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ROUNDTABLE REPORT

Coffee, caffeine, mortality and life expectancy

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Overview

A roundtable of European experts from a variety of backgrounds, including academic research, medical practice and professional associations, convened at the Royal Society of Medicine, London, to discuss the latest research on coffee and life expectancy.

Professor Miguel Martínez-González, Chair of the Department of Preventive Medicine and Public Health, University of Navarra, Spain; and Sian Porter, Registered Dietitian and spokesperson for the British Dietetic Association, shared their knowledge and expertise with roundtable delegates, leading a discussion on the known associations between coffee intake and a reduced all-cause mortality, and the potential mechanisms behind these associations. The delegates discussed the research and considered messages that could be appropriate for dissemination by health professionals.

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Introduction

Life expectancy provides an indication of health status across different population groups. Many factors can impact life expectancy, including gender, age, diet, genetics and disease risk. Life expectancy data can be used to compare health across different countries, cultures and socio-economic groups. Life expectancy can be expressed as average number of years that an individual is expected to live, 'period life' expectancy uses mortality rates from a single year or group of years and assumes that those rates apply throughout the remainder of a persons life[1,2].

Mortality data may be expressed as a summary figure representing all-cause mortality or can be broken down to specific disease incidence, such as mortality from cardiovascular disease or cancer.

The experts

Professor Miguel Martínez-González
*Professor of Nutrition,
University of Navarra, Spain*

Ms Sian Porter, RD MBDA
*Consultant dietitian, Spokesperson
for The British Dietetic Association, UK*

The delegates:

Professor Arne Astrup
*Head of Department of Nutrition,
University of Copenhagen, Denmark*

Dr Ellie Cannon
NHS General Practitioner, UK

Dr Maria Benedetta Donati
*Department of Epidemiology and
Prevention, IRCCS Neuromed, Italy*

Dr Guiseppe Grosso
*Research fellow, Azienda Ospedaliera
Universitaria Policlinico Vittorio
Emmanuelle, Italy*

Dr JW Langer
*Medical doctor, author, lecturer
and medical journalist, Denmark*

Dr Maria del Puy Portillo
*Researcher, University of the Basque
Country, Spain*

Dr Elisabet Rothenberg
*Assistant professor, Department of Food
and Meal Science, Kristianstad University,
Sweden*

Dr Raul Zamora-Ros
*Nutritional Epidemiologist,
Catalan Institute of Oncology, Spain*

N.B. opinions expressed in this report are of those present at the roundtable and not of the associations they represent or ISIC

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Coffee consumption and all-cause mortality

A number of meta-analyses have considered the impact of coffee consumption on all-cause mortality, as well as specific disease mortality statistics, such as risk of cancer or cardiovascular disease.

Overall, data from meta-analyses suggests an inverse but non-linear association between coffee consumption and all-cause mortality, with the greatest benefit at 3-5 cups of coffee per day[3–10].

ALL-CAUSE MORTALITY

Source: Grosso et al. (2016)

