Title: Impact of depressive disorder and anxiety disorder over motivational readiness for health behaviour change: findings from EIRA study.

Authors: Irene Gómez-Gómez[1], María Luisa Rodero-Cosano[2], Juan Á. Bellón [3,4,5,6] Edurne Zabaleta-del-Olmo[3,7], José-Ángel Maderuelo [3,8], Patricia Moreno-Peral[3,4], Rosa Magallón-Botaya [3,9], Barbara Oliván[9], Joan Llobera [3,10], Ana Clavería [3, 11], Alvaro Sanchez-Perez, [3,12] and Emma Motrico[1,3].

1 Department of Psychology, Universidad Loyola Andalucía, Seville, Spain.

2 Department of Quantitative Methods, Universidad Loyola Andalucía, Córdoba, Spain.

3 Prevention and Health Promotion Research Network (redIAPP), ISCIII, Spain.

4 Biomedical Research Institute of Málaga (IBIMA), Málaga, Spain.

5 El Palo Health Centre, Andalusian Health Service (SAS), Málaga, Spain.

6 Department of Public Health and Psychiatry, University of Málaga (UMA), Spain.

7 IDIAP Jordi Gol, Barcelona, Spain.

8 Institute of Biomedical Research of Salamanca, Salamanca, Spain.

9 Universidad de Zaragoza, Zaragoza, Spain.

10 Servei de Salut de les Illes Balears, Palma de Mallorca, Spain.

11 Servicio Galego de Saude, Vigo, Spain.

12 Biocruces Bizkaia Health Research Institute, Vizcaya, Spain.

Abstract

Background: People with anxiety and depression are less likely to adopt health behaviours compared with non-anxious and non-depression people. This study sought two-folds: (1) to examine how motivational readiness for healthy diet and physical activity might differ for Spanish adults with depression or anxiety compared with non-depressed or non-anxious; and (2) to identify social, structural determinants, and intermediary factors related with motivational readiness for healthy diet and physical activity. ***Methods:*** A cross-sectional study was conducted using a sample of 1462 Spanish primary care attenders from the EIRA3-study. Sociodemographic characteristics, motivational readiness for adherence to the Mediterranean diet and physical activity, depression disorder, anxiety disorder, quality of life and, perceived social support were collected. Chi-squares and structural equation modelling were performed. ***Results:*** Major depression disorder was significantly associated with motivational readiness for healthy diet ($V = 0.077, p = 0.003$) and physical activity ($V = 0.061, p = 0.021$). Path analysis showed that major depressive disorder and anxiety disorder were negatively associated with being in the action stages of motivational readiness for both healthy diet and physical activity. This association were statistically significant only for motivational readiness for healthy diet and major depressive disorder ($p = 0.046$). Furthermore, woman and adults with work on one hand, and adults over 70 years old, and adults with higher health-related quality of life on the other hand were more likely to be in the action stages of motivational readiness for healthy diet or physical activity respectively. ***Conclusions:*** These findings suggest that is important to pay attention to mental health when aiming to promote health behaviour change.

Introduction

Around 4.4% and 3.6% of the global population suffered from depression or anxiety respectively during 2015 (World Health Organization, 2017). Depression and anxiety are considered to impact seriously on quality of life and well-being. Thus, the disease burden in terms of years lived with disability (YLDs) is very high (James et al., 2018). According to the last estimates of Global Burden of Disease study, depressive disorders rank third for women and fifth for men and anxiety disorders rank eighth for women and thirteenth for men in global disease burden regarding YLDs (James et al., 2018). The economic consequences attributable to depressive disorders and anxiety disorders are enormous (König et al., 2020; Konnopka & König, 2020; Olesen et al., 2012). It is estimated that anxiety and depression cost to the global economy 1 trillion of US$ per year only in loss of productivity (The Lancet Global Health, 2020). Considering the impact on people's well-being and the global burden on the health system, promoting actions that improve mental health must be a priority. Nowadays, it is widely known that healthy lifestyle behaviours are essential for promote good mental health and for prevent mental disorders.

Previous systematic review reported that around 47% - 54% of the adult populations registered low fruit and vegetable intake and low physical activity (Meader et al., 2016). It means that low fruit and vegetable intake and low physical activity has the highest co-occurrence prevalence of risk behaviours (Meader et al., 2016). Evidence suggest that the prevalence of physical inactivity and unhealthy diet is higher in people with mental disorders (Furihata et al., 2018). Furthermore, previous studies has highlighted that the connection between mental health and lifestyle is bi-directional (Bonnet et al., 2005; Cao et al., 2020; Fluharty et al., 2017; Jacka & Berk, 2013; Li et al., 2017; Lopresti et al., 2013; Ruiz-Estigarribia et al., 2019; Sarris et al., 2014; Zhai et al.,

2015). People who suffer from depression and/or anxiety disorders tend to have unhealthy dietary patterns (less amount of legumes, fruits and vegetables, and more refined grain)(Gibson-Smith et al., 2020; Grases et al., 2019) and people with unhealthy dietary patterns are at higher risk of suffer from depression and/or anxiety disorders (Gibson-Smith et al., 2018; Grases et al., 2019; Jacka et al., 2015; Li et al., 2017; Weng et al., 2012). Similar results were found regarding physical activity: people with anxiety and/or depression disorders are less active than people without depression and/or anxiety disorders (Da Silva et al., 2012; Schuch et al., 2017). Being physically active is associated with a lower risk of suffering from depression and/or anxiety disorders (Anderson & Shivakumar, 2013; Bellón et al., 2021; Mammen & Faulkner, 2013; Pascoe et al., 2020; Rebar et al., 2015; Schuch et al., 2019; Stubbs et al., 2017). Consequently, it has been observed that people with anxiety and/or depressive disorders do not comply with the established physical activity recommendations (Da Silva et al., 2012), being sedentary an average of 8.5 hours a day during wakefulness (Schuch et al., 2017).

