The French Paradox: What can we learn from the French?

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Heart disease research has been ongoing for nearly a century with early observations and studies dating back to the 1940s. Landmark studies such as Ancel Keys' famous Seven Countries Study and the Framingham Heart Study as well as other early epidemiological studies and clinical trials examining coronary heart disease (CHD) paved the way for what would be infamously known as the diet-heart hypothesis.[1] The diet-heart hypothesis speculated that dietary saturated fat and cholesterol were the major causes of CHD.[1,2] This concept, although controversial, was adopted by the American Heart Association (AHA) and later became a part of the national agenda with its publication in the "Dietary Goals for the United States."[2,3] Over the years, it received further support from the federal government as well as promotion by physicians, the food industry, and the media.[1]

Although major studies, such as the Seven Countries Study, provided evidence of a correlation between saturated fat and cholesterol with CHD, other studies yielded inconsistent results.[2] A French epidemiologist, J.L. Richard, and colleagues, conducted a systematic comparison among three epidemiological studies (Paris Prospective Study, Seven Countries Study, and the Pooling Project) and found the incidence of CHD was lower in the French cohorts compared to American cohorts.[4] The lower rates of CHD were not aligning with the high dietary fat intake of the French.[5] Further findings from the MONICA Project (Multinational MONItoring of trends and determinants in CArdiovascular Disease), which examined the incidence and trends of CHD at the population level from the early 1980's to 1990's, confirmed Richard and colleagues' observations. That is, there were lower CHD mortality incidence rates in the French compared to other industrial countries such as the U.S. despite higher intakes of saturated fat and high serum cholesterol levels.[6] This apparent discrepancy, known as the "French Paradox", has been the subject of much debate.[7] Interest in this paradox led to the expansion of research on CHD. Nevertheless, a clear answer about why the French seem to defy the odds with lower CHD risk is lacking. Several hypotheses have been proposed in an attempt to explain the "French Paradox" phenomenon including the French consumption of red wine, incorporation of a Mediterranean diet, and high intakes of cheese, as well as their overall outlook and attitudes towards food and eating.

The Red Wine Hypothesis

The notion that wine consumption has a protective effect on CHD was first suggested in 1979 by St. Leger et al. whose observations in 18 developed countries reported an inverse association between wine intake and CHD mortality rate.[7,8,9] At that time, the belief was that alcohol reduced the risk of CHD by preventing atherosclerosis through increasing blood HDL cholesterol. In France, however, the serum levels of HDL were no higher than other countries. Through closer examination of hemostatic factors, Renaud et al postulated that the alcohol in wine reduces CHD risk through inhibition of platelet reactivity.[10] Since this finding, several epidemiological and experimental studies have sought to assess the associations and mechanisms involving red wine consumption and CHD.[7,8,11] To date, it is unclear whether the beneficial effects of red wine are derived from its non-alcoholic components or due to the alcohol itself.[12]

Polyphenols are non-alcoholic agents in red wine which may be cardio-protective; of these, the flavonoids and resveratrol are thought to be the most beneficial to heart health.[8,11] Polyphenols are natural chemical substances known for their antioxidant capacity and are present in the grapes that are used to produce wine. In addition to grapes, many fruits and vegetables also contain an abundant amount of polyphenols. As a result, this has led to the belief that the "wine-heart" hypothesis does not fully explain the French Paradox and its popularity may be more a result of powerful lobbying by the wine industry.[7]

Some studies have suggested that lifestyle factors associated with wine consumption may contribute to the reduced risk of CHD in addition to the wine itself.[12] A cross-sectional survey evaluating quantity of alcohol intake and beverage preference according to socio-economic status, diet, and lifestyle characteristics of 1,110 middle-aged French men found that moderate wine drinkers (1-19 g alcohol/day which is ~1-2 five oz. glasses of wine) tended to consume an overall healthier diet, smoked less, and were more educated

and physically active than both heavier consumers (>19 g alcohol/day) and non-drinkers (0 g alcohol/day).[12] Similar findings from a French cohort study of 196,000 subjects showed that wine consumers purchased healthier foods.[13] Since consuming a healthy diet, being a non-smoker, and being physically active all have been shown to be beneficial ways to reduce the risk of CHD, is it the wine itself that is the basis of lower mortality from CHD, or is it the diet and lifestyle of moderate wine drinkers that explain the benefits attributed to wine? Or is it a combination of both?

