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INTRODUCTION

Health is vital for everyone and is an important contributor to development and prosperity. Lifestyle changes and urbanization which are the key determinants of health cause detrimental effects on the quality of life of individuals and is therefore of concern. The growing health care industry seen today is an indicator of the increasing health issues the world faces thus making the sustainable development goal by 2030 which propagates “Good Health For All” a big challenge.

Cardiovascular diseases has taken epidemic proportions inflicting every section of the population irrespective of age, gender, economic status and region.

The impact of cardiovascular diseases on the quality of life as well as the economy and health care system is predominantly through its associated complications such as morbidity, diabetes and other life threatening outcomes and recent figures suggest that CVDs have outgrown the barriers of gender, locale, and economic status.

Globally, cardiovascular diseases has led to 17.5 million deaths in 2012 and more than 75% of these deaths occurred in developing countries (WHO, 2014).

Premature occurrence of cardiovascular diseases is a concern in developing countries (Fuster V, 2012). High premature mortality from CVD has been reported and out of a total of 1.89 million annual deaths, 0.59 million (31%) occurred at age <60 years and 1.09 million (58%) at age <70 years. (Million Death Study, 2012)

In South Asian countries, the age-adjusted CVD mortality rates is observed to vary from a low of 179/100,000 in men and 153/ 100,000 among women in Bangladesh and 294/ 100,000 in women in Pakistan.

In India cardiovascular health status has seen a upward trend in the recent years affecting India's productive population.

Fifty two per cent of CVD deaths In India occur before the age of 70 years whereas in western populations the occurrence is estimated to be 23 per cent (Harikrishnan *et al.,* 2014).

This is evident from the stark observation made in the trend of CVD among younger age groups. An increased prevalence of CVD related risk factors have been reported in this age group owing to lifestyle changes and work routines.

The life expectancy of an average Indian male is 67.3 years and that of females is 69.6 years (as per the 2 estimates for 2011–15). This transition has brought a larger number of people to the age group where the CVDs manifest. Thus, India has a larger population of vulnerable older adults that contribute to the CVD inflicted population (Chauhan and Bani , 2015).

CVD rates appears to be much higher than in middle- and high-income countries (Yusuf *et al.,* 2014; Prabhakaran *et al.,* 2014). Regional variations in the prevalence of cardiovascular diseases indicates prevalence rates in rural population to be 1.6–7.4 per cent and in urban populations the rates were 1–13.2 percent (Gupta, 2012).

According to 2010-2013 Registrar General of India. Sample Registration System Report, proportionate mortality from cardiovascular diseases increased to 23 per cent and 32 per cent of adult deaths in years 2010-2013. The mortality varies from 35 per cent in more developed urban locations where highest rates are accountable in the South Indian states, Eastern and Northeastern states and Punjab in both men and women while mortality is lowest in the Central Indian states of Rajasthan, Uttar Pradesh, and Bihar (Mony, 2014)

Owing to such a large rate of prevalence, India is set to lose on it is productive population on accounts of CVD mortality and morbidity hampering growth in every facets of development and has a major share in the burden of non- communicable diseases.

An increasing trend in the prevalence of CVD risk factors has been reported by several epidemiological studies. Risk factors such as family history, ethnicity and age cannot be changed. The four modifiable behavourial risk factors namely tobacco use, physical inactivity, unhealthy diet and excessive alcohol consumption are strongly associated with the accelerated growth in the prevalence of cardiovascular diseases. These factors leads to gradual metabolic and physiological changes resulting in raised blood pressure, overweight/obesity, hyperglycemia and hyperlipidemia.

Asian Indians are known for their unique pattern of dyslipidemia with lower HDL cholesterol, increased triglyceride levels and higher proportion of small dense LDL cholesterol (NCEP, 2001).

The World Health Organisation global status report on non-communicable diseases 2010 points raised cholesterol as the second leading NCD risk factor with 27.1% of prevalence in India (Males- 25.8%, Females- 28.3%).