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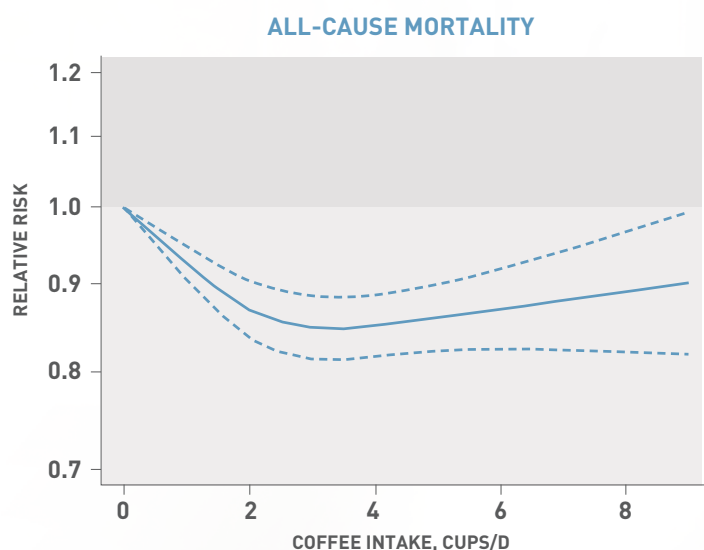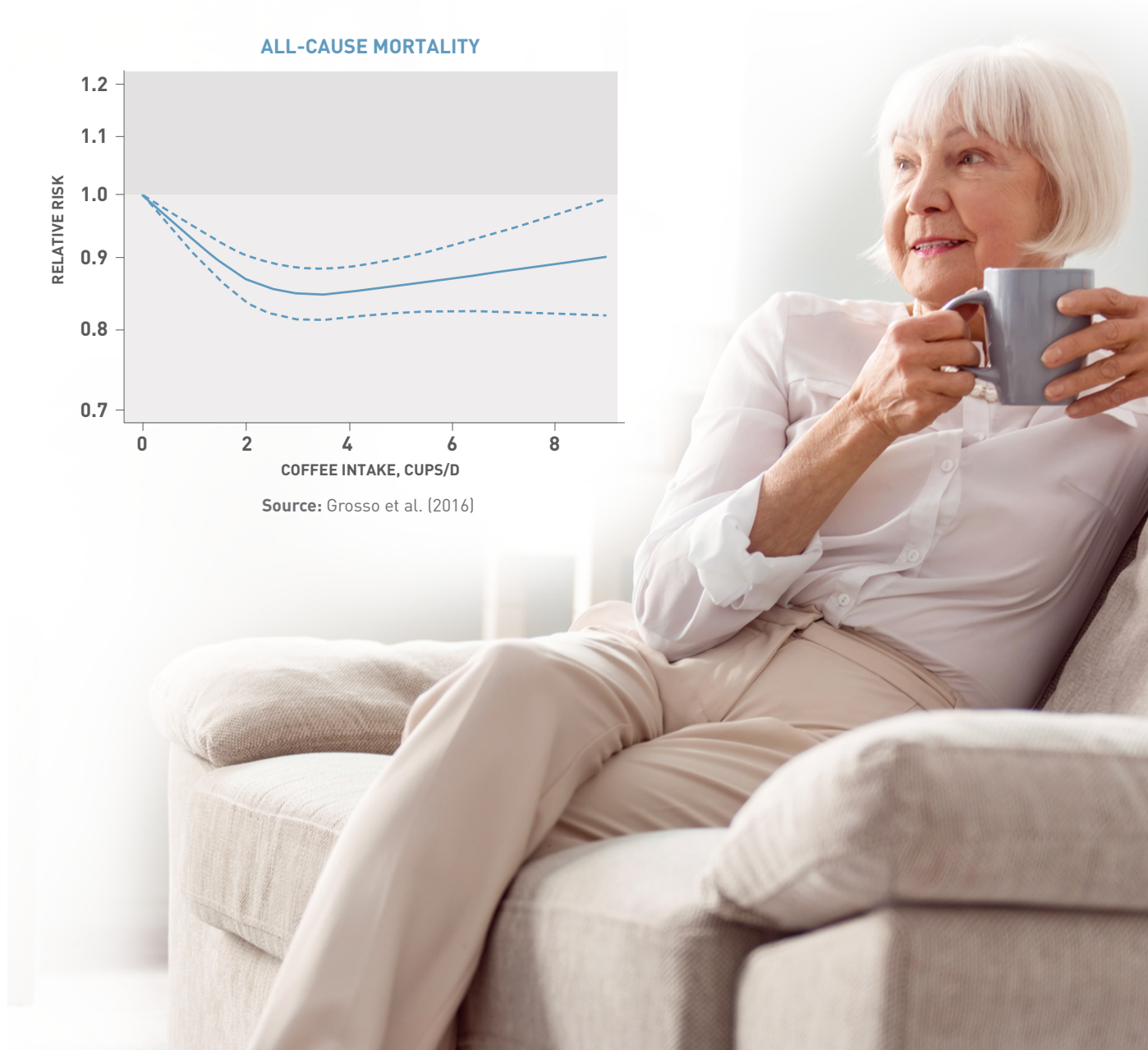
Professor Martínez-González presented a few of the meta-analyses that have been undertaken and the results are summarised below:

META-ANALYSIS	SUMMARY
Malerba et al. *Eur J Epidemiol.* 2013;28(7)527–39	12% reduction in all-cause mortality for highest versus low (≤1 cup/day) coffee drinking categories, and 13% for the smoking adjusted studies.
Je et al. *Br J Nutr.* 2014;111(7):1162–73	14% reduction in total mortality for high coffee consumers when compared with those with low intakes of coffee.
Crippa et al. *Am J Epidemiol.* 2014;180(8)763–75.	Strong evidence of nonlinear associations between coffee consumption and mortality for all causes. 16% risk reduction for 4 cups/day for all-cause mortality.
Zhao et al. *Public Health Nutr.* 2015;18(7):1282–91	Compared with non/occasional coffee drinkers, 11% reduction in all-cause mortality for 1-<3 cups/day, 13% for 3-<5 cups/day and 10% for ≥5 cups/day, and the relationship was more marked in females than in males.
Grosso et al. *Eur J Epidemiol.* 2016 Dec;31(12):1191–1205.	Consumption of 3–4 cups/day was associated with 17% lower mortality risk in men and 37% in women.
Poole et al. *BMJ* 2017;359:j5024	17% risk reduction at intakes of 3-4 cups/day versus none, including all-cause mortality.

In their 2016 meta-analysis, Grosso et al suggested that the association between coffee consumption and a reduced mortality was particularly notable at 3–4 cups of coffee a day, whilst at higher intakes no additional benefit was observed[7].

The 2017 Poole umbrella meta-analysis supported a non-linear inverse association between coffee consumption and a number of disease outcomes. In relation to all-cause mortality, the author suggested that a daily intake of 3–4 cups of coffee is associated with a 17% reduction in all-cause mortality compared to other levels of coffee intake[8].

In addition to the above meta-analyses, 2017 saw the publication of two large studies, both focused on coffee consumption and mortality[9,10].

The study by Imperial College London and IARC used data from the European Prospective Investigation into Cancer and Nutrition (EPIC) study to analyse coffee consumption and mortality rates from over 500,000 people across 10 European countries[9]. After 16 years of follow up, and adjusting for possible confounding factors such as smoking status, the data showed that participants with the highest consumption of coffee had a lower risk for all-causes of death, compared to those who did not drink coffee[9].

Another study, also featuring a large sample size, used data from the Multiethnic Cohort Study, with over 200,000 non-white participants, to examine the relationship between coffee and mortality[10]. The study found that, compared with drinking no coffee, coffee consumption was associated with lower total mortality after adjustment for smoking and other potential confounders. Participants who consumed a cup of coffee a day were 12% less likely to die compared to those who didn't drink coffee[10].

A 2018 paper also concluded that coffee drinking was inversely associated with mortality, including among those drinking 8 or more cups per day and those with genetic polymorphisms indicating slower or faster caffeine metabolism[11].

All-cause and disease specific mortality

Malerba et al. suggested an inverse association between coffee intake and all-cause mortality but particularly noted a slight positive association with cancer incidence as well as with pregnancy outcome and in postmenopausal women with fractures[3]. Professor Martínez-González emphasised that the confidence interval for the data on diabetes in this study was narrow, suggesting a well-established effect of coffee consumption in association with a reduced risk of type 2 diabetes.

Maria Benedetta Donati shared her own work looking specifically at prostate cancer risk in an Italian cohort study, which suggested that a reduced risk of prostate cancer was associated with consumption of Italian style coffee. She suggested that these results were potentially associated with the observations that coffee consumption is associated with a reduced overall mortality[12].

"In relation to all-cause mortality, the author suggested that a daily intake of 3-4 cups of coffee is associated with a 17% reduction in all-cause mortality compared to other levels of coffee intake[8]"

Coffee and all-cause mortality in a Mediterranean cohort

Professor Martínez-González presented detailed data from his own research, which considers coffee consumption and all-cause mortality in a Mediterranean cohort of university graduates from the SUN project, who are followed up biannually to gather further data. Data collection began in 1989 *(as yet unpublished)*.

