MINERVA HEALTH

High cholesterol and Coronary Artery Disease (CAD)

Coronary artery disease (CAD) occurs when the blood vessels in the heart become blocked. These blockages are usually caused by a build-up of cholesterol.

There are different types of cholesterol, including HDL (good) cholesterol and LDL (bad) cholesterol. LDL cholesterol is made up of very small particles which have a tendency to block blood vessels.

When a blockage occurs in the heart it can cause a heart attack; in the brain it can cause a stroke.

We need a certain amount of cholesterol for our bodies to function and this is produced by the liver. Excess cholesterol tends to come from our diets. Reducing excess cholesterol is essential to prevent heart attacks and strokes.

Research shows that maintaining lower than average cholesterol levels can prevent the development of blood vessel blockages, and even start to reverse any blockages that already exist.

Evidence shows that a plant-based diet is necessary for most people to achieve cholesterol levels low enough for this to happen. Additionally plant-based products such as sterols and fibre can actively lower cholesterol.

There is growing evidence that lifestyle changes can stop and even reverse blood vessel damage, even in people who have already suffered a heart attack or stroke. Evidence shows that the results of a lifestyle change can take effect very quickly, and last for many years.

Key points from Research:

- Cholesterol limits on blood tests are too broad -it is still very possible to suffer blood vessel blockages when cholesterol is within normal limits
- Maintaining total cholesterol < 3.8 and LDL cholesterol <1.8 prevents the development of cholesterol-related artery blockages
- Comparing different diets from meat-eaters to vegans shows that the closer we move to a plant-based diet the greater the reduction in cholesterol
- Some plant products including plant sterols and fibre actively help to reduce cholesterol
- An intensive lifestyle change can improve heart health in as little as 24 days
- An intensive lifestyle intervention can shrink blockages that are already present in blood vessels and significantly reduce the risk of heart attacks and strokes

How low should your cholesterol be?

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| Title | Optimal low-density lipoprotein is 50 to 70 mg/dl: Lower is better and physiologically normal |
| Link | https://reader.elsevier.com/reader/sd/pii/S0735109704007168?token=8104B6DBCFF5BFEACA946BAF09545BB84B1A863EC68624BA0C04A9297CD8542FB65B133F77FD6B3FC81B6CF21FA20D9A&originRegion=eu-west-1&originCreation=20211028174413 |
| Question | How low should your low density lipoprotein (LDL) cholesterol be? |
| Summary | This study looked at the risk of heart attacks or stroke based on LDL cholesterol levels. It found that patients with an LDL cholesterol of <1.5 had almost no risk of blocked blood vessels leading to heart attack or stroke. LDL levels of 1.3-1.8 are found in other mammals or in human infants. This is likely the natural range for humans too but due to changes in diet and lifestyle the average LDL cholesterol is generally >3. |
| Background | Low density lipoproteins (LDL) are small particles of cholesterol. They invade the lining of blood vessels and cause them to become damaged and blocked. This can lead to heart attacks and strokes.<br><br>It is usually recommended to keep LDL levels below 3.00. However there is some evidence that LDL levels of <3.00 can still cause damage. It is not clear what the ideal LDL level should be. |
| Methods | This study reviewed previous studies and evidence relating to LDL levels and risk of heart attack or stroke. |
| Results | Results showed that patients with normal levels of LDL cholesterol (<3.00 mmol/L) can still develop blood vessel blockages, and subsequently heart attacks and strokes. Lower LDL levels of 1.3-1.8 seem to prevent the build-up of cholesterol in blood vessels. These levels are similar to what is found in other animals and in newborn babies. |
| Conclusion | Lowering LDL cholesterol to <1.8 can prevent the development of block blood vessels and significantly reduce the risk of heart attack or stroke. |

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| Title | Updating a 12-year experience with arrest and reversal therapy for coronary heart disease (an overdue requiem for palliative cardiology) |
| Link | https://www.ajconline.org/article/S0002-9149(99)00290-8/fulltext (subscription required) |
| Question | Can coronary artery disease be cured? |
| Summary | This study looked at the effect of a low-fat plant-based diet on cholesterol levels over a 12 year period. It found that this diet resulted in a reduction in cholesterol from 6.1 mmol/L to 3.75 mmol/L. It also resulted in an improvement in coronary artery disease (CAD) in 73% of patients and prevented progression of CAD in 100% of patients. |
| Background | CAD is a condition in which the blood vessels of the heart become blocked by cholesterol. The blood vessels are blocked by collections of cholesterol called “plaques”. When these plaques become big enough to block the blood vessel this leads to heart attacks and death.<br>It is well known that lower cholesterol levels are associated with a lower risk of CAD. However it is not clear if there is a certain cholesterol level below which CAD does not occur, and existing CAD blockages can improve. |

