Journal of Endocrinological Science

Mini Review Open Access

Adherence to Mediterranean Diet and Nutritional Status: Impact on Clinical Outcomes in Hospitalized Elderly Patients

Aurelio Lo Buglio, Francesco Bellanti, Gianluigi Vendemiale*

Centre for Aging Research - Department of Medical and Surgical Sciences, University of Foggia, Foggia, Italy

Article Info

Article Notes
Received: April 01, 2020
Accepted: May 27, 2020

***Correspondence:**
*Dr. Gianluigi Vendemiale, Centre for Aging Research - Department of Medical and Surgical Sciences, University of Foggia, Foggia, Italy; Telephone: +30 0881 749177; Email: gianluigi.vendemiale@unifg.it..

Keywords:
Mediterranean diet
Elderly
Malnutrition

Abstract

Malnutrition is associated to poor clinical outcomes, especially in hospitalized patients. High prevalence of low-grade chronic inflammation, low skeletal muscle mass, and insulin resistance are often found in malnourished patients. Increasing evidence shows how these effects can be partially reverted through an adequate intake of food or using specific dietary supplementation. In this scenario, Mediterranean Diet (MD) demonstrated positive effects on the nutritional status, with important clinical finding in hospitalized patients such as low rate of length of stay and in-hospital mortality.

The aim of this review is the summary of the main evidence about the role of Mediterranean diet on health and clinical outcomes in hospitalized elderly patients.

Introduction

Aging is characterized by higher prevalence of several condition such as malnutrition, comorbidities, changes in body composition and chronic low grade inflammation[1–4]. A strong association exists between malnutrition and systemic inflammation. Most conditions that require hospitalization in acute wards are associated with a pro-inflammatory state. This can promote a reduction in both appetite and calorie intake, with an increased risk of malnutrition. On the other hand, malnourished patients are characterized by chronic inflammation[5,6]. Important changes are observed in body composition during aging and malnutrition. Indeed, aging is characterized by progressive loss of muscle mass associated to increase in fat mass[7]. Adipose tissue tends to accumulate at the visceral level, promoting insulin resistance and high levels of circulating pro-inflammatory cytokines[5,8]. Malnutrition induces loss of skeletal muscle mass, with similar effects to those of aging on both the metabolic and the inflammatory status[9–12]. Lifestyle exerts an important effect on quality of aging[13,14].

Mediterranean Diet (MD) is characterized by a high intake of vegetables, fruits, cereals, legumes and nuts, with extra-virgin olive oil as the main source of fat. MD also includes moderate consumption of fish, white meats, and eggs. Conversely, foods such as red meat and processed meat, and foods high in sugar and fat contents are consumed less frequently[5,15,16]. MD exerts several positive effects on serum lipoprotein levels, endothelium vasodilatation, insulin resistance, metabolic syndrome, antioxidant capacity, inflammation, and coagulation markers (Figure 1)[17,18]. Such evidence could justify how MD associates with a lower mortality from all causes, and a lower incidence of several chronic diseases such as obesity, type