The Transtheoretical Model (TMM) is the most frequent theoretical model used for lifestyle modification in primary care settings (Bully et al., 2015). The TMM, proposed by Prochaska & DiClemente, (1982), describes the individual's readiness to behaviour change across six stage: precontemplation, contemplation, preparation, action, termination and maintenance. The TMM was originally created to be applied in people who smoke or with other addictive behaviours but, nowadays, the TTM is widely applied in different health conditions (Delahanty et al., 2006; Edwards et al., 2006; Lee et al., 2006) and settings, such as primary care (Singer, 2007).

Regarding determinants some studies have found that women are more likely to be in the action stages than men (Bonnet et al., 2005; Garber et al., 2008) and those in the action stages are more likely to have better quality of life and higher social support than

those in the pre-action stages (Vallis et al., 2003). Similarly, previous studies have found that people with higher educational level and people with lower age are likely to be in the action stages for physical activity (Garber et al., 2008).

The relationship between TMM stages of change and mental health has been poorly studied so far. Studies focused on smoking behaviour did not find differences in depression symptoms according to stage of change in depressed smokers from USA (Prochaska et al., 2004; Tsoh & Hall, 2004). To the best of our knowledge only one study has explored the link between mental health and stages of motivational readiness for diet or physical activity (Lee et al., 2006). Lee et al., (2006) found middle-aged Korean women in the precontemplation stage of motivational readiness for physical activity presented significant higher symptoms of depression compared with participants in the maintenance stage of motivational readiness. No studies were found related to depression and/or anxiety disorders and the stages of motivational readiness for healthy diet neither conducted in primary care. Nevertheless, for the reason given above, is likely that people with anxiety or depression compared with non-anxious or non-depressive people present different stages of motivational readiness for healthy diet and physical activity according to the TMM.

The objective of this study was two-fold. Firstly, we aimed to examine how stages of motivational readiness for healthy diet and physical activity might differ for adults with depression and/or anxiety disorders compared with non-depressed or non-anxious adults in primary care. Secondly, we aimed to identify which social determinants, structural determinants, and intermediary factors (health-related quality of life, perceived social support, major depression disorders and anxiety disorder) were related with stages of motivational readiness for healthy diet and physical activity change in adults in primary care.

In accordance with the relationships described above and the objectives of this study, a theoretical model (Figure 1) is specified based on an adaptation of the Framework for Action on the Social Determinants of Health that has been proposed by the World Health Organization (World Health Organization, 2010). The model shows how social, economic, and political determinants determine the stratum to which a person belongs. These socioeconomic positions in turn shape specific determinants of health status, named intermediate determinants, which can determine people exposure and vulnerability to agents that influence their health. Thus, it has been differentiated between social determinants, structural determinants, intermediary factors and indicators of physical health. The following hypotheses emerge from this theoretical model:

H1. Socio-demographic factors influence health behaviours.

H2. Health-related quality of life and perceived social support are mediating variables that positively influence mental health and adherence to health behaviours.

H3. Common mental disorders promote poor adherence to health behaviours

Insert here Figure 1

Methods

Study design and participants

This study is a secondary study from the EIRA-3 study (Zabaleta-Del-Olmo et al., 2018). The EIRA-3 study is a cluster randomized controlled hybrid type 2 trial carried out in 25 Spanish primary care centres (PHC) of seven of the 17 Spanish Autonomous Communities: Andalusia, Aragon, the Balearic Islands, Basque Country, Castile and

Leon, Catalonia and Galicia. In this secondary analysis, we analysed baseline data from control arm of the EIRA-3 study. Thus, a cross-sectional design was used.

Participants were recruited in PHC through different strategies (telephone calls, announcements in the waiting room and, physician referral to name few) from January 2017 to February 2018. The inclusion criteria were to give informed consent to participate in the study, aged between 45 and 75 years old, present at least low adherence to two of the following unhealthy lifestyles: a low adherence to the Mediterranean diet, tobacco use, and/ or insufficient physical activity level, and belong to one of the primary care centres included in the EIRA-3 study. Participants were excluded if they presented advanced physical serious illnesses, severe mental illness, cognitive impairment, dependency to carry out daily activities, if they were included in a home health care program, if they were receiving cancer treatment or palliative care and if they did not plan to reside in the area during the intervention. The study received ethical approval by the Research Ethics Committee of the IDIAP Jordi Gol (approval number P16/025) and it was registered with ClinicalTrials.gov (NCT03136211).

Measures

All measurements were collected by independent evaluators through an individual face-to-face interview in PHC. All the data collected during the interviews were recorded in an electronic data collection booklet created specifically for the EIRA-3 study.

