:*	0.004		*Global P:*	0.006	
2nd	0.002 (-0.010; 0.015)	0.74	0.09	0.008 (-0.003; 0.018)	0.15	0.35
3rd	0.009 (-0.003; 0.021)	0.14	0.39	0.009 (-0.001; 0.019)	0.09	0.39
4th	0.013 (0.001; 0.025)	0.04	0.57	0.009 (-0.001; 0.019)	0.07	0.39
5th (highest)	0.022 (0.009; 0.034)	5.52×10^{-04}	0.96	0.020 (0.010; 0.030)	1.58×10^{-04}	0.87
Quintiles of Prudent pattern, vs 1st (lowest)	*Global P:*	0.06		*Global P:*	3.03×10^{-05}	
2nd	0.001 (-0.011; 0.013)	0.85	0.04	0.003 (-0.007; 0.012)	0.60	0.13
3rd	0.002 (-0.010; 0.014)	0.77	0.09	0.008 (-0.002; 0.017)	0.12	0.35
4th	0.007 (-0.005; 0.019)	0.25	0.30	0.013 (0.003; 0.022)	0.009	0.57
5th (highest)	0.016 (0.003; 0.028)	0.012	0.70	0.022 (0.013; 0.032)	6.86×10^{-06}	0.96

Quintiles of Meat intake pattern, vs 1st (lowest)						
Global P:	4.01×10^{-05}			*Global P:*	5.29×10^{-07}	
2nd	-0.015 (-0.028; -0.003)	0.015	-0.65	-0.015 (-0.025; -0.006)	0.002	-0.65
3rd	-0.013 (-0.025; 0.000)	0.042	-0.57	-0.018 (-0.027; -0.008)	2.89×10^{-04}	-0.78
4th	-0.028 (-0.040; -0.015)	1.10×10^{-05}	**-1.22**[f]	-0.026 (-0.036; -0.017)	1.00×10^{-07}	**-1.13**
5th (highest)	-0.027 (-0.039; -0.014)	2.39×10^{-05}	**-1.17**	-0.025 (-0.035; -0.015)	5.10×10^{-07}	**-1.09**

[a]The full model includes the quintiles of adherence to the specific pattern, and is adjusted for age, sex, ethnic background, white blood cell, smoking habits, physical activity, body mass index classification, highest educational qualification, experiencing insomnia, fed-up feelings, low-density lipoprotein, estimated glomerular filtration rate (CKD-EPI) and self-reported diseases diagnosed by doctor (diabetes, cancer, hypertension and vascular diseases). [b]Findings are shown for the subset of participants with available data to extract the patterns (white columns) and for the imputed data in the full cohort (blue shaded columns). [c]All beta coefficients are for z-standardised leucocyte telomere length (z-LTL) with the comparator groups specified in the table. [d]Equivalent years of age-related change in LTL is the ratio of the quintiles of adherence beta and the absolute value of age beta (|-0.023|). For example, in the fully adjusted model of the available data, z-LTL is shorter by 0.028SD in participants classified at the 4th quintile of the meat intake pattern, compared to the 1st quintile. This means that LTL is shorter by approximately 1.22 years (-0.028/0.023) for participants in the 4th quintile of the meat intake pattern compared to those in the 1st quintile. [e]A Global Pvalue has been estimated using a likelihood ratio test. [f]Bold fonts are used to highlight results with effect ≥ 1 year (in absolute value) age-related change in LTL.

Table 9 Supplement. Association of the dietary patterns with leucocyte telomere length, in the UK Biobank using data collected during 2006-10, with the inclusion of continuous covariates for smoking, physical activity and body mass index instead of categorical.

