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This is an **author produced version** of a paper published in:

Psychology & Health 38.3 (2023): 307-323

DOI: <https://doi.org/10.1080/08870446.2021.1960988>

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Title: To Be Happy and Behave in a Healthier Way. A Longitudinal Study about Gender Differences in the Older Population

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Abstract

Introduction: Subjective well-being plays a key role in health. The objectives of this study are to analyse the longitudinal associations between subjective well-being dimensions and healthy behaviours, and to examine gender differences.

Method: A representative sample of 1,190 Spanish non-institutionalised adults aged 50+ were interviewed over a 6-year follow-up period. The Cantril scale was used to measure evaluative well-being. The Day Reconstruction Method measured experienced well-being. The Global Physical Activity Questionnaire was used, whereas fruit and vegetables, tobacco and alcohol consumption, and sleep quality were self-reported. The Generalised Estimating Equation was calculated.

Results: Women show significantly worse subjective well-being than men longitudinally. Higher scores in life satisfaction and positive affect were significantly related to a higher level of physical activity and better-quality sleep for both women and men. Associations between a higher life satisfaction and an adequate intake of fruits and vegetables and being a non-smoker was only found in women (OR = 1.05; 95% IC = 1.00, 1.10 and OR = 1.16; 95% IC = 1.09, 1.23, respectively).

Conclusion: Subjective well-being levels and frequencies in healthy behaviours are different in women and men. Subjective well-being interventions should take into account these differences in the frequency of healthy-unhealthy behaviours.

Keywords: positive affect; negative affect; life satisfaction; healthy life; old; middle age.

Introduction

Older population figures are growing fast. People aged 50+ already accounts for 24.2% of world population, and they are expected to increase over the next several years (United Nations, 2019). Therefore, the preservation of a healthy and independent life and the enhancement of subjective well-being in older adults have become a priority in the global agenda (World Health Organization, 2017). The promotion of healthy ageing should then represent the focus of public health policy in several countries, representing a challenge for policy makers, researchers, as well as health professionals. However, little is known about how healthy lifestyles differ between distinct groups of older adults.

Subjective well-being has been described as the individual's cognitive and affective rating of her or his life, varying from global cognitive evaluations of life satisfaction (evaluative dimension), to momentary positive and negative emotional reactions to events (experienced dimension) (Chang, Lu, & Zhang, 2019; Diener, 2000). The combined assessment of both dimensions is highly recommended since experienced well-being is enclosed in a specific point in time, whereas evaluative well-being is not and can be influenced by memory bias (Diener, Suh, Lucas, & Smith, 1999).

Previous studies have consistently found an association between healthy behaviours and physical as well as mental health (Dale, Brassington, & King, 2014; Dillon, McMahon, O'Regan, & Perry, 2018; Sabia et al., 2012). Previous research has also analysed the impact of healthy behaviours on specific subjective well-being dimensions (Cho, Martin, Margrett, MacDonald, & Poon, 2011; Dohle & Hofmann, 2019; Lee, 2016; Mujcic & J. Oswald, 2016; Pagan, 2017). Additionally, extensive literature has tried to study gender-related differences in healthy behaviours, mainly in child and adolescent

populations (Galan-Lopez, Ries, Gisladdottir, Domínguez, & Sánchez-Oliver, 2018; Poutanen, Lahti, Tolvanen, & Hausen, 2007).

On the other hand, subjective well-being plays a key function as a protective factor against physical morbidity and mental disorders (Mroczek & Kolarz, 1998). It seems to have a positive impact on healthy behaviours, maintaining health status and increasing life span (Helliwell, Layard, & Sachs, 2012; Ostir, Markides, Peek, & Goodwin, 2001). Examining the impact of subjective well-being on healthy lifestyles is important since the promotion of healthy lifestyles in older people might be more difficult than in the adult population (Klusmann, Musculus, Sproesser, & Renner, 2016). In this regard, the World Health Organization claims to promote older persons' health as a critical issue considering the diversity of health and functional states in this population, often driven by circumstances that are over the human being's control such as genetic inheritance and physical and social environments (World Health Organization, 2015). Subjective emotional and self-perception outcomes have been found to have a relevant role on the efficacy of physical exercise (Klusmann et al., 2016) and healthy eating promotion programmes (Fuemmeler et al., 2006) in older adults. A previous study showed that several well-being dimensions were prospectively related to higher healthy lifestyles (Martín-María et al., 2020), but it did not analyse whether these associations differed for women and men.

Apart from that, isolated differences in healthy behaviours between older women and men have already been described. A latent class analysis study, carried out with 3,133 Australian older adults aged 55–65 years, found two classes of lifestyle patterns, one called “healthy”, comprising 53% men and 72% women, and another identified as “less healthy lifestyles” (Södergren et al., 2014). Moreover, in a recent cross-sectional study

with 1,831 community-dwellers aged 65 years and above from China, men were found to smoke more frequently and consume more alcohol and were more cognitively active, whereas women were more socially engaged (Liu, Luo, Tang, & Wong, 2020). Longitudinal knowledge in this context is still limited, supporting the need for exploring which possible factors determine healthier lifestyles between women and men.

To the best of our knowledge, it is still unknown whether the dimensions of subjective well-being could be differently related to healthy behaviours in women and men from the general older population, and whether these differences are maintained over the years despite changes in subjective well-being aspects. The aims of the present study were to examine the longitudinal associations over a 6-year period between subjective well-being dimensions (independent variables) –evaluative well-being and experienced well-being- and five healthy behaviours (outcomes) -high level of physical activity, good quality of sleep, intake of five or more fruits and vegetables per day, being a non-smoker, and a non-heavy drinker- and to analyse whether these potential associations differed between women and men coming from a nationwide representative survey. Based on previous findings, it is hypothesized that: (a) subjective well-being dimensions are prospective and longitudinally associated with healthy behaviours; and (b) there are gender differences in subjective well-being dimensions, healthy behaviours, and their longitudinal relationships.

