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Abstract

In older people is of great interest understand the relationship between socioeconomic status (SES) and health risk factors. We developed the Risk for Mobility Limitation (RML) as an enhanced indicator to classify older adults. Then through concentration index (CI) and structural equation modelling we analyse the relationship between SES and RML. Based on CI, the results show RML distribution inequalities in all Europe and mediation analyses confirm these findings even the presence of mediating variables. Furthermore, vigorous physical activity is the most important mediating variable. Another significant role of SES in reducing RML is that of improving mental health.

Keywords: risk for mobility limitation, obesity, older adults, socioeconomic status, mediation analysis

JEL: I14, I18, I31, J14

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1. Introduction

It is important to analyze the relationship between socioeconomic status (SES) and risk factors for the population's health. Knowing these interactions will make it possible to formulate appropriate policies that reduce health spending. Several articles have shown that SES plays a role in an important risk factor, such as obesity. In the general population, there is a gradient that ranges from the groups with the highest SES and least likely to be obese to those with the lowest SES and most likely to be obese and, therefore, subjects at risk for health (Alaba and Chola, 2014; Hajizadeh et al., 2014; Merino-Ventosa and Urbanos-Garrido, 2016).

In older adults, the study of the relationship is more complex and no specific evidence is found. There may be several reasons for this. On the one hand, the level of household income changes. The socioeconomic status of households adapts to the new retirement situation in the family. For example, as Bardasi et al. (2002) show in UK society, retirement is strongly associated with a decline in household economic well-being. On the other hand, assessing obesity is not easy at these ages. The body mass index (BMI) is the easiest and most commonly used way to evaluate population obesity. However, its measure is formed by weight and height, so in older adults it might not be sufficiently accurate due to involuntary changes in body composition at these ages (body fat increase, muscle mass decrease) possibly not being reflected. Ageing may modify both weight and height in this index (Zamboni et al., 2005), which BMI masks. Consequently, we must find more precise ways to measure these factors that increase health risk for elderly.

In this sense, a recent article showed that hand grip strength is a key predictor for skeletal muscle index in older men (Stoever et al., 2017) and several studies have shown that it is a well-accepted measure of muscular strength, especially in older adults (Roberts et al., 2011; Sayer and Kirkwood, 2015; Schaap et al., 2016). Furthermore, low grip strength was shown to be consistently associated with a greater likelihood of premature mortality, the development of disability, and an increased risk of complications or prolonged length of stay after hospitalization or surgery in middle-aged and older adults (Bohannon, 2008). In addition, Sallinen et al. (2010), in a cross-sectional analysis on 1,084 men and 1,562 women aged 55 years and older, published thresholds of hand grip strength, by gender and BMI, to classify individuals at risk for mobility limitation (RML).

Therefore, we can consider that the classification of persons at RML, a measure that combines gender, BMI and muscle strength, can be much more precise and effective than measuring obesity through BMI in older adults.

The current study aims to determine the relationship between SES and RML. More importantly, this study adds to the current literature by being, as far as we know one of the first studies that focuses on disentangling direct and indirect effects in this relationship, by analysing the mediating role of a battery of lifestyle factors.

2. Methods

2.1. Data

We draw upon the Survey of Health, Ageing and Retirement in Europe (SHARE), specifically the wave administered in 2015. The survey consists of all persons aged 50 years and over who reside in European countries. In particular, we selected participants from European countries with valid information on the study variables. The final sample consisted of a total of 57,124 individuals from 17 European countries. More detailed information on SHARE and data collection procedures can be found elsewhere (Börsch-Supan et al., 2013).

2.2. Definition of variables

As representative variables of SES, we selected the equivalent income per household and the educational level. The first was obtained adjusting for the household size by dividing the income by 1 for the first adult in the household plus 0.5 for each adult, similar to the OECDmodified scale proposed by Hagenaars et al. (1994). The weighting per resident child (0.3) was not used given the characteristics of the sample: in the household, 77.4% of the subjects in the sample live with one or two persons, three persons in 13.3% and four or more in 9.3%. Due to the fact that in the percentage that more than 2 people live in the house, it is very likely that they will be of legal age (i.e. that the older person lives with their son/daughter and partner because they have been widowed or that a single son/daughter lives with the subject and the partner), we weighted all of them by 0.5 instead of 0.3 for children.