	Full model[a]					
	Available data (N=219,266)[b]			*Imputed data (N=422,797)*		
	Beta[c] (95% CI)	P	Equivalent years of age-related change in LTL[d]	Beta (95% CI)	P	Equivalent years of age-related change in LTL
Quintiles of Mediterranean pattern, vs 1st (lowest)	*Global P*[e]*:*	0.006		*Global P:*	0.002	
2nd	$3.34x10^{-05}$ (-0.01; 0.01)	0.99	0.00	0.008 (-0.002; 0.019)	0.127	0.35
3rd	0.010 (-0.003; 0.02)	0.12	0.44	0.010 (-0.0002; 0.020)	0.055	0.43
4th	0.008 (-0.006; 0.02)	0.26	0.33	0.010 (0.0003; 0.020)	0.044	0.43
5th (highest)	0.022 (0.009; 0.04)	0.001	0.97	0.021 (0.011; 0.031)	$2.99x10^{-05}$	0.91
Quintiles of Prudent pattern, vs 1st (lowest)	*Global P:*	0.09		*Global P:*	$8.39x10^{-07}$	
2nd	-0.001 (-0.01; 0.01)	0.83	-0.06	0.005 (-0.004; 0.014)	0.31	0.22
3rd	0.003 (-0.010; 0.02)	0.63	0.14	0.008 (-0.001; 0.017)	0.101	0.35
4th	0.007 (-0.006; 0.02)	0.28	0.32	0.016 (0.006; 0.025)	0.001	0.70
5th (highest)	0.016 (0.002; 0.03)	0.02	0.67	0.026 (0.016; 0.036)	$1.54x10^{-07}$	**1.13**[f]

Quintiles of Meat intake pattern, vs 1st (lowest)						
	Global P:	1.00×10^{-4}		*Global P:*	6.89×10^{-8}	
2nd	-0.001 (-0.03; -0.002)	0.03	-0.66	-0.015 (-0.025; -0.006)	0.002	0.65
3rd	-0.013 (-0.026; 0.00)	0.06	-0.56	-0.018 (-0.028; -0.009)	1.88×10^{-4}	0.78
4th	-0.030 (-0.043; -0.02)	1.23×10^{-05}	**-1.30**	-0.027 (-0.037; -0.018)	2.98×10^{-8}	**-1.17**
5th (highest)	-0.025 (-0.039; -0.01)	2.30×10^{-04}	**-1.10**	-0.027 (-0.036; -0.017)	8.39×10^{-8}	**-1.17**

[a]Compared to the fully adjusted model shown in Table 7, the full model shown here is adjusted for age, sex, ethnic background, white blood cell, packs of years of smoking (UK Biobank field "20161"), MET min/week for all activity ("22040"), body mass index ("21001"), highest educational qualification, experiencing insomnia, fed-up feelings, low-density lipoprotein, C-reactive protein, estimated glomerular filtration rate (CKD-EPI) and self-reported diseases diagnosed by doctor (diabetes, cancer, hypertension and vascular diseases). [b]Findings are shown for the subset of participants with available data to extract the patterns (white columns) and for the imputed data in the full cohort (blue shaded columns). [c]All beta coefficients are for z-standardised leucocyte telomere length (z-LTL) with the comparator groups specified in the table. [d]Equivalent years of age-related change in LTL is the ratio of the quintiles of adherence beta and the absolute value of age beta (|-0.023|). For example, in the fully adjusted model of the available data, z-LTL is shorter by 0.030SD in participants classified at the 4th quintile of the meat intake pattern, compared to the 1st quintile. This means that LTL is shorter by approximately 1.30 years (-0.030/0.023) for participants in the 4th quintile of the meat intake pattern compared to those in the 1st quintile. [e]A Global Pvalue has been estimated using a likelihood ratio test. [f]Bold fonts are used to highlight results with effect ≥ 1 year (in absolute value) age-related change in LTL.

Table 10 Supplement. UK Biobank participants' demographic, lifestyle and clinical characteristics[a], collected during 2006-10, by adherence to a certain dietary practice.