Method

Sample and procedure

A prospective longitudinal study was carried out over a nationally representative sample of non-institutionalised adults from the Spanish population. Baseline data was

obtained between 2011-2012 within the *Collaborative Research on Ageing in Europe* (*COURAGE in Europe*) project, also including nationally representative samples from Finland and Poland (Miret et al., 2014). A second wave was undertaken in 2014-2015 as part of the *Edad con Salud* project. In 2018, the third wave took place. Seeking to guarantee the representativeness of the baseline sample, a stratified multistage design was employed at baseline, taking into consideration the different Spanish autonomous communities and the size of their population. Households' data were provided by the Spanish Statistical Office. Structured face-to-face interviews were conducted at participants' residences by Computer-Assisted Personal Interviewing (CAPI). These interviews were carried out by trained interviewers who took part in a training course before the study.

A representative sample of 4,753 individuals was interviewed at baseline (response rate = 69.9%). A total of 2,528 participants completed the first follow-up, whereas 1,577 subjects participated in the second follow-up. The mean follow-up period was 6.4 years (SD = 1.2). Participants unable to respond due to cognitive or physical impairment participated in the survey through a proxy respondent. As a result, self-reported assessments of subjective well-being and healthy behaviours could not be collected. In the present study, we analysed data from individuals aged 50 years or older at baseline who then completed the two follow-ups. The final analytic sample comprised 1,190 participants who provided information on subjective well-being and healthy behaviours in the three-time occasions.

Ethics statement

The study protocols were approved in each wave by the Ethics Review Committees of the Hospital Universitario de La Princesa, Madrid and Parc Sanitari Sant Joan de Déu,

Barcelona. Written informed consent was provided by all respondents on all three occasions of the data collection.

Measures

Subjective well-being measures

Evaluative well-being (life satisfaction) was measured with the Cantril Self-Anchoring Striving Scale (Cantril, 1965). Subjects were asked to place themselves in a ladder with steps from 0 (illustrating the worst possible life) to 10 (illustrating the best possible life), and report on which step of the ladder they felt they were standing at that time.

Experienced well-being was assessed using an abbreviated version (Ayuso-Mateos et al., 2013) of the Day Reconstruction Method (DRM) (Kahneman, Krueger, Schkade, Schwarz, & Stone, 2004). Participants reconstructed a portion of the activities of the previous day, replying to specific questions about the activity itself: its nature (e.g. preparing food, watching television) and the extent to which they experienced a total of seven emotions (calm or relaxed, enjoying, worried, rushed, irritated or angry, depressed, and tense or stressed), using a seven-point response scale ranging from 0 (not at all) to 6 (very much). *Positive affect* was defined as the average of the positive emotions (calm/relaxed and enjoying) whereas *negative affect* was operationalised as the average of the negative ones (worried, rushed, irritated/angry, depressed, and tense/stressed) (Kahneman et al., 2004). Both assessments were weighted by the duration of the activities (Krueger & Stone, 2008). Global scores ranged from 0 to 6, with higher values indicating greater positive and negative affect. Both positive and negative affect were included as separate aspects of experienced well-being in the study. Omega coefficient values in the overall baseline sample analysed in the present study were 0.84 and 0.93 for positive and

negative affect respectively, used to assess internal consistency for composite reliability. Given that omega coefficient values can range between 0 (no reliability) and 1 (perfect reliability) (McDonald, 2013), the obtained omega coefficients represented a high internal consistency.

Healthy behaviours (outcome variables)

Physical activity was assessed with the Global Physical Activity Questionnaire version 2 (GPAQ v2) developed by the World Health Organization (WHO) (Bull, Maslin, & Armstrong, 2009). It collects data on physical activity involvement in three contexts (activity at work, travel to and from places, and leisure activities), as well as sedentary behaviour. Individuals' responses were translated to Metabolic Equivalent of Task (MET) values, and then physical activity levels were classified according to the GPAQ v2 guidelines (World Health Organization, 2012): *high* (vigorous-intensity activity on at least 3 days achieving a minimum of at least 1500 MET-minutes per week, or 7 days of any combination of walking, moderate or vigorous intensity activities achieving a minimum of at least 3000 MET-minutes per week), *moderate* (3 or more days of vigorous-intensity activity of at least 20 minutes per day, or 5 or more days of moderate-intensity activity or walking at least 30 minutes per day, or 5 or more days of any combination of walking, moderate or vigorous-intensity activities achieving a minimum of at least 600 MET-minutes per week), or *low* (a person not meeting any of the above-mentioned criteria).

Adequate consumption of fruit and vegetables was registered and categorised as fruit and vegetable joined intake of 5 or more servings per day, according to the WHO and Food and Agriculture Organization recommendations (2003).

Tobacco consumption was assessed and categorised considering two different groups: *non-smokers* and *smokers*.

Alcohol consumption was measured and classified into two categories: *heavy drinkers* for consumers of at least 5 (in men) or 4 (in women) standard alcoholic drinks per day on at least one day during the week before the interview, and *non-heavy drinkers* for those who had never consumed alcohol or had ever consumed alcohol but were not heavy drinkers (World Health Organization, 2000a).

Sleep quality was measured using a single item referred to the day before the interview: “Please rate the quality of your sleep last night. Was it very good, good, moderate, poor or very poor?” Participants answered on a 5-point scale ranging from 0 (‘very poor’) to 4 (‘very good’).