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| Methods | 18 patients participated in this study. All had a history of advanced CAD. In the 8 years before this study, these 18 patients had suffered a combined total of 49 heart attacks.<br>All 23 patients were started on a strictly plant-based, low-fat diet and cholesterol medication as required. The aim was to maintain a total cholesterol level of <3.8 mmol/L. |
| Results | After 5 years, the average cholesterol of patients had decreased from 6.1 mmol/L to 3.5 mmol/L. 11 out of 18 patients underwent testing to look at the vessels in the heart. This showed that the existing blood vessel blockages had improved in 73% of cases. There was no progression of blood vessel blockages in any patients.<br>Patients were then followed for a further 7 years. 12 years after the start of the study, 16 out of 18 patients were still following the diet. The average cholesterol in this group was 3.75 mmol/L and they had experienced no deterioration in heart health, no further heart attacks and no need for additional heart procedures. |
| Conclusion | This study showed that maintaining cholesterol levels <3.8 mmol/L can prevent the development of CAD and improve existing CAD, even in patients with advanced disease. A plant-based, low-fat diet is necessary for most people to achieve this level of cholesterol. |

Can lowering cholesterol reverse blood vessel disease?

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| Title | Can Lifestyle Changes Reverse Coronary Heart Disease? |
| Link | https://www.ornish.com/wp-content/uploads/can-lifestyle-changes-reverse-coronary-heart-disease.pdf |
| Question | Can diet and exercise unblock blood vessels? |
| Summary | This study looked at the effect of an intensive lifestyle intervention on coronary artery disease (CAD). It found that patients who underwent this intervention had a reduction in the amount of blood vessel blockage after 12 months, ie an improvement in CAD. Patients who underwent standard treatment showed worsening of CAD over 12 months. |
| Background | Coronary artery disease (CAD) occurs when the blood vessels in the heart become blocked with cholesterol plaques. The severity of the disease depends on what percentage of the blood vessel is occluded by the blockage. When the blood vessel is significantly blocked it becomes impossible for enough blood and oxygen to get past the blockage. When this happens part of the heart muscle becomes starved of oxygen and dies. This is called a heart attack.<br><br>It is accepted that diet and exercise can help to prevent CAD from worsening. However it is not clear if these measures can improve existing CAD, or how lifestyle interventions compare to standard treatment. |
| Methods | 193 patients participated in this study. 53 were assigned to the intervention, 43 were assigned to the control group and asked to continue as normal. All patients had coronary arteriography performed at the beginning and at the end of the intervention period. |

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| | The intervention lasted for 12 months. It started with a one-week residential retreat during which patients learned the skills required for the intervention. Patients were then asked to follow a low-fat, plant-based diet, exercise for 3 hours per week, and practise stress-management techniques for one hour per day. There were group support sessions for 4 hours twice per week. |
| Results | After 12 months the intervention group showed improvement in CAD. Vessels that were initially 40% blocked were 37.8% blocked after 12 months of lifestyle changes. In the control group the blood vessel disease worsened over 12 months. Vessels that were initially 42.7% blocked became 46.1% blocked after 12 months in the control group.<br><br>More severely blocked vessels (>50% blocked) showed bigger improvements with the intervention. These vessels improved from 61.1% blocked to 55.8% blocked in the intervention group. In the control group these vessels worsened from 61.7% blocked to 64.4% blocked. |
| Conclusion | This study showed that an intensive lifestyle intervention over 12 months leads to a reduction in blood vessel blockages. Even a small reduction in these blockages can lead to greatly improved blood flow and a significantly lower risk of heart attacks and death. |