	Total	Vegetarian			Eating five-a-day of fruit and vegetables			Abstaining from eggs/ dairy/ wheat/ sugar		
		Yes	No	P[b]	Yes	No	P	Yes	No	P
n (%)	420,919	7,680 (1.8)	413,239 (98.2)		75,223 (17.9)	345,696 (82.1)		95,850 (22.8)	325,069 (77.2)	
z-LTL[c], SD	-0.0003 (1.000)	0.129 (0.993)	-0.003 (1.000)	$2.38x10^{-30}$	0.025 (0.999)	-0.006 (1.000)	$9.93x10^{-15}$	-0.070 (1.002)	0.020 (0.999)	$8.16x10^{-133}$
Age, year	56.6 (8.0)	53.3 (7.9)	56.6 (8.0)	$1.13x10^{-286}$	57.5 (7.7)	56.3 (8.1)	$2.84x10^{-297}$	58.6 (7.4)	56.0 (8.1)	$<1.00x10^{-300}$
Male sex, n (%)	194,186 (46.1)	2,616 (34.1)	191,570 (46.4)	$9.2x10^{-102}$	28,184 (37.5)	166,002 (48.0)	$<1.00x10^{-300}$	44,621 (46.6)	149,565 (46.0)	0.003
Ethnic background[d], n (%)				$<1.00x10^{-300}$			$9.51x10^{-304}$			$2.15x10^{-14}$
White	398,663 (94.7)	6,167 (80.3)	392,496 (95.0)		69,302 (92.1)	329,361 (95.3)		90,641 (94.6)	308,022 (94.8)	
Black	6,455 (1.5)	42 (0.6)	6,413 (1.6)		1,563 (2.1)	4,892 (1.4)		1,555 (1.6)	4,900 (1.5)	
Asian	8,113 (1.9)	1,312 (17.1)	6,801 (1.7)		2,291 (3.1)	5,822 (1.7)		2,042 (2.1)	6,071 (1.9)	
Mixed	2,497 (0.6)	63 (0.8)	2,434 (0.6)		491 (0.7)	2,006 (0.6)		495 (0.5)	2,002 (0.6)	
Chinese	1,356 (0.3)	15 (0.2)	1,341 (0.3)		355 (0.5)	1,001 (0.3)		228 (0.2)	1,128 (0.4)	
Other	3,835 (0.9)	81 (1.1)	3,754 (0.9)		1,221 (1.6)	2,614 (0.8)		889 (0.9)	2,946 (0.9)	
White blood cell[e], cells/mm^3	6,868 (1,736)	6,753 (1,698)	6,870 (1,737)	$3.17x10^{-09}$	6,716 (1,688)	6,901 (1,744)	$2.87x10^{-158}$	6,932 (1,771)	6,849 (1,725)	$9.66x10^{-34}$
Smoking status, n (%)				$5.23x10^{-62}$			$1.68x10^{-320}$			$3.7x10^{-125}$
Never	229,553 (54.5)	4,876 (63.8)	224,677 (54.6)		41,969 (56.0)	187,584 (54.5)		49,381 (51.8)	180,172 (55.6)	
Previous	145,860 (34.7)	2,247 (29.4)	143,613 (34.9)		27,965 (37.3)	117,895 (34.2)		36,232 (38.0)	109,628 (33.8)	
Current	44,040 (10.5)	521 (6.8)	43,519 (10.6)		4,997 (6.7)	39,043 (11.3)		9,742 (10.2)	34,298 (10.6)	
Missing	*1,466 (0.4)*									
Physical activity, n (%)				$5.84x10^{-04}$			$<1.00x10^{-300}$			$3.01x10^{-49}$
Low	64,521 (15.3)	1,121 (17.5)	63,400 (18.9)		8,005 (12.8)	56,516 (20.3)		14,098 (18.3)	50,423 (19.0)	
Moderate	139,303 (33.1)	2,574 (40.1)	136,729 (40.8)		22,667 (36.2)	116,636 (41.8)		29,994 (39.0)	109,309 (41.3)	
Vigorus	137,855 (32.8)	2,725 (42.5)	135,130 (40.3)		31,869 (51.0)	105,986 (38.0)		32,805 (42.7)	105,050 (39.7)	
Missing	*79,240 (18.8)*									

