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On the Relationship between Lifestyle and Happiness in the UK

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Abstract

In the present paper we attempt to analyse the relationship between ‘lifestyle’ and happiness in the UK using fixed effects and granger causality tests to test for endogeneity. We split the analysis by gender and find different effects between women and men. While men seem to be more physically active and this active lifestyle impacts stronger on their wellbeing than on the one of women, women seem to be more conscientious with respect to nutrition and nutrition impacts stronger on the wellbeing of women than on the wellbeing of men. In general lifestyle variables have a significantly positive impact on happiness and the impact remains significant with the use of fixed effects for both genders. This suggests that a ‘healthy lifestyle’ has a positive impact on happiness and that any policy improving our lifestyle proxies would also make people happier in the UK.

Keywords: Wellbeing, Life Satisfaction, Happiness, Nutrition, Exercise, Lifestyle, Fixed Effects, Granger Causality

JEL Classifications: D31, I31

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Non-technical summary

Diet and life style diseases have become the main causes of morbidity and mortality worldwide. Both in the US and in Europe, the consumption of meat, dairy products, oil and fat, sugar, and alcoholic beverages has increased in the second half of the 20th century. This, together with drug abuse, tobacco and lack of exercise, has increased the risk of developing certain chronic diseases like some types of cancer, heart disease, stroke and obesity. In particular obesity, with its attendant impact on health, has become a central problem in many Western economies. Obesity levels in the UK have more than trebled in the last 30 years and the UK has reached the highest level of obesity in Western Europe, ahead of countries such as Ireland, Spain, Portugal and Germany being labelled 'The fat man of Europe'.¹ This is not only a matter of life and death but also a problem that has a huge economic impact. The cost of diet-related ill health for the healthcare system in the UK have been estimated to be £ 5.8 billion.² Moreover, the National Audit Office estimated that if the population met national nutritional guidelines, the health benefits that would accrue could be valued at £19.9 billion each year in quality adjusted life years.³ In addition, there might well be indirect costs relating to the impact that such a diet may have on subjective well-being. It is this that we are concerned with in this project where we show that a better lifestyle, reflected in our study by increased exercise and a better nutrition does seem to impact significantly positive on the life satisfaction of both men and women. Moreover, we find that the effect of a better life-style has a long-term effect on life-satisfaction. We also find that sports activity impacts more strongly on the well-being of men while nutrition is more significant in the case of women. Therefore, measures targeting the increased consumption of fruit and vegetables especially for women and targeting an increased level of exercise especially for men, may be more efficient than simply encouraging both life style dimensions for both genders equally. These findings could help inform policy in the field of health and well-being.

¹ Source: The State of Food and Agriculture 2013, United Nations Food and Agricultural Organization (<http://www.fao.org/docrep/018/i3300e/i3300e.pdf>).

² Scarborough et al. (2011), Journal of Public Health.

³ National Audit Office C., Food: An Analysis of the Issue, The Strategy Unit, 2008

1. Introduction

In this paper we are concerned with the relationship between lifestyle and happiness. Is a healthy lifestyle associated with greater life satisfaction? Is it associated with better mental health? Which aspects of lifestyle are significant? Is it the food we eat or the physical activity we undertake? We distinguish between life satisfaction and the GHQ measure of mental well-being¹ on the grounds that the former is a longer term evaluative measure of wellbeing and the latter is a psychological shorter term measure (Jackson 2007, Dolan et al. 2008). It is possible that lifestyle has a very different impact on these two aspects of well-being. Thus, while indulgence might lead to short term spikes in well-being as measured by the GHQ, it might result in a worsening of life satisfaction (a longer term evaluative measure of well-being). To analyse this, we consider two lifestyle variables – the number of fruit and vegetables eaten in a day and the amount of exercise undertaken – using data from the Understanding Society survey for the UK.² As with life satisfaction studies more generally, our analysis may also be affected by endogeneity. We therefore test for it using a Granger Causality test. Our results indicate that while there is weak evidence of reverse causality for women, there is none for men. In addition, we use fixed effects to capture the impact of individual-related omitted factors like background and personality (Ferrer-I-Carbonell and Frijters, 2004, Steel, Schmidt and Shulz, 2008). We find that, despite levels of life satisfaction being comparable for men and women, the relationship between life satisfaction and lifestyle is different across gender. In particular, exercise is more important for men and food consumption is more important for women.

Diet and life style diseases have become the main causes of morbidity and mortality worldwide. Both in the US and in Europe, the consumption of meat, dairy products, oil and fat, sugar, and alcoholic beverages has increased in the second half of the 20th century. This, together with drug abuse, tobacco and lack of exercise, has increased the risk of developing certain chronic diseases like some types of cancer, heart disease, stroke and obesity. In particular obesity, with its attendant impact on health, has become a central problem in many Western economies. Obesity levels in the UK have more than trebled in the last 30 years and the UK has reached the

¹ The GHQ was developed ‘as a screening tool to detect those likely to have or be at risk of developing psychiatric disorders, it is a measure of the common mental health problems/domains of depression, anxiety, somatic symptoms and social withdrawal’ (Jackson, 2007).

² Even though the notions wellbeing, happiness and, life satisfaction are not identical, because they are highly correlated we use them interchangeably as most of the literature does. For example using the Euro-Barometer surveys conducted across 12 European countries, a significant correlation of 0.56 was found between happiness and life satisfaction (Di Tella, MacCulloch and Oswald, 2001).

highest level of obesity in Western Europe, ahead of countries such as Ireland, Spain, Portugal and Germany.³

Scarborough et al (2011) have estimated that *poor diet-related* ill health costs for the healthcare system in the UK (NHS) in 2006-2007 were 5.8 billion British Pound (or 7.3 billion Euro). The National Audit Office (NAO 2008) estimated that if the population met national nutritional guidelines, the health benefits that would accrue could be valued at £19.9 billion each year in quality adjusted life years. These are the direct costs. In addition, there might well be indirect costs relating to the impact that such a diet may have on subjective well-being. It is this that we are concerned with in this paper.

This paper makes two main contributions to the literature. First, it is one of the few papers to consider the impact of two aspects of life style– nutrition and exercise – on well-being split by gender. Second, while we do not instrument to correct for endogeneity we do test for the robustness of our results to reverse causality (using Granger Causality) and attempt to correct for omitted variables through the use of fixed effects that is facilitated by the availability of panel data. Reverse causality might arise because happy people may also be those who make healthier lifestyle decisions. Our results for the Granger Causality test provide very limited evidence for reverse causality of this kind. In the context of our study, the potential positive relationship between lifestyle and happiness may be driven by a third variable like personality. Thus, there might be certain types of personality that are less myopic and take a longer term view of their life. Such individuals are more likely to trade off the shorter term discomfort of a healthy lifestyle against the longer term health and life satisfaction benefits from such a lifestyle. Other such confounding factors could be background wealth, or prior family upbringing (Mujcic and Oswald 2016).⁴ We correct for this possibility by using individual fixed effects, which capture the impact of personality amongst other things (Ferrer-I-Carbonell, and Frijters, 2004).

Our dataset is a two-period panel of the Understanding Society Database. Lifestyle questions were asked in wave 2 and wave 5 of this dataset, which was released in November 2015. The fixed factors, of course, help to control for several potential omitted variables (not just personality) that remain fixed over time including childhood environment, parental influence and so on.

³ Source: The State of Food and Agriculture 2013, United Nations Food and Agricultural Organization (<http://www.fao.org/docrep/018/i3300e/i3300e.pdf>).

⁴ In our study we control for both marital status and income but there may be one or more such variables that we do not observe.

The rest of the paper is structured as follows. We will begin with a literature review in the next section, followed by a conceptual framework in section 2 and will discuss data and the methodology we employ in section 3. We will end by discussing our results, starting with our central results and followed by our robustness tests.

Literature Review

More recently, the Global Burden of Disease (GBD) worldwide (2013) study has estimated that up to half of all premature deaths in the US are due to behavioural and other preventable factors. According to the GBD study behavioural factors seem to cause 35% - while metabolic risk factors only 29% - of premature deaths in the US (Murray et al., 2013). In the UK, behaviour seems to account for 28% to disability adjusted life-years, metabolism seems to account only for 19% (Newton et al, 2015). Both studies indicate that there has been progress in reducing early deaths from tobacco and alcohol use, but the gains are being erased by deaths linked to lifestyle factors such as poor diet and lack of physical activity. Thus, declines in mortality have not been matched by similar declines in morbidity and people are living longer with disease.

Loewenstein, O'Donoghue and Bahatia (2015) and Ruhm (2012) develop a 'dual decision model' in which decisions are influenced by two parts of the brain, the "affective" system and the "deliberative" system. The affective system coordinates sensory inputs to generate emotional states like anger or happiness. The deliberative system incorporates higher cognitive processes, such as abstract thinking and planning, which account for long-term consequences of actions. In this dual decision model, "eating behaviours reflect the combined influence of a utility-maximizing deliberative system and an affective system that responds quickly and impulsively to external stimuli, without accounting for the long-term consequences." In this model individuals trade off the utility (or happiness) from eating food today against the expense and disutility of future weight gain and therefore, unhealthy or addictive behaviour may be a perfectly rational outcome. If life satisfaction is a long term evaluative measure and the GHQ a psychological measure of wellbeing, then we might expect to see different effects on these two outcome variables. The negative long term health effect of unhealthy behaviour might be compensated through a positive marginal utility short term effect. This therefore implies that the impact of lifestyle on happiness is not straightforward or clear, especially when studied using cross-sectional data.

Welsch (2012), studying the relationship between organic food and health, indicated that the relationship ‘may be spurious due to common unobserved factors, in particular a health oriented lifestyle’. To correct for this endogeneity, Welsch instrumented the ‘health oriented lifestyle’ by an individual’s acceptance that a consistent switch to renewable energies is needed. When introduced in the regression this instrument produced an insignificant impact of organic food on health. The author concluded that ‘consumers of organic food may have a healthier lifestyle overall which, being unobserved, leads to a positive but spurious relationship between organic food and health status’. Graham, Eggers and Sukhtankar (2004) for example have shown for Russia from 1995-2000 a significant causation from happiness to health and they conclude that happier people do seem to take better care of their health and could therefore have a healthier lifestyle. Moreover, Belot and James (2011) using a natural experiment from the UK show that an improvement of diet in schools, leads to both better achievements and attendance of children.