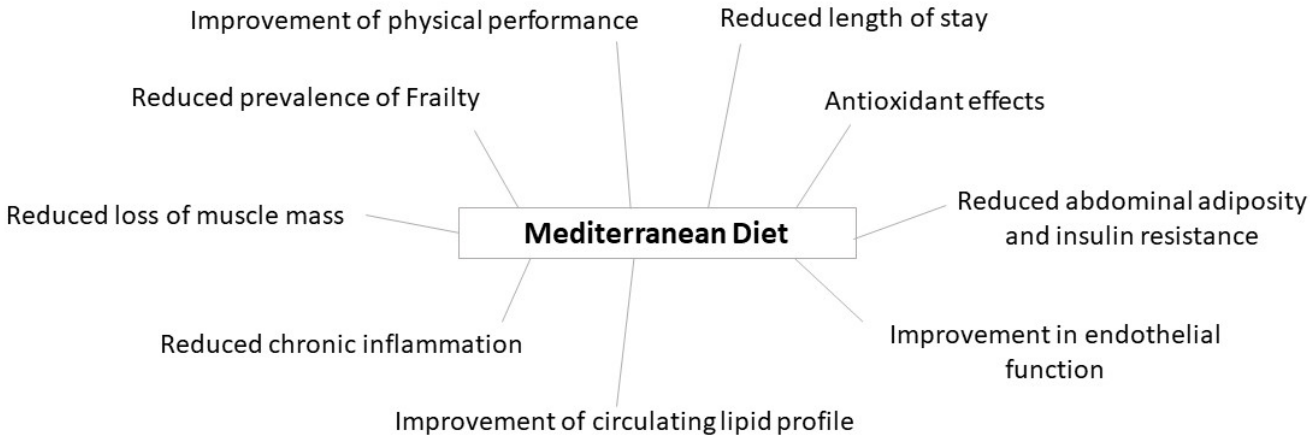

Figure 1: Clinical effects of Mediterranean Diet in hospitalized older patients

2 diabetes, neurodegenerative disease and certain type of cancer[5,16]. However, the exact mechanisms through which MD exerts its beneficial effects is not known[19]. The increased consumption with MD of dried fruit rich in omega-6 and omega-3 fatty acid and plant sterols could play an important role in reducing LDL-cholesterol levels and coronary heart disease risk[19]. The high vegetable fiber content also appears to contribute to lowering of circulating LDL cholesterol levels through a reduction in intestinal reabsorption of cholesterol and bile acids[20]. Several nutrients from a range of diverse foods appear to have synergistic and interactive role on inflammatory state, as shown by several studies[19,21,22]. This evidence has been confirmed in the NU-AGE (European Project on Nutrition in Elderly People) study, where lower plasma level of inflammatory markers was associated with high adherence to comprehensive Mediterranean diet strategy[23]. The low energy intake consequent to satiety induced by inhibiting gastric emptying by intestinal hormones may contribute to reduce the incidence of obesity, insulin resistance, and cancer rate[19]. In this scenario, MD plays a central role in the healthy aging process. In fact, increasing evidence shows correlation between MD and higher longevity, with a delayed onset of health problems[24,25]. Several studies showed the role of nutritional supplements in malnourished patients on different clinical outcomes. Some studies also investigated nutritional intervention strategies in hospitalized patients. In the NOURISH (Nutrition effect On Unplanned ReadmIssions and Survival in Hospitalized patients) study, a multicentre and randomized trial, oral implementation with beta-hydroxy-beta-methylbutyrate was associated with a lower rate of 90-day mortality compared to placebo group. In the EFFORT (The Effect of Higher Protein Dosing in Critically Ill Patients) trial, an individualized nutritional support led to significantly lower incidence of severe complications and mortality compared to standard hospital food[26–28]. Among individuals aged 70-90 years, adherence to a MD and healthful lifestyle led to more than 50% lower rate of all-causes and cause-specific mortality[29]. Furthermore, in the PREDIMED (in Spanish: PREvención con DIeta MEDiterránea) trial, Mediterranean diet supplemented with extra-virgin olive oil or with mixed nuts was associated with a reduced risk of cardiovascular and metabolic diseases by about 30% over five years[28,30]. The aim of this review is the summary of the main evidence about the role of Mediterranean diet on health and clinical outcomes in hospitalized elderly patients.