Body mass index classification, n (%)				$8.56x10^{-233}$			$1.76x10^{-10}$			$1x10^{-300}$
Normal weight[f]	138,869 (33.0)	3,814 (50.2)	135,055 (32.8)		25,269 (33.7)	113,600 (33.0)		27,637 (29.0)	111,232 (34.3)	
Overweight	178,679 (42.5)	2,665 (35.0)	176,014 (42.8)		31,087 (41.5)	147,592 (42.9)		40,476 (42.5)	138,203 (42.7)	
Obesity	101,781 (24.2)	1,126 (14.8)	100,655 (24.5)		18,529 (24.7)	83,252 (24.2)		27,242 (28.6)	74,539 (23.0)	
Missing	*1,590 (0.4)*									
Highest education[g], n (%)				$6.33x10^{-244}$			$1.95x10^{-52}$			$<1.00x10^{-300}$
None	70,315 (16.7)	671 (8.9)	69,644 (17.0)		12,612 (17.0)	57,703 (16.9)		22,558 (23.9)	47,757 (14.8)	
Statutory/ compulsory education	70,027 (16.6)	977 (12.9)	69,050 (16.9)		11,629 (15.7)	58,398 (17.1)		15,861 (16.8)	54,166 (16.8)	
Advanced education	137,931 (32.8)	2,102 (27.7)	135,829 (33.2)		23,737 (31.9)	114,194 (33.4)		30,482 (32.3)	107,449 (33.3)	
University/ college degree	138,425 (32.9)	3,828 (50.5)	134,597 (32.9)		26,335 (35.4)	112,090 (32.7)		25,504 (27.0)	112,921 (35.0)	
Missing	*4,221 (1.0)*									
Insomnia, n (%)				$1.51x10^{-08}$			$2.24x10^{-08}$			$8.87x10^{-55}$
Never/rarely	101,980 (24.2)	2,082 (27.1)	99,898 (24.2)		18,177 (24.2)	83,803 (24.3)		22,340 (23.3)	79,640 (24.5)	
Sometimes	200,524 (47.6)	3,540 (46.2)	196,984 (47.7)		35,246 (46.9)	165,278 (47.9)		44,621 (46.6)	155,903 (48.0)	
Usually	118,091 (28.1)	2,049 (26.7)	116,042 (28.1)		21,739 (28.9)	96,352 (27.9)		28,796 (30.1)	89,295 (27.5)	
Missing	*324 (0.1)*									
Fed-up feelings, n (%)				0.266			$4.08x10^{-103}$			0.679
No	245,028 (58.2)	4,386 (58.9)	240,642 (59.5)		46,399 (63.1)	198,629 (58.8)		55,768 (59.6)	189,260 (59.5)	
Yes	166,622 (39.6)	3,061 (41.1)	163,561 (40.5)		27,181 (36.9)	139,441 (41.3)		37,831 (40.4)	128,791 (40.5)	
Missing	*9,269 (2.2)*									
LDL[h] cholesterol, mg/dL	137.3 (33.2)	129.8 (30.7)	137.5 (33.2)	$1.46x10^{-86}$	135.7 (33.2)	137.7 (33.2)	$8.32x10^{-49}$	133.4 (34.5)	138.5 (32.7)	$<1.00x10^{-300}$
Missing, n (%)	*18,164 (4.3)*									
CRP[i], µg/mL	2.518 (3.690)	2.128 (3.347)	2.525 (3.696)	$2.84x10^{-72}$	2.330 (3.486)	2.559 (3.732)	$1.57x10^{-126}$	2.466 (3.630)	2.694 (3.883)	$1.09x10^{-100}$
Missing, n (%)	*18,276 (4.3)*									
eGFR[j], mg/dL	0.87 (0.85)	1.00 (0.75)	0.87 (0.85)	$8.01x10^{-37}$	1.00 (0.82)	0.85 (0.85)	$<1.00x10^{-300}$	0.86 (0.85)	0.88 (0.85)	$2.25x10^{-06}$
Missing, n (%)	*17,626 (4.2)*									

