International Journal of Multidisciplinary Research and Growth Evaluation.

# Cardiovascular diseases and dietary approaches

**Nivya EM [1*], Dr. Seeja Thomachan Panjikkaran [2], Dr. Aneena ER [3], Dr. Sharon CL [4], Dr. Lakshmy PS [5]**

[1] PhD, Scholar, Department of Community Science, College of Agriculture, Kerala Agricultural University, Vellanikkara, Thrissur, Kerala, India

[2] Associate Professor and Head, Department of Community Science, College of Agriculture, Kerala Agricultural University, Vellanikkara, Thrissur, Kerala, India

[3] Assistant Professor (Community Science), Krishi Vigyan Kendra, Thrissur, Kerala, India

[4,5] Assistant Professor, Department of Community Science, College of Agriculture, Kerala Agricultural University, Vellanikkara, Thrissur, Kerala, India

* Corresponding Author: **Nivya EM**

## Article Info

**ISSN (online):** 2582-7138
**Volume:** 03
**Issue:** 01
January-February 2022
**Received:** 24-12-2021;
**Accepted:** 13-01-2022
**Page No:** 237-242

**Abstract**

Cardiovascular diseases (CVDs) are the group of heart and blood vessel disorders and are the major cause of mortality among non-communicable diseases. WHO (2021) classified cardiovascular diseases as coronary heart disease (CHD), cerebrovascular disease, peripheral arterial disease (PAD), rheumatic heart disease and congenital heart disease. Cardiovascular diseases can be diagnosed by electrocardiogram, x-rays, echocardiogram, troponin test, coronary angiography, magnetic resonance imaging (MRI) and computed tomography (CT) scans. Diet and exercise play a vital role in the management of CVD. Mediterranean diet is one of the healthy eating plans to improve heart health and it suggests daily consumption of fibre rich whole grains, fruits and vegetables, healthy fats like olive oil, fish and moderate intake of dairy products. In addition, aerobic exercises such as brisk walking, running, swimming and jogging for minimum 30 minutes daily help to improve heart health and HDL cholesterol level. A healthy lifestyle with modified food habits, smoking cessation, weight management and proper exercise will positively impact the reduction of cardiovascular diseases.

**Keywords:** Cardiovascular diseases, Atherosclerosis, Dash diet, Mediterranean diet

## 1. Introduction

Heart is the central organ for pumping the blood throughout the body. It is a muscular organ about the size of a fist, located just behind and slightly left of the breastbone. Our heart has four chambers. The upper two chambers are called atrium whereas the lower two chambers are ventricles. The upper right atrium receives blood from the veins and pumps it to the right ventricle. The right ventricle pumps this blood to the lungs for oxygenation via pulmonary artery. After oxygenation, oxygenated blood travels through pulmonary veins and receives in upper left atrium, then pump it to the left ventricle. The left ventricle is the strongest chamber. It pumps oxygen rich blood to the rest of the body. The flow of blood into the heart, within the heart chambers and from the heart is guarded by the four valves present in the heart. The heart gets nutrients and oxygen via the coronary arteries that run along the surface of the heart. It is also richly supplied by a web of nerve tissue that facilitates the rhythmic heartbeat. The heart is enclosed within a fluid-filled sac called the pericardium. The pericardium is a protective covering that produces fluid, which lubricates the heart and prevents friction between the heart and the surrounding organs.

The heart pumps blood through the network of arteries and veins called the cardiovascular system. Cardiovascular diseases (CVDs) are the group of heart and blood vessel disorders and are the major cause of mortality among non-communicable diseases. According to WHO (2021) [19], globally 17.9 million deaths reported due to cardiovascular diseases followed by cancer (9.3 million), respiratory diseases (4.1 million) and diabetes (1.5 million). In India, cardiovascular disease is the leading cause of death among non-communicable diseases (WHO, 2017) [18].