Mediterranean diet and inflammation

In our recent work, we found significant differences on clinical and biochemical parameters as well as clinical outcomes between hospitalized older patients who are adherent to MD and those who are not[5]. Adherence to MD was assessed by the Italian Mediterranean Index, and patients were classified into tertiles, the lowest indicating the worst adherence to MD. The mean age was higher in Tertile II and III compared to Tertile I, whereas haemoglobin, lymphocytes, serum albumin and total cholesterol levels were lower in Tertile I and II with respect to Tertile III[5]. Bach-Faig A. et al. showed how high adherence to MD is associated with high plasma concentrations of β-carotene, folates, vitamin C, α-tocopherol and HDL cholesterol[31]. Data about serum total cholesterol are different among studies[5,32–34]. High adherence to MD showed association with reduction in serum markers of inflammation such as C-reactive protein (CRP), as well as circulating cytokines, increased serum adiponectin levels[6]. However, other studies did not show any significant effect of MD on circulating cytokine levels[35–37]. With respect to patients with low MD adherence, we found lower serum levels of Neutrophil Lymphocyte Ratio (NLR), erythrocyte sedimentation rate (ESR), CRP and ferritin, as well as Interleukin 6 (IL-6) and Tumor Necrosis Factor (TNF) in patients with high adherence to MD[5]. The association between insulin resistance and poor adherence to MD was also demonstrated. Evidence suggests a link between high adherence to the Mediterranean diet

and reduction of abdominal obesity, insulin resistance, and systemic inflammation[38,39].

Effect of Mediterranean diet on body composition, sarcopenia, frailty, and functional autonomy

MD also impacts on body composition. In fact, adherence to MD was associated with reduced weight gain and reduced increase in waist circumference in young people, as well as with lower total and regional adiposity in aged women[40–42]. In the elderly, physical function and muscle strength are also improved by physical activity (i.e. resistance training). Moreover, growing evidence suggests that physical activity improves serum inflammatory markers[43–45]. Body composition may also change with exercise, showing an increase in fat free mass and a reduction in adipose depots[46]. However, some studies report conflicting results showing no effects of physical activity on body composition in elderly patients[47,48]

In elderly population, we found higher percentage of fat free mass (FFM) and muscle mass (MM) and lower percentage of fat mass (FM) in Tertile III (high MD adherence) as compared to Tertiles II and I[5]. No differences were found among Tertile groups in total body water (TBW), intracellular water (ICW), and extracellular water (ECW). Furthermore, arm, thigh and waist circumference were found higher in patients with greater adherence to MD[5]. High adherence to the MD is associated with better muscle health and function, with higher performance in Short Physical Performance Battery (SPPB), grip strength, walking speed, and lower risk of sarcopenia[49]. However, studies are not conclusive in demonstrating a reduction in the risk of sarcopenia, but evidence a protective role on frailty and functional disability[50]. Indeed, Hashemi et al. found a lower prevalence of sarcopenia among individuals in third Tertile (12%) compared to first Tertile (21%)[51]. According to the InCHIANTI (Aging in Chianti) study, subjects with greater adherence to MD showed lower risk of developing frailty after a 6-year period follow-up[52]. Moreover, the highest quartile of MD adherence was associated with higher performance on 30-s chair stands in men and 6-min walking speed in women[53]. In our study, patients in Tertile III showed greater preservation of the activity daily and instrumental activity daily living, with lower overall prevalence of Fried criteria for Frailty (weight loss, exhaustion, low physical activity, low walking speed and low grip strength), with respect to Tertiles II and I[5]. In a 8-year period follow up, the walking speed was faster in the group with higher MD adherence at baseline, with respect to lower MD adherence[54].

Mediterranean Diet, Length of stay and in-hospital mortality

Malnutrition is associated with higher costs of hospitalization, rate of length of stay and mortality[55]. Deutz et al. highlighted how an oral nutritional supplement with high-protein plus beta-hydroxy-beta-methylbutyrate was associated with decreased post-discharge mortality and improved nutritional status[26]. We showed a benefit of high adherence to MD on clinical outcomes in hospitalized elderly patient[5]. We found that length of stay was shorter in Tertile III compared to Tertile II and Tertile I, while no differences were found on in-hospital mortality. However, malnutrition (evaluated with the Mini Nutritional Assessment) showed a significant association with in-hospital mortality.

Conclusion

Nutritional status in hospitalized older patient plays an important role on several clinical outcomes. Adherence to MD is associated to better lipid profile and lower chronic systemic inflammation, as well as a reduction in abdominal obesity and insulin resistance. Furthermore, adherence to MD shows lower overall prevalence of frailty and higher physical performance. Lastly, MD regimen significantly reduces length of stay with lower hospitalization costs and better well-being of the patients.