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| Title | Intensive Lifestyle Changes for Reversal of Coronary Heart Disease |
| Link | https://www.ornish.com/wp-content/uploads/Intensive-lifestyle-changes-for-reversal-of-coronary-heart-disease1.pdf |
| Question | Do lifestyle changes lead to continued improvements in heart health over 5 years? |
| Summary | This study looked at the effect of intensive lifestyle intervention in patients with coronary artery disease over 5 years. |
| Background | Coronary artery disease (CAD) refers to a condition in which bloods vessels in the heart become blocked with cholesterol. This can result in heart attacks.<br><br>It is well evidenced that lifestyle changes can reduce the progression of CAD but it is less clear if it can improve existing blockages and whether this continues to improve with long-term lifestyle changes. |
| Methods | 48 patients enrolled in this study. They were divided into two groups of 24. The treatment group underwent an intensive lifestyle intervention including stress-management, a low-fat, plant-based diet, regular exercise and group support meetings. The control group continued with standard treatment.<br><br>Patients were followed up for 5 years. The amount of blood vessel blockage was measured before and after the study period. |
| Results | 20 patients in the treatment group completed the study, compared to 15 patients in the control group. The percentage blood vessel blockage in the treatment group reduced from 38.9% to 35.9% after 5 years. The percentage blockage in the control group increased from 42.5% to 54.3% over 5 years. Patients in the control group were 2.5 times more likely to suffer a heart attack over the 5 year period than patients in the treatment group. |
| Conclusion | This study showed that CAD continues to improve over a 5 year period of lifestyle intervention. Without standard treatment only CAD deteriorates greatly |

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| | over the same period. After 5 years there was a 15% difference in the level of blood vessel blockage between the intervention and control groups. Compared to the intervention group, patients who did not receive a lifestyle in intervention were 2.5 times more likely to suffer a heart attack over the following 5 years. |

Which diet is best for lowering cholesterol?

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| Title | Vegetarian diet and cholesterol and triglycerides levels |
| Link | https://www.scielo.br/j/abc/a/77dRwx7BWZNNmjm6YWd3qBH/?lang=en |
| Question | Which diet is most effective for lowering cholesterol? |
| Summary | This study compared the effects of 4 types of diet on cholesterol levels. It found that the fewer animal products (meat and dairy) were consumed, the lower the average cholesterol level. Omnivores (people who eat everything) had an average total cholesterol of 5.4 mmol/L and an average LDL (bad) cholesterol of 3.2 mmol/L. Vegans had an average total cholesterol of 3.6 mmol/L and an average LDL cholesterol of 1.8 mmol/L. |
| Background | Cholesterol is responsible for clogging up blood vessels resulting in strokes and heart attacks. Low density lipoprotein (LDL) cholesterol is particularly bad for this. There is evidence that keeping LDL levels very low can negate the risk of heart attack or stroke, even in the presence of other risk factors.<br><br>We know that excess cholesterol comes from our diet, specifically from animal products. However it is not clear how many animal products need to be removed from the diet in order to see an improvement. |
| Methods | 76 patients participated in this study. Patients were divided into 4 groups based on their diet. The 4 groups are based on reducing consumption of animal products: omnivores (meat, dairy and eggs), lacto-ovo vegetarians (dairy and eggs, no meat), lacto-vegetarians (dairy only, no eggs or meat), and vegans (no animal products). Blood samples were taken to monitor cholesterol levels. |
| Results | Results showed that the lower the amount of animal products consumed, the lower the total and LDL cholesterol levels.<br>Omnivores had an average cholesterol of 5.4 mmol/L and average LDL of 3.2 mmol/L. Lacto-ovo vegetarians had an average cholesterol of 4.5 mmol/L and LDL of 2.6 mmol/L. Lacto-vegetarians had an average cholesterol of 4.3 mmol/L and an LDL of 2.3 mmol/L. Vegans had an average cholesterol of 3.6 mmol/L and an LDL of 1.8 mmol/L. |
| Conclusion | This study showed that a stepwise reduction in meat and dairy consumption results in a similar reduction in cholesterol. The highest cholesterol levels were associated with meat consumption, and the lowest levels were associated with a vegan diet. |

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| Title | Effects of Plant-Based Diets on Plasma Lipids |
| Link | https://www.ajconline.org/article/S0002-9149(09)01099-6/fulltext |
| Question | Do plant-based diets lower cholesterol? |
| Summary | This study looked at the effect of different diets on cholesterol levels. It looked at 3 types of plant-based diet; group 1 were allowed small amounts of meat and |