It is also important to mention that the surveyed subjects report their household income in the local currency (which in most cases is the euro), although the survey data itself includes a variable with the exchange rate that allows information to be transformed in one direction or another (euro-local currency; local currency-euro). In our case, all the results are reported in euros. Finally, to reduce the differences derived from the different living conditions between countries, we built a categorical variable in which each subject is associated with an income quintile based on the income distribution of their country of residence.

Educational level was constructed through the variable reported in the International Standard Classification of Education (ISCED-97) (Schneider, 2008). It was categorized into 3 levels (low, middle and high. The first level of the category includes: early childhood education ('less than primary' for educational attention), primary education and lower secondary education. It is interesting to mention that we did not consider generating one more level with the subjects in the first level of the ISCED-97 (less than primary) because the percentage of subjects was not high enough (6.4%), and the jobs to which these subjects were most likely able to access were not substantially different from the subjects included in the same level (lower). The second level: middle upper secondary education and post-secondary non-tertiary education. And finally the third level (high): short-cycle tertiary education, bachelor's or equivalent level, master's or equivalent level, doctoral or equivalent level. More detailed information on these levels can be found on the UNESCO website.

For the dependent variable of our analysis (i.e., RML), we used maximum grip strength as the proxy measurement of muscle mass percent. To obtain the maximum grip strength of respondents, the survey used as valid measurements one taken in both hands (twice in each hand) or one taken in only one hand (twice in the chosen hand), as long as the two measurements taken in the same hand did not differ by more than 20 kilograms (kg). BMI is defined as a person's weight in kilograms divided by the square of their height in meters (kg/m^2). It is based on a self-reported weight and height, and is categorized into normal-weight (BMI below 24.9), overweight (BMI between 25.0 and 29.9) and obesity (30 and above) (15). It is interesting to mention that one more BMI category called underweight could have been included, and that this has not been done because the percentage in this type of population is usually very low, specifically in our sample 1% (see table 1).

Depending on the BMI, there exist maximum grip strength cut-off points for older persons that increase RML. This means that older adults under the cut-off points have an unhealthy distribution of fat mass and muscle mass, and their health status could therefore be categorized as obese or at health risk. The estimated hand-grip threshold is 33 kg for normal weight men, 39 kg for overweight men and 40kg for obese men. For women, hand-grip cut-off points are practically similar across the BMI categories: 20 kg, 21 kg and 23 kg for normal weight, overweight and obesity, respectively (Sallinen et al., 2010). RML was categorized into 1 for subjects at risk and zero for everyone else. It is interesting to mention that the SHARE survey includes a series of questions about mobility difficulties and that could have allowed us to classify the subjects in RML; however, we consider it more appropriate to use completely objective measures to reduce possible biases.

Regarding nutrition, for the frequency of food consumption, the questions referred to how often the participant consumed the different types of food in a normal week. The variables were recoded with the value 1 when the respondent complied with the recommended frequency and 0 otherwise. For fruit or vegetables and dairy products (i.e., a glass of milk, cheese in a sandwich, a pot of yogurt, a can of high protein supplement), the recommended frequency was daily. For legumes, beans, eggs consumption and meat, fish or poultry consumption, the recommended frequency was 3-6 times a week. These calculations follow the Healthy Eating Guide (Dapcich et al., 2004).

In terms of lifestyle issues, the question about how often the subject engaged in vigorous physical activity, such as sports, heavy housework, or a job involving physical labour, this variable was coded as 1 if the subject did so more than once a week and 0 otherwise. In the questionnaire we also found a question about moderate physical activity but it was not considered for the present analysis because it could collect part of the effect of the variable that asks about vigorous physical activity. In addition, as will be mentioned later in the discussion, there are questions about which it is easier for the subjects surveyed to lie trying to generate a better appearance of themselves. The variable on moderate physical activity could be problematic in this regard.

We also measured whether the subject had sleep problems or recent changes in sleeping pattern, and coded as 1, if the person in question had problems and 0 otherwise.

