

Review Article

Evolution of Mediterranean diets and cuisine: concepts and definitions

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Background and Objectives: The Mediterranean diet has been demonstrated to provide a range of health benefits in observational and clinical trials and adopted by various dietary guidelines. However, a broad range of definitions exist impeding synthesis across trials. This review aims to provide a historical description of Mediterranean diets, from the ancient to the modern, to inform future educational and diet index tool development representing the 'traditional' Mediterranean diet. **Methods and Study Design:** Nine databases were searched from inception to July 2015 to identify papers defining the Mediterranean diet. The definition accepted by the United Nations Educational, Scientific and Cultural Organization (UNESCO) was also reviewed. **Results:** The 'traditional' Mediterranean diet is described as high in unprocessed plant foods (grains, vegetables, fruits, legumes, nuts/seeds and extra virgin olive oil), moderate in fish/shellfish and wine and low in meat, dairy, eggs, animal fats and discretionary foods. Additional elements relating to cuisine and eating habits identified in this review include frequent intake of home cooked meals; use of moist, lower temperature, cooking methods; eating main meals in company; reduced snacking occasions; fasting practice; ownership of a vegetable garden; use of traditional foods and combinations; and napping after the midday meal. **Conclusions:** Scope exists for future tools to incorporate additional elements of the 'traditional' Mediterranean diet to improve the quality, consistency, and synthesis of ongoing research on the Mediterranean diet.

Key Words: Mediterranean diet, plant based diet, traditional foods, diet pattern, diet index

INTRODUCTION

The Mediterranean diet has been associated with multiple health benefits and increased survival.¹⁻⁷ However, this diet has proven difficult to define in the literature as it is surprisingly complex and varies between countries and time periods. Variations exist in definitions provided by educational materials such as Mediterranean diet pyramids and dietary guidelines used by educators and health professionals when dealing with the general public.⁸⁻¹¹ Disparities also occur in the criteria, cut offs and scoring systems selected by common Mediterranean diet pattern index tools or scores, which researchers use to assess adherence to this diet pattern in observational studies and clinical trials.^{5,12-16}

This review provides a brief description of the ancient Mediterranean diet, focusses mostly on what is commonly regarded in the scientific literature as the 'traditional' Mediterranean diet and, mentions some variations to this with modern Mediterranean diets. It summarises key 'traditional' Mediterranean diet foods and dishes. It also identifies additional elements relating to 'traditional' cuisine and eating habits that have not been consistently or collectively assessed in the majority of research studies to date, yet may have an influence on wellbeing and health

outcomes, to inform development of future educational and diet index tools.

METHODS

We conducted a review of Mediterranean diet definitions as described by various literature and characterised by diet index tools. Nine databases were searched from inception to July 2015 to identify papers for a related systematic review on the Mediterranean diet and cognitive functioning and brain morphology or function. These were MEDLINE, Premedline, AMED, All EBM review databases including Cochrane Database of Systematic Reviews (DSR), ACP Journal Club, Database of Abstracts of Reviews of Effects (DARE), Cochrane Central

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Manuscript received 25 February 2016. Initial review completed 25 April 2016. Revision accepted 24 June 2016.

doi: 10.6133/apjcn.082016.06

Register of Controlled Trials (CCTR), NHS Economic Evaluation Database (CLEED), Cochrane Methodology Register (CLMCR), Health Technology Assessment (CLHTA), CINAHL, EMBASE, PubMed, PsychINFO, Web of Science. Key search terms included Mediterranean diet, Mediterranean dietary pattern, Mediterranean type diet, Cretan diet, MedDiet, MeDi and MeDiet. In addition grey literature was searched and additional useful historical references were identified from reference lists. Details of the search can be found in our PROSPERO protocol registered at <http://www.crd.york.ac.uk/PROSPERO/asCRD42015024088>.

In the search we identified more than 30 Mediterranean diet index tools. We chose to review seven of these to illustrate the diversity of tools in existence that measure adherence to a Mediterranean diet. The tools selected were either widely cited and/or included a greater number of elements to assess the intake of Mediterranean foods, aspects of cuisine and broader eating habits.

RESULTS

Our main findings are presented within the following framework: a) a historical time line of Mediterranean diets (ancient, 'traditional', modern), with details of characterising foods and cooking methods used within the 'traditional' Mediterranean diet b) additional culinary and psycho-social elements of the 'traditional' Mediterranean diet and c) relevance of existing diet index tools to the 'traditional' Mediterranean diet.

Ancient Mediterranean diet

The Mediterranean diet has its origins in antiquity, from the foods and dietary patterns of countries surrounding the Mediterranean basin considered by historians as the "cradle of civilization".¹⁷ This region was a melting pot of influences from ancient civilizations such as the Minoan (7000 BC-2000 BC) and Phoenician (1200 BC – 332 BC) to various Greek periods, e.g., Classical Greece (479 BC-323 BC) and the Roman Empire (31 BC – 476 AD).¹⁸⁻²⁰ It was also exposed to Arabic/Islamic culture and food discoveries from the New World. The diet in the Mediterranean is therefore not a single construct but has progressively evolved over time and lands. Specific food components have been more or less emphasised according to the historical period, culture, religion, agricultural production and the economy of the time. In addition, climatic conditions, poverty and hardship have contributed to shaping the Mediterranean diet rather than intellectual insight or wisdom, which tends to be the method used in modern times to construct popular diets.²¹

A study of the writings of the Greek philosopher Plato (5th to 4th Century BC) provides valuable insight into some of the early dietary customs of the Mediterranean region. For example, Plato stated that a healthy diet consists of cereals, legumes, fruit, milk, honey, fish and water. He cautioned that meat, confectionary and wine should only be consumed in moderate quantities.²²