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| | dairy, group 2 followed a vegan diet and group 3 followed a vegetarian diet with added fibre, soy and nuts. It found that all groups showed reductions in cholesterol but the greatest reductions (up to 35%) were found in group 3 patients. |
| Background | It is widely accepted that reducing meat and dairy consumption helps to lower cholesterol. However it is not clear what type of diet is most effective. |
| Methods | This study reviewed the results 27 previous studies, all of which examined the effects of a plant-based diet on cholesterol levels. Patients were divided into 3 broad groups according to diet; group 1 ate a plant-based diet but with some lean meat and dairy, group 2 ate a vegan diet (no meat or dairy), and group 3 ate a vegetarian or vegan diet with added fibre, soy and nuts. |
| Results | All 3 groups showed reduced cholesterol levels after the follow-up period (which varied between studies). Group 1 showed an average reduction in total cholesterol and LDL cholesterol of 10-15%, group 2 showed a reduction of 15-25% and group 3 showed a reduction of 20-35%. |
| Conclusion | This study showed that plant-based diets are associated with a significant reduction in cholesterol. Fibre is known to bind cholesterol and help to remove it from the body, which may be one reason that the "added fibre" group showed the greatest reductions in cholesterol. |

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| Title | Effects of a Dietary Portfolio of Cholesterol-Lowering Foods vs Lovastatin on Serum Lipids and C-Reactive Protein |
| Link | https://jamanetwork.com/journals/jama/fullarticle/196970 |
| Question | Do plant products actively lower cholesterol? |
| Summary | This study compared the effectiveness of different cholesterol-lowering diets to cholesterol-lowering statin medications. It found that a low-fat diet which is high in plant sterols and fibre is as effective as a statin for lowering cholesterol. A standard vegetarian low-fat diet lowered LDL cholesterol by only 8%, while the same diet with a statin lowered it by 30%, and the same diet with additional plant sterols, fibre, soy and almonds lowered cholesterol by 28%. |
| Background | Diet is known to contribute to the development of high cholesterol. However dietary intervention is usually thought to be less effective than a cholesterol-lowering medication such as a statin.<br><br>A standard low-fat diet lowers cholesterol by up to 13%, whereas a statin lowers cholesterol by up to 35%. It has been suggested however that adding plant products including sterols, fibre and almonds can lower cholesterol more effectively. This is called a "portfolio" diet. |
| Methods | 46 Canadian patients with high cholesterol participated in this study. Participants were divided into 3 groups. Group 1 followed a standard very low-fat vegetarian diet for high cholesterol including low-fat dairy products. Group 2 followed this standard diet with the addition of a statin medication. Group 3 followed a "portfolio" diet which consisted of a low-fat diet with the addition of plant-sterol enriched margarine, viscous fibre from oats and barley, soy protein and whole almonds. |
| Results | LDL cholesterol was lowered by 8%, 30% and 28% in group 1,2 and 3 respectively. Both the portfolio diet and the statin lowered cholesterol much |

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| | more effectively than a low-fat diet alone, and there was no significant difference between these interventions. |
| Conclusion | This study showed that a low-fat diet with added plant products including sterols and fibre can lower cholesterol as effectively as a statin. |

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| Title | Assessment of the longer-term effects of a dietary portfolio of cholesterol-lowering foods in hypercholesterolemia |
| Link | https://academic.oup.com/ajcn/article/83/3/582/4607506 |
| Question | Does a "portfolio" diet lower cholesterol effectively in real-world conditions? |
| Summary | |
| Background | A "portfolio" diet is a low-fat diet with added plant products, including sterols and fibre, which has been shown to lower cholesterol as effectively as a statin medication in the controlled setting of a clinical trial. However it is not clear if this is as effective in a real-world setting where compliance can be a factor. |
| Methods | 66 patients with high cholesterol participated in this study. Patients followed a "portfolio" diet. They were followed up for 12 months to monitor compliance and changes in cholesterol. |
| Results | Patients reduced their cholesterol by an average of 12.8% which is less than the improvements seen in a clinical trial. However 31.8% of patients lowered their cholesterol by >20%. The greatest reductions were seen in patients who adhered well to the diet plan. |
| Conclusion | This study showed that with strict compliance a "portfolio" diet can lower cholesterol with similar effectiveness to a statin. For motivated patients who would rather avoid medications this could be an appropriate treatment option. |