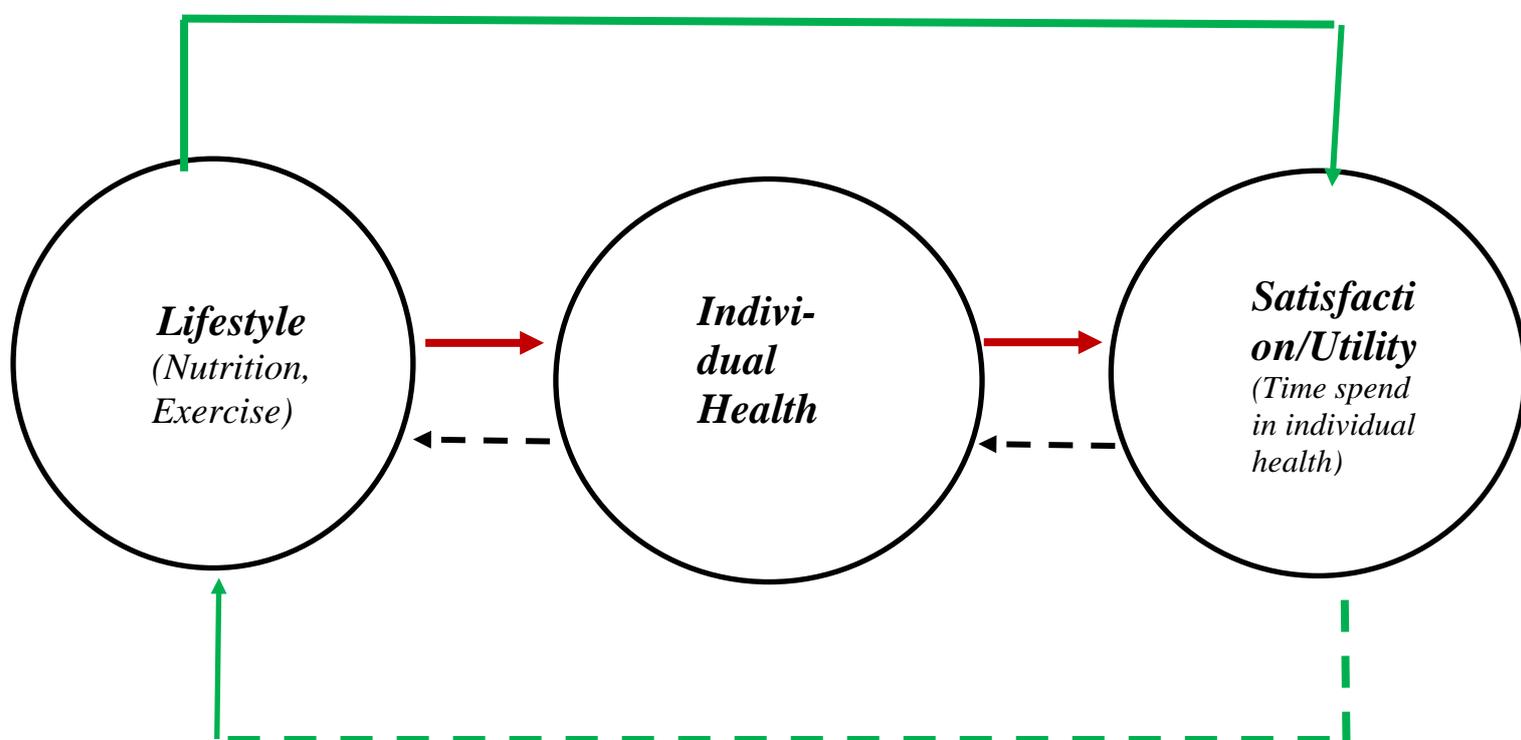
To our knowledge, this is the first study that analyses the relationship between lifestyle and happiness in the UK. Blanchflower, Oswald and Stewart-Brown (2013), which comes closest to our study, looks only at the relation between consumption of fruits and vegetables and mental health in the UK. It does not consider other dimensions of life style and does not make any inferences about causation. Mujcic and Oswald (2016), using Australian data, also analyse the impact of fruit and vegetable consumption on life satisfaction and find that the effect is substantial. They use Granger causality tests to confirm that there is no reverse causality. However, they do not analyse the gender aspect.

Before we go any further, we will consider the framework for our analysis in the next section.

2. Conceptual Framework

The relationship between life-style and happiness can be summarized by the following graph following Grossman’s model of health (1972a):

Figure 1. Lifestyle, Happiness and Health



Grossman's 1972 model of health production has been one of the most influential models in health economics. The model views each individual as both a producer and a consumer of health. Health is treated as a *stock* which degrades over time in the absence of "investments" in health. Therefore, health is viewed as a type of capital. The model acknowledges that health is both a consumption good that yields *direct satisfaction and utility*, and an *investment good*, which yields *satisfaction to consumers indirectly through increased productivity*, fewer sick days, and higher wages. Investment in health is costly as consumers must trade off time and resources devoted to health, such as exercising at a local gym, eating healthier against other goals. These factors are used to determine the optimal level of health that an individual will demand.

Following Grossman (1972b), we assume that people who have a healthier lifestyle (eat more conscientiously and exercise more) are healthier and better health is reflected in greater well-being/happiness. Of course, lifestyle can influence happiness directly, rather than through better health. For example, people who exercise more produce endorphins which impact directly and immediately on their feeling of happiness even if the exercise they do may damage their health. Good examples for this may be extreme sports like skiing or dangerous sports like boxing.

Even excessive jogging on a hard ground may damage the joints but usually makes people more balanced and happy in the short run. The same is true for eating. Consuming unhealthy foods (with high content of fat, sugar or salt) can have a positive effect on happiness in the short run even if their impact on health and long run wellbeing is negative.

The model that we are using here is rooted in the household theory of health production (Grossman 1972a, Grossman 1972b) and follows Chen et al. (2002) closely. However, we cannot use health in our empirical analysis because it is difficult (if not impossible) to disentangle health (especially mental health) from happiness in survey data.⁵ Instead of using health in the present paper, we use healthy lifestyle which is likely to be reflected in better health and therefore, we can use Grossman's model as a theoretical basis.

We extend this model by using a variant described in Chen et al. (2002) wherein consumers maximise utility derived from their Health state (H), Leisure (L) and some other goods called Z.

$$U = U(H, L, Z) \tag{1}$$

The health function H depends on:

1. **Nutrients**⁶ $N_1 \dots N_k$
2. **Exercise time** = E
3. Φ = a vector of exogenous *observable* personal and environmental attributes (like gender, education...)
4. μ = a vector of *unobservables* like genetic ability and health endowment.

Therefore, the health function is given by:

$$H = H(N_1, N_2, N_3, \dots, N_k, E, \Phi, \mu) \tag{2}$$

Consumers maximise utility (1) subject to a budget constraint:

⁵ Table 11 in the Appendix shows correlations between life satisfaction measures and health measures. All correlations are statistically significant at 5% or better. Moreover, subjective measures of health correlate stronger with subjective measures of well-being because people tend to answer subjective questions in a similar manner. For example people that are more optimistic than others are likely to respond more positively to all questions, others may be less positive. This is the reason why they are not included in the life-satisfaction models. In these models just having a long standing illness is included as a control variable.

⁶ Even if in our case we have just one nutrient variable called 'Nr of Fruits and Vegetables' the variable usually summarize more than just one nutrient. As can be seen from descriptive statistics, the typical person consumes on average 3 but typically more such nutrients each day.

$$V + W(T-L-E) = \sum P_i N_i + P_z Z \quad (3)$$

V = non-labour income⁷

W = market wage depending on the working time which is what is left from total time (T) after allocating time to Leisure (L) and Exercise (E).

From this we can derive reduced-form demand functions for the inputs, characteristics and commodities

$$Q^* = Q^*(P_1, P_2, \dots, P_k, P_z, V, W, T, \Phi, \mu) \quad (4)$$

And a reduced form health-function

$$H^* = H^*(P_1, P_2, \dots, P_k, P_z, V, W, T, \Phi, \mu) \quad (5)$$

Where $Q^* = \{N_i^*, E^*, Z^*, L^*\}$ is the set of utility-maximising demands for nutrients, exercise, the composite good Z , and leisure.

Equation (5) says that the individual chooses her health state, conditional on the prices of nutrients, wages, income, and exogenous tastes and endowments. These factors work their way through to her health through their impact upon the consumption decisions she makes about health inputs. Health states are endogenous.

3. Data and Methodology

We make use of the UK Understanding Society Data to estimate our life satisfaction models using subjective-wellbeing in order to capture utility empirically.⁹ This survey follows a sample of 40,000 UK households over time and began in 2009 as a successor to the UK BHPS

⁷ As typically done in the literature we summarize non-labour income and market wage under the variable ‘household income’ since this typically includes both. Household income is weighted with the OECD equivalence scale that basically weights the first adult as 1, other adults as 0.5 and children as 0.3 (<http://www.oecd.org/eo/growth/OECD-Note-EquivalenceScales.pdf>).

⁸ We do not have prices for nutrients but we did try to construct average price indexes for fruits and vegetables a la Mazzocchi et al. (2014) per region. Unfortunately, there was not enough variation.

⁹ For a general discussion on the use of the relation between subjective-wellbeing, hedonic psychology and utility see Bentham (1789/1984), Kahneman (1997), Kahneman et al. (1997), Diener et al. (1999), Kahneman et al. (1999).

longitudinal survey. The survey currently has five waves, including the most recent wave that appeared in November 2015. We specifically use the sample of individuals who fully respond (provide a full interview and self-completion form) in both waves 2 and 5 and provide answers to all the questions we make use of which gives us a sample of about 5,000 men and 7,000 women per wave. We make use of waves 2 and 5 because these waves ask questions about nutrition and exercise, along with other health related behaviours such as smoking and alcohol frequency.

Estimation Methodology

As mentioned earlier, we use two main lifestyle variables in this paper - nutrition and exercise. In particular, we use consumption of fruits and vegetables and frequency of moderate exercise as proxies for lifestyle controlling for other specific factors.

The fixed effects model treats the group specific variables a_i as constant, as indicated in Equation 1 below.

$$LS_{it} = a_i + b_1 x_{it} + \dots + b_2 \text{exercise}_{it} + b_3 \text{fruit and veg}_{it} + \varepsilon_{it} \quad (6)$$

where LS_{it} is the life satisfaction observed for individual i at time t , x is a vector of the typical variables usually found to influence life satisfaction such as number of children, education, income and other, ε_{it} is a typical error term and a_i is the unobserved time-invariant individual effect. Unlike x , a_i cannot be observed. Common examples for time-invariant effects a_i are innate ability for individuals or genetic inheritance, or personality. We treat life satisfaction as a continuous variable rather than an ordered variable as studies have shown there is little difference to (Ferrer-I-Carbonell and Paul Frijters, 2004) results in treating life satisfaction as a continuous or ordered variable but allowing for fixed effects is important. The inclusion of fixed effects requires that we treat life satisfaction as a continuous variable. Fixed effects examine deviations in the means of the variables so that any time invariant variables such as ethnicity or personal traits will drop out.¹⁰ The inclusion of fixed effects also means that it will be more difficult to pick up the effects that do not vary much over time such as age that increases only by 1 each year or location that may not change between the two waves.

¹⁰ Alternatively we could have focussed on first differences but the two models are identical in our case because we have only two periods.

Further, we will discuss the variables that are available in the dataset and also the way in which we use them.

Lifestyle related behaviours

In this paper, we analyse the impact of two sets of lifestyle behaviours – food related and activity related. Waves 2 and 5 of the Understanding Society Survey ask three separate questions relating to fruit and vegetable consumption - how many days per week do you eat fruit; how many days per week do you eat vegetables; and on the days you eat fruit/vegetables how many portions do you eat. For our analysis in this paper, we calculate the average portions of fruit and vegetables consumed per week (by multiplying the number of days an individual eats fruit/vegetables by the portions they eat per day and then divide by 7 to get a measure of the average portions of fruit and vegetables per day they eat across a week). While the dataset also provides information on the type of bread and milk consumed (whether it is low fat or not) we were cautious about using these as lifestyle variables as they may signal allergies instead. We created dummies for whether individuals consume brown, granary or wholemeal bread and no bread, along with dummies for whether they drink low fat milk (skimmed or soya) and no milk. However, we only include these variables as controls in our models.

Our second life-style dimension is exercise. As observed in models such as Chen et al. (2002) nutrition and exercise provide a well-rounded reflection of an individual's lifestyle. The dataset provides a range of activity indicators including information on individual activity levels by including questions on: type of mild and moderate intensity activities and how often an individual participates in mild/moderate intensity sport activities; how often does an individual walk 30 minutes or more; and a ranking on how active an individual is. In our analysis, we use the frequency of moderate exercise rather than 'sports activity' since sports activity gives no indication of the frequency of exercise. Moreover, moderate exercise at least three times a week is our cut-off point. As will be observed from the descriptive statistics, while men perform significantly better on overall sports activity, women seem to perform better on the moderate sports dimension.

Finally, we include controls for smoking and alcohol consumption. This includes both whether the respondents smoke, how many cigarettes they smoke and whether they smoked in the past together with information about alcohol consumption.

