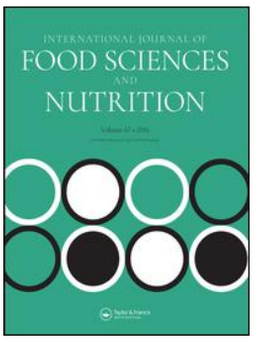

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RESEARCH ARTICLE

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Mediterranean diet – promotion and dissemination of healthy eating: proceedings of an exploratory seminar at the Radcliffe institute for advanced study

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ABSTRACT

The traditional Mediterranean diet is considered the world's most evidence-based eating pattern for promoting health and longevity. However, institutional food environments and their busy consumers often sacrifice health benefits for the convenience of faster and cheaper foods that generally are of lower quality and are more processed, and thus, contribute to the current epidemics of obesity and diabetes. Expert consensus has even identified the Mediterranean diet as the easiest to follow among healthy eating patterns. Nonetheless, fewer American families cook at home and many food services have been slow to implement healthier food options compatible with the Mediterranean diet. In September 2019, we convened a group of thought leaders at an exploratory seminar entitled: "Mediterranean Diet: Promotion and Dissemination of Healthy Eating", hosted by the Radcliffe Institute for Advanced Studies at Harvard University. The multidisciplinary faculty discussed best practices for translating traditional Mediterranean lifestyle principles to modern society.

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Introduction

Variations of what we now as Mediterranean Diet (MedDiet) have been consumed for several millennia in the regions surrounding the Mediterranean Sea basin. In ancient times, native olive trees grew in this area and eventually would be cultivated for their fruit (olives) and its juice (olive oil). The everyday use of olive oil as a fundamental staple in cooking/food preparation and as a component/condiment at almost every meal is the most essential and central element of this eating pattern (Sofi et al. 2010; Hidalgo-Mora et al. 2020). Our modern scientific concept of the Mediterranean Diet is most closely associated with the traditional eating patterns found in rural Greece and Southern Italy during the 1960s. It was first described formally by the American, Dr. Ancel Keys, who made pioneering observations that the MedDiet was strongly associated with a lower incidence of cardiovascular disease (Keys et al. 1986). Keys initiated the famous "Seven Countries Study", a longitudinal investigation of dietary patterns, health and longevity in America, Northern and Southern Europe and Asia. This study documented the traditional diet of Crete (Greece) as

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being associated with remarkably lower cardiovascular risks as compared to "Western" diets and even to be more favourable than the diet of Japan. Over the last 60 years, robust evidence of many types (observational, case-control, cohort and more recently, experimental investigations and randomised controlled trials) (Ros et al. 2014; Sotos-Prieto et al. 2015; Petersson and Philippou 2016; Schwingshackl et al. 2017; Sotos-Prieto, Bhupathiraju et al. 2017; Dinu et al. 2018; Estruch et al. 2018; Rosato et al. 2019; Soltani et al. 2019; Hidalgo-Mora et al. 2020; Sánchez-Sánchez et al. 2020) in a variety of settings and in many countries including the US, have demonstrated Mediterranean eating to be safe in both the short- and long-term, while promoting health, quality of life, longevity and decreasing the risks of a wide variety of chronic illnesses) (Ros et al. 2014; Sotos-Prieto et al. 2015; Petersson and Philippou 2016; Grosso et al. 2017; Schwingshackl et al. 2017; Sotos-Prieto, Bhupathiraju et al. 2017; Dinu et al. 2018; Estruch et al. 2018; Rosato et al. 2019; Soltani et al. 2019; Hidalgo-Mora et al. 2020; Sánchez-Sánchez et al. 2020). Today, as a result, the most recent official nutritional guidelines of the United States formally recognise and recommend MedDiet as a healthy option for Americans (U.S. Department of Agriculture and U.S. Department of Health and Human Services 2020).

The traditional MedDiet is characterised by the following dietary habits: (1) extra virgin olive oil used generously in most food preparation/cooking and serves as the principle dietary fat; (2) meals are generally plant-based with a high consumption of fruits, vegetables, legumes, unrefined cereals, nuts, and seeds; (3) there is moderate consumption of fish, seafood, fermented dairy products (yogurt and cheese), poultry, and eggs; (4) alcohol is used in moderation and with meals (usually wine); and (5) the consumption of red and processed meats and sweets is limited, but not prohibited.

Unfortunately, even in Mediterranean countries, traditional eating patterns have progressively given way to Westernised habits with documented decreases in fruit, vegetable, and bean consumption and increased consumption of red meat, refined carbohydrates, other processed and "fast-foods" (Trichopoulou et al. 1993; Tognon et al. 2014; Imamura et al. 2015; Wang et al. 2019). In developed countries, we are all too familiar with the tendency of time-pressured consumers and the commercial and institutional food environments that cater to them to frequently sacrifice health for the convenience of cheaper and faster meals that usually offer lower quality, more processed foods (Imamura et al. 2015; Wang et al. 2019), which contribute to the current twin epidemics of obesity and diabetes ("diabesity") (Mozaffarian 2016; Piché Marie-Eve et al. 2020). Finally, we have also discussed that given the well-recognised health effects of the MedDiet, caution must be exercised when commercial interests strategically use health claims based on the traditional MedDiet that may be misleading or even false when applied to "Mediterranean themed" products that may in fact be highly processed or otherwise contain unhealthy ingredients (Jiménez-Morales and Montaña Blasco 2021).