Author Contributions

A.L.B, F.B., G.V. equally contributed to the manuscript. All authors have read and agreed to the published version of the manuscript.

Funding

This research received no external funding.

Conflicts of Interest

The authors declare no conflict of interest.

References

1. Kaiser MJ, Bauer JM, Rämsch C, et al. Frequency of Malnutrition in Older Adults: A Multinational Perspective Using the Mini Nutritional Assessment. J Am Geriatr Soc. 2010; 58: 1734–8.
2. Divo MJ, Martinez CH, Mannino DM. Ageing and the epidemiology of multimorbidity.Eur Respir J.2014.DOI:10.1183/09031936.00059814.
3. St-Onge MP, Gallagher D. Body composition changes with aging: The cause or the result of alterations in metabolic rate and macronutrient oxidation? Nutrition. 2010; 26: 152–5.
4. Romano AD, Lo Buglio A, Bellanti F, et al. Diagnostic reliability of the procalcitonin serum marker in septic frail patient. Aging Clin Exp Res. 2018; published online Aug 21. DOI:10.1007/s40520-018-1020-z.
5. Lo Buglio A, Bellanti F, Capurso C, et al. Adherence to Mediterranean Diet, Malnutrition, Length of Stay and Mortality in Elderly Patients Hospitalized in Internal Medicine Wards. Nutrients. 2019; 11: 790.
6. Sureda A, Bibiloni M, Julibert A, et al. Adherence to the Mediterranean Diet and Inflammatory Markers. Nutrients. 2018; 10: 62.
7. Volpi E, Nazemi R, Fujita S. Muscle tissue changes with aging. Curr Opin Clin Nutr Metab Care. 2004; 7: 405–10.
8. Kuk JL, Saunders TJ, Davidson LE, et al. Age-related changes in total and regional fat distribution. Ageing Res Rev. 2009; 8: 339–48.
9. Chatindiara I, Williams V, Sycamore E, et al. Associations between nutrition risk status, body composition and physical performance

among community-dwelling older adults. Aust N Z J Public Health. 2019; 43: 56–62.

