



ROLE OF PREVENTIVE MEASURES IN THE CONTROL OF CARDIAC DISEASES AND DIABETES MELLITUS – A REVIEW

General Medicine

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ABSTRACT

Many studies have predicted a host of factors that precipitate the development of cardiovascular (CVD) and Diabetes Mellitus (DM). Some studies have also recommended preventive measures to avoid such diseases. The risk factors that accelerate Type 2 Diabetes Mellitus (T2DM) are high Blood Pressure (BP); Sedentary lifestyle, obesity, elevated cholesterol, family history and ageing. Both CVD and DM could be easily prevented if certain established protocols are followed. This review article gives a condensed summary of research work done during the last two decades on the preventive measures and their effects in reducing the morbidity and mortality associated with CVD and DM. More researches are required in this field to establish consensus guidelines that could be effectively followed in all cardio and diabetes clinics.

KEYWORDS

DM, CVD, CHD, T2DM, BMI

INTRODUCTION

Both DM and CVD are the major diseases worldwide. Uncontrolled DM will lead to kidney disease and then cardiac related complications. As of date, majority of patients identified as having DM and CVD use drugs to reduce the incidents, but such use of drugs are a lifelong therapy. Many studies have pointed out preventive measures to control both DM and CVD. This article highlights some preventive measures recommended by various studies.

CARDIOVASCULAR DISEASES

CVD is the number one killer disease worldwide. Although preventive measures could reduce the mortality and morbidity, many patients do not follow such preventive measures. Cardiovascular epidemic is found to be increased in industrialized countries and is now spreading to low and middle income countries which accounts to 80% of all CVD related deaths. Studies done in last two decades have laid the foundation for public health awareness and interventions which if followed may reduce the burden of such disease. To assess the trends and pattern of CVD, proven population specific data are indeed the need of the hour. It is therefore important to make studies based on epidemiological surveillance to assess the risk for atherosclerosis disease. Prevention of CVD should be based on adaptable new approaches for each individual and population. Coronary Heart Disease (CHD) and stroke could easily be prevented if timely and effective interventions are taken.¹

During the last several decades, CVD has been identified as the number one cause of death in Spain and studies have shown that it is spreading to low and middle income countries based on studies which have found large difference between countries in terms of CVD mortality. CHD and stroke are the two disease categories that account for the vast majority of CVD event. Studies done in the past have consistently proved that evidence based therapies are cornerstone of CHD mortality prevention and hybrid discipline of knowledge based on biological science and statistics may help to improve public health related to CVD. However, when knowledge required is available, policy intervention makes huddle to implement them. A set of health policies must be framed with easily adaptable healthy lifestyle and well-shaped preventive efforts with a clear monitoring system to assess the distribution of CHD risk factors and the preventive measures must be both adequate and comprehensive; region wise surveys should be conducted based on social economic and health differences using guidelines framed by International Model For Analysis of Agriculture Commodities Trade (IMPACT).²

The contributing factors which are associated with the risk of CVD

mortality are high Chronic Renal Failure (CRF), abnormal Body Mass Index (BMI), Physical inactivity and smoking. Combined analysis of all the above 4 revealed that a minimum of 2 positive health factors could reduce CVD mortality. The weighted scores calculated indicate that combination of high CRF, currently not smoking and normal BMI may help clinically the CVD mortality. In adulthood, more the number of beneficial factors less will be the CVD mortality in men and hence multi behavioural efforts in adulthood should be encouraged.³

For secondary prevention of recurrent CVD and its fatality, an array of evidence based medical and procedural therapies are available. However, primary preventions for reducing the chances of first event is not simple to implement. Smoking, adverse dietary patterns, overweight, sedentary lifestyle are some common predisposing risk factors. Such factors will lead to adverse increase in blood lipids, glucose and BP levels. An average or mildly elevated levels of these risk factors are found in majority of first time CVD events. We will be able to achieve in preventing CVD only through modifications in lifestyle along with environmental changes. In order to shift the entire distribution of risk among population with CVD, medication alone is not enough. According to recent studies, individuals from young adulthood to middle age who maintain ideal profile of cardiovascular risk factors will be able to remain free of lifetime risk associated with CVD because both CVD and non – CVD mortality rate will be reduced in such individuals enabling them to lead an additional 10 years of longevity. Such individuals will have better health related quality of life at older ages leading to less annual medical cost. However, adverse effects of risk factors in middle age may substantially increase the lifetime risk for CVD.⁴