Therefore, with the eventual goal of developing methods to promote and popularise the adoption of evidence-based Mediterranean eating principles among workplaces, schools, hospitals, other institutions and in collaboration with commercial food service providers, in September 2019, we convened a multidisciplinary faculty of thought leaders representing nutrition science, medicine, population health, the food industry and culinary science to discuss best practices for translating traditional Mediterranean lifestyle principles to our non-stop, "24-7" modern society. The exploratory seminar entitled "Mediterranean Diet: Promotion and Dissemination of Healthy Eating" was held at the Radcliffe Institute for Advanced Studies at the Harvard University after being award funding based on a competitive application process.

The seminar participants addressed three main questions through their respective presentations and group discussions: (1) What are the most important challenges to healthy eating in modern society, and what strategies may overcome these barriers? (2) What are the best ways to promote MedDiet principles in workplaces, schools, hospitals, other institutions (e.g., the military) and the food service industry? (3) How can we best adapt traditional MedDiet to various ethnic and regional preferences across the US? In this narrative review, we will discuss each of the questions by summarising the presentations, and then, offering best practices, responses and consensus recommendations derived from the expert discussions and iterative editing of the manuscript.

Session 1. Megatrends. What are the most important challenges to healthy eating in modern society, and what strategies could overcome these barriers?

While the aforementioned benefits of adhering to a MedDiet are numerous, and the health risks of typical

Western diets are well-documented, most people continue to eat the latter (Wang et al. 2015; Wilson et al. 2016; Hecht et al. 2020). Expert consensus has even identified the MedDiet as the easiest to follow among healthy eating patterns. But how could we make it simpler? We spend less time selecting, procuring and preparing our food than previous generations. Both the proportion of persons cooking and the proportion of home-cooked meals have decreased dramatically since 1965 (Taillie 2018). Lack of time or cooking knowledge are seen as barriers, especially among young adults (American Time Use Survey 2020). In addition, access to fresh and healthy food, food prices (Ghosh-Dastidar et al. 2014) and health insecurity, income segregation (Gouri Suresh and Schauder 2020) or the trends of decreased quality but increased portion sizes (Piernas and Popkin 2011) are other important barriers. Is there any way to reverse these trends?

Dr. Frank Hu

Dr. Frank Hu presented data on current trends in overall dietary quality at the global level and estimated the potential reductions in disease burden achievable by improving dietary quality. At present, the eating patterns remain far from optimal and their quality vary substantially across the world. Mediterranean nations, the Caribbean region, and Eastern Asia (except China and Mongolia) had higher diet quality scores, whereas Central Asia, the South Pacific, and Eastern Europe had lower scores (Wang et al. 2019). Comparison of dietary quality among US adults of different racial and ethnic groups demonstrates that African-Americans on average reported the least healthy diets, largely explained by lower socioeconomic status (Wang et al. 2015).

Enhancing nutrition worldwide could prevent 11.6 million of premature deaths annually: including 1.6 million cancer deaths, 3.9 million coronary artery disease deaths, 1.0 million stroke deaths, 1.7 million respiratory disease deaths (Wang et al. 2019). The previous Dietary Guidelines of America (DGAs) continue to provide science-based dietary advice for healthy individuals ages 2 years or older with a goal of chronic disease prevention, but the latest DGAs (2020–2025) have included recommendations for infants. They serve as a roadmap for policy makers, nutrition educators and health professionals, including clinical dietitians and nutritionists. The 2020 DGAs focus on dietary patterns including an endorsement of MedDiet along with other novelties (e.g. moderate coffee consumption (3–5 cups daily), an upper limit of 10% of daily calories from added sugars or saturated fats, and no upper limit on dietary cholesterol). Other emphases of the DGAs were reducing red meat consumption and total calories, both consistent with the more plant-based MedDiet. The other eating patterns recommended by the DGAs have similar features such as higher intakes of fruits, vegetables, whole grains, nuts and legumes and reduced intake of red and processed meats, sugary beverages and refined carbohydrates (2020).

Mr. Greg Drescher

Mr. Greg Drescher suggested ways Dr. Hu's challenge to improve dietary quality can be achieved without sacrificing the variety, taste and overall enjoyment of food. The Culinary Institute of America (CIA) is a private, not-for-profit college dedicated to providing high-quality professional culinary education. The CIA has more than 50,000 alumni working all over the world in diverse sectors of the food industry.

From his perspective at the CIA, Mr. Drescher proposed three questions for greater promotion of the MedDiet. What perspectives might be valuable from the global restaurant and food service sector, including those of chefs? How can these professional gastronomic leaders better connect health aspirations to advance the MedDiet with larger discussions about eating within the culture, environmental sustainability, and food system transformation? How can the culinary world help develop and advance an agenda for translational, academic research as well as for practical, operational research?