Finally, for mental health, the survey includes questions to obtain the score on the Euro-D depression scale (Prince et al., 1999) and we recoded as 1 if the subject had good mental health and 0 otherwise. The scale has a range from 0 to 12 in attention to the sum of symptoms from which the subject indicates that mental health derives: depression, pessimism, suicidality, guilt, sleep, interest, irritability, appetite, fatigue, concentration, enjoyment and tearfulness. As mentioned above, not suffering from at least one of them classifies the subject in good mental health.

As other covariates in our analyses, we used sociodemographic variables, specifically gender, age, marital and employment status, and born in country.

For analyzes, countries with similar characteristics were grouped as follows: Northern Europe (Denmark and Sweden), Central Europe (Austria, Belgium, France, Germany, Luxembourg and Switzerland), South-Western Europe (Greece, Italy, Portugal and Spain) and Eastern Europe (Croatia, Czech Republic, Estonia, Poland and Slovenia).

2.3. Statistics

First, a descriptive analysis was performed. Next, we checked for the presence of a socioeconomic gradient in the health measurements (RML) by calculating the country-wide Concentration Index (CI) for each group of countries. CI shows the existence (or non-existence) of inequality in the distribution of individuals at risk of mobility limitation, with regards to the socioeconomic status. In this case, we used income instead of a composite SES-index; this is sufficient according to previous studies that show good performance of this indicator in capturing health variation in older ages and its strong link to measuring health of individuals (Darin-Mattsson and Fors, 2017). When CI takes values around zero, it means there is no socioeconomic-related inequality with the distribution of RML; if the value is negative, it indicates a high concentration of RML among the poorer individuals; otherwise, positive values of CI mean that RML are located among wealthy people (O'Donnell et al., 2007). The index can be expressed according to Equation 1. This equation shows that the value of the CI is equal to the covariance between the value of the RML (y_i) and the relative ranking of individuals according to their income level (R_i) divided by the average of the RML measure (μ).

$$CI(y) = \frac{2}{\mu} cov(y_i, R_i) \quad (1)$$

The index ranges from -1 to 1 (i.e., $-1 \leq CI \leq 1$, or $y' - 1 \leq CI \leq 1 - y'$, being y' the mean of y, and y a variable related to illness-health, in our case, RML).

As a final point, we relied on structural equation modelling, in particular partial least squares. This powerful, robust statistical procedure (Henseler et al., 2009) allows for causal analyses of complex problems (Hair et al., 2017), as for example in Ruiz-Palomino and Banon-Gomis (Ruíz-Palomino and Banon-Gomis, 2017). As a structural equation modelling approach, it is well suited to test mediation hypotheses (James et al., 2006). It is also suitable when using binary variables (Hair et al., 2017) and represents a powerful and robust technique to provide good evidence on the causality of the relationships (Bollen and Pearl, 2013; Heck and Thomas, 2015).

SES was modelled in the PLS analysis as a formative construct, via two indicators that help form the construct in question, level of education and equivalent income per household. Both indicators help build this construct, in other words, they generate the construct, and not the reverse. For mediators, including dietary habits, vigorous physical activity, sleep problems, mental health, and the dependent variable of RML, dichotomous formats were used, as mentioned above (Yes = 1; No = 0). As such, because the independent variable in this study (SES) was formatively designed or the rest of variables were approached in a dichotomous manner, traditional reliability and validity criteria do not apply to know if the measurement used is of adequate or not (Hair and Alamer, 2022). In the formative case, the non-existence of multicollineariry problems regarding the formative indicators used to build these variable works better as an indicator that the measure used is a good and appropriate one; in our case, the variance inflation factors (VIFs) we calculated for the two formative indicators used and for each cluster of European countries, ranged between 1.00 and 1.20, below the threshold of 5.0, thus revealing that the two indicators used to measure this variable contribute to form its corresponding formative construct (i.e., SES). In the case of dichotomous variables, traditional reliability and validity criteria do not apply either, as commented earlier (Hair and Alamer, 2022), primarily because in these cases, loadings, composite reliability or Cronbach alpha indexes and the Average Variance Extracted (AVE) index reach each the value of 1.

Finally, in tems of hypotheses testing, we used bootstrapping (5,000 subsamples) to generate standard errors and bootstrap t-statistics with n-1 degrees of freedom (where n is the number of subsamples), as recommended (Hair et al., 2014; Henseler et al., 2009). This way we could evaluate the statistical significance of path coefficients. We also used the bootstrap method with 5,000 subsamples to test indirect effects of SES on the dependent variable in this study (Hayes, 2009; Mackinnon, 2012). The bootstrap approach is a superior, powerful and valid technique to test for mediation; it builds the estimate of the indirect effect itself (Hayes, 2009), respects distribution irregularities of the sample, and offers accurate inferences concerning the relationships to be studied (Hayes, 2017).