A study on US population has revealed that majority of them who reached middle age with ideal phenotype showed > 90% of CHD deaths prevented. But in reality, as of now barely 5% of US population maintains such ideal profile into middle age. To prevent this changes required are supportive health based environment and controlling obesity, BP, hyperlipidemia, DM and increasing physical activity.⁵

Lifestyle and environmental modification would certainly benefit all types of population irrespective of race, men or women in reducing stroke, CHD in elderly and younger adults from lower mortality rates. The benefits achieved in CVD low intake of salt was found to be on par with the benefits of population wise reductions in tobacco use, obesity and Total Cholesterol (TC). A reduction in salt intake of 3g per day based on regulatory intervention designed model may save the health cost annually 24 billion for a quality adjusted life years. If such interventions are followed, even salt reduction at 1 g per day may

achieve a reduction in CVD rates for the next 10 years. Such efforts will be cost effective compared to medication to lower BP in all persons with hypertension.⁶

All strategies to prevent CHD are based on the commonly associated risk factor and their distribution. To arrive at base line risk in individuals, multiple risk factors are to be analysed to prevent CHD. A large national population based study has revealed that risk is found only in a modest population. Current treatment guidelines are very effective in preventing death from CHD based on population wise reduction in TC and it is important to evaluate the base line risk in a certain target group population.⁷

Many studies have shown the effect of garlic in preventing atherosclerosis. Many useful benefits of garlic have been discovered which include enhancement of fibrinolytic activity, decreasing BP and reduction in TC and Triglycerides (Tgs). Along with garlic, the use of lemon juice will be effective in reducing inflammation and controlling cardiovascular inducing factors. Garlic may be used in different formulations such as raw, powdered or oil extracted. Use of any one of these forms will reduce lipids, BP, Reactive Oxygen Species (ROS) and other cardiovascular risk factors. Many studies have confirmed these observations.⁸

A study conducted in Isfahan cardiovascular research center in patients with the age group of 30 – 60 years showed significant decrease in TC, LDL-c and fibrogen in the group treated with garlic and lemon juice, while a greater reduction in both systolic and diastolic BP were observed in the group treated with garlic alone, but no such reductions were seen in the group treated with lemon juice alone and control groups. Further, a great reduction in BMI was observed in the mixed group compared to controls. Hence administration of garlic along with lemon juice showed improvement in lipids, fibrinogen and BP of patients with hyperlipidemia.⁹

In a multicentre trial in Spain, among persons at high cardiovascular risk, a mediterrian diet supplemented with extra virgin olive oil or nuts has reduced the incidence of major cardiovascular events such as Myocardial Infarction (MI), Stroke or death from cardiovascular events were found to be reduced.¹⁰

Statin are the drugs of choice for the prevention of CVD in patients with pre diabetes or established DM. As statin shows complex effects in DM patients such as on glucose metabolism, the risk associated with DM has become an area of controversy. Experimental studies have shown lipophilicity effects as well as inhibitory effects on 3 - Hydroxy - Methyl glutaryl - coenzyme - A (HMG - CoA) reductase which are considered as prognostic factors, an adverse impact of statin treatment on carbohydrate metabolism. Further statin affect hypotriglyceridemic capacity, increase in blood flow, anti-inflammatory properties and alter circulating levels of several adipokines, all of which affect glucose homeostasis. Among various statin forms, pravastatin possess beneficial effects on glucose metabolism by reducing the risk for DM. On the whole, the hydrophilic statins pravastatin, rosuvastatin and pitavastatin are more preferable to the lipophilic agents and simvastatin.¹¹

DIABETES MELLITUS

In India, among the four leading chronic diseases, DM is the second as per its prevalence and the top being CVD. The current scenario of the prevalence of DM worldwide is estimated to be around 6.4 % and during the past two decades, there has been a dramatic increase in the diagnosis of T2DM. Dietary factors contribute to the development of T2DM and that could be easily modified. The recent focus has been on the role of carbohydrates and fibres.¹²

In a study, lifestyle intervention reduced the incidence of DM by 58%, 31% by using metformin compared with placebo and the lifestyle intervention was found to be significantly more effective than metformin. The above study was done for a period of 3 years using lifestyle modification on 7 patients and metformin on 13 patients. Combined implementation of lifestyle modification along with metformin use has reduced the incidence of DM in persons with high risk. Hence DM could be prevented either through lifestyle modification or using metformin, but the former is more effective. Such studies showed results comparable to both men and women in all racial and ethnic groups. The effect of intense lifestyle intervention was similar on both old age and young participants.¹³ Treatment with placebo only for 3 months was found to be associated with an increase

in conversion of IGT to DM. Acarbose along with lifestyle could be used to delay the development of T2DM in patients with IGT.¹⁴