Social and Structural Determinants

Social and Structural Determinants were assessed via questionnaire designed by the research team. Sex was assessed using one item with two response categories: *1. Men; 2. Women*, age was assessed with an open single question and then it was categorize as follows: 1. *45-49 years old*; 2. *50-54 years old*; 3. *55-59 years old*; 3. *60-64 years old*; 5.

65-69 years old and 6. *More or equal than 70 years old*. Marital status was measured with a single question with three response categories: 1. *Married or living with partner*; 2. *Separated or divorced* and 3. *Widowed or single*. Related to structural determinants, work status was measured with a single question with five response categories: 1. *Employed*; 2. *Retired*; 3. *Unemployed*; 4. *Looking after family or home* and 5. *Other (leave of absence for work, incapacity for work etc.)* and educational level was assessed with single question with four response categories: 1. *Lower than primary education;* 2. *Primary education;* 3. *Secondary education;* 4. *College and above.*

Intermediary factors

Quality of life. The EQ-5D-3L tool was used to assess quality of life. It is a generic measurement instrument that allows evaluating the quality of life both in the general population and in the population that suffers from different diseases. The first part of the scale is made up of five dimensions: mobility, personal care, daily activities, pain and discomfort, and anxiety and depression. It contains 3 response categories: 1 "*I have no problems*", 2 "*I have some problems* "and 3 "*I have a lot of problems* "(Herdman et al., 2001). The second part of the scale is a vertical visual analogue scale (VAS) that ranges from zero (the worst imaginable health status) to 100 (the best imaginable health status) and in which the person must position themselves based on their health status. The EQ-5D has shown good psychometric properties in the Spanish population (EuroQol Research Foundation, 2018). We applied a scoring algorithm based on the Spanish population to convert EQ-5D-3L states into a single summary index (EuroQol Research Foundation, 2018; Szende et al., 2007). This index is "attached to an EQ-5D profile according to a set of weights that reflect, on average, people's preferences about how good or bad the state is (Devlin et al., 2020) and ranges from 1 (full health) to 0 (a state as bad as being death), although there are negative values for the value, corresponding to

those states of health that are rated as worse than death. This value is often used in economic evaluations, but it can also be used to describe the health of a population or the severity of disease among people (Szende et al., 2007).

Perceived Social support. It was evaluated with the Functional Social Support Questionnaire (DUKE-UNC-11). It consists of 11 items with five response categories ranging from 1 "*much less than I would like*" to 5 "*as much as I would like*". It has shown good psychometric properties in the Spanish population (Bellón et al., 1996).

Major depression disorder. The Patient Health Questionnaire-9 (PHQ-9) was used to determine prevalence of major depression. The PHQ-9 is a self-reported screening tool that has been created according to the diagnostic criteria for major depression disorder proposed by the Diagnostic and Statistical Manual of Mental Disorders (DSM-IV). It contains 9 items that ask respondents about the frequency in which the participant has experienced a series of symptoms during the last two weeks using a scale from 0 "*Not at all*" to 3 "*Nearly every day*". To determine presence of a major depression disorder the ≥ 10 cut-off point was used. The cut-off point of ≥ 10 showed adequate specificity and sensitivity in the Spanish population (Manea et al., 2015; Muñoz-Navarro et al., 2017).

General anxiety disorder. The General Anxiety Disorder-7 questionnaire (GAD-7) was used to determine prevalence of general anxiety disorders (García-Campayo et al., 2010). The GAD-7 is a self-administered questionnaire, which has been created according to the diagnostic criteria for General Anxiety Disorder proposed by the DSM-IV. It contains 7 items ranged from 0 "*Not at all*" to 3 "*Nearly every day*". To determine presence of a general anxiety disorder the > 10 cut-off point was used. A cut-off point of 10 showed adequate values of specificity and sensitivity in the Spanish population (García-Campayo et al., 2010).

Indicators of physical health

Unhealthy behaviours prevalence. The Physical Activity Questionnaire (IPAQ) and the 14-item Questionnaire of Mediterranean diet adherence (MEDAS) were used to assess unhealthy behaviours prevalence. Both questionnaires showed good psychometrics properties in Spanish populations (Roman-Viñas et al., 2010; Schröder et al., 2011).

Stage of motivational readiness for adherence to the Mediterranean diet and physical activity. One item for adherence to the Mediterranean diet (*Does the participant follow a diet rich in fiber, that is, with plenty of fruit, vegetables and legumes?*) and one item for physical activity *(Currently, does the participant engage in regular physical activity)* with six response categories (*precontemplation, contemplation, preparation, action, termination and maintenance*) was used to assess stage of motivational readiness. Then, participants were categorized for adherence to the Mediterranean diet and physical activity into one of the six stages according to their readiness to change: precontemplation, contemplation, preparation, action, termination and maintenance (Prochaska & DiClemente, 1982). For this study, these variables were dichotomized as following: precontemplation, contemplation, preparation (pre-action stages) versus action, termination, and maintenance (action stages).

Analysis

All analyses were conducted in Stata version 16.1. First, an exploratory analysis was performed to detect and delete missing or abnormal values. Frequency and percentage analyses were used to report the characteristics of the participants for categorical variables and mean and standard deviation were calculated for quantitative variables.