Another interesting statistical trend to consider reveals that although death rates for diseases of the circulatory system are low in France, the deaths attributable to alcohol (liver cirrhosis, certain cancers, alcohol related accidents, etc.) are high.[14] Thus, while alcohol consumption may be associated with a reduced risk for heart disease, its detrimental effects may outweigh its benefit.

In summary, even though drinking red wine may appear to be the magic ingredient to prevent heart disease and an answer to the French Paradox, there are still unanswered questions and contradictions to this theory. This is why the AHA currently recommends an average of 1-2 drinks a day for men and one drink per day for non-pregnant women but emphasizes that drinking more alcohol than recommended increases the risk for high blood pressure, obesity, stroke, breast cancer, suicide, alcoholism, and accidents.[15] Because of these potential risks as well as others, the AHA advises people against consuming alcohol if they do not already.

Mediterranean Diet Hypothesis

Further results from the MONICA project revealed the southern European countries that border the Mediterranean had low CHD rates, similar to those of France.[16] This finding led to the idea that a Mediterranean diet, typically high in monounsaturated and polyunsaturated fat, may be able to explain the high intake of energy from fats (>35%) and yet very low rates of heart disease comparable to the French population.[16,17]

For the past two decades, epidemiological and clinical studies have investigated the relationship between the Mediterranean diet and CHD.[18] Results from these studies have shown that consuming a Mediterranean-like diet has protective effects against CHD through improvements in blood lipid levels and reductions in blood pressure, insulin resistance, and serum markers of inflammation.[19] With substantial evidence of its benefits, the Mediterranean diet is now considered to be one of the most effective dietary patterns for CHD prevention.[20] While there is no standard definition of the Mediterranean diet and the diets among Mediterranean countries are widely varied, common features include a high consumption of olive oil, legumes, whole grains, vegetables, fish, and wine, as well as a low consumption of red meat.[20]

Even though France borders the Mediterranean, the French may not follow the typical Mediterranean diet.[7] Results from the DAFNE (Data Food Networking) project, which analyzed the eating patterns of ten European countries, found the French pattern of eating to be more similar to the pattern of northern European countries than that of Mediterranean countries.[21] The French diet actually includes a substantial amount of butter, vegetable oils, juices, wines, and high intakes of cheese, red meats, and eggs.[7,17]

It has been argued that there is a gradient in the mortality rates within France with higher rates in the north, where the diet is more typical of northern Europe, and lower rates in the south where adoption of some typical Mediterranean foods has taken place.[7,20,22] However, standardized death rates from diseases of the circulatory system from 2008-2010 demonstrate that the CHD mortality rates are reasonably uniform throughout France.[23] Thus, the hypothesis that a Mediterranean diet fully explains the French protection against CHD is not fully supported.

The Cheese Hypothesis

The French have one of the highest levels of cheese consumption in the world. Even though cheese is high in saturated fat and cholesterol, it doesn't seem to effect blood cholesterol, LDL, and triglyceride levels and may actually be beneficial.[24] In fact, most prospective studies have found either no relationship or an inverse relationship between cheese intake and risk of CHD.[25]

Cheese contains a number of nutrients and bioactive components that may contribute to CHD prevention.