10. Pierik VD, Meskers CGM, Van Ancum JM, et al. High risk of malnutrition is associated with low muscle mass in older hospitalized patients - a prospective cohort study. BMC Geriatr. 2017; 17: 118.
11. Calder PC, Bosco N, Bourdet-Sicard R, et al. Health relevance of the modification of low grade inflammation in ageing (inflammageing) and the role of nutrition. Ageing Res Rev. 2017; 40: 95–119.
12. Fatyga P, Pac A, Fedyk-Łukasik M, et al. The relationship between malnutrition risk and inflammatory biomarkers in outpatient geriatric population. Eur Geriatr Med. 2020; 1–9.
13. Atallah N, Adjibade M, Lelong H, et al. How healthy lifestyle factors at midlife relate to healthy aging. Nutrients. 2018; 10. DOI:10.3390/nu10070854.
14. Leslie W, Hankey C. Aging, Nutritional Status and Health. Healthcare. 2015; 3: 648–58.
15. Capurso C, Bellanti F, Buglio A Lo, et al. The mediterranean diet slows down the progression of aging and helps to prevent the onset of frailty: A narrative review. Nutrients. 2020. DOI:10.3390/nu12010035.
16. Castro-Quezada I, Román-Viñas B, Serra-Majem L. The Mediterranean Diet and Nutritional Adequacy: A Review. Nutrients. 2014; 6: 231–48.
17. Serra-Majem L, Roman B, Estruch R. Scientific evidence of interventions using the Mediterranean Diet: A systematic review. Nutr Rev. 2006; 64: S27–47.
18. Sofi F, Abbate R, Gensini GF, et al. Evidences on the relationship between mediterranean diet and health status. Recenti Prog Med. 2009.
19. Tosti V, Bertozzi B, Fontana L. Health Benefits of the Mediterranean Diet: Metabolic and Molecular Mechanisms. Journals Gerontol. Ser A Biol Sci Med Sci. 2018; 73: 318–26.
20. Theuwissen E, Mensink RP. Water-soluble dietary fibers and cardiovascular disease. Physiol Behav. 2008; 94: 285–92.
21. Calder PC, Ahluwalia N, Brouns F, et al. Dietary factors and low-grade inflammation in relation to overweight and obesity. Br J Nutr. 2011; 106 Suppl 3: S5-78.
22. Mattei J, Sotres-Alvarez D, Gellman M, et al. Diet quality, inflammation, and the ankle brachial index in adults with or without cardiometabolic conditions. Clin Nutr. 2018; 37: 1332–9.
23. Berendsen AAM, van de Rest O, Feskens EJM, et al. Changes in dietary Intake and Adherence to the NU-AGE diet following a one-year dietary intervention among European older adults—Results of the NU-AGE randomized trial. Nutrients. 2018; 10. DOI:10.3390/nu10121905.
24. Roman B, Carta L, Martínez-González MA, et al. Effectiveness of the Mediterranean diet in the elderly. Clin Interv Aging. 2008; 3: 97–109.
25. Trichopoulou A, Orfanos P, Norat T, et al. Modified Mediterranean diet and survival: EPIC-elderly prospective cohort study. BMJ. 2005; 330: 991.
26. Deutz NE, Matheson EM, Matarese LE, et al. Readmission and mortality in malnourished, older, hospitalized adults treated with a specialized oral nutritional supplement: A randomized clinical trial. Clin Nutr. 2016. DOI:10.1016/j.clnu.2015.12.010.
27. Schuetz P, Fehr R, Baechli V, et al. Individualised nutritional support in medical inpatients at nutritional risk: a randomised clinical trial. Lancet. 2019; 393: 2312–21.
28. Schuetz P, Stanga Z. Nutritional Management and Outcomes in Malnourished Medical Inpatients in 2020: The Evidence Is Growing! J Clin Med. 2019; 9: 27.
29. Knoops KTB, De Groot LCPGM, Kromhout D, et al. Mediterranean diet, lifestyle factors, and 10-year mortality in elderly European men and women: The HALE project. J Am Med Assoc. 2004; 292: 1433–9.
30. Estruch R, Ros E, Salas-Salvadó J, et al. Primary prevention of cardiovascular disease with a mediterranean diet supplemented with extra-virgin olive oil or nuts. N Engl J Med. 2018. DOI:10.1056/NEJMoa1800389.
31. Bach-Faig A, Geleva D, Carrasco JL, et al. Evaluating associations between Mediterranean diet adherence indexes and biomarkers of diet and disease. In Public Health Nutrition. 2006; 1110–7.
32. Barnaba L, Intorre F, Azzini E, et al. Evaluation of the adherence to the Mediterranean diet and its association with clinical and biological markers in an Italian population. Nutrition. 2020; 110813.
33. Estruch R, Camafort M. The Mediterranean Diet and Plasma Lipid Profile. Rev Española Cardiol English Ed. 2015; 68: 279–81.
34. Ferro-Luzzi A, Strazzullo P, Scaccini C, et al. Changing the Mediterranean diet: effects on blood lipids. Am J Clin Nutr. 1984; 40: 1027–37.
35. Casas R, Sacanella E, Estruch R. The Immune Protective Effect of the Mediterranean Diet against Chronic Low-grade Inflammatory Diseases. Endocrine Metab Immune Disord Targets. 2014; 14: 245–54.
36. Mayr HL, Tierney AC, Thomas CJ, et al. Mediterranean-type diets and inflammatory markers in patients with coronary heart disease: a systematic review and meta-analysis. Nutr Res. 2018; 50: 10–24.
37. Piccand E, Vollenweider P, Guessous I, et al. Association between dietary intake and inflammatory markers: Results from the CoLaus study. Public Health Nutr. 2019. DOI:10.1017/S1368980018002355.
38. Park YM, Zhang J, Steck SE, et al. Obesity Mediates the Association between Mediterranean Diet Consumption and Insulin Resistance and Inflammation in US Adults. J Nutr. 2017; 147: 563–71.
39. Tzima N, Pitsavos C, Panagiotakos DB, et al. Mediterranean diet and insulin sensitivity, lipid profile and blood pressure levels, in overweight and obese people The Attica study. Lipids Health Dis. 2007; 6: 22.
40. Agnoli C, Sieri S, Ricceri F, et al. Adherence to a Mediterranean diet and long-term changes in weight and waist circumference in the EPIC-Italy cohort. Nutr Diabetes. 2018; 8: 1–10.
41. Mistretta A, Marventano S, Antoci M, et al. Mediterranean diet adherence and body composition among Southern Italian adolescents. Obes Res Clin Pract. 2017; 11: 215–26.
42. Boghossian NS, Yeung EH, Mumford SL, et al. Adherence to the Mediterranean diet and body fat distribution in reproductive aged women. Eur J Clin Nutr. 2013; 67: 289–94.
43. Liberman K, Forti LN, Beyer I, et al. The effects of exercise on muscle strength, body composition, physical functioning and the inflammatory profile of older adults: A systematic review. Curr Opin Clin Nutr Metab Care. 2017; 20: 30–53.
44. Mitchell D, Haan MN, Steinberg FM, et al. Body composition in the elderly: The influence of nutritional factors and physical activity. J Nutr Heal Aging. 2003; 7: 130–9.
45. Woods JA, Wilund KR, Martin SA, et al. Exercise, inflammation and aging. Aging Dis. 2012; 3: 130–40.
46. Tager IB, Haight T, Sternfeld B, et al. Effects of physical activity and body composition on functional limitation in the elderly: Application of the marginal structural model. Epidemiology. 2004; 15: 479–93.
47. Morisawa T, Tamaki A, Nagai K, et al. Effects of increased physical activity on body composition, physical functions, vascular functions, HR-QOL, and self-efficacy in community-dwelling elderly people. J Phys Ther Sci. 2017; 29: 152–7.
48. Westerterp KR. Changes in physical activity over the lifespan: impact on body composition and sarcopenic obesity. Obes Rev. 2018; 19: 8–13.