Dependant Variables - Life Satisfaction and GHQ Mental Wellbeing

Life satisfaction ('L sat') is measured asking "Please choose the number which you feel best describes how dissatisfied or satisfied you are with the following aspects of your current situation: Life overall" Answers are provided along a seven point scale with 1 being not satisfied at all and 7 being completely satisfied. Such a life satisfaction measure is a slightly longer term, evaluative measure of well-being. However, it is possible that lifestyle may have a different impact on other measures of well-being including psychological well-being as measured by the GHQ mental well-being scale. The General Health Questions (GHQ) survey asks subjects to rate on 12 domains how they have been feeling recently on a scale from 1 to 4. These 12 domains refer to questions about the ability to sleep, to concentrate, to take decisions and to overcome difficulties. Therefore, they combine elements of mental health. The Understanding Society dataset then derives several variables from the responses to these 12 domains, a Likert and caseness variable. To create the Likert variable they use a scale of 0 to 3 (instead of 1 to 4) and sum up across the 12 domains to get an overall subjective well-being Likert score on a scale of 0 (least distressed) to 36 (most distressed). We have reverse coded this Likert score so the highest value relates to the least distressed and makes coefficients easier to interpret. Life satisfaction and the GHQ measures have correlation coefficients of 0.51 for both genders. The two measures are reasonably well correlated

Demographic Variables

We include a range of demographic controls in our model including age¹¹, marital status (whether married, cohabiting or not living with a spouse/partner), number of children (split into those 0-3 years and those 4-15 years old), highest qualification, ethnicity (grouped into White, Black, Asian, other/mixed), employment status and the log of monthly household income (adjusted for household size, with adults weighted as 1 and children 0.5).

Test for Reverse Causality

As already mentioned, life satisfaction studies are often affected by reverse causality. In this paper, we are especially concerned about the possibility of reverse causality between our lifestyle variables (food and exercise) and the dependant variable – life satisfaction and mental well-being. We therefore begin by performing a Granger Causality Test where we regress past

¹¹ We exclude age above 65 from this study because this age group behaves differently.

life satisfaction on today's lifestyle-behaviour to see if there is any reverse causality from life satisfaction to lifestyle.

$$Fruit\ and\ veg_{it} = a + b_1x_{it-1} + b_2lfsat_{it-1} + b_3fruit\ and\ veg_{it-1} + \varepsilon_{it} \quad (7)$$

$$Exercise_{it} = a + b_1x_{it-1} + b_2lfsat_{it-1} + b_3exercise_{it-1} + \varepsilon_{it} \quad (8)$$

where t = Wave 5 contains data for 2013-2014 and $t-1$ = Wave 2 for 2010-2011. Therefore, our data spans a 4 year window of observations.

If b_2 is significant in equations 2 and 3 above, then this would suggest that our independent lifestyle variables are no longer independent. Instead, we can predict them on the basis of past well-being and hence there is evidence for reversed causality. We test this for both fruit and vegetable consumption and exercise. For completeness we perform Granger type causality test in both directions.

Table 1a: Granger Causality (direction 1)

	Life Sat		GHQ	
	Men	Women	Men	Women
DV: Fruit and veg dummy (wave 5)				
lfsat (wave 2)	0.003 [0.004]	0.006* [0.003]		
GHQ (wave 2)			-0.001 [0.001]	0.001 [0.001]
Fruit and veg dummy (wave 2)	0.359*** [0.014]	0.398*** [0.012]	0.357*** [0.014]	0.398*** [0.012]
DV: Fruit and veg portions (wave 5)				
lfsat (wave 2)	-0.001 [0.016]	0.033** [0.013]		
GHQ (wave 2)			-0.003 [0.004]	0.003 [0.003]
Fruit and veg portions (wave 2)	0.519*** [0.013]	0.521*** [0.011]	0.518*** [0.013]	0.522*** [0.011]
Dv: Exercise 3+ times per week (wave 5)				
lfsat (wave 2)	0.003 [0.004]	0.001 [0.003]		
GHQ (wave 2)			0.001 [0.001]	0.001* [0.001]
Exercise 3+ times per week (wave 2)	0.368***	0.304***	0.366***	0.303***

	[0.013]	[0.012]	[0.013]	[0.012]
Dv: Sports frequency (wave 5)				
lfsat (wave 2)	-0.006 [0.007]	-0.005 [0.006]		
GHQ (wave 2)			-0.002 [0.002]	-0.003* [0.002]
Sports frequency	0.432*** [0.013]	0.368*** [0.011]	0.431*** [0.013]	0.366*** [0.011]

Table 1a: Granger Causality (direction 2)

	Men	Women
DV: Life satisfaction (wave 5)		
lfsat (wave 2)	0.343*** [0.014]	0.363*** [0.012]
Fruit and veg dummy (wave 2)	0.145*** [0.052]	0.025 [0.040]
Exercise 3+ times per week (wave 2)	0.094** [0.047]	-0.000 [0.046]
DV: Life satisfaction (wave 5)		
lfsat (wave 2)	0.342*** [0.014]	0.361*** [0.012]
Fruit and veg portions (wave 2)	0.027** [0.011]	0.020** [0.010]
Sports frequency (ref: less often)		
3+ times per week	0.130*** [0.049]	-0.010 [0.048]
1-3 times per week	0.108** [0.046]	-0.014 [0.041]
DV: GHQ (wave 5)		
GHQ (wave 2)	0.407*** [0.013]	0.430*** [0.012]
Fruit and veg dummy (wave 2)	0.196 [0.182]	0.245 [0.152]
Exercise 3+ times per week (wave 2)	0.428*** [0.164]	-0.174 [0.176]
DV: GHQ (wave 5)		
GHQ (wave 2)	0.405*** [0.013]	0.429*** [0.012]
Fruit and veg portions (wave 2)	0.057	0.111***

	[0.038]	[0.037]
Sports frequency (ref: less often)		
3+ times per week	0.535***	-0.222
	[0.173]	[0.182]
1-3 times per week	0.348**	-0.078
	[0.162]	[0.157]

Our results indicate that there is no reverse causality from life satisfaction to the consumption of fruit and vegetables for men and there is only a very small (0.006) and marginally significant effect for women. There is no reversed causation of wellbeing on the consumption of fruit and vegetables using the GHQ measure for either men or women. Again, there is no evidence of reverse causation of exercise 3+ using the life satisfaction measure for either men or women. There is a very small (0.001) and marginally significant effect of exercise 3+ on the GHQ measure of well-being for women but not for men. We therefore do not attempt to correct for this. Instead, we attempt to allow for endogeneity caused by omitted variables by including fixed effects in our model.

4. Descriptive Statistics

Table 2 in the Appendix presents descriptive statistics for our sample for men and women separately. We have a sample consisting of 12,415 individuals from which 7,169 are women and 5,246 are men for which we have data for both waves. Therefore, approximately 58% of our subjects are women. Summary statistics indicate that there is a very small (though significant) difference in the average life satisfaction of men (5.07 on a scale from 1 to 7) and of women (5.13). However, the GHQ measure shows a slightly higher well-being for men (25.22 vs 24.27). Therefore, we conclude that the life satisfaction between men and women is not significantly different in our sample. Other studies on welfare have found similar results but have shown that the determinants and what the construct of life satisfaction is, differs by gender (Della Giusta, Jewell and Kambhampati, 2011).

Men seem to engage significantly more in moderate exercise activity than women while the percentage of women eating 5 portions of fruits and vegetables per day and more is significantly higher than for men. This is a pattern that we will observe throughout our study. Most of our subjects are mature (age groups 35-44 and 45-54) since more than 50% of men and women in our sample belong to these two age groups.

More than 50% of men and women in our sample are married, while 30% have a degree. There are significantly more men with A-levels and more women with GCSE in our sample, possibly reflecting the fact that our sample spans several generations.

When looking at the number of children we are referring to the age of the youngest child (if the individual states they have a child in the household) with men less likely to report they are responsible for a child in general. There are more employed men than women in our model and the difference is significant. In addition, more women report not being in the labour force than men showing that in general women seem to be less active in the labour market. As it is going to be observed later this has a strong negative impact on their life-satisfaction. There seem to be no household income differences between the genders.

The sample statistics show that the difference with respect to smoking seems to be very small between the two genders. However, a higher percentage of men drink more frequently than women in each category (from drinking every day to drinking 1 or 2 days a week) while the percentage of women that drink less often or do not drink at all is significantly higher than the percentage of men. Women in general, seem to drink less than men in our sample and this seems to be a result that can be found worldwide (Wilsnack et al., 2000).

The percentage of women who eat wholemeal, granary or brown bread is significantly higher than for men as is the percentage of women drinking low fat milk. This again suggests that women are more conscientious with respect to their nutrition in general and confirms the patterns obtained for fruit and vegetable consumption. And this is reinforced if we look specifically at the descriptive statistics for fruit and vegetable consumption and sports activity in Table 3 for the two waves. Women on average eat significantly more portions of fruit and vegetables than men and are more likely to report eating 5+ portions per day. For both sexes there has been a statistically significant increase in the average portions of fruit and vegetables eaten between wave 2 and wave 5. We can observe an increase in the percentage of individuals reporting that they eat 5+ portions of fruit and veg, from 15.27% (23.16%) to 18.85% (26.91%) for men (women) but a relatively small proportion report eating the recommended 5 a day, especially men. A relatively small impact of the '5 a day campaign' in the UK is found for example in Capacci and Mazzocchi (2011).

In contrast, men exercise significantly more often than women and are more likely to report exercising 3+ times per week than women. Exercise is statistically significantly different by gender but there are changes between the two waves for both sexes. In general, more men and women report that they exercise 3 times per week in wave 5 than in wave 2. Thus, there does

seem to have been an improvement in both aspects of lifestyle (diet and exercise) between waves 2 and 5. However, the increase in sports activity is less strongly pronounced than the increase in consumption of fruit and vegetables between the two waves. For example the percentage of men that do not exercise at all seems to have increased which is a worrying trend.

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Table 3: Fruit/Veg and Exercise by Gender

	Men (n= 5,246)		Women (n= 7169)	
	Wave 2	Wave 5	Wave 2	Wave 5
Portions of Fruit/Veg (%)**				
less than 1 per day	19.25	17.44	13.34	11.56
1-2 per day	13.48	11.19	9.01	8.01
2-3 per day	23.12	22.44	20.21	19.05
3-4 per day	16.57	17.58	17.85	18.64
4-5 per day	12.31	12.5	16.43	15.83
5-6 per day	10.33	12.49	15.78	17.59
6-7 per day	3.2	3.77	4.44	5.37
7+ per day	1.73	2.59	2.94	3.95
Average portions of fruit and veg**	3.42	3.62	3.95	4.13
5+ portions fruit/veg (%)**	15.27	18.85	23.16	26.91
Frequency of Moderate Exercise (%)*				
3+ times per week	19.5	19.79	14.59	15.16
1-3 times per week	22.61	21.39	20.76	20.63
Less often/never	57.89	58.83	64.65	64.21
Life satisfaction (1-7)**	5.14	5.00	5.21	5.05
Subjective well-being (GHQ), reverse coded (0-36)*	25.24	25.21	24.34	24.21

**Significantly different by wave and significantly different by gender

*Significantly different by gender but not wave

5. Empirical Results

We estimate the fixed effects equation (1) above separately for men and women and report the results both for life satisfaction and for GHQ in Table 4 below. We additionally present random effects and results separately for Wave 2 and Wave 5 to see if there are any differences across time in the Appendix. In order to further justify the use of fixed effects we present in the Appendix results for FE which show the variation within individuals, BE (between effects) that

¹² Table 13 in the Appendix shows that the small increase in the average fruit and vegetables and exercise between the two waves is rather due to small changes in many than due to big changes in few respondents which further justifies the use of FE in our further analysis.

show the variation across time between individuals, and RE (random effects) which use a weighted average of FE and BE. All the estimates have significant coefficients and R-squared values that show that there is enough variation to justify the use of this approach.