Covariates

Respondents were asked to provide socio-demographic information: age, gender, marital status (single, married or living in a partnership, separated or divorced, and widowed), level of education (less than primary, primary, secondary, and tertiary), quintile of household income (personal earnings of all family members, as well as earnings coming from pensions, unemployment payment and investments, in the last 12 months), and residential setting (rural/urban). Other potential confounders were also analysed. *Height* was measured with a stadiometer and *weight* was quantified with an electronic scale in order to calculate body mass index (BMI). According to the standard definition (World Health Organization, 2000b), BMI was classified as underweight ($<18.5 \text{ kg/m}^2$), normal weight ($18.5\text{-}24.9 \text{ kg/m}^2$), overweight ($25\text{-}29.9 \text{ kg/m}^2$), and obesity ($\geq 30.0 \text{ kg/m}^2$). *Physical multimorbidity* was defined as the presence of two or more physical chronic conditions from the following list: asthma, osteoarthritis, hypertension,

diabetes, chronic lung disease, angina pectoris, and stroke. These chronic physical conditions were evaluated by asking the individuals whether they had received a medical diagnosis in the previous 12 months [see (Garin et al., 2016)]. Moreover, questions about specific symptoms were included to detect undiagnosed subjects (with the exception of diabetes, which was established only by self-report). Hypertension was also assessed by a blood pressure monitor. Participants with systolic blood pressure ≥ 140 mmHg and/or diastolic blood pressure ≥ 90 mmHg were considered to have hypertension (World Health Organization, 2013). Finally, *depression* was defined as the presence of a 12-month depressive episode according to the definitions and criteria of the International Classification of Diseases ICD-10 (World Health Organization, 1993) by using an adapted version (Haro et al., 2006) of the World Health Organization Composite International Diagnostic Interview (CIDI 3.0), (Kessler, Andrews, Mroczek, Ustun, & Wittchen, 1998).

Statistical analysis

Baseline weights were used to consider sampling design and post-stratified modifications were made to adjust for the population distribution obtained from the Spanish national census at baseline (2011) and for non-response (Moussavi et al., 2007).

Weights were employed to report mean population estimates for the subjective well-being variables. Descriptive analyses were performed to characterise the study sample, including socio-demographics and healthy behaviours. Significance tests for differences in the prevalence by socio-demographic characteristics between women and men were conducted for the entire population and separated by gender, using unpaired *t*-tests for the quantitative variables, and the Rao-Scott chi-square statistic for the categorical ones, which adjusts for complex sample designs (Rao & Scott, 1984). As part

of an attrition analysis, followed-up participants were compared in baseline characteristics to those who did not complete the follow-up, notifying effect sizes when significant differences at the 95% confidence interval were detected. Hedges' g for unpaired t -tests and Cramer's V for chi-square-tests were reported as effect size measures. Cohen's guidelines were used as a reference (Cohen, 1988) to assess the magnitude associated to these differences. Hedges' g values of 0.20, 0.50, and 0.80 constitute small, medium, and large effect sizes, respectively; for Cramer's V , these values are 0.10, 0.30, and 0.50.

After confirming the cross-sectional association between subjective well-being dimensions and healthy behaviours through linear and logistic regression models, Generalised Estimating Equation (GEE) models (Hilbe & Hardin, 2008) were conducted to analyse the longitudinal relationship between evaluative well-being, positive affect and negative affect, and each healthy behaviour.

All variables (i.e. subjective well-being dimensions, healthy behaviours), and all covariates at three measurements in 2011-12, 2014-15, and 2018 were included in the GEE models. GEE analyses were carried out for panel data, clustered by the individual identification number, and run considering a population-averaged model. An exchangeable correlation structure and a logit link function were used to account for the correlation between baseline and follow-up observations in the same individual, and the dichotomous nature of the dependent variable (adequate consumption of fruit and vegetables, being a non-smoker, and being a non-heavy drinker). On the other hand, an identity link function was employed for ordinal outcomes (good levels of physical activity and sleep quality). The robust variance estimator (Pan, 2001) was used to account for the within-subject correlation and to obtain reliable standard errors.

A preliminary analysis was performed to determine the covariates included in each of the final GEE models examined, as well as to reduce the number of independent variables in the models and take into account only those covariates that could have a potential significant association with healthy behaviours (p -value < 0.10). For each potential confounder (marital status, level of education, household income, residential setting, BMI, physical multimorbidity, and depression), a preliminary GEE model was performed to predict each healthy behaviour, controlling only for age. Then, selected covariates were incorporated in several GEE models that analysed the association between the predictor variables (life satisfaction, positive affect, and negative affect) and each healthy behaviour for women and men separately, taking into account the remaining healthy behaviours. Beta coefficients (B) and their 95% confidence interval (CI) were reported. All analyses were carried out with Stata software, version 14 (StataCorp, 2015).

Results

In order to examine the potential bias of lack of representativeness of the longitudinal sample, an attrition analysis was conducted comparing the baseline socio-demographic characteristics of participants who comprise the analytic sample ($n = 1,190$) to those who were eligible for the analyses but did not completed the three follow-up interviews ($n = 1,934$). The results are presented in Table S1 (Supplementary Material). Participants not followed-up were significantly older ($p < 0.001$, Hedges' $g = 0.22$) and more individuals were widowed ($p = 0.036$, Cramer's $V = 0.05$), although these effect sizes were small in both cases, meaning that substantial differences were not found based on the sample not analysed. No significant differences between the two groups in the remaining variables (e.g. gender, physical multimorbidity, or depression) were found.