χ^2 test was performed to verify differences in stage of motivational readiness for physical activity and adherence to the Mediterranean diet according to the profile of depression and/or anxiety disorders. Cramér's V was performed to assess effect size and the classification proposed by Cohen (Cohen´s f) (Cohen, 1988) to interpret it. According to Cohen's f, an effect size of 0.1 is considered small, 0.3 is considered medium, and 0.5 is considered large. The existence of statistically significant differences at the cluster level was explored, but no significant differences were observed between PHC centres. Hence, cluster effect was not considered in the analysis.

Path analysis was performed to examined simultaneously relationships between the variables included in the study (Duncan, 1966). This type of analysis has been used in multiple kinds of research in the health issue to be able to analyse multiple regressions at the same time (Álvarez-Gálvez et al., 2019; Leggat et al., 2017; Palese et al., 2019; Ye et al., 2014). Path analysis allows measuring the direct and indirect effect of every independent variables (sex, age, marital status) and structural and intermediary variables (work status, educational level, quality of life, perceived social support, depression disorder and anxiety disorder) over predicted variables (stage of motivational readiness for physical activity and stage of motivational readiness for adherence to the Mediterranean diet) all at once.

The model was tested using Maximum Likelihood estimation with robust standard errors because there was absence of multivariate normality. Overall significance of the individual relationships was tested using coefficients of determination (R^2) and t-tests. R^2 indicates the amount of variability or information that the indicator contributes to the model and amount global variability of the model while t tests are performed to examine if the hypothesized linear relationship holds. The Hu and Bentler criteria was used to

evaluate the fit of the path model (Hu & Bentler, 1999). According to Hu and Bentler SRMR must be below 0.09.

Results

Characteristics of the participants

A total of 1581 Spanish primary care users were recruited, 119 of whom were excluded from further study due to missing values. Thus, 1462 participants were included in this study. The mean age of participants was 58.28 (SD 8.29) and women accounted for 54.86%. Around 40% had secondary education and almost the half were employed (45.42%). Regarding lifestyles, 79.79% of the participant were non-adherent to the Mediterranean diet and 49.10% were physically inactive. People with major depression disorder or anxiety disorder accounted for 13.68% and 13.27% respectively (see Table 1).

Insert here Table 1

Association between stages of motivational readiness with major depression disorder and anxiety disorder.

In this sample, 67.99% of the participants were in the pre-action stages of motivational readiness and 32.01% were in the action stages of motivational readiness for adherence to the Mediterranean diet (Table 2). Stages of motivational readiness for adherence to the Mediterranean diet were significantly associated with major depression disorder ($V = 0.077, p = 0.003$). Of the 13.68% of the participants with major depression disorder, 77.00% were in the pre-action stages of motivational readiness whereas 23.00% were in the action stages of motivational readiness.

Regarding stages of motivational readiness for physical activity, 79.34% were in the pre-action stages of motivational readiness and 20.66% were in the action stages of motivational readiness for physical activity. Stages of motivational readiness for physical activity were significantly associated with major depression disorder ($V = 0.061, p = 0.021$). Of the 13.68% of the participants with major depression disorder, 85.50% were in the pre-action stages of motivational readiness whereas 14.50% were in the action stages of motivational readiness.

Insert here Table 2

Stages of motivational readiness for adherence to the Mediterranean diet ($V = 0.039, p = 0.113$) and for physical activity ($V = 0.050, p = 0.055$) were not significantly associated with anxiety disorder (Table 2).

Determinants and associated factors related to motivational readiness for adherence to the Mediterranean diet and for physical activity.

Gender, age and marital status were introduced into the model as independent effects to directly explain structural determinants (work status and educational level), intermediary factors (health-related quality of life, perceived social support, major depression and anxiety disorder) and indicators of physical health (stage of motivational readiness for physical activity and adherence to the Mediterranean diet).

The standardized path coefficients (β) for the structural equation model are presented in Table 3. Results showed that sex has a significant effect on work status, quality of life, major depression disorder, anxiety disorder and motivational readiness for adherence to the Mediterranean diet. Age has a significant effect on work status, educational level, major depression disorder and, motivational readiness for physical activity. Marital status has a significant effect on perceived social support, health-related

quality of life, anxiety disorder and motivational readiness for adherence to the Mediterranean diet.

Sex, marital status, work status, and major depressive disorder presented a statistically significant association with motivational readiness for adherence to the Mediterranean diet. Specifically it has been found that being a women on one hand and being married on the other hand were associated with being in the action stages of motivational readiness for adherence to the Mediterranean diet. Related to structural determinants being working were positively associated with being in the action stages of motivational readiness for adherence to the Mediterranean diet. Furthermore, focused on intermediary factors it has been observed that major depressive disorder were negatively associated with being in the action stages of motivational readiness for adherence to the Mediterranean diet.

Regarding motivational readiness for physical activity, it has been found that age and health-related quality of life presented a positive significant relationship with motivational readiness for physical activity. Thus, adults aged over 70 years old on one hand and higher health-related quality of life on the other hand were associated with the action stages of motivational readiness for physical activity. Significant direct relationships between variables are described in Figure 2.