Early diagnosis is a must in order to avoid Diabetes – related complication in Gestational Diabetes Mellitus (GDM). Women in this group, during screening may likely to have hydramnios and preterm deliveries. Hence it is important to screen for GDM during pregnancy as studies showed rupture of membranes and fetal abnormalities in the later screening group. Hence it is recommended to screen all women for GDM to avoid late diabetes – related complication. Further studies are required if such screening to be done in all pregnant women or only in those with a high risk for developing diabetes.¹⁵

DIET AND EXERCISE AS PREVENTIVE MEASURES

The primary preventive measures include all the activities that prevent diabetes from occurring in susceptible individuals as well as in general population. Questionnaire covering environmental, lifestyle, behavioral, dietary habits and specific pharmacological intervention should be used to screen the population. Many epidemiological prospective studies have demonstrated that regular physical activity, several times a week said to decrease the incidence of the disease on a long term basis in both men and women of different age group. Studies have demonstrated that lifestyle interventions will reduce the incidence of diabetes compared to the use of metformin in persons at high risk. A study done in Finland has shown that lifestyle intervention reduced the risk of acquiring diabetes compared to diet and exercise. A Cochrane study has recommended weight reduction through lifestyle change as the best way to avoid getting DM.¹⁶

During the last decades, substantial increase in the incidence of DM have been observed, which were attributed to the prevalence of obesity, a contributor of Insulin Resistance (IR) which is the key parameter in altering the pathophysiological mechanism in all people at risk of developing DM. Hence the two key factors to the progression of T2DM are obesity and sedentary life style. The first step in the management of T2DM is lifestyle modification followed by exercise to reduce weight; however such implementations were found to be very short and often considered as short lived in effectiveness. Antihyperglycemic agent like metformin is the only choice for treatment when all the other preventive measure fail. Significant improvements in glycemic control were achieved within 26 weeks if canagliflozin 100 and 300mg were given in. The treatment with this drug was associated with low incidence of hypoglycemia. The above study was done in patients with normal renal function as well as with low to moderate renal impairment and estimated Glomerular Function Rate (eGFR) was < 50 mL/minute and hence canagliflozin may be a useful therapeutic option when diet and exercise could not maintain glycemic control.¹⁷

A study has shown that combined aerobic and resistance training showed decreased in HbA1c compared to control group; however the difference in mean BMI between exercise and control group were not significant. Hence exercise may reduce HbA1c and decrease the risk for DM, but no significant reduction in BMI.¹⁸ A large population based study on DM patients, the use of fruits and vegetables have revealed that those with mean daily intake of fruits and vegetables with 5 or more fruits per day showed improvement in glycemic control compared to the group that does not consume fruits and vegetables. After adjustment for age, race, ethnicity, smoking, BP, anti-hypertensive drugs and alcohol consumption, patients with 5 or more serving of fruits per day showed an inverse association with diabetes incidence, particularly among women.¹⁹

ROLE OF VITAMIN D IN DIABETES MELLITUS

Vitamin D has received attention in the recent past as it showed a pivotal role in preventing CVD associated with T2DM. Many epidemiological studies have suggested that individuals with low vitamin D levels have increased risk for heart disease, stroke, hypertension and diabetes. Vitamin D receptors are present in some cells and tissues may stimulate the nuclear transcription of various genes which may alter cellular function. Vitamin D also shows many other functions on numerous diseases and disorders such as osteoporosis, chronic musculoskeletal pain, diabetes, CVD and Cancers. Further, vitamin D may contribute to maintain insulin secretion and hypovitaminosis D may cause hyperglycemia, T2DM and metabolic disorders like increase in IR, reduction in Insulin secretion and increase in damage to pancreatic islets.²⁰

Obesity related DM are on the increase and studies have shown that there may be an interplay between the gutflora, energy homeostatis and inflammation. All these may be linked to the pathogenesis of obesity related DM. The factors that accelerate such interplay mechanisms are increased energy from diet, alternation in fat metabolism and adipose and liver contents.²¹ To prevent the progression of T2DM, primary intervention should be focused at the stage of IFG/IGT. Such preventions are based on pharmacological and lifestyle modification. The secondary prevention is to monitor the recurrence of diabetic complication and tertiary prevention should encompass the treatment of specific diabetic complications in order to prevent excess morbidity and mortality.²²