In the Roman tradition, which was based on the ancient Greek model, bread, wine and oil were the triad characteristic of the Mediterranean diet. Additional foods included some sheep's cheese, vegetables (chicory, leeks, lettuce, mallow and mushrooms) and only a small

amount of meat with a strong preference for fish and seafood.¹⁷

One significant yet underappreciated influence on the historical path of the Mediterranean diet is the contribution made by Arabic/Islamic culture. As an example, at the time when the Moors occupied much of Spain, the Christian (Catholic) diet was based on meat, wine and grains with poor dietary variety. However, in Islamic food culture meat comprised only a small part of the diet, whereas a variety of vegetables were plentiful.²³ Islamic culture helped to transform the Mediterranean culinary model by introducing many new varieties of foods, such as eggplant, spinach, citrus, pomegranate, almonds and spices, as well as providing preparation methods for recipes.¹⁷ Grains, such as wheat, barley and rice (and especially bread), were considered important by Muslims and many legumes were classified as having medicinal properties.²³

A further noteworthy influence on the Mediterranean diet was the discovery of the Americas. Christopher Columbus's voyages (first journey was in 1492) resulted in novel foods from the New World, such as tomato, potato, capsicum, corn, various legumes and chilli, later becoming commonplace within this diet.^{17,24} For example, while the tomato is now generally considered the food most synonymous with Mediterranean cuisine, the historical account testifies this was not the case in the ancient diet.¹⁷

'Traditional' Mediterranean diet

When speaking of the 'traditional' Mediterranean diet in the scientific literature, most researchers tend to refer to a plant based dietary pattern common to the olive growing areas of the Mediterranean region as described in the late 1950s and early 1960s on the island of Crete, Greece and rural villages in Southern Italy such as Nicotera, which were part of the famous Seven Countries Study.²⁵⁻²⁷

'Traditional' is defined by the European Union EuroFIR project as referring to practices or specifications established prior to the Second World War, meaning before the modern era of factory farming and mass scale food production.²⁸ As Trichopoulou et al point out, 'traditional' reflects a period "when most population groups still applied simple, time honoured approaches" to grow most of the food they personally consumed.²⁹ It also refers to a time before the globalisation of ultra-processed foods. Although sounding like the distant past, Keys³⁰ argued the 'traditional' Mediterranean diet definition was a relatively new invention rather than what was consumed by natives of the Mediterranean region in ancient times.

The 'traditional' Mediterranean diet can be defined as being high in unprocessed plant foods (cereals (grains), vegetables, fruits, legumes, nuts/seeds and extra virgin olive oil); moderate in fish/shellfish (until recent times, fish consumption was a function of proximity to the sea) and wine (usually consumed only with meals and if acceptable by religious belief); and low in meat and dairy products, eggs, animal fats and discretionary foods.³¹ When the ratio of plant versus animal foods is considered, the 'traditional' Mediterranean diet presents as a semi vegetarian diet, abundant in unrefined plant foods with a notable absence of ultra-processed foods, such as extruded snacks, sugary foods and drinks, fast foods and refined

fats and oils, now commonplace in modern day diets.

A plant based diet

In his personal reflections, the principal investigator of the Seven Countries Study, Ancel Keys,³⁰ stated the “heart of this diet is mainly vegetarian and differs from American and Northern European diets in that it is much lower in meat and dairy products and uses fruit for dessert”. Keys described “pasta in many forms, leaves sprinkled with olive oil, all kinds of vegetables in season, and often cheese, all finished off with fruit, and frequently washed down with wine”. Further, when comparing modern interpretations of the Mediterranean diet he criticised Italian restaurants in the US and England as serving a travesty of the healthy ‘traditional’ Mediterranean diet as “everything has to be loaded with butter or margarine and ground meat”. Also, he rebuked them because “serving only fruit for dessert is not common” whereas “ice cream or pie is customary”.³⁰

Despite the fact that the dishes traditionally consumed by the Greeks were not the same as that consumed by the Spaniards, Lebanese or Moroccan, the Cretan diet circa 1960’s remains the preferred prototype in the literature for the ‘traditional’ Mediterranean diet.^{21,32} See Table 1 for a descriptive list of foods consumed by Cretan men in the 1960’s.

Bread as a staple food

Local food choices available for the preparation of ‘traditional’ Mediterranean meals were influenced by the seasons, which can help promote dietary diversity over the year or be a vulnerability in the case of bad weather. Seasons determined the cuisine, helped to impart varied flavours and increase phytonutrient intakes when abundant harvests were available. Unlike recent times where low carbohydrate diets have been increasingly promoted in the popular and social media, it was common to eat large quantities of unrefined bread in many forms with each

meal including soups, cooked dishes, salads and even fruit.⁵ These breads were based on stone ground whole-meal flour and made with sourdough culture, and would therefore have been lower in Glycaemic Index (GI) than most modern breads consumed.³¹ Rusks (*paximadia*) made from barley were staple foods in Crete. These would presumably have elicited a particularly low glycaemic response since barley is rich in viscous dietary fibre and the GI of barley is low compared with other grains.^{33,34} In addition, rusks were always softened with olive oil prior to consumption further lowering their glycaemic response. Whole grains, including any foods made from unrefined or minimally processed grains such as whole wheat and barley (intact, cracked, rolled or flour products), also provided good amounts of dietary fibre and unique phytonutrients such as lignans, phytates and phenolic acids that complemented those found in fruit and vegetables.³⁵

Dishes based on vegetables, legumes and extra virgin olive oil

Large amounts of salads, soups and cooked vegetable dishes were traditionally consumed. These were based on seasonal vegetables and legumes from the region (e.g., lentils, chickpeas, broad beans, white beans, lupins), doused with copious amounts of extra virgin olive oil leading to composite dishes with mixtures of antioxidants.³³ Examples include stuffed vegetables (tomato, capsicum, eggplant and zucchini), white beans with fennel, chickpeas with spinach and broad beans with wild artichokes. Lemon juice or vinegar, herbs and onion/garlic were also frequently used to season salads or legume soups before consumption, as well as in food preparation, such as when baking ‘lemon potatoes’ or cooking goat or lamb. Modern research suggests addition of condiments such as lemon juice/vinegar may help lower the GI of a meal and reduce the formation of advanced glycation end products (AGE’s), generally low in raw or

Table 1. Description of the food intake of Cretan men in the 1960’s[†]