Hyperlipidemia is a condition characterized by an increase in one or more of the plasma lipids such as triglycerides, cholesterol and phospholipids and or plasma lipoproteins like very low-density lipoprotein (VLDL), low-density lipoprotein(LDL) and reduced high-density lipoprotein (HDL) levels (Mishra *et al.,* 2011). Hyperlipidemia as a strong risk factor for coronary heart disease is well established and it is characterized by elevated lipid fractions which can precipitate as elevated cholesterol or elevated TG or both.

. Hypertriglyceriderimia and cardiovascular events have a strong independent association and elevated serum triglycerides produces concomitant changes in the other lipid fractions such as high density lipoprotein (HDL), low density lipoprotein (LDL) and other lipoproteins. Hypercholesterolemia and hypertriglyceridemia are considered to be the main etiological factors causing atherosclerosis which is strongly related to ischemic heart disease and research findings have indicated a strong relation between ischemic heart disease and the high mortality rate which causes more than four million deaths in a year

(Brouwers *et al.,* 2012 and Kumar*,* 2012) and attributable one third of the ischaemic heart disease globally (Nag and Ghosh, 2013).

To tackle this upsurge World Health Organisation launched a new initiative in 2016 called “Global Hearts” with the initiative to beat back the global threat of cardiovascular diseases - the world’s leading cause of death.

Overwhelming evidences has indicated the role that unhealthy diet plays in atherogenesis with positive association of excessive intake of dietary fats such as saturated fats and trans fats with cardiac events. Modifying the risk factors through diet and lifestyle intervention is considered as the cornerstone in prevention of cardiovascular diseases.

An integrated approach combining lifestyle modification with pharmacologic treatment is important to reduce cardiovascular risk factors, to improve vascular health and reducing costs associated with the disease. Healthy lifestyle habits include maintaining a healthy body weight, engaging in regular physical activity, consuming a healthy diet, reducing intake of saturated fats, trans fatty acids and cholesterol, avoiding the use of tobacco products and undergoing routine medical checkups for blood pressure and cholesterol

Mediterranean diet and the DASH diet are commonly recommended diet for reducing cardiovascular risk and the importance of the relationship between dietary fat and coronary heart disease has been extensively investigated. Apart fromthese vegetarian diet which is devoid of meat and fish and high in fruits, vegetables, and nuts is also widely recommended. Okinawan diet, which is low in saturated fat and high in carbohydrates (mostly from vegetable sources) has been beneficial for reducing the risk of CVD among many due to its low-energy, nutrient-dense with high-quality carbohydrates (Willcox *et al.,* 2007)

The role of diet in cardiovascular diseases has focused mostly on dietary fats however protective effects of other nutrients as part of entire food intake and the lack of effectiveness of single nutrient supplementation in trials has led to a focus on whole foods as protective against CVD.

Although diet low in fat and calories seem effective for the management of these diseases, they are difficult to maintain on a long-term basis and their efficacy diminishes over time. Alternative dietary interventions with inclusion of functional foods such as soluble fibre, soy protein, plant sterols and functional foods like probiotics and prebiotic compounds may exert positive effects on the composition of gut microbiota and improve heart health.

Functional foods are potentially beneficial components found naturally in foods or added to them as functional ingredients and include bioactive components. Many functional foods have been found to be potentially beneficial in the prevention and treatment of cardiovascular disease.

Prebiotics exert a myriad of effects of health promotion which can satisfy the need of consumers for food and in addition nurture and provide health benefits. Production of functional foods containing prebiotic ingredientis an area that has dominant featuring in the food industry in recent years.

Prebiotics are nonviable food components that exert a benefit on the health of the host, associated with modulation of the intestinal flora (FAO and WHO, 2007).

Colonic microflora has a profound effect on health and in view of the progressive increase of non-communicable diseases highlighting the importance of colonic microbiota as an active mechanism for alleviating such diseases can be given paramount importance.