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| Title | Mediterranean Diet, Traditional Risk Factors, and the Rate of Cardiovascular Complications After Myocardial Infarction |
| Link | https://www.ahajournals.org/doi/full/10.1161/01.CIR.99.6.779 |
| Question | Can a Mediterranean diet reduce the risk of a second heart attack? |
| Summary | This study compared a Mediterranean diet with a prudent Western diet in patients who had suffered a heart attack. It found that patients who followed a Mediterranean diet were 47% less likely to suffer further complications including heart attack, stroke and death than those following a Western diet. |
| Background | A Mediterranean diet is typically high in fruit, vegetables, nuts, grains and fish, and low in meat and dairy. |
| Methods | 423 patients completed this study which lasted for 46 months. Patients were all aged < 70 and had suffered one previous heart attack. Patients were divided into two groups. Group 2 were advised to follow a Mediterranean diet. Group 2 were given no specific dietary advice. Patients were monitored for 46 months and further heart problems including deaths were recorded. |
| Results | In the Mediterranean diet there were 14 instances of heart attack or death during the study period, compared to 44 instances in the normal Western diet group. Similarly there were 27 instances of chest pain, stroke, heart failure or blood clots in the Mediterranean group, compared to 90 in the Western diet group. Overall the risk of suffering one of these problem was reduced by 47% in the Mediterranean group compared to the Western diet group. The effect of |

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| | the Mediterranean diet was so clear that the trial was stopped early in order to enable those on a Western diet to change to a Mediterranean diet if desired. |
| Conclusion | This study showed that a Mediterranean diet is protective against further heart problems after a first heart attack. This effect lasts long-term (4 years in the case of this study). |

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| Title | A way to reverse CAD? |
| Link | https://dresselstyn.com/JFP_06307_Article1.pdf |
| Question | Can a plant-based diet eliminate the risk of heart attack or stroke? |
| Summary | This study looked at the effect of a plant-based diet in 198 patients with atherosclerosis. |
| Background | Atherosclerosis describes the process in which blood vessels becomes blocked with cholesterol. When this affects the blood vessels in the heart it is called coronary artery disease (CAD) and can lead to heart attack. When it occurs in the blood vessels of head or neck it can cause a stroke.<br><br>Atherosclerosis is mainly caused by high cholesterol. It is known that lowering cholesterol can reduce the risk of atherosclerosis progressing, however it is not clear if existing atherosclerosis can be reversed. |
| Methods | 198 patients with known atherosclerosis participated in this study. All patients were counselled on how to maintain a plant-based diet and given recipes to follow. Patients were followed up for an averaged of 3.7 years. |
| Results | 89% of patients managed to adhere to the diet. Out of this group one patient (0.6%) had a stroke.<br>Out of the 21 patients who did not adhere to the diet 13 suffered either a heart attack, stroke or other major event (62%). |
| Conclusion | This study showed that a plant-based diet can greatly reduce the risk of heart attack stroke or death in patients with known risk factors. |

Is the Western Lifestyle responsible for CAD?

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| Title | Diet, lifestyle, and the etiology of coronary artery disease: the Cornell China Study |
| Link | https://www.ajconline.org/article/S0002-9149(98)00718-8/fulltext |
| Question | Is the Western diet responsible for heart disease? |
| Summary | This study compared the diet and levels of heart disease between the USA and rural China |
| Background | Coronary artery disease (CAD) refers to blockages in the blood vessels in the heart, mainly due to cholesterol. This can lead to heart attack and death.<br><br>It is widely accepted that a high meat and dairy intake promotes CAD but it is not clear how much CAD could be prevented with a different diet. |
| Methods | 50 rural Chinese patients participated in this study. They provided dietary information and blood samples to measure cholesterol levels. The causes of |