**2. Classification**

World Health Organisation (2021) classified cardiovascular diseases as coronary heart disease (CHD), cerebrovascular disease, peripheral arterial disease (PAD), rheumatic heart disease (RHD) and congenital heart disease.

a. Coronary heart disease-a disease of the blood vessels supplying blood to the heart muscle
b. Cerebrovascular disease-a disease of the blood vessels supplying blood to the brain
c. Peripheral arterial disease-a disease of blood vessels supplying blood to the arms and legs
d. Rheumatic heart disease-damage to the heart muscle and heart valves from rheumatic fever, caused by streptococcal bacteria
e. Congenital heart disease-birth defects that affect the normal development and functioning of the heart caused by malformations of the heart structure from birth

**2 a) Coronary heart disease (CHD)**

Coronary heart disease is also known as coronary artery disease. It is the most common type of CVD and is caused by atherosclerosis in the large and medium sized arteries which is supplying oxygen and nutrients to the heart. Globally, forty nine per cent of the population are suffering from CHD (American Heart Association, 2015). This is the leading cause of death among cardiovascular diseases.

The major etiological factors of CHD are atherosclerosis, hypertension, hypercholesterolemia, diabetes mellitus, obesity, faulty food habits, sedentary lifestyle and smoking. Mochtar and Hooper (2012) [10] conducted a study among CHD patients and reported that majority of sample had atherosclerosis followed by hypertension. They concluded that atherosclerosis is the most prevalent risk factor among CHD patients.

**Risk factors**

**1) Atherosclerosis**

Atherosclerosis is also known as hardening of arteries. Healthy arteries are very flexible and elastic, but over time, the walls of arteries become thick and stiff, this condition is called hardening of arteries. This is because of the build-up of fats, cholesterol and other substances on the artery walls. This build-up is called plaque. The plaque can cause arteries to narrow and blocking normal blood flow. The plaque can also burst and form blood clots. This lead to heart attack, stroke and heart failure.

Mild atherosclerosis usually doesn't have any symptoms. In moderate or severe conditions people may have symptoms such as chest pain or angina, pain in legs and arms, shortness of breath, fatigue, confusion and muscle weakness. Atherosclerosis is a slow progressive disease that may begin as early as childhood. Although the exact cause is unknown. The major risk factors of atherosclerosis are increasing age, gender, unhealthy diet, high cholesterol level, physical inactivity and stress.

According to Toma and McCaffrey (2011) [17] the incidence of atherosclerosis is increasing with increasing age and they also reported that atherosclerosis is higher among men than women (Figure 3). In the case of women, the secretion of ovarian hormone oestrogen shows the cardio-protective capacity. It helps to increase the blood flow, keep the blood pressure low, lowers the LDL cholesterol level and also prevent the formation of plaque. Due to the oestrogen production, the risk of developing atherosclerosis is lower in women than men.

Atherosclerosis can be managed by following a healthy diet with full of fruits, vegetables and whole grains, eliminating refined carbohydrates, sugar and saturated fats, doing regular exercise, quit smoking and reducing stress as much as possible by doing meditations or relaxing techniques. Following a healthy lifestyle can help to prevent or slow down the progression of atherosclerosis.

A low calorie, complex carbohydrates, normal protein, restricted fat, high vitamins, low sodium, high potassium and high fibre diet is prescribed to the patients. Foods like legumes (lentils, kidney beans, chick pea), brown rice, whole wheat, fish like salmon and tuna, soy milk and almonds should be included in the diet. Saturated fats, trans fats, refined carbohydrates, sugar foods, sweet drinks, salty foods, whole milk and red meat should be restricted.

Johnsen *et al*. (2018) [8] conducted a study to prove the relation between fish consumption and heart health. They concluded that fishes are good source of omega-3 fatty acids that act as a vasodilator and improve the heart health. Consumption of 100 to 200 g fatty fish like salmon for 2 to 3 times a week helps to decrease triglyceride level and also prevent heart health. Daily consumption of 10 to 15 g of fish oil extract also helps to control hypertriglyceridemia.