Insert here Table 3

Insert here Figure 2

One of the specific contributions of path analysis is that it allows to explore not only direct effects of some variables on others but also indirect effects that these variables have on a final variable through intermediate variables. For example, it has been found that age directly affect work status and indirectly affects work status through educational

level. Table 4 reported the indirect effects. Results showed that the variables that indirect influence motivational readiness for adherence to the Mediterranean diet were sex, work status, educational level, perceived social support and health-related quality of life. Sex has a significant indirect effect over motivational readiness for adherence to the Mediterranean diet through work status, which at the same time has a significant indirect effect over motivational readiness for adherence to the Mediterranean diet through quality of life and them through major depression disorder. Regarding educational level, it does not have a direct effect over motivational readiness for adherence to the Mediterranean diet but it has a significant indirect effect through work status. Perceived social support and health-related quality of life does not have a direct effect over motivational readiness for adherence to the Mediterranean diet but they have a significant indirect effect through major depression disorder. Indirect effect are marked in orange in Figure 2.

Regarding physical activity, the variables that had a significant indirect influence on motivational readiness for physical activity were sex, marital status, work status and educational level. Specifically, sex does not have a direct effect over motivational readiness for physical activity but it has a significant indirect effect through work status and them through health-related quality of life. The same happen with marital status, work status and educational level. They do not have a direct effect on motivational readiness for physical activity but they have a significant indirect effect for motivational readiness for physical activity through health-related quality of life.

Insert here Table 4

According to Hu and Bentler criteria (Hu & Bentler, 1999), the model presented good overall data fit ($SRMR = 0.02$). The model explains 20.48% of the variance being major depression disorder (18.07%) and anxiety disorder (11.54%) the variables that

more percentage of variance explained. Motivational readiness for adherence to the Mediterranean diet explain 1.99% and motivational readiness for physical activity explain 1.70% of the variance.

Discussion

Using data from the EIRA-3 study, this secondary study aimed to examine how motivational readiness for healthy diet and physical activity differed for adults with depression and/or anxiety disorders compared with non-depressed or non-anxious adults. Additionally, this study aimed to identify which social determinants, structural determinants, and intermediary factors predicted motivational readiness to change for healthy diet and physical activity. Results showed that having major depression disorder was significantly associated with stages of motivational readiness for healthy diet and physical activity while no significant associations were found for anxiety disorder. As expected, path analysis results showed that people with major depressive disorder were largely in the pre-action stages of motivational readiness for adherence to the Mediterranean diet. Contrary to our hypotheses, no significant results were observed for the relationships between major depression disorder and motivational readiness for physical activity and between motivational readiness for adherence to the Mediterranean diet and physical activity and anxiety disorder.

To the best of our knowledge, no previous studies have explored the relationship between major depression and/or anxiety disorders with stages of motivational readiness for physical activity and adherence to the Mediterranean diet. However, the results found in this study are consistent with preliminary results which found that people with major depression and/or anxiety disorders are more likely not to meet the physical activity guidelines, to be sedentary and, to practice less moderate physical activity compared with non-depressed or non-anxious population (Bélair et al., 2018; Bonnet et al., 2005;

Vancampfort et al., 2017). Regarding diet, previous studies have found that people with depression and/or anxiety disorders are more likely to have unhealthy diet with an increased intake of cholesterol and a reduced intake of poly-unsaturated fatty acids (Bonnet et al., 2005; Luyster et al., 2009).

Related to social determinants and structural determinants this study found that women and adults with work were more likely to be in the action stages of motivational readiness for adherence to the Mediterranean diet. Additionally adults over 75 years old and adults with higher health-related quality of life are more likely to be in the action stages of motivational readiness for physical activity. These results are consistent with previous studies which found that women were more likely to be in the action and maintenance stages than men (Bonnet et al., 2005; Garber et al., 2008) and those in the action stages were more likely to have better quality of life than those in the pre-action stages (Vallis et al., 2003). Conversely to our results, previous studies have found that people with lower age are more likely to be in the action stages for physical activity (Garber et al., 2008). This could be explained because in this study those older adults are retired and therefore may have more free time compared to younger adult. It has been found that having free time is a facilitator to reducing sedentary time (Martínez-Ramos et al., 2015). Additionally they may be motivated to maintain physical and mental health which have been identified as a facilitator of physical activity intervention participation in older adults (Bethancourt et al., 2014).

We have to note that educational level was negatively associated with work status. This may be explained by the operationalization of the variables: participants with lower educational level have higher probabilities to be leave of absence for work, have an incapacity for work etc. Additionally, age is negatively associated with educational level.

This may be explained by generational differences in the opportunities to access education in the Spanish population.

The proposed model explained 20.48% of the variance. On one hand, major depression disorder and anxiety disorder variables explained 18.07% and 11.54% respectively being the variables with the highest explained capacity. On the other hand, motivational readiness for adherence to the Mediterranean diet and motivational readiness for physical activity only could explained 1.99% and 1.70% of the variance respectively. This can be explained by lack of explanatory variables. However, the results found in this study are very important because it ratifies the relationship between structural and intermediate factors with motivational readiness for adherence to the Mediterranean diet and physical activity and ratifies the two-way relationship between mental health and health behaviours.