Mr. Drescher emphasised that from a commercial perspective the MedDiet already has high visibility in the US market. For example, olive oil use is no longer considered "foreign" and has even become very common. However, there is less understanding and awareness of the MedDiet as a cultural model combining an eating pattern that is an optimal paradigm for promoting health as well as being a sustainable model as suggested by the work of the EAT-Lancet commission on healthy diets (Willett et al. 2019). Along these lines, the CIA in collaboration with the Harvard TH Chan School of Public Health-Department of Nutrition has presented the principles of healthy, sustainable menus through its CIA-Harvard Menus of Change initiative (Menus of Change – The Culinary Institute of America 2020). These principles incorporate findings from nutrition and environmental science perspectives on optimal food choices, trends in

consumer preferences, operational insights, and impacts of projected demographic shifts. They also consider that still-rising global burden of diet-related chronic diseases suggests that many of today's food and foodservice business models are not sustainable for the long term. They further outline pivotal culinary strategies designed to increase the odds that customers will reward pioneering and innovative restaurants and other industry operations with their business. Practical examples of this include the use of the olive oil to enhance the flavour of ingredients with pounded/blended sauces with olive oil, nuts, herbs, spices, keeping them at room temperatures to preserve aromatics of the extra virgin olive oil; pan-frying and deep-fry in olive oil leveraging its high smoke point or reimagining dessert menus based on the healthy Mediterranean market basket.

Challenges for the future include increasing the awareness of the traditional, plant-forward core of the MedDiet and its world heritage of Mediterranean vegetable and legume-based home cooking, deepen our engagement around food preparation techniques/flavour strategies and engage the scientific community in a greater focus on translational research. At the same time, there is a need for more collaboration with chefs and the foodservice business to test promising operational strategies that would promote translational advances.

Ms. Chavanne Hanson

Ms. Chavanne Hanson reviewed the implementation of healthy nutrition practices and translation of MedDiet principles at Google's food program (The Google Food Program 2015). They serve more than 270,000 meals per day provided by 45 food service partners, 1300 "micro-kitchens", 10 teaching kitchens and 42 food trucks. Google tells employees to view food in the following contexts: (1) food brings them together; (2) food is personal, (3) food fuels the body, mind and soul, (4) the better choice can also be the easiest choice, (5) flavour rules, (6) chefs make our food great, (7) food at Google is a shared responsibility, (8) we care for those who feed us, (9) every decision count, (10) food matters. Google' goal is to use behavioural science to shift diets to heathier patterns (eating more vegetables and fruit, drinking more water, eating less added sugar and salt and moving towards a more balanced, plant-forward diet). Behavioural science influencers include the interaction between a person and the product offering and can be a result of choice architecture (how, when and where choices are made) as well as communicating the right message at the right time.

Session 2. What are the best ways to promote MedDiet principles in workplaces, schools, hospitals, other institutions and the food service industry?

Mr. Ken Toong

Mr. Ken Toong discussed that while some institutional food services have been slow to implement food options compatible with the MedDiet, healthy Mediterranean eating can be marketed effectively as an enjoyable option, acceptable for long-term adherence in the college setting. Moreover, he described how it was possible to provide high-quality, healthy foods even while working with limited dining service budgets and profit margins. UMass Dining at the University of Massachusetts (UMass) is the largest campus dining operation in the nation serving 45,000 meals per day to students who visit various campus food operations an average of 4.5 times daily. Internal research for the dining service indicates that food culture for Generation Z of "Gen Z'ers" (birth years 1995–2015) is one of healthy, sustainable and delicious food. UMass surveys of students' favourite cuisines find the Mediterranean Diet ranked first most often at 29%, more than Asian at 12% and any other genre of cuisine. Thus, UMass dining views the MedDiet as an appealing option to Gen Z'ers within the college and university segment due to its variety of colours and flavours that incorporate healthy fats and proteins such as olive oil, nuts, legumes and fish.

Accordingly, serving food that is healthy, sustainable and delicious has been a key to the success of UMass Dining (ranked the "Best Campus Food" by the Princeton Review for the 5th year in a row). UMass was the first public university to serve sustainable seafood, grass-fed beef, and 100% "no antibiotics ever" chicken, in all of their retail and residential operations. Additionally, they use extra virgin, first cold pressed olive oil (600 thousand gallons annually) from Greece extensively in its culinary production. Mediterranean selections range from various salads (Caprese, Greek), kofta, imported branzino (Mediterranean seabass), as well as offering from their retail concept "Tavola" that serves exclusively Mediterranean foods such as traditional falafel and hummus bowls, homemade pizzas and pites (e.g. spinach pies) All of these options fit within UMass dining's larger signature concept of "small plate, big

flavour" focussed on meals based on plant-forward global cuisines.

UMass dining's efforts are obviously popular, but they appear to have additional positive benefits beyond customer satisfaction. First, there has been a change in student dining behaviour as documented by the dining service over a 10-year period from 2009 to 2018. Students are now consuming more plant-based proteins and whole grains, while eating less red meat. In 2009 UMass Dining served on average 40 plant-based menu items per week, while in 2018 the items available had increased to 120—a 200% increase. An internal study of UMass students found that students with a higher diet quality—specifically greater consumption of greens, fruits and whole grains— had higher GPAs. Finally, 88% of UMass students believe the dining program positively contributes to their lifestyle behaviours and their personal wellbeing. UMass' experience exemplifies that a strong collegiate dining program helps attract top students to the university, while improving the quality of campus life.