**2) Hypertension**

Hypertension is elevated blood pressure (BP). Blood pressure is the force exerted by the circulating blood against the wall of the blood vessels. Every individual has blood pressure which is necessary to move blood through arteries and to provide oxygen to the tissues of the body. Normal blood pressure is 120/80 mm Hg. WHO defines hypertension as a condition in which systolic pressure exceeds 160 mm Hg and diastolic pressure exceeds 95 mm Hg. Hypertension is not a disease but only a symptom indicating that some underlying disease is progressing. There are 3 stages of hypertension mild hypertension, moderate hypertension and severe hypertension.

**Mild hypertension/Stage I hypertension:** Diastolic pressure is 90 to 99 mm Hg in this form. Treatment is based on weight loss, sodium restriction and behavioural techniques.

**Moderate hypertension/ Stage II hypertension:** Diastolic pressure is 100 to 109 mm Hg with moderate hypertension. Nutritional therapy is supported by drugs such as beta-blockers.

**Severe hypertension/Stage III hypertension:** Diastolic pressure is above 110 mm Hg. Apart from giving treatment for moderate hypertension peripheral vasodilators are given. Diet therapy revolves around potassium replacement, nutritional support for weight management and sodium modification.

Many person with hypertension have no symptoms. Head ache, irregular heart rhythms, dizziness, vision changes, nausea, vomiting, chest pain and unexplained tiredness are some of the symptoms. Globally 25 per cent population are suffering from hypertension. In that, one in 4 men and one in 5 women are hypertensive (WHO, 2021) [19]. Ostchega *et al*. (2021) [12] reported that blood pressure is increasing with increasing age and hypertension is higher among males than women.

Following a healthy diet with low calorie, normal protein, low fat and low sodium, help to maintain normal blood pressure. Rodrigues *et al*. (2015) [13] conducted a study

among adults to know the relation between salt intake and hypertension. They reported that systolic and diastolic pressure is increasing with increasing intake of salt. So, limit the consumption of salt and sodium rich foods to control hypertension.

DASH (Dieatry Approach to Stop Hypertension) diet is a dietary pattern promoted by the US based National Heart and Lungs Institute to prevent and control hypertension. DASH diet suggests high amount of fruits and vegetables, fish, low fat milk, low fat foods, low sodium foods such as amla, guava, apple, cucumber etc., and high potassium foods like banana, orange, raisins, dates etc.

**3) Hypercholesterolemia**

Hypercholesterolemia is the term used to refer to a high serum cholesterol level. Our body needs cholesterol to build healthy cells, but high levels of cholesterol can increase the risk of heart disease. High level of serum cholesterol limits the normal flow of blood and leads to heart attack. The normal level and risk level of cholesterol is given in the table: 1.

**Table 1:** Lipid profile

| Cholesterol | Desirable | Normal risk | High risk |
|---|---|---|---|
| Total cholesterol (mg/dL) | <160 | 200-240 | >240 |
| HDL cholesterol (mg/dL) | >55 | 35-55 | <35 |
| LDL cholesterol (mg/dL) | <130 | 130-160 | >160 |
| Triglycerides (mg/dL) | <50-150 | 200-400 | >400 |

High cholesterol can be inherited, but it's often the result of unhealthy lifestyle choices, which make it preventable and treatable. A healthy diet with low calorie, normal protein, low fat and high fibre can help to reduce high cholesterol level. Some foods like amla, ginger, garlic, birds eye chilli, curry leaves and fenugreek are known as hypocholesterolemic foods. Inclusion of these foods in the diet helps to decrease the serum cholesterol level.

Gopa *et al*. (2012) [6] conducted a study to assess the effect of amla supplementation on lipid profile. In this study, they supplemented 500 mg of amla capsule daily for 42 days for 60 selected hypercholesterolemic patients. They reported that amla supplemented group showed low level of total cholesterol, LDL, VLDL cholesterol and serum triglyceride level than the control group. They concluded that amla is a hypocholesterolemic food and inclusion of amla in the diet help to prevent metabolic disorders.