3. Results

The general socio-demographic characteristics of the 57,127 European individuals in our study sample are shown in Figure 1. The average age was 67.19 (SD: 9.63), with a higher percentage of women than men. Approximately two thirds were retired, a slightly higher percentage were married and almost 40% reported a low educational level. Regarding diet and physical activity patterns, we observe that three quarters do not consume the recommended frequency of legumes, beans or eggs and that a third perform vigorous physical activities. In terms of health problems, a third reported sleep problems and 22.5% had no mental health problems. In addition, 22.2% were obese, according to BMI categories, and 23.3% had RML.

Table 1 shows the descriptive characteristics of the variables involved in the creation of the RML formative variable, as well as the distribution of this same variable between men and women. It is interesting to observe that subjects at the extremes (underweight and obese) are at higher risk (RML). It is also observed that there is not much difference in this percentage between overweight and obese men (30.2 and 33.0%) while the difference is greater among women (20.1 and 28.9%).

Table 2 shows the CIs of each group of countries analysed. We find that all of them have a significant CI and the sign is negative, which indicates the existence of an RML concentration in poor people; in those who have the highest levels of equivalent income per household, the probability of RML concentration decreases. The values range between -0.078 for Central Europe and -0.187 for Northern Europe. In addition, the largest gap was found between the last mentioned group of countries (Denmark and Sweden) and the rest.

Figure 2 also shows that the variance explained by SES of each mediating variable used in our analysis was negligible; yet the variance explained of the final dependent variable, once after all mediating variables were included, reached relatively good values across the 4 clusters. Specifically, it ranged between 0.046 (Central Europe) and 0.071 (Northen Europe).

Table 3 shows the (direct and indirect) effects of SES on RML after coefficients were standardized and bootstrapped standard errors were calculated. Concerning the test of our mediation model, even with the presence of the mediating variables in the equation, SES influenced RML negatively in all clusters studied, thus indicating that the higher the SES the lower is the probability of RML. The direct effects of SES on RML were all negative and significant, with bias and corrected (BCA) 95% confidence intervals not including the number zero, which confirms the existence of such significant direct effects. However, the effect size analysis (f^2) across all clusters indicated that SES had a small (sometimes very small) effect size in producing the R^2 of RML (Table 2). Yet, this was one of the most important effect sizes revealed over the research model and analysis, but this was still small, as it was lower than 0.02

(Cohen, 1992). In addition, as Tables 3 and Figure 2 reveal, the SES-RML relationship was partially mediated (percentages of indirect effects over total effects were 17.5%, 14.3%, 13.7% and 10.9% in Central, Eastern, Northern and South-Western Europe respectively). In support of the existence of mediation between SES and RML, the total indirect effects had to be significant (Hayes, 2009). This condition was met in all clusters, thus increasing the total effect of SES on RML in all cases. Interestingly, neither did all mediation variables included in our study mediate equally in size and significance nor did they do so for the same clusters.

As seen in Table 3, doing *vigorous physical activity* was the most important mediating variable of all; though with less impact in the south-western European countries. Table 3 reflects that doing vigorous physical activity had the most significant mediation effect in Central and Eastern Europe ($f^2 = 0.026$ in both cases). Although in all clusters the effect size of this mediation was small, this was the most important of all revealed in the model or PLS analysis (Figure 2). In fact, the physical activity effects on total effects were 13.9%, 8.4%, 10.5% and 2.7% in Central, Eastern, Northern and South-Western Europe, respectively, so the probability of older adults engaging in vigorous physical exercise can be said to be associated with SES, which ultimately was a determinant to reduce their RML (see Figure 2).

Having good mental health also contributed significantly to mediating between SES and RML for all clusters studied account for 2.2%, 3.2%,2.3% and 4.8% of total effects for Central, Eastern, Northern and South-Western Europe respectively; SES influenced mental health positively, which in turn reduced RML in all countries studied (see Figure 2). However, the effect size and the mediating role of this variable was practically unimportant (at least compared to that of doing vigorous physical activity) as the effect sizes were lower than 0.02 (Cohen, 1992), and were therefore negligible (Table 3).