Ms. Fania Yangarber

Ms. Fania Yangarber focussed on the great challenge in improving K-12 school lunches. She reviewed the history of reform efforts, noting that the National School Lunch and School Breakfast Programs were originally enacted as feeding programs in response to wide-spread undernutrition in the US, dating back to the deleterious effects of poverty on the health of the nation's schoolchildren (Poppendieck 2011). Since the National School Lunch Act of 1946 created the National School Lunch Program, it has grown to serve over 30 million children at 100,000 public and non-profit private schools each school day at a cost of over $14 billion (Ralston et al. 2020). However, over time, obesity and diabetes have replaced undernutrition as the most pressing challenges for school feeding programs, prompting comprehensive reforms in nutritional standards over the last decade. The Healthy Hunger-Free Kids Act (HHFKA) was enacted in 2010, and implemented in 2012 (Healthy Hunger-Free Kids Act | USDA-FNS 2020). Among the goals of the HHFKA was to "reduce America's childhood obesity epidemic and reduce health risks for America's children by helping schools produce balanced meals" (Healthy Hunger-Free Kids Act | USDA-FNS 2020). The HHFKA updated the meal patterns and nutrition standards for school meals to align with the Dietary Guidelines for Americans (Johnson et al. 2016). Implementation of the HHFKA's science-based nutritional standards has correlated with substantial decline in the risk of obesity for children in poverty each year after the Act's implementation, suggesting that healthy, science-based standards should be maintained to support healthy growth (Kenney et al. 2020).

Healthy School Food Maryland began as a coalition of parents and community groups concerned about the nutritional value of the meals served in Montgomery County, Maryland's Public Schools through USDA's school meal programs: National School Lunch Program (NSLP), School Breakfast Program (SBP), and After-School Snacks and Suppers provided as part of the NSLP (USDA ERS – Child Nutrition Programs 2020). The schools also sell "competitive" foods, which are snacks, chips, cookies and sweetened beverages that are available on the cafeteria line and in vending machines. The latter food items "compete" for children's attention and often result in children choosing to eat lower quality foods outside of the meals that are part of professionally planned menus. Healthy School Food Maryland advocates for both greater adherence to the Dietary Guidelines for Americans and for innovations in school food. One approach is to promote freshly-prepared, healthy food to replace the ultra-processed, packaged foods the Maryland school district relies on. For example, the organisation hosts community activities and an annual festival where schoolchildren from the district join professional chefs in a cooking facility to compete to create a "school lunch worthy meal". The contest rules stipulate that the meal must be prepared within the cost constraints and nutritional standards that the county faces: the total food cost in raw product must be about $1 per serving, meals must contain whole grains, fresh fruits and vegetables, and be low in sodium. The teams produce dishes such as: Mediterranean style salmon croquettes with lemon herb aioli; mini mole chicken tacos with whole grain corn tortillas and pumpkin seeds; maki trio: BLT maki, southwest chicken roll with chipotle aioli and fire-roasted corn and black bean salsa, and vegetable maki roll with quinoa. Last year, the festival included a luncheon for food service professionals, where a Mediterranean-style plant-based meal was served, prepared with the help of high school-aged culinary students, supervised by Chef Philip Thompson: chickpea salad bowl with hummus, falafel and vegetable kabobs. The winning dishes are recommended to the District's Food Service Director, who is in attendance, as an optional menu item. The most rewarding part of the event, though, is the delight of all the participants in tasting what scratch cooking makes possible for school

lunch and the confidence to try new things in the kitchen that all the "chef-testants" walk away with.

Dr. Angelo Mojica

Dr. Angelo Mojica spoke to another area of great challenge and opportunity. Hospitals are a unique setting where providing healthy food to patients and staff can be of large potential benefit to both groups. The elements of the MedDiet are easily incorporated into healthier dining options in hospitals for patients, staff and visitors, and the Johns Hopkins Health System promotes healthy, plant-forward dining through both their menu options and their pricing structure. Their retail models offer a variety of traditional options with the majority of outlets allowing customisation options with enhanced opportunities to make healthy choices. Plant-based options are presented daily at each station, as opposed to a "meatless Monday" model. Examples of these options include the following.

- "The Greens Project" – made to order salads with more than 60 choices with a variety of vegetables and homemade dressings. The additional protein options for this concept include marinated, baked tofu as a plant-based option.
- "Rocco's" – an Italian Trattoria offering made to order Neapolitan pizzas and pastas and another rotating Italian entree. The plant-based option for this concept is a whole wheat pasta served with house made marinara and finished with extra virgin olive oil.
- "AJ's Deli" – a delicatessen with customised sandwiches. The plant-based protein option for this concept is a faux chicken salad developed with a soy based "veggie shred".
- "Umami Sushi" – features tailor-made sushi with a plant-based protein option consisting of tofu in an avocado summer roll.
- "Prime Grill" – grilled to order station. The plant-based protein options for Prime Grill include house-made black bean burgers and portobello mushroom burgers.
- "Lemongrass" – a pan-Asian concept offering a rotating variety of traditional Thai, Indian and Vietnamese entrees, including a plant-based protein option of a vegetable stir fry with the addition of soy "veggie shreds".
- "Super Bowls" – highlights different cuisines from around the globe with a rotating selection of bowl-based value meals (Burrito, American comfort, Mediterranean, Pho/Ramen, Cajun, Indian, Caribbean, Korean Bibimbap) offering diverse starch (including whole grain), vegetable and protein options (including beans), as well as a diverse selection of sauces.