**4) Diabetes mellitus**

Diabetes mellitus is a complex, progressive metabolic disorder which is accompanied by several complications. Hyperglycaemia, or raised blood sugar, is a common effect of uncontrolled diabetes and over time leads to serious damage to many of the body's systems, especially the nerves and blood vessels. Diabetes is a major cause of blindness, kidney failure, heart attacks and stroke.

Tarigan *et al*. (2014) [16] conducted a study among diabetic patients and reported that majority of the selected samples showed coronary artery disease followed by neuropathy, retinopathy and nephropathy. They also pointed that more than sixty percent in the CAD patients were hypertensive. They concluded that the risk of developing CAD is very high among diabetic patients.

Diabetes can be treated and its consequences avoided or delayed by following a healthy diet, regular physical activity, maintaining a normal body weight, avoiding tobacco use, medication and regular screening and treatment for complications.

**5) Obesity**

Obesity is a complex disease involving an abnormal or excess amount of fat. It is a medical problem that increase the risk of other diseases and health problems such as heart disease, hypertension, heart failure etc. Ndumele *et al*. (2016) [11] reported that overweight and obesity is strongly associated with the incidence of coronary heart disease. The risk for developing heart disease is increasing with increasing body mass index and they concluded that proper weight management is needed to prevent coronary heart disease.

**6) Food habits**

Faulty food habits also an important risk factor for developing coronary heart disease. Nowadays people show more interest to some foods like refined carbohydrates containing white bread and white rice, carbonated beverages, saturated and trans fats containing ghee and butter, baked products such as cakes, cookies etc., red and processed meat and sodium rich foods. These foods cause cholesterol to build up in the arteries. This increase the risk for developing heart attack, stroke and other health problems.

**7) Sedentary lifestyle**

Physically inactive, less fit persons have 30 – 40 per cent greater risk for developing CHD. The cardiorespiratory activity of that persons will be very low. If a person take too much time for sitting, the blood flow slows down which allows fatty acids to build up in the blood vessels. It is called plaque formation. This can lead to coronary heart disease.

**8) Smoking**

Every year more than one million people die due to tobacco induced heart disease. Smoking is a major risk factors of CHD. Both nicotine and carbon monoxide from the smoke damage the lining of coronary arteries that also lead to blood clots in veins and arteries.

**2 b) Cerebrovascular disease**

Cerebrovascular disease is also known as cerebrovascular accident that affect the blood flow and blood vessels in the brain. Stroke is the most common type of cerebrovascular disease and also known as brain attack. This is because of the temporary or permanent interruption of blood flow to the brain due to the blockage of arteries or bursting of blood vessels. Due to the interruption of normal flow of blood and oxygen, brain cells start to die within minutes and functions like speech, sensation and muscle movement controlled by the particular area of brain is impairing or completely lost.

Stroke is classified into ischemic stroke and haemorrhagic stroke. Majority of the strokes are ischemic. It occurs when a blood clot blocks or narrows the artery leading to the brain. The blood clots are forming due to the atherosclerosis condition. Haemorrhagic stroke is caused by a burst or leaking of blood vessels. When a blood vessel ruptures, blood accumulates in the tissues around the rupture and also spills into the surrounding area. This condition may be because of high blood pressure in the blood vessels. Symptoms of stroke come suddenly without any warning signs. The common symptoms are difficulty in walking, sudden confusion and dizziness, vision changes, loss of coordination, severe head

ache and muscle weakness.

Stroke can also affect the nutritional health of a person. After a stroke maintaining a healthy habits can be challenging. Some people may have some neurological problems such as dysphagia or difficulty in swallowing as well as arms and hand movement which may limits the ability to consume food properly and use utensils like spoons and forks. After a stroke some people may feel lack of appetite due to the lack of sensation by brain damage. It leads to malnutrition, unhealthy weight loss and also slowdown the recovery process.