Table 4: Fixed Effects Life Satisfaction Models

	Men		Women	
	Life Sat (1-7)	GHQ (0-36)	Life Sat (1-7)	GHQ (0-36)
5+ portions of fruit/veg per day	0.046 [0.049]	0.402** [0.181]	0.108*** [0.042]	0.379*** [0.142]
Exercise 3+ times per week	0.118** [0.051]	0.189 [0.170]	0.057 [0.046]	0.163 [0.169]
Wave 5	-0.152*** [0.023]	-0.189** [0.078]	-0.156*** [0.020]	-0.156** [0.076]
Marital Status(ref: never married)				
Married	-0.005 [0.133]	0.938** [0.466]	0.276** [0.113]	-0.100 [0.455]
Cohabiting	0.096 [0.110]	0.456 [0.390]	0.245*** [0.095]	-0.238 [0.385]
Separated	-0.405* [0.245]	-0.816 [0.916]	0.292* [0.164]	-0.006 [0.668]
Divorced	-0.399* [0.209]	-0.032 [0.737]	0.262 [0.165]	0.194 [0.626]
Widowed	-0.371 [0.469]	3.927* [2.016]	-0.163 [0.263]	-2.054** [0.974]
Highest Qualification (ref: No qualifications)				
Degree and above	0.582* [0.319]	2.060 [1.493]	-0.604* [0.338]	-0.627 [1.233]
Other higher qualifications	0.231 [0.354]	1.776 [1.542]	-0.319 [0.325]	0.426 [1.235]
A-level	0.570* [0.310]	1.966 [1.490]	-0.544* [0.311]	-0.485 [1.115]
GCSE	0.524* [0.304]	1.616 [1.438]	-0.440 [0.311]	0.821 [1.138]
Other qualifications	0.686* [0.354]	0.159 [1.230]	0.038 [0.323]	1.048 [1.114]
Age of the youngest child (ref: no children under 16)				
Aged 0-2	-0.056 [0.083]	-0.241 [0.287]	0.156** [0.075]	0.054 [0.307]
Aged 3-4	-0.072 [0.102]	-0.148 [0.359]	-0.033 [0.088]	-0.007 [0.346]
Aged 5-11	-0.149 [0.091]	-0.398 [0.342]	-0.044 [0.079]	-0.328 [0.313]

Aged 12-15	-0.032 [0.081]	-0.110 [0.296]	-0.085 [0.064]	-0.228 [0.258]
Economic Activity (ref: Employed)				
Unemployed	-0.416*** [0.089]	-2.504*** [0.338]	-0.207** [0.090]	-1.465*** [0.396]
Retired	0.292*** [0.113]	0.919** [0.409]	0.028 [0.104]	0.977*** [0.320]
Education	0.270** [0.119]	-0.044 [0.456]	0.147 [0.097]	-0.113 [0.408]
Not in the labour force	-0.468*** [0.146]	-2.681*** [0.617]	-0.148** [0.064]	-0.998*** [0.255]
Log (equivalised income)	0.064* [0.037]	0.144 [0.112]	-0.035 [0.026]	-0.253** [0.103]
Long-standing illness	-0.120** [0.049]	-0.804*** [0.172]	-0.195*** [0.044]	-0.810*** [0.176]
Smoker	-0.066 [0.076]	-0.510* [0.287]	0.041 [0.068]	-0.233 [0.285]
Alcohol frequency(ref: less often/don't drink)				
Almost every day	-0.001 [0.111]	-0.945** [0.396]	-0.123 [0.112]	-0.641 [0.411]
5 or 6 days per week	0.024 [0.103]	-0.498 [0.371]	-0.080 [0.096]	-0.607* [0.364]
3 or 4 days per week	-0.062 [0.078]	-0.682** [0.279]	-0.008 [0.065]	-0.095 [0.254]
1 or 2 days per week	-0.006 [0.059]	0.003 [0.200]	0.025 [0.045]	0.218 [0.182]
Healthy Bread	-0.020 [0.043]	-0.076 [0.152]	-0.030 [0.038]	0.094 [0.134]
No bread	-0.119 [0.188]	0.312 [0.610]	-0.192** [0.087]	0.153 [0.333]
Low fat milk	0.026 [0.070]	-0.288 [0.220]	0.021 [0.053]	-0.013 [0.193]
No Milk	0.146 [0.148]	0.455 [0.437]	0.004 [0.127]	-0.048 [0.437]
Observations	10,492	10,454	14,338	14,292
R-squared	0.028	0.038	0.022	0.017
Number of pidp	5,246	5,246	7,169	7,169

standard errors in brackets

*** p<0.01, ** p<0.05, * p<0.1

We will begin by providing a short discussion of the control variables. It is worth noting that our results show a significant decrease in both life satisfaction and mental health for both men and women between waves 2 and wave 5.

Married and cohabiting men and women generally have higher life satisfaction than those who have never been married, and separated men are less happy. Education has a positive and marginally significant impact on the life satisfaction of men and a negative and marginally significant impact on women. Women with higher education levels may have higher expectations and/or may find it more difficult to reconcile family duties with career. Being unemployed or not in the labour force are associated with lower life satisfaction for both men and women while being retired is associated with higher life satisfaction especially for men. Income is associated with higher life satisfaction for men and a negative GHQ for women, while a long standing illness is associated with lower life satisfaction. Having children aged 2 years and above has no significant impact on life satisfaction for either men or women. For women, however, having babies (0-2 years) increases life satisfaction. Other studies have found children to have a negative impact on life satisfaction (Crohan 1996, Alesina et al. 2004, Stutzer and Frey 2006, Clark et al. 2008, Powdthavee 2009, Frijters et al. 2011, Stanca 2012, Clark and Georgellis 2013).

Finally, smokers (both men and women) have lower life satisfaction than non-smokers. Alcohol consumption is associated in general with higher life satisfaction for both men and women. However, in the FE model, the impact turns from positive to insignificant or even negative and significant for both men and women at higher levels which proves that the positive impact obtained in the RE model and the results by wave (Appendix Table 9) is due to fixed effects (potentially sociability). Eating no bread has a significantly negative impact on the LS of women while eating healthy bread and drinking low fat milk does not seem to have an significant impact on life satisfaction either for men or women.

In what follows, we will not discuss the controls any further and will focus instead on the variables central to our study – those on life style.

Our results indicate that the consumption of fruit and vegetables has no significant impact on life satisfaction for men. However, it significantly increases the life satisfaction of women. The consumption of fruit and vegetables is also associated with higher GHQ scores (better mental health) for both men and women. While the size of the impact for men is lower in Wave 5 (see Appendix) than in Wave 2, for women the size of the impact increased between the two waves

(from 0.107 to 0.202). By Wave 5, therefore, the consumption of fruit and vegetables had a larger association with life satisfaction for women (0.202) than for men (0.168).

Turning to exercise, we find that exercise has a significant effect on life satisfaction only for men and is not associated with any improvement in mental health either for men or women. This effect increased between wave 2 (coefficient of 0.146) and wave 5 (0.223) for men.

Finally we attempt to analyse long term effects because the effect of healthy nutrition and exercise may also have a long-term component. Nutrition and exercise may impact directly on wellbeing but a healthy (or unhealthy) lifestyle may take time to be reflected in a better (or worse) health and in a higher (or lower) level of life-satisfaction. It is very important therefore, to analyse the effects with a lag. Since we compare wave 2 with wave 5 we have 4 years in-between. This should be enough for the benefits (or negative effects) of good (or bad) life style to show up. The empirical specification is as follows:

$$LS_{it} = a_{it} + b_{1it}x_{it} + b_{2it-1}exercise_{it-1} + b_{3it-1}fruit\ and\ veg_{it-1} + \epsilon_{it} \quad (9)$$

where LS_{it} is life satisfaction at wave 5 and $exercise_{it-1}$, $fruit\ and\ veg_{it-1}$ are the life style variables at wave 2.

The table below compares results just for life satisfaction and GHQ in wave 5 compared with two versions of fruit and vegetables and exercise – one which is contemporaneous (i.e. wave 5) and a second in which we use lagged versions of fruit and vegetables and exercise from wave 2. We have done this for both measures - life satisfaction and mental wellbeing- and both for the dummy and the continuous version of the two life-style variables. The results show that the impact of a good (bad) life style seems to have a long-term positive (negative) effect.

Table 5: Long-Term Effects (Fixed Effects Life Satisfaction Models with a Lag)¹³

	Wave 5 Men	Wave 2 Men	Wave 5 Women	Wave 2 Women
Life Satisfaction Using dummy 5+ portions of fruit/veg per day	0.168***	0.194***	0.183***	0.066

¹³ Note this is different to the Granger causality test as here at wave 5 we use everything at time t except the life style values where we include them with values at t-1 (wave 2).

	[0.048]	[0.051]	[0.039]	[0.041]
Exercise 3+ times per week	0.227***	0.123**	0.087*	0.027
	[0.047]	[0.048]	[0.046]	[0.049]
Life Satisfaction				
Using Continuous variable				
Portions of fruit/veg per day	0.060***	0.044***	0.065***	0.035***
	[0.011]	[0.011]	[0.010]	[0.010]
Exercise 3+ times per week	0.216***	0.122**	0.079*	0.017
	[0.047]	[0.048]	[0.046]	[0.049]
GHQ				
Using dummy				
5+ portions of fruit/veg per day	0.426**	0.380**	0.678***	0.522***
	[0.172]	[0.188]	[0.146]	[0.155]
Exercise 3+ times per week	0.535***	0.615***	0.257	-0.035
	[0.166]	[0.166]	[0.177]	[0.188]
GHQ				
Using Continuous variable				
Portions of fruit/veg per day	0.196***	0.110***	0.236***	0.169***
	[0.040]	[0.041]	[0.039]	[0.039]
Exercise 3+ times per week	0.487***	0.604***	0.230	-0.064
	[0.166]	[0.166]	[0.177]	[0.188]

6. Robustness Checks

To consider whether the above estimates are sensitive to alternative measures of fruit and vegetable consumption or exercise, we consider three different measures. The 3 alternative measures for fruit and vegetables that we use are:

1. A 5+ dummy (taking value 1 if the individual has consumed 5 or more portions of fruit and vegetables per day). Since the '5 A DAY' campaign in the UK recommends to eat five or more portions of fruit and vegetables per day, this seemed intuitive.¹⁴
2. A continuous measure of the portions of fruit and vegetables eaten per day.
3. A measure treating the continuous variable as categorical.

We run the same regressions as before with the full set of controls but report just the results only for our variables of interest in Tables 5, 6, 7 and 8.