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| | death for 65 counties in rural China was also recorded to measure the rate of death from heart problems.<br><br>These findings were then compared to the average data available for the USA regarding diet, cholesterol and death from heart disease. |
| Results | In the rural Chinese diet fat intake was half what it was in the USA, and fibre intake was 3 times higher. Animal protein intake was 10 times lower in rural China than in the USA. Average cholesterol in rural China was 3.2 mmol/L compared to 5.25 mmol/L in the USA. American men were 16.7 times more likely to die of heart disease than rural Chinese men, and American women were 5.6 times more likely to die of heart disease than Chinese women. |
| Conclusion | This study showed that a diet which is low in fat and animal protein and high in fibre was associated with lower cholesterol levels and a 5-16 times lower risk of death due to heart disease. |

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| Title | Epidemiological studies in a total highland population, Tukisenta, New Guinea: Cardiovascular disease and relevant clinical, electrocardiographic, radiological and biochemical findings |
| Link | https://www.sciencedirect.com/science/article/abs/pii/0021968173900313 (subscription required) |
| Question | Can a plant-based diet reduce the risk of heart attack and stroke? |
| Summary | This study looked at the effect of plant-based diet in a rural population in New Guinea. It found that no patients in this group of 779 patients had suffered a heart attack or stroke. |
| Background | Atherosclerosis is the name for a process in which blood vessels become blocked up. This interferes with blood flow and stops oxygen from travelling around the body. It can result in a heart attack, stroke or death.<br><br>Anecdotally, ethnic groups that do not follow a standard Western lifestyle are said to have a lower risk of atherosclerosis. This study investigated this idea in Papua New Guinea in the 1960s, when this society was largely based around plant-based food, particularly sweet potatoes. |
| Methods | From 1966-1968, 779 patients were recruited to this study in Papua New Guinea. Patients were examined and interviewed about their medical history. |
| Results | No patients had a history of heart attack or stroke. Only 2 patients had a history of chest pain which can suggest atherosclerosis in the heart. |
| Conclusion | This study suggests that a plant-based diet may help to protect again atherosclerosis, and consequently heart attacks, strokes and death. |

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| Title | The plasma lipids, lipoproteins, and diet of the Tarahumara Indians of Mexico |
| Link | https://academic.oup.com/ajcn/article-abstract/31/7/1131/4650360?redirectedFrom=fulltext (subscription required) |
| Question | Is high cholesterol inevitable as we age? |
| Summary | This study looked at the cholesterol levels of 523 Tarahumaras, aged 5-70. It found that their average total cholesterol was 3.2 mmol/L and average LDL |

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| | cholesterol was 2.25 mmol/L. Their cholesterol levels also remained very steady from childhood into adulthood and they had almost no incidence of high blood pressure or obesity. |
| Background | The Tarahumara Indians of Mexico are known for their plant-based diet and their skill in long-distance running. Their lifestyle is very different from the standard Western lifestyle. This study investigated whether these differences affect their cholesterol levels over time. |
| Methods | 523 Tarahumaras participated in this study. Participants were aged 5-70. Their cholesterol levels were measured via blood test. 174 participants also provided information on their diets. |
| Results | Results showed that the average total cholesterol was 3.2 mmol/L and the average LDL cholesterol was 2.25 mmol/L. The Tarahumara diet was low in cholesterol (71 mg/ day), low in fat (12% of calories) and particularly low in saturated fat (2% of calories). It was high in fibre (19 mg/ day). The Tarahumara had almost no incidence of high blood pressure and obesity, and they did not show an age-related increase in cholesterol which is standard in other cultures. |
| Conclusion | This study showed that the plant-based diet of the Tarahumara may contribute to the stability of their cholesterol levels throughout their lifetimes and the absence of related problems such as obesity and high blood pressure. |

How effective is a Lifestyle Intervention?

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| Title | Effects of Stress Management Training and Dietary Changes in Treating Ischemic Heart Disease |
| Link | https://www.ornish.com/wp-content/uploads/effects-of-stress-management-training.pdf |
| Question | Can stress management and diet improve heart health in patients with significant heart disease? |
| Summary | This study looked at the use of an intensive lifestyle intervention in patients with known coronary artery disease (CAD). It found that after 24 days of treatment patients who underwent this lifestyle training had a 20% reduction in cholesterol, a 44% increase in exercise tolerance, and improved heart function compared to patients who did not have this training. |
| Background | Coronary artery disease (CAD) is a condition in which the blood vessels in the heart becomes blocked with cholesterol. This can lead to heart attack or death. It is well known that lifestyle factors including diet and stress play a role in the development of CAD. This study investigated whether intensive stress management and a plant-based diet can reduce the signs and symptoms of CAD. |
| Methods | 46 patients participated in this study. They were divided into 2 groups. Group 1 underwent an intensive lifestyle intervention. They lived together for 24 days in a residential setting where all their food and drink was provided by staff. They followed a strictly plant-based diet. They also received training in stress management. Group 2 (the control group) carried on as normal with no intervention. |
| Results | After 24 days Group 1 patients showed a 44% increase in the length of time for which they were able to exercise. They also had a 20.5% decrease in cholesterol and a 91% decrease in episodes of chest pain. They also showed an improved ability of the heart to pump blood, especially during exercise. |