Prebiotics are bifidogenic in nature and inulin type fructans such as inulin, oligofructose and fructooligosaccharides (FOS) can modify the colonic microflora, stimulating the proliferation and growth of non-pathogenic bacteria with health promoting potential particularly *Lactobacilli* and *Bifidobacteria.*

Prebiotic potential are associated with the changes that take place in the composition of the microbial population and the generation of short-chain fatty

acids (propionate, butyrate, acetate). Many studies have attribute the health promoting effect of prebiotics to the production of short chain fatty acids. Evidence suggests that these metabolites exert phlethora of health benefits such as lipid lowering effect ,anticarcinogenic , immunomodulatory property, enhance mineral absorption and promote gut health.

Inulin is considered to be a fat substitute carbohydrate or a dietetic fiber and possess the capacity of jellification when exposed to water, it is also used as food additive along with functional probiotics.

Inulin is used an additive providing texture, stabilizing foam, or improving mouth feel in miscellaneous products such as fermented dairy products; desserts and bakery products such as cookies, breads, and pastries; spreads and infant formulas (Mussatto and Mancilha, 2007).

Inulin is added to food products to offer a dual benefit of an improved organoleptic quality and a better-balanced composition. It is used in foods products as either individually or combined with other fructooligosaccharides or with probiotic strain to develop synbiotic foods.

In many foods, inulin is added only with the aim of improving technological characteristics without reducing the possibility of its potential as a prebiotic food and the prebiotic content after processing are not always evaluated.This poses a challenge to correct labeling of foods and in order that adequate intake recommendations are indicated in cases where prebiotic properties are declared.

Although some foods naturally contain prebiotics, are not consumed in sufficient amounts, considered for inulin to be from 5 to 15 g/day for a few weeks (Kolida and Gibson, 2007).

An option to improve the intake of prebiotics is to fortify commonly consumed foods and prebiotic ingredients such as inulin have the advantage that they can be added to a wide range of commonly consumed foods because of

their technological properties. It can be a replacement of carbohydrates and fat along with being a good source of fiber to enrich different foods for product development. Many studies have proved its role as a good fat replacer (up to 50%) for developing products with healthier properties and desired sensory characteristics. Hence inulin can provide an important vehicle to provide the need of the hour which bringing both health and taste to food products.

With the food industry is currently facing the challenge of meeting consumer demand for foods that provide additional health benefits and at the same time meet nutritional requirements, it is an important challenge for current and future research is to utilize the dual benefitting property of prebiotic ingredient such as inulin to bring metabolic changes to concrete health benefits.

Changing the trends in the eating habits and food production will take a pivotal role to promote health. Increased energy uptake, unbalanced diets and highlyprocessed foods used in fast food outlets are huge problems of concern as these are contributory factors causing lifestlyle diseases which are often linked to modern society.

Therefore there is a need for studying the different natural prebiotics and probiotic foods in the target region and develop new functional foods/food supplements with novel health benefits. The possible health benefits of prebiotics and probiotics need to be explored which should be facilitated by their safety and ease of use and hence the study has been proposed.

Incorporating inulin as functional food ingredients in the normal diet can stem the tide of cardiovascular risk factors and surmount the rising morbidity and mortality rates. Hence the study has been proposed to explore the possible health benefits of prebiotic inulin facilitated by their nutraceutical, technological property and ease of use and to develop appropriate dietary interventions through the use of functional foods for the management of cardiovascular diseases such as hyperlipidemia.

In order to address the above mentioned issues, the research study was carried out with the following objectives:

Primary Objectives:

1. To study the consumption pattern of prebiotic foods and develop a prebiotic food and
2. Find out its effect on hyperlipidemic subjects

Secondary Objectives:

1. To study the knowledge, awareness and practice of prebiotic foods among population groups.
2. Formulate a common food with prebiotic ingredient and standardize.
3. Assess the developed food product in terms of acceptability, nutrient content and microbial analysis and
4. Supplement the food product to selected hyperlipidemics and study the impact on their lipid profile.