At Johns Hopkins Health System, healthier food purchases trigger discounts – a unique approach that has proven effective in nudging consumers towards healthier choices. For instance, choosing whole-wheat crust over standard crust on a pizza reduces the price of the pizza by $1.10. Additional discounts can be had by choosing simple crushed tomatoes with fresh basil rather than marinara or alfredo sauce. Fresh Mozzarella is the third possible discount as the moisture content improves the spread on the pizza which requires a reduced portion of cheese from 3 to 2 oz. The salad station or "Greens Project" is a great option because it automatically qualifies for a 20% discount. Additional discounts are obtained when choosing other healthy options.

The health system also offers many of these retail offerings to its patient populations in order to provide delicious and wholesome options that are intended to support improved clinical outcomes, facilitating more rapid and safe hospital discharges.

Session 3. Workplaces and the community. How can we best adapt traditional Mediterranean diet to various ethnic and regional preferences across the US while being inclusive and maintaining cultural sensitivities?

Different geographic regions and ethnic groups across the US enjoy numerous dietary traditions, each of which offers unique cultural value and deserves respect. Therefore, in attempting to motivate persons to adapt and adopt heathier habits, we should do so in ways that are sensitive to existing dietary patterns and incorporate traditions. One possible paradigm emerges from Keys' Seven countries study (Keys et al. 1986; Menotti and Puddu 2015). Among all the countries studied, the least healthy diet during that time period was found in Finland. Yet, in recent years, Scandinavians have reconfigured their traditional eating using principles drawn from the traditional Mediterranean diet and local food staples to create the "Nordic diet" (Kanerva et al. 2014). In a shocking reversal, Northern European diets are now often healthier on average than those currently followed in Mediterranean countries (Tognon et al. 2014). Could these same strategies be applied to adapt and

transform various dietary traditions in the US into healthier versions? What are the cultural and socioeconomic barriers?

Dr. Mercedes Sotos-Prieto

Despite the well-known and scientific-based health effects of the MedDiet (Hidalgo-Mora et al. 2020), studies evaluating their effects and implementation in the workplace are scarce (Menotti and Puddu 2015; Korre et al. 2017). Among various popular diets, US firefighters have demonstrated a preference for MedDiet when asked to rank them (Yang et al. 2015). Qualitative studies to evaluate cultural barriers and challenges to improve nutrition or adopt a MedDiet style pattern among US (midwestern) firefighters showed that the design of fire service nutrition interventions should consider the cultural expectations of the fire service, firefighters' work and family schedule and that educational resources need to target affordable and convenient meal planning (Muegge et al. 2018). Similar information was found among fire recruits or fire academy training staff that reported that incentives for good choices and the elimination of certain poor choices from the food environment would promote healthier choices (Sotos-Prieto et al. 2019). Based on these qualitative findings and robust evidence of MedDiet benefits, "Feeding Americás Bravest" is a cluster-randomised trial within the fire stations of the Indianapolis and Fishers, Indiana Fire Departments. The study compared a Mediterranean Diet Nutritional Intervention (MDNI) (Group 1) vs. usual care (Group 2) for 12 months; followed by 12 months of self-sustained continuation phase in the Group 1 and cross-over to MDNI in Group 2. Group 2 then received the MDNI for 6 months to test the efficacy of a shorter intervention followed by 6 months of self-sustained phase. The MedDiet intervention was designed to respect Firefighters traditions and culture (https://www.hsph.harvard.edu/firefighters-study/feeding-americas-bravest/) and included: educational sessions about how and why to use olive oil, consuming nuts as healthy snacks, how to cook sofrito and other videos related to MedDiet. Firefighter favourite recipes were "Medi" adapted by chefs and dieticians, chef demonstrations, strategies for healthy eating in the settings of fast food and "on the go" (because of job- and other time-related constraints) were also featured. Home and fire station budgets were previously identified as barriers to healthy eating, and therefore, supermarket discount coupons (e.g. fruits, vegetables, fish and lean proteins) and free samples of key food items were delivered to intervention fire houses (olive oil, nuts and whole grain, high-protein/fiber pasta) were included (Sotos-Prieto, Cash et al. 2017). Preliminary results at 6 months showed that those in the intervention group had a 15.5% increase in the values in the mMDS score in comparison with baseline score (23.10 ± 6.59 vs. 26.69 ± 5.82, $p < 0.001$). No significant improvement was found in the control group (2.6%, $p = 0.138$). Additionally, nut consumption ($p = 0.022$) and daily olive oil consumption ($p = 0.001$) were all significantly increased compared the control group (work in preparation). Feeding America's Bravest is a good example of the translation and application of the MedDiet principles in the US population in a very specific population. We are now working on translating the Mediterranean lifestyle intervention to firefighting academies in order to influence health-related behaviours at an earlier career stage.