Food	Description	Quantity/frequency
Bread	Made with stoneground wholemeal flour, sourdough	At least 6 slices per day
Fruit	Seasonal e.g. grapes, figs, apples, melons	At least 2 pieces per day
Vegetables	Seasonal; regular inclusion of wild greens and dishes cooked in a rich tomato sauce with onions/garlic, herbs and olive oil	
Meat	Mainly sheep or goat; usually boiled or casserole	Once per week or less
Fish/seafood	Any type available, depending on proximity to the sea e.g. sardines, cod, herring, octopus	Once per week or less
Legumes	Lentils, chickpeas, broad beans etc. in place of meat	2-3 times per week
Nuts	All types available e.g. walnuts, almonds, chestnuts	At least 3 times per week
Olives	All types available	Daily
Eggs	Free range	Average of 3 per week
Cheese/yoghurt	Made from sheep/goats milk	2-3 times per week or more
Milk	From sheep/goats milk; full cream	Reserved for children
Olive oil	Extra virgin	More than 4 tablespoons daily
Wine	Red wine or retsina	100-200 mL per day
Tea	Sage, mountain tea (sideritis or ironwort), lemon verbena, dittany, chamomile, mint	Daily
Coffee	Made from grounds and boiled	Daily, if available
Herbs	Oregano, parsley, celery leaf, dill etc.	Daily
Spices	Cinnamon, cumin, cloves, saffron etc.	Several times per week

[†] Adapted from Kouris-Blazos et al and used with permission.³²

cooked vegetables but formed in significant amounts when cooking potatoes with added fat at high temperature e.g. French fries.^{36,37}

While Greece still claims the highest per capita consumption of olive oil as a country, Cretans still consume the largest amounts in the world.^{38,39} A survey carried out by the American Rockefeller Foundation in 1948 in Crete indicated that olive oil contributed heavily to the daily caloric intake and “food seemed literally to be ‘swimming’ in oil”.⁴⁰ Recently, Ramirez-Anaya Jdel et al showed that frying vegetables in extra virgin olive oil can increase their overall polyphenol content by virtue of absorption of the polyphenols from the oil.⁴¹ In Greece and Southern Italy, cooking vegetables in olive oil was commonplace. Fresh dark green leaves and/or boiled wild (often bitter) varieties such as endive, chicory, sow thistle, amaranth and purslane drizzled with olive oil and lemon juice were an important part of daily cuisine when in season. Vine leaves stuffed with rice and spices were also consumed. The bitter cooking water that remained after boiling greens was usually drunk by the cook as it was believed to be highly nutritious. More than 80 different edible varieties of wild greens (weeds) have been identified on Crete.³³ Wild greens and green pies prepared with a combination of leaves and herbs were found to contain exceptionally high levels of antioxidants, including a wide range of flavonoids.²⁷ Dark leafy greens are also particularly rich in the carotenoid lutein, which can be preferentially taken up by the brain and macula and provides antioxidant and anti-inflammatory effects.⁴² Further, in addition to beetroot, which was cooked (both bulb and leaves) and eaten cold as a salad dressed with olive oil and lemon or vinegar, dark green leafy vegetables were a major contributor to the high nitrate content of the ‘traditional’ Mediterranean diet, which promotes vasodilation of blood vessels and lowers blood pressure.⁴³⁻⁴⁵ Emerging research has also shown that leafy greens contain a sugar called sulfoquinovose that can beneficially improve the gut microbiota.⁴⁶

The type of olive oil used traditionally for all cooking and eating purposes was extra virgin. There are two major reasons why extra virgin olive oil might be preferential for health compared with refined olive or vegetable oil extracted with solvents. First, it contains a high proportion of monounsaturated to polyunsaturated fatty acids, which makes it more resistant to lipid peroxidation.⁴⁷ Second, ‘extra virgin’ means that the olives were mechanically pressed to squeeze out their juice, preserving their polyphenol and tocopherol content. Such phytonutrients further contribute to oxidative stability and may provide anti-inflammatory benefits.⁴⁸ It was not customary to spread any butter or margarine on bread in the Mediterranean. Twice baked Cretan rusks, which could survive long journeys by shepherds were softened before eating by drizzling with extra virgin olive oil and fresh tomato juices.³³ Olives themselves, a fermented food with live cultures, were also regularly consumed as a condiment to meals.

Traditional seasonings

Onion and garlic were generously used, both raw as part of daily salads and as the basis of most cooked dishes,

including the preparation of rich tomato pasta sauces where, together with the extra virgin olive oil, they increased the content of flavonoids.^{49,50} The regular use of herbs/spices in cooking, even in small quantities, further contributed to a higher dietary intake of polyphenols.^{21,51} For example, dried oregano, which is one of the richest sources of polyphenols among herbs, was regularly added to almost all dishes, along with some salt, pepper, lemon and extra virgin olive oil.⁵² Cultivated for centuries in the Mediterranean, and used also as medicine, oregano has more recently been shown to contain several antioxidants with anti-inflammatory, blood glucose and lipid lowering potential although clinical trials are lacking.⁵³ Other popular herbs used traditionally include dill, mint, rosemary and wild fennel, although their usage depended on the region. Recent analyses of traditional Greek foods and dishes determined that the addition of capers in a sauce to the humble Santorini dish called fava (made from split peas cooked with onion) further enriched it with flavonol, flavone and flavan-3-ol.²⁹ A simple green bean dish (known as *fasolakia*) was found to contain the highest content of flavonoids in an analysis of a weekly Mediterranean menu due to the addition of onion and parsley in cooking.²¹ Indeed, the Greek version of the Mediterranean diet used for this analysis was found to be high in flavonoids compared with diets in Northern European countries.²¹ Interestingly, Cretan cuisine incorporated a wider range of herbs and spices due to its extensive history of invasions from the Byzantines and Arabs to the Venetians and Ottoman Turks prior to Crete becoming unified with and influenced by mainland Greece. For example, herbs and spices often associated with Asian cuisine, such as cumin, coriander and saffron, were used. This may help explain why Cretan cuisine was even more beneficial than the cuisine of mainland Greece at that time period.³³ Trichopoulou²⁹ pointed out that the nutritional secrets of ‘traditional’ Mediterranean foods and dishes were not immediately obvious as they appeared to relate to their phytonutrients. This is not surprising since dietary analysis using standard food composition tables found in most apps and software programs omits the diverse range of phytonutrients existing in plant foods (as there is incomplete compositional data), so that the analytical focus remains on macro and micronutrients.