For Professor Martínez-González's study, total coffee intake was obtained using a food frequency questionnaire, recorded in serving sizes of 50ml. This included both caffeinated and decaffeinated coffee, although the consumption of decaffeinated was almost negligible. Coffee drinkers were grouped according to their level of consumption with the most common level of consumption between 1 and 4 cups per day.

The results suggest a reduction in all-cause mortality in relation to coffee consumption in the SUN cohort, at intakes of 3–6 cups of coffee a day.

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Subgroup analyses

The association was particularly noted in participants aged over 55 years

'Never smoking' was associated with a lower all-cause mortality than 'ever smoked'

Those who showed a strong adherence to a Mediterranean diet had a lower all-cause mortality than those with a weaker adherence

The addition of sugar to beverages was associated with a weaker effect on mortality than in those who did not sweeten their beverages

Professor Martínez-González made a particular effort in designing the research to remove any reverse causality bias; which in this instance would be caused by participants with a history of disease (such as cancer or type 2 diabetes, putting them at higher risk of mortality) avoiding coffee as they change their dietary habits, thus confusing any statistical correlation between coffee consumption and mortality. However, when reviewing the data, Professor Martínez-González concluded that there was no bias.

Confounding factors

Research data must be interpreted carefully to ensure that any confounding factors that may affect the results are carefully controlled for.

A key factor when considering coffee intake and all-cause mortality data is the occurrence of smoking, currently or previously. Professor Martínez-González explained that his team had taken particular steps to analyse the effect of smoking in detail. Not only did they request information on whether participants were smokers currently, but they also gathered information on whether they had previously been smokers and if so how long it had been since they had smoked. He remarked that the proportion of smokers in the 'higher coffee consumption' group in his study was also higher. Dr Donati and Dr Langer, whilst speaking from their own national perspectives, agreed that associations between smoking and coffee consumption differed in populations. Smoking appears to have a notable effect on mortality data, reducing the benefit associated with coffee consumption. Professor Martínez-González advised that this level of detail was important to understand the true effects of coffee consumption. Dr Grosso suggested that smoking can be either a confounding factor or an effect modifier. In a given cohort an association between coffee consumption and smoking may modify the outcome that is being measured. He explained that in an Eastern European cohort there was a strong association between coffee drinking and smoking, whilst in the Spanish cohort the association was not so strong.

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The Imperial/IARC study suggested that there was a significant inverse linear trend between coffee intake and all-cause mortality. In line with other research, the authors suggested that there was a striking difference between smokers and 'never smokers'[9].

Dr Rothenberg proposed that the overall food quality of the diet could also have an impact and may be associated with smoking incidence. Professor Martínez-González agreed, suggesting that in the SUN cohort there was good adherence to high quality diet as they were all graduates and quality of diet was better. He suggested this was also the case with the Nurses Health Study as this was a motivated and health conscious cohort.

"Smoking appears to have a notable effect on mortality data, reducing the benefit associated with coffee consumption."

Potential mechanisms

The evidence presented on coffee consumption and reduced all-cause mortality was compelling, leading the roundtable to discuss the potential mechanisms behind this association. Professor Martínez-González commented that coffee is complex and contains a number of compounds including caffeine, polyphenols, and the diterpenes cafestol and kahweol, and it can be difficult to identify one specific element to explain an effect. For more information on coffee composition click here.

Together with Dr Grosso, they suggested that caffeine was unlikely to explain the effect on mortality, mentioning a potential role for polyphenols, such as chlorogenic acid, found in coffee, which may have antioxidant and anti-inflammatory effects. Indeed, previous discussions on the associations with a reduced risk of liver disease and type 2 diabetes have also suggested that an anti-inflammatory effect may be particularly important in these conditions too. See Looking after the liver: lifestyle coffee and caffeine report.

The roundtable concluded that whilst the research showing an association between coffee consumption and reduced all-cause mortality is well documented, the mechanisms to explain this effect are unknown and further work is required.