Table 6: Alternative Fruit and Veg Measures

	Men	Women
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¹⁴ <http://www.nhs.uk/livewell/5aday/Pages/5ADAYhome.aspx>

	Life Sat	GHQ	Life Sat	GHQ
Dummy				
5+ portions of fruit/veg per day	0.043 [0.049]	0.396** [0.180]	0.108** [0.042]	0.377*** [0.142]
Frequency of moderate exercise (ref: less often)				
3+ times per week	0.144** [0.056]	0.255 [0.191]	0.087* [0.049]	0.247 [0.184]
1-3 times per week	0.052 [0.046]	0.132 [0.153]	0.065* [0.038]	0.184 [0.145]
Continuous				
Portions of fruit/veg per day	0.048*** [0.013]	0.177*** [0.048]	0.040*** [0.012]	0.139*** [0.042]
Frequency of moderate exercise (ref: less often)				
3+ times per week	0.134** [0.056]	0.237 [0.191]	0.085* [0.049]	0.240 [0.184]
1-3 times per week	0.046 [0.046]	0.120 [0.153]	0.065* [0.038]	0.185 [0.145]
Categorical				
Portions of fruit/veg per day (ref: less than 1 per day)				
1-2 per day	0.017 [0.065]	0.533** [0.222]	0.041 [0.062]	0.241 [0.246]
2-3 per day	0.122** [0.059]	0.511** [0.206]	-0.074 [0.061]	0.217 [0.232]
3-4 per day	0.196*** [0.068]	0.793*** [0.234]	0.047 [0.064]	0.294 [0.245]
4-5 per day	0.228*** [0.073]	0.649** [0.262]	0.104 [0.069]	0.601** [0.258]
5-6 per day	0.176** [0.077]	0.859*** [0.284]	0.127* [0.072]	0.749*** [0.267]
6-7 per day	0.253** [0.103]	1.244*** [0.369]	0.202** [0.096]	0.826** [0.329]
7+ per day	0.452*** [0.134]	1.912*** [0.502]	0.281*** [0.100]	0.846** [0.385]
Frequency of moderate exercise (ref: less often)				
3+ times per week	0.136** [0.056]	0.232 [0.191]	0.084* [0.049]	0.233 [0.184]
1-3 times per week	0.049 [0.046]	0.124 [0.153]	0.068* [0.038]	0.183 [0.145]

Each panel refers to a different regression
Controls the same as in table 4

Our results indicate that there is no significant impact of fruit and vegetable consumption as a dummy on life satisfaction for men though this variable is significant and positive for women. This is similar to our results in Table 4. The continuous measure of fruit and vegetable consumption is positive and significant for both men and women for both life satisfaction and

GHQ. Using the continuous measure, increasing fruit and vegetables by one portion has an impact of 0.049 on the wellbeing of men and a slightly smaller effect for women (0.04). In line with Mujcic and Oswald (2016) going from the minimum to the maximum portion of fruit and vegetables using all the controls increases life satisfaction by 0.392 (0.049×8) and 0.32 (0.04×8) for women. This is comparable with other coefficients such as being unemployed and is therefore meaningful in size.

Analysing the impact of fruit and vegetables as a categorical variable (1-2 per day to 7 plus portions per day), we find that there is a positive and largely monotonic impact of increased portions of fruit and vegetables both on life satisfaction and GHQ measures for men (beyond 1-2 portions which is insignificant). For women, surprisingly, the impact on the fixed effects model only begins to show up beyond 5-6 portions a day. In the cross-sectional results for the two waves (see Appendix), however, the impact of fruit and vegetable portions is apparent from 2-3 portions per day. For example eating 5-6 portions per day has a 3-6 times larger impact on women than on men. The difference is even larger and increasing when we look at higher portions of fruit and vegetables. This may again be related to the fact that men eat fewer portions of fruit and vegetables per day or it may suggest that women need more fruit and vegetables before they see any impact on their life satisfaction. In general the alternative measures for fruit and vegetables seem to suggest as before that fruit and vegetables have a stronger impact on the life satisfaction of women than on men.

Overall, however, we can conclude that changing the way in which we measure fruit and vegetable consumption does not affect the results either for men or for women.

Exercise

Next we attempted to analyse in more depth the impact of sports and exercise on the wellbeing of men and women in our sample. Individuals are asked if they do any sports and then asked how often they exercise. As an attempt to look at gender differences, we have firstly examined the sports frequency per week that subjects report doing a type of sport for men and women separately. We have created the following sports categories: Gym, Running, Swimming, Cycling, Team Sports, Other Sports. In an attempt to reduce the number of categories we have also joined running, swimming and cycling.

The table below reports the type of sports and their frequencies by gender.

Table 7. Types of Sports and Frequencies¹⁵

	Wave 2				Wave 5			
	3+ times	1-3 times	Less often	All	3+ times	1-3 times	Less often	All
Men								
Gym	66.1	47.5	15.9	32.8	69.3	49.0	13.0	38.6
Running	47.8	33.2	11.5	23.5	47.9	31.3	8.8	16.7
Swimming	51.8	50.4	32.5	40.3	52.5	49.9	27.8	47.8
Cycling	56.0	42.2	23.3	33.9	56.7	43.7	19.3	20.1
Running/cycling/swimming	84.8	74.4	46.2	60.1	84.1	73.8	40.5	57.9
Team sports	51.1	51.0	21.5	34.0	46.1	48.6	15.8	14.2
Other sports	57.6	57.6	36.3	45.3	56.1	55.7	29.2	29.4
Women								
Gym	75.8	65.5	21.6	31.8	77.8	70.3	17.5	37.6
Running	41.8	25.7	8.2	21.4	41.7	27.2	8.4	17.3
Swimming	61.5	63.4	39.8	37.4	58.0	62.5	36.2	44.9
Cycling	38.0	27.2	13.8	31.9	37.6	28.5	12.0	19.3
Running/cycling/swimming	81.9	77.6	46.1	56.3	80.0	76.1	42.4	55.0
Team sports	21.9	21.6	10.1	28.8	20.1	21.4	7.0	12.0
Other sports	47.8	38.8	22.2	40.2	43.6	36.5	19.4	26.6

The table above shows that swimming is by far the most popular sport both among men and women and its popularity has increased between the two waves as opposed to cycling and team sports. Going to the gym is the most popular sport only for those who exercise 3 times or more per week, followed by cycling for men and swimming for women. The table also reveals that team sports are much more popular among men than among women.

Table 7 analyses the proportion of people who exercise 3 times or more per week and a particular sport among all men/women.

Table 8. Sports activity: 3+ times week plus a sort type

	Men		Women	
	Wave 2	Wave 5	Wave 2	Wave 5
3+ times per week plus:				
Gym	12.89	13.71	11.06	11.80
Running	9.32	9.47	6.10	6.32
Swimming	10.10	10.39	8.97	8.79
Cycling	10.92	11.23	5.54	5.71
Running/cycling/swimming	16.53	16.64	11.95	12.14

¹⁵Note that the only row that adds up to 100 is the 'All' row – all other columns and rows do not add up to 100 as people can list more than one sport.

Team sports	9.97	9.13	3.19	3.05
Other sports	11.23	11.09	6.97	6.61
All	19.50	19.79	14.59	15.16

It can be observed that men are more likely to do all sports 3 times a week than women and are 3 times more likely than women to do team sports at this frequency. The gym is the most popular single activity among both men and women with men going more frequently to the gym than women. The difference is extremely strong also with respect to cycling. Men are twice more likely than women to do cycling 3+ times per week.

The next table presents the results of interacting those who did exercise 3+ times per week with the different sporting groups in the fixed effects model.

Table 9. Sports Type and fixed effects

	Life sat		GHQ	
	Men	Women	Men	Women
5+ portions of fruit/veg per day	0.046	0.107**	0.402**	0.368***
	[0.049]	[0.042]	[0.181]	[0.142]
Exercise 3+times per week	0.093	-0.08	-0.062	0.008
	[0.142]	[0.119]	[0.414]	[0.439]
Exercise 3+times per week*Sport				
Gym	0.018	0.055	0.077	0.534
	[0.091]	[0.090]	[0.297]	[0.328]
Running/swimming/cycling	0.027	0.174*	0.148	-0.114
	[0.132]	[0.099]	[0.364]	[0.361]
Team Sport	0.033	-0.148	0.35	-0.899**
	[0.080]	[0.100]	[0.298]	[0.373]
Other Sport	-0.043	-0.03	-0.134	0.051
	[0.086]	[0.085]	[0.288]	[0.299]

Turning to consider whether a different measure of activity might change our results, we interact the dummy indicating exercise more than 3 times a week with the different types of sports that can be undertaken. In particular, we consider whether team sports with their sense of community might make a difference to our results. We find (see Table 8) almost no impact of the different types of sport on life satisfaction. There is some evidence that women prefer individual activity (running/swimming/cycling) to team sports (which have a negative association with their life satisfaction). There is no significant effect or men.

In this case cell sizes for a given sport and exercise 3+ times a week start to become smaller and therefore, it is difficult to pick up significant effects. Nevertheless, some of the coefficients

are meaningful in size. For men there are no significant impacts of any sports in particular, it seems that just exercise in general gives significant results. However, the effects of running/swimming/cycling and team sports are quite large when using the General Health Questions (GHQ) measure. For women swimming, cycling or running has a positive impact (at 10%) on life satisfaction. Team sports on the other hand, have a highly negative impact on life satisfaction of women when measured by the GHQ measure. This may be because it is harder to find time for a team sport than for an individual sports and women may find it hard to face time trade-offs to pursue them or women may like them less because they are more competitive.

In general the results for sports activity seem to confirm the ones obtained before: men seem to exercise more and exercise has a stronger positive impact on their wellbeing than on the one of women.

7. Conclusions and policy recommendations

In conclusion, we can argue that together with other variables that have been identified to have a significant impact on life satisfaction, 'lifestyle' has to also be considered. A better lifestyle, reflected in our study by increased exercise and a better nutrition does seem to impact significantly positive on the life satisfaction of both men and women even after correcting for fixed effects. Moreover, we find that the effect of a better life-style has a long-term effect on life-satisfaction. We also find that sports activity impacts more strongly on the well-being of men while nutrition is more significant in the case of women. While our analysis does not consider why lifestyle may affect life satisfaction, we can put forward two possibilities. First, which we have already mentioned, consumption of fruit and vegetables as well as exercise may have a physical impact on individuals, for instance, through the release of endorphins upon exercise or through keeping individuals more healthy. There is, however, a second possibility and this is that, for both men and women, these lifestyle variables reflect conformity to gender norms. Thus, for women, eating fruit and vegetables conforms to their gender norms as does exercising regularly for men. Our analysis does not allow us to conclude in favour of one or the other of these possibilities.

It is worth remembering that as opposed to men, both exercise and nutrition seem to be slightly endogenous for women. Therefore, especially for them (but not only) any measures that could lead to increased wellbeing, such as making wellbeing counselling more popular and affordable, will also result in a better nutrition and more exercise. Moreover, measures targeting

the increased consumption of fruit and vegetables especially for women and targeting an increased level of exercise especially for men, may be more efficient than simply encouraging both life style dimensions for both genders equally.