Diabetes[k], n (%)				0.043			7.67×10^{-45}			$<1.00\times10^{-300}$
No	397,855 (94.5)	7,292 (95.3)	390,563 (94.8)		70,320 (93.8)	327,535 (95.0)		83,751 (87.7)	314,104 (96.9)	
Yes	21,890 (5.2)	360 (4.7)	21,530 (5.2)		4,687 (6.3)	17,203 (5.0)		11,737 (12.3)	10,153 (3.1)	
Missing	*1,174 (0.3)*									
Cancer[k], n (%)				1.55×10^{-08}			9.36×10^{-18}			2.02×10^{-35}
No	387,662 (92.1)	7,194 (94.1)	380,468 (92.4)		68,712 (91.6)	318,950 (92.6)		87,286 (91.5)	300,376 (92.7)	
Yes	31,937 (7.6)	452 (5.9)	31,485 (7.6)		6,272 (8.4)	25,665 (7.5)		8,159 (8.6)	23,778 (7.3)	
Missing	*1,320 (0.3)*									
Hypertension[k], n (%)				8.3×10^{-68}			1.31×10^{-15}			$<1.00\times10^{-300}$
No	306,106 (72.7)	6,252 (81.6)	299,854 (72.7)		53,814 (71.7)	252,292 (73.1)		63,325 (66.3)	242,781 (74.8)	
Yes	113,963 (27.1)	1,407 (18.4)	112,556 (27.3)		21,246 (28.3)	92,717 (26.9)		32,246 (33.7)	81,717 (25.2)	
Missing	*850 (0.2)*									
Vascular disease[k], n (%)				2.69×10^{-27}			0.074			$<1.00\times10^{-300}$
No	395,838 (94.0)	7,436 (97.1)	388,402 (94.2)		70,627 (94.1)	325,211 (94.3)		87,427 (91.5)	308,411 (95.0)	
Yes	24,231 (5.8)	223 (2.9)	24,008 (5.8)		4,433 (5.9)	19,798 (5.7)		8,144 (8.5)	16,087 (5.0)	
Missing	*850 (0.2)*									

[a]Data are shown as mean (SD) unless otherwise indicated; [b]P values are estimated using the Jonckheere-Terpstra test for trend for both continuous and categorical variables; [c]zLTL, Z-standardised leucocyte $\log_e$ telomere length; [d]Ethnic background is presented as reported through UK Biobank data collection. White ethnic background also includes British, Irish, and any other White background. Asian ethnic background also includes Asian or Asian British, Indian, Pakistani, Bangladeshi, and any other Asian background. Black ethnic background also includes Black or Black British, Caribbean, African, and any other Black background. Mixed ethnic background also includes White and Black African, White and Black Caribbean, White and Asian, and any other Mixed background; [e]Conversion factor from cells/mm^3 to 10^9 cells/Litre: divide with 0.001; [f]Normal weight category also includes 2,155 participants with BMI<18.5kg/m^2; [g]Statutory/ compulsory education is equivalent to

“O-levels/CSE/GCSE” of the UK educational system, Advanced education is equivalent to the “A-levels/Non-vocational qualifications/ Other professional educational qualifications” of the UK educational system; [h]LDL, low-density lipoproteins (conversion factor from mg/dL to mmol/L: divide with 0.0259); [i]CRP, C-reactive protein (conversion factor from μg/mL to mg/L: multiply by 1); [j]eGFR, estimated glomerular filtration rate (CKD-EPI) (conversion factor from mg/dL to umol/L: multiply by 88.496); [k]diseases are self-reported as diagnosed by doctor.