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Coffee drinking in Europe

Sian Porter discussed the variability in coffee consumption throughout Europe, particularly noting the lower levels of coffee consumption in Southern Europe compared to Northern Europe.

Actual coffee Intakes (ml per day) by grouping low/medium/high

	LOW	LOW TO MED	MED TO HIGH	HIGH
DENMARK	500ml	900ml	1300ml	1300ml+
FRANCE	150ml	280ml	450ml	450ml+
GERMANY	261ml	395ml	580ml	580ml+
GREECE	70ml	140ml	240ml	240ml+
ITALY	60ml	92ml	138ml	138ml+
THE NETHERLANDS	375ml	500ml	750ml	750ml+
NORWAY	300ml	420ml	540ml	540ml+
SPAIN	50ml	105ml	196ml	196ml+
SWEDEN	300ml	400ml	601ml	601ml+
UK	83ml	380ml	488ml	488ml+

Source: Gunter, M. J. et al. (2017). Coffee Drinking and Mortality in 10 European Countries: A Multinational Cohort Study.

This prompted a group discussion about the variability in choice of coffee beverages throughout Europe, highlighting a wide variation in the coffee culture across Europe. Small espresso style coffee is favoured in many southern European countries, whilst longer coffee beverages are preferred in many northern European countries. Indeed, Professor Martínez-González commented that the coffee typically drunk in his Spanish cohort was espresso style coffee without added sugar or milk, and had not been filtered through a paper filter (which typically retains the diterpenes that are associated with raising cholesterol levels[12,13]). Dr Grosso further commented from his work in Eastern European countries that the population typically hydrates with tea and coffee, while in Italy coffee beverages are small and water is drunk additionally. These factors all add variables to coffee and mortality research.

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Individual variability in response to coffee drinking

Commenting on the variability in intakes of coffee, Dr Langer shared his expertise on individual responses to caffeine, which are moderated by genetic variability in the pathways for metabolism of caffeine (for more information see Genetics, metabolism and individual responses to caffeine and 'Inter-individual differences in caffeine metabolism and factors driving caffeine consumption'[14]).

Whilst Dr Langer advised that individuals can be divided into fast and slow metabolisers of caffeine according to a genetic polymorphism, Professor Martínez-González suggested that this was not involved in the association between coffee intake and all-cause mortality.

Communicating the science around coffee and health

Sian Porter outlined the importance of using appropriate language when communicating scientific research findings to the general public. Health professionals, including dietitians, are experts in translating scientific information into user-friendly language and providing evidence-based advice to the public. Dr Langer agreed that communicating science accurately to the public can be difficult as scientific research often does not give definitive answers, rather presents associations between lifestyle choices and health outcomes.

The roundtable agreed that the research on coffee consumption and all-cause mortality provides valuable evidence-based information about the role of coffee in the diet. In considering specific advice on coffee intake, the group agreed that coffee beverages could be part of a healthy, balanced diet for most people. Since research suggests particular benefits associated with coffee consumption, including a reduced all-cause mortality, a reduced risk of type 2 diabetes, and a reduced risk of cardiovascular disease, the group felt this information was important to share[3-10].

Dr Cannon raised the question of how best to communicate this information to patients, when typically coffee intake is not discussed during a patient consultation. Professor Astrup suggested that advice to drink coffee as a potential

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preventative measure could be given to patients specifically at risk of cardiovascular disease or type 2 diabetes, given the strong research base indicating that coffee can help reduce the risk of both conditions. Professor Astrup also put forward the notion that, as research suggests that in the general healthy population coffee has no adverse effects, people can safely drink coffee if they like it, and do not need to change their consumption habits (provided they are not exceeding the daily recommended allowance[15]). He also suggested that some may turn to coffee to address issues like daytime tiredness, rather than addressing the underlying problem of sleep deficit. Professor Martínez-González's added that pregnant women and some people on specific medications need to exercise caution with caffeine intakes. Dr Rothenberg reminded the roundtable that consumption depends on context — that is, coffee in conjunction with a healthy diet can be beneficial, but if consumed as part of a cigarette break, for example, it is unlikely to provide much benefit. Dr Langer agreed and emphasised Professor Astrup's point that people should be reassured that, if they enjoy coffee, they can continue to enjoy it as part of a healthy diet without concern.