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| Conclusion | This study showed that an intensive lifestyle intervention of only 24 days can improve heart health, increase exercise tolerance and reduce cholesterol significantly. |

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| Title | Angina Pectoris and Atherosclerotic Risk Factors in the Multisite Cardiac Lifestyle Intervention Program |
| Link | https://www.ajconline.org/article/S0002-9149(07)02320-X/fulltext (subscription required) |
| Question | Can a lifestyle intervention relieve chest pain? |
| Summary | This study looked at the effects of an intensive lifestyle intervention on the symptoms and quality of life of patients with heart disease. It found that of the 282 patients who experienced regular chest pain at the start of the intervention, 75% were pain free by the end of the 12 week plan. Patients who were pain-free also showed a significant improvement in exercise capacity and symptoms of depression. |
| Context | Heart disease usually results from blockages in the blood vessels of the heart, known as coronary artery disease or CAD. This causes chest pain which can limit the ability of people with this condition to exercise and carry out their daily activities.<br><br>It is widely accepted that lifestyle interventions can improve heart health but it is not clear if this directly improves the pain associated with heart disease. |
| Methods | 1,152 patients with CAD participated in this study. Patients underwent a lifestyle intervention for a 12 week period. This involved doing at least 3 hours of exercise per week, following a low-fat, plant-based diet, and practising stress management for 1 hour per day. |
| Results | At the beginning of the intervention 90 patients suffered from mild chest pain and 158 patients had chest pain that limited their daily activities. After 12 weeks, 74% of these patients were free from chest pain. Patients who became pain-free showed the greatest improvements in exercise capacity and symptoms of depression. |
| Conclusion | This study showed that a targeted 12 week lifestyle intervention can eliminate chest pain in certain patients with heart disease. Resolving chest pain can improve patients' ability to exercise and reduce symptom of depression. |

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| Title | Intensive Lifestyle Changes for Reversal of Coronary Heart Disease |
| Link | https://www.ornish.com/wp-content/uploads/Intensive-lifestyle-changes-for-reversal-of-coronary-heart-disease1.pdf |
| Question | Do lifestyle changes lead to continued improvements in heart health over 5 years? |
| Summary | This study looked at the effect of intensive lifestyle intervention in patients with coronary artery disease over 5 years. |

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| Context | Coronary artery disease (CAD) refers to a condition in which bloods vessels in the heart become blocked with cholesterol. This can result in heart attacks.<br><br>It is well evidenced that lifestyle changes can reduce the progression of CAD but it is less clear if it can improve existing blockages and whether this continues to improve with long-term lifestyle changes. |
| Methods | 48 patients enrolled in this study. They were divided into two groups of 24. The treatment group underwent an intensive lifestyle intervention including stress-management, a low-fat, plant-based diet, regular exercise and group support meetings. The control group continued with standard treatment.<br><br>Patients were followed up for 5 years. The amount of blood vessel blockage was measured before and after the study period. |
| Results | 20 patients in the treatment group completed the study, compared to 15 patients in the control group. The percentage blood vessel blockage in the treatment group reduced from 38.9% to 35.9% after 5 years. The percentage blockage in the control group increased from 42.5% to 54.3% over 5 years. Patients in the control group were 2.5 times more likely to suffer a heart attack over the 5 year period than patients in the treatment group. |
| Conclusion | This study showed that CAD continues to improve over a 5 year period of lifestyle intervention. Without standard treatment only CAD deteriorates greatly over the same period. Compared to the intervention group, patients who did not receive a lifestyle in intervention were 2.5 times more likely to suffer a heart attack over the following 5 years. |