To prevent the malnutrition, consumption of a healthy diet with full of fruits and vegetables, whole grains and low in fat and sodium is needed. Some studies have shown that high intake fruits and vegetables results in low mortality among those with stroke. Low levels of dietary flavanoids are associated with a higher risk of stroke. Fibre and folic acid have also been associated with protection against stroke. Green leafy and cruciferous vegetables and citrus fruits in particular are found to be protective.

Chiu *et al*. (2020) [2] conducted a study to find out the effect of vegetarian and non-vegetarian diet on stroke incidence. They reported that vegetarian people experienced lower risk of overall stroke, ischemic and haemorrhagic stroke compared to non-vegetarians. They concluded that plant based diet is rich in antioxidants and dietary fibre and helps to protect against stroke.

**2 c) Peripheral arterial disease**

Peripheral arterial disease is also known as peripheral vascular disease. It is a common circulatory problem in which narrowed arteries reduce the blood flow to the limbs. It is due to the build-up of fats in the arteries. In this condition, legs and arms don't receive enough blood flow to keep up with demands. This may cause symptoms such as painful cramping in hips and thighs, leg numbness or weakness, claudication (leg pain when walking), coldness and change the colour of legs.

Some studies reported that high intake of vitamin D, E, K and potassium decrease the risk of peripheral arterial disease and high intake of saturated fats and sodium increase the risk (Goncalves and Abreu, 2020; Delaney *et al*., 2019; Lannuzzo *et al*., 2018) [5, 3]. Peripheral arterial disease can be managed by controlling the blood pressure, doing exercise and following a healthy diet with low saturated fats and sodium.

**2 d) Rheumatic heart disease (RHD)**

Rheumatic heart disease is a condition in which the heart valves have been permanently damaged by rheumatic fever. Rheumatic fever is an inflammatory disease that can develop strep throat or scarlet fever. This is caused by an infection with streptococcus bacteria. Fever can cause damage to the heart including damaged heart valves and heart failure. The symptoms of heart valve damage include chest pain or discomfort, shortness of breath, fatigue and rapid or irregular heartbeat. The major clinical manifestations of rheumatic heart diseases are carditis (inflammation of heart), arthritis (painful inflammation and stiffness of the joints), chorea (movement disorder) and subcutaneous nodules on the skin. The minor manifestations are fever and polyarthralgia.

In RHD patients, inflammation can be prevented by the inclusion of some anti-inflammatory foods such as turmeric, pepper, ginger, garlic, olive oil, tomato etc. (Ambardekar, 2020). These foods contain phytochemical components that help to treat inflammation, boost immunity and reduce the risk of heart diseases.

**2 e) Congenital heart disease**

Congenital heart disease is a birth defect that affect the normal functioning of heart. The problem can affect the heart walls, heart valves and blood vessels. There are mainly two types of congenital heart disease. If the defect lowers the amount of oxygen in the body, it is called cyanotic. If the defect doesn't affect oxygen in the body, it is called acyanotic. The common symptoms are bluish lips, skin, fingers and toes, breathlessness, chest pain etc.

Tabib *et al*. (2019) [15] conducted a study among under five years old children with congenital heart disease. They reported that the prevalence of malnutrition was higher among children. Majority showed severe malnutrition. They concluded that administration of a well-balanced diet should be considered for these vulnerable children. Balanced diet should contain different types of food in such quantities and proportions for meeting the nutritional requirement of a person.

**3. Diagnosis**

Cardiovascular diseases can be diagnosed by electrocardiogram, x-rays, echocardiogram, troponin test, coronary angiography, magnetic resonance imaging (MRI) and computed tomography (CT) scans.

**a) Electrocardiogram (ECG)**-It is a simple test that monitors the electrical activity of heart. A sensor is attached to the skin to detect the electrical signals. It is used to check the irregular heartbeat and heart damages.