The mediating effect of the other mediating variables was not shared across a majority of clusters. In addition, these mediation effects were negligible in size (f^2 lower than 0.02; (31)). For example, although having sleep problems was found to have a partial mediating role between SES and RML, it exhibited this role for only East and South-Western European regions. Our findings showed in these countries that SES reduced older adults' sleep problems which has a positive effect on not having RML (see Figure 2). Fruit consumption were also mediators for East and North clusters. Finally, according to our findings, legumes, beans or eggs and the consumption of meat, fish or poultry, even if healthy recommendations are followed, did not play a mediating role in the relationship between SES and RML.

4. Discussion

Our findings show evidence that for older adults in Europe, having a higher SES implies a lower probability to be with RML. The CI results reveal that RML distribution entails a pro-poor concentration. In addition, and perhaps counterintuitively, we show that the greatest differences are found in the Northern Europe countries evaluated (Denmark and Sweden). If we look at the data, between the countries of Central Europe, South-Western Europe and Eastern Europe, the differences in the CI are not too large, but if we compare with Northern Europe we observe an increase in the reduction of up to -0.109 (with Central Europe). Because the relationship between SES and RML in older people is somewhat novel compared to this relationship between SES and health inequalities, we found no literature to support our results. Future studies should corroborate our results on this point, however, a possible cause could be due to the different number of countries in each cluster (Northern Europe = 2; Central Europe = 6; South-Western Europe = 4 and Eastern Europe = 5).

As the most compelling findings of the study, we find that the SES-RML relationship is partially mediated in all country clusters. In general terms, the powerful mediating effect of engaging in vigorous physical activity more than one-day-per-week. There is evidence in the literature on the relationship between SES and physical activity suggesting persistent socioeconomic differences in old age. On the other hand, the association between SES and health appears to be weaker after retirement. People with low SES are less physically active and have worse health status compared to those with higher socioeconomic status. (Trachte et al., 2016). In addition, several studies indicate that PA mediates the association between SES and health (Reiner et al., 2013 Samitz et al., 2011). Our findings, although within the sphere of health, focus on a different construct, the RML (a measure that classifies risk and is made up of muscle strength and BMI), underlining the importance of vigorous physical activity (sports, heavy housework, or a job involving physical labor more than once a week) for older adults. Low socioeconomic status leads to reduced mobility but also a lower socioeconomic status implies a lower probability of engaging in vigorous physical activity and not engaging in this type of physical activity implies a greater risk of reduced mobility. Therefore, regardless of socioeconomic level, vigorous physical activity could dampen RML in older people, so it will be important to develop programs and policies that break the barrier of low SES, making it easier for older people to be able to perform vigorous physical activity more than once a week. Another question for the future will be to establish the appropriate programs and activities for the initiation of this population in the activity.

Other important mediating mechanisms were having good mental health. In this line, a recent study shows how depressive symptoms are associate with decreased in hand-grip strength and SES (Han et al., 2019). Having no sleep problems was also significant for the countries of the East and South Europe. The fact that these differences occur is not surprising, the most likely cause may be the higher social inequalities and worse health and social welfare systems among different countries.

With regards to the dietary habit variables, these habits do not appear to play an important role in this relationship, which is in line with other previous studies aimed at predicting other health risk-related measurements (Janssen et al., 2006; Merino-Ventosa and Urbanos-Garrido, 2016). Nevertheless, we know that healthy eating habits do lead to better health and reduce the use of healthcare resources (Del Pozo-Rubio et al., 2018). Our study reveals that meat, fish or poultry consumption do not mediate the SES-RML relationship. This is probably because in developed countries like those in the study the diet is rich enough for many of the older adults, so this is not a substantially differential element in these population. The SES-RLM path is arguably better explained through other aspects that are not so easily similar across older adults (i.e., mental health, sleep problems, vigorous physical activity).