Dr. Ramon Estruch

In Spain, a similar workplace study was conducted among automobile manufacturing workers. The goal was to assess the effects of a combined Mediterranean lifestyle intervention on cardiovascular risk factors and overall health status as compared to usual care. The intervention included the promotion of a healthier MedDiet based on the PREDIMED intervention (Estruch et al. 2018), increased physical activity, better sleep quality and emotional well-being. Workers from two similar car factories within the same automobile manufacturer were eligible. Participating employees at the first factory were cluster-allocated to the MedDiet-lifestyle intervention, while participants at the other manufacturing plant were cluster-allocated as controls to receive no intervention or "usual care". Additionally, at the intervention factory, environmental modifications included changing the vending machine contents to healthier products and providing a healthy mid-morning snack were offered to participants instead of the traditional less healthy snack. As compared to workers in the control factory, participants in the intervention group significantly improved MedDiet adherence as measured by PREDIMED scores (1.29 points vs. 0.45 points; $P = 0.001$), had a greater reduction in waist circumference (–1.80 vs. −1.67 cm; $P < 0.001$), a significant decline in plasma hs-C-reactive protein concentration (–0.45 vs. 0.79 mg/l; $P = 0.002$), an improved 12-Item General Health Questionnaire (GHQ-12) score ($P = 0.048$) and better reports of sleep quality as assessed by the Jenkins Sleep Evaluation Scale (JSES) ($P = 0.020$)

(submitted work). This trial in a different work setting and a culturally distinct setting also supports that it is feasible to use the workplace as a setting to improve workers' overall health.

Dr. James McClung

Nutrition is of paramount importance for optimising the physical and cognitive performance of military personnel. At the same time, the military environment provides unique opportunities for providing nutrition education and enhancing feeding to improve military readiness, while having positive health impacts throughout the lifespan. Current research within the Department of Defense (DoD) focuses on field feeding through the development and continuous optimisation of military rations as well as dining options in the garrison or cafeteria environment. Military nutritional requirements are based upon available evidence and recommendations from the US Institute of Medicine coupled with primary evidence collected directly from military populations. Requirements for energy and individual nutrients are collated and published in a document titled "Nutrition and Menu Standards for Human Performance Optimization"; these nutritional requirements are mandated for inclusion in both military operational rations and garrison feeding programs (Nutrition and Menu Standards for Human Performance Optimisation 2021).

Recent studies in the military training environment have detailed the importance of individual nutrients on military performance, such as the maintenance of normal iron stores among female military personnel to avoid iron deficiency anaemia and its negative effects on aerobic performance and mood (McClung et al. 2009). Other studies have assessed the importance of calcium and vitamin D for reducing the risks of stress fractures (Lappe et al. 2008; Gaffney-Stomberg et al. 2014), and the impact of protein level and source on the maintenance of lean body mass during energy deficit (Pasiakos et al. 2013).

Although the US military has not adopted the MedDiet per se, recent studies have assessed the impact of diet quality and dietary patterns on relevant military outcomes. For example, a recent study (Lutz et al. 2017) in Army and Air Force initial military training recruits found that improved diet quality as assessed with the Healthy Eating Index-2010 was associated with higher resilience (Conner-Davidson Resilience Scale). A second investigation (Farina et al. 2020) detailed the relationship between diet quality and selection for Army Special Forces training. Higher scores on the Healthy Eating Index-2015 were associated with a greater probability of selection for advanced training as a Special Operator. Current efforts include Go for Green, a program in garrison dining facilities that uses improved labelling, changes in built architecture, updated menus and recipes, as well as nutrition education to promote healthier choices aimed at supporting better military performance (Go For Green | HPRC 2021). Implementation of a similar program tailored to Special Operations Forces resulted in improved diet quality and meal satisfaction (Cole et al. 2018). These studies demonstrate the importance of diet quality on relevant military outcomes and highlight the need for continued efforts to improve the nutritional content of both military operational rations and garrison feeding programs.

Dr. Daniele del Rio

To increase community access to the MedDiet, local food policies regarding nutrition education, awareness and public engagement should be implemented. In particular, we have found that addressing children's nutrition knowledge and eating behaviours allows them to become educators and positive change agents for the rest of the family. Within this framework in the city of Parma, three major stakeholders: The University, the Municipality and a local network of private businesses and industries have been conducting a multidisciplinary, healthy lifestyle collaboration for some years now. The University of Parma has developed a series of research and educational competencies revolving around food science and nutrition. The "Food Project" of the University (Food Project Parma 2020) and the foundation of the School of Advanced Studies on Food and Nutrition as the leading institute for post-graduate studies within the University (Scuola di studi superiori in Alimenti e Nutrizione 2020) offer rich training in all areas of food and nutrition in an attempt of create a "food culture revolution" that will attract the most prominent worldwide experts to Parma. The Municipality of Parma has already invested in numerous healthy nutrition education efforts and is now closely coordinating with the University to transfer the most relevant and recent knowledge into translational activities that directly address school children and their parents. At the same time, in a context of corporate social responsibility, the private network operating in and around the city actively sponsors activities that have a direct and positive impact on the wellbeing of the local population (where most of their employees live).

Specifically, the most prominent Parma-based companies have joined together in a non-profit association called "Parma, Io Ci Sto" ("Parma, I'm there") (Vanelli et al. 2014), which selects and sponsors projects seen as having the best likelihood to impact the health of the city's community.