Some studies have shown no conclusions on the use of fruits and vegetables as to whether they could actually decrease the risk of T2DM as conflicting evidence are within the literature. The exact mechanisms by which fruits and vegetables reduce the risk of various chronic diseases are not yet precisely shown. It is understood that antioxidants and phytochemicals present in fruits and vegetables might promote health by scavenging the free radicals which are linked with early phase development of some chronic disease.²³ Many studies have proved consistently that fruits and vegetables are important components of the dietary patterns associated with a decreased risk of T2DM.²⁴ Some meta - analysis studies recommended the consumption of green leafy vegetables to reduce the risks associated with T2DM. Hence lifestyle modification plays a significant role in the prevention of T2DM. Such recommendation should be established by further investigations.²⁵

The important recommendations to decrease the risk of DM are physical activity to maintain normal BMI to overcome IGT outcome. The identified factors leading to T2DM developments are overweight, obesity, abdominal obesity, physical inactivity and maternal DM. High intake of saturated fats will lead to intrauterine growth retardation in women, while non - starch polysaccharides will decrease such incidents. Consumption omega 3 fatty acids, low glycemic index foods and breast feeding may play protective role, but more trans-fat intake will lead to increase risk. However, insufficient are currently available to prove such observation. Based on many previous studies and evidence available regarding diet and lifestyle in preventing T2DM the convincing recommendation are to maintain normal weight to height lower BMI and regular physical activity from young age till adulthood to avoid getting DM. 26

CONCLUSION

This review article has highlighted the importance of adapting preventive measures, based on previous research findings to control / prevent both CVD and DM. The factors to be controlled to reduce CVD are smoking, BMI, Dietary patterns, sedentary life, blood lipids and BP. Many studies have shown improvement in CVD mortality if at least three of the above factors are controlled and reduction in salt intake is considered as the first step in preventing CVD. Studies have shown that regular use of garlic and lemon reduces CVD outcome. Lifestyle interventions along with regular use of metformin have shown a 50 % reduction in the incidence of DM. Regular exercise has shown beneficial effect for both CVD and DM. Of all the preventive measures, diet and regular exercise have beneficial effects for both disorders. All the preventive measures highlighted in this article, as per previous research findings have been found to be effective. Research area should focus on establishing a set of preventive measures that could be easily followed by patients both at cardio and diabetic clinics.