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Appendix

Table 2. Descriptive Statistics for Variables in the Regression Models (pooled statistics for wave 2 and wave 5) by gender

	Men				Women			
	Mean	Sd	Min	Max	Mean	Sd	Min	Max
Life satisfaction	5.07	1.43	1	7	5.13	1.47	1	7
5+ portions fruit/veg Frequency of moderate exercise	0.17	0.38	0	1	0.25	0.43	0	1

3+ times per week	0.20	0.40	0	1	0.15	0.36	0	1
Age group								
16-24	0.09	0.28	0	1	0.09	0.29	0	1
25-34	0.17	0.37	0	1	0.19	0.39	0	1
35-44	0.25	0.43	0	1	0.25	0.43	0	1
45-54 (ref)	0.28	0.45	0	1	0.27	0.44	0	1
55-64	0.22	0.42	0	1	0.20	0.40	0	1
Marital status								
Married	0.57	0.50	0	1	0.54	0.50	0	1
Cohabiting	0.16	0.37	0	1	0.15	0.35	0	1
Separated	0.01	0.12	0	1	0.02	0.15	0	1
Divorced	0.05	0.21	0	1	0.09	0.29	0	1
Widowed	0.01	0.09	0	1	0.02	0.13	0	1
Single, never married (ref)	0.21	0.40	0	1	0.18	0.39	0	1
Highest Qualification								
Degree and above	0.30	0.46	0	1	0.30	0.46	0	1
Other higher education	0.12	0.33	0	1	0.16	0.36	0	1
A level etc.	0.24	0.43	0	1	0.20	0.40	0	1
GCSE etc.	0.20	0.40	0	1	0.22	0.42	0	1
Other qualification	0.09	0.28	0	1	0.07	0.25	0	1
No qualifications (ref)	0.05	0.22	0	1	0.06	0.23	0	1
Age of the Youngest Child								
Aged 0-2	0.10	0.30	0	1	0.11	0.31	0	1
Aged 3-4	0.05	0.22	0	1	0.06	0.23	0	1
Aged 5-11	0.12	0.32	0	1	0.15	0.36	0	1
Aged 12-15	0.06	0.24	0	1	0.08	0.27	0	1
No children under 16	0.66	0.47	0	1	0.60	0.49	0	1
Employment Status								
Employed (ref)	0.81	0.40	0	1	0.71	0.45	0	1
Unemployed	0.06	0.24	0	1	0.04	0.19	0	1
Retired	0.05	0.22	0	1	0.06	0.23	0	1
Full time Student	0.03	0.18	0	1	0.04	0.19	0	1
Not in the labour force	0.05	0.22	0	1	0.16	0.36	0	1
Log (equivalised household income)								
	7.57	0.71	-3.91	9.90	7.50	0.69	-4.28	9.66
Have a long term illness of impairment								
	0.29	0.45	0	1	0.30	0.46	0	1

Smoker	0.22	0.42	0	1	0.21	0.40	0	1
Frequency of drinking alcohol								
Almost every day per week	0.09	0.29	0	1	0.05	0.22	0	1
5 or 6 days per week	0.07	0.26	0	1	0.05	0.22	0	1
3 or 4 days per week	0.20	0.40	0	1	0.14	0.35	0	1
1 or 2 days per week	0.33	0.47	0	1	0.29	0.45	0	1
Less often/don't drink (ref)	0.31	0.46	0	1	0.47	0.50	0	1
Eat wholemeal, granary or brown bread								
Don't eat bread	0.43	0.50	0	1	0.49	0.50	0	1
Drink low fat (skimmed or soya) milk	0.01	0.12	0	1	0.04	0.18	0	1
Don't drink milk	0.13	0.34	0	1	0.20	0.40	0	1
	0.03	0.16	0	1	0.03	0.16	0	1
Alternative well-being measures								
Subjective well-being (GHQ), reverse coded	25.22	5.16	0	36	24.27	5.67	0	36

Table 10. FE and RE Regression Models (pooled statistics and separate regressions for wave 2 and wave 5) by gender

Life Sat

	Men				Women			
	FE	RE	Wave 2	Wave 5	FE	RE	Wave 2	Wave 5
5+ portions of fruit/veg per day	0.046 [0.049]	0.155*** [0.035]	0.197*** [0.052]	0.168*** [0.050]	0.108*** [0.042]	0.148*** [0.028]	0.107*** [0.040]	0.202*** [0.040]
Exercise 3+ times per week	0.118** [0.051]	0.174*** [0.034]	0.146*** [0.047]	0.223*** [0.049]	0.057 [0.046]	0.066** [0.033]	0.040 [0.046]	0.076 [0.048]
Wave 5	-0.152*** [0.023]	-0.169*** [0.022]			-0.156*** [0.020]	-0.185*** [0.019]		
Age group(ref: 45-54)								
Aged 16-24		0.390*** [0.074]	0.588*** [0.090]	0.216** [0.098]		0.420*** [0.062]	0.323*** [0.079]	0.660*** [0.088]
Aged 25-34		0.211*** [0.048]	0.272*** [0.062]	0.185*** [0.068]		0.205*** [0.044]	0.176*** [0.057]	0.245*** [0.061]
Aged 35-44		0.092** [0.041]	0.090* [0.053]	0.129** [0.058]		0.054 [0.037]	0.034 [0.049]	0.082 [0.053]
Aged 55-64		0.157*** [0.045]	0.219*** [0.059]	0.159*** [0.058]		0.127*** [0.042]	0.188*** [0.055]	0.128** [0.054]
Marital Status(ref: never married)								
Married	-0.005 [0.133]	0.359*** [0.054]	0.357*** [0.063]	0.364*** [0.066]	0.276** [0.113]	0.386*** [0.044]	0.347*** [0.054]	0.420*** [0.056]
Cohabiting	0.096 [0.110]	0.228*** [0.055]	0.203*** [0.066]	0.224*** [0.073]	0.245*** [0.095]	0.210*** [0.048]	0.222*** [0.059]	0.178*** [0.064]
Separated	-0.405* [0.245]	-0.390*** [0.142]	-0.493*** [0.165]	-0.455*** [0.164]	0.292* [0.164]	-0.129 [0.095]	-0.255** [0.109]	-0.145 [0.122]
Divorced	-0.399* [0.209]	-0.016 [0.092]	0.132 [0.101]	-0.086 [0.103]	0.262 [0.165]	-0.080 [0.063]	-0.164** [0.073]	-0.016 [0.076]
Widowed	-0.371 [0.469]	-0.062 [0.205]	-0.276 [0.220]	0.150 [0.212]	-0.163 [0.263]	0.003 [0.117]	-0.056 [0.139]	0.089 [0.132]
Highest Qualification (ref: No qualifications)								
Degree and above	0.582* [0.319]	0.030 [0.084]	-0.035 [0.091]	-0.015 [0.099]	-0.604* [0.338]	0.287*** [0.074]	0.257*** [0.078]	0.259*** [0.085]
Other higher qualifications	0.231 [0.354]	0.004 [0.089]	-0.014 [0.097]	-0.043 [0.105]	-0.319 [0.325]	0.279*** [0.076]	0.264*** [0.080]	0.244*** [0.087]
A-level	0.570* [0.310]	0.001 [0.084]	-0.042 [0.090]	-0.043 [0.099]	-0.544* [0.311]	0.199*** [0.075]	0.199** [0.079]	0.164* [0.086]
GCSE	0.524* [0.304]	0.018 [0.084]	-0.011 [0.090]	-0.034 [0.099]	-0.440 [0.311]	0.169** [0.073]	0.162** [0.075]	0.154* [0.083]
Other qualifications	0.686* [0.354]	-0.032 [0.096]	-0.059 [0.100]	-0.078 [0.109]	0.038 [0.323]	0.118 [0.087]	0.033 [0.090]	0.194** [0.097]

Age of the youngest child (ref: no children under 16)

Aged 0-2	-0.056	0.040	0.069	0.047	0.156**	0.257***	0.214***	0.370***
	[0.083]	[0.050]	[0.068]	[0.077]	[0.075]	[0.045]	[0.062]	[0.070]
Aged 3-4	-0.072	-0.004	-0.078	0.067	-0.033	0.027	0.018	0.078
	[0.102]	[0.061]	[0.089]	[0.096]	[0.088]	[0.053]	[0.075]	[0.081]
Aged 5-11	-0.149	-0.069	-0.019	-0.098	-0.044	-0.008	-0.014	0.043
	[0.091]	[0.049]	[0.065]	[0.067]	[0.079]	[0.041]	[0.053]	[0.056]
Aged 12-15	-0.032	0.020	-0.063	0.134	-0.085	-0.055	-0.059	0.011
	[0.081]	[0.055]	[0.079]	[0.084]	[0.064]	[0.046]	[0.063]	[0.068]

Economic Activity (ref: Employed)

Unemployed	-0.416***	-0.549***	-0.648***	-0.466***	-0.207**	-0.453***	-0.438***	-0.622***
	[0.089]	[0.067]	[0.077]	[0.093]	[0.090]	[0.070]	[0.083]	[0.095]
Retired	0.292***	0.304***	0.259**	0.350***	0.028	0.286***	0.479***	0.281***
	[0.113]	[0.075]	[0.107]	[0.088]	[0.104]	[0.064]	[0.094]	[0.074]
Education	0.270**	0.187**	0.096	0.145	0.147	0.170***	0.250***	-0.044
	[0.119]	[0.081]	[0.107]	[0.143]	[0.097]	[0.066]	[0.088]	[0.125]
Not in the labour force	-0.468***	-0.964***	-1.086***	-0.959***	-0.148**	-0.324***	-0.307***	-0.395***
	[0.146]	[0.083]	[0.091]	[0.094]	[0.064]	[0.041]	[0.048]	[0.052]
Log (equivalised income)	0.064*	0.130***	0.136***	0.146***	-0.035	0.068***	0.108***	0.078***
	[0.037]	[0.025]	[0.029]	[0.032]	[0.026]	[0.021]	[0.026]	[0.028]
Long-standing illness	-0.120**	-0.345***	-0.449***	-0.322***	-0.195***	-0.454***	-0.592***	-0.429***
	[0.049]	[0.033]	[0.042]	[0.045]	[0.044]	[0.029]	[0.036]	[0.038]
Smoker	-0.066	-0.179***	-0.161***	-0.199***	0.041	-0.192***	-0.226***	-0.174***
	[0.076]	[0.038]	[0.046]	[0.051]	[0.068]	[0.035]	[0.041]	[0.045]

Alcohol frequency(ref: less often/don't drink)

Almost every day	-0.001	0.032	0.032	0.022	-0.123	0.028	0.011	0.059
	[0.111]	[0.057]	[0.070]	[0.073]	[0.112]	[0.061]	[0.076]	[0.078]
5 or 6 days per week	0.024	0.138**	0.194**	0.090	-0.080	0.128**	0.201***	0.113
	[0.103]	[0.055]	[0.076]	[0.078]	[0.096]	[0.056]	[0.077]	[0.079]
3 or 4 days per week	-0.062	0.080*	0.114**	0.081	-0.008	0.132***	0.118**	0.161***
	[0.078]	[0.041]	[0.053]	[0.056]	[0.065]	[0.036]	[0.049]	[0.052]
1 or 2 days per week	-0.006	0.089**	0.113**	0.085*	0.025	0.149***	0.170***	0.167***
	[0.059]	[0.035]	[0.046]	[0.047]	[0.045]	[0.028]	[0.038]	[0.040]
Healthy Bread	-0.020	0.035	0.074*	0.029	-0.030	0.014	-0.016	0.055
	[0.043]	[0.029]	[0.039]	[0.040]	[0.038]	[0.025]	[0.034]	[0.036]
No bread	-0.119	-0.057	-0.059	-0.033	-0.192**	-0.064	0.099	-0.089
	[0.188]	[0.128]	[0.177]	[0.146]	[0.087]	[0.066]	[0.104]	[0.084]
Low fat milk	0.026	-0.029	-0.058	-0.029	0.021	0.024	0.028	0.009
	[0.070]	[0.040]	[0.055]	[0.057]	[0.053]	[0.031]	[0.041]	[0.043]
No Milk	0.146	0.021	-0.089	0.082	0.004	-0.015	0.044	-0.096
	[0.148]	[0.092]	[0.120]	[0.116]	[0.127]	[0.080]	[0.102]	[0.102]

Observations	10,492	10,492	5,246	5,246	14,338	14,338	7,169	7,169
R-squared	0.028		0.153	0.121	0.022		0.131	0.108