Regarding the differences between regions, it is known that income inequalities have a strong and negative effect on health levels, also observing an increase in economic inequality in most countries (Pickett and Wilkinson, 2015). This income inequality also negatively affects mental health, although the magnitude of the impact depends on the country analyzed and the type of study, observing significant heterogeneity between studies (Ribeiro et al., 2017). In this sense, one study revealed that the association between income inequality and the socioeconomic well-being is weak, complex and moderated by the country economic development (Ngamaba et al., 2018), even depending on the type of measurement scale (Tibber et al., 2022). However, a systematic review found that the level of association between income inequality and the subjective well-being did not depend on the geographic region (Ngamaba et al., 2018).

Anycase, in general terms, population from France and Greece have better physical health, along with Finland, United Kingdom, Denmark or Netherlands. However, in terms of mental health, while France would be the country with the population with better mental health, Greece and United Kingdom would have the population with poor level of mental health (Theodossiou and Zangelidis, 2009). Regarding the level of economic inequality, it is interesting to observe how countries like Ireland, Spain, Germany or the Netherlands have better levels of mental health than would correspond to them according to their levels of inequality, while Malta, Slovakia and Slovenia show levels of mental health below those that would correspond to them according to their level of inequality (Layte, 2012).

The irruption of the pandemic has broken a large part of the existing economic and social schemes up to now, so it would be as advisable as necessary to replicate these works with data after the year 2020.

This study has some limitations. With regard to our research design, our data were cross-sectional; this limits our causal conclusions but does not undermine our correlation findings. In addition, data from new waves of the survey used (SHARE) have been published, which will be used to explore the temporal dimension based on these results, trying to generate more evidence on the SES-RML relationship and mediating variables. In addition, most of the variables of our study are self-reported, which can imply a type of bias that has to be taken into account when interpreting our results. We refer to the fact that in the literature there is evidence when the study subjects report their weight, they generally tend to underestimate the figure (Nieto-Garcia et al., 1990), they also tend to respond about the frequency of consumption of healthy foods, avoiding criticism or seeking praise (Hebert et al., 1997). With regards to what is or is not “doing vigorous physical activity”, the same risk of desirability bias can occur. On the other hand, it is also interesting to point out that an important part of our study sample (69.0%) is retired and therefore with lower income expectations. Maybe for these people the wealth can be an important source of consumption that has not been included in the SES construct, however several studies indicate that income and education are the most used and common proxies of a person's socioeconomic status (Ware, 2019). Overall, further research should evaluate all these variables in a more detailed way to confirm our findings, for example, including the wealth of the subjects analyzed.

In conclusion, the current study contributes to the existing literature about the impacts of social inequities on being at health risk in Europe by including a new way to measure this risk and by analysing a large number of European countries. Future studies should corroborate the associations presented in this study as well as try to delve into other aspects that may affect the SES-BMI relationship, such as comorbidities, gender and health dimensions. Also, further research could use longitudinal data, so the causality of the relationships tested could be clarified.

Compliance with Ethical Standards:

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Conflict of Interest: The authors declare that they have no conflict of interest

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Figure 1. Sociodemographic characteristic of study sample (N=57.124)