For example, dairy foods, including cheeses, are rich sources of calcium. Many studies have shown an inversea relationship between higher calcium intakes and decreased blood pressure.[26]

The antihypertensive properties of calcium are thought to be due to the mineral's vasorelaxing effect on smooth muscle. Furthermore, an inverse relationship between dairy calcium intake and body fat has been observed.[27] This finding may be attributed to dietary calcium forming insoluble calcium soaps with fatty acids and/or bile acids in the intestines, resulting in a decrease in fat absorption.[27]

Beyond calcium, dairy products are a major source of conjugated linoleic acids (CLA). CLA are a mixture of linoleic acid isomers with conjugated double bonds that are produced naturally in the rumen of animals such as cows, goats, and sheep. The CLA content of dairy products varies, but aged cheeses seem to have an increased CLA content.[28] With the high intake of cheese in France, it is no surprise that their dietary CLA intake is higher than that of other countries, including the United States.[29] Recently, CLA has been shown to have beneficial human health implications on atherosclerosis, immunity, cancer, and obesity.[30] Although the molecular mechanisms are still not fully known or understood, it is thought that CLA activates peroxisome proliferator-activated receptor (PPAR) mediated signaling, which in turn regulates expression of specific genes for metabolic, immune, inflammatory, and other biological functions.[30] For instance, Sofi et al. found that the consumption of pecorino cheese in the diet, which is naturally rich in CLA, significantly reduced platelet aggregation and inflammatory cytokines in a cross-sectional intervention study.[31] Despite such findings, very few highly controlled clinical studies looking at the effects of CLA on risk factors of CHD have been conducted.

In addition, fermentation is thought to alter the constituents in cheese, inhibiting LDL increases that would otherwise be expected with cheese consumption. For example, the ripening process of cheeses produces secondary metabolites called andrastins A-D, which have been shown to be inhibitors of a major cholesterol biosynthesis enzyme called farnesyltransferase. Thus, the highly molded cheeses like Roquefort, Camembert, and Gorgonzola may have an even more beneficial effect when it comes to CHD prevention.[25] Is cheese the overlooked element in the French paradox mystery? It is hard to tell. In the meantime, evidence supporting the recommendation of ripened cheese intake with respect to CHD prevention and treatment is lacking.

Food Attitudes and Beliefs

Additional cultural elements may play a synergistic role in protecting the French population from heart disease.[32] In fact, the meaning behind food in the lives of the French and the role food plays in their culture could be the underlying answer to the so-called "French Paradox." Culture and cultural values play a substantial role in determining how, where, and when foods are consumed. A cross-sectional study comparing meal patterns and cooking practices in France vs. England indicated that two-thirds of the French population reported eating together. This reflects how the French value the social aspects of eating and find pleasure in coming together at the table.[33] Because of this, the French take more time to eat and on average spend one-third longer eating a meal than people in the U.S.[7] Even with the infiltration of "fast-food" in the past decade, the French continue to hold to the value of taking time to eat as indicated by longer eating sessions even at McDonalds.[34] Previous research has shown that taking time to sit down and eat with others improves dietary intake.[35] The French also value quality in what they eat. Thus, it is of no surprise that the term gourmet has its roots in France. On the contrary, quantity is of emphasis in the English and American culture where portion sizes tend to be 25 percent larger than that of France.[7,32]

Beyond cultural values, there are substantial differences in the attitudes towards food and health between the French and Americans. A brief 25-item questionnaire exploring the role food plays in people's lives was given to college students and a random sample of adults residing in the U.S., Japan, Belgium, and France. Answers to the questionnaire revealed that Americans tend to worry most about their diet and are obsessed with trying to modify it

towards what they perceive to be more "healthy foods." The French experience less stress and more pleasure with eating and focus on the eating experience while Americans worry and focus on the consequences of what they eat.[32] Negative outlooks on diet and health, such as those expressed by the Americans, may have a negative influence on health outcomes as well as quality of life. Studies have shown that stress triggers the release of glucocorticoids as well as other chemical mediators and this chronic release can over time lead to ill effects on the cardiovascular system resulting in higher risk of CHD.[36]

Conclusion

It is unlikely that the French Paradox is due to a single causative factor. Possible factors such as moderate wine consumption, the incorporation of a Mediterranean-like diet, and cheese intake may all contribute to CHD prevention. In fact, beyond dietary intake, there seems to be a psychological component contributing to the health of the French. More research is still warranted in the field of CHD in order to modify and enhance current understanding of dietary and lifestyle factors that aid in primary prevention. For now, there seems to be limited risk and potential benefit in eating in the French tradition.[7] So, as the French would say, "bon appétit."

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