Number of pidp 5,246 5,246 7,169 7,169

standard errors in brackets

*** p<0.01, ** p<0.05, * p<0.1

GHQ

	Men				Women			
	FE	RE	Wave 2	Wave 5	FE	RE	Wave 2	Wave 5
5+ portions of fruit/veg per day	0.402** [0.181]	0.454*** [0.127]	0.480** [0.187]	0.412** [0.172]	0.163 [0.169]	0.324*** [0.122]	0.447*** [0.170]	0.250 [0.178]
Exercise 3+ times per week	0.189 [0.170]	0.508*** [0.119]	0.670*** [0.162]	0.568*** [0.167]	0.379*** [0.142]	0.570*** [0.102]	0.546*** [0.148]	0.702*** [0.146]
Wave 5	-0.189** [0.078]	-0.145* [0.077]			-0.156** [0.076]	-0.251*** [0.073]		
Age group(ref: 45-54)								
Aged 16-24		1.158*** [0.262]	1.613*** [0.335]	0.750** [0.371]		0.814*** [0.251]	0.629* [0.322]	1.448*** [0.352]
Aged 25-34		0.453*** [0.175]	0.636*** [0.221]	0.191 [0.249]		0.411** [0.173]	0.297 [0.221]	0.557** [0.246]
Aged 35-44		-0.043 [0.151]	0.124 [0.203]	-0.011 [0.214]		0.140 [0.147]	-0.018 [0.196]	0.321 [0.210]
Aged 55-64		0.557*** [0.159]	0.675*** [0.229]	0.723*** [0.213]		0.506*** [0.157]	0.606*** [0.223]	0.766*** [0.209]
Marital Status(ref: never married)								
Married	0.938** [0.466]	0.437** [0.199]	0.130 [0.248]	0.585** [0.258]	-0.100 [0.455]	0.484*** [0.184]	0.426* [0.228]	0.582** [0.240]
Cohabiting	0.456 [0.390]	0.169 [0.201]	-0.349 [0.250]	0.491* [0.274]	-0.238 [0.385]	0.084 [0.198]	0.132 [0.246]	0.103 [0.271]
Separated	-0.816 [0.916]	-1.162** [0.561]	-1.829** [0.795]	-0.734 [0.733]	-0.006 [0.668]	-0.777** [0.349]	-0.767* [0.440]	-1.240** [0.519]
Divorced	-0.032 [0.737]	0.053 [0.334]	0.068 [0.381]	0.127 [0.434]	0.194 [0.626]	-0.394 [0.262]	-0.448 [0.319]	-0.348 [0.335]
Widowed	3.927* [2.016]	0.745 [0.788]	-0.753 [0.965]	1.319 [0.857]	-2.054** [0.974]	-0.462 [0.483]	-0.391 [0.632]	-0.116 [0.563]
Highest Qualification (ref: No qualifications)								
Degree and above	2.060 [1.493]	-0.535* [0.304]	-0.882** [0.355]	-0.483 [0.383]	-0.627 [1.233]	0.802*** [0.293]	0.802** [0.341]	0.555 [0.368]
Other higher qualifications	1.776 [1.542]	-0.591* [0.324]	-0.957** [0.379]	-0.454 [0.402]	0.426 [1.235]	0.818*** [0.303]	0.748** [0.349]	0.656* [0.378]
A-level	1.966 [1.490]	-0.336 [0.306]	-0.699** [0.355]	-0.190 [0.380]	-0.485 [1.115]	0.521* [0.300]	0.613* [0.346]	0.284 [0.378]
GCSE	1.616 [1.438]	-0.052 [0.306]	-0.220 [0.355]	-0.099 [0.385]	0.821 [1.138]	0.853*** [0.291]	0.859** [0.335]	0.645* [0.362]
Other qualifications	0.159 [1.230]	-0.472 [0.346]	-0.530 [0.403]	-0.489 [0.433]	1.048 [1.114]	0.501 [0.340]	0.306 [0.399]	0.629 [0.416]
Age of the youngest child (ref: no children under 16)								

Aged 0-2	-0.241	-0.070	0.086	-0.214	0.054	0.472**	0.551**	0.562**
	[0.287]	[0.177]	[0.239]	[0.262]	[0.307]	[0.183]	[0.243]	[0.275]
Aged 3-4	-0.148	0.115	0.474*	-0.092	-0.007	0.295	0.270	0.399
	[0.359]	[0.217]	[0.283]	[0.329]	[0.346]	[0.212]	[0.293]	[0.325]
Aged 5-11	-0.398	-0.245	-0.203	-0.306	-0.328	0.065	0.097	0.285
	[0.342]	[0.186]	[0.241]	[0.252]	[0.313]	[0.163]	[0.209]	[0.221]
Aged 12-15	-0.110	-0.186	-0.438	-0.104	-0.228	0.008	-0.329	0.591**
	[0.296]	[0.211]	[0.299]	[0.308]	[0.258]	[0.178]	[0.249]	[0.260]
Economic Activity (ref: Employed)								
Unemployed	-2.504***	-2.403***	-2.468***	-1.998***	-1.465***	-2.327***	-2.273***	-3.078***
	[0.338]	[0.265]	[0.350]	[0.425]	[0.396]	[0.312]	[0.394]	[0.505]
Retired	0.919**	0.515*	0.647	0.283	0.977***	0.899***	0.828**	0.891***
	[0.409]	[0.268]	[0.409]	[0.323]	[0.320]	[0.210]	[0.346]	[0.261]
Education	-0.044	-0.410	-0.776**	-0.568	-0.113	-0.379	-0.088	-1.804***
	[0.456]	[0.312]	[0.386]	[0.564]	[0.408]	[0.277]	[0.331]	[0.530]
Not in the labour force	-2.681***	-4.539***	-5.452***	-4.350***	-0.998***	-1.721***	-1.821***	-1.876***
	[0.617]	[0.354]	[0.483]	[0.437]	[0.255]	[0.168]	[0.216]	[0.228]
Log (equivalised income)	0.144	0.221***	0.209*	0.262**	-0.253**	-0.015	-0.065	0.176
	[0.112]	[0.083]	[0.111]	[0.121]	[0.103]	[0.076]	[0.106]	[0.111]
Long-standing illness	-0.804***	-1.712***	-1.981***	-1.931***	-0.810***	-2.172***	-2.676***	-2.464***
	[0.172]	[0.123]	[0.170]	[0.176]	[0.176]	[0.117]	[0.154]	[0.160]
Smoker	-0.510*	-0.564***	-0.464***	-0.592***	-0.233	-0.652***	-0.801***	-0.455**
	[0.287]	[0.144]	[0.176]	[0.194]	[0.285]	[0.139]	[0.176]	[0.190]
Alcohol frequency(ref: less often/don't drink)								
Almost every day	-0.945**	-0.187	-0.102	-0.033	-0.641	-0.087	-0.270	0.147
	[0.396]	[0.205]	[0.261]	[0.274]	[0.411]	[0.231]	[0.320]	[0.297]
5 or 6 days per week	-0.498	0.123	-0.001	0.214	-0.607*	0.171	0.255	0.419
	[0.371]	[0.195]	[0.263]	[0.263]	[0.364]	[0.209]	[0.271]	[0.286]
3 or 4 days per week	-0.682**	0.003	0.058	0.171	-0.095	0.287**	0.311	0.254
	[0.279]	[0.153]	[0.198]	[0.206]	[0.254]	[0.147]	[0.190]	[0.203]
1 or 2 days per week	0.003	0.308**	0.213	0.427**	0.218	0.540***	0.631***	0.532***
	[0.200]	[0.124]	[0.170]	[0.171]	[0.182]	[0.111]	[0.145]	[0.155]
Healthy Bread	-0.076	0.153	0.330**	0.142	0.094	0.214**	0.085	0.376***
	[0.152]	[0.102]	[0.139]	[0.143]	[0.134]	[0.096]	[0.133]	[0.140]
No bread	0.312	0.816*	0.917*	1.039	0.153	0.348	0.554	0.387
	[0.610]	[0.488]	[0.557]	[0.680]	[0.333]	[0.258]	[0.422]	[0.333]
Low fat milk	-0.288	-0.230	-0.384*	-0.059	-0.013	-0.124	-0.184	-0.140
	[0.220]	[0.146]	[0.208]	[0.201]	[0.193]	[0.121]	[0.161]	[0.166]
No Milk	0.455	0.440	0.545	0.468	-0.048	0.113	0.445	-0.132
	[0.437]	[0.293]	[0.399]	[0.401]	[0.437]	[0.297]	[0.394]	[0.436]
Observations	10,454	10,454	5,209	5,245	14,292	14,292	7,125	7,167
R-squared	0.038		0.152	0.119	0.017		0.114	0.103
Number of pidp	5,246	5,246			7,169	7,169		

standard errors in brackets
 *** p<0.01, ** p<0.05, * p<0.1

Table 11. Correlation between LS and Health measures (all significant at 5% or higher)

(Men) Women	LS	GHQ	Long-Standing Illness	Health Satisfaction	General Health
Life Satisfaction (LS)	(1) 1				
Mental Wellbeing (GHQ)	(0.54) 0.52	(1) 1			
Long Standing Health Issue (0,1)	(-0.21) -0.21	(-0.25) -0.25	(1) 1		
Satisfaction with Health (1 to 5)	(0.57) 0.56	(0.36) 0.33	(-0.15) -0.17	(1) 1	
General Health (1 to 5)	(0.36) 0.36	(0.38) 0.39	(-0.45) -0.47	(0.29) 0.29	(1) 1

Table 12. Life Satisfaction Models for Comparison of Fixed Effects, Between Effects and Random Effects

	Men			Women		
	FE	BE	RE	FE	BE	RE
5+ portions of fruit/veg per day	0.046 [0.049]	0.234*** [0.051]	0.153*** [0.036]	0.108*** [0.042]	0.152*** [0.039]	0.139*** [0.028]
Exercise 3+ times per week	0.118** [0.051]	0.202*** [0.047]	0.179*** [0.034]	0.057 [0.046]	0.039 [0.047]	0.071** [0.033]
Wave 5	-0.152*** [0.023]		-0.171*** [0.022]	-0.156*** [0.020]		-0.191*** [0.019]
Marital Status(ref: never married)						
Married	-0.005 [0.133]	0.276*** [0.050]	0.266*** [0.044]	0.276** [0.113]	0.228*** [0.043]	0.268*** [0.038]
Cohabiting	0.096 [0.110]	0.136** [0.060]	0.167*** [0.050]	0.245*** [0.095]	0.096* [0.054]	0.144*** [0.045]
Separated	-0.405* [0.245]	-0.721*** [0.154]	-0.486*** [0.118]	0.292* [0.164]	-0.454*** [0.105]	-0.242*** [0.083]
Divorced	-0.399* [0.209]	-0.027 [0.084]	-0.123 [0.075]	0.262 [0.165]	-0.241*** [0.059]	-0.204*** [0.054]
Widowed	-0.371 [0.469]	-0.064 [0.182]	-0.126 [0.166]	-0.163 [0.263]	-0.085 [0.113]	-0.104 [0.102]
Highest Qualification (ref: No qualifications)						