From this harmonious collaboration, the "Giocampus" project was born (Rosi, Brighenti et al. 2016), jointly funded by the stakeholders and also referred to as the "Educational Alliance". In developing this project, the three partners of this public-private interaction work side by side. The Municipality provides financial support and grants access to the schools. The University offers knowledge and training, and the private business offer the largest portion of the funding, close to 1 M € per year. The project is a unique multidisciplinary educational activity focussed on children and young people with the primary aim of promoting healthier lifestyles through structured education in the framework of physical activity, food and nutrition, and environmental sustainability. Every year, the project involves 15,000 children and more than 100 instructors. The Giocampus School initiative (Rosi, Brighenti et al. 2016) provides 20 h per year of Food and Nutrition Education, 60 h a year of Physical education for all the elementary schools of the area and together with the Summer and Winter initiatives, it guarantees access to knowledge in the fields of nutrition, physical and general wellbeing to an entire generation of children. The MedDiet is at the very centre of almost all the messages conveyed during the educational activities. Much research on this topic has been accomplished, which in turn is used to improve the educational interventions in subsequent years (Rosi, Dall'Asta et al. 2016; Rosi et al. 2020). Additionally, the MedDiet is taught also for its proven impact on environmental sustainability (Germani et al. 2014), reinforcing the school children's understanding of the relevance of food choices on both individual wellbeing and global health.

The three-way collaboration has led to several other spin-off projects: "Madegus" (an acronym for Maestri Del Gusto (Taste Teachers) that develops innovative educational tools (Madegus – Maestri del Gusto 2020), including a specific mobile phone application, named NuBi (Nutrition for Kids) that helps the parents identify the best meals for their children. Madegus also interacts, locally and nationally, with large supermarket chains, developing "edu-tainment" activities based on healthy nutrition for children, also fully focussed on increasing the intake of fruit and vegetables and reinforcing the principles of the MedDiet.

Progress towards these goals is being made in Parma through the public-private collaboration, where educational strategies addressing children and focussed on healthy MedDiet nutrition and physical activity are crucial to raising a heathier generation of adults that will make informed choices about what foods to buy, cook and eat.

Session 4. Chefs, culinary medicine and the food industry – What are the best ways to promote Mediterranean diet principles in the food service industry?

Maria Loi

As a Chef, entrepreneur, author, television personality and "ambassador" of traditional Greek foods, Ms. Loi conceptualises her Chef's Prescription as "One Healthy Greek Bite at a Time". Whether she is speaking to a customer at the restaurant, to children at a school or an audience on television or at a nutrition conference, her goal is to encourage and guide people towards healthier eating using tasty, colourful and healthy Greek foods. Based on her childhood as a farmgirl in rural Greece, she saw choosing and eating the right foods as the path to wellness – what we eat directly affects our body and its internal systems. The traditional Greek diet's reliance on extra virgin olive oil, legumes, whole grains, vegetables, and nuts as the main sources of caloric intake is both cost effective as well as healthy. These ingredients are varied and versatile and can be combined and recombined into endless dishes, both hot and cold, savoury and sweet, with distinct textures and flavours. Some additional points that she emphasises as a Chef and public speaker: animal proteins, especially red meat, should take a back seat to vegetables and legumes; and everything should be consumed in moderation, with the exception of olive oil. Olive oil is certainly the most important and central element of the Greek Diet for which the traditional Cretan diet, as seen in the original seven countries study (Trichopoulou et al. 1993) is the prototype MedDiet. The Cretans of the 1950s and 60's consumed up to 40% of their calories as extra virgin olive oil, now known to be rich in antioxidants, including polyphenols (Trichopoulou et al. 1993). Olive oil offers a path to health and wellness, because beyond its own healthy properties, it makes other foods taste better, not just salads, but many vegetable and legume-based meals cooked in olive-oil based sauces become easy and delicious to eat as

compared to raw or simply steamed vegetables. Beyond the ingredients, the methods of cooking with these ingredients are of paramount importance, in order to reap their respective nutritional benefits. For example, when caramelising alliums at the start of a recipe, add only a pinch of salt, not olive oil, in order to extract the moisture from the ingredients, and not denature the nutrients in the olive oil. The key here is to add olive oil later in the cooking process, to maintain its nutrient composition, and enhance the flavour and texture of the dish. As another example, deep frying in olive oil almost guarantees the deterioration of the micronutrients present, whereas sauteing in olive oil likely will not, due to the smoke point of olive oil. Teaching people how to choose, cook and eat healthier is a passion. Shopping, preparing and eating healthful foods are cost effective and have long standing effects not only physically, but mentally as well (Sanchez-Villegas et al. 2013).

Daniela Puglielli

As a businesswoman with a background in marketing Italian foods, Ms. Puglielli created the Mediterranean Diet Roundtable (MDR) as a hub for the food Industry and beyond. In reference to the important question: "What are the most important challenges to healthy eating in modern society, and what strategies could overcome these barriers?" The MDR is positioned to play a strategic role in disseminating healthy Mediterranean eating by nurturing a multidisciplinary community of Food Industry professionals, scholars, policymakers, nutritionists and dieticians. As a starting point and from a vantagepoint of the market, the MDR recognises several barriers to the average American consumer: accessibility to "Mediterranean Products" of national or international origin; dignifying and familiarising the kaleidoscope of different Mediterranean cuisines; and understanding that the marketplace is influenced by price-driven offerings, rather than a recognition of the true value of certain Mediterranean products, especially those adhering to PDO (Protected Denomination of Origin) regulations and other traditional production methods, which truly express specific territorial/regional authenticity. Even when such products are manufactured in the US (after all, many Mediterranean ingredients like tomato, eggplants, beans etc. come from different areas of the planet), the focus should remain on production excellence and sustainable practices, rather than compromising the quality to favour quantity. The MDR also addresses the important question of promoting Mediterranean Diet principles in workplaces, schools and specific environments, by sharing success stories connecting the meals served and the performance achieved, such as the study mentioned by Mr. Toong at U-Mass correlating healthy diet and students' grades. Studies with longer follow-up will be necessary to assess the correlations from university dining and rates of chronic disease years later in middle- and older-age.