Nuts and honey to make nutritive sweets

Nuts and seeds were eaten by the handful and used to make nutritive sweets together with honey e.g. *pastelli* (made from sesame seeds and honey) or grape juice syrup/must (*petimezi*) and occasionally dried fruit, since the use of table sugar was very low in the ‘traditional’ diet. Spoon sweets were made by cooking fruit, vegetables or green walnuts in their shell with sugar to create a syrupy sweet. However, these sweets were considered only an occasional treat, provided as one spoonful followed by water, and mostly served to guests as a gesture of hospitality. Key Mediterranean nuts include almonds, hazelnuts, pine nuts, pistachios, and walnuts.⁵⁴ Walnuts provide a particularly rich source of alpha linolenic acid and the highest level of phenolic compounds compared to other nuts.⁵⁵ Honey has been used traditionally as medicine and recent research suggests it can provide antioxi-

dant, anti-inflammatory and anti-microbial effects beneficial for treating certain conditions.^{56,57}

Beverages: water as the main drink

In addition to water being consumed as the daily drink, moderate amounts of herbal tea, such as from sage and various mountain herbs, and/or boiled Greek coffee were consumed as part of the 'traditional' Mediterranean diet, although there is a paucity of data on actual quantities.⁵⁸ It was the job of children to pick herbs for making tea, while the coffee beans were purchased according to household budgets which, for most, were limited. More recent research has confirmed these beverages supply various antioxidants, which may provide health benefits.^{59,60} While coffee consumption may potentially provide both positive and negative health effects, Siasos et al reported boiled Greek coffee contained only a moderate amount of caffeine while it is rich in antioxidants, such as polyphenols, and magnesium.^{61,62} In the 'traditional' diet, herbal teas and coffee were also consumed with lower quantities of honey or sugar compared with amounts of added sugars contained per serve in modern sugar sweetened beverages.

Some dairy from sheep and goats

Dairy was traditionally sourced from sheep and goats (occasionally buffalo), which provide A2 beta-casein, as found in breast milk.⁶³ In Western society however, most milk is sourced from cows that exist in mixed herds supplying a combination of A1 and A2 beta-casein. While further research is required, some studies suggest A2 beta-casein may be better tolerated by certain individuals and may be associated with a reduced risk of some chronic diseases compared with A1 beta-casein.^{63,64} In the Mediterranean, full cream sheep or goats milk was reserved for drinking by children, whereas yoghurt (usually strained, which decreases lactose and increases the protein content) and soft white fermented cheese was preferred by adults. In Greece, for example, *fetta* cheese (with live cultures) was regularly added to salads and to finish the preparation of vegetable stews.⁵ On Crete, *myzithra* (a mild whey cheese that hardens with age and can be grated) was most commonly produced, used and shipped around the Mediterranean as the cheeses of Crete have been famous since antiquity.³³ It has been suggested

that fermented foods in the 'traditional' Mediterranean diet, including yoghurt, cheese, trahana (fermented wheat and milk), olives and sourdough bread, may contribute to a healthy microbiome and that, at least, some of the benefits obtained from Mediterranean diets might be operating through the microbiome.³²

Meat in very small amounts

The small amount of meat consumed in the prototype Cretan diet usually came from small animals that grazed on pasture, (e.g., goats and sheep), rather than cows lot fed or lot finished with grains, as is the case with most beef produced today in Western countries.⁶⁵ These animals provided an additional source of omega-3 fatty acids to the diet, as did snails which were popular during religious fasting and throughout the year.⁶⁶ As compared to modern diets where meat takes centre stage on the plate and dishes are named accordingly further elevating the status of meat, legumes were the pillars of the 'traditional' Mediterranean diet. The Southern Greeks had quite a puritanical attitude towards meat, viewing regular meat intake as being greedy.³³

Further, the cooking methods used to prepare meats were usually lower temperature and higher moisture e.g. boiling, stewing with the frequent addition of herbs and lemon retarding the formation of AGE's, polyaromatic hydrocarbons (PAH's) and/or heterocyclic amines (HCA's), which have all been associated with chronic disease.^{37,67}

While traditional dishes varied in Mediterranean countries, modulated by ethnic background, agricultural production, economy and religious beliefs, what all Mediterranean countries shared in common was the unrefined plant based dietary pattern typical of this time period.⁶⁸ See Table 2 for a sample one day 'traditional' Mediterranean (Greek) summer menu.

Whole diet pattern more important than individual foods

With regards to the question of which food/s in a Mediterranean diet are most important, current data suggest there is no specific food or component that is as beneficial as the whole diet pattern and, possibly, the broader traditional cuisine and lifestyle habits which may be significant elements. This is because simply changing one

Table 2. Sample one day 'traditional' Mediterranean (Greek) summer menu

Eating occasion	Foods
Breakfast	Sourdough bread topped with grated fresh tomato and raw onion, crumbled feta, dried oregano and drizzled with extra virgin olive oil Herbal tea or boiled Greek coffee
Lunch (main meal)	Oven baked giant Lima beans in tomato sauce+ boiled potato and endive drizzled with olive oil and lemon + sourdough bread Small glass red wine or retsina
Dinner (lighter meal)	Vegetable stew with eggplant, green beans, zucchini, potato, tomato, onion, garlic and parsley + sourdough bread OR village salad with barley rusks, tomato, cucumber, onion, olives and oregano drizzled with extra virgin olive oil OR Greek yoghurt topped with walnuts and drizzled with honey
Snacks	Water Fresh fruit in season Nuts Dried fruit e.g. figs, raisins

food or adding a few traditional dietary components may not completely override the detrimental effects of a Western diet.⁶⁹