<INSERT TABLE 1 ABOUT HERE>

The mean age of the overall sample was 63.73 (SD= 9.50), there were more women (53.45%) than men, and more married people or people living in a partnership (65.80%) than single, separated or divorced, and widowed. Almost a third of the sample had completed primary education (31.09%), and most of them (85.46%) lived in an urban setting (Table 1). Overall, mean scores (95% CI) for life satisfaction, positive and negative affect were 6.66 (6.54, 6.77), 4.98 (4.91, 5.06), and 0.67 (0.62, 0.76) respectively.

The proportion of widowed and separated or divorced women was significantly higher than in men, with a medium effect size (Cramer's $V = 0.33$). Women also presented a significantly lower household income and higher rates of depression, with small effect sizes (Cramer's $V = 0.11$ and 0.10 , respectively). Significant differences between women and men were observed across all healthy behaviours. Men consumed more tobacco and were more likely to be heavy drinkers (with small effect sizes; Cramer's $V = 0.16$ and 0.11 , respectively), and consumed less fruits and vegetables than women (with no even a small effect size, being less than 0.10 ; Cramer's $V = 0.08$), although they practiced a higher level of physical activity and reported to have better sleep quality (Hedges' $g = 0.12$ and 0.28 , informing about a small and a medium effect size, respectively). Subjective well-being dimensions also differed between genders with small effect sizes: men reported a higher life satisfaction and more positive affect (Hedges' $g = 0.29$ and 0.24 , respectively), whereas women experienced more negative emotions (Hedges' $g = 0.19$).

<INSERT TABLE 2 ABOUT HERE>

Multiple linear regression models were used for ordinal variables, whereas multiple logistic regression models were used for dichotomous variables. Both models

were performed at each wave, with subjective well-being dimensions as the independent variables and healthy behaviours as dependent variables. Results are displayed in Table 2. A higher life satisfaction showed a longitudinal significant and consistent relationship with high physical activity and not smoking at baseline, first and second follow-up, after controlling for potential cofounders. The three subjective well-being dimensions (higher life satisfaction and positive affect, and lower negative affect) showed the same association with good sleep quality..

<INSERT TABLE 3 ABOUT HERE>

GEE models are shown in Table 3. While higher scores in life satisfaction were significantly related to a higher level of physical activity in both genders over the six-year follow-up period, lower scores in negative affect were associated with a higher level of physical activity only for women ($B = -0.08$; 95% CI = -0.11, -0.04), whereas higher scores in positive affect were related to better outcomes only for men ($B = 0.04$; 95% CI = 0.01, 0.07). Higher scores in life satisfaction and positive affect and lower scores in negative affect were significantly related to better-quality sleep in both genders ($p < 0.001$ in all cases). The significant associations between higher scores in life satisfaction and the consumption of five or more fruits or vegetables per day and being a non-smoker six years later were only found in women (OR = 1.05; 95% IC = 1.00, 1.10 and OR = 1.16; 95% IC = 1.09, 1.23, respectively). Finally, no association was found between any dimension of subjective well-being and alcohol consumption over the groups examined.

Discussion

The objective of the present study was to examine the independent longitudinal associations between subjective well-being dimensions and healthy behaviours, and to

analyse whether this effect differed between genders. Life satisfaction was longitudinally associated with high physical activity, not smoking, and good sleep quality. Although significant relationships between subjective well-being and healthy behaviours were also found in men, these were found fundamentally in women. Presenting a higher score in life satisfaction was significantly related to higher physical activity, better sleep quality, an adequate intake of fruits or vegetables (five or more per day), and being a non-smoker in women. By contrast, a higher score in life satisfaction was only associated with better quality sleep and higher physical activity in men. These findings are promising, since older women reporting higher subjective well-being would experience an enhancement in their health status via healthy behaviours (Chei, Lee, Ma, & Malhotra, 2018; Steptoe, Deaton, & Stone, 2015).

It should be noted that women presented significantly less life satisfaction and positive emotions, as well as more negative feelings than men. This is despite the fact that they are older women, mostly retired and without dependent children (Barnett & Marshall, 1991). The results show that women are kept subordinate at least in the economic aspect, which could have a negative impact on their subjective well-being. In this sense, a greater supply of human rights (e.g., civil, political) and wide equality (e.g., education, income) have been associated with higher rates of subjective well-being in the general population (Oishi & Diener, 2014). Although a recent meta-analysis that explored gender differences in subjective well-being found no differences in life satisfaction (Batz-Barbarich, Tay, Kuykendall, & Cheung, 2018), the results of the present study are in line with other previous studies, which informed about men presenting higher levels of life satisfaction and happiness (Pinquart & Sörensen, 2001) and lower levels of negative emotions than women (Zuckerman, Li, & Diener, 2017).

Fruit and vegetable intake is associated with a reduced risk of all-cause mortality and also specifically of cardiovascular disease mortality and of metabolic syndrome (Hong et al., 2012; Zhang et al., 2011). However, the findings of the present study showed that only a third of individuals followed the recommended guidelines related to fruit and vegetable consumption (World Health Organization & Food and Agriculture Organization, 2003), which has previously been seen in the United States population (Moore & Thompson, 2015). Older women and men are at high jeopardy of developing certain mental and physical diseases and negative health outcomes (e.g. dementia, falls, and frailty). Considering that nutrition is one of the modifiable factors of health in the older population (Payette, Coulombe, Boutier, & Gray-Donald, 2000), further research is needed to boost policies for health-promotion interventions, being particularly important that these studies analyse late-life eating habits (Nicklett & Kadell, 2013).