Degree and above	0.582*	-0.093	0.045	-0.604*	0.206***	0.301***
	[0.319]	[0.078]	[0.075]	[0.338]	[0.067]	[0.064]
Other higher qualifications	0.231	-0.077	0.012	-0.319	0.217***	0.289***
	[0.354]	[0.083]	[0.081]	[0.325]	[0.069]	[0.067]
A-level	0.570*	-0.075	0.029	-0.544*	0.180***	0.234***
	[0.310]	[0.077]	[0.075]	[0.311]	[0.068]	[0.065]
GCSE	0.524*	-0.060	0.026	-0.440	0.146**	0.184***
	[0.304]	[0.077]	[0.075]	[0.311]	[0.065]	[0.063]
Other qualifications	0.686*	-0.111	-0.038	0.038	0.075	0.102
	[0.354]	[0.086]	[0.083]	[0.323]	[0.078]	[0.075]
Age of the youngest child (ref: no children under 16)						
Aged 0-2	-0.056	0.167**	0.063	0.156**	0.423***	0.298***
	[0.083]	[0.069]	[0.048]	[0.075]	[0.061]	[0.043]
Aged 3-4	-0.072	-0.082	-0.003	-0.033	0.055	0.035
	[0.102]	[0.106]	[0.061]	[0.088]	[0.087]	[0.050]
Aged 5-11	-0.149	-0.090	-0.105**	-0.044	-0.026	-0.042
	[0.091]	[0.059]	[0.046]	[0.079]	[0.045]	[0.036]
Aged 12-15	-0.032	-0.062	-0.034	-0.085	-0.068	-0.111**
	[0.081]	[0.084]	[0.056]	[0.064]	[0.067]	[0.044]
Economic Activity (ref: Employed)						
Unemployed	-0.416***	-0.551***	-0.535***	-0.207**	-0.660***	-0.431***
	[0.089]	[0.084]	[0.059]	[0.090]	[0.095]	[0.061]
Retired	0.292***	0.426***	0.339***	0.028	0.563***	0.325***
	[0.113]	[0.084]	[0.067]	[0.104]	[0.071]	[0.056]
Education	0.270**	0.370***	0.312***	0.147	0.395***	0.298***
	[0.119]	[0.109]	[0.078]	[0.097]	[0.095]	[0.067]
Not in the labour force	-0.468***	-1.091***	-0.967***	-0.148**	-0.368***	-0.318***
	[0.146]	[0.084]	[0.069]	[0.064]	[0.047]	[0.037]
Log (equivalised income)	0.064*	0.167***	0.131***	-0.035	0.139***	0.071***
	[0.037]	[0.029]	[0.022]	[0.026]	[0.026]	[0.019]
Long-standing illness	-0.120**	-0.483***	-0.356***	-0.195***	-0.626***	-0.467***
	[0.049]	[0.042]	[0.032]	[0.044]	[0.035]	[0.027]
Smoker	-0.066	-0.181***	-0.183***	0.041	-0.212***	-0.192***
	[0.076]	[0.042]	[0.036]	[0.068]	[0.038]	[0.033]
Alcohol frequency(ref: less often/don't drink)						
Almost every day	-0.001	-0.011	0.010	-0.123	0.011	0.000
	[0.111]	[0.065]	[0.053]	[0.112]	[0.071]	[0.057]
5 or 6 days per week	0.024	0.123	0.119**	-0.080	0.183**	0.097*
	[0.103]	[0.076]	[0.056]	[0.096]	[0.077]	[0.056]
3 or 4 days per week	-0.062	0.101**	0.066	-0.008	0.110**	0.111***
	[0.078]	[0.050]	[0.040]	[0.065]	[0.048]	[0.037]
1 or 2 days per week	-0.006	0.106**	0.086**	0.025	0.188***	0.141***
	[0.059]	[0.044]	[0.034]	[0.045]	[0.038]	[0.028]

Healthy Bread	-0.020	0.047	0.023	-0.030	0.007	0.003
	[0.043]	[0.038]	[0.029]	[0.038]	[0.034]	[0.025]
No bread	-0.119	-0.032	-0.070	-0.192**	0.047	-0.076
	[0.188]	[0.166]	[0.110]	[0.087]	[0.095]	[0.064]
Low fat milk	0.026	-0.082	-0.034	0.021	-0.004	0.016
	[0.070]	[0.052]	[0.041]	[0.053]	[0.038]	[0.031]
No Milk	0.146	-0.041	0.015	0.004	-0.055	-0.025
	[0.148]	[0.112]	[0.086]	[0.127]	[0.096]	[0.075]
Observations	10,492	10,492	10,492	14,338	14,338	14,338
R-squared	0.028	0.186	0.1299	0.022	0.169	0.1136
Number of pidp	5,246	5,246	5,246	7,169	7,169	7,169

standard errors in brackets

*** p<0.01, ** p<0.05, * p<0.1

GHQ Measure

	Men			Women		
	FE	BE	RE	FE	BE	RE
5+ portions of fruit/veg per day	0.402**	0.447**	0.450***	0.379***	0.698***	0.562***
	[0.181]	[0.188]	[0.128]	[0.142]	[0.154]	[0.108]
Exercise 3+ times per week	0.189	0.737***	0.509***	0.163	0.342*	0.323**
	[0.170]	[0.174]	[0.122]	[0.169]	[0.188]	[0.126]
Wave 5	-0.189**		-0.134*	-0.156**		-0.252***
	[0.078]		[0.075]	[0.076]		[0.072]
Marital Status(ref: never married)						
Married	0.938**	0.242	0.220	-0.100	0.235	0.299**
	[0.466]	[0.185]	[0.162]	[0.455]	[0.170]	[0.150]
Cohabiting	0.456	-0.110	-0.005	-0.238	-0.052	-0.026
	[0.390]	[0.221]	[0.182]	[0.385]	[0.215]	[0.175]
Separated	-0.816	-1.468**	-1.440***	-0.006	-1.486***	-0.950***
	[0.916]	[0.573]	[0.424]	[0.668]	[0.418]	[0.323]
Divorced	-0.032	0.057	-0.208	0.194	-0.614***	-0.577***
	[0.737]	[0.310]	[0.274]	[0.626]	[0.236]	[0.212]
Widowed	3.927*	0.305	0.659	-2.054**	-0.173	-0.578
	[2.016]	[0.668]	[0.604]	[0.974]	[0.450]	[0.402]
Highest Qualification (ref: No qualifications)						
Degree and above	2.060	-0.950***	-0.554**	-0.627	0.371	0.779***
	[1.493]	[0.291]	[0.277]	[1.233]	[0.268]	[0.255]
Other higher qualifications	1.776	-0.932***	-0.614**	0.426	0.454*	0.796***
	[1.542]	[0.308]	[0.297]	[1.235]	[0.276]	[0.265]
A-level	1.966	-0.621**	-0.294	-0.485	0.293	0.544**
	[1.490]	[0.287]	[0.275]	[1.115]	[0.270]	[0.258]
GCSE	1.616	-0.308	-0.076	0.821	0.556**	0.845***
	[1.438]	[0.287]	[0.277]	[1.138]	[0.259]	[0.251]
Other qualifications	0.159	-0.627*	-0.515*	1.048	0.270	0.442
	[1.230]	[0.320]	[0.307]	[1.114]	[0.309]	[0.295]

Age of the youngest child (ref: no children under 16)

Aged 0-2	-0.241	-0.240	-0.166	0.054	0.696***	0.497***
	[0.287]	[0.255]	[0.171]	[0.307]	[0.243]	[0.165]
Aged 3-4	-0.148	0.048	-0.054	-0.007	0.103	0.261
	[0.359]	[0.390]	[0.217]	[0.346]	[0.346]	[0.193]
Aged 5-11	-0.398	-0.519**	-0.487***	-0.328	0.045	-0.052
	[0.342]	[0.217]	[0.167]	[0.313]	[0.180]	[0.142]
Aged 12-15	-0.110	-0.856***	-0.389**	-0.228	-0.071	-0.148
	[0.296]	[0.313]	[0.197]	[0.258]	[0.265]	[0.167]

Economic Activity (ref: Employed)

Unemployed	-2.504***	-1.747***	-2.339***	-1.465***	-3.117***	-2.295***
	[0.338]	[0.312]	[0.211]	[0.396]	[0.377]	[0.234]
Retired	0.919**	0.812***	0.705***	0.977***	1.454***	1.092***
	[0.409]	[0.312]	[0.242]	[0.320]	[0.280]	[0.218]
Education	-0.044	0.091	-0.000	-0.113	-0.476	-0.168
	[0.456]	[0.404]	[0.280]	[0.408]	[0.379]	[0.258]
Not in the labour force	-2.681***	-5.199***	-4.518***	-0.998***	-1.899***	-1.703***
	[0.617]	[0.312]	[0.248]	[0.255]	[0.188]	[0.142]
Log (equivalised income)	0.144	0.248**	0.219***	-0.253**	0.150	-0.012
	[0.112]	[0.107]	[0.078]	[0.103]	[0.104]	[0.074]
Long-standing illness	-0.804***	-2.353***	-1.728***	-0.810***	-3.138***	-2.183***
	[0.172]	[0.154]	[0.113]	[0.176]	[0.140]	[0.105]
Smoker	-0.510*	-0.566***	-0.593***	-0.233	-0.636***	-0.661***
	[0.287]	[0.157]	[0.132]	[0.285]	[0.152]	[0.130]

Alcohol frequency(ref: less often/don't drink)

Almost every day	-0.945**	0.086	-0.221	-0.641	-0.091	-0.116
	[0.396]	[0.240]	[0.193]	[0.411]	[0.283]	[0.222]
5 or 6 days per week	-0.498	0.021	0.093	-0.607*	0.576*	0.122
	[0.371]	[0.282]	[0.199]	[0.364]	[0.308]	[0.216]
3 or 4 days per week	-0.682**	0.267	-0.029	-0.095	0.142	0.251*
	[0.279]	[0.187]	[0.145]	[0.254]	[0.192]	[0.145]
1 or 2 days per week	0.003	0.332**	0.300**	0.218	0.596***	0.525***
	[0.200]	[0.163]	[0.123]	[0.182]	[0.150]	[0.110]

Healthy Bread

	-0.076	0.256*	0.121	0.094	0.208	0.199**
	[0.152]	[0.142]	[0.102]	[0.134]	[0.136]	[0.096]
No bread	0.312	1.235**	0.761*	0.153	0.515	0.332
	[0.610]	[0.615]	[0.389]	[0.333]	[0.378]	[0.245]
Low fat milk	-0.288	-0.248	-0.255*	-0.013	-0.255*	-0.138
	[0.220]	[0.192]	[0.149]	[0.193]	[0.153]	[0.121]
No Milk	0.455	0.401	0.419	-0.048	0.202	0.087
	[0.437]	[0.414]	[0.308]	[0.437]	[0.383]	[0.288]

Observations	10,454	10,454	10,454	14,292	14,292	14,292
R-squared	0.038	0.174	0.1274	0.017	0.151	0.1031

Number of pidp	5,246	5,246	5,246	7,169	7,169	7,169
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standard errors in brackets

*** p<0.01, ** p<0.05, * p<0.1

Table 13. Variation of Life Satisfaction, Fruit and Veg Consumption and Exercise between the two waves (overall, within and between)

	Men	Women
Life satisfaction		
Mean	5.07	5.13
Overall sd	1.43	1.47
between sd	1.20	1.23
within sd	0.79	0.80
GHQ		
Mean	25.22	24.27
Overall sd	5.16	5.67
between sd	4.41	4.83
within sd	2.70	2.97
Portions of fruit and veg		
Mean	3.52	4.04
Overall sd	1.84	1.86
between sd	1.63	1.66
within sd	0.86	0.84
5+ portions fruit/veg		
Mean	0.17	0.25
Overall sd	0.38	0.43
between sd	0.31	0.37
within sd	0.21	0.23
Exercise 3+ times per week		
Mean	0.20	0.15
Overall sd	0.40	0.36
between sd	0.33	0.29
within sd	0.22	0.21
Frequency of Moderate Exercise		
Mean	2.39	2.50
Overall sd	0.79	0.74
between sd	0.68	0.62
within sd	0.40	0.40

Table 14. Variation of Life Satisfaction, Fruit and Veg Consumption and Exercise between the two waves (Increases and Decreases)

	Men	Women
Portions of fruit and veg		
No change	30.88	31.36
Fewer fruit and veg	30.29	30.35
<i>1</i>	16.2	16.64
<i>>1</i>	14.09	13.71
More fruit and veg	38.83	38.29
<i>1</i>	18.64	18.94
<i>>1</i>	20.19	19.35
5+ portions fruit/veg dummy		
No change	82.04	78.56
No longer 5+	7.19	8.84
Switch to 5+	10.77	12.6
Exercise 3+ times per week dummy		
No change	80.92	82.77
No longer 3+	9.4	8.33
Switch to 3+	9.68	8.9
Frequency of Moderate Exercise		
No change	63.25	63.19
Increase exercise	19.06	18.16
Decrease exercise	17.69	18.65

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