However, some studies have attempted to identify the relative importance of individual foods within predictive index tools. When considering the Mediterranean Diet Pattern Score (MDPS) used for data from the Food Habits in Later Life (FHILL) study, which included five ethnic cohorts, Darmadi-Blackberry et al found that a higher legume intake was the most predictive dietary factor for longevity, with a 7-8% reduction in mortality risk for every 20 g increase in daily legume intake.⁷⁰ In the Greek European Prospective Investigation into Cancer and Nutrition (EPIC) where a higher adherence to the Mediterranean diet was associated with a significant reduction in total mortality, the dominant components of the Mediterranean diet pattern index that predicted lower mortality were moderate alcohol intake, low intake of meat and meat products and high intake of vegetables, fruits and nuts, olive oil and legumes.⁷¹ A meta-analysis on the Mediterranean diet and cardiovascular disease (CVD) revealed that the protective effects of the diet pattern specifically related to CVD as an outcome, and assessed using various index tools, could mostly be attributed to olive oil, fruit, vegetables and legumes.⁷²

Modern Mediterranean diet

While it is believed that Ancel Keys first coined the term 'Mediterranean diet', the concept of the Mediterranean diet was not widely recognised in the scientific literature until the 1990s with the publication of the Lyon Diet Heart Study. This clinical trial showed a 50% reduction in risk of a second heart attack or cardiovascular complications, fewer cancers and a significant decrease in all-cause mortality among those receiving the intervention diet.⁷³⁻⁷⁵ Yet despite being a type of Mediterranean diet, the intervention used in the Lyon Diet Heart Study was not 'traditional' and included some variations. For example, the intervention was not high in total fat and the subjects were provided with an additional margarine made from rapeseed oil to increase their alpha linolenic acid intake, since at the time of the study the exact dietary sources of alpha linolenic acid in the 'traditional' Mediterranean (Greek) diet were unknown.⁷³

More recently, the Mediterranean diet gained acclaim after the publication of the PREDIMED trial from Spain. This was a primary prevention trial of subjects at high risk of CVD placed on one of two versions of a Mediterranean diet compared with a slightly lower fat control diet. The findings were a 30% reduction in CVD risk, primarily due to decreased stroke risk, with either of the Mediterranean diets.⁷⁶ Also, a reduction in the risk of type 2 diabetes and peripheral artery disease was reported, as well as attenuation of decline or slight improvement in some aspects of cognitive function over time, compared with the control diet.⁷⁷ PREDIMED is a further example of a modernised Mediterranean diet since the design of the study meant that one intervention group was supplemented with polyphenol rich extra virgin olive oil while the other received supplements of mixed nuts to encourage a higher intake of these key foods in the respective groups, compared with controls. Also, a higher allowance for

meat intake was provided in PREDIMED (less than one serve daily) compared with intakes in the 'traditional' Mediterranean diet (a few times per month). Unlike other studies, PREDIMED did include cuisine based advice with the recommendation to consume meals with sofrito (a rich sauce made with tomato and onion, often including garlic and aromatic herbs, slowly simmered in olive oil) at least two times per week.

Therefore, strictly speaking, neither the Lyon Diet Heart Study nor PREDIMED used a purely 'traditional' Mediterranean diet as their intervention, making interpretation and comparison of the results more complex.⁷³ It is interesting, however, that both trials were stopped early as interim analyses indicated the Mediterranean diet groups had a significantly reduced risk of disease compared with controls.

Unfortunately, the diets currently consumed in Mediterranean countries (including the region where the prototype 'traditional' Mediterranean diet was described) are progressively being modernised and influenced by Western dietary habits due to rapid economic development and high urbanisation rates and there is decreasing adherence to a 'traditional' Mediterranean diet pattern.⁷⁸ While the influence of American fast food culture can easily be observed, some of the move towards a greater use of animal products in modern Greek diets and a reduced use of herbs and spices has been more subtle and can be traced back to earlier culinary instruction by the famous Chef Tselementes (1878-1958). After spending considerable time abroad at prestigious eating establishments, Tselementes returned to Greece in the early 20th century to open a cooking school and publish his first cookbook. His cooking methods reduced the emphasis on herbs and spices and, instead, added butter and cream to foods so that recipes conformed more to classic French cuisine and appealed to the cosmopolitan upper class.⁷⁹ While his influence was not apparent in Crete in the 1960s (the major location and period that defined the "traditional" Mediterranean diet), it prevails today in most modern Greek kitchens in the form of more bland dishes with rich cream sauces i.e. bechamel, such as moussaka and pasticcio, which are mistakenly considered traditional. Hence, modern Mediterranean diets have been shaped by external and internal forces.

Ironically, Tourlouki et al have suggested the 'traditional' Mediterranean diet is being forsaken at the fastest pace possibly within the countries of its origin, based on data from the MEDIS (Mediterranean Islands Study) of people aged over 65 years from 12 islands in the Mediterranean, and research conducted on primary school children in Malta.^{80,81} In the MEDIS study of 'elders', Crete was recently found to have the highest frequency of fast food and sweets consumption.⁸¹

Additional culinary and psycho-social elements of the 'traditional' Mediterranean diet

In 2010 the United Nations Educational, Scientific and Cultural Organization (UNESCO) recognised the Mediterranean diet as an Intangible Cultural Heritage. Indeed, to date, it is the only diet in the world protected by UNESCO in an effort to safeguard the traditional aspects of the diet, which are at risk of being abolished. As the

word 'diet' comes from the Greek word '*diaita*', meaning a way of life or lifestyle, the recognised Mediterranean diet is much more than just a diet pattern that can be described by consideration of its foods and/or nutrients, although a quantitative definition may have particular uses in research.⁸² The Candidature Dossier submitted to UNESCO describes the Mediterranean diet as "a social practice based on the set of skills, knowledge, practices and traditions ranging from the landscape to the cuisine, which in the Mediterranean basin concern the crops, harvesting, fishing, conservation, processing, preparation and, particularly, consumption".⁸³ Hence, domestic cooking using distinct methods, as well as eating and other social habits that revolve around the foods consumed, also play an integral role in the 'traditional' Mediterranean diet. Yet these elements have generally escaped the attention of researchers, despite the likelihood that they may interact with the type and quantity of foods consumed and possibly exert independent health effects. While evidence is currently lacking within the context of a Mediterranean diet to support the importance of such elements, emerging research within the wider scientific literature suggests these elements could be a significant contributing factor to the value of the 'traditional' Mediterranean diet.