Higher scores in subjective well-being dimensions were significantly related to better levels of physical activity, quality sleep, and the adequate consumption of fruits and vegetables in both groups. These findings concur with former literature (Blanchflower, Oswald, & Stewart-Brown, 2013; Lacruz et al., 2016; Strine, Chapman, Balluz, Moriarty, & Mokdad, 2008) and with an interesting randomized controlled trial showing that if patients with cardiovascular disease who received a positive affect induction after a coronary intervention significantly increased their level of physical activity for one year, that could reduce mortality rates (Peterson et al., 2012). Because subjective well-being has been shown to affect and preface several lifestyle behaviours, the development of interventions to increase happiness of older population might consequently improve the long-term success of both men and women in diverse life domains.

The relationship between a higher life satisfaction and not smoking was only found in women. Preceding studies did not find an association between these variables in both older women and men (Chou & Chi, 1999), whereas a recent longitudinal research with data from the Health and Retirement Study carried out by Lappan, Thorne, Long, and Hendricks (2020) found that greater life satisfaction predicted a reduced likelihood of smoking four years later. Improving life satisfaction may promote smoking cessation and hence might be a central point of potential programmes to help people quit smoking. Future research should continue exploring this possibility of prevention and treatment.

Negative affect was associated with poorer quality sleep in both genders. Very few studies have analysed gender differences in negative affect on large-representative samples, probably due to the greater interest in discrepancies between women and men in mental health, particularly the experience of depression, despite being different constructs (Luhmann, Hofmann, Eid, & Lucas, 2012). In this sense, the relationship between depressive symptoms and sleep problems is well-known, in both older women (Maglione et al., 2012) and men (Paudel et al., 2008).

Moreover, the results of the present study showed that negative affect was associated with a lower level of physical activity only in women. Similar findings with significant implications have been reported before. In a focus-group study mostly composed of older women, negative affect was one of the most important barriers mentioned by non-exercisers (Lees, Clark, Nigg, & Newman, 2005). Likewise, the degree of negative affect was inversely associated with exercise in women with early stage breast cancer (Perna, Craft, Carver, & Antoni, 2008). Given that physical activity limitations generally increase with age, especially for women (Holmes, 2009), special attention to emotional factors should be given to design more effective exercise interventions for this

population and, lastly, to increase exercise-participation levels. Finally, the lack of association between any dimension of subjective well-being and alcohol consumption might indicate that the non-heavy drinkers' group was not homogenous. Future studies should be aware of the possible variation between drinkers and abstainers.

Along with the considerable findings of the study, some limitations should be discussed. First, although the experienced well-being measure is enclosed in a specific point in time, since it is asking participants to report on activities done during the previous day, it is still prone to memory bias. Second, despite sample attrition, the socio-demographic comparison between completers and drop-outs showed small differences. Third, despite being a longitudinal study, further research is needed to infer causality from the previously informed associations, since it is also possible that engaging in healthy behaviours helps older people to improve their subjective well-being (Baker, Cahalin, Gerst, & Burr, 2005). Finally, reversal causality (i.e. healthy behaviours impact on subjective well-being measures) cannot be ruled out, either.

To the best of our knowledge, this is the first study to examine longitudinal associations between distinct dimensions of subjective well-being (i.e. life satisfaction, positive affect, and negative affect) and healthy behaviours, comparing both women and men from a representative sample of the Spanish older population. The results suggest that subjective well-being is associated with healthy behaviours in both women and men, even after adjusting for potential confounders. Although women showed lower subjective well-being scores than men, subjective well-being was associated with a higher number of healthy behaviours in women than in men. The results of our study also added the knowledge that, whereas physical activity or good sleep quality might be strongly related to subjective emotional experience and satisfaction both in women and men, other healthy

lifestyles, such as healthy eating or tobacco use, might potentially be moderated by different factors in women and men (Hughes, Bennett, & Hetherington, 2004). These gender differences and their potential moderators probably warrants further research. Beyond comprehending the origins of gender differences in subjective well-being dimensions, it is also essential to keep exploring the resulting consequences of these discrepancies. Since life satisfaction and positive and negative affect appear to encompass many individual life domains in the aging population, they may be important concepts for public health research and policy. Interventions to improve subjective well-being should take into account differences in the frequency of healthy-unhealthy behaviours across genders. This way, they would have an impact on preserving a healthy lifestyle, and probably on decreasing morbidity and raising life expectancy.

Data Availability Statement

Data will be made available upon request made to the corresponding author.

Acknowledgments

This work was supported by the European Community's Seventh Framework Programme (FP7/2007-2013) under agreement number 223071 (COURAGE in Europe), by the Spanish Ministry of Science and Innovation ACI-Promociona (ACI2009-1010), and by the Instituto de Salud Carlos III-FIS research grants [PS09/00295, PS09/01845, PI12/01490, PI13/00059, PI16/00218, and PI16/01073]. Projects PI12/01490, PI13/00059, PI16/00218, and PI16/01073 have been co-funded by the European Union European Regional Development Fund (ERDF) "A Way to Build Europe". The work was also supported by the Instituto de Salud Carlos III Centro de Investigación Biomédica en Red de Salud Mental (CIBERSAM). NMM is supported by the programme "Contratos predoctorales para Formación de Personal Investigador, FPI-UAM", Universidad Autónoma de Madrid, Spain. EL's work is supported by the Sara Borrell postdoctoral

program (CD18/00099) of the Instituto de Salud Carlos III (Spain) and co-funded by the European Union (ERDF/ESF, “Investing in your future”). BO’s work is supported by the PERIS program 2016–2020 “Ajuts per a la Incorporació de Científics i Tecnòlegs” (grant number SLT006/17/00066), with the support of the Health Department from the Generalitat de Catalunya.

Declaration of interest statement

No conflicts of interest declared.