49. Granic A, Sayer AA, Robinson SM. Dietary patterns, skeletal muscle health, and sarcopenia in older adults. Nutrients. 2019; 11. DOI:10.3390/nu11040745.

50. Silva R, Pizato N, da Mata F, et al. Mediterranean Diet and Musculoskeletal-Functional Outcomes in Community-Dwelling Older People: A Systematic Review and Meta-Analysis. J Nutr Heal Aging. 2018; 22: 655–63.

51. Hashemi R, Motlagh AD, Heshmat R, et al. Diet and its relationship to sarcopenia in community dwelling iranian elderly: A cross sectional study. Nutrition. 2015. DOI:10.1016/j.nut.2014.05.003.

52. McClure R, Villani A. Mediterranean Diet attenuates risk of frailty and sarcopenia: New insights and future directions. JCSM Clin Reports. 2017; 2. DOI:10.17987/jcsm-cr.v2i2.45.

53. Bibiloni M, Julibert A, Argelich E, et al. Western and Mediterranean Dietary Patterns and Physical Activity and Fitness among Spanish Older Adults. Nutrients. 2017; 9: 704.

54. Shahar DR, Houston DK, Hue TF, et al. Adherence to Mediterranean Diet and Decline in Walking Speed over 8 Years in Community-Dwelling Older Adults. J Am Geriatr Soc. 2012; 60: 1881–8.

55. Ruiz AJ, Buitrago G, Rodríguez N, et al. Clinical and economic outcomes associated with malnutrition in hospitalized patients. Clin Nutr. 2019; 38: 1310–6.