In the Mediterranean, food was *traditionally cooked at home* or prepared by family and friends rather than by commercial and industrial operators. This is important because recent data on Western populations has suggested more home cooking is associated with higher diet quality as indicated by increased consumption of fruit, vegetables and salads.^{84,85} Because of their dominant role within the home in the past, Mediterranean women were the custodians of their culinary culture and self-production of food.⁸⁶ Second, the *traditional slow cooking methods used in the Mediterranean included high moisture and lower temperature*, e.g., boiling or stewing. These conditions are now known to reduce the formation of various noxious chemicals in foods such as AGE's, mentioned above, and acrylamide produced by faster modern cooking methods using intense and dry heat, associated with chronic disease.^{37,87-91} It is also now appreciated that preparation methods where vegetables are soft cooked so that cell walls are broken down increase bioavailability of phytonutrients, further aided by the presence of olive oil since many phytonutrients, e.g. carotenoids, are fat soluble. Third, *main meals in the Mediterranean were usually consumed by sitting around the table* (rather than in front of a screen or while driving), where food can be savoured and eaten more mindfully in a convivial environment with the company of family and friends.⁹² The Greek historian Plutarch stated "we do not sit at table to eat, but to eat together".⁸³ This method of eating provides social connectedness and a sense of community, now recognised to be important for health.⁹³ Indeed, frequent socialisation is a hallmark of Mediterranean traditions renowned for their longevity.⁹⁴ Fourth, *frequent snacking between meals was not common* in the 'traditional' Mediterranean diet. In contrast, 96% of Australians say they regularly consume snack foods and Australians are now snacking four times as much as they did a decade ago according to market research.^{95,96} Recent data from four US surveys suggests excessive grazing between main

meals may drive obesity as eating frequency has been shown to account for twice the variance in energy intake compared with portion size.⁹⁷ Fifth, in the Orthodox, Catholic and Islamic religions some form of '*fasting*' or *food restriction was traditionally practised*. For example, those compliant with the Orthodox Church recommendations abstain from eating most foods of animal origin every Wednesday and Friday as well as for three other significant periods leading to religious holidays. This means they virtually follow a total plant based diet (vegan) for up to 200 days, or more than half of the year.⁹⁸ Modern science has confirmed fasting or abstaining from meat, chicken, fish, dairy and eggs may have a favourable impact on the microbiome and result in less production of potentially harmful bacterial metabolites and inflammation.^{32,99-102} Further, high fibre vegetable based diets whether they be vegan, vegetarian or Mediterranean are associated with increased levels of faecal short chain fatty acids, which confer a protective effect against various chronic diseases.¹⁰³ Fasting practice may also contribute to moderation in overall food intake and a more frugal diet, which is less commonly observed in Western society. Sixth, Mediterranean people *traditionally grew most of their own produce*, a practice which has been suggested to impact consumption levels of vegetables. The Australian arm of the MEDIS found having a home garden is positively correlated with a high Mediterranean diet pattern index score.¹⁰⁴ Seventh, *certain traditional foods and culinary combinations were consumed regularly* in the 'traditional' Mediterranean diet, such as Greek yoghurt and olives (both fermented foods), tomato salsa/sofrito, wild dark green leafy vegetables drizzled with lemon juice and olive oil and vegetables and/or legumes cooked with herbs and olive oil, discussed earlier. Such foods and combinations lend themselves to providing a greater diversity and/or higher concentration of phytonutrients compared with adding a slice of tasty cheese, squirt of ketchup, a side salad without dressing (or low fat dressing) or a portion of steamed vegetables to the dinner plate, which tends to be more common in Western society. Eighth, taking a *short nap following the main midday meal* is well known to be part of the 'traditional' Mediterranean lifestyle,¹⁰⁵ which also included a considerable amount of physical activity. A daily siesta has been associated with reduced coronary mortality in a Greek population,¹⁰⁶ with a recent study on midday napping finding an association with reduced blood pressure.¹⁰⁷ However, while the additional elements identified in this review, were an integral part of the 'traditional' Mediterranean lifestyle, further research is required to confirm their contribution to reducing chronic disease risk within the context of that lifestyle. Finally, despite the 'traditional' Mediterranean diet being used as a valuable reference point for health within the scientific literature, capturing such a diet and trying to preserve and use it in different contexts may be fraught with difficulties and may have some unintended consequences. For example, gender roles, time availability and daily routines are changing across the world, which may impact on the ability to regularly cook at home, tend a garden or take a short nap after the midday meal, even in Mediterranean countries.

Relevance of existing diet index tools to the 'traditional' Mediterranean diet

Existing Mediterranean diet pattern index tools have been used in epidemiology and clinical trials to assess whole dietary patterns and measure the combined effects of food components on disease outcomes, overcoming limitations of studies on single nutrients or foods.^{108,109} However, there have been disparities in their ability to predict similar risk reductions for chronic disease. These tools, developed *a priori*, have mostly focussed their attention on foods and, in some cases, nutrients and they generally do not attempt to measure the broader elements of the 'traditional' Mediterranean diet and cuisine discussed in this review.^{5,12-14,16} Most index tools, with the exception of MEDLIFE (see below), are also not based on the definition of the 'traditional' Mediterranean diet.¹¹⁰

The first Mediterranean diet pattern index tool (MDPS) was developed in 1995 by Trichopoulou et al.⁵ It examined the association between defined Mediterranean food patterns and overall survival using data collected for the FHILL study. Scoring for the MDPS ranged from 0-8 and focussed on broad food groups derived from the traditional Cretan diet as described in the Seven Countries Study but it did not reflect cooking methods or other aspects of cuisine. Nevertheless this pioneering tool, and the study it was based on, facilitated the work of researchers around the world to explore additional benefits of a Mediterranean diet, resulting in rapid growth of publications and development of multiple other index tools with variations.¹¹¹