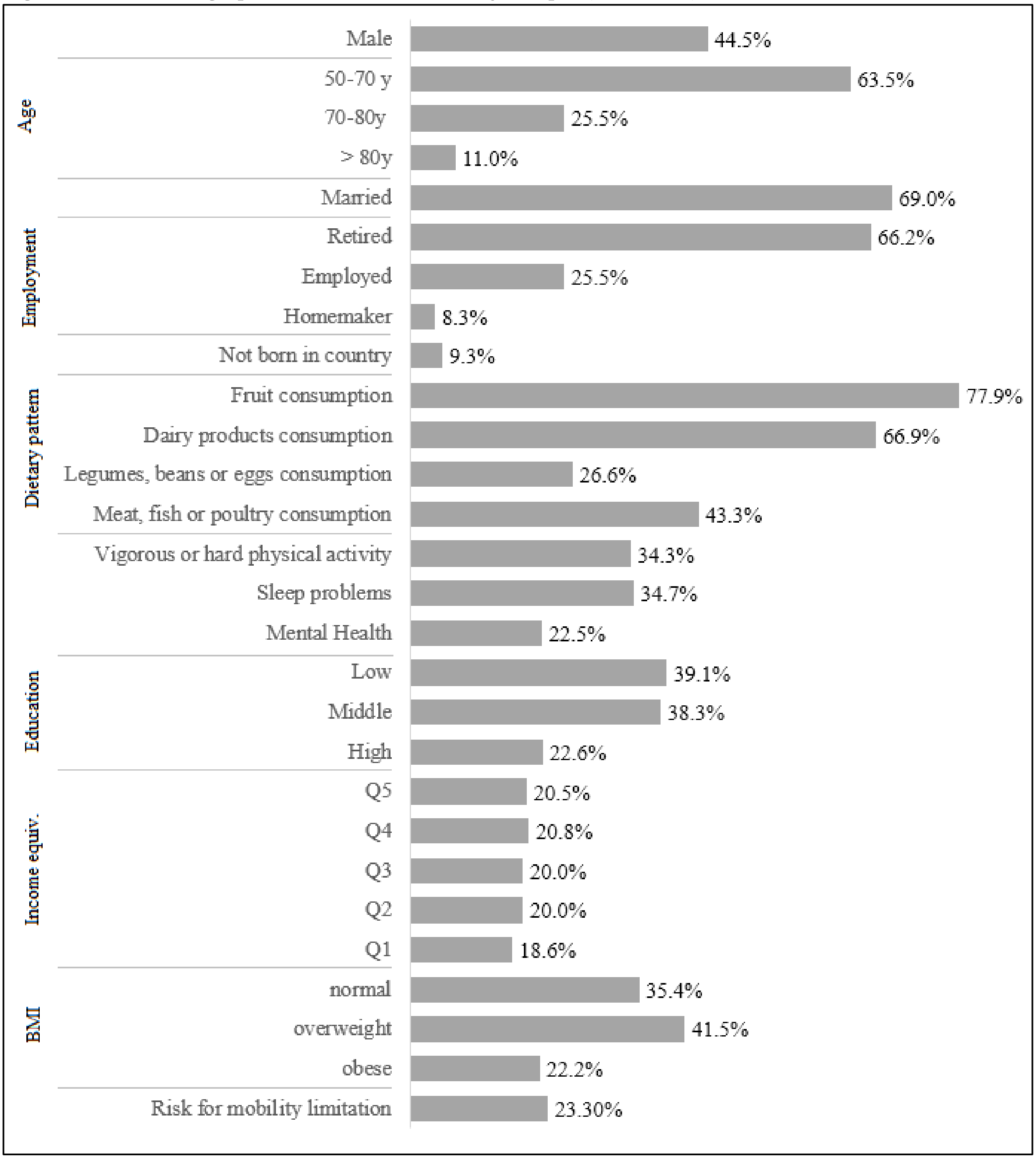

Table 1. Descriptives of Body Mass Index and Max Grip Strength measure in study sample

Gender	Body mass index categories	Body mass index	Max. of grip strength measure	Subjects at Risk for Mobility Limitation (%)
Male	1. Below 18.5 - underweight	17.396 (0.936)	33.51 (9.87)	47.1
	2. 18.5-24.9 - normal	23.226 (1.43)	40.642 (10.071)	20.4
	3. 25-29.9 - overweight	27.245 (1.382)	42.891 (10.051)	32.3
	4. 30 and above - obese	33.121 (3.158)	43.58 (10.541)	33.0
Female	1. Below 18.5 - underweight	17.486 (0.99)	23.204 (6.872)	26.6
	2. 18.5-24.9 - normal	22.614 (1.643)	26.157 (6.777)	15.1
	3. 25-29.9 - overweight	27.274 (1.391)	26.228 (6.820)	20.1
	4. 30 and above - obese	33.823 (3.627)	26.336 (7.092)	28.9
Total	1. Below 18.5 - underweight	17.471 (0.981)	24.939 (8.392)	30.0
	2. 18.5-24.9 - normal	22.846 (1.593)	31.654 (10.788)	17.1
	3. 25-29.9 - overweight	27.259 (1.386)	34.836 (12.001)	26.4
	4. 30 and above - obese	33.519 (3.449)	33.81 (12.234)	30.7

Mean and Standard Deviation in brackets; Chi-squared test indicate significance differences in the 3 RML groups between different intervals; Percentage in each BMI group where 1%, 34.7%, 41.9% and 22,4% in order from least to greatest.