Dr. Timothy Harlan

In the US, the frequency of cooking at home has decreased (Smith et al. 2013), while the consumption of food away from home has increased (Saksena et al. 2018). Evidence demonstrates that those who frequently prepare meals at home have a better diet quality determined by higher vegetable intake (Farmer et al. 2019) and lower daily calorie intake (Wolfson and Bleich 2015). Observational studies also show possessing a greater number of cooking skills is linked to healthier food choices (McGowan et al. 2017). Thus, these secular trends towards less home-cooking and more frequent eating out are likely part of the challenge for Americans in meeting recommended guidelines for fruit and vegetable consumption (Mozaffarian 2016).

The Health meets Food (HmF) curriculum is currently implemented in over 50 academic medical centres across the United States to increase cooking and food choice literacy. Professional coursework forms the core of the programming using an eight-module series that educates medical students, nursing students, resident physicians and practicing healthcare professionals on how to change the dialogue they have with their patients around food. The focus of the classes is to culturally translate Mediterranean diet principles for the American kitchen.

Additionally, medical students act as force-multipliers in teaching community members using the HmF community courseware—a 24-h nutrition and culinary course delivered as a series of 12 modules. The modules instruct community participants on general nutrition concepts and evidence-based principles of the Mediterranean diet through hands-on cooking classes.

The Health meets Food team have shown via observational studies and randomised trials that participation in the programming is associated with significant improvement in Mediterranean diet adherence as well as an increased frequency of cooking at home (Birkhead et al. 2014; Monlezun et al.

Table 1. Mediterranean diet, promotion and dissemination.

Issue/Question	Challenges	Strategies/Solutions	Settings where most applicable
Most important challenges to healthy eating in modern society	- Less people cooks - Less meals at home - Time pressures - Lower access to fresh and healthy food at higher costs - Abundance of refined and processed, calorie-dense unhealthy foods - Decreased quality and increased portion sizes at lower costs	- Teach the value of home cooking and cooking, food shopping skills - Development of simple, fast, healthy and sustainable menus - Implementation of healthy nutrition practices and translation of MedDiet principles at schools and workplaces. - Increased access to healthy and fresh foods in all neighbourhoods	- Homes/families - College /University canteens. - Restaurants. - Companies/other workplaces
Best ways to promote MedDiet principles in workplaces, schools, hospitals, other institutions (e.g. the military) and the food service industry	- Costs/budget constraints - Time pressures - Not prioritised - Lack of nutrition/health knowledge - Perception of authority removing choices	- Nutrition education, awareness and public engagement. - Smartphone applications to assist in making healthy choices - Clearer Food labelling - Choice and Price Architecture that promotes healthy choices without eliminating traditional choices. - Reduce portion sizes, while increasing quality and improving taste. - Addressing children's nutrition knowledge, eating behaviours and physical activity attitude improve choices and to become positive family change agents	- Workplace cafeterias - Primary School canteens - University Cafeterias - Hospital cafeterias and patient food service. - Military canteens - Food Service Industry
Best adapting traditional Mediterranean diet to various ethnic and regional preferences across the US while being inclusive and maintaining cultural sensitivities	- Less healthy habits/choices which maybe based on traditions and/or ethnic and regional preferences - Commercial/Political interests promoting less healthy foods	- Know and respect individual and group preferences - Build on and adapt traditions, rather than trying to eliminate them - Identify local products, foods and recipes that exemplify healthy eating principles (e.g. Nordic Diet paradigm) - Adapt traditional recipes and menus with respect and cultural sensitivity	- Various ethnic and regional communities

2015; Razavi, Monlezun et al. 2020; Razavi, Sapin et al. 2020).

Dietary behaviours are an intersection of food choices, meal preparation, cooking behaviours and consumption habits. A program such as HmF that trains healthcare providers to train their patients in food-choice and cooking literacy can positively influence both cooking and eating behaviours.

Conclusions

As a result of the abundant and high-quality evidence, the 2020–2025 Dietary Guidelines for Americans (DGAs) formally recognise and recommend MedDiet as one of a healthy option for Americans. Moreover, for the last three years in a row, a consensus of health experts selected the MedDiet as the best overall diet for *US News and World Report*. Many experts at the conference, noted that while most people react negatively and even reject vegetarian diets out of hand, they respond positively to the MedDiet concept and pattern. The participants offered a variety of effective methods from different perspectives, in a diversity of environments and across several countries and cultures for disseminating healthier eating based in MedDiet principles. Table 1 summarises the challenges, strategies and solutions and the most applicable settings of the main three questions tackled at the conference. Future studies and efforts should focus on translational interventions across the variety of settings (schools, workplaces, etc.) discussed at the Radcliffe Symposium.

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Data availability statement

Data sharing is not applicable to this article as no new data were created or analysed in this study.

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