The variations in index tools appear primarily due to differences in purpose and how these tools were constructed. While the majority of Mediterranean diet pattern tools seemingly aim to assess overall adherence to a Mediterranean diet pattern, specific elements included in some tools would suggest greater relevance to a particular health outcome or population being studied. For example, Ciccarone et al who studied peripheral artery disease in Italian patients with type 2 diabetes, included a frequency measure of raw vegetable, carrot, butter and cream intake, presumably to enable some proxy for carotenoid and saturated fat intake, which are related to diabetes complications.¹¹² The Mediterranean Diet Adherence Screener (MEDAS) used in PREDIMED on the other hand seems to have been largely designed to enable a rapid assessment of compliance to a Mediterranean diet pattern so feedback can be provided to participants during dietary interventions as part of a clinical trial. Unfortunately, MEDAS also lacks a measure for frequency of intake of home cooked meals, the cooking methods used, socialisation at meals, snacking occasions throughout the day, fasting practice, availability of a home vegetable garden and napping after the main meal, which are characteristics of the 'traditional' Mediterranean diet.^{15,113}

Indices also vary according to the number and actual dietary elements assessed, whether quantity or frequency of the elements is being measured, cut-offs used for scoring (absolute or a scale, and determined *a priori* or based on gender specific mean intakes of the population assessed, which may not reflect true adherence to the 'traditional' Mediterranean diet) and the computation method. Some index tools include composite food groups such as

fruit and nuts or legumes, nuts and seeds, whereas others incorporate measures for discretionary foods not part of the 'traditional' Mediterranean diet, such as sugary beverages and sweets, in order to capture the potentially negative effects of such items now common in Westernised diets. The intake of discretionary foods may be of particular interest when assessing non-Mediterranean populations, and the degree of acculturation by Mediterranean populations.

While an exhaustive comparison of Mediterranean diet index tools is beyond the scope of this review, the elements from seven commonly used tools out of more than 30 existing in the literature are provided (see Table 3). A comparison of these example indices reveals that all include some measure of vegetables, meat and meat products and fruit (even if as a composite group with nuts). Most include a measure of fish/seafood, dairy, legumes, alcohol and olive oil intake. Few include a measure of wholegrain cereals, sofrito, poultry/white meat, eggs, vegetable oil, butter, margarine, cream, sugary beverages and sweets while none include a measure of vegetable variety, dark green leafy vegetables, onions/garlic/leeks/shallots, olives, fermented dairy, 'extra virgin' olive oil, lemon/vinegar use in food preparation, herbs and spices, water, herbal tea and coffee, despite the latter being part of the 'traditional' Mediterranean diet and cuisine.

Therefore, it has been suggested that while existing Mediterranean diet pattern index tools may be a helpful way of describing a Mediterranean diet, such indices may have led to an over simplification and confusion about the 'traditional' Mediterranean diet.⁷³ There are also currently no Mediterranean diet indices that capture the broader elements of 'traditional' cuisine and consumption habits discussed in this review. The most holistic example identified is MEDLIFE, a 28 item index based on criteria from the new Spanish Mediterranean diet pyramid. This includes measures for diet, physical activity patterns and social interaction but lacks the same elements as the educational pyramid, discussed above, upon which it is based.^{8,114}

DISCUSSION

Emulating and assessing the 'traditional' Mediterranean diet can be a challenge. The Mediterranean Diet Foundation from Spain in conjunction with experts in the field, recently updated the 'traditional' Mediterranean diet pyramid in areas that have evolved with modernisation and to incorporate cultural and lifestyle elements.⁸ However, some of the updated dietary recommendations may be controversial, such as the higher allowance for red and processed meat, which exceeds amounts consumed traditionally in the prototype diet.²⁶ Also, despite considering a wide range of Mediterranean lifestyle elements, this educational tool does not emphasise the potentially important role of traditional cooking methods such as stewing rather than barbecuing meat, unique traditional foods such as fermented dairy products, fasting practice, and ownership of a home vegetable garden, which may contribute to the health outcomes provided by the 'traditional' Mediterranean diet.

The literature supports that the 'traditional' Mediterranean diet is much more comprehensive than just a collec-

Table 3. Elements measured in selected Mediterranean diet index tools[†]

Type of index	Trichopoulou et al 1995, ⁵ <i>Greece (MDPS)</i>	Trichopoulou et al 2003, ¹⁶ <i>Greece</i>	Ciccarone et al 2003, ¹¹² <i>Italy</i>	Goulet et al 2003, ¹³ <i>Canada</i>	Panagiotakos et al 2007, ¹⁰⁹ <i>Greece (MedDietScore)</i>	Schroder et al 2011, ¹⁵ <i>Spain (MEDAS)</i>	Sotos-Prieto et al 2014, ¹¹⁴ <i>Spain (MEDLIFE)</i>
	Mediterranean diet pattern	Mediterranean diet pattern	Mediterranean diet pattern	Mediterranean diet pattern	Mediterranean diet pattern	Mediterranean diet pattern + cuisine	Mediterranean diet pattern + lifestyle
Number of elements assessed	8	9	15	11	11	14	28
Vegetables	X	X	X	X	X	X	X
Vegetables raw	-	-	X	-	-	-	-
Vegetables variety	-	-	-	-	-	-	-
Dark green leafy vegetables	-	-	-	-	-	-	-
Sofrito	-	-	-	-	-	X	-
Carrots	-	-	X	-	-	-	-
Potatoes	-	-	-	-	X	-	X
Onions/garlic/leeks/shallots	-	-	-	-	-	-	-
Fruit	-	-	X	X	X	X	X
Fruits & nuts composite	X	X	-	-	-	-	-
Nuts	-	-	-	-	-	X	-
Olives	-	-	-	-	-	-	-
Nuts & olives composite	-	-	-	-	-	-	X
Legumes	X	X	-	-	X	X	X
Legumes, nuts & seeds composite	-	-	-	X	-	-	-
Cereals	X	X	-	-	-	-	X
Cereals wholegrain	-	-	-	X	X	-	-
Wholegrain preference	-	-	-	-	-	-	X
Dairy	X	X	-	X	X	-	-
Dairy low fat	-	-	-	-	-	-	X
Dairy fermented e.g., yoghurt, fetta	-	-	-	-	-	-	-
Cheese (all types)	-	-	X	-	-	-	-
Meat & meat products	X	X	X	X	X	X	X
Processed meat	-	-	X	-	-	-	X
Poultry/white meat	-	-	-	X	X	-	X
White meat preference	-	-	-	-	-	X	-
Fish/seafood	-	X	X	X	X	X	X
Eggs	-	-	X	X	-	-	X
Olive oil extra virgin	-	-	-	-	-	-	-
Olive oil	-	-	X	X	X	X	X
Olive oil principal fat	-	-	-	-	-	X	-
Vegetable oil	-	-	X	-	-	-	-

