

Mini-Review

Heart Failure and Plant-Based Diet: A Mini-Review

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Received: 24 August 2020; **Accepted:** 29 August 2020; **Published:** 03 September 2020

Citation: Syed Adeel Hassan, Umar Farooque, Ali Choudhry, Fahad Nawaz Sheikh, Somia Jamal, Naresh Kumar, Komal Girdhari, Tooba Hussain, Yusra Minahil Nasir. Heart Failure and Plant-Based Diet: A Mini-Review. Archives of Internal Medicine Research 3 (2020): 191-194.

Abstract

The role of diet in the development and prevention of heart disease has gained much attention. This is due to the rapidly growing evidence that supports the efficacy of nutrition in attenuating the incidence and severity of heart failure. Herein, we review current clinical studies that support the efficacy of a plant-based diet in patients with heart failure. Furthermore, we also outline the effectiveness of plant-based diets in the reduction of cardiovascular risk factors.

Keywords: Heart Failure; Plant-Based Diet; Risk Factors

1. Introduction

Heart Failure (HF) is defined as the reduced ability of the heart to pump or fill with blood leading to unmatched metabolic demands [1]. It usually presents with a complex constellation of symptoms such as dyspnea, bilateral lower limb swelling, and orthopnea

[1]. Furthermore, patients also present with clinical signs such as elevated jugular venous pressure and pulmonary congestion [1]. The clinical signs and symptoms are usually seen once the compensatory neurohormonal activation is ineffective in maintaining a normal cardiac output. For clinical purposes, HF is subdivided on the basis of echocardiogram derived ejection fraction. Therefore, the clinical subtypes of HF include HF with reduced ejection fraction (HFrEF), HF with preserved ejection fraction (HFpEF), and HF mid-range ejection fraction (HFmrEF). HF accounts for one of the leading causes of hospitalization and mortality worldwide. Currently, In the United States, 5.7 million people have HF [2]. This figure is projected to increase to more than 8 million by the year 2030 [2]. This accounts for a 46% increase in the prevalence of HF patients. Annually, > 550,000 are diagnosed with HF in the US alone [3]. These worrisome figures warrant an alternative approach and strategy to treat and prevent cardiovascular diseases. Risk factors leading to the development of heart failure are multi-factorial. These risk factors include diet, diabetes mellitus, hypertension, hyperlipidemia, and obesity [4]. In turn, most of the risk factors leading to the development of heart disease are influenced by the patient's dietary routine. Most of the current research pertaining to HF focuses on the clinical utility of various drugs and devices [5]. Therefore, data regarding the role of nutrition in the pathogenesis and prevention of HF is scarce. Exploring nutritional therapy as an alternative means provides us with low risk and low-cost options to reduce the incidence and severity of HF. Therefore, we assess the possible efficacy of plant-based diets in HF patients and risk factor prevention.

2. Discussion

2.1 Supporting clinical studies

Relevant to the context of our discussion, a plant-based diet refers to the intake of plant foods coupled with a

reduction in the intake of animal-based foods. Several studies have indicated that plant-based diets reduce the risk of cardiovascular risk factors such as ischemic heart disease, obesity, diabetes mellitus, and hypertension [6, 7]. In an interventional study, Najjar, and Montgomery initialized plant-based diets in three heart failure (HF) patients as an adjunct to standard HF therapy [8]. The diet based regime was instituted for an average of 79 days. Clinical improvement in various cardiac parameters of all patients was noted in this study. A cardiac magnetic resonance revealed a 92% increase ($22.0 \pm 6.9\%$ vs $42.2 \pm 18.4\%$) in ejection fraction [8]. A 21% reduction in left ventricular mass (214 ± 90 g vs 170 ± 102 g), 62% increase (55.8 ± 24.3 cc vs 90.3 ± 30.6 cc) in stroke volume and 17% increase (3.6 ± 1.2 L/min vs 4.2 ± 1.6 L/min) in cardiac output were duly noted [8]. Furthermore, in one of the study participants, 90-95% of ostial stenosis of the left anterior descending artery nearly regressed [8]. Therefore, results from this interventional study support the clinical efficacy of a plant-based diet as an adjunct in the care of HF patients. Furthermore, a plant-based diet may reverse and attenuate the functional and morphological features of HF.

Choi et al. reported an interventional study, where a patient with left ventricular systolic dysfunction and low ejection fraction was placed on a whole food plant-based diet [9]. At the 2 months follow up, an echocardiogram revealed an increase in baseline ejection fraction from 35% to 50% [9]. Furthermore, other cardiac disease risk factors improved drastically over a period of 2 months [9]. Therefore, in conclusion, 60 days of whole food plant-based diet improves ejection fraction significantly. In 2007, Pischke et al. conducted an interventional study comprising of 46 participants with left ventricular dysfunction and reduced ejection fractions [10]. All patients were initiated on plant-based diets for a period of 90 days

[10]. Follow up revealed a decrease in cardiovascular disease risk factors ($P < 0.05$) such as body weight, body fat, blood pressure, resting heart rate, total cholesterol, and low-density lipoprotein cholesterol [10].

2.2 Mechanistic insight

The clinical efficacy of plant-based diets may be due to several underlying pathophysiological mechanisms. They work specifically to mitigate the development of various cardiovascular disease risk factors. Recent studies have implied the importance of the gut microbiome in the maintenance of cardiovascular health. The gut microbiome metabolizes various dietary nutrients such as l-carnitine and choline to yield the pro-atherogenic molecule trimethylamine N-oxide (TMAO) [11]. TMAO is known to impede reverse cholesterol transport [9]. Furthermore, it may also exacerbate vascular inflammation and platelet reactivity [11]. Several clinical studies have indicated that elevated levels of TMAO are associated with worsening rates of HF and overall mortality [11, 12]. Institution of a plant-based diet ensures that the microflora produces less TMAO as compared to when an animal-based diet is consumed [13]. This may account for the association between plant-based diets and fewer cardiovascular events. Furthermore, plant-based diets contain soluble fiber, which improves the health of the gut bacteria. As a consequence, gut bacteria tend to produce more short-chain fatty acids (SCFA) [14]. SCFA is associated with the repression of enterocyte genes involved in cholesterol synthesis [15]. Therefore, reduced cholesterol synthesis may translate to a reduced risk of HF. Plant-based diets are also known to reduce total LDL-C molecules [9]. This may in turn aid to reduce the progression of atherosclerosis. Furthermore, such diets are also high in antioxidants and help neutralize reactive oxygen species (ROS) [9]. This helps alleviate ROS induced myocyte hypertrophy, aortic stiffness, and interstitial fibrosis [9]. Finally, plant-based diets may

also help alleviate inflammation by decreasing the plasma concentrations of inflammatory molecules such as soluble intercellular adhesion molecule-1, and interleukin-6 [9].

3. Conclusion

From the results of the above discussed literature, plant-based diets can be useful as an adjunct to standard heart failure treatment. When used in adjunct for a period of 60 days or more, they possess the capability to improve functional and morphological disturbance in heart failure. Further large trials and interventional studies are needed to explore plant-based diets as a therapeutic option in heart failure patients. This sets up a precedent for a multifaceted clinical approach to such patients in the future.

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