This study presents some limitations. First, the number of people who suffer from anxiety or major depression disorders compared to non-anxious or non-depressed people was uneven. Second, because it is a secondary study, we only evaluated motivational readiness for adherence to the Mediterranean diet and physical activity, not evaluating other important constructs within the TTM such as self-efficacy and decisional balance (Prochaska & Diclemente, 2005). Third, due to a cross-sectional design was used; further longitudinal research would be needed to ascertain robust conclusions. In spite of these limitations, this study presents some strengths. First, to the best of our knowledge this is the first study published to explore the effect of major depression disorder or anxiety disorder over motivational readiness for adherence to the Mediterranean diet and physical activity. Second, this study has explored which social determinants, structural determinants, and intermediary factors are related with motivational readiness for adherence to the Mediterranean diet and physical activity. Third, in the path analysis, the

specification of the model was based on an adaptation of the Framework for Action on the Social Determinants of Health that has been proposed by the World Health Organization (World Health Organization, 2010). Four, this study includes a very large sample from different areas of Spain with different characteristics, which support its external validity. In addition, trained external units using high quality questionnaires with good psychometrics properties for the Spanish population collected measures. Finally, yet importantly, our study has important implications not only for the scientific community but also for clinical practice. Health professionals must consider mental health when they are promoting health behaviours change. Exploring mental health status of people could maximize both physical and mental health promotion and therefore quality of life.

Conclusion

In sum, our results suggest that some socio-demographics factors such as sex, age, work status and marital status (*H1*) and health-related quality of life (*H2*) and major depression disorder (*H3*) have an influence over motivational readiness for adherence to the Mediterranean diet or physical activity. These results contribute to ratify the relationship between structural and intermediate factors with motivational readiness for adherence to the Mediterranean diet and physical activity and contribute to ratify the two-way relationship between mental health and healthy lifestyles. However, further longitudinal studies would be needed to ascertain robust conclusions.

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Conflict of interest None.

Ethical standards

The authors assert that all procedures contributing to this work comply with the ethical standards of the relevant national and institutional committees on human experimentation and with the Helsinki Declaration of 1975, as revised in 2008.

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Figure 1.

Theorical model adapted by "Framework for Action on the Social Determinants of Health (World Health Organization, 2010)

Social Determinants	Structural Determinants	Intermediary Factors	Indicators of physical health
Age Sex Marital status	Work status Educational level	Social support HRQoL Depression Anxiety	Motivational readiness
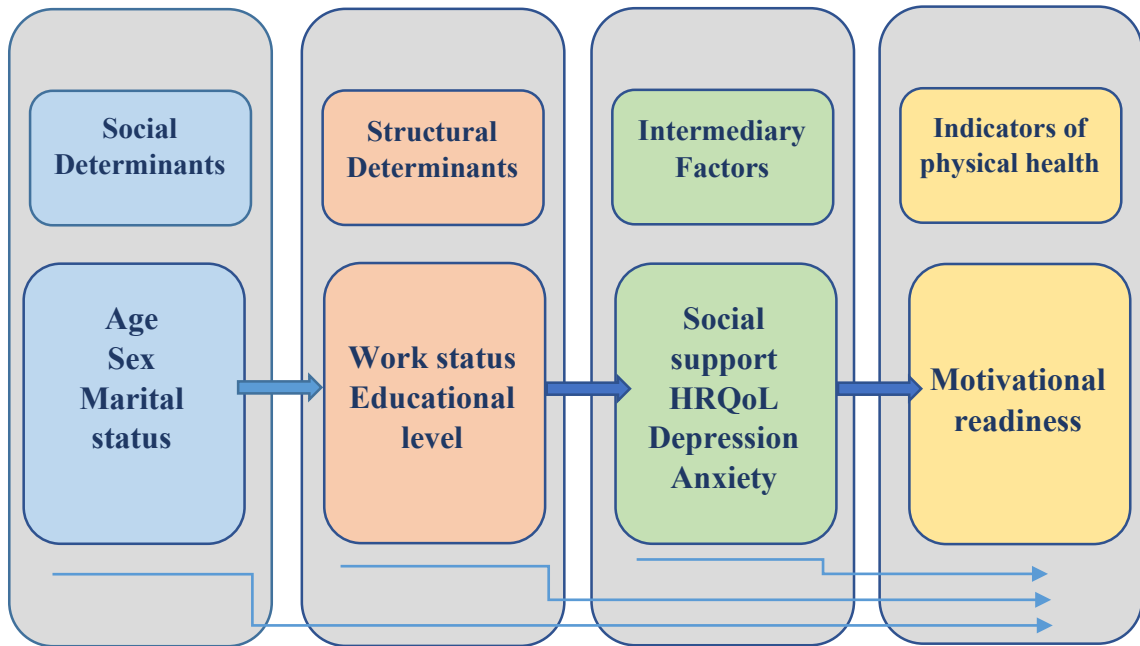
Note. HRQoL, Health-related Quality of Life

Table 1.

Characteristics of the participants

	Participants n= 1462
Social Determinants	
Sex, n (%)	
Male	660 (45.14)
Female	802 (54.86)
Age (years), M (SD)	58.28 (8.29)
Marital Status, n (%)	
Married or living with partner	980 (67.03)
Separated or divorced	192 (13.13)
Widowed or single	290 (19.84)
Structural Determinants	
Work status, n (%)	
Employed	664 (45.42)
Retired	406 (27.77)
Unemployed	135 (9.23)
Looking after family or home	172 (11.76)
Other (leave of absence for work, incapacity for work etc.)	85 (5.81)
Education level, n (%)	
Lower than primary education	79 (5.40)
Primary education	552 (37.76)
Secondary education	583 (39.88)
College and above	248 (16.96)
Intermediary Factors	
Social support (DUKE-11), M (SD)	45.44 (8.46)
Health- Related quality of life (EQ-5D- 3L index) M (SD)	0.83 (0.19)
Major depression (PHQ-9), n (%)	200 (13.68)
Anxiety (GAD-7), n (%)	194 (13.27)
Indicators of physical health	
Non-adherent Mediterranean diet, n (%)	1165 (79.79)
Insufficiently active, n (%)	711 (49.10)

Table 2.