[†]For the sake of brevity, the lifestyle and non-food elements of cooking or eating behaviour discussed in this review are not represented in this table as none of the existing tools assessed these except for a measure of snacking behaviour in MEDLIFE, which also includes additional lifestyle elements. For Goulet et al a maximum of 1 point from refined grain products counted towards wholegrain products; a maximum of 1 point from vegetable juice counted towards vegetables; a maximum of 1 point from fruit juice counted towards fruit; a maximum of 1 point from canola oil or olive oil margarine counted towards olive oil.¹³

Table 3. Elements measured in selected Mediterranean diet index tools[†] (cont.)

Type of index	Trichopoulou et al 1995, ⁵ <i>Greece (MDPS)</i>	Trichopoulou et al 2003, ¹⁶ <i>Greece</i>	Ciccarone et al 2003, ¹¹² <i>Italy</i>	Goulet et al 2003, ¹³ <i>Canada</i>	Panagiotakos et al 2007, ¹⁰⁹ <i>Greece (MedDietScore)</i>	Schroder et al 2011, ¹⁵ <i>Spain (MEDAS)</i>	Sotos-Prieto et al 2014, ¹¹⁴ <i>Spain (MEDLIFE)</i>
	Mediterranean diet pattern	Mediterranean diet pattern	Mediterranean diet pattern	Mediterranean diet pattern	Mediterranean diet pattern	Mediterranean diet pattern + cuisine	Mediterranean diet pattern + lifestyle
Butter	-	-	X	-	-	-	-
Margarine	-	-	X	-	-	-	-
Cream	-	-	X	-	-	-	-
Butter, margarine, cream composite	-	-	X	-	-	X	-
MUFA: saturated fat ratio	X	X	-	-	-	-	-
Sugary beverages	-	-	-	-	-	X	-
Sugary beverages limited intake	-	-	-	-	-	-	X
Sweets	-	-	-	X	-	X	X
Processed snacks	-	-	-	-	-	-	X
Salt limit at meals	-	-	-	-	-	-	X
Lemon/vinegar in food preparation	-	-	-	-	-	-	-
Herbs & spices	-	-	-	-	-	-	-
Herbs, spices & onion/garlic garnish	-	-	-	-	-	-	X
Water	-	-	-	-	-	-	-
Herbal teas	-	-	-	-	-	-	-
Water or herbal teas	-	-	-	-	-	-	X
Coffee	-	-	-	-	-	-	-
Alcohol	X	X	X	-	X	-	-
Wine	-	-	-	-	-	X	X
Snacking behaviour	-	-	-	-	-	-	X

[†]For the sake of brevity, the lifestyle and non-food elements of cooking or eating behaviour discussed in this review are not represented in this table as none of the existing tools assessed these except for a measure of snacking behaviour in MEDLIFE, which also includes additional lifestyle elements. For Goulet et al a maximum of 1 point from refined grain products counted towards wholegrain products; a maximum of 1 point from vegetable juice counted towards vegetables; a maximum of 1 point from fruit juice counted towards fruit; a maximum of 1 point from canola oil or olive oil margarine counted towards olive oil.¹³

tion of foods. It includes a cuisine with unique recipes and other psycho-social factors that may also impact on food and nutrient intake, although a broader discussion of social science parameters is outside the scope of this review. Taking these factors into consideration, it has been proposed that integrating the concept of the Mediterranean diet with the concept of the Mediterranean way of cooking should become a priority for the future.¹¹⁵ Cannon¹¹⁶ suggests nutrition scientists should pay attention to the history, tradition and culture of foods as they do to biochemistry, food chemistry and other emerging and relevant scientific areas e.g., the microbiome and nutrigenomics.

When designing new tools or updating existing ones to assess or promote adherence to the 'traditional' Mediterranean diet, researchers may wish to consider a more holistic definition as endorsed by UNESCO and include additional measures (either directly or by proxy), while giving consideration to regional food cultures where the tool is intended for use.¹¹⁷ These measures include:

1. Frequency of intake of home cooked meals
2. Style of cooking methods used
3. Frequency of eating main meals in company vs. alone
4. Number of snacking occasions outside main meals
5. Regular fasting of any type
6. Availability of a home vegetable garden
7. Use of traditional foods (or their nutritional counterparts) and combinations within dishes
8. Napping after the main midday meal

Tools that incorporate traditional culinary practices and eating habits from the 'traditional' Mediterranean diet may have increased usefulness for researchers, health professionals, school educators, chefs and the general public.^{113,118,119}

Conclusion

Plant based diets appear best for the prevention of chronic disease,^{67,120} and a more sustainable way of eating for the future.¹²¹ The Mediterranean diet shares many food similarities with modern vegetarian diets, but may find greater acceptance due to its high palatability and allowance for a low intake of animal foods.^{122,123} The Mediterranean diet is recommended for use by dietary guidelines in Australia and the US.^{124,125} Increased compliance with a Mediterranean diet pattern, even in non-Mediterranean countries, has been associated with protection against chronic disease and a decreased risk of premature mortality.^{29,73,126} As the 'traditional' Mediterranean diet includes additional culinary and consumption habits for a 'way of life' uncommon in modern society, future research should assess the relevant contribution of these elements to the effectiveness of the Mediterranean diet and give consideration to their inclusion in educational and index tools for research, clinical practice and public health promotion.

ACKNOWLEDGEMENTS

We thank St Vincent's Clinic Foundation, Sydney, Australia for funding of a multidisciplinary grant.

AUTHOR DISCLOSURES

On behalf of all authors, the corresponding author declares there is no conflict of interest for this review. St Vincent's Clinic

Foundation provided a multi-disciplinary grant to support publication of this manuscript.

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