Conflict of Interest: None

REFERENCE

- Manuel Franco MD, PhD, Richard S. Cooper, MD, Usama Bilal, MD, Valentin Fuster, MD, PhD. Challenges and Opportunities for Cardiovascular Disease Prevention. The American journal of medicine. 2011; 124(2): 95–102.
- Manuel Franco,a,b, Richard Cooper,c Usama Bilal,a and Valenti n Fustera,d. Control of Coronary Heart Disease Risk Factors and Evidence-Based Therapies: Joint Efforts for Coronary Heart Disease Prevention in Spain Rev Esp Cardiol. 2011; 64(11) : 962–964. Jonathan A. Mitchell
- MSc , Daniel B. Bornstein, BSc, Xuemei Sui, MD, Steven P. Hooker, PhD, Timothy S. Church, MD, Chong D. Lee, PhD, Duck-chul Lee, PhD, Steven N. Blair, PED. The impact of combined health factors on cardiovascular disease mortality. American heart journal. 2010; 160(1):102-108.
- Simon Capewell; Donald M. Lloyd-Jones. Optimal Cardiovascular Prevention Strategies for the 21st Century. American medical association. 2010; 304(18): 2057-2058.
- Capewell S, Ford ES, Croft JB, Critchley JA, Greenlund KJ, Labarthe DR. Cardiovascular risk factor trends and potential for reducing coronary heart disease mortality in the United States of America. Bull World Health Organ. 2010; 88(2): 120-130.
- Bibbins-Domingo K, Chertow GM, Coxson PG, et al. Projected effect of dietary salt reductions on future cardiovascular disease. N Engl J Med. 2010; 362(7): 590-599. Douglas G Manuel
- Jenny Lim, Peter Tanuseputro, Geoffrey M Anderson, David A Alter, Andreas Laupacis, and Cameron A Mustard . Revisiting Rose: strategies for reducing coronary heart disease BMJ. 2006 Mar 18; 332(7542): 659–662.
- Batsis JA, Lopez-Jimenez F. Cardiovascular risk assessment – From individual risk prediction to estimation of global risk and change in risk in the population. BMC Med. 2010;8:29 Negar Aslani
- Mohammad Hasan Entezari, Gholamreza Askari,Zahra Maghsoudi and Mohammad Reza Maracy . Effect of Garlic and Lemon Juice Mixture on Lipid Profile and Some Cardiovascular Risk Factors in People 30-60 Years Old with Moderate Hyperlipidaemia: A Randomized Clinical Trial, Int J Prev Med. 2016; 7: 95 Estruch R, Ros E, Salas-Salvado J et al. Primary prevention of cardiovascular disease with a Mediterranean diet, N Engl J Med. 2013; 368(14): 1279-90.
- Sasaki J, Iwashita M, Kono S. Statins: Beneficial or adverse for glucose metabolism. J Atheroscler Thromb. 2006; 13:123–9.
- Schulze MB, Hu FB. Primary prevention of diabetes: what can be done and how much can be prevented? Annu Rev Public Health. 2005; 26: 445-67.
- Diabetes Prevention Program Research Group. Reduction in the Incidence of Type 2 Diabetes with Lifestyle Intervention or Metformin. New England Journal of Medicine. 2002; 346: 393–403.
- Jean-Louis Chiasson, Robert G Josse, Ramon Gomis et al. Acarbose for prevention of type 2 diabetes mellitus: the STOPNIDDM randomised trial, Lancet. 2002; 359: 2072–77.
- Jose L Bartha , Pilar Martinez-Del-Fresno & Rafael Comino-Delgado. Early diagnosis of gestational diabetes mellitus and prevention of diabetes-related complications. 2003; 109(1); 41–44.
- Leonardo J Orozco, Ana Maria Buchleitner, Gabriel Gimenez-Perez, Marta Roqué i Figuls, Bernd Richter, Didac Mauricio. Exercise or exercise and diet for preventing type 2 diabetes mellitus. Cochrane Metabolic and Endocrine Disorders Group. 2008 K. Stenlöf
- W. T. Cefalu , K. A. Kim , M. Alba et al. Efficacy and safety of canagliflozin monotherapy in subjects with type 2 diabetes mellitus inadequately controlled with diet and exercise. A journal of pharmacology and therapeutical. 2015 (4),372-382. Normand G. Boulé, MA
- Elizabeth Haddad, MD; Glen P. Kenny, PhD; et al George A. Wells, PhD. Effects of Exercise on Glycemic Control and Body Mass in Type 2 Diabetes Mellitus, A Meta-analysis of Controlled Clinical Trials. JAMA. 2001; 286(10): 1218-1227. Earl S. Ford M.D., M.PH
- Fruit and Vegetable Consumption and Diabetes Mellitus Incidence among U.S. Adults. Preventive Medicine. 2001; 32(1): 33-390.
- Gröber U. Vitamin D-An old vitamin in a new perspective. Med Monatsschr Pharm. 2010; 33: 376–83.
- Musso G, Gambino R, Cassader M. Obesity, diabetes, and gut microbiota. The hygiene hypothesis expanded? Diabetes Care. 2010; 33: 2277–84. Neeraj Choudhary
- Sanjay Kalra, Ambika Gopalkrishnan Umnikrishnan, and T. P. Ajish Preventive harmcotherapy in type 2 diabetes mellitus, Indian J Endocrinol Metab. 2012; 16(1): 33–43.
- Miller HE, Rigelhof F, Marquart L, Prakash A, Kanter M. Antioxidant content of whole grain breakfast cereals, fruit and vegetables. J Am Coll Nutr. 2000;19:312-9S.
- Van Dam RM, Rimm EB, Willett WC, Stampfer MJ, Hu FB. Dietary patterns and risk for type 2 diabetes mellitus in US men. Ann Intern Med. 2002;136:201-9.
- Patrice Carter, Laura J Gray, Kamlsh Khunti, Melanie J Davies. Fruit and vegetable intake and incidence of type 2 diabetes mellitus: systematic review and meta-analysis. BMJ. 2010; 341 :c4229.
- Steyn NP, Mann J, Bennett PH, Temple N, Zimmet P, Tuomilehto J, et al. Diet, nutrition and the prevention of type 2 diabetes. Public Health Nutr. 2004; 7: 147-65.