Association between stages of motivational readiness and major depression

Stages of motivational readiness	n (%)	Major depression		*p* value	*V* de Cramer
		Non-depressed *n* (%)	Depressed *n* (%)		
Mediterranean diet					
Pre-action stages	994 (67.99)	840 (66.56)	154 (77.00)	**0.003**	0.077
Action stages	468 (32.01)	422 (33.44)	46 (23.00)		
Physical activity					
Pre-action stages	1160 (79.34)	989 (78.37)	171 (85.50)	**0.021**	0.061
Action stages	302 (20.66)	273 (21.63)	29 (14.50)		
	n (%)	**Anxiety**		**p value**	**V de Cramer**
		Non-anxious *n* (%)	Anxious *n* (%)		
Mediterranean diet					
Pre-action stages	994 (67.99)	853 (67.27)	141(72.68)	0.113	0.039
Action stages	468 (32.01)	415 (32.73)	53 (27.32)		
Physical activity					
Pre-action stages	1160 (79.34)	989 (85.26)	164 (84.54)	0.055	0.050
Action stages	302 (20.66)	273 (90.40)	30 (15.46)		

*p-value < 0.05

Table 3.

Structural equations models results

Dependent	Predictors	Coef.	Std. Err.	z	p>|z|	[95% Conf. Interval]	
Work status							
	Sex	**.433**	**.062**	**6.96**	**0.000**	**.311**	**.555**
	Age	**.132**	**.018**	**7.44**	**0.000**	**.097**	**.167**
	Marital status	.001	.041	0.02	0.986	-.080	.082
	Educational level	**-.280**	**.038**	**-7.36**	**0.000**	**-.355**	**-.206**
	Cons.	1.699	.170	9.98	0.000	1.365	2.033
Educational level							
	Sex	.023	.041	0.54	0.588	-.059	.104
	Age	**-.133**	**.012**	**-10.7**	**0.000**	**-.158**	**-.109**
	Marital status	-.013	.026	-0.48	0.630	-.064	.039
	Cons.	3.104	.082	37.66	0.000	2.942	3.265
Perceived social support							
	Sex	-.657	.456	-1.44	0.150	-1.552	.237
	Age	.265	.145	1.83	0.067	-.019	.548
	Marital status	**-1.233**	**.301**	**-4.1**	**0.000**	**-1.822**	**-.643**
	Work status	**-.506**	**.205**	**-2.47**	**0.014**	**-.908**	**-.104**
	Educational level	-.092	.288	-0.32	0.749	-.656	.472
	Cons.	48.769	1.337	36.47	0.000	46.148	51.390
Health related Quality of life							
	Sex	**-.032**	**.010**	**-3.36**	**0.001**	**-.051**	**-.013**
	Age	.003	.003	0.98	0.325	-.003	.009
	Marital status	**-.018**	**.006**	**-3.03**	**0.002**	**-.030**	**-.006**
	Work status	**-.028**	**.005**	**-5.89**	**0.000**	**-.037**	**-.018**
	Educational level	**.015**	**.006**	**2.29**	**0.022**	**.002**	**.027**
	Cons.	.912	.029	31.12	0.000	.854	.969
Major depression							
	Sex	**.080**	**.016**	**4.97**	**0.000**	**.049**	**.112**
	Age	**-.016**	**.005**	**-3.1**	**0.002**	**-.026**	**-.006**
	Marital status	-.013	.011	-1.22	0.222	-.034	.008
	Work status	.012	.008	1.44	0.149	-.004	.028
	Educational level	-.004	.011	-0.36	0.716	-.025	.017
	Perceived Social support	**-.008**	**.001**	**-6.55**	**0.000**	**-.010**	**-.005**
	Health-related quality of life	**-.582**	**.054**	**-10.73**	**0.000**	**-.688**	**-.476**
	Cons.	.900	.083	10.84	0.000	.737	1.063
Anxiety							
	Sex	**.108**	**.016**	**6.64**	**0.000**	**.076**	**.140**
	Age	-.006	.005	-1.11	0.269	-.016	.005
	Marital status	**-.023**	**.011**	**-2.04**	**0.041**	**-.045**	**-.001**