**b) Chest X-ray**-Small amount of radiation is used to create image of chest including heart. This test helps to determine the cause of shortness of breath or chest pain.

**c) Echocardiogram**-Sound waves are used to create a picture of heart. It is used to evaluate heart valves and heart muscles.

**d) Troponin test**-It measure the levels of troponin T and I proteins in the blood. These proteins are released when the heart muscles has been damaged, such as occurs with a heart attack.

**e) Coronary angiography**-A special dye is injected into the blood vessels of the heart and take x-rays to look at the coronary arteries. This test is used for detecting the narrowed or blocked arteries.

**f) Magnetic Resonance Imaging (MRI) scans**-Strong magnetic fields and radio waves are used to produce the detailed images of the inside of our body.

**g) Computerised Tomography (CT) scans**-x-rays and computers are used to create a detailed images of the inside

of the body. It takes cross sectional image of heart for diagnosing heart diseases.

## 4. Management

Cardiovascular diseases can be managed by following a healthy diet, doing regular exercise/ yoga/ meditations, quit smoking and avoid sedentary lifestyle. Nowadays dieticians are recommending mediterranean diet to CVD patients. Mediterranean diet is a healthy eating plan recommended by the dietary guidelines for Americans to promote health and prevent chronic diseases. There is no single definition for this particular diet. It suggest fruits, vegetables, whole grains, nuts and olive oil.

The main components of mediterranean pyramid includes: daily physical activity; daily consumption of whole grains, fruits, vegetables and healthy fats like polyunsaturated and monounsaturated fats; weekly intake of fish, poultry, egg and sweets; moderate amount of dairy products and wine; limited intake of red meat and daily 8 glass of water. Mediterranean diet gives importance to olive oil because of its healthy effect. Olive oil provides monounsaturated fat and protect our heart. Inclusion of polyunsaturated fats (PUFA) and monounsaturated fats (MUFA) in the daily diet is essential for the healthy heart. PUFA and MUFA are healthy fats, that has cardio protective effect and act as a vasodilator. Walnuts, flax seeds, olive oil, soybean, avocado. Fish (salmon) are the good sources of healthy fats. Saturated and trans fats are considered as an unhealthy fats. They rise the bad cholesterol level and act as a vasoconstrictor. Unhealthy fats are present in butter, ghee, palm oil, cakes, chocolates, fried foods etc.

Mediterranean diet suggests fibre rich foods that reduces cholesterol level and serum cholesterol level which in turn lower the risk of blood clot formation. Pectin in guava and apple, betaglucan in oats, mucilaginous fibre and saponins in fenugreek are some of the examples of fibrous substances present in foods. They have hypocholesterolemic effect and provide heart health. Estruch *et al*. (2018) [4] conducted a study among 50 to 80 years aged people to know the effect of mediterranean diet on cardiovascular diseases. They concluded that mediterranean diet decreased the risk of CVD among highly risk group.

Mediterranean diet give importance to daily exercise. Daily physical activity is beneficial to CVD patients. Exercises increase the heart size and strength. The heart's stroke volume is also increased. Exercise raises the HDL cholesterol level, blood volume and improve the oxygen carrying capacity of blood. Daily physical activity also helps to reduce total and abdominal fat. Schroeder *et al*. (2019) [14] conducted a study to know the effectiveness of exercise on cardiovascular diseases risk factors and they reported that combination of aerobic and resistant exercise helped to decrease the risk of CVD. In addition, aerobic exercises such as brisk walking, running, swimming and jogging for minimum 30 minutes daily help to improve heart health and HDL cholesterol level (Miele and Headley, 2017) [9].

## 5. Conclusion

Cardiovascular disease is a group of diseases of heart and blood vessels. Diet and exercise play a vital role in the management of CVD. A healthy diet with low calorie, plant based proteins, mono and poly unsaturated fats, antioxidants, low sodium, high potassium and high fibre should be prescribed. A healthy lifestyle with modified food habits, smoking cessation, weight management and proper exercise will positively impact the reduction of cardiovascular diseases.