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Table 1. Baseline characteristics: socio-demographics, estimated percentages for healthy behaviours and mean estimates on subjective well-being (overall and by gender), the COURAGE in Europe Study, Spain, 2011–12.

| | Total sample (<i>n</i>=1190) | Women (<i>n</i>=636) | Men (<i>n</i>=554) | <i>t</i>/<i>x</i>² (<i>d.f.</i>) | <i>p</i> | Effect size |
|---|---|---------------------------------|-------------------------------|--|-----------------|------------------------|
| Socio-demographics | | | | | | |
| Age, mean (SD) | 63.73 (9.50) | 64.14 (9.94) | 63.26 (8.97) | -1.59 (1188) | 0.11 | - |
| Marital status, <i>n</i> (%) | | | | | | |
| Single | 108 (9.08) | 50 (7.86) | 58 (10.47) | 132.98 (3) | *** | 0.33 |
| Married or living in a partnership | 783 (65.80) | 342 (53.78) | 441 (79.61) | | | |
| Separated or divorced | 91 (7.65) | 65 (10.22) | 26 (4.69) | | | |
| Widowed | 208 (17.47) | 179 (28.14) | 29 (5.23) | | | |
| Level of education, <i>n</i> (%) | | | | | | |
| No/basic education | 343 (28.82) | 190 (29.87) | 153 (27.62) | 5.59 (3) | 0.13 | - |
| Primary | 370 (31.09) | 207 (32.55) | 163 (29.42) | | | |
| Secondary | 327 (27.48) | 171 (26.89) | 156 (28.16) | | | |
| Tertiary | 150 (12.61) | 68 (10.69) | 82 (14.80) | | | |
| Quintile of household income, <i>n</i> (%) | | | | | | |
| 1 st or 2 nd (lower) | 445 (41.74) | 266 (46.58) | 179 (36.16) | -11.85 (1) | ** | 0.11 |
| 3 rd , 4 th or 5 th (higher) | 621 (58.26) | 305 (53.42) | 316 (63.84) | | | |
| Living in an urban setting, <i>n</i> (%) | 1017 (85.46) | 538 (84.59) | 479 (86.46) | 0.83 (1) | 0.36 | - |
| Normal BMI (18.5-24.9 kg/m ²), <i>n</i> (%) | 268 (23.32) | 173 (28.27) | 95 (17.69) | 23.37 (3) | *** | 0.14 |
| Physical multimorbidity, <i>n</i> (%) | 343 (28.82) | 191 (30.03) | 152 (27.44) | 0.97 (1) | 0.32 | - |
| Depression, <i>n</i> (%) | 128 (10.76) | 87 (13.68) | 41 (7.40) | 12.16 (1) | *** | 0.10 |
| Healthy behaviours, <i>n</i> (%) | | | | | | |
| Physical activity | | | | | | |
| High | 361 (30.34) | 179 (28.14) | 182 (32.85) | -2.12 (1188) | * | 0.12 |
| Moderate | 465 (39.08) | 248 (39.00) | 217 (39.17) | | | |
| Low | 364 (30.58) | 209 (32.86) | 155 (27.98) | | | |
| Five or more fruits and vegetables per day | 397 (33.53) | 234 (36.97) | 163 (29.58) | 7.21 (1) | ** | 0.08 |
| Non-smokers | 946 (79.50) | 543 (85.38) | 403 (72.74) | 28.99 (1) | *** | 0.16 |
| Non-heavy drinkers | 1166 (97.98) | 632 (99.37) | 534 (96.39) | 13.32 (1) | *** | 0.11 |
| Sleep quality | | | | | | |
| Very good | 287 (24.12) | 132 (20.75) | 155 (27.98) | -4.83 (1188) | *** | 0.28 |

| | | | |
|-----------|-------------|-------------|-------------|
| Good | 629 (52.86) | 326 (51.26) | 303 (54.69) |
| Moderate | 194 (16.30) | 122 (19.18) | 72 (13.00) |
| Poor | 64 (5.38) | 43 (6.76) | 21 (3.79) |
| Very poor | 16 (1.34) | 13 (2.04) | 3 (0.54) |

Subjective well-being, mean population estimates (95% CI)

| | | | | | | |
|---------------------------------|-------------------|-------------------|-------------------|--------------|-----|------|
| Life satisfaction (range: 0-10) | 6.66 (6.54, 6.77) | 6.44 (6.29, 6.59) | 6.90 (6.73, 7.07) | 3.97 (1186) | *** | 0.29 |
| Positive affect (range: 0-6) | 4.98 (4.91, 5.06) | 4.86 (4.75, 4.97) | 5.17 (5.03, 5.22) | 3.50 (1189) | *** | 0.24 |
| Negative affect (range:0-6) | 0.67 (0.62, 0.76) | 0.77 (0.67, 0.86) | 0.60 (0.51, 0.68) | -2.62 (1189) | ** | 0.19 |

Estimates are based in weighted data.

Note: *d.f.*: degrees of freedom. SD: standard deviation. BMI: body mass index. 95% CI: 95% confidence interval. -: Effect size was not provided since significant differences were not found. Cramer's *V* for chi-square-tests (categorical variables) and Hedges' *g* for unpaired *t*-tests (quantitative variables) were considered as effect size measures for statistically significant differences. Physical multimorbidity refers to the presence of two or more physical chronic conditions from: asthma, osteoarthritis, hypertension, diabetes, chronic lung disease, angina pectoris, and stroke.

p-values (**p*<0.05, ***p*<0.01, ****p*<0.001)

Table 2. Multiple linear regression and logistic regression models to assess the relationship between different subjective well-being dimensions and healthy behaviours at baseline (2011-2012) and at both follow-ups (2014-15 and 2018). The COURAGE in Europe Study, Spain.

