# EXPLORING SOCIO-ECONOMIC FACTORS ASSOCIATED WITH ADHERENCE TO THE MEDITERRANEAN DIET: A MULTILEVEL APPROACH

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**ABSTRACT:** At first sight, the Mediterranean diet appears to be the best and most well-balanced diet to follow as it links environmental and human health. By using repeated cross-sections of the ISTAT "Aspects of daily-life" survey over the period 1997-2012, we construct a Mediterranean Diet index with the aim of evaluating the adherence of Italians to this sustainable diet and exploring the role of socio socio-economic and lifestyle factors.

**KEYWORDS**: Mediterranean diet, socio-economic factors, multilevel models.

## 1 Introduction and background

Over the last few years, the Mediterranean diet (MD) has received growing attention as it represents a sustainable and healthy diet in which nutrition, local food production, biodiversity, culture and sustainability are strongly interconnected, with a low impact on the environment (Germani et al., 2014).

The traditional MD is characterized by a high consumption of vegetables, fresh fruit, legumes, cereals and a moderate intake of alcohol as main source of fiber and antioxidants, with fish, nuts, and olive oil that ensure a high intake of monounsaturated fatty acids, associated with a low intake of trans fatty acids from meat and sweets (Bach-Faig et al. 2011).

Unfortunately, it seems that Mediterranean countries are replacing the traditional MD with other less healthy eating habits and orienting their food choices towards products typical of the Western diet which is rich in refined grains, saturated fats, sugars, red and processed meat.

There are several reasons why people keep on drifting from one dietary regimen to another although social and cultural changes appear to have contributed to radical reversal in dietary habits in Southern European societies.

Recent nutritional surveys carried out in Italy found that income and education are associated with a greater adherence to Mediterranean style eating patterns (Bonaccio et al, 2013). Therefore, it is clear that the analysis of factors influencing

people's dietary habits could help to promote the MD thus reaping benefits both in terms of public health and environmental impact.

The aim of this paper is to assess the prevailing food patterns of the Italians and explore the socio-economic and lifestyle determinants of their adherence to MD by using a series of repeated cross-sectional sample surveys, the ISTAT "Aspect of Daily Life" surveys, for the period from 1997 to 2012. By adopting the multilevel framework we will be able to determine whether and to what extent differences in individuals' adherence to MD are associated with the socio-economic context in which they reside. Preliminary results for the year 2012 seem to confirm a positive association between education and adherence to MD. Future developments of the study will address the issue of temporal dimension within the multilevel framework.

## 2 Data description and the Italians' adherence to MD

A specific section of the "Aspect of Daily Life" survey, carried out annually by the Italian National Statistical Institute (ISTAT), is devoted to the exploration of individuals' food consumption habits in which the participants are questioned about their frequency of intake of various types of food and they are asked to self-report the frequency of these intakes in terms of times per day, week or less often.

We considered 15 repeated cross-sections of this survey for the period 1997-2012 and taking into account the Mediterranean pyramid recommendations we evaluated the Italians' adherence to the MD by constructing the Mediterranean composite score which summarizes the frequency of consumption of 12 selected types of food as well as oils and/or fats used in the case of raw or cooked food. A score ranging from 0 to 4 was assigned to the frequency of consumption of each food component according to the degree of adherence to the MD. The indicator can assume values between 0 (minimal adherence to the Mediterranean diet) and 56 (maximal adherence to the Mediterranean diet). It is worth noting that a minimum cut-off age equal to 14 was considered when computing the index.

The Italians appeared to have a moderately high level of adherence to the MD throughout the entire study period. The overall average level of adherence to the MD is approximately equal to 73% (corresponding to a mean value of the constructed Mediterranean score of approximately 41 out of a maximum value equal to 56), even if movements and changes can be observed during the period 1997-2012 with decreasing values observed since the beginning of the economic crisis.

Concerning differences across territorial areas, it is worth noting that Lazio, Umbria, Puglia, Abruzzo and Liguria are the regions in the highest values of the Mediterranean score.

With the aim of exploring the association between the socioeconomic status and the adherence to MD we computed a composite relative indicator obtained by using a Multiple Correspondence Analysis which considered five variables: dwelling ownership, whether one has spent a holiday period of at least 4 nights in the last 12 months or not, number of cars owned, judgment concerning the economic resources of all household members (categories ranging from "excellent" to "totally

inadequate"). The education level was divided into two classes: up to 8 years of education and more than 8 years (Fig.1).