	Work status	.005	.008	0.62	0.538	-.011	.021
	Educational level	-.014	.011	-1.3	0.195	-.036	.007
	Perceived Social support	**-.004**	**.001**	**-3.03**	**0.002**	**-.006**	**-.001**
	Health-related quality of life	**-.460**	**.056**	**-8.16**	**0.000**	**-.571**	**-.350**
	Cons.	.590	.082	7.21	0.000	.430	.751
Motivational readiness for MD							
	Sex	**.073**	**.025**	**2.87**	**0.004**	**.023**	**.122**
	Age	.014	.008	1.78	0.074	-.001	.029
	Marital status	**-.029**	**.015**	**-1.98**	**0.048**	**-.058**	**.000**
	Work status	**-.025**	**.010**	**-2.49**	**0.013**	**-.044**	**-.005**
	Educational level	-.012	.016	-0.79	0.427	-.043	.018
	Perceived Social support	.003	.001	1.9	0.058	.000	.006
	Health-related quality of life	.019	.071	0.27	0.789	-.119	.157
	Major depression	**-.076**	**.038**	**-2**	**0.046**	**-.151**	**-.001**
	Anxiety	-.019	.039	-0.48	0.634	-.095	.058
	Cons.	.165	.113	1.46	0.143	-.056	.385
Motivational readiness for PA							
	Sex	.035	.022	1.6	0.109	-.008	.079
	Age	**.014**	**.007**	**2.08**	**0.038**	**.001**	**.027**
	Marital status	.016	.014	1.15	0.250	-.011	.042
	Work status	-.003	.009	-0.29	0.768	-.020	.015
	Educational level	-.005	.013	-0.4	0.687	-.032	.021
	Perceived Social support	.001	.001	0.96	0.336	-.001	.004
	Health-related quality of life	**.205**	**.058**	**3.51**	**0.000**	**.091**	**.320**
	Major depression	-.017	.034	-0.5	0.618	-.084	.050
	Anxiety	-.024	.033	-0.71	0.476	-.088	.041
	Cons.	-.116	.092	-1.25	0.211	-.297	.066

Note. *P-value < 0.05*

Figure 2.

Path model of significant relationships between variables
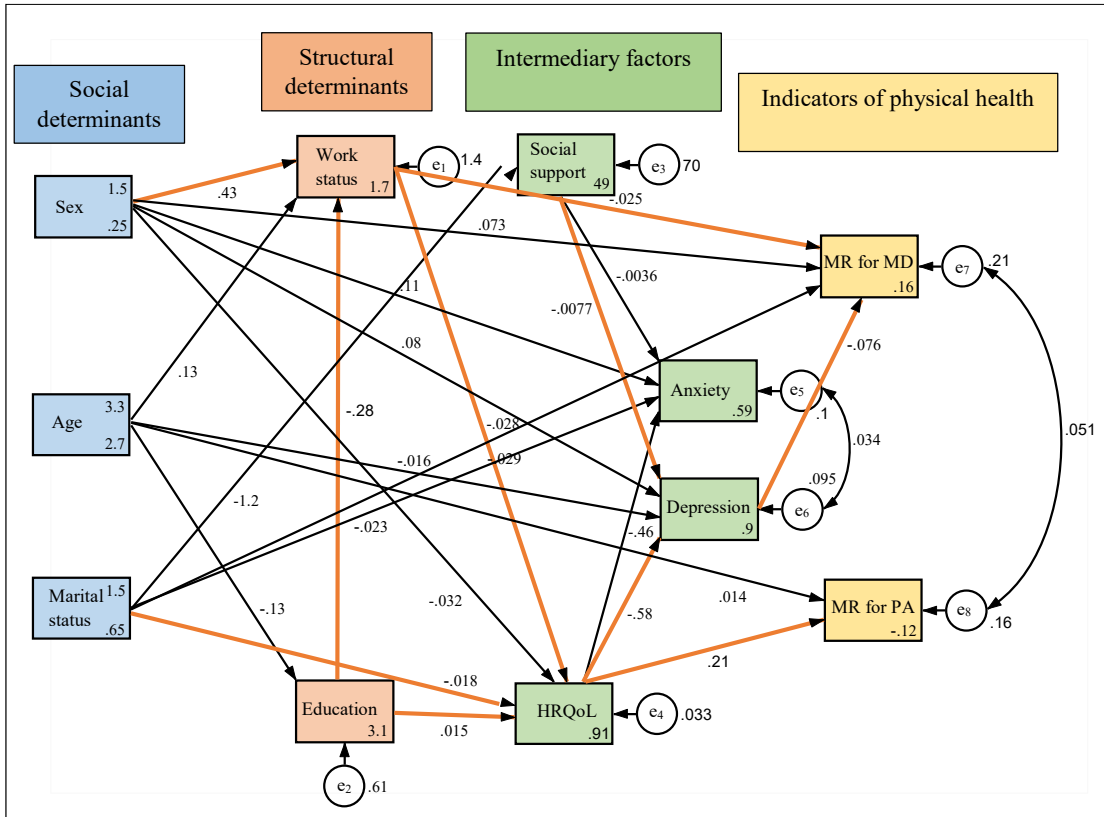
Note. HRQoL, Health-related Quality of Life; MR for MD. Motivational readiness for the adherence to the Mediterranean diet; MR for PA. Motivational readiness for physical activity.

Table 4

Indirect effects

	Work status	Educational level	Perceived Social support	Health-related QoL	Major depression	Anxiety	Motivational readiness MD	Motivational readiness PA
Sex	-0.006	-	**0.142***	-0.011	**0.037****	**0.025****	**-0.025****	**-0.016***
Age	**0.037****	-	-0.073	-0.007	0.003	0.004	-0.001	0.000
Marital status	0.004	-	-0.001	0.000	**0.020****	**0.013****	-0.004	**-0.005***
Work status			-	-	**0.020****	**0.015****	**-0.005***	**-0.007****
Educational level			**-0.218***	0.008	**-0.017***	**-0.012***	**0.010***	**0.006***
Perceived Social support					-	-	**0.001***	0.000
Health-Related Quality of Life					-	-	**0.053***	0.021
Major depression							-	
Anxiety							-	

*p-value < 0.05, **p-value < 0.001*