Subjective well-being dimensions at each wave

| | Baseline | | | First follow-up | | | Second follow-up | | |
|---|-----------|-----------|-----------------|-----------------|-----------|-----------------|------------------|-----------|-----------------|
| High physical activity | B | SE | β | B | SE | β | B | SE | β |
| Life satisfaction | 0.04*** | 0.01 | 0.07 | 0.06*** | 0.01 | 0.11 | 0.08*** | 0.02 | 0.15 |
| Positive affect | 0.02 | 0.02 | 0.03 | -0.04 | 0.02 | -0.05 | 0.09*** | 0.02 | 0.14 |
| Negative affect | -0.03 | 0.02 | -0.04 | -0.137*** | 0.03 | -0.16 | -0.10* | 0.05 | -0.08 |
| Good sleep quality | | | | | | | | | |
| Life satisfaction | 0.01*** | 0.01 | 0.19 | 0.07*** | 0.01 | 0.15 | 0.07*** | 0.02 | 0.17 |
| Positive affect | 0.11*** | 0.01 | 0.14 | 0.06** | 0.02 | 0.08 | 0.07** | 0.02 | 0.11 |
| Negative affect | -0.05* | 0.02 | -0.05 | -0.08*** | 0.02 | -0.09 | -0.28*** | 0.05 | -0.18 |
| Five or more fruits and vegetables per day | | | | | | | | | |
| | OR | SE | (95% CI) | OR | SE | (95% CI) | OR | SE | (95% CI) |
| Life satisfaction | 1.09*** | 0.03 | (1.04, 1.15) | 1.06 | 0.04 | (0.99, 1.14) | 0.99 | 0.05 | (0.90, 1.09) |
| Positive affect | 1.02 | 0.05 | (0.93, 1.12) | 1.18** | 0.08 | (1.04, 1.34) | 1.03 | 0.06 | (0.92, 1.15) |
| Negative affect | 0.99 | 0.06 | (0.89, 1.11) | 1.14 | 0.08 | (0.99, 1.30) | 1.03 | 0.13 | (0.81, 1.32) |
| Not smoking | | | | | | | | | |
| Life satisfaction | 1.14*** | 0.04 | (1.07, 1.21) | 1.12* | 0.05 | (1.03, 1.23) | 1.16* | 0.08 | (1.02, 1.32) |
| Positive affect | 0.85* | 0.05 | (0.79, 0.98) | 1.21* | 0.09 | (1.04, 1.40) | 0.99 | 0.07 | (0.86, 1.15) |
| Negative affect | 0.88* | 0.06 | (0.77, 0.99) | 1.08 | 0.10 | (0.91, 1.29) | 1.12 | 0.18 | (0.81, 1.53) |
| Not heavy alcohol consumption | | | | | | | | | |
| Life satisfaction | 1.04 | 0.09 | (0.87, 1.24) | 0.89 | 0.10 | (0.72, 1.11) | 1.16 | 0.13 | (0.94, 1.44) |
| Positive affect | 0.94 | 0.14 | (0.70, 1.26) | 0.89 | 0.18 | (0.60, 1.31) | 1.15 | 0.11 | (0.94, 1.40) |
| Negative affect | 0.90 | 0.16 | (0.63, 1.28) | 0.74 | 0.14 | (0.51, 1.07) | 1.17 | 0.29 | (0.71, 1.92) |

Note. Multiple linear regression models used for ordinal variables; multiple logistic regression models used for dichotomous variables. B: non-standardised coefficient; SE: standard error; β: beta (standardised) coefficient; OR: Odds Ratio. 95% CI: 95% confidence intervals. All regression models adjusted for age, gender, marital status, level of education, household income, residential setting, body mass index, physical multimorbidity, and depression.

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Table 3. GEE models to analyse the associations between subjective well-being dimensions and healthy behaviours by gender groups, controlling for the remaining healthy behaviours and potential covariates. The COURAGE in Europe Study, Spain, 2011–2018.