Sian Porter reminded the roundtable of the advice from the European Food Safety Authority on caffeine intakes in the population, which advises that 400mg caffeine per day is fine for healthy adults, with single doses of caffeine of up to 200mg. Pregnant women should limit their caffeine intake to 200mg per day.

Professor Martínez-González's work suggested that higher coffee intakes were associated with slightly higher total energy intakes, leading the group to acknowledge that those who eat more would be likely to drink more too. Sian Porter pointed out that additions to coffee (such as sugar, milk and cream) can increase the calorific value of a beverage and consumers should be advised to monitor the amount of added fat and sugar in their preferred coffee beverages. Dr Cannon mentioned that in the UK, chain-store coffee shops do typically sell coffee with syrups and creams that are very different to the plain black coffees preferred in countries such as Spain, the location of Professor Martínez-González's research cohort.

efsa
European Food Safety Authority

"Sian Porter reminded the roundtable of the advice from the European Food Safety Authority on caffeine intakes in the population, which advises that 400mg caffeine per day is fine for healthy adults, with single doses of caffeine of up to 200mg. Pregnant women should limit their caffeine intake to 200mg per day."

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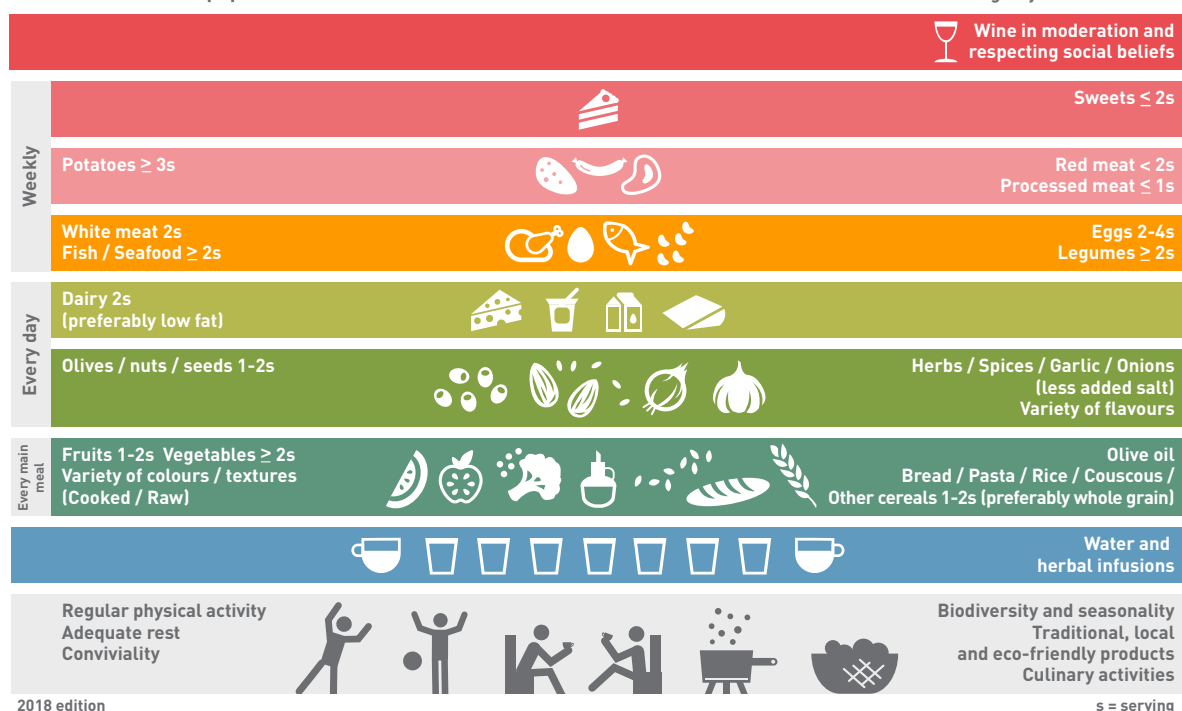from the institute for scientific information on coffee

Dr Langer added that the potential associations between coffee intake and body weight were interesting. The Nurses Health Study suggested that intakes of caffeine and coffee had a suppressive effect on appetite, and that those with a higher intake of coffee had lower weight gain. Indeed Dr Langer in a study of his own gave 100mg caffeine 3 times a day, which resulted in a small fat loss in a group of adults. Clearly this is an area for further investigation.