## 7. References


1. [Cited on 15/07/2017] Available From: https://www.heart.org/en/health-topics/consumer-healthcare/what-is-cardiovascular-disease/coronary-artery-disease
2. Chiu THT, Chang HR, *et al.* Vegetarian diet and incidence of total, ischemic and hemorrhagic stroke in two cohorts in Taiwan. Neurology. 2020; 94(11):1112-1121.
3. Delaney CL, Smale MK, *et al.* Nutritional considerations for peripheral arterial disease: a narrative review. Nutrients. 2019; 11(6):1219.
4. Estruch R, Ros E, *et al.* Primary Prevention of Cardiovascular Disease with a Mediterranean Diet Supplemented with Extra-Virgin Olive Oil or Nuts. New England Journal of Medicine. 2018; 368(14):1279-1290.
5. Gonçalves C, Abreu S. Sodium and Potassium Intake and Cardiovascular Disease in Older People: A Systematic Review. Nutrients. 2020; 12(11):3447.
6. Gopa B, Bhatt J, *et al*. A comparative clinical study of hypolipidemic efficacy of amla with 3-hydroxy-3-methylglutaryl-coenzyme-A reductase inhibitor simvastatin. Indian Journal of Pharmacology. 2012; 44(2):238-242.
7. Iannuzzo G, Forte F, *et al.* Association of Vitamin D deficiency with peripheral arterial disease: a meta-analysis of literature studies. The Journal of Clinical Endocrinology and Metabolism. 2018; 103(6):2107-2115.
8. Johnsen SH, Jacobsen BK, *et al.* Fish consumption, fish oil supplements and risk of atherosclerosis in the Tromso study. Nutrition Journal. 2018; 17(1):1-9.
9. Miele EM, Headley SAE. The effect of chronic aerobic exercise on cardiovascular risk factors in persons with diabetes mellitus. Current Diabetes Reports. 2017; 17(10):1-7.
10. Mochtar I, Hooper RW. Assessment of the 10-year risk of coronary heart disease events for Qatar Petroleum's firefighters and non-firefighter staff in Qatar. Eastern Mediterranean Health Journal. 2012; 18(2):127-131.
11. Ndumele CE, Matsushita K, *et al.* Obesity and Subtypes of Incident Cardiovascular Disease. Journal of the American Heart Association. 2016; 5(8):1-10.
12. Ostchega Y, Nwankwo T, *et al.* Comparing Blood Pressure Values Obtained by Two Different Protocols: National Health and Nutrition Examination Survey, 2017-2018. Vital Health statistics. 2021; (87):1-26.
13. Rodrigues SL, Souza PR, *et al.* Relationship between salt consumption measured by 24 h urine collection and blood pressure in the adult population of Victoria (Brazil).Brazilian Journal of Medical and Biological Research. 2015; 48(8):728-735.
14. Schroeder EC, Franke WD, *et al.* Comparative effectiveness of aerobic, resistance, and combined training on cardiovascular disease risk factors: A randomized controlled trial. PloS one. 2019; 14(1):210-292.
15. Tabib A, Aryafar M, *et al*. Prevalence of malnutrition in children with congenital heart disease. Journal of Comprehensive Pediatrics. 2019; 10(4):1-6.
16. Tarigan JE, Yunir E, *et al*. Profile and analysis of

diabetes chronic complications. Medical Journal of Indonesia. 2014; 24(3):156-162.
17. Toma I, McCaffrey TA. Transforming growth factor-β and atherosclerosis: Interwoven atherogenic and atheroprotective aspects. Cell and Tissue Research. 2012; 347(1):155-175.
18. [Cited on 15/07/2017]. Available From: http:// www.who.int/healthinfo/global_burden_disease/estimates/en/index1.html.
19. [Cited on 11/06/2021]. Available From: https://www.who.int/news-room/fact-sheets/detail/cardiovascular-diseases-(CVD)