| | Women | | | Men | | |
|---|-------|--------------|------|-------|--------------|------|
| High physical activity | B | 95% CI | p | B | 95% CI | p |
| <i>Life satisfaction</i> | 0.04 | 0.02, 0.06 | *** | 0.05 | 0.02, 0.06 | *** |
| <i>Positive affect</i> | 0.02 | -0.01, 0.05 | 0.07 | 0.04 | 0.01, 0.07 | * |
| <i>Negative affect</i> | -0.08 | -0.11, -0.04 | *** | -0.01 | -0.04, 0.04 | 0.97 |
| Good sleep quality | -0.01 | -0.04, 0.03 | 0.92 | -0.01 | -0.05, 0.04 | 0.77 |
| Five or more fruits and vegetables per day | 0.14 | 0.09, 0.20 | *** | 0.12 | 0.05, 0.18 | *** |
| Not smoking | -0.02 | -0.09, 0.09 | 0.64 | 0.07 | -0.01, 0.15 | 0.06 |
| Not heavy alcohol consumption | -0.16 | -0.21, -0.09 | 0.17 | -0.11 | -0.25, 0.03 | 0.12 |
| Age | -0.01 | -0.02, -0.01 | *** | -0.01 | -0.01, -0.01 | *** |
| BMI (ref.=normal) | -0.06 | -0.08, -0.03 | *** | -0.06 | -0.10, -0.03 | *** |
| Depression (ref.=no) | 0.02 | -0.07, 0.11 | 0.70 | -0.11 | -0.27, 0.04 | 0.16 |
| Good sleep quality | | | | | | |
| <i>Life satisfaction</i> | 0.10 | 0.08, 0.11 | *** | 0.08 | 0.07, 0.10 | *** |
| <i>Positive affect</i> | 0.08 | 0.06, 0.11 | *** | 0.08 | 0.05, 0.10 | *** |
| <i>Negative affect</i> | -0.06 | -0.09, -0.02 | *** | -0.11 | -0.15, -0.08 | *** |
| High physical activity | 0.01 | -0.04, 0.04 | 0.93 | -0.01 | -0.04, 0.03 | 0.84 |
| Five or more fruits and vegetables per day | 0.03 | -0.03, 0.09 | 0.37 | 0.03 | -0.03, 0.09 | 0.30 |
| Not smoking | -0.02 | -0.11, 0.08 | 0.70 | -0.06 | -0.13, 0.01 | 0.09 |
| Not heavy alcohol consumption | -0.09 | -0.34, 0.16 | 0.48 | 0.04 | -0.08, 0.17 | 0.52 |
| Age | 0.01 | -0.01, 0.01 | 0.19 | -0.01 | -0.01, 0.01 | 0.98 |
| Marital status (ref.=single) | 0.01 | -0.02, 0.05 | 0.47 | 0.01 | -0.04, 0.05 | 0.72 |
| Level of education (ref.=less than primary) | 0.06 | 0.03, 0.10 | *** | 0.02 | -0.01, 0.05 | 0.12 |
| Physical multimorbidity (ref.=no) | -0.13 | -0.19, -0.06 | *** | -0.13 | -0.19, -0.07 | *** |
| Depression (ref.=no) | -0.36 | -0.46, -0.27 | *** | -0.39 | 0.52, -0.25 | *** |
| Five or more fruits and vegetables per day | | | | | | |
| <i>Life satisfaction</i> | OR | 95% CI | p | OR | 95% CI | p |
| <i>Life satisfaction</i> | 1.05 | 1.00, 1.10 | * | 0.99 | 0.93, 1.04 | 0.59 |
| <i>Positive affect</i> | 1.05 | 0.99, 1.13 | 0.12 | 1.09 | 1.00, 1.19 | 0.05 |
| <i>Negative affect</i> | 1.06 | 0.97, 1.16 | 0.19 | 0.99 | 0.88, 1.11 | 0.85 |
| High physical activity | 1.23 | 1.13, 1.35 | *** | 1.20 | 1.08, 1.33 | *** |
| Good sleep quality | 1.04 | 0.95, 1.13 | 0.42 | 1.05 | 0.94, 1.18 | 0.38 |
| Not smoking | 1.61 | 1.26, 2.05 | *** | 1.53 | 1.24, 1.89 | *** |
| Not heavy alcohol consumption | 1.11 | 0.59, 2.07 | 0.75 | 1.34 | 0.90, 2.02 | 0.15 |
| Level of education (ref.=less than primary) | 1.16 | 1.06, 1.26 | *** | 1.10 | 1.00, 1.20 | * |

| | | | | | | |
|--|------|------------|------|------|------------|------|
| Not smoking | | | | | | |
| <i>Life satisfaction</i> | 1.16 | 1.09, 1.23 | *** | 1.04 | 0.98, 1.09 | 0.20 |
| <i>Positive affect</i> | 1.00 | 0.92, 1.08 | 0.98 | 1.00 | 0.93, 1.07 | 0.97 |
| <i>Negative affect</i> | 1.00 | 0.90, 1.11 | 0.99 | 0.98 | 0.89, 1.08 | 0.70 |
| High physical activity | 0.93 | 0.82, 1.04 | 0.19 | 1.04 | 0.94, 1.14 | 0.45 |
| Five or more fruits and vegetables per day | 1.00 | 0.90, 1.11 | 0.98 | 0.94 | 0.84, 1.05 | 0.26 |
| Good sleep quality | 1.28 | 1.04, 1.56 | * | 1.24 | 1.04, 1.47 | * |
| Not heavy alcohol consumption | 1.51 | 0.83 2.74 | 0.18 | 1.61 | 1.19, 2.19 | ** |
| Age | 1.10 | 1.09, 1.12 | *** | 1.06 | 1.05, 1.08 | *** |
| BMI (ref.=normal) | 1.17 | 1.07, 1.28 | *** | 1.25 | 1.14, 1.36 | *** |
| Not heavy alcohol consumption | | | | | | |
| <i>Life satisfaction</i> | 0.88 | 0.72, 1.09 | 0.25 | 1.01 | 0.90, 1.14 | 0.83 |
| <i>Positive affect</i> | 1.25 | 0.96, 1.62 | 0.09 | 1.11 | 0.94, 1.31 | 0.22 |
| <i>Negative affect</i> | 0.94 | 0.66, 1.34 | 0.73 | 1.25 | 0.97, 1.62 | 0.09 |
| High physical activity | 0.73 | 0.49, 1.11 | 0.14 | 0.83 | 0.66, 1.04 | 0.11 |
| Good sleep quality | 0.87 | 0.59, 1.29 | 0.49 | 1.07 | 0.84, 1.37 | 0.57 |
| Five or more fruits and vegetables per day | 1.06 | 0.55, 2.06 | 0.86 | 1.35 | 0.88, 2.07 | 0.17 |
| Not smoking | 2.04 | 0.94, 4.42 | 0.07 | 1.86 | 1.24, 2.77 | ** |
| Age | 1.04 | 1.00, 1.09 | 0.05 | 1.02 | 1.00, 1.04 | 0.06 |

Note: Normal BMI (18.5-24.9 kg/m²): body mass index; B: beta coefficient; 95% CI: 95% confidence intervals; OR: Odds Ratio. Each model take into account only those covariates that have a potential significant association with healthy behaviours (p -value < 0.10). Physical multimorbidity refers to the presence of two or more physical chronic conditions among the following: asthma, osteoarthritis, hypertension, diabetes, chronic lung disease, angina pectoris, and stroke.

p -values (* p <0.05, ** p <0.01, *** p <0.001)