A Mediterranean diet

Professor Martínez-González undertook his work in a Mediterranean cohort, prompting a discussion with Sian Porter about the attributes of this style of diet with its abundance of fruit, vegetables, healthy fats, and fibre. Other roundtable members added that the diet can be adapted to suit local foods, for instance Dr Langer outlined that in Scandinavian countries rapeseed (canola) oil can be substituted for olive oil. Overall the group supported a role for the Mediterranean-style diet, and added that coffee can be part of this regime for those who enjoy it. In addition, there was a discussion of the growing science surrounding a modern Nordic diet, which has also been linked to specific health benefits, although the amount of research is smaller than for a Mediterranean diet. Dr Langer mentioned his own research programme in Denmark using the principles of the Mediterranean diet substituted with foods available in Nordic countries (local and regional products that were therefore more sustainable). The results suggested that such a diet gave similar results to the traditional Mediterranean diet when various health outcomes were considered.

Mediterranean Diet Pyramid: a lifestyle for today
Guidelines for Adult population

Serving size based on frugality and local habits

Wine in moderation and respecting social beliefs

Weekly

Sweets ≤ 2s

Potatoes ≥ 3s

Red meat < 2s
Processed meat ≤ 1s

White meat 2s
Fish / Seafood ≥ 2s

Eggs 2-4s
Legumes ≥ 2s

Every day

Dairy 2s
(preferably low fat)

Olives / nuts / seeds 1-2s

Herbs / Spices / Garlic / Onions
(less added salt)
Variety of flavours

Every main meal

Fruits 1-2s Vegetables ≥ 2s
Variety of colours / textures
(Cooked / Raw)

Olive oil
Bread / Pasta / Rice / Couscous /
Other cereals 1-2s (preferably whole grain)

Water and
herbal infusions

Regular physical activity
Adequate rest
Conviviality

Biodiversity and seasonality
Traditional, local
and eco-friendly products
Culinary activities

2018 edition

s = serving

Source: Fundación Dieta Mediterránea ″Mediterranean Pyramid′[16].

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In summary

Data on cause of death and years lived combined with life expectancy data can be a useful way to understand the general population's health, and is research that is frequently examined by health organisations to help inform policy to guide people towards healthier diets and lifestyles. The growing body of research on coffee consumption and all-cause mortality presents new data for consideration, although more research is needed to understand the association and mechanisms behind the results.

About ISIC

The Institute for Scientific Information on Coffee (ISIC) is a not-for-profit organization, established in 1990 and devoted to the study and disclosure of science related to "coffee and health." Since 2003 ISIC also supports a pan-European education programme, working in partnership with national coffee associations in nine countries to convey current scientific knowledge on "coffee and health" to health care professionals.

ISIC's activities are focused on:

↘ the study of scientific matters related to "coffee and health"

↘ the collection and evaluation of studies and scientific information about "coffee and health"

↘ the support of independent scientific research on "coffee and health"

↘ active dissemination of balanced "coffee and health" scientific research and knowledge to a broad range of stakeholders.

ISIC respects scientific research ethics in all its activities. ISIC's communications are based on sound science and rely on scientific studies derived from peer-reviewed scientific journals and other publications.

ISIC members are six of the major European coffee companies: illycaffè, Jacobs Douwe Egberts, Lavazza,Nestlé, Paulig, and Tchibo.

About coffeeandhealth.org

The website www.coffeeandhealth.org is a science-based resource developed for health care and other professional audiences and provides the latest information and research into coffee, caffeine and health.

Follow us on twitter: @coffeeandhealth

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