Controlling Experimentally Induced Heart Failure With the Aid of Diet Rich in Antioxidants and Probiotic Elements

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Heart Failure (HF) is a progressive, complex clinical syndrome that can result from any structural or functional cardiac injury that impairs the ability of the ventricle to fill with or eject blood. It represents a profound derangement of otherwise fine-tuned physiologic mechanisms to maintain cardiac output (CO), blood pressure (BP), and fluid balance. The resulting myocardial injuries alters the biochemical environment of both impaired and uninjured cardiac cells. Endocrine, paracrine, autocrine, or intracrine mechanisms all can contribute to a subsequent net biologic response (Lionetti, Bianchi et al. 2010). These signals potentially reinitiate a fetal growth repertoire of transcription and translation. Over time, characteristic patterns of cardiac morphology emerge, leading to the progression of ventricular systolic and/or diastolic impairment. Shifts in the physical characteristics of the heart require an orchestrated sequence of cell proliferation, apoptosis, hypertrophy, and atrophy—a process referred to as ventricular remodeling. Cardiac remodeling process has been attributed to a variety of cellular mechanisms that are activated with cardiac dysfunction (Rathi and Deedwania 2012, Cowie and Poole-Wilson 2013).

The fundamental manifestations of HF implicate fatigue, dyspnea, and fluid retention. These manifestations usually lead to decreased exercise tolerance, peripheral edema and/or congestion of splanchnic and/or pulmonary arteries. HF has become progressively prevalent and constitutes a considerable socioeconomic burden all over the world. HF patients suffer an increased morbidity and/or mortality attributed to the presence of comorbidities besides the lack of effective therapies (Konstantinou et al., 2013).

Medical therapies and lifestyle modification constitute general measures for HF management. (Kemp and Conte, 2012). Lifestyle modifications may include excess weight loss, cigarettes and alcohol caseation, and enhancing physical condition through tolerable exercise. Consumption of healthy food constitutes one of the lifestyle modifications that should be encouraged.

The present study was an attempt to investigate the beneficial effects of consumption of food enriched with natural antioxidants and probiotics in attenuating
Summary and Conclusion

doxorubicin (Dox)-induced HF. In the present study, a freshly prepared food formula - consisting of: carrot (Crt), defatted yogurt (Ygt), and green tea extract (GTE), in amounts of 8, 0.084, and 10 g/kg weight, respectively, were added to standard laboratory food – was investigated for a probable cardioprotective effect against Dox-induced cardiomyopathy compared to carvedilol (Carv) as standard drug.

HF was induced by i.p. injections of Dox (2.5 mg/kg). Dox was administered in six equal injections at 48 h intervals for a period of a two week to achieve a cumulative dose of 15 mg/kg (Lou et al. 2004).

The cardioprotective effects of the tested food were investigated by measuring various parameters and biomarkers. Mortality in rat, heart weight/body weight ratio (HW/BW) and deviation in normal Electrocardiogram ECG pattern were investigated. Histopathological parameters were also investigated besides analysis of cardiac parameters that reflect cardiac injury in rats such as serum creatine kinase-MB (CK-MB), lactate dehydrogenase (LDH), serum creatinine, and blood urea nitrogen (BUN). Complete lipid profiles of rats were also investigated. The proinflammatory cytokines, tumor necrosis factor –alpha (TNF-α) and interlukin 6 (IL-6) and endogenous antioxidant capacity were measured to elucidate possible underlying mechanisms for cardiac function improvement.

The tested food, either alone or in combination with Carv, showed potential cardioprotective effects as illustrated by improving the cardiac function. The cardioprotective effect of the tested food results in decreased mortality in rat. The tested food normalized the HW/BW ratio and neutralized the Dox-induced abnormalities in ECG pattern which are an index for its role in attenuating the development of myocardial hypertrophy. Histopathological parameters showed potential cardioprotective effects in the group received the tested food, either alone or in combination with Carv. Cardiac parameters that reflect cardiac injury in rats, such as CK-MB, LDH, serum creatinine and BUN, showed the highest cardioprotction in the groups received the tested food, either alone or in combination with Carv. The tested food also enhances the complete lipid profiles of rats as indicated by its potential to elevate serum high density lipoproteins (HDL) cholesterol and decrease serum levels of low and very low density lipoproteins (LDL and VLDL) cholesterol and triglycerides (TGs).
Summary and Conclusion

The tested food, either alone or in combination with Carv, counteract the deleterious effects of the proinflammatory cytokines, TNF-α and IL-6. The endogenous antioxidant capacity were also increased via administration of the tested food, as reflected either directly through increased level of reduced glutathione (GSH) in cardiac tissues or indirectly by diminished cardiac malondialdehyde (MDA)levels. All the previous data support the potential cardioprotection employed by the tested food consumption.

Conclusions

1. Consuming healthy diet is pivotal in controlling cardiovascular diseases and HF.
2. Diet enriched with natural antioxidants such as green tea and carrots in addition to yogurt containing the probacteria *L. acidophilus* can help in maintaining cardiac function and myocardial membrane integrity besides ameliorating secondary damage by compensatory mechanisms in Heart Failure.
3. Further investigations on other models of cardiomyopathy should be directed before being introduced as a pharmacological intervention.