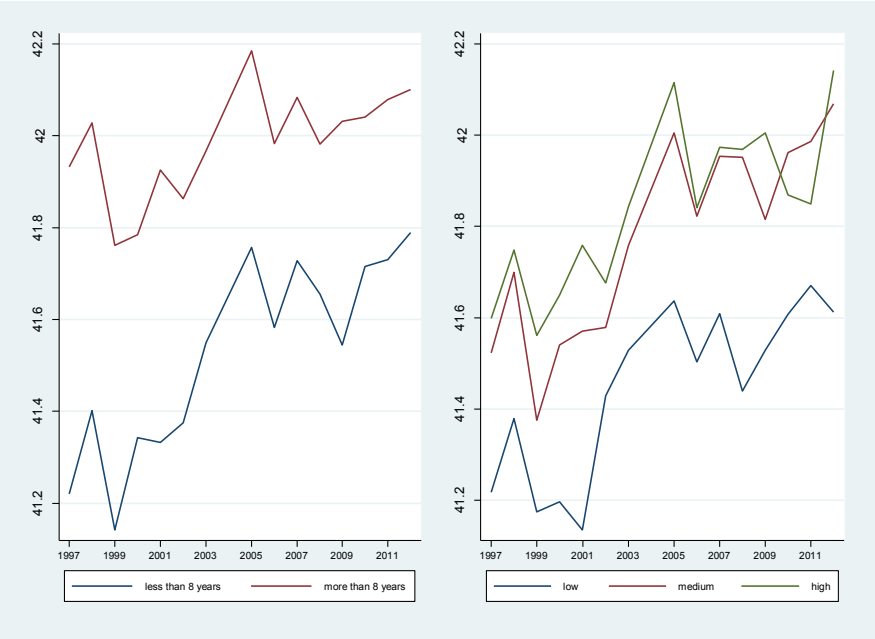


Fig. 1. Adherence to MD: education and wealth levels (years 1997-2012)

# 3 Model specification and preliminary results

The hierarchical structure of the micro data – namely individuals (level 1) grouped in regions (level 2) – enabled us to adopt a multilevel framework for analysing the influence of covariates both at individual and regional level on MD adherence. From a statistical perspective this structure of the data (grouped-data) implies a violation of the assumption of independence among observations within the same second-level units. In order to deal with this issue we referred to the class of random effect models and specifically to the random-intercept logistic specification in which a region-specific (level-2) random intercept is included in the linear predictor thus enabling us to explicitly model the hierarchical structure of the data and the unobserved heterogeneity (Rabe-Hesketh and Skrondal, 2008).

We modelled a dichotomous variable $Y_{ij}$ which represents the degree of adherence to MD of individual *i* living in region *j*, which is equal to 0 if the level of adherence to MD is less than the median value equal to 42 while it is equal to 1 if the level of adherence is greater than or equal to the median.

As a first exploratory analysis we considered the 2012 wave of the survey which includes 40,530 individuals living in the 20 regions of Italy. The Likelihood Ratio

test supports the significance of the multilevel framework compared to the single-level logistic regression (p-value=0.000).

Demographic characteristics proved to be associated with the respondents' adherence to MD and their effect is also confirmed when introducing contextual variables in the model. A significant positive association was observed for age: the higher the age, the higher the estimated probability of having a greater adherence to the MD, holding constant the other variables in the models. Regarding gender, females have a 43.0% higher OR of reporting a high level of adherence to MD.

Concerning socio-economic factors, the level of education proved to be a strong predictor of the Mediterranean dietary pattern. In fact, people who studied more than 8 years appear to have a higher adherence to MD compared to individuals with years of education lower or equal to 8 years OR=1.26).

Life-style variables were found to be associated with food diet patterns. Individuals who never smoked or stopped smoking were found to have a positive association with a high level of adherence to MD (ORs equal to 1.37 and 1.48, respectively) compared to individuals who current smoke.

Concerning occupational status, we found that people who were not part of the labour force (i.e. pensioners, housewives, students) are more likely to have a level of adherence to the MD greater than the median value (OR 1.06). Moreover, the higher the socio-economic status the higher is the likelihood of reporting high values of adherence towards MD.

The variables at regional level introduced in the models have a significant effect in explaining differences across regions and contributing to the reduction of the second-level variability. On one hand, an OR equal to 0.86 was observed for the GDP per capita thus suggesting a negative association with the level of adherence to MD. This result, which needs further exploration, could be related to social and cultural changes that have characterized the most developed regions. On the other hand, individuals living in regions with a higher level of participation at cultural activities are more likely to have a greater adherence to MD (OR=1.06).

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