Table 11 Supplement. Association of the dietary practices with leucocyte telomere length, in the UK Biobank using data collected during 2006-10.

	Available data (N=420,919)[a]					
	Base model[b]			*Full model*[c]		
	Beta[d] (95% CI)	P	Equivalent years of age-related change in LTL[e]	Beta (95% CI)	P	Equivalent years of age-related change in LTL
Follow vegetarian diet vs No	0.029 (0.007; 0.051)	0.011	**1.26**[f]	0.006 (-0.020; 0.031)	0.66	0.26
Eating five-a-day of fruit and vegetable vs No	0.031 (0.023; 0.039)	5.61×10^{-15}	**1.35**	0.027 (0.018; 0.036)	5.36×10^{-09}	**1.17**
Abstaining from eggs/dairy/wheat/sugar vs No	-0.026 (-0.033; -0.019)	2.57×10^{-13}	**-1.13**	-0.016 (-0.024; -0.007)	2.51×10^{-04}	-0.70
	Imputed data (N=422,797)					
	Base model			*Full model*		
	Beta (95% CI)	P	Equivalent years of age-related change in LTL	Beta (95% CI)	P	Equivalent years of age-related change in LTL
Follow vegetarian diet vs No	0.025 (0.003; 0.047)	0.027	**1.09**	0.009 (-0.013; 0.031)	0.42	0.39
Eating five-a-day of fruit and vegetable vs No	0.031	7.83×10^{-15}	**1.35**	0.027	9.96×10^{-12}	**1.17**

	(0.023; 0.038)			(0.019; 0.035)		
Abstaining from eggs/dairy/wheat/sugar vs No	-0.026	$2.26x10^{-13}$	**-1.13**	-0.013	$3.18x10^{-04}$	-0.57
	(-0.034; -0.019)			(-0.020; -0.006)		

[a]Findings are shown for the subset of participants with available data on dietary practices (white columns) and for the imputed data in the full cohort (blue shaded columns). [b]The base model includes the adherence to the specific dietary practice and is adjusted for age, sex, ethnic background and white blood cell. [c]The full model is additionally adjusted for smoking habits, physical activity, body mass index classification, highest educational qualification, experiencing insomnia, fed-up feelings, low-density lipoprotein (LDL), C-reactive protein (CRP), estimated glomerular filtration rate (CKD-EPI; eGFR) and self-reported diseases diagnosed by doctor (diabetes, cancer, hypertension and vascular diseases). [d]All beta coefficients are for z-standardised leucocyte telomere length (z-LTL) with the comparator groups specified in the table. [e]Equivalent years of age related change in LTL is the ratio of the adherence beta and the absolute value of age beta (|-0.023|). For example, in the fully adjusted model of the available data, z-LTL is longer by 0.027SD in participants who adhere to the “eating five-a-day servings of fruit and vegetables” guideline, compared to non-adherents. This means that LTL is longer by approximately 1.17 years (0.027/0.023) for adherents to the guideline of “eating five-a-day” compered to non-adherents. [f]Bold fonts are used to highlight results with effect ≥ 1 year (in absolute value) age-related change in LTL.

Table 12 Supplement. Association of the dietary practices with leucocyte telomere length, after excluding C-reactive protein from the fully adjusted model, in the UK Biobank using data collected during 2006-10.