Table 2.Erreygers Concentration Index for RML

		Percent dif.
Northern Europe	-0.187	Ref
Central Europe	-0.078	-41.71%
South-Western Europe	-0.102	-54.55%
Eastern Europe	-0.092	-49.20%

All values are significant at p<0.001 level; Percent difference represent the porcentual difference with Nothern Europe, the reference value.

Table 3. Standardized effects (indirect, total indirect, direct and total) of Socioeconomic Status (SES) on Risk for Mobility Limitation (RML)

	Central	East	North	South-Western
Fruit consumption	0.000 (-0.001;0.000)	-0.001* (-0.003;-0.001)	-0.002* (-0.004;-0.001)	0.000 (-0.001;0.000)
Mediation effect size		f^2 =0.000 (negligible)	f^2 = 0.001 (negligible)	
Dairy products consumption	0.000 (-0.001;0.000)	0.001 (-0.001;0.002)	0.000 (-0.001;0.001)	0.000 (-0.001;0.001)
Legumes. beans or eggs consumption	0.000 (0.000;0.000)	0.000 (0.000;0.000)	-0.001 (-0.002;0.000)	-0.001 (-0.002;0.000)
Meat. fish or poultry consumption	0.000 (-0.001;0.000)	0.000 (0.000;0.001)	0.001† (0.001;0.003)	0.000 (-0.001;0.000)
Mediation effect size			f^2 = 0.001 (negligible)	
Vigorous or hard physical activity	-0.019*** (-0.021;-0.017)	-0.013*** (-0.015;-0.010)	-0.023*** (-0.028;-0.019)	-0.004*** (-0.006;-0.002)
Mediation effect size	f^2 = 0.026 (small)	f^2 = 0.026 (small)	f^2 = 0.019 (very small)	f^2 =0.017 (very small)
Troubles with sleep	0.000 (-0.002;0.001)	-0.003*** (-0.005;-0.002)	0.000 (-0.001;0.001)	-0.004*** (-0.006;-0.003)
Mediation effect size		f^2 = 0.001 (negligible)		f^2 = 0.002 (negligible)
Mental health	-0.003*** (-0.004;-0.002)	-0.005*** (-0.007;-0.004)	-0.005*** (-0.008;-0.003)	-0.007*** (-0.009;-0.005)
Mediation effect size	f^2 = 0.003 (negligible)	f^2 = 0.007 (negligible)	f^2 = 0.004 (negligible)	f^2 = 0.008 (negligible)
% of variance (R^2) explained by the mediators	58.7%	57.1%	32.4%	56.0%
Total indirect	-0.024*** (-0.026;-0.021)	-0.022*** (-0.025;-0.018)	-0.030*** (-0.036;-0.024)	-0.016*** (-0.019;-0.012)
Total Mediation effect size	f^2 *total* = 0.028 (small)	f^2 *total* = 0.034 (small)	f^2 *total* = 0.024 (small)	f^2 *total* = 0.029 (small)
Direct (SES→RML)	-0.113*** (-0.127;-0.099)	-0.132*** (-0.147;-0.117)	-0.189*** (-0.212;-0.166)	-0.131*** (-0.147;-0.115)
Direct effect size	f^2 = 0.013 (very small)	f^2 = 0.018 (very small)	f^2 = 0.037 (small)	f^2 = 0.018 (very small)
Total	-0.137*** (-0.151;-0.122)	-0.154*** (-0.169;-0.139)	-0.219*** (-0.242;-0.196)	-0.147*** (-0.163;-0.131)

*** p< 0.001; ** p< 0.01; * p< 0.05; † p< 0.10; For calculating the size of the mediation effects: f^2 = (R^2 included- R^2 excluded) / (1- R^2 included), where $f^2 \geq 0.02$, 0.15 or 0.35 implies that the mediation effect is of a small, medium or large size, respectively (Cohen, 1992). For the direct effect of SES on RML, size effects were also calculated to indicate the extent to which SES has a small, medium or large effect in producing the R^2 of RML The rest of direct involved in the model were not calculated as they all were less than 0.02 and therefore are negligible in producing the R^2 of the dependent and mediating variables. SES = Socioeconomic Status; RML= Risk for Mobility Limitation. effects

Figure 2. Direct effects of Mediation Variables in the relationship between Socioeconomic Status (SES) and Risk for Mobility Limitation (RML).