	Full model[a]					
	Available data[b] *(N=420,919)*			*Imputed data (N=422,797)*		
	Beta[c] (95% CI)	P	Equivalent years of age-related change in LTL[d]	Beta (95% CI)	P	Equivalent years of age-related change in LTL
Follow vegetarian diet vs No	0.005 (-0.021; 0.030)	0.72	0.22	0.009 (-0.013; 0.032)	0.40	0.39
Eating five-a-day of fruit and vegetables vs No	0.028 (0.019; 0.037)	$1.14x10^{-09}$	**1.22**[e]	0.028 (0.020; 0.036)	$1.13x10^{-12}$	**1.22**
Abstaining from eggs/dairy/wheat/sugar vs No	-0.015 (-0.024; -0.007)	$3.32x10^{-04}$	-0.65	-0.013 (-0.020; -0.006)	$3.72x10^{-04}$	-0.57

[a]The full model includes the adherence to the specific dietary practice, and is adjusted for age, sex, ethnic background, white blood cell, smoking habits, physical activity, body mass index classification, highest educational qualification, experiencing insomnia, fed-up feelings, low-density lipoprotein, estimated glomerular filtration rate (CKD-EPI) and self-reported diseases diagnosed by doctor (diabetes, cancer, hypertension and vascular diseases). [b]Findings are shown for the subset of participants with available data to extract the practices (white columns) and for the imputed data in the full cohort (blue shaded columns). [c]All beta coefficients are for z-standardised leucocyte telomere length (z-LTL) with the comparator groups specified in the table. [d]Equivalent years of age-related change in LTL is the ratio of the adherence beta and the absolute value of age beta (|-0.023|). For example, in the fully adjusted model of the available data, z-LTL is longer by 0.028SD in adherents to the "eat five-a-day servings of fruit and vegetables" guideline, compared to non-adherents. This means that LTL is longer by approximately 1.22 years

(0.028/0.023) in adherents to the guideline of “eating five-a-day”, compared to non-adherents. [e]Bold fonts are used to highlight results with effect ≥ 1 year (in absolute value) age-related change in LTL.

Table 13 Supplement. Association of the dietary practices with leucocyte telomere length, in the UK Biobank using data collected during 2006-10, with the inclusion of continuous covariates for smoking, physical activity and body mass index instead of categorical.

	Full model[a]					
	Available data[b] (N=385,074)			*Imputed data (N=422,797)*		
	Beta[c] (95% CI)	P	Equivalent years of age-related change in LTL[d]	Beta (95% CI)	P	Equivalent years of age-related change in LTL
Follow vegetarian diet vs No	0.005 (-0.02; 0.03)	0.71	0.22	0.010 (-0.012; 0.032)	0.37	0.44
Eating five-a-day of fruit and vegetables vs No	0.028 (0.018; 0.037)	$2.89x10^{-08}$	**1.22**[e]	0.029 (0.021; 0.037)	$2.58x10^{-13}$	**1.26**
Abstaining from eggs/dairy/wheat/sugar vs No	-0.015 (-0.024; -0.006)	0.002	-0.65	-0.013 (-0.020; -0.006)	$3.85x10^{-04}$	-0.57

[a]Compared to the fully adjusted model shown in Table 11, the full model shown here is adjusted for age, sex, ethnic background, white blood cell, packs of years of smoking (UK Biobank field "20161"), MET min/week for all activity ("22040"), body mass index ("21001"), highest educational qualification, experiencing insomnia, fed-up feelings, low-density lipoprotein, C-reactive protein, estimated glomerular filtration rate (CKD-EPI) and self-reported diseases diagnosed by doctor (diabetes, cancer, hypertension and vascular diseases). [b]Findings are shown for the subset of participants with available data to extract the patterns (white columns) and for the imputed data in the full cohort (blue shaded columns). [c]All beta coefficients are for z-standardised leucocyte telomere length (z-LTL) with the comparator groups specified in the table. [d]Equivalent years of age-related change in LTL is the ratio of the quintiles of adherence beta and the absolute value of age beta (|-0.023|). For example, in the fully adjusted model of the available data, z-LTL is longer by 0.028SD in participants adhering to the "eat five-a-day servings of fruit and vegetables" guideline, compared to non-adherents. This means that LTL is longer by approximately 1.22 years (0.028/0.023) for

adherents to the guideline of “eating five-a-day”, compared to non-adherents. [e]Bold fonts are used to highlight results with effect ≥ 1 year (in absolute value) age-related change in LTL.